Impact of Improved Landscape Quality and Tree Cover on the Price of Single-Family Homes[1]

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Abstract

Impacts of the quality of landscaping and percentage of tree cover on home prices were estimated from a sample of 75 home sales within the Melonie Park neighborhood in Lubbock, TX, from 2003 to 2005. Estimates were derived using a regression of house sale price on house characteristics, landscape quality, and tree cover. Homes that improved landscaping from average quality to good or excellent quality increased selling price by 5.7 and 10.8%, respectively. Approximately 30% of the increase in sale value was accounted for by added tree cover. The results show that each $1.00 invested in upgrading an average landscape to excellent quality returns $1.35 in added property value.

Index words: hedonic model, home prices, landscape investment, landscape quality, tree cover.

Significance to the Nursery Industry

Homeowners are often aware of the monetary value associated with specific features of their homes. Previous studies indicate that costs of kitchen and bath remodels are often easily recouped when a home is sold. Landscaping of the adjacent grounds can also add value to a home. Landscape services can create a functional and aesthetically pleasing environment surrounding the home, and the benefits of a landscape environment are enjoyed by a homeowner on a daily basis. Improved landscaping is capitalized into the price a buyer is willing to pay for a home. Because market pricing of single-family homes does not provide for specific valuation of landscape characteristics, information about the value of landscaping services is limited. A better understanding of the expected economic value of landscaping is vital to homeowners as they make informed decisions regarding landscape improvements. Landscape professionals in the landscape and nursery industries can increase sales of landscape services and materials if the value of landscape improvements is quantified. This study uses a hedonic pricing model to estimate the increase in home price and return on investment from improvement in landscape quality and added tree cover.

Introduction

Many studies have analyzed how specific housing characteristics — categorized in relation to structural, location, or neighborhood attributes — influence property value of single-family homes. Structural attributes such as additional bedrooms and bathrooms increase house value, while the age of the house has a negative impact on price. Presence of a central air conditioning unit increases price by varied amounts, depending on the geographic region and local climate. Features such as fireplaces, basements, and garage space have a positive effect on sale price (28, 29). Location characteristics such as distance to a central business district and a 'good view' usually add a premium to the selling price (7, 12, 15, 21, 22, 24). Neighborhood attributes including crime level, noise, and local traffic contribute to lower property values, while the quality of public education has a large positive price impact (12, 21, 23).

Individual home buyers and sellers likely recognize the positive value of landscaping services on property value. A Gallup survey found that 9 out of 10 households recognized the value of a well-maintained lawn and landscape and observed the enriching and relaxing qualities landscaping provides the neighborhood (10). Further, the survey found that thirty-five percent of the respondents felt a property has increased real estate value due to landscaping but were unsure of the extent of the increase.

Research indicates that characteristics of the landscape surrounding a home affect property value. General tree cover adds 2–9% to the value of existing homes and 7% for new construction on tree-covered lots. A single tree can add as much as 2% to the property value (1, 2, 5, 18, 27). Landscape attributes such as hedges or walls, dense vegetation, and landscaped curbs, each add 2–4% to the property value, and homes with landscapes containing more trees than nearby properties are valued at up to 7% higher (4). Components of landscape design such as plant type, plant size, and design sophistication affect property value. The perceived value of a home may increase by 5–11% with landscape that is sophisticated in design, incorporating large plant size, evergreen and deciduous plants, annual color plants, and colored hardscapes (3).

Henry (9) conducted research on the contribution of quality of landscaping on home sale price using data from 218 homes sold in Greenville, SC, during 1996–97. A first-stage hedonic model was estimated relating house sale price to house characteristics and landscape quality. The results were intended to provide guidelines to homeowners about the expected impact to sale price from landscaping upgrades. The house characteristics included area measured by square footage, lot size, days on market, and dummy variables for homes with 4 or 5 bedrooms, garage, and central air conditioning. On-site landscape evaluations of each home in the sample were conducted by landscape design and real estate professionals. Landscape was evaluated as average, good, or excellent quality. Results from the study indicated an increase in property value of 10–12% as quality of the landscape was improved from average to excellent. This result confirmed Henry's previous work using a different sample of Greenville homes (8).

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Des Rosiers (4) states that 'while the impact of tree cover on residential prices has already been the object of several studies, little attention has been devoted to landscaping as such.' And, although Henry's studies (8, 9) included trees in the overall landscape evaluations, no previous research has included impacts from both overall landscaping and tree cover as separate factors of property value. The objective of this research is to jointly analyze the impact of improved landscaping and added tree cover on property value.

Materials and Methods

The hedonic model represents a commodity or good as a basket or bundle of characteristics, with each characteristic (or attribute) having its own implicit (marginal) price (14). Rosen (25) developed the hedonic modeling approach such that the marginal price for an attribute is estimated in the first stage of the modeling process. The marginal attribute prices are estimated by regressing the price of the commodity or good on its attribute levels. The estimated slope coefficients (b_i) represent the marginal prices of each attribute. The hedonic modeling approach is used here to estimate the contribution to residential property value resulting from given home characteristics. Specifically, the focus of the current model is the estimation of the contributions of tree cover and other landscaping services to the sale price of a house. Influences from structural characteristics like house size measured in square footage were held constant in order to evaluate the effect of improved landscaping on a home's value.

The sample of residential property sales used in the hedonic analysis includes 75 single-family homes which sold in the Melonie Park neighborhood of Lubbock, TX, between January 1, 2003, and December 31, 2005. Lubbock is located in the Texas Panhandle and is at the center of a 26-county trading area in the South Plains with agricultural industry as the center of its economy. During the study period, the average sale price of a Melonie Park home was $162,153 compared to $120,433 for all home sales in Lubbock and $244,000 for the United States (31). Melonie Park home prices are higher than the average Lubbock home price but lower than the U.S. average price. Melonie Park is considered an established (developed in the 1960s), upper middle-class neighborhood, similar to neighborhoods of this type in other U.S. cities.

Two types of data on each property in the sample are used in this analysis — housing characteristics and landscape quality. Each data set is discussed below.

Housing data. Housing characteristics and prices of the 75 Melonie Park homes were obtained from the Multi-List Service (MLS) in Lubbock. The sample largely included ranch-style, brick houses with similar structural characteristics. Housing data included in the study were sale price, total square footage of living space, the number of days the house was on the market, the number of exterior home features (such as covered patios or sprinkler systems), and a dummy variable for two-story houses. Selected sample housing characteristics and their statistical properties are presented in Table 1.

Landscape data. Landscape characteristics were collected on each of the 75 sample homes using a detailed evaluation of selected landscape features. The evaluation was conducted in spring 2006. Although a difference in time exists between the occurrence of a sales transaction and the landscape evaluation, pictures taken at the time of sale (available from the MLS) were used to reconcile any differences in current versus past landscaping. Landscape architects, designers, and professionals in related fields were consulted during development of the evaluation criteria[3].

For each home in the sample, landscape quality was evaluated on nine features: eight individual landscape features and one rating of the coordination of those features. Each item was scored independently and then summed for an overall score of landscape quality. Landscape was evaluated on tree cover and quality, grass quality, volume and diversity of foundation plants, plant maintenance, concrete condition and size, amount of soft- and hardscapes, and design coordination. The evaluation of landscape quality and coordination were necessarily impacted by a limited level of subjectivity entering the scoring process. Evaluation scores ranged from 2.5 to 19. Most of the landscapes were judged to have good landscaping (47%). About 32% of the landscapes were judged average and 21% excellent in landscaping. Summary statistics of the landscape evaluations are presented in Table 2.

Contrary to similar studies (8, 9), noticeably absent from the landscape evaluation is any consideration for landscape quality of adjacent homes. As the Melonie Park neighborhood is an established and well-kept neighborhood, homeown-

[3]The landscape evaluation form was designed with the advice of faculty in the Departments of Landscape Architecture and Design at Texas Tech University. The form is available on request from the authors.

Table 1. House characteristics for the Melonie Park neighborhood, Lubbock, TX, 2003–05.

Variable	Mean	Standard deviation
Sales price, $	162,153	46,699
Price per sq. ft., $	60.44	7.02
House size, sq. ft.	2,681	685
Days on market	85	55
Age, years	39	2.39
Lot size, sq. ft.	9,733	1,842
Percent with:		
3 or more exterior features	24.0	
Two stories	13.3	
4 or 5 bedrooms	45.3	
2.5 or more bathrooms	45.3	
Sample size (n)	75	

Source: 2003–2005 Multi-List Service (MLS), Lubbock, TX.

Table 2. Landscape quality summary for the sample homes in the Melonie Park neighborhood, Lubbock, TX.

Variable	Mean	Std. dev.	Min	Max
Total landscape (LT)	11.5	4.0	2.5	19.0
Categories of LT	**Score range**		**Mean score**	**% in sample**
Average	LT ≤ 10.0		7.3	32.0
Good	10.0 < LT ≤ 15.0		12.2	46.7
Excellent	LT > 15.0		16.5	21.3

Source: On-site surveys of homes sold in the Melonie Park neighborhood, Lubbock, TX, 2003–05.

ers generally maintain an understood level of quality with respect to the landscape appearance. Therefore, adjacent landscapes that would tend to detract from the property value are largely absent from the neighborhood.

Hedonic model specification. Given the selected measures of landscape quality and house characteristics, a linear regression model was specified to estimate the impact of different levels of landscape quality on house value. Ordinary least squares regression (OLS) was used to estimate the model.

(1) $LNSPRICE = b_0 + b_1\ SQFT + b_2\ HPI + b_3\ DAYS + b_4\ EXT + b_5\ LVL2 + b_6\ LT + e;$

where,

- LNSPRICE = natural log of the sale price of a house;
- SQFT = square footage of living area in the house;
- HPI = House Price Index (HPI)[4], a measure of the movement of single-family house prices in Lubbock, TX;
- DAYS = number of days a house is on the market prior to sale;
- EXT = number of exterior features of the home;
- LVL2 = dummy variable, equal to one for homes with two levels, and zero otherwise;
- LT = total landscape quality score from the landscape evaluation;
- b_0 and b_i's = intercept and slope regression coefficients, respectively;
- e = random error term.

Equation (1) was estimated using data from residential property sales in a single neighborhood of Lubbock, TX. It is important to note that research on home price influences in a single neighborhood has not been attempted. Previous research has had a city- or county-wide focus; however, a single neighborhood focus allows location related characteristics to be constant for all properties in the sample. The single neighborhood focus eliminates the need to include variables in the hedonic model that account for variation in sale prices associated with different school districts or different neighborhoods or communities within a city.

Considering previous research showing the positive effect of the presence of trees on home sale price, Henry (8) argued that the value attributed to trees may, in fact, be impacted by other landscape features such as plants, grasses, etc. Consequently, Henry justified his study by including trees and other landscape features in an overall evaluation of landscape quality on house sale price. Given the influential import of trees in landscape quality, an alternate approach is to consider trees and other landscape features as separate aspects of landscape quality. Thus, Equation (2) was specified to measure the impact of landscape quality and tree cover as separate variables.

(2) $LNSPRICE = b_0 + b_1\ SQFT + b_2\ HPI + b_3\ DAYS + b_4\ EXT + b_5\ LVL2 + b_6\ LTNOTREE + b_7\ COVER + b_8\ COVER^2 + e;$

where,

- LTNOTREE = total landscape quality score from the landscape evaluation minus points for tree cover and tree quality;
- COVER = percentage of tree-cover square footage in the front yard area;
- $COVER^2$ = square of the tree-cover variable.

Points assigned on the landscape evaluation form for tree cover and tree quality were subtracted from the total landscape score, LT in Equation (1), and a new variable, LTNOTREE, was formed for Equation (2). COVER, a measure of the percentage of tree cover on a lot, and its squared term were also added. Initially, the measure for tree quality was included in Equation (2); however, due to non-significance, it was omitted. One can attribute this to the fact that most

[4]The Office of Federal Housing Enterprise Oversight (OFHEO) publishes the Housing Price Index (HPI) using data provided by Fannie Mae and Freddie Mac. The HPI is a measure designed to capture changes in the value of single-family homes in the U.S. as a whole, in various regions of the country, and in individual states and the District of Columbia. The HPI used in this study is for the Lubbock, TX, Metropolitan Statistical Area (MSA), which includes Lubbock and Crosby counties (20).

Table 3. Regression results for equations (1) and (2), with the dependent variable being the natural log of the house sale price (LNSPRICE).

		Equation (1)				Equation (2)			
Variable	Regression coefficient	Coefficient estimate	Std. error	$P(t \geq T_{n-k})$ one-tailed	VIF	Coefficient estimate	Std. error[z]	$P(t \geq T_{n-k})$ one-tailed	VIF
INTERCEPT	b_0	10.82830	0.29679	< 0.0001	0	10.78964	0.46970	< 0.0001	0
SQFT	b_1	0.00024	0.00002	< 0.0001	1.81	0.00026	0.00004	< 0.0001	1.81
HPI	b_2	0.00197	0.00215	0.1814	1.04	0.00258	0.00319	0.2108	1.05
DAYS	b_3	–0.00011	0.00023	0.3125	1.18	–0.00019	0.00044	0.3375	1.19
EXT	b_4	0.03065	0.01107	0.0036	1.22	0.03338	0.01260	0.0052	1.23
LVL2	b_5	0.16280	0.03987	< 0.0001	1.35	0.15502	0.05520	0.0032	1.38
LT	b_6	0.01172	0.00357	0.0008	1.49				
LTNOTREE	b_6					0.00962	0.00530	0.0369	1.33
COVER	b_7					0.00344	0.00165	0.0205	13.43
$COVER^2$	b_8					–0.00004	0.00002	0.0308	13.06
		Summary statistics				**Summary statistics**			
		R^2			0.8608	R^2			0.8572
		F-value			70.1	F-value			49.5
		Prob > F			< 0.0001	Prob > F			< 0.0001
		Root MSE			0.1001	Root MSE			0.1038
		Coeff. of variation (CV, in %)			0.8448	Coeff. of variation (CV, in %)			0.8687

[z]Robust standard errors based on a heteroskedasticity-consistent covariance matrix estimator for OLS.

homebuyers do not recognize specific trees nor can they judge the quality of a tree.

The results for Equations (1) and (2) are discussed in the following section.

Results and Discussion

The ordinary least squares (OLS) regression of Equation (1) is useful in explaining the variation of home prices within the Melonie Park neighborhood of Lubbock, TX, as indicated by the R-square and the coefficient of variation, CV (Table 3). Eighty-six percent (86%) of the variation in sale prices around the sample mean is explained by the variables included in the model. Moreover, the model is accurate in estimating price because the average error in predicting sale price is less than 1% of the mean log sale price (CV = 0.8). The F-Value of 70.1 rejects the null hypothesis that the regression parameters from Equation (1) are all equal to zero ($p < 0.0001$).

The model was examined to insure that all the assumptions for OLS regression hold. Possible colinearity between the independent variables is a concern in regression analysis because it causes the standard deviations of the regression coefficients to become large and makes it difficult to find significance for individual coefficients even though a definite relation exists. Variance inflation factors (VIF) were calculated to aid in identifying variables that are colinear.[5] Based on standard rules of interpretation of VIF's, no evidence was found of colinearity in the independent variables in Equation (1) (19).

Although there is not a strong theoretical backing for the correct functional form of a hedonic model, the log-linear or semi-log form has its advantages over other forms. Malpezzi (17) states that the semi-log form mitigates the common statistical problem of heteroskedasticity, or changing variance of the error term. Heteroskedasticity precludes generalization and external validity because, although the estimates are unbiased and consistent, the OLS standard errors are biased and lead to invalid significance tests. The Breusch-Pagan test was calculated for Equation (1) and indicated that heteroskedasticity was not a problem at the 5% significance level.

Influence of house characteristics on sale price. The estimated regression coefficients for the housing characteristics in Equation (1) are consistent with previous research and expectations (Table 3). Variables for square footage (SQFT), exterior features (EXT), and two levels (LVL2) all have an expected positive influence on the sale price and are statistically significant ($p < 0.01$). In a semi-log model, the coefficient for a continuous variable, multiplied by 100, gives the approximate percentage change in Y for a one-unit change in the X variable (i.e., $\%\Delta Y \approx b_i \cdot 100$). The coefficient of SQFT indicates that each additional square foot of living space increases sale price by 0.024%. The coefficient on EXT indicates that the addition of one exterior feature adds 3% to the sale price. Exterior features in the data set include items such as covered patios, sprinkler systems, outdoor storage sheds, hot tubs or spas, and cul-de-sac or corner lots. The coefficient of LVL2 indicates that two-story homes sell for 17.6% more than one-story homes.[6]

Two time-related variables were included to control for the influence of price changes over time: Housing Price Index (HPI) and days on market. The HPI serves as an indicator of the house price trend in Lubbock, TX. The estimated coefficient for the HPI variable in Equation (1) indicates that house sale prices in Melonie Park increased by 0.2% for each one-point change in the HPI ($p = 0.18$, Table 3). The duration of time the home remained on the market (measured by the variable DAYS in Table 3) has a negative effect on house price; each additional day on the market implies a 0.011% decrease in price. A home remaining on the market for 90 days beyond the average duration (85 days for Melonie Park for 2003–05, Table 2) has a decrease in value of about 1%. Note that the HPI and DAYS variables both have the expected signs but are not significant at common significance levels.

Previous studies of the residential housing market have presented detailed models with more structural characteristics included than what is presented in this study. Henry (9) states that the addition of other attributes adds little to the explanatory power in his model and some variables, such as the number of bedrooms and square footage, are highly correlated. Similar results were seen in this study when a large number of detailed structural variables were included such as number of bedrooms, bathrooms, fireplaces, garages, etc., and consequently they were omitted. In addition, various measures of interior quality were initially included in the model; however, the results were not significant because there was not enough variation in the sample.

Influence of landscape characteristics on sale price. Equation (1) includes the variable LT which is the total landscape quality score from the landscape evaluation. The estimated coefficient (0.01172) is positive, as expected, and significant and indicates that improved landscaping is associated with higher property values (Table 3). The interpretation is that a one-point increase in the landscape quality score is associated with a 1.17% increase in house sale price. Based on MLS data during the study period, the *average* home in Melonie Park sold for $162,153. With this information and the mean landscape evaluation scores for homes with average, good, and excellent landscaping (Table 2), we calculated the percentage change in sale price and the dollar value added when landscaping is improved from average to good or excellent quality landscaping. An improvement from average to good quality landscaping is associated with an increase in sale price of $9,243, or 5.7%, while an improvement from average to excellent quality landscaping increases sale price by $17,513, or 10.8% (Table 4).

The results from this study for Lubbock, TX, are similar to those reported by Henry (9) for Greenville, SC. Henry's results indicate that improving landscape from average to good quality increases sale price by an estimated 4.8%, as compared to the 5.7% found for Lubbock; and, Henry found when landscaping is improved from average to excellent

[5]The PROC REG procedure in SAS was used to estimate Equations (1) and (2). The VIF option in the MODEL statement of the PROC REG procedure was used to generate VIFs. The VIF for an independent variable, X_i, is: $VIF_i = 1 / (1 - R^2_i)$ where, R^2_i is obtained from the regression of a particular independent variable (X_i) on all the remaining independent variables (26).

[6]For a semi-log equation like Equation (1), a transformation is required before the coefficient of a dummy variable can be interpreted as a percentage change. That is, if b_i is the estimated coefficient on a dummy variable X_i, when ln(Y) is the dependent variable, the percentage change in the predicted Y when $X_i = 1$ versus when $X_i = 0$ is $\exp(b_i - 1/2\hat{V}(b_i)) - 1$, where exp is the exponential function and $\hat{V}(b_i)$ is the variance of b_i (13).

Table 4. Increase in house sale price from improved landscaping based on equation (1).

Beginning quality[z]	Improved quality[z]	Change in total landscape quality score (LT)	% increase in sale price[y]	$ increase in sale price[x]
Average	Good	4.9	5.7	9,243
Average	Excellent	9.2	10.8	17,513

[z]Landscape quality based on the total landscape quality score (LT), with mean scores of average = 7.3, good = 12.2, and excellent = 16.5 (Table 2).
[y]Calculated as change in total landscape quality score (column 3) times 1.172 ($100 \times b_6$ from Equation (1), Table 3).
[x]Calculated as % increase in sale price (column 4) times the average 2003–05 sale price of a Melonie Park house ($162,153, Table 1).

quality, house price increases by 11.7% compared to 10.8% for Lubbock. In both cases, the difference between the estimates of the two studies is less than one percentage point. The fact that the price impacts for a semi-arid area (Lubbock) and a more vegetative area (Greenville) are similar provides some evidence that the findings can be generalized to other areas. Research is needed from other locations to provide additional support for generalizing the impact of improved landscaping on house sale price.

In regard to generalizing hedonic study results, Sirmans et al. (30) conducted a meta analysis of results from hedonic housing models to evaluate variation of hedonic coefficients as location and study period change. Their results show that hedonic estimates indicate some variation across location and time, but perhaps not as much as traditionally believed. The meta analysis covered structural housing characteristics (e.g., square footage, number of bedrooms, etc.) and neighborhood characteristics, but not landscape characteristics that are the focus of this study. The hedonic models of landscape evaluation of Henry and this study show some differences in model specification and coefficient estimates, but close agreement is found in the overall prescriptive knowledge provided by the studies (6). From the perspective of landscape professionals, the results indicate that improvement in overall landscaping increases house value by a strikingly similar percentage across different locations and study periods. It is important to note that the results here (and in Henry's studies) do not indicate how home value is affected by a specific landscape improvement — e.g., adding a certain type of shrub or tree, or a particular floral enhancement to a given landscape. Additional research might be warranted to determine the value of specific features of landscape improvements on home value, and this is left as an area for further research.

Next we present results of the estimation of Equation (2) where tree cover and other landscape features are treated as separate aspects of landscape quality (as discussed in the previous section). Initially, heteroskedasticity was found in Equation (2) based on the Breusch-Pagan test with a chi-square test statistic of 16.71 ($p < 0.05$). A heteroskedasticity-consistent covariance matrix estimator (HCCME) for OLS was used to correct for heteroskedasticity and robust standard errors were calculated.[7] The results for Equation (2) are not greatly different from those of Equation (1). The R-square is 0.86 and CV is still less than 1% (Table 3). The variables for square footage, exterior features, and two-story homes are still positive and significant, having only changed slightly, while the positive coefficient for HPI and the negative coefficient for DAYS continue to be not significant.

The results from Equation (2) show that tree cover has a positive linear relation with house sale price (Table 3). However, in the quadratic specification of Equation (2), COVER and COVER^2 are together only marginally significant based on an F-test ($p = 0.17$). A graph of the quadratic relation between house price and tree cover is shown in Fig. 1 for the *average* Melonie Park house with 2,681 square feet, a single story, two exterior features, 85 days on the market, and a landscape evaluation score of good. Notice that tree cover and sale price move together, with price increasing until a peak is reached at about 40% tree cover. Beyond this level, price declines as tree cover increases. When tree cover increases from 0% (no trees) to 40%, house value increases by an estimated 7.6%. Overall, tree cover has a diminishing marginal effect on house value, with each additional percentage point of tree cover adding a smaller amount to house value. For example, when tree cover increases from 10 to 25%, house value increases by 3.2%, or $5,197. By comparison, when tree cover increases from 25 to 40%, house value increases by only 1.3%, or $2,187. At the peak of the curve in Fig. 1, a wide range exists where house value changes little with varying tree cover percentage, e.g., from 30 to 55% tree cover, house values differ by only 0.7%.

The landscape quality coefficient (excluding tree effect) for LTNOTREE in Equation (2) is positive and significant ($p < 0.05$, Table 3). Compared to the landscape coefficient for LT in Equation (1), the LTNOTREE coefficient is slightly smaller (0.00962 vs. 0.01172). This is due to the fact that tree quality and cover have been removed from the LTNOTREE variable and their effects are now captured by the variables, COVER and COVER^2. Table 5 reports the percentage change in house price and the dollar value added when LTNOTREE is improved from average to good or excellent quality landscaping.

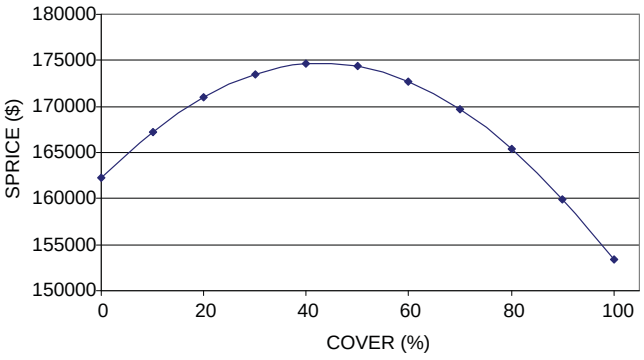

Fig. 1. Relation between house sale price and tree cover percent.

[7]The HCCME = 3 option in the FIT statement in SAS was used to estimate the heteroskedasticity-consistent covariance matrix. This variation approximates a more complicated estimator of Efron (1982, as cited by MacKinnon and White, 1985): $HC3 = (X'X)^{-1} X' \text{ diag } [e_i^2 / (1 - \hat{h}_i)^2] X (X'X)^{-1}$, where $\hat{h}_i = X_i (X'X)^{-1} X'_i$ and e_i is the regression residual (16).

Table 5. Increase in house sale price from improved landscaping based on equation (2).

Beginning quality[z]	Improved quality[z]	Change in total landscape quality score minus tree cover and quality (LTNOTREE)	% increase in sale price[y]	$ increase in sale price[x]
Average	Good	3.6	3.5	5,675
Average	Excellent	7.1	6.8	11,026

[z]Landscape quality based on the total landscape quality score minus tree cover and quality ((LTNOTREE), with mean scores of average = 6.6, good = 10.2, and excellent = 13.7.

[y]Calculated as change in total landscape score minus tree cover and quality (column 3) times 0.962 ($100 \times b_6$ from Equation (2), Table 3).

[x]Calculated as % increase in sale price (column 4) times the average 2003–05 sale price of a Melonie Park house ($162,153, Table 1).

Improvement in landscaping from average to good quality is associated with an increase in sale price of 3.5%, or $5,675 for the *average* Melonie Park house; and improvement in landscape quality from average to excellent quality increases sale price by 6.8%, or $11,026. These impacts are smaller than those reported in Table 4 when tree cover and quality were included in the total landscape quality measure.

The results from Equation (2) can be used to determine the impact of varying tree cover and landscape quality on house value. For example, consider the *average* house in the Melonie Park neighborhood. If the property has 15% tree cover and landscape quality is in the average category, the estimated house value from Equation (2) is $163,527.[8] If tree cover is increased to 40%, house value increases to $168,676, which represents a 3.1% increase. Continuing, if we take the house with 40% tree cover and improve the landscaping to excellent quality, the estimated house value increases to $180,669, which is 10.5% above the value of $163,527 for a house with average landscape and 15% tree cover. The increase in tree cover from 15 to 40% is responsible for 3.1% of the 10.5% total increase in house value. In this example, approximately 30% of the increase in sale price is accounted for by added tree cover.

Return on investment in improved landscaping. The results in Table 4 show that improving landscaping from average quality to excellent quality adds an estimated $17,513 to the value of the *average* house in the Melonie Park neighborhood of Lubbock, TX. This begs the question, what is the cost of making improvements in a Melonie Park landscape to upgrade it from average to excellent quality?

To answer this question, cost of improving the landscape quality of three sample homes was estimated. Three homes having average rated landscapes were randomly selected from the sample. A local landscape firm estimated the cost of upgrading the average landscapes to excellent quality. The landscape scoring system used to evaluate Melonie Park landscapes was explained to the firm representative. Photographs of the three randomly selected homes were provided along with photos of 8–10 homes with excellent rated landscape scores for comparison. Using the photographs, the firm representative developed an estimated cost of $11,000 to improve an average quality landscape to excellent quality for the Melonie Park neighborhood. This estimate was based on 2008 landscaping costs.

An influential characteristic of an excellent quality landscape in Melonie Park is its maturity. As most homes and landscapes in Melonie Park are about 40 years old, the initially established landscapes have developed significant growth and maturity and many of the landscapes have been upgraded and modernized. Clearly, the initial cost of upgrading a landscape does not include the additional cost required to maintain the landscape until the elements achieve maturity in appearance and function. In the last paragraph we discussed the procedures used to estimate the cost of upgrading a landscape, but the problem we face is that an upgraded landscape is not comparable to the mature landscapes rated excellent in this study. Thus, to adjust for lack of maturity in our upgraded landscape, we made the assumption that a landscape would have to be in place for several years to reach maturity. Five years was chosen as a reasonable time period for the landscape to mature to the level a buyer would consider as an excellent quality landscape. The annual cost to maintain an excellent quality Melonie Park landscape was obtained from local landscape maintenance firms in Lubbock. Maintenance was specified to include lawn care, weed abatement, pruning for shrubs and trees, and watering cost for the lawn, shrubs, flowers, and trees. Based on 2008 costs of labor and materials, the cost of landscape maintenance for an excellent quality landscape in Melonie Park was estimated to be $800 per year, or $4,000 for the five-year period required for the landscape to reach maturity.

When comparing the value added and cost of improving a landscape, an adjustment must be made if the value and cost are for different years. For this study, the estimated $17,513 value added was developed from the hedonic analysis based on sample data for 2003–05, while the landscape upgrade and maintenance cost of $15,000 ($11,000 for upgrading and $800 per year for five years for maintenance) was obtained from landscape firms in 2008. To account for the impact of inflation between 2004 and 2008, the 2008 cost of $15,000 was deflated to a 2004 basis of $13,000 (with the deflation adjustment based on the Consumer Price Index for All Urban Consumers (32)). By dividing the value added of $17,513 by the improvement/maintenance cost of $13,000, we obtained a value-to-cost ratio of 1.35. This ratio indicates that for each $1.00 invested in improving a landscape, a $1.35 is returned in added property value. It is important to note that, in addition to the investment return, an improved landscape provides aesthetic beauty and a relaxing quality to a homeowner and the neighbors on a daily basis (11). The favorable investment return plus the intangible aesthetic beauty of an improved landscape makes it advisable for a homeowner to consider an investment in improved landscaping.

[8]The predicted price ($\hat{P}$) is obtained using the following equation from Wooldridge (33):

$$\hat{P} = \exp(\ln\widehat{(P)} + 1/2s^2)$$

where exp = exponential function;
$\ln\widehat{(P)}$ = predicted price from Equation (2) in Table 3;
s^2 = Root MSE from Equation (2) in Table 3.

To summarize, results from this study show increased property value with improvements to landscaping and added tree cover. These results are consistent in both magnitude and direction with those of previous studies evaluating the impact of landscape quality and tree cover on residential property value. The results show that improvement in landscaping from average to excellent quality increases house sale price by 10.8%, with approximately 30% of the increase in sale value due to added tree cover. When a house is viewed as an investment, the results in this study show that each $1.00 invested in upgrading an average landscape to excellent quality returns $1.35 in added property value. It is important to note that, in addition to added value, an improved landscape provides a relaxing and enriching quality for the homeowner and the neighborhood. Moreover, tree cover is important to the homeowner because trees provide shade in summer and shelter in winter, possibly reducing heating and cooling costs. This research may prove beneficial for the nursery and landscape industries as they market their goods and services to homeowners.

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