Hedonic Pricing Project Final Report
Department of Geographical and Sustainability Sciences

THE UNIVERSITY OF IOWA
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES
iisc.uiowa.edu

Class Led by Dr. Heather Sander
Course: Ecosystem Services: Human Dependence on Natural Systems

KYLE BAUM
TREVOR RILEY

EVAN CAYTON

JASON MCCURDY
ERINN ROGOWSKI

In partnership with the City of Iowa City

12.2015

CITY OF IOWA CITY

THE UNIVERSITY OF IOWA | COLLEGE OF LIBERAL ARTS & SCIENCES
DEPARTMENT OF GEOGRAPHICAL & SUSTAINABILTY SCIENCES

This project was supported by the Iowa Initiative for Sustainable Communities (IISC), a program of the Provost's Office of Outreach and Engagement at the University of Iowa that partners with rural and urban communities across the state to develop projects that university students and faculty complete through research and coursework. Through supporting these projects, the IISC pursues a dual mission of enhancing quality of life in Iowa while transforming teaching and learning at the University of Iowa.

This publication may be available in alternative formats upon request.

Iowa Initiative for Sustainable Communities
Provost's Office of Outreach & Engagement
The University of Iowa
111 Jessup Hall
Iowa City, IA, 52241
Email: iisc@uiowa.edu
Website: http://iisc.uiowa.edu/

Economic Valuation of Protected Open Spaces in Iowa City, Iowa through Hedonic Pricing

Kyle Baum, Evan Cayton, Jason McCurdy, Trevor Riley & Erinn Rogowski

Department of Geographical and Sustainability Sciences

316 Jessup Hall
Iowa City, Iowa 52242

Introduction

Humans depend on numerous ecosystem services, which can be defined as "the benefits humans derive from ecosystems" (MEA 2005). Provisioning services, such as food, water, timber, plant fibers, and naturally-occurring medicinal substances, are tangible, easily quantified, and typically possess markets that allow for easy economic valuation. Many ecosystem services, however, including cultural services such as natural aesthetics and access to outdoor recreation, are not as easily measured and often lack direct markets, making assigning monetary values to them much less straightforward (Koetse et al. 2015). While these services and amenities decidedly have worth, a lack of information concerning how the public perceives and values those provided by protected open spaces is poorly understood and are often overlooked during planning and policy-making processes. If the economic benefits of these spaces, along with investments made in improving and expanding them, can be demonstrated in financial terms, more attention will be paid to them in local and regional planning.

While a number of methods aimed at valuing less tangible or marketable ecosystem services exist, this project will focus on hedonic pricing, a technique that identifies the values of marketed goods based on the premise that sale price is determined by both the internal factors of the commodity itself and the external characteristics that affect it (Monson 2009). This method is frequently used to estimate economic values for ecosystem services that have a direct effect on market prices, most commonly housing prices that indicate the value of local environmental services or amenities. Fundamentally, the price of a residential property (marketed good) is a function of the properties of the structure and parcel on which it sits (e.g. finished square feet, number of bedrooms and bathrooms, home age and condition, lot area and dimensions), neighborhood characteristics (e.g. population density, mean home price, average household income, school ratings, crime statistics), and environmental factors (e.g. proximity to open spaces, water bodies, views). Using the hedonic pricing model, a marginal implicit price, which is the effect a small change in an independent variable has on the dependent variable (i.e. home sale price) given that all other variables remain constant, can be estimated for each characteristic of interest. In this way, values for environmental amenities such as protected open spaces can be evaluated.

The hedonic pricing method has been used successfully to draw relationships between housing prices and protected open spaces in several studies in a number of locations. Morancho (2003) investigated this link in Castellón, Spain using the conventional explanatory variables tied to housing prices along with three environmental variables: the presence of views overlooking open space, distance to the nearest open space, and the size of that open space. Results showed that only the distance from a parcel to the nearest open space was significant, and that for every 100 meters further a home was from a green space its value decreased by approximately €1,800 (equal to $2,000 USD in 2003). Two studies using data collected in the Twin Cities Metropolitan Area in 2005 utilized hedonic pricing to value ecosystem services linked to outdoor recreation. Sander and Polasky (2009) considered aesthetic quality (views) and access to outdoor recreation areas in Ramsey County, Minnesota, and found that increasing access to all types of protected open spaces and many aesthetic characteristics increased the sale value of homes in the study area. A subsequent analysis focused on Dakota County, Minnesota considered access to outdoor recreation and found that road distance to protected open spaces greater than one hectare and Euclidean distance to lakes both had a slight but positive affect on home sale prices (Sander and Haight 2012). In general, research demonstrates that in many cases people pay more for a home in order to live closer to recreational opportunities afforded by certain environmental amenities.

This project investigated the economic value of the cultural ecosystem services made available to Iowa City residents by varying types of protected open spaces using a hedonic pricing model. More specifically, the project sought to quantify how the provision of outdoor recreational services contributes to the value of single-family owner occupied residences within the city limits of Iowa City, Iowa. We hypothesized that increasing proximity to protected open spaces of all types will have a slight but positive effect on the value of single-family owner-occupied homes in Iowa City. We also posited that proximity to larger parks will have a more pronounced and positive effect on home prices.

This assessment of homeowner and homebuyer preferences in regard to the ways in which residents value protected open spaces may offer insights into the management of these areas, provide justification for increased funding for parks, and assist in the improvement of current park spaces and the planning of additional outdoor recreational areas.

Methods

Study Area

This project focused on the area bounded by the city limits of Iowa City, Iowa, and also included the area within a 500 meter buffer surrounding the city in order to include any adjacent protected open spaces in our analyses. Our research concerned all single-family owner-occupied residential properties within city limits sold between 2010 and 2015 and all protected open spaces larger than one hectare (an area equal to 100 m × 100 m, or 10,000 m^2). For a map of the study area, refer to Figure 1.

Data Requirements and Sources

Several datasets from a number of sources were required to complete our analysis and are summarized in Table 1.

Table 1. Names, descriptions, and sources of shapefiles and datasets used in analyses.

Shapefiles

Name	Description	Source
ICboundary	Polygon file delimiting the current city limits of Iowa City, Iowa	City of Iowa City
Parcel_POLY_v2	Polygon file of all parcels within Johnson County, Iowa	City of Iowa City
Parks	Polygon file of all protected open spaces within Johnson County, Iowa	City of Iowa City
School_Districts_ES	Polygon file of elementary school district boundaries within Johnson County, Iowa	Iowa GIS Data Repository
World_Imagery	Raster file including aerial imagery of Johnson County, Iowa	ESRI

Data

Name	Description	Source
Iowa Assessment scores	Math and reading proficiency scores for grades 3 and 5 by school district	greatschools.org; schooldigger.com
Parks, alphabetical listing	Descriptions of each park, including a listing of all available amenities	icgov.org
Sale data	Property characteristics including acres, net building area, bedrooms, bathrooms, total rooms, garage area, age of home, sale price, and date of sale	City of Iowa City

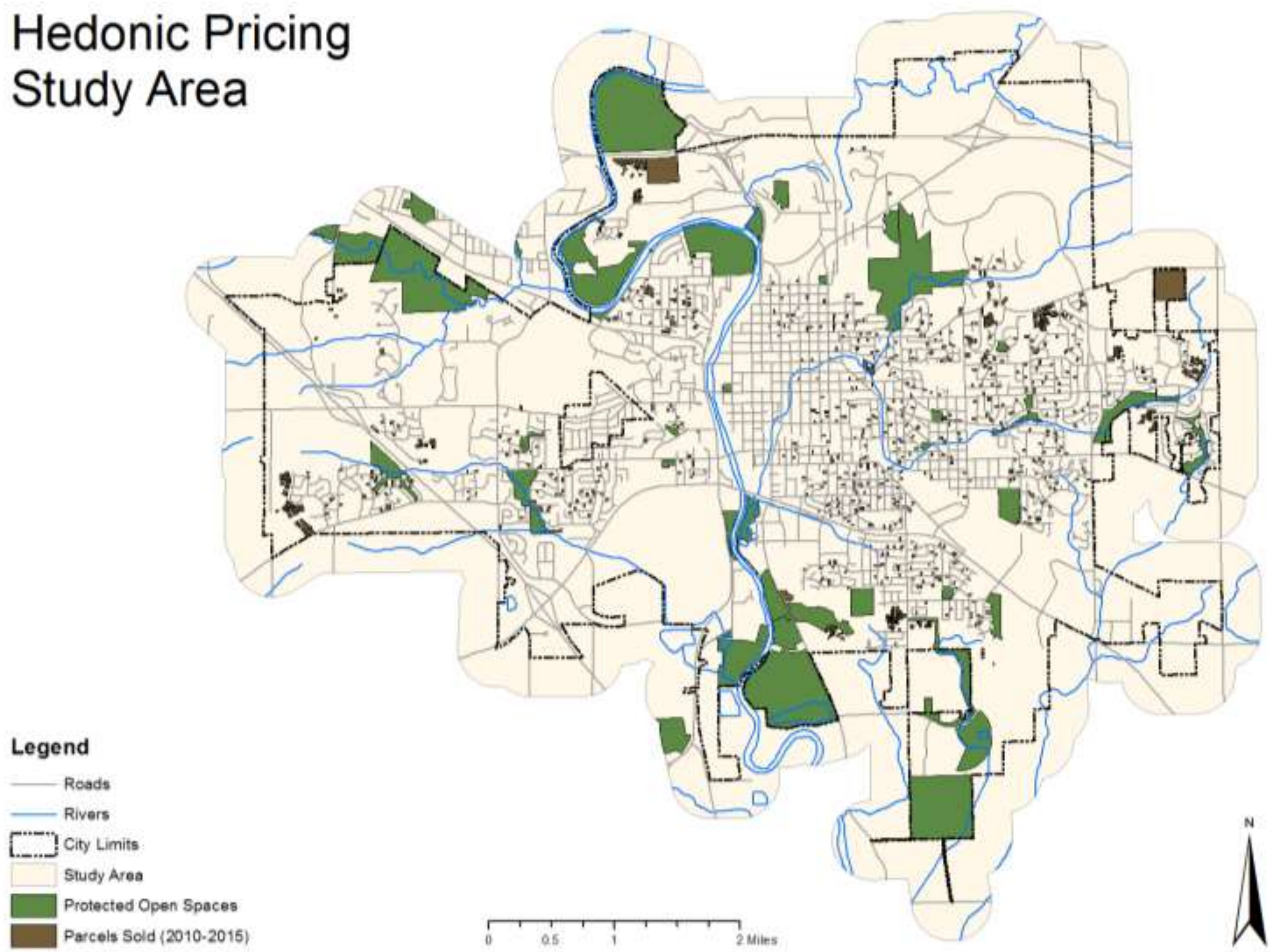

Figure 1. Project study area, including all protected open spaces >1 hectare and all single-family owner-occupied homes sold between 2010 and 2015.

Data Preprocessing

As the project was interested in single-family owner-occupied homes, parcel data was filtered to include only this property category, returning 12,998 parcels. To ensure our analysis reflected the current housing market, we filtered the sale data to include only parcels that sold between 2010 and 2015 (home sales prior to 2010 were likely impacted by the recession precipitated by the financial and sub-prime mortgage crises of 2007-2009). Nine-hundred and eighty-nine distinct parcels sold in Iowa City during this timeframe; these parcels were the focus of our hedonic pricing model. To ensure home values over this period were comparable, sale prices were adjusted to 2015 currency using inflation rates for each respective year. Sales were also broken out by month to account for variations in sale price at different times of the year.

We predicted that residents utilize and value outdoor spaces differently based on their size, the types of recreational opportunities offered, and proximity to their homes. In order to test this, we divided protected open spaces in Iowa City into three categories based on their area and attributes (Figure 2). Using a combination of aerial photography and information gathered from the Iowa City Parks and Recreation Department webpage we classified parks based on their land cover and available amenities. Spaces that possessed features including manicured lawns, playgrounds, and athletic courts and fields were considered mixed use, while areas that were largely undeveloped and covered primarily by forests and/or grasslands were deemed conservation/natural areas. Parks greater than one hectare but less than ten hectares were classified as small mixed-use parks, while parks larger than ten hectares were classified as large mixed-use parks. Conservation/natural areas were not distinguished by size. Euclidean distances between each parcel and the nearest park of each type were calculated; the area of the closest park of each type was also recorded.

To account for the effects of nearby amenities, we measured the Euclidean distance from each study parcel to the Iowa City Pedestrian Mall (i.e. business district) and east and west portions of the University of Iowa campus. We divided the campus because we theorized that proximity to the medical campus/hospital on the west side of the Iowa River would have a different influence than proximity to the primarily liberal arts campus to the east. Polygons for each area were created using ArcMap 10.3. Distances between each parcel and these polygons were then calculated using the "Generate Near Table" tool.

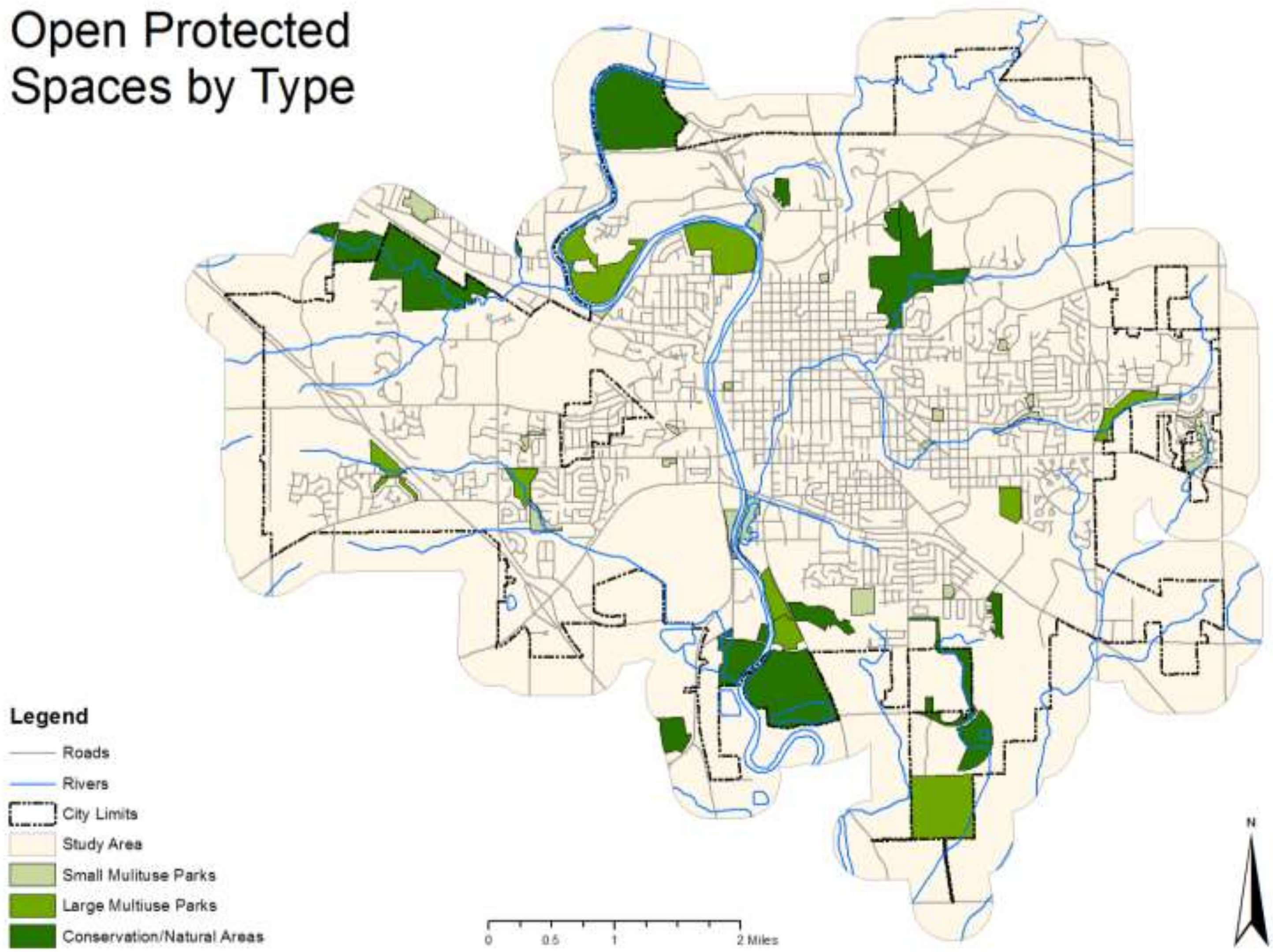

Figure 2. Protected open spaces in Iowa City, Iowa, distinguished by size and use.

The reputation and performance of schools can have an influence on the value of residential properties (Oates 1969). To include this phenomenon in our model, we assigned each parcel to its respective school district using current elementary school boundaries for Iowa City. Similar districts were later aggregated to improve model performance. We then linked third and fifth grade Iowa Assessment math and reading proficiency scores using data provided by Greatschools.org (2015).

Finally, the data described in Table 1, including all associated modifications, needed to be organized into a usable configuration. All parcel, neighborhood, and environmental variables relevant to construction of the hedonic pricing model were aggregated into a single table for analyses.

Analyses

Ordinary Least Squares (OLS) is a linear regression model that is able to estimate unknown parameters and generate outputs based on the relationship between a dependent variable and a list of explanatory variables. The OLS tool within ArcGIS models spatial relationships and explains observed spatial factors. To begin the spatial analysis, a composition was created using ArcMap 10.3 that contained all fields of relevant parcel, neighborhood, and environmental characteristics. A unique ID field was created within the attribute tables of each layer allowing the model to join each table together correctly. The dependent variable chosen as our input for the linear regression was the adjusted 2015 sale value of each home sold between 2010 and 2015. This variable was logically chosen as all other variables comprise and create the sale value of the home. The list of explanatory variables included parcel, neighborhood, and environmental characteristics. Being that our sample size was slightly less than 1000 parcels, we included 15 or fewer variables into each regression in order to increase the fit of the model, which also helped in avoiding collinearity between one or more variables. When collinearity is present, it signifies redundancy among the variables, which should be avoided when performing OLS regression. In efforts to reduce the collinearity in our results, certain dummy variables were purposefully excluded from the list of chosen explanatory variables. Examples of dummy variables were the months with the lowest average home sale price and the school districts with the poorest math and reading proficiency scores. Exclusion of these dummy variables allowed for the other sale months and higher-performing school districts to be compared amongst each other. Once the appropriate amount of explanatory variables were chosen while leaving out the expressed dummy variables, multiple iterations of the model were run in order to achieve the best model fit. Between each iteration, different combinations of explanatory variables were tested. Once the appropriate variables were selected, the model was run again and produced an OLS report as well as a coefficient table that was used to calculate marginal implicit prices for the environmental variables.

Results and Discussion

Analytical outputs from the model included a summary of OLS results (Table 2), an OLS diagnostic table (Table 3), and a coefficient output table (Table 4). *Note: results presented in this report reflect progress at the time the project concluded. Additional analyses will improve model fit and thereby yield different results.*

Summary of OLS Results - Model Variables

Variable	Coefficient [a]	StdError	t-Statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]	VIF [c]
Intercept	-192486.0221	38078.552201	-5.054972	0.000001*	41165.167644	-4.675944	0.000005*	--------
ACRES	25705.663039	3507.451872	7.328871	0.000000*	9712.475351	2.646664	0.008255*	1.020320
BATHROOMS	21327.516061	8413.002997	2.535066	0.011388*	7477.082920	2.852385	0.004436*	2.571877
BD	16.748684	6.685595	2.505190	0.012390*	6.289993	2.662751	0.007874*	3.057282
SOLDSUM	45740.211384	11393.251066	4.014676	0.000072*	11384.690608	4.017695	0.000071*	1.027103
LINMANSHI	136666.96763	30541.874737	4.474741	0.000011*	34336.269772	3.980251	0.000082*	4.056003
BLDG_AREA	56.718605	12.378693	4.581954	0.000007*	14.903040	3.805841	0.000161*	1.911821
GARAGE	-46967.49493	15116.467894	-3.107042	0.001957*	17084.956165	-2.749056	0.006087*	1.079327
SMMX_PKD	13.631890	3.102508	4.393829	0.000016*	4.016806	3.393713	0.000733*	1.717704
LGMX_PKD	11.581328	4.340607	2.668135	0.007750*	4.146148	2.793274	0.005322*	2.294437
CONS_PKD	11.093410	2.535605	4.375055	0.000017*	2.576787	4.305134	0.000022*	1.903507
SMMX_PKAR	1.180760	0.224383	5.262242	0.000000*	0.193513	6.101720	0.000000*	1.411131
LGMX_PKAR	0.147003	0.074147	1.982577	0.047688*	0.066502	2.210513	0.027286*	3.353351
CONS_PKAR	0.060188	0.022226	2.708024	0.006885*	0.019147	3.143507	0.001734*	1.362965

Table 2. Summary of Ordinary Least Squares regression results and variables included in the model.

OLS Diagnostics

Input Features:	parcel_data_10Dec	Dependent Variable:	VALUE_2015
Number of Observations:	989	Akaike's Information Criterion (AICc) [d]:	26652.181597
Multiple R-Squared [d]:	0.318569	Adjusted R-Squared [d]:	0.309483
Joint F-Statistic [e]:	35.062446	Prob(>F), (13,975) degrees of freedom:	0.000000*
Joint Wald Statistic [e]:	322.697450	Prob(>chi-squared), (13) degrees of freedom:	0.000000*
Koenker (BP) Statistic [f]:	248.997389	Prob(>chi-squared), (13) degrees of freedom:	0.000000*
Jarque-Bera Statistic [g]:	5626.744279	Prob(>chi-squared), (2) degrees of freedom:	0.000000*

Table 3. Ordinary Least Squares regression model diagnostic report.

Variance inflation factor (VIF) scores are a measure of redundancy (collinearity) among explanatory variables; values greater than 7.5 should be excluded one by one from subsequent model runs. Previous regression models were used to help identify and eliminate collinearity in our model. For example, proficiency scores and school districts were found to be collinear, as were Euclidean distances to the University of Iowa campus and downtown business district. This led to the exclusion of test scores and distances from parcels to campus from further model runs.

The OLS diagnostic table output provides information on model performance, significance, stationarity, bias, and spatial autocorrelation. The Koenker statistic for this model is significant, which indicates heteroscedasticity, or non-constant variance. This violates regression assumptions, which signifies relying on the robust probabilities from the OLS results summary to assess the significance of model coefficients. The Joint F-statistic and Joint Wald statistic are both significant, indicating that the model is able to predict the dependent variable based on the independent variables. However, the multiple r-squared and adjusted r-squared values, which are indicators of model performance and fit and identify how much of the variation in the dependent variable the model is able to predict based on the independent variables selected, is 0.309, indicating that our model is able to explain only approximately 31% of the variation in the dependent variable. This indicates poor model fit.

The Jarque-Bera statistic is used to determine if there is a pattern in the model's prediction error (bias). This is significant in the OLS diagnostics, indicating bias is present in the model, likely due to a combination of spatial autocorrelation and omitted explanatory variables. These factors are likely at least partially to blame for the model's low r-squared values. Addressing spatial autocorrelation and including additional variables (e.g. aesthetic quality variables like views from each property) would likely improve model performance.

Variable	Coef	StdError	t_Stat	Prob	Robust_SE	Robust_t	Robust_Pr	StdCoef
Acres	25705.6630	3507.4519	7.3289	0.0000	9712.4754	2.6467	0.0083	0.1957
Baths	21327.5161	8413.0030	2.5351	0.0114	7477.0829	2.8524	0.0044	0.1075
Bus Dist	16.7487	6.6856	2.5052	0.0124	6.2900	2.6628	0.0079	0.1158
Sold Sum	45740.2114	11393.2511	4.0147	0.0001	11384.6906	4.0177	0.0001	0.1076
LinManShi	136666.9676	30541.8747	4.4747	0.0000	34336.2698	3.9803	0.0001	0.2382
Bldg Area	56.7186	12.3787	4.5820	0.0000	14.9030	3.8058	0.0002	0.1675
Garage	-46967.4949	15116.4679	-3.1070	0.0020	17084.9562	-2.7491	0.0061	-0.0853
SMX_PKD	13.6319	3.1025	4.3938	0.0000	4.0168	3.3937	0.0007	0.1522
LMX_PKD	11.5813	4.3406	2.6681	0.0078	4.1461	2.7933	0.0053	0.1068
CON_PKD	11.0934	2.5356	4.3751	0.0000	2.5768	4.3051	0.0000	0.1596
SMX_PKA	1.1808	0.2244	5.2622	0.0000	0.1935	6.1017	0.0000	0.1653
LMX_PKA	0.1470	0.0741	1.9826	0.0477	0.0665	2.2105	0.0273	0.0960
CON_PKA	0.0602	0.0222	2.7080	0.0069	0.0191	3.1435	0.0017	0.0836

Table 4. Ordinary Least Square regression model coefficient output table.

The coefficient output table mirrors much of the information contained in the OLS model results summary, but also provides standardized coefficients which indicate the strength of the relationship between each independent variable and the dependent variable (sale price). Using the results generated by the model described above, the standardized coefficients can be used to calculate marginal implicit prices (the price a buyer is willing to pay for an additional unit of a particular variable or characteristic given all other characteristics remain constant) for each of the environmental variables being researched.

Variable	StdCoef	Mean Home Sale Price	250 m Closer to Park	MIP
SMX_PKD	0.1522	$236,662.00	-250	-$144.12
LMX_PKD	0.1068	$236,662.00	-250	-$101.14
CON_PKD	0.1596	$236,662.00	-250	-$151.06

Table 5. Marginal implicit price for each 250 meter increment a parcel is located closer to each type of park space.

Variable	StdCoef	Mean Home Sale Price	Mean Park Area (sq m)	MIP
SMX_PKA	0.1653	$236,662.00	37,849.20	$1.03
LMX_PKA	0.0960	$236,662.00	251,009.56	$0.09
CON_PKA	0.0836	$236,662.00	363,416.69	$0.05

Table 6. Marginal implicit price for each additional square meter of area added to each type of park space.

When distance to protected open space is considered, it appears there is a slight but negative relationship between increasing proximity and home sale value, which contradicts our hypothesis concerning proximity to park space and home sale price. For each 250 meter interval closer a home is situated to a small mixed-use park, the sale value of the home can be expected to decrease by $144.12. This relationship holds true for large mixed-use and conservation/natural areas as well, as sale value decreases by $101.14 and $151.06 with increasing proximity to these respective park types. A different association exists when the area of each type of park is considered. A positive relationship can be seen between the area of protected open space and price when the type of park nearest to each parcel is larger. This effect is most pronounced when considering small mixed-use parks, where each additional square meter of park space equals an increase in home sale price of $1.03. While this may not seem like a large sum, the addition of a 500 square meter parcel (a square of land measuring only 22.36 meters on a side) to a park of this kind would add $516.65 to the sale value of a single family home. Smaller increases in home value are associated with large-mixed use and conservation/natural areas. This is likely due to the fact that these parks tend to be larger in general, and a small increase in area would have a decreasing impact on price as size increases. Small mixed-use parks also tend to be located more closely to many of the parcels included in this study, which may partially explain this relationship. Further, nearby small mixed-use parks that tend to be larger may be valued more highly by local residents as they often offer more amenities and recreational opportunities. This connection between park area and home sale price partially confirms our hypothesis concerning these parameters, but the relationship is more complex than initially anticipated and warrants further study.

Conclusion

While the results of this project did not confirm our hypotheses as to the relationship between protected open spaces and home sale price, they serve as the introductory steps to providing an economic valuation of protected open spaces in Iowa City, Iowa through the use of the hedonic pricing method. Additional research and improvements to modeling are needed to satisfactorily explain the relationship between park space and home sale prices.

A major flaw surrounding project results stems from poor model performance. The model upon which the OLS outputs are based has an adjusted r-squared value of only 0.309, meaning it explains only 31% of the variation in the dependent variable (home sale price), leaving 69% of the variation unexplained. Correcting for heteroscedasticity and spatial autocorrelation in future models should improve model fit, however these factors could not be addressed during the timeframe of this project. Additionally, key explanatory variables may have been omitted from the model. Similar research conducted in the Twin Cities Metropolitan Area of Minnesota found that the quality of certain types of views from a residential parcel had a positive effect on home sale prices (Sander and Polasky 2009); data of this kind was unavailable for our analyses, but could prove important if included in modeling tied to future research. More complete data describing structural, neighborhood, and environmental characteristics may help to improve modeling efforts as well.

A number of other factors may affect the relationship between the value of protected space and home sale prices. Negative values associated with distance and area metrics linked to green space may reflect attributes that people associate with parks as opposed to the parks themselves. Just as neighborhoods and other areas can be associated with high crime rates, people may link certain park spaces with drug use and gang activity, which may lower sale values. Another aspect that may have affected results is that only single-family owner-occupied properties were considered in our analyses. Residents in other property types might utilize and therefore value protected open spaces differently. College students make up a large portion of the population of Iowa City and the vast majority of them live in rented apartments close to the

University of Iowa campus; excluding these and other renters from the study may have influenced our results. Finally, larger recreational parks within the Iowa City metropolitan area (e.g. Coralville Reservoir, Lake Macbride State Park, and F.W. Kent Park) were not considered in this analysis. Information on the willingness of residents to spend time driving to and utilizing the recreational opportunities offered by more distant parks may be required to fully understand the ways in which they value parks located more closely to home.

Protected open spaces clearly hold value to Iowa City residents, but research beyond the scope of this project will be required to estimate their economic worth through the hedonic pricing method. In addition to revealed preference methods like hedonic pricing, stated preference methods (e.g. surveys) may shed light on what homebuyers consider and value when choosing a home, offering information that may assist in refining modeling efforts. Improvements to analytical procedures and model performance may provide better-quality information, which may help to showcase the need to maintain or enhance protected open spaces and at the same time provide justification for the monetary expenditures necessary for these improvements. Furthermore, the differing marginal implicit prices generated through this method for various types of open space will also help to determine the kinds of parks Iowa City residents value and utilize most, which may also serve to guide planning of these spaces moving into the future.

Acknowledgements

We would like to thank the City of Iowa City for providing data necessary for the completion of this project, the Iowa Initiative for Sustainable Communities for facilitating this partnership between the University of Iowa Geographical and Sustainability Sciences department and the City, and Dr. Heather Sander for her considerable guidance over this course of the project.

Citations

City of Iowa City. "Parks, alphabetical listing." Iowa City Recreation Division. Parks and Recreation Department. Web. 20 Nov. 2015. https://icgov.org/city-government/departments-and-divisions/parks-and-recreation/parks-and-forestry/parks/parks

GreatSchools. GreatSchools.com. Great Schools Inc., 1999-2015. Web. 10 Dec 2015.

Iowa GIS Data Repository. IowaGISData.org. Iowa Counties Information Technology, 2015. Web. 2 Dec 2015.

Keotse, M.J., R. Brouwer, and P.J.H. van Beukering. 2015. "Economic valuation methods for ecosystem services." In *Ecosystem Services: From Concept to Practice*, edited by J.A. Bouma and P.J.H. van Beukering. Cambridge, UK: Cambridge University Press.

Millennium Ecosystem Assessment (MEA). 2005. *Millennium Ecosystem Assessment: Eco-systems and Human Well-being*. Washington, DC: Island Press.

Monson, M. 2009. "Valuation Using Hedonic Pricing Models." *Cornell Real Estate Review* 7:62-73.

Morancho, A.B. 2003. "A hedonic valuation of urban green areas." *Landscape and Urban Planning* 66 (1):35-41

Natural Resources Geographic Information Systems Library. www.programs.iowadnr.gov/nrgislibx/. GIS Section, Iowa Geological and Water Survey, Iowa DNR. Web. 2 Dec 2015.

Oates, W.E. 1969. "The effects of property taxes and local public spending on property values: an empirical study of tax capitalization and the Tiebout hypothesis." *Journal of Political Economy* 77 (6):957-971

Sander, H.A. and R.G. Haight. 2012. "Estimating the economic value of cultural ecosystem services in an urbanizing area using hedonic pricing." *Journal of Environmental Management* 113:194-205

Sander, H.A. and S. Polasky. 2009. "The value of views and open space: estimates from a hedonic pricing model for Ramsey County, Minnesota, USA." *Land Use Policy* 26:837-845.

SchoolDigger. SchoolDigger.com. Claarware LLC, 2006-2015. Web. 10 Dec 2015.