

Purchase of Development Rights in Fayette County: A Hedonic Price Analysis of Easement Payments

**Submitted by Perry A. Papka
March 30, 2006**

**Capstone in Public Administration
Martin School of Public Policy & Administration
University of Kentucky**



Table of Contents

I. Executive Summary.....	3
II. Issue Statement.....	4
III. Development Pressure in Fayette County, KY.....	6
IV. The Purchase of Development Rights Program.....	8
Funding.....	8
Farm Selection Criteria	9
Valuation of Easements	12
V. Literature Review	13
Valuation of Conservation Easements	14
Use of Hedonic Price Analysis	16
VI. Methodology	18
Independent Variables & Expected Effects	19
VII. Results of Analysis	21
VIII. Estimates of Development Right Costs	24
Farm Level Estimates	25
Characteristic Level Estimates	26
IX. Limitations of Analysis	28
X. Conclusions	29
XI. References	31
XII. Appendix A (Maps)	33
XII. Appendix B (Tables)	35

I. Executive Summary

In January of 2000, the Lexington-Fayette Urban County Government established a *purchase of development rights* (PDR) program as part of the comprehensive Rural Service Area Land Management Plan. The goal of the program is to purchase conservation easements on 50,000 acres of farmland and natural areas within the county by the year 2020. By purchasing the development rights of these lands, the program intends to preserve the agricultural and natural character of the county that development pressures otherwise threaten.

Typically, PDR programs calculate the value of a conservation easement by subtracting the current value of the property with the easement in force from the current value of the land if it were to be developed. While there are rules to appraising consistency remains an issue. As well, traditional techniques may not capture values on which public land programs place an emphasis. Some researchers and policy makers suggest using a point or attribute-based system reflecting the contribution of certain characteristics to easement values. In the past, this has proven difficult due to the lack of data on easement values. Such a system, if properly modeled, could provide an alternative and/or supplement to costly appraisals.

A hedonic price analysis of 116 easement transactions in Fayette County, from 2001 to 2005, provides information on easement costs and the contribution of specific characteristics to these costs. The estimated model explains 33.65% of the observed variation in easement values. Results of this analysis suggest that the marginal contributions to easement cost of several parcel characteristics are significant including the following: parcel size, distance from urban center, adjacency to other lands under easement or designated for long-term natural resource use, adjacency to or within the view of the interstate, within the view shed of public lands, within a national or local historic district, designation as a national historic landmark, possessing registered or significant archeological sites.

Considering these characteristics carefully when evaluating applicant farms may reduce total purchase costs and maximize social benefits. Specifically, program administrators can use this information to refine the relative weights of the selection criteria to focus on the most desirable mix of parcel attributes.

This type of analysis can also be used as an alternative to traditional, more costly appraisal systems. Fayette County's current appraisal fees are approximately \$2,500 for each farm. Using a formula-based appraisal to eliminate this cost for the remaining land needed to reach the program's goal could save over \$700,000 in current dollars. Moreover, this report suggests savings approaching \$9 million, in current dollars, could be realized by purchasing the remaining land needed (36,000 acres) to reach the program's goal using this report's estimates vs. the current actual average. As the pool of land available for participation diminishes and funding sources tighten, efforts to reduce costs and maximize available dollars may be prudent.

II. Issue Statement

The conversion of agricultural lands to nonagricultural uses represents a substantive policy issue for all levels of government. At the federal and state level, various policies seek to address this concern. For example, the 1981 Farmland Protection Policy Act directs federal agencies to reduce or eliminate farmland conversion caused by federal programs. Additionally, the Farm and Ranch Land Protection Program, administered by the USDA, distributes grants to states and localities to purchase conservation easements. Many state governments offer property tax relief to farms in the form of preferential use value assessments meant to discourage the sale of agricultural land for development. Policies at the local level represent the most direct response to farmland conversion, typically through zoning ordinances that restrict the type and density of development. Some research argues that these efforts have proven ineffective at preserving farmland (Buist, Fischer, Michos, & Tegene 1995).

Beginning in the 1970s, governments developed new policy tools to discourage the conversion of agricultural lands for development purposes. In addition to preserving agricultural capacity, advocates for land preservation cited a growing list of reasons for new policy approaches including: open space amenities, economic growth, and environmental protection. One such tool meant to address these concerns is *purchase of development rights* (PDR) programs. PDR programs use the legal instrument of easements to establish common property rights over qualifying lands. In the case of local governments, the county or municipality purchases the conservation easement from the land owner, precluding the development of the land in perpetuity. The owner maintains all other rights over the land, but divests the right to develop.

Principally, PDR programs attempt to preserve the maximum amount of socially desirable land given available funds. Preferred land attributes, as well as the amount and source of funding, varies among states and local jurisdictions. For example, Daniels (1990) notes that certain localities more heavily weight development pressure in selecting land to purchase, while others focus on the land's agricultural potential. Additionally, local programs across the U.S. purchasing agricultural conservation easements receive funds from various sources. These include bond issues, state/federal transfers, general appropriations, real estate transfer taxes, and property taxes (American Farmland Trust, "Status of Local PACE Programs", 2005).

As PDR programs expand, several questions with respect to implementation consistently arise. Primarily, program administrators find difficulty maximizing the public's preferences for land preservation, while also minimizing program costs. The fiscal constraints imposed upon government budgets often compel administrators to purchase less land than is desirable, thus undermining the chief program goal of preservation. By focusing analysis on the major implementation elements of a PDR program, efficiencies may be identified that reduce cost and maximize social welfare. These elements include 1) funding sources 2) selection mechanisms for ranking and choosing lands to purchase and 3) appraisal methods for valuing conservation easements.

This report evaluates the PDR program of Fayette County, Kentucky with respect to its farm selection and appraisal system. A review of the county's program provides a précis illustrating the program's development and key components. Subsequently, a hedonic price analysis of easement transactions made from 2001 to 2005 provides

information on easement costs and the contribution of specific characteristics to these costs. This type of analysis can be used as an alternative to more costly, traditional appraisal systems. As well, such an analysis may aid in crafting selection criteria that include attributes land markets typically do not capture. Fayette County's program administrators may use this analysis to reduce costs and/or to refine current procedures. Moreover, Fayette County's program represents the pilot for the state of Kentucky. Other counties may find the information in this report useful in developing and implementing their own PDR programs.

III. Development Pressure in Fayette County, KY

According to the U. S. Department of Agriculture's (USDA) Census of Agriculture, Fayette County contained 738 farms in 2002, a reduction of 11% from the 826 farms counted in 1997. The actual number of acres in farming decreased by 14% over the same time period. Even with this decline, the county ranks #2 in Kentucky in terms of agricultural cash receipts, selling approximately \$289 million in agricultural products in 2003. Moreover, Fayette County maintains one of the most famous and productive horse industries in the world serving as the bedrock of an estimated \$669 million tourism industry providing over 14,000 jobs (ftp://ftp/lfucg.com/AdminSvcs/PDR/King_Info.pdf).

The Lexington-Fayette Urban County government (LFUCG) utilizes a mix of policy tools to manage development and urban growth. Since 1958, the city has maintained an "urban services area" (USA) demarcating the extent to which the

government develops services such as sanitary sewers. Reviewed and updated every five years, the USA complements more traditional tools such as zoning ordinances.

From 1964 until 1998, the “rural service area” (RSA) had a zoning density of 1:10- meaning land owners retained one development right per ten acres of property. From 1990 to 1998, the county saw a rise in the creation of ten acre lots in the RSA as these properties became more economically viable for single-family residences. During this period, property owners platted 429 new lots over an area of 4740 acres (LFUCG Rural Land Management Plan, 1999). Due to such pressure from a growing urban fringe, the city began a process to develop a Rural Service Area Land Management Plan (RLMP). The RLMP ultimately catalogued the land capabilities for the entire county outside of the USA and provided policy alternatives to manage growth and development. These alternatives included the development of a PDR program to preserve agricultural and natural lands indefinitely.

Prior to the adoption of the RLMP in 1999, the city placed a moratorium on ten acre plats in the RSA. The new zoning density changed to 1:40- meaning land owners retained one development right per forty acres of property. To make this *down-zoning* more palatable to land owners, the new ordinance included a sunset provision. It required the city to adopt and adequately fund a purchase of development rights program. Otherwise the zoning density would revert back to the ten acre level (Margaret Graves Personal Communication, 2006).

IV. The PDR Program

In January of 2000, the city council passed Ordinance No. 4-2000 establishing the new PDR program. Program goals included purchasing the development rights of 50,000 acres in the RSA by the year 2020. This area represents nearly 27% of the entire county and 41% of eligible lands defined as “natural areas” or “core agricultural and rural land” in the RLMP (see Appendix A for a map of these lands). The acquisition of these lands will “preserve and manage agricultural, rural and natural lands” (LFUCG Ordinance 4-2000, p. 1). To date, conservation easements for approximately 16,000 acres have been acquired (see Appendix A for a map of these lands). While the rate of easement purchases may be viewed as a program success, challenges remain in achieving the overall goal. Issues related to funding, farm selection, and easement valuation may be problematic in the future as the supply of land available for participation declines.

Funding

Fayette County’s PDR program receives funding from a mix of sources including: general appropriations from the city government, the issuance of general obligation bonds, and state and federal transfers. Table 1 provides a summary of these funds through the year 2005.

Table 1: Total PDR Funds through 2005

	General Appropriations	G.O. Bonds	State Transfers	Federal Transfers
Total	\$4.4 million	\$12.5 million	\$15 million	\$6.9 million

Source: Billy Van Pelt, Personal Communication, 2006 & LFUCG Finance Records

The program initially received a one-time, \$15 million grant from Kentucky’s Agricultural Development Board. Local G.O. bonds matched these funds, as well as a commitment of \$2 million per year from the city council. Currently, the program has

utilized the balance of the state grant and average appropriations from the city are \$1.1 million (Billy Van Pelt, Personal Communication, 2006). The federal Farm and Ranch Lands Protection Program (FRLP) provides additional funds, but must be matched dollar for dollar.

The initial state grant allowed the city to avoid a potentially difficult public referendum to initiate a new tax to fund the program. Bond issues have continued to provide monies needed for easement acquisitions. As more land is preserved and development pressures continue, easement costs are likely to increase. Fiscal pressures to appropriate revenues elsewhere may limit these financing options. Moreover, federal dollars appropriated to the FRLP have declined 34% in the past three years (http://www.farmland.org/policy/farm_conservation_funding_frpp.htm). Recognizing these strains on funding sources, program administrators acknowledge that a dedicated source of funding may become necessary (Donna Counts and Margaret Graves, Personal Communication, 2006). Efforts made to reduce administrative and land acquisition costs could ease future financial strain and make potential public tax referenda practicable.

Farm Selection Criteria

Most PDR programs use a variation of the USDA's *Land Evaluation and Site Assessment* (LESA) system to assess and prioritize farms seeking to participate. Initially used to implement provisions of the Federal Farmland Protection Act of 1981, state and local governments have widely adopted this framework for their own programs (Coughlin et. al., 1994). The USDA's Natural Resource and Conservation Service defines LESA as "a technical framework to numerically rank land parcels based on local

resource evaluation and site considerations” (<http://www.nrcs.usda.gov/programs/lesa/>).

LESA essentially provides a mechanism by which program administrators can prescribe socially desirable parcel characteristics, assign these weights, score parcels and prioritize applicants such that the program may acquire the most desirable lands given the amount of funding available. Two elements comprise the LESA assessment:

1. Land Evaluation- This assesses agricultural value typically through measures of soil quality.
2. Site Assessment- This assesses non-soil factors related to agricultural use, factors related to development pressure, and other locally specific public values.

Typically, LESA criteria are crafted and weighted in order to reflect broader program goals. The following reasons for preservation are cited in the originating ordinance of Fayette County’s PDR program:

1. Maintenance of scenic views and historical landmarks.
2. Preservation of cultural identity and sense of place
3. Maintenance of agricultural and tourism economy.
4. To enhance planning for future urban needs and growth management.

Table 2 provides the detail of LESA criteria utilized by Fayette County including a description, maximum point value, and the relative weight of the category.

Table 2: Fayette County LESA Criteria, Points, and Weights

LESA Category	Description	Maximum Point Value	Relative Weight
1	Size (Acres)	12	9%
2	Give Up 40 Acre Right	8	6%
3	Road Frontage (Feet)	5	4%
4	Proximity to Other PDR	10	7%
5	Batch Application	5	4%
6	Soil Quality	30	21%
7	Active Farming	5	4%
8	Agricultural Improvements	5	4%
9	Environmentally Sensitive Areas	5	4%
10	Designated Rural Greenway	5	4%
11	Designated Focus Area	10	7%
12	Natural Protection Areas	5	4%
13	Linkages	4	3%
14	Historic/Cultural Resources	11	8%
15	Scenic Resources	11	8%
16	Eliminate Nonconforming Tracts	10	7%
	TOTAL +	141	100%
17	Proximity to Urban Service Area	-15	-11%
18	Urban Development	-30	-21%
	TOTAL -	-30	-21%

The categories for parcel size, soil quality, active farming and agricultural improvements proxy for agricultural viability. Together, these comprise 38% of the total possible score. Environmental attributes account for 18% of the total possible score including location within an environmentally sensitive area, rural greenway, focus area, or natural protection area. These characteristics proxy for whether the land represents critical habitat or a groundwater recharge site, but also capture open space amenities. Scenic and historic/cultural attributes comprise 16% of the total possible score. These include whether location on designated scenic roads, location within a historic district, or retention of traditional stone fencing. Lastly, the negative scores for proximity to the USA and urban development reflect a compromise with land developers during the program's creation. The development community wanted to avoid an "emerald necklace" of preserved land around the border of the urban service area. To this end, farms within one mile of the USA or within certain sewerability districts receive a reduction in points (Margaret Graves, Personal Communication, 2006).

Fayette County's LESA system attempts to capture the broader social value of attributes not necessarily associated with agricultural productivity. The inclusion and relative weights of the environmental, scenic, historic, and cultural attributes reflects local preferences regarding these features. Several of these (i.e. stone fencing and archeological sites) set Fayette County apart from other local and state programs across the country (Coughlin et al., 1994; Wright et al., 1983; Daniels, 1990). Other counties in Kentucky implementing PDR programs may choose categories and weights more suited to their local economy and development pressures.

Valuation of the Easements

Typically, PDR programs calculate the value of a conservation easement by subtracting the current value of the property with the easement in force from the current value of the land if it were developed, termed the *before-after* approach (Vicary, 1994). To arrive at these values real estate appraisers typically utilize comparable sales data and/or the capitalization of income approach.¹ While there are rules to appraising, consistency remains an issue, as well as whether these techniques can capture values on which public land programs place an emphasis.

Fayette County takes a unique approach to valuing conservation easements for lands applying to its PDR program. While utilizing the *before-after* approach, the PDR ordinance defines the *before* value as the “unrestricted value of the tract...as of August 26, 1998” (LFUCG Ordinance 4-2000, p. 4). Immediately following this date, a moratorium on ten acre plats took place effectively reducing the option value of land in the rural service area. Therefore, the *before* value represents not a current value, but a value restricted to a particular time. The *after* value remains the current value of the land as encumbered by the conservation easement. Problems with this approach, as well as challenges faced by traditional appraisal techniques in valuing easements, will be discussed further in this report’s literature review.

Despite problems associated with the ability of appraisal techniques to capture the true economic value of easements, Fayette County’s program has proceeded without much complaint (Maner Ferguson, Personal Communication, 2006). The existence of

¹ Capitalization of income equals the net present value of all future streams of rent to the land.

four years worth of easement transactions between the PDR program and land owners enables an analysis of easement values. Specifically, estimates can be made using a hedonic price analysis of the average easement value per acre given certain parcel characteristics. Such an analysis could provide a less costly alternative (currently \$2,500 per appraisal) to existing appraisal techniques, and also derive the marginal contribution of certain attributes to easement values (Lynch and Lovell, 2002). Policy makers and program administrators may use this information when implementing new or refining existing PDR programs.

V. Literature Review

A broad scope of academic literature exists with respect to land use, growth management and the economic implications of various policy alternatives, particularly zoning regulations (Fischel, 1990). Narrowing the extent of research to farmland protection programs yields a thinner body of literature more appropriate to Fayette County's PDR program. Researchers have taken various approaches to evaluating farmland and programs whose primary goal is preservation. For example, Libby (1997) takes a broad brush to farmland protection policies and their effect on the efficiency of land use. Peddle (1997) uses a descriptive approach to illustrate the effect certain growth management alternatives have on agricultural land values. More specifically, Daniels (1991) offers a comprehensive review of PDR programs and specific pros and cons of interest to policy makers. Kline and Wichelns (1996) study public preferences regarding the goals of farmland preservation in Rhode Island. Their research reveals a strong belief that environmental objectives- including critical habitat and groundwater protection-

should be central to preservation programs. In evaluating preservation programs in Maryland, Lynch and Musser (2001) determined the relative efficiency of programs in achieving the goals of preserving productive, contiguous farms and maximizing the total number of acres under easement. While this research largely informs the discussion of Fayette County's program, other literature deals more closely with the focus of this report. Specifically, an examination of the literature with respect to the valuation of easements and the use of hedonic price analyses informs this report.

Valuation of Conservation Easements

Lassner (1998) defines the value of a conservation easement as “the difference between the value of the land without conservation restrictions and the value of the land after restrictions have been imposed” (p. 146). This calculation, illustrated below, has long been the accepted method for valuing easements and is termed the *before and after* method (Vicary, 1994).

$$\text{➤ Before Value (Unencumbered by Easement) – After Value (Encumbered by Easement) = Value of Easement}$$

The dominant use of this method primarily reflects the lack of data regarding actual sale transactions of land encumbered by easements (Byrne and Minck, 2000). Moreover, inconsistencies arise with respect to what constitutes the actual before and after values of the land.

Commonly, the before value represents the *highest and best* use of the land in question. Byrne and Minck (2000) define the highest and best use as “the reasonable and probable use that supports the highest present value” (p. 414). Typically, the value of the

land in development constitutes the before value. The after value of land is subject to considerably more variation. Generally, analyses of land sales having similar attributes to the parcel of interest provide the before and after values. This proves difficult for the after value due to underdeveloped markets for encumbered lands. In the absence of such data, the appraiser must derive a discount to the land caused by the easement restriction. Alternatively, some preservation programs calculate the after value as the most profitable agricultural use in the area. For example, Rhode Island's PDR program utilizes this method and subtracts the estimated value of turfgrass production from the fair market value defined by the land's highest and best use (Wichelns and Kline, 1993).

The alternative to the *before and after* method utilizes *direct comparable sales*. Much of literature challenges this approach due to the lack of data with respect to sales of land with easement restrictions (Vicary, 1994; Lassner, 1998; Byrne and Minck, 2000; Buist et al, 1995). Vicary (1994) and Byrne and Minck (2000) note that federal regulators increasingly prefer the direct comparison method as more data becomes available.

As previously discussed, Fayette County employs a variation of the *before and after* method. The PDR ordinance defines the after value as the current value of the restricted land, while the value of the land fixed in 1998 (prior to more restrictive zoning regulations) represents the before value. This approach remains open to questions raised by Buist et al. (1995) and Plantinga and Miller (2001) with respect to the ability of standard appraisal methods to capture the option to develop in the future. Specifically, current methods cannot predict future rents from development or when development

might occur. Therefore, the “option” to develop may not be capitalized into the easement value. Moreover, other researchers suggest that current methods may not capture the value of characteristics that are socially desirable (Wichelns and Kline, 1993; Lynch and Lovell, 2002; Loomis et al, 2004). Some researchers and policy makers suggest using a point or attribute-based system reflecting the contribution of certain characteristics to easement values. In the past, this has proven difficult due to the lack of data on easement values. Such a system, if properly modeled, could provide an alternative and/or supplement to costly appraisals.

Use of Hedonic Price Analysis

Economists typically use hedonic analyses to estimate property value differentials stemming from public goods such as air or water quality (Loomis et al, 2004). Since property sells as a bundle of attributes, knowledge of the value of each attribute provides an estimate of the benefit derived from that attribute. Hedonic analyses derive this information by decomposing land value into the “marginal implicit price” for each attribute. Chicoine (1981), in oft cited research, utilized the hedonic method to estimate farmland values at the urban fringe of Chicago. He hypothesized that determinants of land value included distance to urban area, road frontage, soil quality, access to services (i.e. sewer), natural amenities, parcel size, and use restrictions. Shonkwiler and Reynolds (1986) conducted a similar analysis on land surrounding the Sarasota-Bradenton area of Florida. These studies provide a theoretical framework for hedonic analyses, but do not specifically address transactions involving the sale of conservation easements and development rights.

Loomis et al. (2004) estimate a hedonic model for the purchase of lands and easements to preserve open space along the Front Range in Colorado. Their model included independent variables such as parcel size, access to water, and adjacency to other public lands. Similarly, Wichelns and Kline (1993) estimated the appraised value of development rights for 34 parcels participating in Rhode Island's PDR program. Their model regressed the development right value against the parcel size, distance from urban areas and the coast, road frontage, and a scenic view of water. The estimated price elasticities showed that as distance from urban areas and parcel size increased, the value of the development right decreased. As well, a view of water and an increase in road frontage increased the development right value.

Lynch and Lovell (2002) improved upon previous work by analyzing 409 actual easement transactions in three Maryland counties. Their model regresses actual easement value per acre against parcel size, distance to city and town, soil quality, proximity to other preserved parcels, and current land use. Similar price effects to that of Wichelns and Kline resulted from this hedonic price analysis. Easement values decreased as parcel size and distance from urban areas increased. Interestingly, Lynch and Lovell hypothesized that easement values would decrease as soil quality increased. Better soils indicate greater agricultural productivity and landowners may accept lower easement payments reflecting higher net returns to agricultural. In contrast to the hypothesis, easement values actually increased with higher quality soils.

The research discussed above provides the theoretical and empirical basis for the hedonic price analysis of easement transactions in Fayette County. Such an analysis has

two major functions: 1) estimates the price per acre for various parcels with a particular combination of attributes and 2) acts as a guide to the cost of various desirable characteristics (Loomis et al, 2004). These estimates may provide a possible alternative to traditional, more costly appraisal systems and guide future decisions with respect to selection criteria that attempt to maximize social preferences given available funds.

VI. Methodology

Actual LESA assessments and easement purchases on 116 farms in Fayette County, from 2001 to 2005, constitute the data for the hedonic price analysis. PDR program staff provided the information in the following format: 1) individual LESA scoring sheets for each farm and 2) condensed spreadsheets showing the appraised values of the land and the actual value of the easement paid to the land owner. LESA criteria provide the independent variables for the hedonic price analysis. Since these criteria prioritize farm parcels based on parcel characteristics, as well as reflect social preferences, it is reasonable to use them to evaluate the cost of actual easements. The data were merged and used to estimate the following empirical model as an ordinary least-squares regression:

$$\begin{aligned} \text{➤ } \ln(\text{ease } \$/\text{acre}) = & \ln\beta_0 + \beta_1\ln(\text{acres}) + \beta_2\ln(\text{distance}) + \beta_3(\text{ownership}) + \beta_4(\text{frontage}) \\ & + \beta_5(\text{proximity}) + \beta_6(\text{soil}) + \beta_7(\text{environmental}) + \beta_8(\text{scenic}) + \beta_9(\text{cultural}) \end{aligned}$$

The non-linear functional form selected for the model displays the influence of the marginal value of one variable on another. As well, the double-log form allows the regression coefficients to be interpreted as price elasticities (Loomis et al, 2004). From this model, cost functions can be inferred for lands with particular attributes.

Many of the independent variables selected conform to those found in the literature including: parcel size, distance from urban area, road frontage, soil quality, and proximity to other preserved parcels (Loomis et al, 2004; Lynch and Lovell, 2002; Wichelns and Kline, 1993). The LESA assessment conducted by Fayette County includes measures of environmental, scenic and cultural attributes that previous research lacked in analyses of easement prices. Valuing these characteristics provides information with respect to how the market may discount socially preferred lands.

Independent Variables & Expected Effects

Table 3 below provides a summary of the independent variable categories, their proxy characteristic, and the expected effect on the easement value.

Table 3: Expected Effect of Independent Variables

Variable	Proxy For	Expected Sign	Variable	Proxy For	Expected Sign
Parcel Size	Agricultural Value	-	Proximity to Other Lands		+
Distance	Development Pressure	-	Soil Quality	Agricultural Value	-
Retained Ownership	Development Pressure	-	Environmental Attributes		Uncertain
Road Frontage	Development Pressure	+	Scenic Attributes		Uncertain
Proximity to Preserved Parcels		+	Cultural Attributes		Uncertain

The expected effects of the independent variables follow expectations from the literature previously cited. Parcel size represents a proxy for agricultural productivity and should decrease the easement value as size increases. The other proxy for agricultural productivity, soil quality, is measured as a series of five dummy variables reflecting various percentages of prime farmland. A decline in easement value should occur with higher quality soil resulting from a farm owner’s higher expected income from more productive land.

Distance, a proxy for development pressure, measures the miles from the parcel to the main office of the Lexington-Fayette Urban County Government. Despite the crude calculation of this value by Google^R Maps, an increase in distance from the city center should lower the value of the easement. An increase in road frontage, measured as a series of three dummy variables representing various levels of feet, should increase the value of the easement. Additionally, some farm owners choose to retain 40 acre development rights. This allows them to build another residence, particularly for family members. Retaining this ownership right should significantly reduce the value of the easement.

A series of dummy variables measured proximity to other preserved parcels and to lands designated for long-term natural resource use or conservation. An increase in proximity was expected to increase the value of easements capturing the spill-over effect associated with the environmental amenity. The expected effects of other environmental attributes remained uncertain. These included dummy variables reflecting parcel location within environmentally sensitive areas, within a designated rural greenway, within a designated focus area, or within a designated natural protection area. The Fayette County Rural Land Management Plan defines these environmental designations.

As well, the expected effects of specific scenic and cultural/historic attributes remained uncertain. Scenic resources included the following dummy variables: location on a scenic rural road, location on a local/state designated scenic highway, adjacent to or in the viewshed of I-64/I-75, location in the scenic viewshed of public lands, and possessing other features such as tree-lined canopies or significant viewsheds. Cultural

and historic resources included the following dummy variables: placement on the National Register of historic places or a designated local historic landmark, location within a national or local historic district, designation as a national historic landmark, possessing a minimum of 100 linear feet of stone fence, and possessing registered or significant archeological sites.

All independent variables used to estimate the easement value represent LESA measures employed by Fayette County to rank land seeking participation in the PDR program. The LESA assessments provided the best available data given the time constraints of this report. Variables such as parcel size, distance, soil quality, road frontage and proximity have a basis in the academic literature. The additional environmental, scenic and cultural/historic attributes are more particular to this analysis, but provide reasonable measures of important social preferences.

VII. Results of Analysis

Appendix B provides complete tables summarizing the results of the analysis including: the frequency of each LESA characteristic, regression coefficients and their relative effect on easement value, and cost functions estimating the value of particular farms and particular attributes using the hedonic equation. For the 116 farms evaluated, the mean easement cost per acre was \$2,572.32 with an average parcel size of 126.9 acres and an average distance from the city center of 10.2 miles. The frequencies of specific attributes vary widely, but certain ones stand out. Nearly 80% of farms possess greater than 1001 feet of road frontage and contain scenic features such as tree-lined canopies or significant viewsheds. As well, more than 50% of farms are within ½ mile of other

preserved land or land designated for long-term natural resource use or conservation. Over 70% of farms fall within a designated greenway or focus area, while nearly 50% contain registered or significant archeological sites. The estimated model explains 33.65% of the observed variation in the cost of conservation easements. The effects of certain parcel characteristics on easement value are mixed with respect to expectations (see Appendix B, Table 3).

Parcel Size, Distance, Ownership, & Road Frontage

Easement value was expected to decrease as parcel size increased, yet the model observed the opposite effect. For a 1% increase in parcel size, the model suggests easement values will increase 0.08%. On the other hand, the elasticity of distance suggests that a 1% increase in distance from the city center decreases easement values by 0.23%. As expected, retaining 40 acre development rights had a negative and significant impact on easement value. The coefficient suggests that the retention of such rights decreases easement value by 40.7%. The amount of road frontage had no statistically significant impact on easement values. A joint f-test on the three dummy variables representing this category confirmed this result (Appendix B, Table 4).

Soil Quality

The coefficients on the five dummy variables representing soil quality were all positive, but statistically insignificant. A joint f-test revealed that the null hypothesis that the dummy variables together have no effect cannot be rejected (Appendix B, Table 4). The absence of an effect may reflect how little soil variation is observed in a small area

such as a single county. Moreover, the importance of soil quality to the dominant equine-based industry in Fayette County is uncertain.

Proximity to Other Preserved Lands

Proximity to other preserved land or lands designated for long-term natural resource use was expected to increase easement value, yet results were mixed. The coefficient for adjacency to other preserved lands is negative and significant. This suggests that easement values for farms adjacent to lands with conservation easements decline 13.85%. Conversely, the model suggests that easement values for farms adjacent to other lands designated for long-term natural resource use increase by 23.68%. Joint f-tests on the three dummy variables representing each of these proximity categories rejected the null hypotheses of no effect at statistically significant levels (Appendix B, Table 4). This may reflect the market's preference for property closer to public lands with long-term protection, rather than private land in which protection remains unclear and access more restrictive.

Environmental Attributes

Expectations for environmental attributes in the model were uncertain. Negative coefficients on five of the six dummy variables suggest that the market discounts lands in these areas. Only one of these variables, location within a designated focus area, approached statistical significance. The coefficient for focus areas suggests easement values for lands in such areas decrease by 15%.

Scenic Attributes

Expectations for scenic resources in the model were also uncertain. Negative coefficients on four of the five dummy variables suggest that the market discounts farms with such attributes. Location within the viewshed of public land or being adjacent to or seen from the interstate both had statistical significance. This suggests that easement values for lands with these attributes decrease by 11% and 14.75%, respectively. In contrast, the model suggests easement values for lands with other features such as tree-lined canopies or scenic viewsheds increase by 12.5%. Such a contrast may reflect the market's preference for land outside of the public's view, but with some measure of internal environmental attributes.

Cultural & Historic Attributes

Three of the five dummy variables reflecting cultural and historic attributes were statistically significant: location within a national or local historic district, designation as a national historic landmark, and possessing registered or significant archeological sites. The estimated coefficients suggest that easement values for farms with these attributes increased by 30%, decreased by 17.25%, and decreased by 12.2%, respectively. This may reflect the difficulties in developing property with archeological sites or historic landmarks, while acknowledging some preference to locate within a historic district.

VIII. Estimates of Development Right Costs

The results discussed above suggest certain farm attributes serve to either increase or decrease the amount paid for conservation easements. For example, the model estimates that distance from the city center, adjacency to preserved land, the presence of

archeological sites, and adjacency to or views of the interstate all decrease easement values. Conversely, the model suggests that larger parcel size, adjacency to lands designated for long-term natural resource use, and location within a national or local historic district all increase easement values. From the results of the model, which utilized actual transaction data, cost functions for properties with particular attributes may be estimated. Such estimations may offer an alternative to more costly and time consuming traditional appraisal methods.

Farm Level Cost Estimates

Table 4 below presents per acre costs for several farms. It reports both the actual transaction value and the easement value derived from the model (see Appendix B, Table 5 for more detail).

Table 4: Cost Functions for Certain Parcels Using Regression Estimates

Category	Variable	Highest Scoring Farm	Lowest Scoring Farm	Mean Scoring Farm	Estimated Typical Farm
Descriptors	Total Point Score	112	22	76	N/A
	Actual Easement				
	\$/Acre	\$ 3,000.00	\$ 1,746.00	\$ 3,120.00	\$ 2,572.32
	Estimated				
	Easement \$/Acre	\$ 2,413.17	\$ 2,134.24	\$ 3,392.65	\$ 2,318.66
		\$ 586.83	\$ (388.24)	\$ (272.65)	\$ 253.66

Results in Table 4 suggest that for the farm scoring highest on the LESA assessment the actual easement value exceeded the model’s estimate by \$586.83 per acre. Conversely, the model estimates that for the lowest scoring farm and a mean sample farm the actual easement values fell below the model’s estimate by \$388.24 and \$272.65, respectively. These figures imply that the program may over pay or under pay for certain easements, relative to the average.

The estimated typical farm compares the actual mean easement value from the sample with an estimate of the typical farm using the model. Attributes of the typical farm include: the mean log of parcel size, the mean log of distance, and all dummy variables possessed by 50% or more of the sample. The estimate shows, that on average, the typical farm's easement value is \$253.66 less than the mean easement value from the sample. This information suggests that the city could realize cost savings from utilizing a formula-based valuation method. These savings might reflect reduced appraisal fees, but also potential reductions in the average per acre easement cost.

Parcel Characteristic Cost Estimates

The hedonic model also provides estimates of the effect particular parcel characteristics have on easement value. Characteristic level data provides information that could serve two major functions: 1) the creation of a formula based appraisal mechanism and 2) refinement of the relative weights applied to the LESA-based assessment and selection system. Table 5 below displays the effect certain features have on easement cost per acre and total parcel cost (see Appendix B, Table 6 for greater detail). For each variation, all other parcel characteristics are held at the mean/typical level.²

² Parcel Size and Distance are held at mean log levels, whereas dummy variables are considered typical if more than 50% of the sample possessed the attribute.

Table 5: Price of Development Rights at Different Levels of Selected Parcel Characteristics*

Characteristic	Effect on Development Right (\$/Acre)	Effect on Total Parcel Cost (\$)
Located Within Designated Focus Area	\$ (408.29)	\$ (51,812.00)
Located Within National or Local Historic District	\$ 684.69	\$ 86,887.16
Includes Archeological Site	\$ (321.48)	\$ (40,795.81)
Designated National Historic Landmark	\$ (400.03)	\$ (50,763.81)
Adjacent to property with conservation easement	\$ (599.28)	\$ (76,048.63)
Contiguous to land designated for long-term natural resource use, conservation or preservation	\$ 881.43	\$ 111,853.47
Adjacent to or in Scenic viewshed of Interstate	\$ (341.92)	\$ (43,389.65)
In Scenic viewshed of Public Lands	\$ (256.00)	\$ (32,486.40)

*All parcel characteristics other than the one being varied are set at the mean/typical level.

The estimated easement value per acre increased by \$684.69 for a parcel located within a national or local historic district. The market for development rights places a premium on this attribute, perhaps because some view it as a desirable place to locate. As well, the easement cost for parcels adjacent to lands otherwise designated for long-term natural resource increased \$881.43. Other development restrictions may exist in these designated areas and should be evaluated to see if these characteristics are appropriately weighted in the LESA assessment.

The estimated per acre easement value for a parcel located within a designated focus area is \$408.29 less than one located outside this designation. This suggests the market for development rights discounts this attribute. If program goals include giving priority to lands within focus areas, administrators may want to consider giving this attribute a higher LESA weight given the reduction in cost. The model estimated similar

reductions for the following attributes: possessing an archeological site, designation as a national historic landmark, adjacency to other lands with conservation easements, adjacency to or within the scenic viewshed of the interstate, and location within the scenic viewshed of public lands. The discount applied to these attributes suggests it may be possible to purchase more socially desirable land at lower costs by increasing the relative weight of such attributes on the LESA assessment.

IX. Limitations of Analysis

Several deficiencies in the regression model limit the generalizability of the results. First, the use of Google^R Maps to measure distance represents a crude proxy for development pressure. More appropriate and ideal would be the distance from the urban service area and/or sewerability districts. Time constraints did not allow for the collection of such information. Second, the extensive use of dummy variables limits the models ability to predict marginal price effects for otherwise continuous attributes. Ideally, measures of road frontage, soil quality, and proximity to other preserved lands would be continuous allowing for better estimates of these attributes' price elasticity. Taken together, these limitations likely influenced the explanatory power of the regression model. While an R^2 of 34% is similar to some analyses in the literature, the use of such a model to calculate actual easement values may require greater power to gain acceptance.

Participation in the PDR program is voluntary. Therefore, there exists a self-selection bias in the sample evaluated. Farm owners choosing to participate may in fact be conservation minded and be willing to accept a lower easement payment. Such

institutional factors are not controlled for in the regression model presented. Future analyses may want to consider variables such as participant motivation, although this may have little impact at the county level.

X. Conclusions & Recommendations

This report examined the impact of certain farm attributes on the value of conservation easements. Results of this analysis suggest that the marginal contributions to easement cost of several parcel characteristics are significant. These include:

- Parcel size
- Distance from urban center
- Adjacency to other lands under easement or designated for natural resource use
- Adjacency to or within the view of the interstate
- Within the view shed of public lands
- Within a national or local historic district
- Designation as a national historic landmark
- Possessing registered or significant archeological sites

Considering these characteristics carefully when evaluating applicant farms may reduce total purchase costs and maximize social benefits. Specifically, program administrators can use this information to refine the relative weights of the LESA assessment criteria to focus on the most desirable mix of parcel attributes.

Additionally, the analysis presented here could form the basis of an alternative to traditional appraisal techniques. Using a formula-based system saves administrative costs associated with appraisals and may better account for the value of characteristics not typically captured by the market. Several programs have done just this. Howard County, Maryland and the Maryland Rural Legacy Program both use formulas for attribute-based easement valuation (Lynch and Lovell, 2002).

Fayette County's current appraisal fees are approximately \$2,500 for each farm. Using a formula-based appraisal to eliminate this cost for the remaining land needed to reach the program's goal could save over \$700,000 in current dollars. Moreover, this report suggests savings approaching \$9 million, in current dollars, could be realized by purchasing the remaining land needed (36,000 acres) to reach the program's goal using this report's estimates vs. the current actual average. As the pool of land available for participation diminishes and funding sources tighten, efforts to reduce costs and maximize available dollars may be prudent. Additionally, other counties may find the information in this report useful in developing and implementing their own PDR programs.

Further research is needed prior to any attempt to utilize the type of analysis presented in this report. First, limitations to using an attribute-based formula to calculate easement values need to be identified. It may be the case that certain government programs providing funds for land acquisition require a specific appraisal method. Second, land owners may be reluctant to accept offers calculated by such a formula. A survey of Fayette county farm owners could reasonably gauge how such a method would be accepted. Lastly, the model presented here needs refinement to more adequately capture the variation in easement values. The use of GIS information and real appraisal data could greatly enhance the power of the estimates.

References

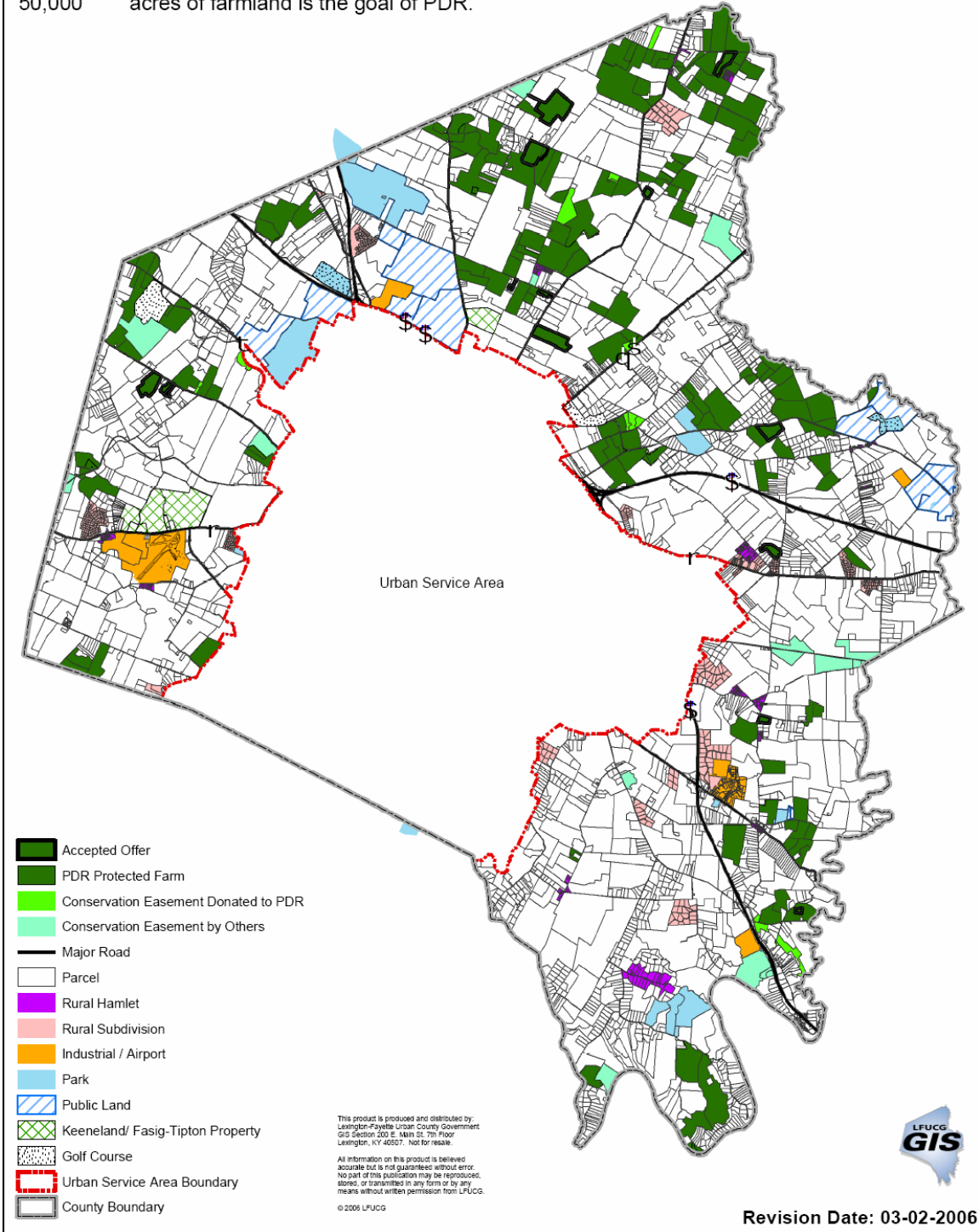
- American Farmland Trust. “Fact Sheet: Status of Local PACE Programs.” (2005), http://www.farmlandinfo.org/documents/30302/PACE_Local_8-05.pdf.
- Beaton, W. Patrick and Pollock, Marcus. “Economic Impact of Growth Management Policies Surrounding the Chesapeake Bay.” *Land Economics* 68, no. 4 (November 1992): 434-453.
- Brown, Ralph and Schmitz, Jerome. “Appraising Wetlands Easements.” *The Appraisal Journal* 46, no. 2 (April 1978): 176-184.
- Brunstadt, Rolf; Gaasland, Ivar and Vardal, Erling. “Agricultural Production and the Optimal Level of Landscape Preservation.” *Land Economics* 75, no. 4 (November 1999): 538-546.
- Buist, Henry; Fischer, Carolyn; Michos, John and Tegene, Ababayehu. “Purchase of Development Rights and the Economics of Easements.” AER No. 718, U.S. Department of Agriculture, Economic Research Service: Washington D.C., 1995.
- Byrne, Craig and Minck, Michael. “Understanding the Evolution of Conservation Easement Appraisal through Case Law.” *The Appraisal Journal* 68, no. 4 (October 2000): 411-419.
- Chicoine, David. “Farmland Values at the Urban Fringe: An Analysis of Sale Prices.” *Land Economics* 57, no. 3 (August 1981): 353-362.
- Coughlin, R.E.; Pease, J.R.; Steiner, F. et al. “The Status of State and Local LESA Programs.” *Journal of Soil and Water Conservation* 49, no. 1 (Jan-Feb 1994): 7-13.
- Daniels, Tom. “Using LESA in a Purchase of Development Rights Program.” *Journal of Soil and Water Conservation* 45, no. 6 (Nov-Dec 1990): 617-621.
- Daniels, Tom. “The Purchase of Development Rights.” *Journal of the American Planning Association* 57, no. 4 (Autumn 1991): 421-432.
- Field, Barry and Conrad, Jon. “Economics of Compensation in Development Rights Programs.” *Journal of the Northeastern Agricultural Economics Council* 4, no. 2 (October 1975): 185-194.
- Fischel, William. “Introduction: Four Maxims for Research on Land-Use Controls.” *Land Economics* 66, no. 3 (August 1990): 229-236.
- Fischel, William. “The Urbanization of Agricultural Land: A Review of the National Agricultural Lands Study.” *Land Economics* 58, no. 2 (May 1982): 236-259.
- Gardner, B. Delworth. “The Economics of Agricultural Land Preservation.” *American Journal of Agricultural Economics* 59, no. 5 (December 1977): 1027-1036.
- Kay, Steve and Scott, Jean. “Preserving the Bluegrass.” (Fall 2002).
- Kentucky Agricultural Development Board Press Release. “Kentucky Agricultural Development Board Announces Application Process, Farmland Preservation Effort.” (December 1, 2001), http://agpolicy.ky.gov/board/documents/001201_release.pdf.
- Kline, Jeffrey and Wichelns, Dennis. “Public Preferences Regarding the Goals of Farmland Preservation Programs.” *Land Economics* 72, no. 4 (November 1996): 538-549.
- Lassner, Janis. “Valuing Conservation Easements.” *The Appraisal Journal* 66, no.2 (April 1998): 145-150.
- Lexington-Fayette Urban County Government. “Ordinance No. 4-2000.” (2000), <ftp://ftp.lfucg.com/AdminSvcs/PDR/PDROrdinance.pdf>.
- Lexington-Fayette Urban County Government. “Rural Service Area Land Management Plan: Our Rural Heritage in the Next Century.” (1999).
- Lexington-Fayette Urban County Government. “Selling Your Development Rights.” (2005), ftp://ftp.lfucg.com/AdminSvcs/PDR/King_Info.pdf.
- Libby, Lawrence. “Farmland Protection Policy: An Economic Perspective.” Working Paper 97-1, American Farmland Trust, Center for Agriculture in the Environment (1997), <http://afresearch.org/research/resource/publications/wp/wp97-1.html>.

- Loomis, John; Rameker, Vicki and Seidl, Andy. "A Hedonic Model of Public Market Transactions for Open Space Protection." *Journal of Environmental Planning and Management* 47, no. 1 (January 2004): 83-96.
- Lynch, Lori and Lovell, Sabrina. "Hedonic Price Analysis of Easement Payments in Agricultural Land Preservation Programs." University of Maryland, Department of Agricultural and Resource Economics, Working Paper 02-13 (2002), <http://www.arec.umd.edu/publications/papers/Working-Papers-PDF-files/02-13.pdf>.
- Lynch, Lori and Musser, Wesley. "A Relative Efficiency Analysis of Farmland Preservation Programs." *Land Economics* 77, no. 4 (November 2001): 577-594.
- Nickerson, Cynthia and Lynch, Lori. "The Effect of Farmland Preservation Programs on Farmland Prices." *American Journal of Agricultural Economics* 83, no. 2 (May 2001): 341-351.
- Peddle, Michael. "Farmland Protection Policy: The Effects of Growth Management on Agricultural Land Values." Working Paper 97-7, American Farmland Trust, Center for Agriculture in the Environment (1997), <http://afresearch.org/research/resource/publications/wp/wp97-7.html>.
- Personal Communication with Margaret Graves, Chair of Lexington-Fayette County Rural Land Management Board (February 5, 2006).
- Personal Communication with Maner Ferguson, Program Manager for the Lexington-Fayette County PDR Program (February 8, 2006).
- Personal Communication with Billy Van Pelt, Administrative Officer for the Lexington-Fayette County PDR Program (February 17, 2006)
- Personal Communication with Billy Van Pelt, Administrative Officer for the Lexington-Fayette County PDR Program (February 17, 2006)
- Personal Communication with Chris King, Planning Director for the Lexington-Fayette County Planning Office (February 17, 2006)
- Personal Communication with Paul Moore, Review Appraiser for the Lexington-Fayette County PDR Program (March 10, 2006)
- Personal Communication with Donna Counts, Finance Director for the Lexington-Fayette Urban County Government (March 22, 2006).
- Plantinga, Andrew and Miller, Douglas. "Agricultural Land Values and the Value of Rights to Future Land Development." *Land Economics* 77, no. 1 (February 2001): 56-67.
- Ready, Richard; Berger, Mark and Blomquist, Glenn. "Measuring Amenity Benefits from Farmland: Hedonic Pricing vs. Contingent Valuation." *Growth and Change* 28, no. 4 (Fall 1997): 438-459.
- Shi, Yue Jin; Phipps, Timothy and Colyer, Dale. "Agricultural Land Values under Urbanizing Influences." *Land Economics* 73, no. 1 (February 1997): 90-100.
- Shonkwiler, J.S. and Reynolds, J.E. "A Note on the Use of Hedonic Price Models in the Analysis of Land Prices at the Urban Fringe." *Land Economics* 62, no. 1 (February 1986): 58-63.
- U.S. Department of Agricultural. "2002 Census of Agriculture: County Profile, Fayette, Kentucky." (2002), <http://www.nass.usda.gov/census/census02/profiles/ky/cp21067.pdf>.
- Vicary, Brent. "Trends in Appraising Conservation Easements." *The Appraisal Journal* 62, no. 1 (January 1994): 138-143.
- Wichelns, Dennis and Kline, Jeffrey. "The Impact of Parcel Characteristics on the Cost of Development Rights to Farmland." *Agricultural and Resource Economics Review* 22, no.2 (October 1993): 150-158.
- Wright, Lloyd; Zitzmann, Warren; Young, Keith and Googins, Richard. "LESA-Agricultural Land Evaluation and Site Assessment." *Journal of Soil and Water Conservation* 38, no. 2 (Mar-Apr 1983):82-86.

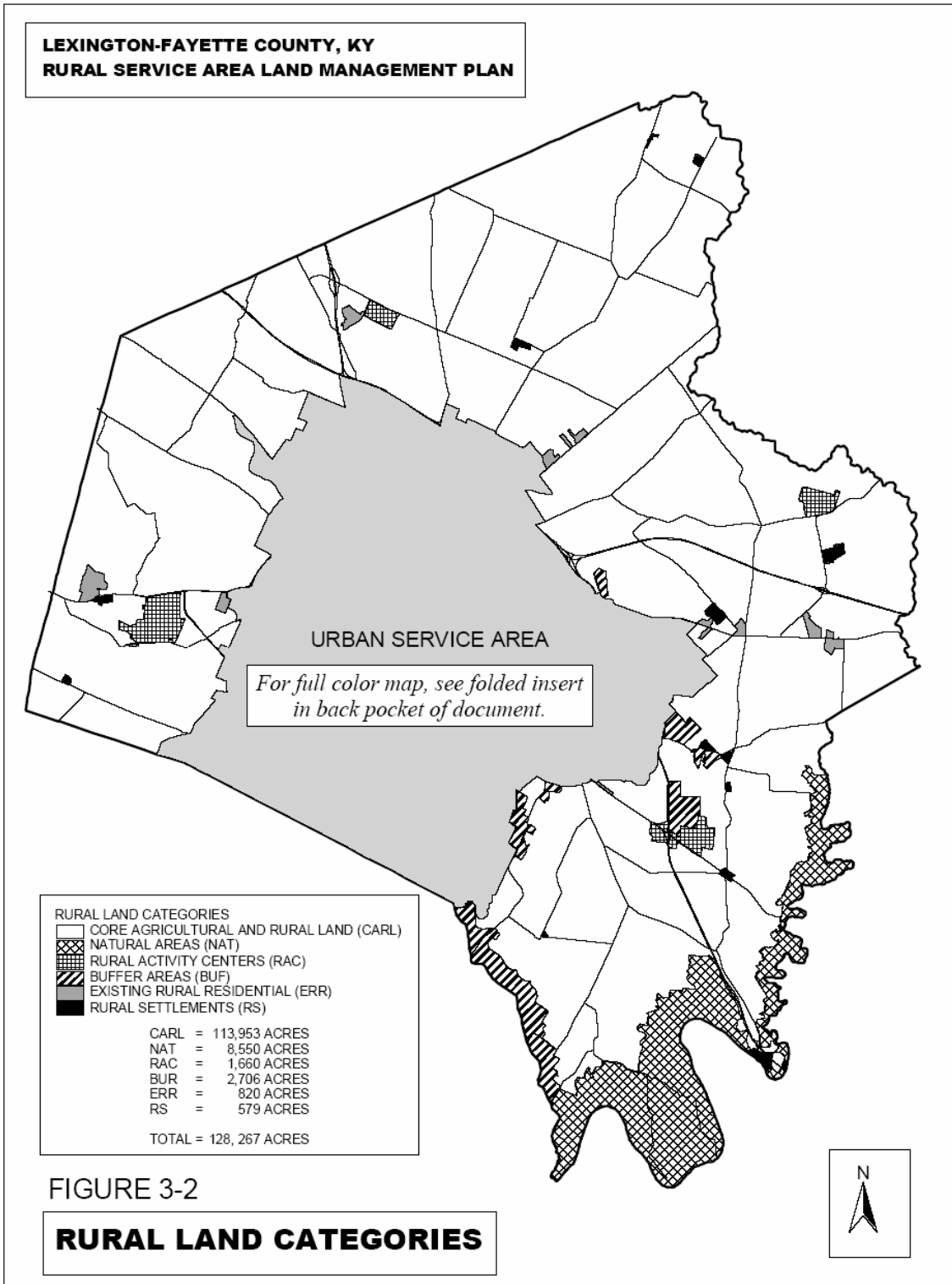
Appendix A

PDR Protected Farms, Accepted Offers, Other Protected Farms, and Other Public Lands

16,044.862 acres of preserved farmland now protected by PDR
 50,000 acres of farmland is the goal of PDR.



Appendix A



Appendix B

Table 1: Summary Statistics for Parcel Characteristics Used to Evaluate the Cost of Development Rights

Variable	Units	Mean	Standard Deviation	Minimum	Maximum
Easement Cost	\$/Acre	\$ 2,572.32	\$ 662.66	\$ 821.19	\$ 4,216.80
Size	Acres	126.9	101.7	21.3	637.4
Distance	Miles/LFUCG	10.2	2.6	4.4	16.1

n= 116

Appendix B

Table 2: Frequency Table for Parcel Characteristics Used to Evaluate the Cost of Development Rights

Category	Variable	Frequency	% of Total Farms
Ownership	Owner retained right to 40 acre parcel	10	8.6%
Road Frontage	>1001 feet of public road frontage	92	79.3%
	501-1001 feet of public road frontage	15	12.9%
	350-500 feet of public road frontage	3	2.6%
	<350 feet of public road frontage	6	5.2%
Adjacent Lands	Adjacent to property with conservation easement	44	37.9%
	w/in 1/2 mile of property with conservation easement	27	23.3%
	w/in 1 mile of property with conservation easement	7	6.0%
	>1 mile from property with conservation easement	38	32.8%
	Contiguous to land designated for long-term natural resource use, conservation or preservation	55	47.4%
	w/in 1/2 mile of land designated for long-term natural resource use, conservation or preservation	29	25.0%
	w/in 1 mile of land designated for long-term natural resource use, conservation or preservation	12	10.3%
	>1 mile from land designated for long-term natural resource use, conservation or preservation	20	17.3%
	Soil Quality	At least 80% prime farmland	29
At least 70% prime farmland		28	24.1%
At least 60% prime farmland		20	17.2%
At least 50% prime farmland		18	15.5%
Other Soil Categories		17	14.7%
Environmental Characteristics	>50% Environmentally Sensitive Area	21	18.1%
	<50% Environmentally Sensitive Area	95	81.9%
	w/in Designated Rural Greenway	82	70.7%
	w/in Designated Focus Area	90	77.6%
	w/in "A" list of Natural Protection Areas	20	17.2%
	w/in "B" list of Natural Protection Areas	67	57.7%
Scenic Resources	On scenic rural road	47	40.5%
	On local/state designated scenic/historic highway	41	35.3%
	Adjacent or in scenic viewshed of I-64/I-75	8	6.9%
	In scenic viewshed of public lands	21	18.1%
	Other features: i.e. tree-lined canopy or scenic viewsheds	92	79.3%
Cultural Resources	On National Register of Historic Places or designated local historic landmark	34	29.3%
	w/in National or local historic district	13	11.2%
	Designated national historic landmark	8	6.9%
	Includes at least 100 linear feet of stone fence	33	28.4%
	Includes registered/significant archeological sites	55	47.4%

n=116

Appendix B

Table 3: OLS Estimates of Impact for Parcel Characteristics Used to Evaluate the Cost of Development Rights

Category	Variable	Coefficient	Std. Err.	t-statistic	Relative Effect (%)
Continuous Var.	Log parcel size (acres)**	0.076	0.041	1.84	0.08%
	Log Distance (miles from LFUCG Government Center)***	-0.226	0.115	-1.97	-0.23%
Ownership	Owner retained right to 40 acre parcel***	-0.523	0.105	-4.98	-40.70%
Road Frontage	>1001 feet of public road frontage	0.086	0.113	0.76	8.99%
	501-1001 feet of public road frontage	-0.053	0.127	-0.42	-5.15%
	350-500 feet of public road frontage	0.223	0.193	1.16	24.97%
Adjacent Lands	Adjacent to property with conservation easement*	-0.149	0.098	-1.52	-13.85%
	w/in 1/2 mile of property with conservation easement	0.149	0.122	1.22	16.08%
	w/in 1 mile of property with conservation easement	0.160	0.135	1.19	17.33%
	Contiguous to land designated for long-term natural resource use, conservation or preservation**	0.213	0.125	1.71	23.68%
	w/in 1/2 mile of land designated for long-term natural resource use, conservation or preservation	-0.110	0.143	-0.77	-10.38%
	w/in 1 mile of land designated for long-term natural resource use, conservation or preservation	0.084	0.137	0.61	8.76%
Soil Quality	At least 80% prime farmland	0.179	0.176	1.01	19.55%
	At least 70% prime farmland	0.211	0.177	1.19	23.45%
	At least 60% prime farmland	0.235	0.183	1.28	26.49%
	At least 50% prime farmland	0.272	0.173	1.58	31.31%
	Other Soil Categories	0.186	0.164	1.13	20.42%
Environmental Characteristics	>50% Environmentally Sensitive Area	-0.005	0.200	-0.02	-0.50%
	<50% Environmentally Sensitive Area	0.043	0.207	0.21	4.36%
	w/in Designated Rural Greenway	-0.018	0.114	-0.16	-1.80%
	w/in Designated Focus Area	-0.162	0.131	-1.24	-14.97%
	w/in "A" list of Natural Protection Areas	-0.011	0.101	-0.11	-1.10%
	w/in "B" list of Natural Protection Areas	-0.037	0.084	-0.44	-3.60%
Scenic Resources	On scenic rural road	-0.031	0.067	-0.46	-3.04%
	On local/state designated scenic/historic highway	-0.010	0.074	-0.13	-0.95%
	Adjacent or in scenic viewshed of I-64/I-75**	-0.160	0.096	-1.66	-14.75%
	In scenic viewshed of public lands*	-0.117	0.076	-1.54	-11.04%
	Other features: i.e. tree-lined canopy or scenic viewsheds	0.118	0.088	1.34	12.48%
Cultural Resources	On National Register of Historic Places or designated local historic landmark	0.015	0.064	0.23	1.51%
	w/in National or local historic district***	0.259	0.107	2.43	29.53%
	Designated national historic landmark*	-0.189	0.125	-1.51	-17.25%
	Includes at least 100 linear feet of stone fence	0.038	0.065	0.58	3.86%
	Includes registered/significant archeological sites***	-0.130	0.062	-2.09	-12.18%

n=116, ***Significant at the 0.05 level, **Significant at the 0.10 level, *Significant at the 0.15 level, Adjusted R² = 0.3365

Appendix B

Table 4: Joint F-Tests for Variable Group Significance

Category	Variable	F-Statistic	p-value
Road Frontage	>1001 feet of public road frontage	1.63	0.1889
	501-1001 feet of public road frontage		
	350-500 feet of public road frontage		
Adjacent Lands	Adjacent to property with conservation easement	2.34**	0.0793
	w/in 1/2 mile of property with conservation easement		
	w/in 1 mile of property with conservation easement		
	Contiguous to land designated for long-term natural resource use, conservation or preservation	2.62***	0.056
	w/in 1/2 mile of land designated for long-term natural resource use, conservation or preservation		
	w/in 1 mile of land designated for long-term natural resource use, conservation or preservation		
Soil Quality	At least 80% prime farmland	0.62	0.683
	At least 70% prime farmland		
	At least 60% prime farmland		
	At least 50% prime farmland		
	Other Soil Categories		

n=116, ***Significant at the 0.05 level, **Significant at the 0.10 level

Appendix B

Table 5: Cost Functions for Certain Parcels Using Regression Estimates

Category	Variable	Highest Scoring Farm	Lowest Scoring Farm	Mean Scoring Farm	Estimated Typical Farm
Descriptors	Total Point Score	112	22	76	N/A
	Actual Easement \$/Acre	\$ 3,000.00	\$ 1,746.00	\$ 3,120.00	\$ 2,572.32
	Estimated Easement \$/Acre	\$ 2,413.17	\$ 2,134.24	\$ 3,392.65	\$ 2,318.66
Continuous Var.	Constant	7.798	7.798	7.798	7.798
	Log parcel size (acres)	0.351	0.324	0.365	0.348
	Log Distance (miles from LFUCG Government Center)	-0.368	-0.511	-0.433	-0.516
Ownership	Owner retained right to 40 acre parcel	0.000	0.000	0.000	0.000
Road Frontage	>1001 feet of public road frontage	0.086	0.000	0.086	0.086
	501-1001 feet of public road frontage	0.000	-0.053	0.000	0.000
	350-500 feet of public road frontage	0.000	0.000	0.000	0.000
Adjacent Lands	Adjacent to property with conservation easement	-0.149	0.000	0.000	0.000
	w/in 1/2 mile of property with conservation easement	0.000	0.000	0.000	0.149
	w/in 1 mile of property with conservation easement	0.000	0.000	0.160	0.000
	Contiguous to land designated for long-term natural resource use, conservation or preservation	0.213	0.000	0.000	0.000
	w/in 1/2 mile of land designated for long-term natural resource use, conservation or preservation	0.000	0.000	0.000	-0.110
	w/in 1 mile of land designated for long-term natural resource use, conservation or preservation	0.000	0.000	0.084	0.000
Soil Quality	At least 80% prime farmland	0.179	0.000	0.000	0.000
	At least 70% prime farmland	0.000	0.000	0.000	0.211
	At least 60% prime farmland	0.000	0.235	0.235	0.000
	At least 50% prime farmland	0.000	0.000	0.000	0.000
	Other Soil Categories	0.000	0.000	0.000	0.000
Environmental Characteristics	>50% Environmentally Sensitive Area	0.000	0.000	0.000	0.000
	<50% Environmentally Sensitive Area	0.043	0.043	0.043	0.043
	w/in Designated Rural Greenway	-0.018	0.000	0.000	-0.018
	w/in Designated Focus Area	-0.162	0.000	-0.162	-0.162
	w/in "A" list of Natural Protection Areas	0.000	0.000	0.000	0.000
	w/in "B" list of Natural Protection Areas	-0.037	0.000	-0.037	-0.037
Scenic Resources	On scenic rural road	-0.031	0.000	0.000	-0.031
	On local/state designated scenic/historic highway	0.000	-0.010	-0.010	0.000
	Adjacent or in scenic viewshed of I-64/I-75	0.000	-0.160	0.000	0.000
	In scenic viewshed of public lands	-0.117	0.000	-0.117	0.000
	Other features: i.e. tree-lined canopy or scenic viewsheds	0.118	0.000	0.118	0.118
Cultural Resources	On National Register of Historic Places or designated local historic landmark	0.015	0.000	0.000	0.000
	w/in National or local historic district	0.000	0.000	0.000	0.000
	Designated national historic landmark	0.000	0.000	0.000	0.000
	Includes at least 100 linear feet of stone fence	0.000	0.000	0.000	0.000
	Includes registered/significant archeological sites	-0.130	0.000	0.000	-0.130
TOTAL		7.789	7.666	8.129	7.749

Appendix B

Table 6: Price of Development Rights at Different Levels of Selected Parcel Characteristics*

Characteristic	Measure	Price of Development Right (\$/Acre)	Total Parcel Cost (\$)
Located Within Designated Focus Area	Yes	\$ 2,318.66	\$ 294,237.95
	No	\$ 2,726.95	\$ 346,049.96
		\$ (408.29)	\$ (51,812.00)
Located Within National or Local Historic District	Yes	\$ 3,003.35	\$ 381,125.12
	No	\$ 2,318.66	\$ 294,237.95
		\$ 684.69	\$ 86,887.16
Includes Archeological Site	Yes	\$ 2,318.66	\$ 294,237.95
	No	\$ 2,640.14	\$ 335,033.77
		\$ (321.48)	\$ (40,795.81)
Designated National Historic Landmark	Yes	\$ 1,918.63	\$ 243,474.15
	No	\$ 2,318.66	\$ 294,237.95
		\$ (400.03)	\$ (50,763.81)
Adjacent to property with conservation easement	Yes	\$ 1,719.38	\$ 218,189.32
	No	\$ 2,318.66	\$ 294,237.95
		\$ (599.28)	\$ (76,048.63)
Contiguous to land designated for long-term natural resource use, conservation or preservation	Yes	\$ 3,200.09	\$ 406,091.42
	No	\$ 2,318.66	\$ 294,237.95
		\$ 881.43	\$ 111,853.47
Adjacent to or in Scenic viewshed of Interstate	Yes	\$ 1,976.74	\$ 250,848.31
	No	\$ 2,318.66	\$ 294,237.95
		\$ (341.92)	\$ (43,389.65)
In Scenic viewshed of Public Lands	Yes	\$ 2,062.66	\$ 261,751.55
	No	\$ 2,318.66	\$ 294,237.95
		\$ (256.00)	\$ (32,486.40)

*All parcel characteristics other than the one being varied are set at the mean/typical level.