Community Benefits and Costs of Purchase of Agricultural Conservation Easements

Prepared by
American Farmland Trust
for United States Department of Agriculture
Natural Resources Conservation Service

December 2005

American Farmland Trust™

ACKNOWLEDGMENTS

American Farmland Trust would like to thank the Berks County Agricultural Land Preservation Board and Massachusetts Department of Agricultural Resources for assistance in identifying and providing background information and data for the case studies in this report.

American Farmland Trust (AFT) is a national, nonprofit organization founded in 1980 to stop the loss of productive farmland and to promote farming practices that lead to a healthy environment. AFT provides technical assistance services to landowners and land trusts, USDA and other agricultural and conservation agencies, planners, planning offices and planning commissions, and others. The foundation of these services is the Farmland Information Center (FIC), a clearinghouse for information about farmland protection and stewardship supported by the USDA Natural Resources Conservation Service. The FIC includes an online collection of literature, laws, sample documents and statistics and a staffed answer service to answer questions by phone, fax and e-mail. Additional services include planning for agriculture—including fiscal and agricultural economic analysis; farmland protection policy analysis and program development; direct land protection and easement management; stakeholder input and task force facilitation; and education and outreach: seminars and workshops, publications and publicity materials, as well as professional development and training.

NATIONAL OFFICE
1200 18th Street NW, Suite 800
Washington, DC 20036
(202) 331-7300
(202) 659-8339 FAX
www.farmland.org

TECHNICAL ASSISTANCE SERVICES
One Short Street, Suite 2
Northampton, MA 01060
(413) 586-9330
(413) 586-9332 FAX

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The National Resources Conservation Service (NRCS) provided funding for American Farmland Trust (AFT) to estimate the benefits that a farm could provide a local community in the future when its development rights are purchased. AFT analyzed the financial impacts to communities and individuals that result from protected farmland. Through the use of existing sources of data to generate this information, potential benefits are quantified in a way that taxpayers can understand and appreciate.

AFT compared the costs of purchasing easements on two farms to the benefits those farms could provide to their communities to field test a methodology developed by J. Dixon Esseks, Richard C. Owens, Charles A. Francis and Dennis Schroeder in "Estimating the Benefits to Local Stakeholders from Agricultural Conservation Easements." Their research identified local residents or stakeholders who are likely to benefit from purchase of agricultural conservation easements (PACE) including: 1) owners of the farm, 2) subsequent buyers, 3) owners of adjacent or neighboring properties, 4) local travelers enjoying the views of the protected parcel, 5) local residents who find recreational opportunities, 6) consumers who purchase agricultural products grown on that land, 7) owners and employees of local businesses providing goods and services to the farm, 8) users of downstream water who avoid flood damage or flood control costs, 9) users of downstream water who avoid the costs of sediment build-up or water pollution, and 10) local residents who value farmland preservation for protecting wildlife habitat, rural "history and heritage," curbing urban sprawl or achieving other civic purposes.

AFT evaluated and tested methods to determine the value of protected farmland to each category of stakeholder. A goal of the research was to measure the extent to which the benefits of placing a conservation easement on farmland equal or come close to the easement cost. Therefore, we attempted to measure as many types of benefits as possible in dollars so that the estimated values of the different types could be aggregated or compared.

AFT found that the largest benefit value was from the farm's economic contribution to the local community through purchases of local goods and services, employment and product sales. Essentially, PACE acts as an economic development mechanism. When compared to a $44,000 easement purchase for the farm in Deerfield, Massachusetts, significant benefits included the following:

- Neighboring properties received $10,790 in lease payments and contributed an additional $1,045 in property taxes annually.

- Annual purchases of local goods and services amounted to $327,496, while the total local economic impact of the farm operation was $863,315.
- A one-time cost of $2,139 in soil loss from erosion was prevented by not using the property for residential development.
- A net annual fiscal benefit of $82 in property tax revenue was generated to pay for community services.

A PACE cost of $393,330 for the farm in Berks County, Pennsylvania, compared to significant benefits which included:

- Local businesses received $133,964 from selling goods and services to the farm.
- Recreation benefits valued at $804 per year.
- Local consumers purchased $2,107 in direct sales of farm products.
- The value of local residents desires to have the farmland as part of their community was $49,466 per year for a five-year period.

INTRODUCTION

In 2005, America's effort to conserve and protect farmland through the purchase of agricultural conservation easements (PACE) marked its 29th year. Suffolk County, New York, began purchasing easements (or development rights) on farmland in 1976 to protect the valuable breadbasket of eastern Long Island from skyrocketing demand for new homes and vacation properties. Massachusetts and Maryland quickly followed, starting the first statewide PACE programs in 1977 and 1978.

As of June 2005, PACE activity in 30 states has led to the protection of 1,361,591 acres of agricultural land by state programs and 241,181 acres by local programs. The cumulative amount spent on acquiring easements as of June 2005 stood at roughly $3.8 billion from all sources.[1] State and local programs have spent $2.6 billion. These funds have been matched with another $1.2 billion from federal agencies (primarily NRCS), foundations, land trusts and individuals. State and local PACE programs have always been accountable to the public. With the expansion of the federal program, this scrutiny will intensify.

PACE is a popular tool to compensate willing agricultural landowners for limiting or restricting their rights to develop their land in the future. PACE programs are created and payments made in an attempt to permanently secure the benefits of farmland including a stable food supply and protection of open space and environmental amenities. PACE programs involve voluntary arrangements between willing sellers and willing buyers, an advantage that avoids the resistance to and controversy of legislated conservation measures.

Selling an easement allows farmers to cash in a percentage of the equity in their land, thus creating a financially competitive alternative to development. Permanent easements prevent development that would effectively foreclose the possibility of farming. Because non-agricultural development on one farm can cause problems for neighboring agricultural operations, PACE may help protect their economic viability as well. Removing the development potential from farmland generally reduces its future market value, which helps facilitate farm transfer. The reduction in market value may also reduce property taxes and help prevent them from rising. PACE programs provide landowners with liquid capital that can enhance the economic viability of individual farming operations and help perpetuate family tenure on the land. For example, the proceeds from

[1] Farmland Information Center, PACE Fact Sheets, 2005.

selling agricultural conservation easements may be used to reduce debt, expand or modernize farm operations, invest for retirement or settle estates. The reinvestment of PACE funds in equipment, livestock and other farm inputs may also stimulate local agricultural economies. Finally, PACE gives communities a way to share the costs of protecting farmland with landowners. Non-farmers have a stake in the future of agriculture for a variety of reasons, including keeping locally grown food available and maintaining scenic and historic landscapes, open space, watersheds and wildlife habitat. PACE allows them to participate in the protection of farming and be assured that they are receiving something of lasting value.

METHODOLOGY

This NRCS funded research compares the costs of purchasing an easement on a farm to the benefits a farm could provide a local community in the future. The financial impacts to communities and individuals that result from protected farmland are reviewed. Using existing sources of data to generate this information, potential benefits are quantified in a way that taxpayers can understand and appreciate. The research was undertaken to measure benefits identified by J. Dixon Esseks, Richard C. Owens, Charles A. Francis and Dennis Schroeder in "Estimating the Benefits to Local Stakeholders from Agricultural Conservation Easements." This research attempts to quantify the following potential stakeholder benefits:

1. Owners of the agricultural parcel receiving PACE funds;
2. Future owners of property after a PACE transaction;
3. Owners of properties adjacent to protected farmland;
4. Tourists' and local residents' enjoyment of farmland's scenic qualities;
5. Consumers of recreational opportunities available on farmland;
6. Local consumers of goods and services produced on the protected farmland;
7. Owners and employees of local business that continue to provide goods and services to a farm;
8. Communities that avoid downstream flooding costs;
9. Community avoidance of costs associated with erosion as a result of residential development, versus costs associated with erosion as a result of a farm's regular operations;
10. Local residents with little or no contact with the farm who value agriculture simply because it is a part of the community.

Two additional benefits were evaluated:

11. The local economic impact of the farm; and
12. The fiscal benefits of the farm.

These potential benefits were examined by collecting and analyzing data for two case study farms in Deerfield, Massachusetts, and Berks County, Pennsylvania.

AFT estimated the financial benefits associated with farmland protection under the premise that the case study farms were protected to avoid future development. While it is likely that a farm operation without an easement would provide similar benefits, given the development trends in the communities of both case study farms, AFT assumed that the alternative land use for these farms would have been residential development.

Identifying Case Study Locations

Researchers established criteria to identify sites for potential case studies. These included areas with active PACE programs and information on soils, watershed data, flooding, land use statistics, assessors' data, appraisal records and local support for the study. With these criteria in mind, researchers considered the following areas as sites for potential case studies: Catskill Region of New York; Lancaster and Berks Counties, Pennsylvania; Dunn Township, Wisconsin; and the Connecticut River Valley region of Massachusetts.

The Catskill region, while an intriguing area with New York City watershed lands, would not immediately transfer over to rural areas that receive no payments for providing watershed protection. While this could be a valid location for future studies, it was not seen as a desirable avenue to pursue and was, therefore, not selected.

Dunn Township, Wisconsin, operates a municipality-wide easement program, with funding from a mixture of local property taxes, state and federal funds, and program activity limited to the town's borders. The ease of identifying local stakeholders and easy delineating of the program's impacts were appealing characteristic. A farm was identified as a potential case study, but the owners declined the opportunity to participate in the research. While Dunn Township was not selected, it might be a good location for testing PACE benefits and costs in the future.

Lancaster County, Pennsylvania, has a wealth of data that would make it an excellent candidate for a case study. However, at the time of this project, the county was heavily involved in growth management planning, making local staff too busy to be consulted about additional research.

The remaining two locations, the Connecticut River Valley (also known as the Pioneer Valley) in Massachusetts and Berks County, Pennsylvania, were selected as the locations for two case

studies. A short list of farms in the Pioneer Valley was developed from phone calls to the Department of Agriculture Resources and discussions with local officials familiar with area farms. Based on their recommendations, AFT selected a farm in the town of Deerfield. The Berks County farm was selected based on the recommendations of the Berks County Agricultural Land Preservation Board.

Approaches to Finding the Value of Farmland Benefits

In the course of this project, AFT reviewed a wide range of literature, Web sites, farm records, and local data in an attempt to quantify the dollar value of the costs and benefits of protecting farmland to specific stakeholders. Selection of the methods used to select research and generate values was conducted within the following parameters: 1) the data exist in the public records and did not have to be created through a lengthy research process; 2) the methods used to calculate a value can be replicated by other researchers without inordinate effort and expense; 3) the approach used makes practical sense to someone without specialized knowledge of the subject; and 4) if technical software is required it can be easily obtained or can be run by a consultant with reasonable effort.

The research also required some consideration of the appropriate geographic and time scales for data collection and benefit calculation. For example, some data are more readily available at the county level than at the town level. The acreage of land in farms in the U.S. Census of Agriculture is reported by county and is not as easy to obtain at the town or township level. In New England, towns provide assessment records, while in Pennsylvania this data can be obtained at the county or town level. On a smaller geographic scale, benefits to an entire farm operation have to be apportioned to only those acres under conservation easement to show the benefit the easement. On a time scale, some benefits, such as the purchase of the easement, are a one-time payment while other benefits theoretically continue as long as the farm is in operation. The specific results are described in the case studies, but the following section describes the general approaches that were used to estimate values for stakeholder benefits that could be valued and identifies which values could not be determined.

Methods for Those Values That Were Evaluated

Owners of the Agricultural Parcel

To determine the profitability of selling an agricultural conservation easement, researchers used AFT's spreadsheet software, *Winning the Development Lottery*. This spreadsheet model predicts the revenue a landowner could expect to earn from a specific parcel of farmland for two competing scenarios over a 30-year period—selling an easement versus a fee simple sale. Data inputs include easement value, acreage, crop type, rate of return on investment, value of land under agriculture only and value of land with development rights. An Excel spreadsheet allows the user to select between a PACE scenario and a non-PACE scenario. The spreadsheet also allows users to project the number of years from the present that a development scenario is likely to occur. For the purposes of this research, both easement and fee simple sales were immediate. A conservative 5 percent interest rate for any investment of funds was used.

Owners of Adjacent Properties

To determine whether the value of neighboring properties was influenced by the protected farmland, AFT searched for local studies describing property values in the communities and reviewed data collected for the case study such as farm profit and loss statements, appraisals and property assessments. For the Deerfield farm, identified benefits included lease payments made to owners of neighboring properties by the operator of the protected farmland and increases in assessed value and property tax revenue from adjacent properties. In Berks County, a combination of the nature of the operation, the alternative for large-lot residential development, and the findings of a research paper demonstrated that there were no measurable benefits to neighboring properties from the purchase of an agricultural easement.

Recreational Opportunities Available on Farmland

Finding the value of recreational opportunities on farmland is fairly straightforward. The interviewed farmers were asked about the types of recreation, if any, provided on the farm. While no recreation was provided by the Deerfield farm, opportunities for future recreation related to a scenic and recreationally used river flowing past the property were analyzed. The Berks County farm contributes to wildlife and fisheries habitat, and hunting and fishing are allowed on the property, but no direct payment is made to the farmer. Therefore, the value of the sale of hunting and fishing licenses sold in the county was determined and apportioned to the farm property.

Local Consumers of Goods Produced on the Protected Farmland

The amount of local consumer purchases, if any, was provided by the farm operator's record of sales. Adjustments to the reported value were required since records of sales were kept for the whole farm, but the agricultural conservation easement was for only a portion of the farm. For the Deerfield farm, there were no direct sales to local consumers, but an analysis of potential sales was made based on data from existing Massachusetts farm stands.

Local Consumers of Goods and Services Produced on the Protected Farmland

The value of goods and services provided to local consumers was based on the farm operator's profit and loss statements. Some of the goods and services provided include insurance payments, office expense, payroll wages, repairs, utilities, machine hire, feed, fertilizer, fuel, rent, seeds, supplies, taxes, utilities and veterinary and breeding services. Adjustments to these values were required to reflect the portion of the farm under easement.

Local Economic Impacts

AFT used Impact Analysis for Planning (IMPLAN) software and county data to determine the value of protected farmland on local economies. Capturing the local economic impact of a business is possible using input-output economic modeling techniques. IMPLAN measures the transfers between industries for a given period of time within a given geographic boundary by tracking the extent to which different industries send goods to other industries or receive goods from other industries. These transfers are then arranged in a table from which a multiplier is derived that tells the impact on the final demand for all industries if one industry increases or decreases its output. Analyzing the interdependence of industries through market-based transactions can help describe the effects of changes to a local economy after an increase or decrease of activity in one industry. More detailed information about how IMPLAN works is provided in Appendix C of this report.

Flood Avoidance for Downstream Communities

Federal Emergency Management Agency (FEMA) records for flood damage compensation and watershed land use data were compiled to determine the amount of flood damage caused by different land uses. Protected farmland was then compared to the allowed density of residential development on the parcel.

Farmland being considered for a conservation easement may help downstream users of land to avoid the costs of flooding or of installing flood-control structures. While individual PACE parcels may not be large enough to make a significant difference for many parcels below them in their watershed, even modest-sized farmland can absorb or detain enough stormwater to prevent substantial damage to its immediate neighbor or to property a parcel or two away.

Local Residents Who Value Agriculture Because It Is a Part of the Community

Local residents having no direct contact with the subject land or the consequences of how it is managed may value farmland preservation for protecting wildlife habitats, rural history and heritage, curbing urban sprawl, or achieving other civic purposes. To estimate this value, AFT reviewed local open space and farmland protection programs, and searched for previous studies to find actual expenditures by residents and then compared them to the amount of local land protected.

In an effort to address some of the non-market goods that a community derives from open space, researchers have looked at ways to measure local residents' willingness to pay for land protection. These studies attempt to identify and describe the maximum amount of money an indifferent individual is willing to pay (WTP) to have an environmental service rather than do it himself or not at all (Champ et al., 2003). In such studies, respondents are asked to rank their WTP on a scale from zero to some maximum number for a fixed number of years (Blaine, 2003). A specific type of study that analyzes the willingness of residents in a community to pay for environmental amenities is a Contingent Valuation Method (CVM) study that focuses on local citizens' willingness to pay for a scenic view. While this approach is valid, it requires the specialized knowledge of resource economists, and local municipal officials are not likely to have the tools at their disposal to successfully complete a CVM study.

The USDA's Economic Research Service (ERS) found that of that out of six studies conducted in states varying from South Carolina to Alaska that the willingness to pay ranged from a low of $0.12 per 1,000 acres in South Carolina to a high of $49.80 per 1,000 acres in Massachusetts (USDA – ERS, 2001). A study conducted in the Pioneer Valley found that residents were willing to pay $7.50 per year for 10 years for a hypothetical program that would preserve 10,000 acres of farmland over a 10-year period (AFT, 2003).

Fiscal Benefits

The potential fiscal benefit of protected farmland was considered by reviewing a Cost of Community Service Study (COCS) in Deerfield, Massachusetts, that found that agricultural land consistently costs less to service (i.e., for road maintenance, police services, fire protection and other purposes) than it generates in revenue (property taxes, gasoline tax, etc.). These studies require collecting community budget and property assessment data and interviewing public officials to determine how services are delivered to different land uses. While a full study was beyond the scope of this research, the property tax contribution for education, one of the largest community services, was reviewed. This approach might work for a town or township where all services are provided within one government level, but it could not be used in Berks County with its more complicated town, school district and county service structure.

Benefits Not Determined

The benefit value of protected farmland to future buyers of the property, local travelers' enjoyment of the scenic qualities of the farmland, and downstream residents' avoidance of costs associated with water pollution could not be quantified within the limited scope of this research effort. The following sections describe what was considered and why a value was not determined.

Future Buyers of Protected Farmland

In theory, the financial benefit to future owners of protected farmland would be the difference between what they paid for the land and the price they would have faced if the development rights were intact. However, buyers seeking hobby farms or estates often inflate prices beyond levels that farmers can afford.[2] After reviewing the literature on selling prices for protected farmland and considering the steps required for this analysis, AFT researchers came to the conclusion that an analysis of this potential benefit was beyond the scope of this effort. A small number of studies have attempted to observe competitive prices and parcel characteristics from land sales of a sufficient number of parcels with and without restrictions on development, using

[2] Nickerson and Lynch (2001) offered this second potential explanation for their findings from a study in three Maryland counties: the differences in per-acre sale prices of land under agricultural conservation easements and the prices for unrestricted farmland were not statistically significant when various competing determinants of are price controlled for.

regression analysis to tease out any effect on market values that an easement confers. Collecting data is extremely difficult, however, and the results from these efforts have been inconsistent.[3]

Local Travelers' Enjoyment of Scenic Qualities

Initial consideration was given to assembling focus groups in the study site and querying the group to determine its average willingness to pay for the scenic benefits of farmland. A focus group would view a series of images (for items varying from candy bars to mountain views) and then each participant would record the amount of money he or she would be willing to pay for the object shown in the image. However, the research AFT conducted in the process of compiling the literature review for this report indicated that the cost of determining the willingness to pay for individuals, or groups of individuals, was much greater than the scope of this project.

Avoidance of Costs Associated with Water Pollution

Watershed documents were reviewed to find the types of contaminants and land use sources that impact water quality in the watersheds in which the case study farms were located. After a review of available sources on water pollution monitoring programs, it became apparent that the financial impacts of all types of water pollution were far too complex to measure specific benefits from protected farmland and compare them to the alternative residential development. A summary of water quality issues in each watershed is provided in Appendix B of this report.

The Environmental Protection Agency (EPA) and the USDA's Agricultural Research Service (ARS) began the construction of a mock village in Coshocton, Ohio, in the fall of 2003 to try to understand the impacts of increased urbanization within a watershed. This effort will examine pesticide usage and erosion and attempt to describe their impacts on surface water quality (ARS, accessed 2005). The ARS offers training to professionals interested in learning how to use and apply the ARS Agricultural Non-Point Source Pollution Model (AGNPS), which describes non-point source pollution events within watersheds. Researchers interested in understanding the results of USDA's modeling efforts in Ohio may be able to use the AGNPS software package. However, based on e-mail correspondence with AGNPS instructors it became apparent that use of the software would require travel to Mississippi for a week of training. It was, therefore, not practical to pursue this approach to measure the value of pollution avoided.

[3] Anderson, Kathryn. Do Conservation Easements Reduce Land Prices? The Case of South Central Wisconsin, June 2005.

One form of water pollution, erosion and sediment loading is fairly easy to evaluate and value. Different land use regimes will produce different results on the rate at which prime soils erode. Whether land is more vulnerable to erosion in an agricultural state or within a development scenario is a question that has been studied at length by the NRCS, and there are experts at county levels who are trained to analyze local data. The Revised Universal Soil Loss Equation2 (RUSLE2) was applied to estimate the value of soil erosion loss for the farm in Deerfield, Massachusetts. It was not used for the Berks County farm because the operation was a grass-based dairy and erosion from runoff from the farm or from any future large-lot residential development was determined to be very limited.

Lessons Learned

Calculating a monetary value for all of the stakeholders identified in the initial list of benefits provided as guidance in this research effort was an ambitious goal. However, by using two case study farms, we found that most of these benefits could be estimated. Only the values to future owners of PACE properties, to tourists' and local residents' enjoyment of farmland's scenic qualities, and water pollution impacts could not be given a dollar amount in this analysis. Two additional categories, the local economic impact and the fiscal impacts of the protected farm, can also be evaluated to add to the benefit values from PACE.

CASE STUDY #1: DEERFIELD, MASSACHUSETTS

Background

Massachusetts' Pioneer Valley has a long and rich agricultural history. The state's PACE program, the Agricultural Preservation Restriction (APR), has a strong commitment to preserving farmland in the region because the valley's prime alluvial floodplains, scouring from glacial activity, and centuries of sedimentation have made it a prime location for agriculture. In spite of regional trends, farming here remains a vital economic activity.

The Massachusetts farmland protection program is one of the country's oldest. Coming on the heels of New York's Suffolk County PACE program, Massachusetts' APR program was established in 1977 to prevent farmland loss. As of June 2005, the program had protected 53,000 acres on more than 600 farms. This amount represents more than 10 percent of the state's total remaining agricultural land base.

The Farm

The owner of the farm in Deerfield was contacted to determine his willingness to participate in the study and was sent a brief survey with questions about the farm and a list of desired information. AFT arranged a meeting with the farmer to discuss the details of the farm operation and to collect information. During the interview, the farmer produced the completed questionnaire and discussed his operation.

The 52-acre farm operation consists of 16 acres of APR land, Chapter 61A land[4] and several leased parcels. The farmer provided tax and title records, a profit and loss balance sheet, operational data and basic information about the farm's history. With the tax and parcel information, the easement deed as well as the APR transaction records associated with the farm could then be collected.

The farmer owns and operates a rootstock nursery that ships internationally and across the United States. While a business plan was not available, his business records for 2004 contained several pieces of financial information including individual costs for materials, supplies and labor, as

[4] Chapter 61A, in Massachusetts, is a taxation program that allows owners of working lands to be taxed according to their land's value for agricultural use, rather than be taxed on the potential residential value.

well as total sales and profit. He had a very favorable view of the Massachusetts APR program, and believed his initial cost of investing in farmland had been reduced through the easement, making it possible for him to begin his operation. He agreed to participate in the study under the condition of strict confidentiality of his financial records and operation.

Identified Benefits of Protected Farmland

Owners of the Agricultural Parcel

The Franklin Land Trust (FLT) initially financed the $44,000 cost of acquiring easements on two parcels equaling 16 acres of land. Later, the Massachusetts Department of Agricultural Resources (MDAR) reimbursed the FLT and transferred the easement to the Commonwealth of Massachusetts. The average per-acre value of the easements was $2,750. The remaining value as farmland was $4,633 per acre.

Table 1: Land Values for Deerfield Farm*

APR Acreage	Market Value Unrestricted	Restricted Value	Value of Easement Sold	Restricted Value Per Acre	Easement Value Per Acre
16	$ 118,122	$74,122	$44,000	$4,633	$2,750

*As determined by Appraisal

Comparing Investment Scenarios

The $44,000 sale of the easement represents an immediate benefit to the farmer. The easement limits the farmer's ability to realize present and future earnings from selling the property unrestricted for full market value. This represents an opportunity cost. This study considers the potential future dollar benefits and compares the financial impacts of an easement payment versus a fee simple sale of the property.

AFT developed software to estimate the rate of return a landowner would realize from investing dollars earned from an easement and from investing the proceeds of selling the land. The model inputs include easement value, acreage, crop type, a rate of return on investment (5, 8, or 10 percent), the value of land under easement, and the value of land with development rights. The software also requires that the number of years from the present in which a development scenario is likely to occur be selected. An immediate sale was selected in the Pioneer Valley, since there are few parcels that are distant from either a major interstate or a population center. A 5 percent

interest rate was selected for any money the landowner could invest after receiving payments for either the conservation easement or the outright transfer of land with development rights intact.

Table 2 below compares the rate of return that results from investing the money received for the easement on the case study farm and the amount that would have been received for the full market value. The first line shows the amount of money the farmer could earn from investing the dollar value of the easement ($44,000) at three different rates of return. The dollar value represents the amount of money the farmer could expect to earn per year over a 30-year period. Selling the farm and investing the $118,122 produces a higher annual cash return, but it does not include the remaining value of the farm for agriculture and the returns from farm sales.

Table 2: Annual Returns from Investment Scenarios

Investment Scenario	5% return	8% return	10% return
Easement Sale – $44,000	$ 2,200	$ 3,520	$ 4,400
Unrestricted Sale – $118,122	$ 5,906	$ 9,450	$ 11,812
Difference	($ 3,706)	($ 5,930)	($ 7,412)

AFT made a 30-year projection of dollars that the farmer would receive from investing the proceeds from selling his land as well as product sales. Using figures from the farm's 2004 profit and loss sheet, the 16 acres produced an annual return of $35,545, or $2,222 per acre. The protected farm continues to earn $35,545 a year in addition to the $2,200 return from the sale of the easement. When farm income is included, the easement purchase yields $2,276,695 while selling the farm only generates $551,539 over a 30-year period (see Table 3). The long-term financial benefits are much greater when an easement is sold, assuming that the operator continues to run an active, profitable farm.

Table 3: Comparison of Long-Term Benefit: Easement vs. Sale of Farm						
Years	**Easement Purchase**	**Farm Sale**		**Years**	**Easement Purchase**	**Farm Sale**
	Total Cash Value Including Principal (end of year) *	Total Cash Value Including Principal (end of year)**			Total Cash Value Including Principal (end of year)	Total Cash Value Including Principal (end of year)
0	$ 154,952	$ 160,853				
1	$ 195,381	$ 168,297		16	$ 1,009,564	$ 318,216
2	$ 237,266	$ 176,009		17	$ 1,080,759	$ 331,326
3	$ 280,658	$ 183,999		18	$ 1,154,517	$ 344,907
4	$ 325,613	$ 192,277		19	$ 1,230,931	$ 358,978
5	$ 372,186	$ 200,853		20	$ 1,310,095	$ 373,555
6	$ 420,435	$ 209,737		21	$ 1,392,109	$ 388,656
7	$ 470,422	$ 218,942		22	$ 1,477,076	$ 404,302
8	$ 522,208	$ 228,477		23	$ 1,565,102	$ 420,510
9	$ 575,858	$ 238,356		24	$ 1,656,296	$ 437,302
10	$ 631,440	$ 248,591		25	$ 1,750,774	$ 454,699
11	$ 689,023	$ 259,193		26	$ 1,848,652	$ 472,722
12	$ 748,678	$ 270,178		27	$ 1,950,055	$ 491,393
13	$ 810,481	$ 281,558		28	$ 2,055,108	$ 510,737
14	$ 874,510	$ 293,348		29	$ 2,163,942	$ 530,777
15	$ 940,843	$ 305,562		30	$ 2,276,695	$ 551,539

*Includes the value of the protected farm, return from farm sales, cash payment for easement, and return on cash investment.

**Includes the payment from sale of the farm and return on investment.

Future Buyers of Protected Farmland

The easement value is the difference between the market value of $118,122 and the restricted value $74,122. In theory, a future buyer of the 16-acre parcel would not pay the full market value for this restricted parcel of agricultural land. Instead, a buyer would pay $74,122 for the restricted value of the land for agriculture. On a per-acre basis, the benefit to the current owner of the property works out to $4,633. This assumes that the real estate market will remain relatively stable for restricted farmland. However, buyers seeking hobby farms or estates may bid up the price to the original market value for development.

Owners of Adjacent Properties

Lease payments

In addition to the 16-acre APR parcel, the farmer also leased 37.6 acres and actively farmed them. Without the 16-acres that form the core of the farm's operations, it is likely that the other acres would not be used for agriculture. Lease payments amounted to $10,790.

Property Value Increases as a Result of Proximity to Easement

To determine the potential impact of the easement on the value of neighboring properties, assessors' records were collected for abutting properties. Starting with 1995, assessed values for nine properties were selected and tracked through 2004. The assessed values for each of the properties for 1995, 2000 and 2004 were collected and entered into a spreadsheet. Changes in value were calculated for the five-year period preceding the easement transaction in 2000 as well as the four-year period after the easement transaction occurred. These values were then compared with the total assessed value of all properties in the Town of Deerfield. This process is detailed in Table 4.

For the five years before the easement was sold, the assessed value of the properties adjacent to the farm declined 21 percent, while all other properties in the town increased 13 percent in value. After the easement was sold in 2001, adjacent properties increased 79 percent while the total town assessment increased 30 percent. By the end of the 2004 tax year, the value of adjacent properties had grown 49 percent faster than the rest of the town. For the town of Deerfield, this increase resulted in an increase of $1,405 in property taxes.

Table 4: Assessed Values on Adjacent Properties – Before and After APR					
Before Easement					
	Acres	**1995**	**2000**	**2000 minus 1995**	**Percent change 1995 to 2000**
Total value for properties next to APR	102.6	$ 292,108	$ 231,181	$ (60,927)	-20.86%
Total value for all other town properties	20,845	$ 311,396,869	$ 350,108,491	$ 38,711,622	12.43%
After Easement					
	Acres	**2000**	**2004**	**2004 minus 2000**	**Percent change 2000 to 2004**
Total value for properties next to APR	102.6	$ 231,181	$ 414,140	$ 182,959	79.14%
Total value for all other town properties	20,845	$ 350,108,491	$ 456,246,517	$ 106,138,026	30.32%
Net Difference					48.83%
Property Tax Calculation					
		Actual Assessed Value in 2000	**Estimated Value Using Town Rate in 2004 (30.32%)**	**Actual Assessed Value in 2004**	**Difference (Actual Minus Estimated)**
If properties abutting APR only increased by the town-wide value, this shows the difference		$ 231,181	$ 301,265	$ 414,140	$ 112,875
Difference			$ 112,874		
Tax rate per thousand in 2004			0.0125		
Tax benefit to the town (difference times tax rate)			$ 1,405		

Purchases of Local Goods and Services

AFT obtained a profit and loss sheet for the farm to estimate the economic impact of the study farm. The farm operation had total expenses of a little over $1.3 million. Some of the expenses, such as depreciation (a tax benefit to the owner), real and personal property taxes (considered in the fiscal benefits section), payroll taxes (money sent to the state and federal government), and travel (money spent outside of the county), were removed from consideration as local economic benefits. The remaining payments for local goods and services included: insurance payments

($41,839), office expense (16,995), payroll wages ($894,782), repairs ($81,415), utilities ($23,867), and workshop supplies ($5,440) for a total of $1,064,338. Lease payments for neighboring farmland rental are shown separately in the section on benefits to neighboring properties. Applying the percentage of the operation represented by the 16-acre parcel (30.77 %) to the total payment results in $327,496 of local goods and services from this parcel of protected farmland.

Local Economic Impact

AFT performed an IMPLAN analysis of Franklin County to calculate output (defined as sales plus additions to inventory) tables for the entire county. The total output for all industrial sectors within Franklin County was $3.26 billion in 2002 dollars. The agricultural sector, excluding food processing and forestry, produced $43.4 million of the county's total economic output, about 1.33 percent of the total economy.

Within the agricultural sector, greenhouse and nursery businesses accounted for $11.3 million of output. Of this number, the APR farm accounted for $2.4 million, or about 21 percent of the greenhouse and nursery sector output in Franklin County.

The APR parcel (16 acres) was 30.77 percent of the operation. This percentage was multiplied by the total farm sales to estimate the portion of the farm's earnings that result from the APR parcel. For the $2.4 million in sales, it was estimated that $804,637 came from this farm.

Next, AFT created a table using the Output, Employment and Value-added multipliers for the greenhouse and nursery sector in Franklin County (Table 5). Each line of the table shows the resulting economic activity attributed to the study site. The Type I multiplier in the Output section describes the total impact on local businesses that trade with the farm. The APR protected portion of the farm contributes a total of $863,315 of local economic activity.

The protected farm also generates employment opportunities. Based upon the employment multipliers, an estimated 10 jobs remain in Franklin County as a result of the economic activity of the farm. This is interesting to note because the study farm pays an average of $29,826 per year to its employees. Interviews with the farmer indicated that he was willing to pay more to retain skilled employees because he has a high value crop.

The total value-added section estimates the dollar value that the economy receives in addition to the impacts on local industries. It is designed to capture sales taxes, rents, employee

compensation and proprietary income. The study parcel generates (Type 1 Multiplier) $850,244 of total revenue for businesses not linked to the farm and (Type SAM Multiplier) $903,574 of total spending within Franklin County when households are factored into the economic picture. According to the software literature, IMPLAN is designed to account for travel, so perhaps the lower values (compared to Output) are due to expenditures outside of Franklin County. In terms of economic activity and employment, this APR farm made a positive contribution to the economy of Franklin County.

Table 5: Multipliers and Total Impact for Output, Employment and Total Value Added

Output				
Type of Multiplier	**Total Sales**	**APR Sales**	**Multiplier**	**Total Impact***
Type I	$ 2,615,104	$ 804,647	1.072911	$ 863,315
SAM		$ 804,647	1.160916	$ 934,128
Employment				
Type of Multiplier	**Total Employment**	**APR Employment**	**Multiplier**	**Total Impact***
Type I	30	9	1.052426	9
SAM		9	1.121656	11
Total Value Added				
Type of Multiplier	**Total Sales**	**APR Sales**	**Multiplier**	**Total Impact***
Type I	$ 2,615,104	$ 804,647	1.056669	$ 850,244
SAM		$ 804,647	1.122944	$ 903,574

***** Total includes the portion from APR property as well as the multiplier effect.

Flood Avoidance for Downstream Communities

AFT calculated the total of all insurance payments made by the Federal Emergency Management Agency (FEMA) between 1978 and 2004 for the main stem of the Connecticut River in Massachusetts[5]. Since this effort is only intended to analyze the effect on *downstream* flooding, any flood damage that occurred above the town of Deerfield was excluded from the total dollar amount the FEMA paid out during the time period. Based upon EPA watershed maps for the main stem of the Connecticut River, the FEMA paid $468,456 during the 26 years of collected data for a yearly average of $18,017.

[5] Online at www.fema.gov

Table 6: Flooding Costs in Main Stem of Connecticut River Watershed			
FEMA Data	Claims	Damage	Per Year
Deerfield	3	$ 1,546	$ 59
Other Communities	124	$ 468,456	$ 18,018

The Pioneer Valley Planning Commission (PVPC) provided historic development patterns for the watershed. In the section of the Connecticut River studied, there were 101,105 acres of developed land in 1999. FEMA flooding statistics, which are recorded according to incidents and dollars within each community, were used to measure local flooding costs. These costs were combined with PVPC land use statistics, to estimate a per-acre cost of flooding from developed land in the watershed.

Without an easement, it is likely that the study parcel would have been developed for residential purposes. In Deerfield, current zoning regulations call for a minimum 1½-acre lot size in the town's Rural Agricultural zone. Using an average of 15 percent impervious surface coverage, the result from residential development of this 16-acre parcel is 2.4 acres (16 times .15 = 2.4). Looking at the potential increase in flooding costs (Table 7) gives an average annual cost of $2.48 per year if the entire 16-acre parcel is developed. It should be noted that these are average costs for existing conditions. The amount of flooding caused by any future development would vary depending on the amount of impervious surface. There may also be greater flooding damage and costs as the amount of developed land increases, resulting in a greater average per acre.

Table 7: Flooding Costs from Development				
Developed Acreage, 1999	Total Acreage Downstream of Deerfield	Estimated Annual Flood Payments	Cost Per Acre	Additional Impact of 16 acres
117,925	433,956	$ 18,018	$ 0.15	$ 2.48

Avoidance of Water Pollution

The United States Geological Survey (USGS) National Water-Quality Assessment (NAWQA) program's study of the Connecticut River in 1995 (the most recent NAWQA study for the Connecticut River Watershed) stated that the Connecticut River was not in violation of any of the

relevant chemical categories, and, therefore, a cost of clean up could not be ascribed to pollution. Furthermore, concentration levels for given pollutants fluctuate within a watershed and vary according to degrees of urban and rural influence. The primary concern that emerged from reviewing NAWQA documents was the fact that each management regime—agricultural, industrial or commercial—produces its own set of chemical pollutants. While agricultural sections of the Connecticut River manifested concentrations of atrazine,[6] metolachlor[7] and simazine[8], urban areas were more likely to leave concentrations of prometon,[9] diazinon[10] and carbaryl.[11] Also, the problem of differentiating between surface and ground water contamination and comparing the costs of urban and agricultural regimes would be necessary to fully understand the costs associated with pollution. Therefore, it was decided that estimating pollutant loads from protected farmland and from potential development and comparing the costs would require a significant amount of research beyond the scope of this project. A summary of the NAWQA findings for the Connecticut River can be found in Appendix B of this report.

One form of water pollution, erosion and sediment loading, is fairly easy to evaluate and value. Different land use regimes will produce different results on the rate at which prime soils erode. Whether land is more vulnerable to erosion in an agricultural state or within a development scenario is a question that has been studied at length by the NRCS, and there are experts at county levels who are trained to analyze local data.

The ARS and NRCS provided funding for updating the Universal Spoil Loss Equation through a cooperative agreement with The University of Tennessee, Knoxville. The resulting software

---

[6] Atrazine is a photosynthesis-inhibiting herbicide often used to kill weeds and quack grass that can affect the cardiovascular and reproductive systems.

[7] Metolachlor is common herbicide that is in the chloracetanilide family of herbicides.

[8] Simazine is a white, crystalline organic compound used as a pre-emergence herbicide for the control of broad-leaved and grassy weeds on a variety of deep-rooted crops such as artichokes, berry crops, broad beans, etc., and on non-crop areas such as farm ponds and fish hatcheries.

[9] Prometon is used for bare ground weed control around buildings, storage areas, fences, roadways, railroads, recreation areas, lumberyards, non-crop areas on farms, and rights-of-way.

[10]Diazinon is an insecticide. In 1986, EPA banned its use on open areas such as sod farms and golf courses because it posed a danger to migratory birds. The ban did not apply to agricultural, home lawn or commercial establishment uses.

[11] Carbaryl is a chemical in the carbamate family used chiefly as an insecticide. It is commonly sold under the brand name Sevin.

program modified an older Dos-based program by switching it to a user-friendly Windows program and created the Revised Universal Soil Loss Equation 2 (RUSLE2). The Revised Universal Soil Loss Equation 2 can be applied to estimate the value of soil erosion loss. The responsibility of the researcher rests in locating a farm, talking with the farmer about management practices and obtaining an NRCS soil survey map for the county in which the farm is located. With these pieces of data, an analyst can roughly describe the effects of erosion on a given parcel of land.

RUSLE2 predicts erosion from water and relies upon local factors such as soil, precipitation, climate, slope and management regime to arrive at a number that represents the tons per acre per year that erode from any given site. RUSLE2 was designed to be a free software package, which is a benefit to small towns and land trusts looking for reliable affordable tools.

In order to run the RUSLE2 program, AFT interviewed an NRCS field staff member from the NRCS field office in Amherst, Massachusetts, about the applicability of RUSLE2 to this research project. Having determined that RUSLE2 could be a useful tool, NRCS offered assistance in matching the appropriate state database with the program. The way the software is designed, data tables are presented on the state level and users then scroll through a list of state counties and select the appropriate county for their study. Franklin County was selected and entered it into the location field. According to the Franklin County Soil Survey Map (dated 1967) the primary soil type for the farm in question was Hadley very fine sandy loam b, with a 0 to 3 percent slope. A default slope length of 150 feet was selected, and, due to the very flat nature of the Deerfield River Valley, a 1 percent slope grade was selected. NRCS field office staff helped to develop a description of the management regime likely to take place under the specific farming practices of the study parcel. Based upon this input, the model had the farmer plowing in the spring, applying mulch, disking later in the summer, disking and finishing, planting rootstock, harvesting 12 inches down, disking again and scattering seeds for a cover crop in late summer (see Appendix A). With these inputs, RUSLE2 estimates that 1.3 tons per acre per year eroded from the farm. For the entire 16 acres this amounted to 20.8 tons per year.

Following these calculations, a scenario in RUSLE2 was built that would account for soil loss during the development stage of any conversion from farmland to residential uses, since most residential erosion takes place during development (either through negligence or the stripping and selling of topsoil). Once an area has been covered with impervious surfaces and vegetation, erosion is drastically reduced. Working with NRCS field staff, it was possible to model the

impacts of development by selecting the option, “Bulldozer, filling/leveling” from the management option table. This was carried forward for the entire year due to the nature of RUSLE2 reporting the tons per acre, per year that would be lost on a particular parcel; this also fits in with possible building timelines on the 16-acre APR farm in Deerfield. Based upon this data, RUSLE2 presented soil loss factors that amounted to 8.3 tons per acre per year, or 132.8 tons of soil loss per year as a result of development.

Because it is very difficult to isolate the costs associated with soil loss in New England—individual counties do not maintain drainage systems where the high volume of clay particles and irrigation result in the need for drainage management practices and fees—it was decided that focusing on the theoretical cost of replacing all of the soil that would be lost during development was one possible method for estimating soil costs. One market identified was the cost associated with buying topsoil in bulk from excavators. Estimates from local excavator supply companies ranged between $22 per cubic yard and $25 per cubic yard of soil, so an average of $23.50 was selected.

To calculate the weight of an acre of topsoil, the following steps were applied:

1. The weight of an acre furrow slice (normally six inches deep) = 2,000,000 pounds.
2. Double the weight of an acre furrow slice to estimate the weight of a 12-inch slice = 4,000,000 pounds per acre of land.
3. Divide 4,000,000 pounds by 43,560 cubic feet (the number of cubic feet per acre) = 91.83 pounds per one cubic foot of soil.
4. Multiplying this one cubic foot value by 27 (the number of cubic feet in a cubic yard) = 2,479 pounds.

Next, soil loss from the protected farmland (1.8 tons per acre) was subtracted from soil loss under the development scenario (8.8 tons per acre) resulting in a difference of 7 tons per acre per year. This equaled a net loss of 112 tons (7 tons x 16 acres) of soil for the year during which development would take place. To replace the soil lost during development, the owner of the development, or the town, would need to purchase roughly 91 cubic yards of topsoil (at 1.24 cubic yards per ton) to adequately replace the amount of soil lost during one year of development, at a local value of $2,139.

Table 8: Calculation of Erosion Costs	
Soil loss per acre during development	8.8 tons
Soil loss per acre from agriculture (per year)	1.8 tons
Difference	7 tons
Total soil loss during development (16 acres)	112 tons
Number of cubic yards (1.24 cubic yards per ton)	91
Cost at $23.50 per cubic yard	$2,139

Local Residents Who Value Agriculture Because It Is a Part of the Community

AFT found two sources of information that demonstrated the value that local residents place on agriculture because it is a part of the community. One was a CVM study that had surveyed hundreds of residents to determine their willingness to pay for farmland protection. The other data source was actual expenditures by towns under the Massachusetts Community Preservation Act (CPA), a program funded by real estate transfers and a surcharge on local property values.

Contingent Valuation Method

In 2001 AFT conducted a CVM study in the Pioneer Valley in conjunction with the University of Massachusetts. The study found that individuals in the Pioneer Valley were willing to pay $77.43 a year for a theoretical program that would save 20,000 acres of farmland over a course of five years –a rate of $ 9.40 per acre, per year. If this value were assumed for the 16-acre study site, Deerfield residents would be willing to pay $150.40 per year over the course of five years for a total of $752.

Table 9: Results of AFT's 2001 CVM Study in Pioneer Valley	
Survey Item	**Results**
Number of Surveys	2,400
Number of Households Responding	570
Total agricultural acreage in PV	20,000
Ratio of households to acres	8:33
Willingness to pay for program	**$ 77.47**
Revenue generated	$ 185,928
Dollar value per acre, based on 20,000 acres	**$ 9.30**
Acreage of subject APR property	16
Farm in Deerfield	$ 148.74

Massachusetts' Community Preservation Act

The Massachusetts CPA provides a unique opportunity to ascertain the value placed on farmland by local residents. Communities are able to levy a maximum tax of 3 percent on real estate properties to fund projects that are exclusively related to housing, open space and historic preservation. The state provides matching funds for every dollar raised by communities that have authorized funding for the CPA.

In the Pioneer Valley region, the towns of Amherst, Southampton and Easthampton had authorized a local CPA tax surcharge (as of 2004). The average amount each community spent on open space, represented as a fraction of the tax base, was multiplied by the total acreage of open space in a community. This average was used as the willingness to pay for farmland and then multiplied by the total amount of farmland in Deerfield. Using this value, this study concluded that Deerfield residents might be willing to pay $2.08 an acre per year for open space. A more detailed description of the process used to calculate figures derived from existing Massachusetts statistics is provided in the Appendix D.

Table 10: Using the Massachusetts Community Preservation Act to Determine the Public Value of Farmland

Item	Amherst	Southampton	Easthampton	Combined and Average	Deerfield Estimate
Taxable Value of Properties	$1,116,742,200	$ 337,095,024	$ 733,850,670	$2,187,687,894	$ 439,648,164
Dollars Raised by CPA*	$154,264	$ 85,347	$174,773	$ 414,384	$ 83,277
Percent of Assessment	0.0138%	0.0253%	0.0238%	0.0189%	0.0189%
Percent of CPA Dollars Spent on Open Space**	71.88%	60.46%	2.75%	45.03%	45.03 %
Amount of CPA dollars Spent on Open Space	$110,890	$51,597	$4,805	$167,291	$37,499
Percent of Assessment Spent on Open Space	0.0099%	0.01531%	0.0007%	0.0076%	0.00853%
Acres of Farm and Open Land					18,019
Potential $ Citizens Are Willing to Spend Per Acre (CPA $ divided by farm acres)					**$2.08**
Subject Parcel					16 acres
Value for Total Parcel					**$33.30**

* Because the amount of funding for the CPA includes 1:1 matching grants with the state paying as much as the community raised, the line item amount from the state in each community budget was used.
**Community Preservation Coalition data

Fiscal Benefits

An additional benefit considered in this case study was the estimated fiscal impact of the farm. This was done by comparing the amount of property taxes paid to the cost of providing community services to the property. AFT conducted a Cost of Community Service study (COCS) in Deerfield in 1992 that determined that farm and open lands paid far more for town services than they received (Table 11). This indicates that agricultural land in Deerfield saves the town money because it demands few public services.

COCS studies indicate that farmland, around the nation, pays more in taxes than the cost of public services it receives. Without a detailed COCS study of a community, it is difficult to know the exact net benefit of farmland. A COCS study completed in Deerfield (AFT, 1992) estimated that the net fiscal benefit of working and open lands was $146,594. With 18,261 acres of farm, forest and open land in the study, the average for each acre of farmland was a surplus of $8.03 for town services. The total benefit from the property, in 1992, was $128.44 ($8.03 * 16).

Table 11: COCS Information for Deerfield, 1992

Land Use	Residential (Including Farm Houses)	Commercial and Industrial	Working and Open Lands
Ratio*	$1.00: $1.16	$1.00: $ 0.38	$1.00: $0.29
1992 Net Benefit of Farm, Forest and Open Land		$146,594	
Acres of Open Land		8,261	
Per-acre Benefit		$ 8	
For 16 Acres		$ 128	

* Cost of providing services for every dollar of revenue

A Cost of Community Services study takes revenues and expenditures from a recent fiscal period and distributes them according to land use—residential, commercial and working lands (farm, ranch and forest land). Results are compared to provide a ratio that shows how much a community spent on public services for every $1 raised from a specific land use.

In order to calculate the tax revenue from the property, the assessed values for the APR parcels (one of 1.8 acres and another of 14.2 acres) were obtained. Due to differential assessment practices in Massachusetts, the assessed value of these parcels is lower than the use value. The two separate values for the APR parcels were summed to create a total assessed value of $8,994**.**

The assessed value was then multiplied by the tax rate ($12.45 per $1,000) resulting in a $112 property tax ($8,994 times .01245) contribution for the parcels.

In reviewing the relationship of the farm property to community services, education costs were considered because they were the largest service costs. However, only a portion of the property tax pays for education. To determine the portion of the town budget represented by education services a copy of the town budget was obtained. Out of a total budget of $9,606,391, educational services cost $5,862,538. Funding for education from state ($1,360,186) and federal aid ($29,023) programs, as well as local charges for services ($576,729) were subtracted, leaving $3,896,600 paid from property taxes. The portion of $5,301,488 of local property taxes paid for education in Deerfield was 74 percent. The portion of the $112 paid in property taxes by the farm property for education is $82.30. Since farmland does not require educational services, this is a net fiscal benefit to the town.

Therefore, the results from the Deerfield COCS study completed in 1992, which show a per-acre average of $128, support the 2004 analysis that only looked at the farms contribution ($82) for education services in 2004.

Table 12: Abbreviated Cost of Community Services Study Deerfield, Massachusetts, 2004	
Assessed Value – 1.8 Acres	$146
Assessed Value – 14.2 acres	$8,848
Total Assessed	$8,994
Tax Rate	0.01245
Property Taxes	$ 112
Education Percent of Town Budget	73.5 %
Fiscal benefit from the 16 acres	$ 82.30
Calculation of Education Costs	
Total Town Expenditures	$ 9,606,391
Cost of Education Services	$ 5,862,538
State Aid	$ 1,360,186
Federal Aid	$ 29,023
Local Charges for Services	$ 576,729
Portion Paid by Local Property Taxes	$ 3,896,600
Total Property Taxes	$ 5,301,488
Percentage of School Taxes	73.5%

Other Benefits of Protected Farmland Considered

Local Travelers' Enjoyment of Scenic Qualities

Traffic counts tallied by the Franklin Regional Council of Governments found that the road adjacent to the farm had an average daily traffic load of 2,000 cars per day. This alone might be a persuasive descriptive statistic, and if a local official has the time and resources to manipulate local data sources, an estimate of local financial valuation of a scenic view, based upon travelers viewing the scenery, could be determined. However, without any readily available local data, researchers decided that the effort required to conduct consumer comparison surveys that place a comparative value on scenic views was beyond the scope of this project.

Recreational Opportunities Available on Farmland

The farmer allows no recreation on his property, but the Deerfield River runs along the northern border of the property for 1,500 feet. While the owner did not have any recreation-based businesses operating on his farm, the opportunity exists to derive additional income from the farm's proximity to this valuable natural amenity.

This particular farm could derive revenue if the farmer sold access rights for fishing or water sport enthusiasts. The Deerfield river draws recreational enthusiasts from around New England and serves as the home river for several rafting companies, professional fishing guides and local fly fishermen. In fact the farmer himself expressed appreciation for the river's scenic and wild values during the interview when he stated that he enjoyed canoeing there because he could go for miles without seeing a single house. He could establish a spot for taking-out or putting-in canoes and kayaks and derive income from charging for parking or for river access for fly-fishing. Simply because he has not realized any revenue from the scenic beauty of the Deerfield River does not mean that it is not a possibility for him or a future owner.

Local Consumers of Goods Produced on the Farm

The study farm sold no products to local consumers through either farm stand sales or direct sales. However, the Massachusetts Department of Agricultural Resources (MDAR) maintains statistics that convey the importance of direct sales to Massachusetts consumers and farmers. In Massachusetts there are 95 farmers' markets and 400 roadside farm stands. This means that Massachusetts' 6,100 farms have about one farm stand for every 15 farms. This favorable relationship between the state's rural and urban areas has made Massachusetts the seventh-

highest-ranking state in direct sales in the country, with direct sales valued at $20 million, for an average of $16,000 per farm.

Massachusetts farms average 92 acres in size. The study parcel was 17.4 percent of the average farm size in Massachusetts. In theory, the study farm could have a direct sales impact of $2,784 (17.4 percent of $16,000) in the future if the land were shifted into row crops yielding average local sales.

Results

The owner of the case-study farm received an initial $44,000 payment for his easement. The combined value of the return from investing this amount and the economic return from farming showed a 30-year value of almost $2.3 million. Selling the property at the appraised value of $118,000 and investing the proceeds over 30 years would have yielded $551,539. This analysis shows the farm property producing a net difference of about $1.7 million dollars when the farm is protected with an easement.

The owners of adjacent properties benefited from lease payments and from higher than average townwide assessed property values. Neighboring properties received $10,790 in lease payments for the year studied. Assessed values for neighboring properties after the easement was placed were 49 percent higher than the town-wide average, yielding an additional $1,405 in taxes annually to the community. The benefit to owners of nearby properties is the higher assessed value, while the higher tax revenues benefit the community.

While the farm did not have any local direct sales, the property could change hands or products and become an operation more focused on local markets. If this were to occur, the estimated potential value is $2,782 of direct local sales annually. This was derived from Massachusetts statewide estimates. Similarly, there is significant potential for recreation revenue, but there are no state-level figures that enable making an estimate.

Because the farm studied has very high sales volumes, the local economic benefits associated with the property are very high. Purchases of local goods and services amounted to $327,496 for the year studied. The total economic output for the farm parcel ranged from $863,315 to $934,128 depending on the type of multiplier used. The annual value of flooding avoided was $2.48 per year. While this is a small amount, it is only one measure of flood damage and if multiplied by the entire acreage of open land in the watershed, it would be significant.

For the cost of avoiding erosion, the NRCS RUSLE2 equation was used to calculate the difference between erosion rates under a management regime normally used for a rootstock operation and the amount of erosion from disturbance by development. The net financial cost avoided was $2,139 or $133 per acre. This is a one-time cost because at some point regular soil loss from agricultural operations exceeds soil loss from disturbance during development. This was estimated to be about six and a half years for this farm. However, since RUSLE2 does not have the capacity to calculate erosion rates in a residential scenario, it is likely that data for residential erosion could alter the break-even point for these competing scenarios.

A previous study of the Pioneer Valley region found that residents were willing to pay $9.40 per acre for farmland preservation. The sixteen-acre parcel would be valued at $150 by local residents, using the results of the study. By using Massachusetts CPA data from three nearby communities, it was estimated that residents of the Town of Deerfield might be willing pay $2.08 per acre annually for farmland preservation, or $33.28 for the entire parcel.

The study parcel contributed $112 in property taxes to Deerfield's budget. Since roughly 74 percent of property taxes collected in the community pay for education services, the farm contributes a surplus of $83 per year for public services.

Compared to the original purchase price of $44,000, it is evident that Deerfield, Franklin County and the Commonwealth of Massachusetts derive significant financial and fiscal benefits from preserving this parcel of property in Deerfield. A summary of those benefits is shown in Table 13.

Table 13: Summary of Results – Deerfield, Massachusetts Farm			
Category of Benefits	**Estimated Value**	**Time Period**	**Source**
Benefit Values Determined			
Owners of the Property			
a. Payment received for the easement	$44,000	One time	Property deed
b. Economic return from easement payment and farm operation	$2,276,695	30 years	Winning the Development Lottery Model
c. Investment return from sales of farm for development.	$551,539	30 years	Winning the Development Lottery Model
d. Net difference between b and c	$1,725,156	30 years	Winning the Development Lottery Model
Owners of adjacent property			
a. Lease payments	$10,790	Annual	Financial records
b. Increase in property taxes	$1,405	Annual	Town of Deerfield property assessments
Local consumers of direct sales	$2,782	Annual	Estimated based on Mass. agricultural statistics
Owners and employees of local business that continue to provide goods and services	$327,496	Annual	Farm records
Local economic output	$863,315	Annual	IMPLAN software analysis
Flood avoidance	$2.48	Annual	FEMA statistics
Avoidance of water pollution (erosion only)	$2,139	One time	Based on RUSLE2 modeling
Local residents value of agriculture	$150 $33	Annual Annual	Contingent Valuation Method study Mass. Community Preservation Act Estimates
Fiscal benefits	$82 to $128	Annual	Cost of Community Services Study
Benefit Values Not Determined		**Notes**	
Future buyers of property	No Value Determined	Would require appraisals and real estate market analysis.	
Local travelers scenic value	No Value Determined	A lengthy research effort using consumer survey methods could not be completed.	
Recreational opportunities	No Value Determined	There was no recreation on the farm property.	

CASE STUDY #2: BERKS COUNTY, PENNSYLVANIA

Background

Berks County, Pennsylvania is located about 56 miles northwest of Philadelphia. Agriculture accounts for nearly $300 million in sales and remains diverse with field crops, livestock, poultry, nursery and greenhouse products. Combined with other natural resource industries such as forestry and forest products, the total agricultural sector produces more than $1.2 billion in economic output, supplies $248 million in wages and employs 8,578 people annually. The county's 1,791 farms occupy approximately 39 percent of the county's 215,679 acres, according to the 2002 U.S. Census of Agriculture.

AFT decided to study a Berks County farm because the county has one of the nation's leading local PACE programs. The Berks County Agricultural Land Preservation Board (BCALPB) was founded right after the creation of the Pennsylvania Farmland Protection Program in 1989. As of June 2005 BCALPB had protected 39,878 acres on 346 farms in 28 of the municipalities in the county. County officials believe the $30 million investment in these easements ensures the continued agricultural use of the land and stimulates reinvestment in the local farm economy. The BCALPB board willingly provided information about local farmers and sources of data to support this case study.

The Farm

The farm site selected for this case study was a 187-acre parcel of a 300-acre organic dairy in Heidelberg and Lower Heidelberg Townships in Berks County. It is located in the Spring Creek watershed, a subwatershed of Tulpehocken Creek, which in turn drains into the Schuylkill River and eventually the Delaware Bay. The BCALPB purchased an agricultural conservation easement on the parcel in 2001. The terrain is hilly and the soils are mostly Berks shale, which is a well-drained and moderately productive soil. The farm is located in a rural, agricultural community. It is adjoined by other farms on three sides, with several new houses on the remaining side. It is zoned agricultural preservation which allows one house per 40 acres.

Identified Benefits of Protected Farmland

For the farm in Berks County, AFT calculated dollar values for the following categories of stakeholders resulting from the ongoing operation of the farm because of an agricultural conservation easement: the owner of the parcel, future buyers of the property, recreational users

involved in hunting and fishing, local purchasers of goods produced on the farm, local purchasers of goods and services, and local residents who value agriculture because it is part of the community.

Owners of the Agricultural Parcel

AFT calculated future estate benefits using an economic analysis model developed in AFT's 2001 *Winning the Development Lottery* report that compares the financial returns of preservation versus development. The Berks County farm owner was paid $393,330, or $2,103 per acre, for a conservation easement in 2001. If he were to sell the parcel for development, AFT estimates in 30 years he would receive $3,118,656 compared to $3,711, 207 from selling an easement. Because he sold the easement, he has a $592,547 greater long-term benefit than had he sold the acreage for development and invested the proceeds. Much of this additional value comes from the annual return from agricultural sales for the 187-acre protected parcel. It does not take into account additional sales from the rest of the farm operation.

Table 14: Land Values for Berks County Farm *

PACE Acreage	Market Value Unrestricted	Restricted Value	Value of Easement Sold	Restricted Value Per Acre	Easement Value Per Acre
187	$ 861,580	$468,250	$ 393,330	$ 2,490	$ 2,103

*As determined by Appraisal

Comparing Investment Scenarios

The $393,330 sale of the easement represents an immediate benefit to the farmer. The easement limits the farmer's ability to realize present and future earnings from selling the property unrestricted for full market value. This represents an opportunity cost. This study considers the potential future dollar benefits and compares the financial impacts of an easement payment versus a fee simple sale of the property.

AFT developed software to estimate the rate of return a landowner would realize from investing dollars earned from an easement and from investing the proceeds of selling the land. The model inputs include easement value, acreage, crop type, rate of return on investment (5, 8, or 10 percent), the value of land under with an easement, and the value of land with development rights. The software also requires that the number of years from the present be selected in which a development scenario is likely to occur. An immediate sale was selected in the Berks County. A

5 percent interest rate was selected for any money the landowner could invest after receiving payments for either the conservation easement or the outright sale of land with development rights intact.

Table 15 below compares the rate of return that results from investing the money received for the easement on the case study farm and the amount that would have been received for the full market value of that acreage. The first line shows the amount of money the farmer could earn from investing the dollar value of the easement ($393,330) at three different rates of return. The dollar value represents the amount of money the farmer could expect to earn per year over a 30-year period. Selling the farm and investing the money produces a higher annual cash return, but it does not include the remaining value of the farm for agriculture and the returns from farm sales.

Table 15: Annual Returns from Investment Scenarios

Investment Scenario	**5% return**	**8% return**	**10% return**
Easement Sale – $393,330	$16,779	$ 26,846	$ 33,558
Unrestricted Sale – $861,580	$ 36,754	$ 58,806	$73,508
Difference	($ 19,975)	($ 31,960)	($39,950)

AFT made a 30-year projection of dollars that the farmer would receive from investing the proceeds from selling his land as well as product sales. Using figures from the farm's 2004 profit and loss sheet, the 187 acres produced an annual return of $29,140, or $156 per acre. The protected farm continues to earn $29,140 a year in addition to the $16,779 return from the sale of the easement. When farm income is included, the easement purchase yields $3,711,203 while selling the farm generates $3,118,656 over a 30-year period (see Table 16). The long-term financial benefits are greater when an easement is sold, assuming that the operator continues to run an active, profitable farm.

Table 16: Comparison of Long-Term Benefit: Easement vs. Sale of Farm						
Years	**Easement Purchase**	**Farm Sale**		**Years**	**Easement Purchase**	**Farm Sale**
	Total Cash Value Including Principal (end of year) *	Total Cash Value Including Principal (end of year)**			Total Cash Value Including Principal (end of year)	Total Cash Value Including Principal (end of year)
0	$ 835,958	$ 802,212				
1	$ 885,120	$ 841,820		16	$ 1,930,623	$ 1,684,130
2	$ 936,371	$ 883,110		17	$ 2,026,308	$ 1,761,219
3	$ 989,800	$ 926,155		18	$ 2,126,060	$ 1,841,584
4	$ 1,045,500	$ 971,030		19	$ 2,230,051	$ 1,925,364
5	$ 1,103,567	$ 1,017,812		20	$ 2,338,461	$ 2,012,705
6	$ 1,164,102	$ 1,066,582		21	$ 2,451,479	$ 2,103,758
7	$ 1,227,210	$ 1,117,425		22	$ 2,569,300	$ 2,198,681
8	$ 1,293,000	$ 1,170,428		23	$ 2,692,129	$ 2,297,638
9	$ 1,361,586	$ 1,225,685		24	$ 2,820,178	$ 2,400,801
10	$ 1,433,087	$ 1,283,289		25	$ 2,953,669	$ 2,508,348
11	$ 1,507,626	$ 1,343,342		26	$ 3,092,833	$ 2,620,466
12	$ 1,585,334	$ 1,405,948		27	$ 3,237,912	$ 2,737,349
13	$ 1,666,344	$ 1,471,213		28	$ 3,389,157	$ 2,859,199
14	$ 1,750,797	$ 1,539,253		29	$ 3,546,829	$ 2,986,229
15	$ 1,838,839	$ 1,610,184		30	$ 3,711,203	$ 3,118,656

*Includes the value of the protected farm, return from farm sales, cash payment for easement and return on cash investment.

**Includes the payment from sale of the farm and return on investment.

Future Buyers of the Protected Farmland

The easement value for the Berks County protected parcel was $393,330. This was determined by subtracting the restricted value of $468,250 from the market value of $861,580. A future buyer of the 187-acre parcel would, in theory, pay the restricted value of the land under easement not the full market value. On a per-acre basis, the benefit to a future buyer of the property works out to $2,103 in current dollars, assuming that the real estate market remains relatively stable for restricted farmland.

Recreational Opportunities Available on Farmland

AFT used several sources of data to estimate the contribution of the protected parcel to the farm's two potential sources of recreational activity: hunting and fishing. These included the Berks County Comprehensive Plan, watershed plans and hunting and fishing license records from the Pennsylvania Game Commission. Cooperative Farm Game projects established by the Pennsylvania Game Commission, which allow public hunting on private farms and woodlots, are scattered through the Tulpehocken Creek watershed. The Tulpehocken Creek watershed also contains several streams that are popular fisheries. The Pennsylvania Fish and Boat Commission and local cooperative sportsman organizations stock many of these streams with trout.[12]

AFT identified county records for hunting and fishing revenues and divided them over the acreage of land use that contributes to those activities in the county. This approach is based on the assumption that open lands (public nonprofit, agricultural and woodlands) provide habitat for wildlife and sites for hunting. These lands also have a positive impact on fishery habitat as opposed to residential, commercial and industrial properties, with their greater areas of impervious surface and contaminants. According to the Berks County Comprehensive Plan,[13] there are 376,413 acres in the public nonprofit, agricultural and woodland categories. With total fishing license revenues of $742,272 in 2004[14], this amounts to $1.97 per acre of benefit, or $368.86 for the 187-acre parcel. With $874,655 of hunting license revenue, the per-acre benefit is $2.32, or $434.52. Therefore, AFT determined a potential revenue value for the farm as $803 per year.

Table 17: Calculation of Recreational Benefits in Berks County

Land Use (1)	Acreage	Licenses (2)	Revenue	Value Per Acre	Subject Property (187 acres)
Public Nonprofit	68,231	Fishing	$ 742,472	$ 1.97	$ 368.86
Agriculture	189,912	Hunting	$ 874,655	$ 2.32	$ 434.52
Woodland	118,270				
Total Acreage	376,413	Total Revenue	$ 1,617,127	$ 4.30	**$ 803.38**

(1) Land Use Data is from the Berks County Comprehensive Plan, 2005

(2) Revenue reported by Pennsylvania Game Commission, 2004 for Berks County

[12] Tulpehocken Creek Watershed Protection Plan and Environmental Assessment, November 1997. NRCS
[13] Berks County Planning Department (online at www.co.berks.pa.us/planning)
[14] Pennsylvania Game Commission, State Wildlife Management, 2003 (online at www.pgc.state.pa.us/cwp)

Local Consumers of Goods Produced on the Protected Farmland

The farmer sells non-pasteurized or raw whole milk directly to local consumers in addition to his wholesale operation selling organic milk and dairy calves. The farmer pointed out that sales are steady and that there is a waiting list for customers. He estimated annual sales of $3,380. The portion of this sale represented by the 187-acre parcel is **$2,107**.

Local Economic Benefits

Information from the farm operator's latest income statement shows that the 300-acre operation had the following expenses: machine hire ($4,178), feed ($53,601), fertilizer ($3,577), trucking ($45), fuel and lube ($11,393), insurance ($11,055), labor ($51,668), rent ($2,601), machine repair ($13,082), seeds ($6,285), supplies ($17,196), taxes ($9,069), utilities ($6,898), veterinary and breeding services ($4,618) and other expenses ($19,650) for a total of $214,916 paid to local businesses and county government for providing goods and services. Assuming that these expenses were shared equally across the farm operation, the portion represented by the 187-acre protected parcel would be $133,964 per year**.**

Local Residents Who Value Agriculture Because It Is a Part of the Community

In the process of updating its Comprehensive Plan, the Berks County Planning Commission mailed approximately 4,900 surveys to a random sample of county residents to inquire about attitudes on future land use development in the county. Twenty percent of the surveys were returned. Respondents indicated that the loss of productive farmland was the single most serious problem.[15]

In 1999, the county commissioners issued a $33-million bond for the sole purpose of purchasing agricultural conservation easements over a five-year period. At that time, there were 25,000 acres on backlog for potential preservation under the county program. While it could be argued that the $33 million was intended to preserve the 25,000 acres waiting for preservation, a more conservative estimate is that the taxpayers supported the funding for all agricultural properties. Dividing the acreage of existing 25,000 acres of farmland in farms by the bond amount yields a value of $1,320 per acre of farmland. For the 187-acre subject parcel, this amounts to $246,840.

In addition, the Berks County Agricultural Preservation Board's Adopt-An-Acre-Program generated $65,431 over a five-year period. Dividing this revenue by the 25,000 acres of farmland

[15] Berks County Agricultural Land Preservation Board Newsletter, (June, 2005)

on back log yields a value of $2.62 per acre, or $489 for the 187-acre parcel. When combined, the two sources of local revenue for farmland preservation result in an average value of $247,329 for the farm parcel. Since both sources of funding were for a five-year period, the annual "willingness to pay" for preservation of the farm is $49,466.

Table 18: Calculation of Local Residents Value of Farmland

Source of Revenue	Amount*	Acreage of Farmland in Preservation Applications	Value Per Acre	Value of 187-Acre Parcel
1999 Bond Issue	$ 33,000,000	25,000	$ 1,320	$ 246,840
Adopt An Acre	$ 65,431	25,000	$ 2.62	$ 490
Five Year Total	$ 33,065,431		$ 1,582	$ 247,330
Annual Basis	$ 6,613,086		$ 316	$ 49,466

* Berks County Agricultural Land Protection Board

Other Benefits of Protected Farmland Considered

Owners of Adjacent Property

Researchers at the University of Pennsylvania[16] estimated the impact that surrounding land use has on residential property values in Berks County. Using regression analysis for 8,090 single-family houses sold between 1998 and 2002, they determined an implicit house price function. They used information on surrounding land use, proximity to potential local disamenities (landfills, large scale agricultural operations, high traffic roads, etc.) and structural attributes of the houses to explain variation in house prices. They found that the distance from an amenity had an affect on the house price. For example, simple open space and large lots had a positive amenity value close to the house and *"between 400 and 1600 meters away from the house, only land that is owned by local, state or the federal government and land covered by conservation easements had a statistically significant positive amenity value."*

The report also concluded that the net impact on surrounding house prices from preserving an agricultural parcel depended on the type of agriculture. Animal production facilities were considered disamenties, though the farm in this case study was a well-managed organic grass based operation and the recent construction of new houses on one border of the farm implies that the farm is not an undesirable neighbor. Ultimately, the authors found that there was no statistical difference between the impact on house prices of privately owned open space covered by crops

[16] Ready and Abdalla, The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania.

and pasture and large-lot residential development. In other words, privately owned open space covered by grass, pasture and crops and large-lot residential development have essentially the same positive impact. Development of the property at the currently allowed zoning density of one house per 40 acres would have the same impact on neighboring properties as preserving the farm. Only if the farm were to convert to a highly undesirable land use (small-lot residential, multi-family residential, industrial) would there be a statistically significant negative impact from the farmland loss.[17]

Local Travelers Enjoyment of Scenic Quality

The farm is located on a rural road that is used primarily by local residents. There were no calculations made for scenic value for this farm.

Flood Avoidance for Downstream Communities

AFT reviewed watershed information for the drainage area of the farm and found that flood avoidance benefits could not be calculated. Since local zoning would only allow one house per 50 acres, the resulting amount of impervious surface in the watershed would be very small for any new residential development. Even allowing for a change in zoning to a higher density, flood damages would be minimal since the entire watershed drains into an Army Corps of Engineers flood control structure. The Army Corp of Engineers owns Blue Marsh Lake, a 1,150-acre impoundment on the Tulpehocken Creek, with 11 billion gallons of floodwater storage capacity. The designated uses of the reservoir are flood control, recreation, water supply, and water quality control.

Unless it has steep slopes, pastureland should be effective in reducing runoff. Cropland can be good if appropriate conservation practices (e.g., reduced tillage, contour cropping, or terraces) are used. Arnold and Gibbons (1996) cite an EPA study predicting that about 10 percent of the rain runs off when the land is in "natural ground cover" or well-managed pasture. The runoff proportion increases to 20 percent when impervious surfaces range from 10 percent to 20 percent (low-density housing), and climbs to about 30 percent if the impervious areas are 35 percent to 50 percent of the total surface.[18]

---

[17] E-mail correspondence from Richard Ready, October 18, 2005.

[18] Arnold, Chester L. and Gibbons, James C. (1996). Impervious Surface Coverage: The Emergence of a Key Environmental Indicator. *Journal of the American Planning Association*. Vol. 62 No. 2, Spring.

Avoidance of Costs Associated with Water Pollution.

AFT reviewed Pennsylvania Department of Environmental Protection 303(d) reports for the Tulpehocken Creek to gain an understanding of the causes of any water quality impairments in the watershed. Based on that review it was determined that a comparison of protected farmland and the alternative large lot residential development could not be made given the limitations of this study effort. Spring Creek is a major tributary of the Tulpehocken Creek which enters Blue Marsh Lake in Lower Heidelberg Township. Spring Creek is classified as a cold water fishery (CWF) and trout-stocking fishery (TSF) from Hospital Creek to the mouth. Rainbow trout are stocked in the stream, and it supports naturally reproducing brook and brown trout (USDA 1997). Information from the 303 (d) report is included in Appendix B.

Fiscal Benefits

Any potential fiscal benefits from the farm property could not be determined without an extensive study of revenues and expenditures in the community and school district in which the farm is located, as well as for Berks County. In addition, assessment records for all three geographic areas would have to be accumulated and analyzed. This level of complexity was beyond the scope of this project.

Summary of Benefits

The owner of the Berks County farm received an initial payment for the easement of $393,330. The combined value of the return from investing this amount and the economic return from farming showed a 30-year value of a little over $3.7 million. Selling the property at the appraised value and investing the proceeds over 30 years yields roughly $3.1 million. This analysis shows the farmer gaining $592,000 dollars when the farm is retained with an easement.

Other measured benefits for the protected farm parcel included:

- Recreational opportunities for fishing and hunting as a result of the farmland led to sales of hunting and fishing licenses, generating an estimated $435 of hunting licenses and $369 of fishing licenses.
- Local direct sales for raw milk amounted to $2,107.
- A total of $133, 964 was paid to local businesses from the farm parcel for the year studied, with payments of this size likely to continue into the future.
- The value of local residents' willingness to pay for farmland values was $49,466 per year.

Compared to the original purchase price of $393,330, it is evident that Berks County and the Commonwealth of Pennsylvania derive significant financial and fiscal benefits from preserving this parcel of property.

Table 19: Summary of Results – Berks County, Pennsylvania Farm			
Category of Benefits	**Value**	**Time Period**	**Source of Estimate**
Benefits Values Determined			
Property Owner			
a. Payment received for the easement	$393,330	One time	Appraisal
b. Economic return from easement payment and farm operation	$3,711,203	30 years	Winning the Development Lottery Model
c. Investment return from sales of farm for development.	$3,118,656	30 years	Winning the Development Lottery Model
d. Net difference between b and c	$592,547	30 years	
Future Buyers of the Property	$393,330	One time	Appraisal
Recreational Opportunities Hunting licenses Fishing licenses	 $435 $369	 Annual Annual	Pa. Game Commission
Local Consumers of Goods	$2,107	Annual	Farm operator's estimates of sales
Local Business	$133,964	Annual	Farm operator's income statement
Local Residents Value	$ 49,466	Annual	County bond sale and contributions divided by farmland acreage.
Benefit Values Not Determined		Notes	
Owners of Adjacent Property	No value	There were no lease payments and the assessment benefit was thought to be neutral.	
Local Travelers Scenic Value	No value	Beyond the scope of the project.	
Flood Avoidance	No Value	Flood control structures are in place and the alternative residential development would not have altered the hydrology significantly.	
Avoidance of Water Pollution	No Value	Agriculture was the dominant land use and a major cause of pollution according to watershed reports. Erosion was not significant enough to determine a value.	
Fiscal Benefits	Not Determined	A Cost of Community Services analysis at the county level with a network of municipal, school district and county services was beyond the scope of the project.	

CONCLUSION

This research identified the value of benefits that are provided to local residents or stakeholders from the purchase of agricultural conservation easements including: 1) owners of the farm, 2) subsequent buyers, 3) owners of adjacent or neighboring properties, 4) local travelers enjoying the views of the protected parcel, 5) local residents who find recreational opportunities, 6) consumers who purchase agricultural products grown on that land, 7) owners and employees of local businesses providing goods and services to the farm, 8) users of downstream water who avoid flood damage or flood control costs, 9) users of downstream water who avoid the costs of sediment build-up or water pollution, 10) local residents who value farmland preservation for protecting wildlife habitat, rural "history and heritage," curbing urban sprawl or achieving other civic purposes, 11) the local economy and 12) community fiscal impacts.

While it was initially thought that farms selected as case studies would provide useful information for all categories, the nature of the farm operation being evaluated determines the types of benefits identified. Some farms do not have recreational opportunities or direct sales to local consumers. In addition, some benefits could not be quantified without further study beyond the limited time and scope of this research effort. Benefits requiring further research included the value to future landowners, the scenic value to local residents, and water pollution costs, with the exception of some erosion costs.

The range of findings shows that the ongoing benefits of protected are significant. Based on these two case studies, AFT found that:

- The owners of property will achieve greater economic income in the future by selling the development rights on their property.
- Adjacent properties can benefit from direct payments for leasing of property for agricultural operations, and there is a relatively higher increase in assessed values than other properties in the community.
- Recreational opportunities, while not found as a direct payment to the operators of the case study farms, can be evaluated as an indirect community service or a potential future use.
- Local businesses continue to receive financial benefits by selling goods and services to the operation.

- The economic contribution from farming operations is fairly easy to quantify and had a very significant value.
- Soil loss from erosion during development is a cost that can be avoided by keeping the land in agriculture, although the long-term cost of erosion during farming may negate that benefit.
- Flood costs, though small, are quantifiable in watersheds without flood control structures.
- Existing local data sources and reports can provide information that can be used as evidence to support funding for farmland protection.

The overall picture gained from this research is that, at least for the two farm properties studied, the one-time cost of purchasing an agricultural conservation easement is more than offset by the value of the benefits to community stakeholders in farmland preservation. Additional research, using different types of farm operations in different geographic areas would be useful to further refine this approach and provide a larger sample of benefits.

APPENDICES

Appendix A: RUSLE2 Modeling

RUSLE2 Profile Erosion Calculation Record: Development

Inputs: **File:** profiles\bare ground bulldozer

Location: Massachusetts\Franklin County

Soil: HbA Hadley very fine sandy loam, 0 to 3 percent slopes\HADLEY very fine sandy loam 85%

T value: 5.0 t/ac/yr Slope length (horiz): 150 ft

Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*Yield (# of units)*

Contouring: default

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Adjust res. burial level: Normal res. burial

Outputs:

Soil loss for cons. plan: 9.2 t/ac/yr Sediment delivery: 9.2 t/ac/yr

Net C factor: 0.98 Net K factor: 0.52 Net LS factor: 0.16

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
4/15/0	Bulldozer, filling/leveling		0
9/15/0	Bulldozer, filling/leveling		0

Soil conditioning index (SCI): -0.6

Wind & irrigation-induced erosion for SCI: 0 t/ac/yr

SCI OM subfactor: -1.0

SCI FO subfactor: 0.90

SCI ER subfactor: -2.6

STIR value: 10.40

Note: The SCI is the Soil Conditioning Index rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system. The STIR value is the Soil Tillage Intensity Rating. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

RUSLE2 Profile Erosion Calculation Record: Easement Scenario

Inputs: **File:** profiles\flowers

Location: Massachusetts\Franklin County

Soil: HbA Hadley very fine sandy loam, 0 to 3 percent slopes\HADLEY very fine sandy loam 85%

T value: 5.0 t/ac/yr

Slope length (horiz): 150 ft

Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*Yield (# of units)*
CMZ 65\c.Other Local Mgt Records\flowers	Flowers	lbs	1000.0
CMZ 65\c.Other Local Mgt Records\flowers	Rye, winter cover	pounds	2240.0

Contouring: e. relative row grade 10 percent of slope grade

Strips/barriers: (none)

Diversion/terrace, sediment basin: (none)

Adjust res. burial level: Normal res. burial

Outputs:

Soil loss for cons. plan: 1.3 t/ac/yr Sediment delivery: 1.3 t/ac/yr

Net C factor: 0.16 Net K factor: 0.52 Net LS factor: 0.15

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
4/20/0	Plow, moldboard		3.5
4/21/0	Add mulch		62
4/21/0	Disk, tandem secondary op.		62
4/22/0	Disk, tandem light finishing		27
4/23/0	Planter, transplanter, vegetable	Flowers	28
8/15/0	Harvest, dig root crops 12 in depth res. on surf		24
8/15/0	Disk, tandem secondary op.	Rye, winter cover	24
8/15/0	Planting, broadcast seeder		24

Soil conditioning index (SCI): -0.06

Wind & irrigation-induced erosion for SCI: 0 t/ac/yr

SCI OM subfactor: 0.57 SCI FO subfactor: -0.98

SCI ER subfactor: 0.49 STIR value: 199.6

Appendix B: Watershed Reports

FINDINGS FROM NAWQA – CONNECTICUT RIVER EXAMPLE

Nutrient (nitrogen and phosphorus) concentrations are a concern for surface-water quality.

The large amount of nitrogen entering Long Island Sound from streams, precipitation, and coastal communities has stimulated algal blooms. Decay of the algae then produces low dissolved-oxygen conditions in the Sound, creating poor habitat for fish and other marine animals. Nitrogen and phosphorus concentrations are highest in urban streams, primarily because of wastewater discharges from sewage-treatment facilities.

Pesticides were frequently detected in Study Unit streams.

The herbicides atrazine, metolachlor, prometon, and simazine, and the insecticides diazinon and carbaryl were the most frequently detected compounds. Concentrations of atrazine, metolachlor, and simazine were highest in surface water draining from agricultural areas. Concentrations of prometon, diazinon, and carbaryl were highest in surface water draining from urban areas. However, current drinking-water standards were not exceeded. None of the pesticides were detected at concentrations greater than the U.S. Environmental Protection Agency's maximum contaminant level (MCL) or the health advisory limit (HAL), and few pesticide concentrations exceeded 1 microgram per liter (1 µg/L). Current drinking-water standards, however, do not include some detected pesticides (or breakdown products), and do not include consideration of more than one pesticide in the water. Thus, the actual health concern posed by these results is somewhat uncertain.

Several classes of contaminants were detected in ground water.

These contaminants included pesticides, volatile organic compounds (VOCs), and nitrate. Twenty-four different pesticides (or their breakdown products) were detected in shallow ground water beneath the Study Unit. Atrazine, prometon, and simazine were the most commonly detected pesticides in ground water. VOCs were detected in 70 percent of the shallow groundwater samples collected in urban areas. Methyl *tert*-butyl ether (MTBE), a gasoline additive, was the most frequently detected VOC, and chloroform, a byproduct of water disinfection, was the second most frequently detected. Median nitrate concentrations in shallow ground water beneath agricultural fields (3.8 mg/L) were nearly 30 times higher than background concentrations (0.14 mg/L).

Maximum Contaminant Levels (MCLs)

The pesticides atrazine and ethylene dibromide were detected at concentrations greater than their MCLs in a few samples collected from agricultural areas. The VOCs--tetrachloroethene, trichloroethene, benzene, and naphthalene--exceeded their MCLs in some samples collected from urban areas. Nitrate concentrations exceeded the MCL in 15 percent of the samples of shallow ground water collected in agricultural areas.

Tulpehocken Creek Watershed Protection Plan and Environmental Assessment

Water Quality Impairment

The Pennsylvania Department of Environmental Protection 303(d) list contains seven streams in this subbasin with agricultural sources of impairment. Failing septic systems and improper construction activities also contribute nonpoint source pollution. Industrial point sources add excess chlorides, metals, and siltation to subbasin streams. Agricultural activities have a large impact on water quality due to field and cropland erosion, nutrient losses through leaching and surface runoff, improper animal waste management and disposal, and wetlands conversion and impairment of riparian habitats. Sediment and nutrient loads in the Tulpehocken Creek watershed and the Blue Marsh Lake in particular are very high.

Monitoring/Evaluation

The Tulpehocken Creek Watershed Protection Plan and Environmental Assessment, completed in November 1997 by US Natural Resources Conservation Service (NRCS), authorized financial and technical assistance for implementation projects in the Tulpehocken Creek watershed in Berks and Lebanon Counties under the Watershed Protection and Flood Prevention Act, P.L.83-566. The purpose of this ten-year plan is watershed protection, water quality improvement, and fish and wildlife development through conservation practice implementation, acquisition of conservation easements and the installation of aquatic habitat improvement projects. The Berks and Lebanon County Conservation Districts and the Berks County Conservancy act as sponsors of remediation projects.

The Agricultural Nonpoint Source Pollution Assessment for Tulpehocken and Perkiomen Creek Watersheds prepared by the Berks County Conservation District (CD) in 1982 documented impairments due to animal wastes, nutrients and sediment loads. The Berks County CD conducted a watershed assessment and subsequently hired a technician to implement best management practices on farms in the Tulpehocken watershed, using Section 319 nonpoint source funds from FY94 through FY97 grants.

Future threats to water quality

With the slow anticipated population growth, the subbasin should be subjected to the same water quality impairments as now present, agricultural runoff, streambank erosion, urbanization, and on-lot septic system leachate. Sediment, nitrogen, and phosphorus loading rates to Blue Marsh Lake and Tulpehocken Creek are expected to decrease over the next 20 years, primarily due to implementation of better agricultural practices. Urban and streambank erosion sources are expected to increase over this period.

Appendix C: Background Information for IMPLAN

IMPLAN was developed to model input-output transactions based upon local sources of economic activity. This software was designed for the U.S. Forest Service to catalog and forecast the local economic impact of a timber harvest. In addition to forest products, IMPLAN works as an input output-model that produces tables for linkages between NAIC (North American Industrial Classification System) defined industrial sectors. IMPLAN uses commodity flows from producers to intermediate and final consumers to describe a regional economy. The factors IMPLAN analyzes in this form of input-output analysis are: total industry purchases of commodities, services, employment compensation, value added and imports. The software runs as a detailed, data rich, inverse matrix and produces multipliers, which describe the final impact of an increase or decrease of one dollar of spending.

County data is run through IMPLAN software, creating tables that describe total industry output, total employment and final value-added are created. Output is defined as the value of production by a given industry per year. Employment is defined as wage and salaried employees for full and part-time workers within each industry. Total value-added describes the following: income to workers paid by employers, income, rents, royalties, dividends, profit, excise and sales tax.

Each of these tables contains a set of numbers that describe the amount of money that must be spent to generate one unit in dollars, services, products or jobs. Direct effects account for production changes associated with final demand changes within an industry. Indirect effects describe backward-linked industries and the corresponding changes that result from changes in input demands for directly affected industries. Induced effects account for the changes in regional household spending behaviors (footnote for IMPLAN). These numbers are then manipulated as follows to create different types of multipliers:

- Type I and Type Social Accounting Method Multipliers, Type I = (Direct Effects + Induced Effects)/Direct Effects
- Type SAM = (Direct Effects + Induced Effects + Indirect Effects)/Direct Effects

Type I multipliers take into account the change in industry demand if one industry experiences an increase or decrease in final demand. It does this by factoring in the response of an industry and its suppliers. Type SAM multipliers include household spending as well as industry spending. Therefore, for each of the IMPLAN tables, results are presented in a way that describes industrial spending and household spending. In order to find the total impact of an industry, it is possible to

take the SAM multiplier for the output table generated from this software, as the SAM multiplier is designed to capture the impacts of economic changes within a local economy on both industries and households.

Appendix D: Calculation of Potential CPA Funds for Deerfield, Massachusetts

The first step in assessing the potential for determining the community's willingness to pay for farmland (or open space) protection required finding the total taxable value for the communities that have acquired open space with CPA dollars. The state Department of Revenue provided records of the most recent year of data for the three towns. The total taxable value for the towns was then summed and averaged.

Next, this study identified the dollars raised through the local tax increment increase (Table 10) using the following steps:

1. Identify the taxable value of all properties
2. Locate a source that tells the amount of money each community has raised as a result of CPA (in the case of Massachusetts, CPA dollars are provided on a 1:1 ratio which means that the amount the Commonwealth allocates to each town is exactly the same as the amount the town raises)
3. Calculate the percent raised by CPA in relation to total taxable value
4. Comb through CPA spending records and identify the amount spent on open space
5. Calculate the percent spent on open space in comparison to total CPA dollars
6. Multiply the percent raised by CPA (Step 3) by the percent of CPA spent on open space (Step 5)
7. The number resulting from Step 6 reveals the percent of the total taxable value that is spent on open space
8. Average all results

To apply this value to the Town of Deerfield, the following steps were taken:

1. Find the total taxable value for the town
2. Multiply the average percent of assessment number by the total taxable value
3. Take the dollar amount from step 2 (estimated CPA assessment) and multiply it by the average amount spent on open space.
4. Find out how many acres in town are in open space
5. Divide step 3 (estimated amount spent on open space) by the open space acreage. This is amount citizens in the study population may be willing to pay to protect open space.
6. Multiply this by the number of acres in the parcel to find the value to the public.

REFERENCES

1. Arnold, Chester L. and Gibbons, James C. (1996). Impervious Surface Coverage: The Emergence of a Key Environmental Indicator. *Journal of the American Planning Association*. Vol. 62, No. 2, Spring.
2. American Farmland Trust (1997). *Saving American Farmland: What Works*. (Northampton, MA: American Farmland Trust) pp: 167-194.
3. American Farmland Trust (1998). *Investing in the Future: The Massachusetts Program and The Permanence Syndrome* (Washington, DC: American Farmland Trust).
4. American Farmland Trust (2001). *Winning the Development Lottery: A Landowner's Guide to Agricultural Conservation Easements and the Development Potential of Farmland in California's Central Valley* (Washington, DC).
5. American Farmland Trust (2002). *Cost of Community Services Studies: Making the Case for Conservation*. (Washington, DC).
6. American Farmland Trust & U.C. Davis Agricultural Issues Center (2003). *A National View of Agricultural Easement Programs: Profiles and Maps—Report 1*. (Davis, CA)
7. American Farmland Trust (2005). *Easement Stewardship Roundtable*. March 21, 2005. Washington, D.C.
8. American Farmland Trust (2005). *Summary of Cost of Community Service Studies, Revenue-to-Expenditure Ratios in Dollars*
9. Beaseley, Steven D., Workman, William G., Williams, Nancy A. (1986). Estimating Amenity Values of Farmland: A Contingent Valuations Approach. *Growth and Change*. October: 70-78.
10. Bergstrom, John C., 2001. *Postproductivism and Rural Land Values* (Athens, GA: Department of Agricultural and Applied Economics, The University of Georgia, FS 01-20).
11. Blaine, Thomas W., 2003. An Assessment of Residents' Willingness to Pay for Green Space and Farmland Preservation Conservation Easements Using Contingent Valuation Method (CVM). *Journal of Extension*. August 2003, 41: 4

12. Brown, A.D. (2003) *Feed or Feedback: Agriculture, Population Dynamics and the State of the Planet* (Utrecht: International Books.)
13. Bromley, Daniel W., 2000. Can Agriculture Become an Environmental Asset? *World Economics*, 1 (3): 127-139.
14. Champ, Patricia A.; Boyle, Kevin J., Brown, Thomas C. (2003). A Primer on Nonmarket Valuation. *Kluwer Academic Publishers*. Dordrecht, The Netherlands.
15. Chen, Ming-chein (2001). Evaluation of Environmental Services of Agriculture in Taiwan. International Seminar on Multifuncionality of Agriculture. Food & Fertilizer Technology Center. Available online: www.agnet.org
16. Community Farm Alliance (2003). *Bringing Kentucky's Food and Farm Economy Home*. (accessed online May 23, 2005 at http://www.foodroutes.org/doclib/cfa_kentucky.pdf)
17. Correl
18. M.J. Lillydahl and L. Singell (1978). The Effects of Greenbelts on Residential Property Values: Some Finding on the Political Economy of Open Space, *Land Economics*, 54:2, pp. 207-217.
19. Costanza, Robert, et. al. (1998). The value of ecosystem services: putting the issues in perspective. *Ecological Economics* 25, pp. 67—72.
20. Costanza, Robert, et. al. (1997). The Value of the world's ecosystem services and natural capital. *Nature*, 387; 15, May 1997: 253-60.
21. Crompton, John L. (2004). The Proximate Principle: The Impact of Parks, Open Space and Water Features on Residential Property Values and the Property Tax Base, *National Recreation and Parks Association*, Second Edition, Ashburn, Virginia.
22. Daniels, Tom (1998). The Purchase of Development Rights, Agricultural Preservation and Other Land Use Policy Tools: The Pennsylvania Experience, a chapter in *Increasing Understanding of Public Problems and Policies* (Oak Park, IL: The Farm Foundation), pp. 34-44.

23. Drake, L. (1992). The Non-Market Value of the Swedish Agricultural Landscape. *European Review of Agricultural Economics*, 19: 351-64
24. Duke, Joshua M. and Aull-Hyde, Rhonda (2002). Identifying public preferences for land preservation using analytic hierarchy process. *Ecological Economics*, 42: 131-145.
25. Deller, Steven C. (1993). Regional Economic Models for the State of Wisconsin: An Application o the Micro-IMPLAN Modeling System. Center for Economic Development Department of Agriculture Economics University of Wisconsin-Madison/Extension. Staff Paper 93.6.
26. Economic Research Service/USDA (2001). *Development at the Urban Fringe and Beyond*. AER-803.
27. Elconin, Paul and Valerie A. Luzadis (1997). *Evaluating Landowner Satisfaction with Conservation Restrictions* (Syracuse, NY: State University of New York, College of Environmental Science and Forestry).
28. Franklin Regional Council of Governments (March, 2004). *Average Annual Daily Traffic Count Data Franklin County, Massachusetts: 1991-2003*. Greenfield, MA.
29. Goulder, Lawrence H. and Donald Kennedy (1997). Valuing Ecosystem Services: Philosophical Bases and Empirical Methods. *Nature's Services: Societal Dependence on Natural Ecosystems*, edited by Gretchen C. Daily (Washington, D.C.: The Island Press), pp 51-70.
30. Halstead, J. (1984). Measuring the Non-market Value of Massachusetts Agricultural Land: A Case Study. *Journal of Northeastern Agricultural Economic Council* 13: 226-247.
31. Hansen, L.T., V.E. Breneman, C. W. Davidson and C.W. Dicken, 2002. The cost of soil erosion to downstream navigation. *Journal of Soil and Water Conservation*, 57 (4): 205-212.
32. Heimlich, Ralph E. and Anderson, William D (2001). *Development at the Urban Fringe: Impacts on Agriculture and Rural Land*. Agricultural Economic Report No. 803 (Washington, D.C.: U.S. Department of Agriculture-Economic Research Service).

33. Hellerstein et. al. (2002). *Farmland Protection: The Role of Public Preferences for Rural Amenities / AER-815*. (Washington, D.C.: U.S. Department of Agriculture-Economic Research Service).
34. Irwin, E.G. and N.E. Bockstael (2001). The Problem of Identifying Land Use Spillovers: Measuring the Effects of Open Space on Residential Property Values. *American Journal of Agricultural Economics*, 83 (3): 698-700
35. Income Opportunities in Special Forest Products: Self-Help Suggestions for Rural Entrepreneurs. USDA Forest Service, Agricultural Information Bulletin 666, May 1993. USFS, Washington, DC.
36. Kantor, L.S. (2001). Community Food Security Programs Improve Food Access. *Food Review*. 24 (1), 20-27.
37. Kaplan, R. & Kaplan S. (1990) The restorative experience: The healing power of nearby nature. In M. Francis and R. T. Hester Jr. (Eds.) *The Meaning of Gardens.* Cambridge, MA: MIT Press. Pp. 238-243
38. Lesher, William G. and Eiler, Doyle A. (1978). *American Journal of Agricultural Economics*, February, 140-143.
39. Libby, Larry and Elena G. Irwin, *Rural Amenities and Farmland Values* (Columbus, OH: Department of Agricultural, Environmental and Developmental Economics, The Ohio State University), available at http://www.agecon.ag.ohio-state.edu/programs/swank/pages.htm [accesses February 2, 2005].
40. Loomis, John; Kent, Paula; Strange, Liz; Fausch, Kurt; Covich, Alan (2000). Measuring the total economic value of restoring ecosystem services in an impaired river basin: results from a contingent valuation survey. *Ecological Economics* 33 103-117.
41. Manning, R. (2004). The Oil We Eat. *Harpers Magazine.* Feb., 37-45.
42. Massachusetts Department of Agricultural Resources. *Fingertip Facts*. (Accessed at www.mass.gov/agr/facts/fingertip.htm on May 23, 2005)
43. Morancho, A. (2003). A Hedonic Valuation of Urban Green Areas. *Landscape and Urban Planning*. 66, 35-41.

44. Nickerson, C. and L. Lynch (2001). The Effect of Farmland Preservation Programs on Farmland Prices. *American Journal of Agricultural Economics*. 83:2, pp. 315-324.
45. O'Connor Real Estate Associates, Inc. (2002). *Appraisal Number 4590A*.
46. Passour Jr., E.C. Agricultural Land Protection: Is Government Intervention Warranted? *Cato Journal*, Vol. 2, No. 3 (Winter 1982): pp. 739-758.
47. Pierce, Robert A (1997). Lease Hunting: Opportunities for Missouri Landowners. January. University of Missouri Journal of Extension. http://muextension.missouri.edu/explore/agguides/wildlife/g09420.htm
48. Prindle, Allen M and Blane, Thomas W. (2000). Local Governments Topics: Cost of Community Service Studies. *Local Government Information and Education Network (LGIEN)*. Fact Sheet. Urbana, Ill. University of Illinois Extension Service, 2000. Available online at http://www.extension.uiuc.edu/factsheets/lgien0011.ps.pdf.
49. Ready, R.C., M.C. Berger and G.C. Blomquist (1997). Measuring Amenity Benefits from Farmland: Hedonic Pricing and Contingent Valuation. *Growth and Change*, 28: 438-458.
50. Randall, A. and E. Castle. Land Resources and Land Markets in A.V. Kneese and J.L. Sweeney eds., *Handbook of Natural Resource and Energy Economics*, v. II. Amsterdam: Elsevier Science Publishers.
51. Riddel, M (2001). Hedonic Prices for Environmental Goods. *Land Economics* 77:4, pp. 495-512.
52. Roe, B., E.G. Irwin and H. Morrow-Jones (2002). The Effects of Farmland, Farmland Preservation and Other Neighborhood Amenities on Proximate Housing Values: Results of a Conjoint Analysis of Housing Choice. Working Paper, Department of Agricultural, Environmental and Development Economics, Ohio State University.
53. Rosenberger, R. and R. Walsh, R. (1997). Non-Market Value of Western Valley Ranchland Using Contingent Valuation. *Journal of Agricultural and Resource Economics* 22:2, pp. 296-309.

54. Sen, A. (1995). Fundamental Evaluation and Social Choice: Contingent Valuation and the Market Analogy. *The Japanese Economic Review*. 46 (1): 23-37
55. United Nations Food and Agriculture Organization (2002). *Land Tenure and Rural Development*. Rome, Italy.
56. United Nations Millennium Ecosystem Assessment Synthesis Report (2005). *Millennium Ecosystem Assessment Report*. Summary for Decision Makers: 16-31. Available online at: http://www.millenniumassessment.org/en/products.aspx.
57. USDA Agricultural Research Service. "ARS Builds Mock Village to Measure Runoff Effects on Water Quality. Accesses May 17, 2005. (Available online at: http://www.ars.usda.gov/is/pr/2003/030630.htm).
58. USDA Economic Research Service (2000). Agriculture and Rural Trends: Urbanization Affects a Large Share of Farmland. Washington, DC: USDA Economic Research Service; ERS Agricultural Economic Report; volume 10; number 2; pp. 1-7.
59. USDA Soil Conservation Service (1967). *Soil Survey: Franklin County Massachusetts*. (Washington, D.C.).
60. USGS National Water Quality Assessment Program: http://water.usgs.gov/nawqa.
61. Walker, Peter A., Marvin, Sarah J. and Fortman, Louise P. (2003). Landscape Changes in Nevada County reflect social and ecological transitions. *California Agriculture* October/December, 2004 pp. 115-121.
62. Western Governors' Association (2001). *Purchase of Development Rights: Conserving Lands, Preserving Western Livelihoods*. Crossfire Graphics (Denver, CO)
63. Wolfram, Gary (1981). The sale of Development Rights and Zoning in the Preservation of Open Space: Lindahl Equilibrium and a Case Study. *Land Economics* 57: 3 pp. 398-413.
64. Young, Dennis R. (2004). *Effective Economic Decision-Making by Nonprofit Organizations*. New York, NY (The Foundation Center).