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*“Enhancing the capacity of Land Grant Universities
to foster rural development and regional prosperity”*

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David A. Fleming, David A. McGranahan and Stephan J. Goetz²

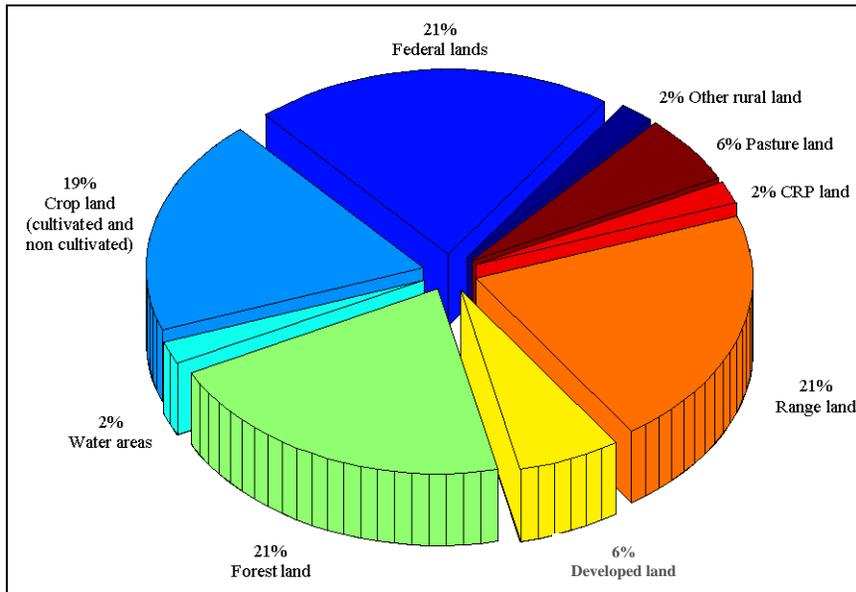
Abstract: Although natural amenities are generally not considered as a program outcome in the US (at least not formally at the Federal level), environmental and ecological programs have important socioeconomic consequences that need to be identified. This paper examines, in the context of land use more broadly, how one would assess the socioeconomic outcomes of land-focused programs, and the barriers to such an assessment. We first summarize the pertinent literature on the effects of various amenities – including those subject to public policy change and those that are not – on socioeconomic factors. Then we describe the myriad State and Federal programs that affect land use as an amenity. One problem in evaluation is the large and diverse number of actors involved in land use policy, including State, local and private conservancy programs. A further gap in knowledge is the extent to which States see land-use programs as having socioeconomic impact, and the sizes of these State/local/nonprofit programs. We conclude with a discussion of key factors that need to be taken into account and a proposed framework to evaluate the effects of land-based policies on the provision of amenities and on socioeconomic conditions.

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² The Pennsylvania State University, Economic Research Service (USDA) and The Pennsylvania State University/Northeast Regional Center for Rural Development, respectively. *The views expressed here are those of the authors and may not be attributed to the Economic Research Service or the U.S. Department of Agriculture.*

I. Introduction

The US ranks as one of the largest countries in the world with a surface area exceeding 2.4 billion acres (0.01 billion km²). Excluding Alaska, islands and water bodies, its land area surpasses 1.8 billion acres. The proportion of urbanized land is small compared to the large amount of crop, forest, range and Federal lands (figure 1). Nevertheless, the relative abundance of land has allowed large-scale land consumption for development purposes, reaching total growth of nearly 50% since 1980 (Wu 2008). A key feature of US land use is high density development in coastal areas and the South especially, compared to central parts of the country. These mega-regions enjoy enormous agglomeration economies and the question arises whether rural areas can offer sufficient natural amenities so as to not increasingly be left behind (Irwin *et al.* 2007). To elucidate this topic we begin by briefly reviewing studies that consider natural amenities as drivers of rural development.



Source: NRCS (2009)

Figure 1. Land cover composition, to the year 2003, contiguous US.

As noted in the report from the first “Rural Development Project” workshop [*EuroChoices* 7(1)], the US government does not directly consider the provision of natural amenities in its rural development policy (McGranahan and Thompson 2008; Cochrane and Wojan 2008). Given that ‘natural’ or ‘environmental’ amenities are broad concepts that can be affected by multiple policies, we narrow our study to the role of land-based conservation policies affecting the provision of open spaces, landscapes and recreational sites in rural areas across the US. Most of these conservation programs are based on agri-environmental goals, which seek to preserve soil under conditions of intensive agriculture. On the other hand, some programs focus on the preservation of farmland when it is threatened by land use change. However, in neither case are rural development prospects considered explicitly via the potential role of amenities on economic growth. In addition to providing background on the socioeconomic impacts of natural amenities in the US, this paper compiles and analyzes Federal as well as State/local conservation programs and policies that impact land use. It also examines factors to consider when evaluating land-focused conservation programs and when measuring their potential impacts on socio-economic outcomes via natural amenities provision. We conclude by discussing issues to consider in evaluating these kinds of policies and sketch a framework that could be used to evaluate these policies in rural areas.

II. The socio-economic role of natural amenities in the US

A considerable body of research has examined relationships between environmental amenities and socioeconomic well-being in the US, particularly in rural areas. Most of this research has used counties as units of analysis as they tend to be the smallest units for which a variety of socioeconomic data are available. While the studies have differed in variables, geographic coverage and statistical methods, together they suggest that landscape, climate and other environmental amenities have substantially shaped the location of rural US growth over the past 30 years. Moreover, despite their association with typically low-wage service industries, these amenities are not negatively related to socioeconomic well-being.

Research in this field has begun to deal with issues that should eventually make a socioeconomic evaluation of environmental projects a realistic goal. One issue is spatial spillovers, important because environmental attributes have little respect for political boundaries and people may cross county lines to work and recreate. In part this is a question of proper statistical technique: studies have only recently adopted spatial econometrics to take into account that local qualities generally “spill over” from one county to the next (e.g., Rupasingha and Goetz 2004; Gustafson *et al.* 2005). However, it is more than a question of general spillover. Environmental amenities may have a range of influences. Thus, for instance, Schmidt and Courant (2006) found that wages were depressed in metropolitan areas with nearby national parks and rural recreational areas. In rural areas, since environmental amenities raise housing costs and provide employment, their economic and demographic influence likely extends to neighboring areas (counties).

A second issue is spatial variation in the value of amenities. Partridge *et al.* (2008) found in a geographically weighted regression, which allows regression coefficients to vary across space, that amenities associated with economic growth in some areas of the US had little relationship with growth in others. Thus, the incremental effect of a body of water on job growth is much higher in a water-scarce region than in a region with abundant shorelines. McGranahan (2008) found that more forest generally meant more net migration and higher gains in housing values, but both indicators declined beyond a certain tipping point.

Finally, much of environmental amenity research has involved “fixed” amenities, topography, climate and other features that are relatively unchanging over time. This provides an analytical advantage in that these qualities are unlikely to be endogenous – i.e., affected by the very socioeconomic conditions and changes under investigation. But it means that we know relatively little about amenities that may be influenced by environmental or other policy. An exception is Gustafson *et al.* (2005), who explicitly incorporated land cover composition into an analysis of changes in population and housing densities in the Midwest. They found that, overall, forest had a positive effect on population change and agricultural cover a negative effect, but these findings were not consistent across the region. Agricultural cover was particularly negative in the heavily agricultural prairie section, but even positive (though not significant) in the relatively forested “Laurentian Province.” At the same time, forest had a negative coefficient in the latter area. The study also showed counties with interspersed land cover attracted or retained more people than did counties with segregated land cover. This study is consistent with the research cited in the previous paragraph in suggesting that people prefer mixed landscapes and that change tilting a landscape toward too much of one element or another is likely to reduce appeal.

Another exception is work assessing the growth impacts of conservation programs. Lewis *et al.* (2002, 2003) incorporate endogenously determined amenities by investigating the effects of public forest conservation land on employment and migration change in the Northeast and Great Lakes States, where forest is the predominant resource-based industry. In pointed contrast to earlier studies (and conventional wisdom), they find that conservation efforts in these regions not only fail to reduce employment but actually increase in-migration, which indirectly promotes local employment growth. This result is to some extent supported by Sullivan *et al.* (2004) who find that the Federal Conservation Reserve Program (CRP), which takes agricultural land out of production, has not had significant long term effects on employment change. It is not clear, however, whether these findings are applicable to all settings. For instance, taking agricultural land out of production may reduce amenity value in areas dominated by forest.

Table 1 presents a summary of key regional economic studies that have incorporated natural amenities as variable affecting different socio-economic indicators.

Table 1. Selected county-level econometric models using environmental amenities as rural development predictor (last 8 years).

Study	Model's dependent variable	Amenities studied (co-variates)	Findings/Results	Method	Notes
<i>Implicitly spatial models</i>					
Deller et al. (2001)	- Δ Population - Δ Employment - Δ Income	- Climate-based - Built-based - Land-based - Water-based - Winter-based	(+), NS, (+) (+), (+), (+) (+), (+), NS (+), NS, (+) (+), (+), (+)	OLS	Δ : 1985 to 1995. Sample: 2,243 rural counties. Amenities are included under indexes constructed using a Principal Component approach.
Lewis, Hunt & Plantinga (2002)	- Δ Employment - Net migration	Percentage of total county land in conservation in 1990	NS, (+)	3SLS	Δ and net migration: 1990-1997. Sample: 92 counties in the northern Lakes States region, northeastern NY, and northern New England. Based on simultaneous equations authors find evidence of indirect (+) correlation between employment and amenity. Similar results (and NS for wage growth) are reported in Lewis, Hunt & Plantinga (2003)
Rappaport and Sachs (2003)	- Δ Population density(s)	Ocean and Great Lakes Coasts	(+)	GMM	Δ : the authors consider different time periods and definitions for their dependent variables. Sample: 3069 counties. Appealing to scale and productivity effects, the authors claim that coastal counties present higher population density because the amenity role of water as recreational, scenic and weather buffer provider, ergo as improving quality of life. The GMM used is based on a generalization of the Huber-White heteroskedasticity-consistent estimator provided by Conley (1999)
Pagoulatos et al. (2004)	- Δ Employment - Δ Per worker earnings	ERS natural amenity index	(-), NS	3SLS	Δ : 1987-1995. Sample: 3,036 counties. A third equation used by the authors includes as dependent variable 'pollution per squared mile growth' with (+) and (-) correlation to employment and earnings growth, respectively. An interaction between the amenity index and housing value was (+) correlated to employment growth.

Sullivan et al. (2004)	<ul style="list-style-type: none"> - Δ Population - Δ Employment 	<ul style="list-style-type: none"> - CRP (see table 2) - CRP interaction with pop. density - ERS natural amenity index 	<ul style="list-style-type: none"> NS all NS all, but (-) in short term Δ Employment NS all 	OLS	<p>Δ: 1985 to 1992 (short-term) and 1985 to 2000 (long-term). Sample: 1,481 counties (counties in which farm employment comprised more than 5% of jobs and with urban population of less than 20,000 by 1980). Regressions are based on matched-pair differences.</p> <p>CRP is measured as payments (provided by this program) to income ratio by county.</p>
Dissart & Marcoullier (2005)	- Δ Household income	<ul style="list-style-type: none"> - Water - Climate (snow) - Topography - Land - Nature - Wildlife 	<ul style="list-style-type: none"> NS all, but (+) in mountains cluster NS all NS all, but (-) in snowfall cluster NS all NS all NS all, but (+) in snowfall and no-amenity clusters 	OLS by clusters	<p>Δ: 1989-1999. Sample: six clusters of 686, 177, 249, 85, 36 and 30 remote counties defined by amenity related characteristics.</p> <p>Prior to the estimation the authors, using cluster analysis, divided remote counties into six clusters based on the predominant natural asset. Thus amenities variables are constructed based on outdoor recreational facilities directly related to the amenity.</p>
Dearien, Rudzitis & Hintz (2005)	- Net migration	<ul style="list-style-type: none"> - % of public lands - Distance to high amenities land - % high amenities land 	<ul style="list-style-type: none"> NS (-) (+) 	OLS	<p>Net migration: 1990-2000. Sample: 100 interior Northwestern counties.</p> <p>High amenities land is defined as the sum of federal wilderness, national forests, national parks and national wildlife refuges in a county.</p>
Goe & Green (2005)	<ul style="list-style-type: none"> - Δ Absolute well-being index - Δ Relative well-being index 	<ul style="list-style-type: none"> - Land-based - River-based - Lake-based - Warm-weather built-based - Cold-weather built-based - Abuts ocean coast 	<ul style="list-style-type: none"> NS, (+) NS all NS all (+), NS NS all NS all 	OLS	<p>Sample: 466 nonmetropolitan commuter zones.</p> <p>Absolute well being index defined by total employment, aggregate income and total population.</p> <p>Relative well-being index defined by different household income levels.</p>
Deller & Lledo (2007)	<ul style="list-style-type: none"> - Δ Population - Δ Employment - Δ PC income 	<ul style="list-style-type: none"> - Climate-based - Built-based - Land-based - Water-based - Winter-based 	<ul style="list-style-type: none"> (+), (-), NS (+), (+), NS NS all (+), (+), NS (+), NS, NS 	OLS	<p>Δ: 1989 to 1999. Sample: 2,243 rural counties.</p> <p>BMA is used to derive the models used. Amenity variables are calculated as in Deller et al. (2001).</p> <p>An expanded analysis is provided for Appalachian counties.</p>

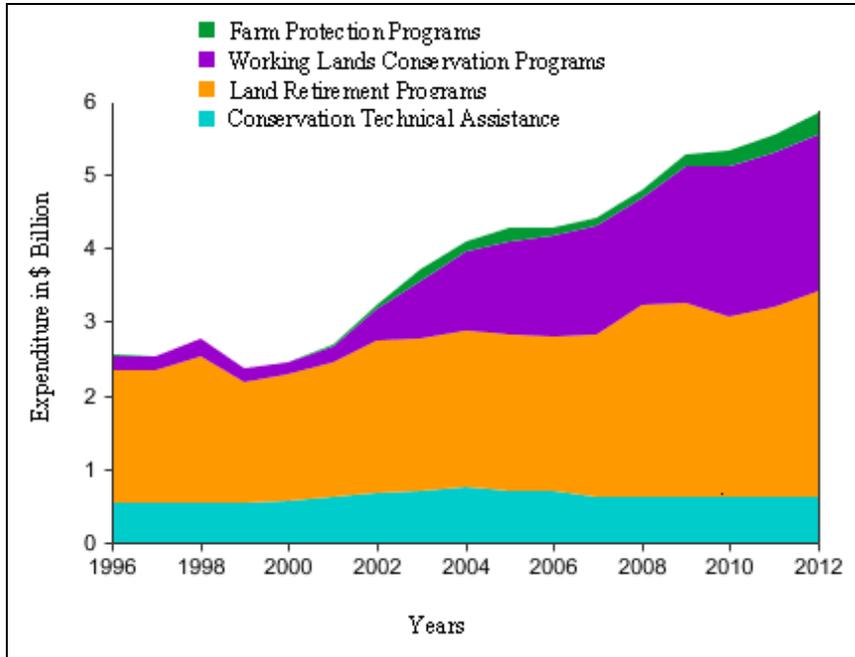
McGranahan (2008)	- Net migration - Δ Housing value	- Forest land - Forest squared - Topography - % Water area - Cropland - Jan. Temp. - Jan. Sunny days - July humidity - July Temp.	(+) all (-) all (+) all (+) all (-), (+) (+) all (+) all (+) all (+) all	OLS, 3SLS	Δ : 1990 to 2000. Sample: 2,209 rural counties. Similar results are reported with a subsample of 508 'completely rural counties', defined as counties with no centers of over 2,500 residents and not adjacent to metropolitan counties. Climate variables not included in the housing value change model.
<i>Explicitly Spatial Models</i>					
Rupasingha & Goetz (2004)	- Net migration	- Recreational inf. - Jan. Temp. - Jan. Sunny days - July humidity - July Temp. - % Water area - Topography	NS all (+) all NS all (-) all (-) all NS all (+) all	OLS, SAC	Net migration: 1990-1999. Sample: 3,104 counties. Models also include disamenities, such as cancer risk, with (-) effect results.
Koo, Marcoulier & Deller (2005)	- Δ Population - Δ Service and retail work - Δ PC income - Δ Gini index	- Land-based - River-based - Lake-based - Warm weather-based - Cold weather-based	NS all NS all NS, (+), NS, NS NS all NS all	SEM	Δ : 1980-1990, except for Gini index that considers the period 1979-1089. Sample: 242 counties of Michigan, Minnesota, and Wisconsin Amenities are included under indexes constructed using principal components.
Deller et al. (2005)	- Δ Population - Δ Employment - Δ PC income	- Climate-based - Built-based - Land-based - Water-based - Winter-based	NS, (-), (-) (+), (+), NS NS all (+), (+), (-) (+), NS, (+)	BMA, SAR	Δ : 1990 to 1999 [assumed by the authors since it is not specified in Deller et al. (2005)]. Sample: Not specified. BMA is used to derive the models used. Amenity variables are calculated as in Deller et al. (2001).
Gustafson et al. (2005)	- Δ Population density - Δ Housing density - Δ Seasonal housing density	- Forest land - Agricultural land - Wetlands - Topography - Shoreline density	(+), (+), (+) (-), (-), (-) (+), (NS), (+) (+), (+), (+) (+), (+), (+)	SLM	Δ : 1980 to 1990. Sample: 643 counties encompassed in three provinces of seven Midwestern states. Results presented are for the overall sample. Across provinces results vary, where the "Laurentain Province" presents the most different results.

Partridge et al. (2006)	- Δ Employment	- Jan. Temp. - Jan. Sunny days - July humidity - % Water area - Topography	Nonmetropolitan (+) all (+), NS in OLS & SEM (+), NS in OLS & SEM (+) all (+) all	OLS, GWR, SEM	Δ : 1990-2004. Alternative results are presented for the period 1990-2000. Sample: 1,972 nonmetropolitan Results based on 2003 metropolitan area boundaries. Results are also provided for metropolitan areas as well as for both cases considering 1999 boundaries. All amenity estimates were (-) and (+) in the lower and upper quintiles, respectively, in the GWR model.
Cho et al. (2007)	- Creative work density	ERS natural amenity index	(-) all	2SLS, GWR	Sample: 1,424 counties in 17 southern states. Definition of Creative employment category is given by Florida (2002).
Wu & Mishra (2008)	- Net migration - Δ Employment - Δ Household income	ERS natural amenity index	(+), NS, NS	GS3SLS	Δ : 1990-2000. Sample: 119 counties from OR, WA and ID states. Household income is the median of this variable reported in the county.

Note: (+), (-) and NS stand for positive, negative and non-statistically significant impacts, respectively. The effects are reported sequentially in the same order as the socioeconomic indicators used as dependent variables. The ERS natural amenity index is described in McGranahan (1999).

III. Land-based policies in the US

Various US policies directly or indirectly affect the provision of natural amenities in rural areas. Among these are land-based programs managed at the Federal as well as State and local levels. The Federal programs in general focus on agri-environmental protection via land retirement or working lands conservation, with the exception of farmland protection policies that focus on development rights (see Table 1). These programs have become more important in the last decades as concerns about environmental degradation and urban sprawl in the US have increased. Figure 2 shows budget trends of major types of land conservation programs managed at the Federal level over the last 20 years.



Source: ERS (2008).

Figure 2. Land-based conservation program's budget trends in the last 20 years.

Figure 2 clearly shows the increasing budgetary importance of land conservation within the Federal government. Projections indicate that working lands and farmland protection programs will continue to expand while land retirement programs will tend to stabilize. A similar tendency (although of smaller magnitude) is evident from budget allocations by State and local governments to conservation (ERS 2008). However, these latter policies focus more on farmland protection, especially from urban sprawl, than on agri-environmental targets. The following subsections discuss in more detail the array of programs in place under different conservational efforts of the Federal as well as State and local governments, and their linkage to natural amenities. We also discuss how private organizations and the price and income support programs could alter amenities to be potentially provided by conservation programs and therefore bias evaluations that exclude these actors.

Federal Programs

Table 2 lists major land-based programs managed by the Federal government through the USDA, divided into land retirement, working land conservation and farm easement programs, according to their *modus operandi*. Of the programs described in table 2, all but the Farmland Protection Program (FPP) directly or

indirectly address the goal of protecting ecosystem in lands under pressure of intensive agriculture. Federal land-based programs within the US have generally not been oriented to conserving land for amenity purposes, but instead to attenuate some of the adverse effects of agriculture in the economic and biological environments. However, these programs to some extent also regulate the potential disamenities generated by intensive agriculture (see Box 1) and at the same time contribute to amenities via landscape provision or recreational land uses.

The CRP is the largest land retirement program operating in the US. Although the 2008 farm bill reduces its acreage cap to 32 million acres (previously 39 million), the total land that it retires is still large relative to other land uses in the country (figure 1). Consequently, the CRP is a crucial player in American rural development, through its effects on the landscape as well as water quality. While the program has been subject to considerable research, the focus has been on its agricultural and food supply impact. Only a few studies have examined its amenity-related effects, which are seen to counteract local economic losses stemming from reduction in farm activity (Sullivan *et al.* 2004). The main objectives of this program are summarized in the Environmental Benefit Index (EBI) that assesses potential benefits and costs of protecting a particular farmland under CRP.

The EBI is built into the awarding of rental contracts with farmers. Contract bids are assigned points according to estimates of wildlife benefits, water and air quality improvement, reduction in soil erosion and the likelihood that benefits will endure after the contract expires (Cattaneo *et al.* 2006). Within these categories, contract offers for land in designated wildlife priority and water quality zones receive extra points. Farm offers are ranked and contracts awarded in descending order to the point at which the targeted program size is met. In practice, farmers with highly erodible land in areas of poor water quality are almost assured of receiving contracts. Otherwise, land cover management in support of wildlife becomes increasingly essential. On paper, at least, the provisions for wildlife enhancement mean the introduction of land cover that raises landscape amenities as well. Points are given for mixed land cover, hardwood trees, siting in a designated wildlife zone, providing a wildlife corridor, and so forth. And the enhancement of wildlife itself should enhance amenity values.

A detailed study by the Economic Research Service of the USDA (Sullivan *et al.* 2004) suggests that the CRP program has indirectly contributed as a land-based amenity to rural economic growth in non-metropolitan counties. In particular, the authors report that the program has generated annual revenues close to \$400 millions from outdoor activities and that it has had no long-term negative effects on employment or population. Explanations for this last observation include offsetting growth in employment through recreation, although the greater attractiveness of the preserved countryside to potential residents may also have played a role (McGranahan 2008).

Enrolling land parcels in the CRP involves a 10-year contract. One potential downside is that, since land is taken out of production, a surge in farm prices could result in former pristine natural land being converted to agriculture (Wu 2000). This effect could reduce the amount of natural amenities in an area as well as be environmentally destructive. Another issue with this program is the voluntary nature of participation. This means that land in conservation could be scattered across the countryside, limiting the potential aggregate impacts on landscape attractiveness and recreational opportunities. This last issue is important because land retirement program are more commonly used by small producers (Lambert *et al.* 2006), which accentuates the likely patchy distribution of conserved land.

A final consideration when evaluating CRP effects is to measure what happens with retired lands once the CRP contract expires. The ideal outcome for efficient long-term policy would be to have protected acres maintained as wildlife reservoirs or wetlands. However, this continuity of conservational efforts is in fact not assured and thousands of acres are returned to farmland after contract expiration every year. For this reason, a long term perspective is key when evaluating retirement land policies.

Table 2. Selected land-based programs managed by the USDA.

Program	Main objectives	Acres to 2006	Notes
<i>Land Retirement Programs</i>			
Conservation Reserve Program (CRP)	To retire ecologically sensitive land from agriculture	36 million	Has retired land in nearly 2,700 counties and provides around \$1.5 billion annually in direct payments.
Wetlands Reserve Program (WRP)	Offers landowners the opportunity to protect, restore, and enhance wetlands on their property.	2 million	The 2008 farm bill increases it acreage cap by 34%.
<i>Working Lands Conservation Programs</i>			
Conservation Stewardship Program (CSP)	To promote the conservation of natural resources on Tribal and private working lands.	--	New program. Has the target of conserving 12.7 million acres annually (till 2017).
Environmental Quality Incentives Program (EQIP)	To provide guidance to landowners who face threats to natural resources on their land.	51.5 million	At least 60% of EQIP funds go to livestock producers.
Wildlife Habitat Incentives Program (WHIP)	To support owners who want to develop and improve wildlife habitat primarily on their land.	2.3 million	NRCS provides up to 75% cost-share assistance.
Grassland Reserve Program (GRP)	To protect and enhance grasslands while maintaining the areas as grazing lands.	n/a	Grasslands are the largest land cover on America's private lands.
<i>Farm Protection (easement) Programs</i>			
Farmland Protection Program (FPP)	To provide funds to local governments, Tribal entities, and NGO's for farmland protection.	0.5 million	Funding has increased more than tenfold in period 2002-2007.

Source: Authors, using information from NRCS (2009) and 2008 US Farm Bill.

Working lands programs such as EQIP are more likely to be used by large producers, who account for approximately two-thirds of US cropland. This means that working land programs could more efficiently contribute to contiguous land conservation and thus improved landscapes. However, the conservation efforts provided by working lands programs often do not directly benefit local residents because their contributions to amenities provision are few and far between. Thus, the evaluation of working lands policies from the amenities perspective is complicated by the fact that potential socio-economic impacts are likely to be indirect and long run. The potential outputs of these programs are not the short-term provision of

landscapes or recreational areas, but instead long-term effects in terms of less polluted watersheds and fewer soils eroded.

Box 1. Is Farmland a Natural Amenity in the US?

Several researchers have studied the role of farmland as amenity provider in rural and urban periphery settings. Results range from negative impacts (Palmquist *et al.* 1997; Ready and Abdalla 2005) to positive perceptions of farmland (Irwin 2002). The difference between these contradictory results is based mainly on the kinds of attributes that agriculture can provide for particular regions. On the disamenity side of agriculture, it is possible to affirm that people dislike farmland when:

- as field size increases, perennial fences vanish
- winter soil is left empty or with residuals from last exploitation
- odor spreads, specially in livestock farms (animal density is an important factor)
- noise and pollution is produced by farm machinery
- landscape becomes homogeneous, such as the case when land presents high concentration of row crops (corn, wheat, etc.)
- soil erosion problems concatenate more dust and arid landscapes
- other nonfarm rural lands are abundant

On the opposite side, Irwin *et al.* (2003) argue that farmland can become a positive amenity for people in particular regions. It is possible to argue that demand for farmland amenities increases when:

- agricultural land, and open space in general, become scarce
- household income levels are high
- population has high educational attainment
- population density increases (especially near the rural-urban fringe)
- there is diversification in production (mix of trees, crops, etc.)
- agriculture replaces formerly undesired spaces
- there is more supply of fresh products in areas where they have historically been lacking

Therefore, in contrast to the European case, farmland in the US often is not related to amenities for dwellings of particular regions. This generally happens when agriculture is abundant and intensive so that WTP for farm land decreases relative to WTP for more developed land or urban-related amenities (Bergstrom and Ready 2009).

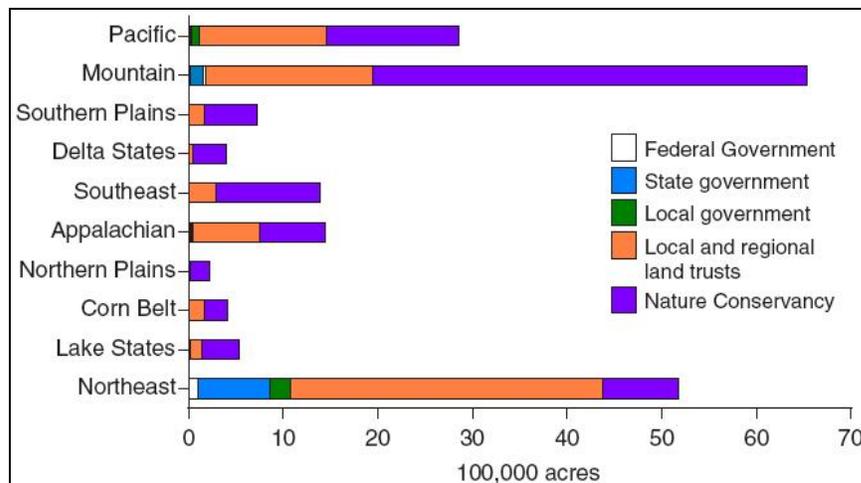
FPP, unlike retirement and working land policies, focus on the protection of farmland, especially when this is threatened by urban sprawl. The major contribution of this program is the financial support it provides to State, local, Tribal and private farmland protection efforts.

A common question that arises for the outputs of all the described policies is the issue of public access. Participation in conservation programs is voluntary and does not impose the need to provide public access on landowners. This in turn reduces considerably the potential impact of these programs in supplying land for outdoor recreational use, and as a result outdoor activities, employment growth and/or migration are below their potential, or what would be possible under greater coordination. However, the 2008 US Farm Bill introduces resources to solve this problem via “voluntary public access grants”. This new initia-

tive could, in the medium term, allow more outdoor activities to be carried out on land under conservation, thereby significantly the value of land amenities to communities and consumers.

State and Local Policies and Programs

A number of States view agriculture as providing public goods. In this vein at least 30 out of the 48 contiguous States US mention scenic beauty and open space as a farmland amenity in their legislation (Hellerstein *et al.* 2002). Consequently, although agricultural viability is the main focus of many farmland protection programs, these programs are used to protect natural amenities (McGranahan and Thompson, 2008). Unlike Federal agri-environmental programs concentrated in agriculturally intensive regions, State legislation in more densely populated regions focuses more on preserving rural amenities provided by farmland (Hellerstein *et al.* 2002; Cochrane and Wojan 2008). Figure 3 shows the importance of this program for US regions. The Northeast especially (characterized by high population density) has large agricultural acreages protected by State FPPs. This is consistent with the notion that farmland is most valuable where it is most scarce.



Note: Local and Regional trusts and The Nature Conservancy numbers include all kinds of land protected.
Source: ERS (2008).

Figure 3. Farmland acres protected in different regions of the US.

Many regions seek to protect their farmland heritage as farming is threatened. In these cases, as is often true in Europe, agriculture can contribute to natural amenities through the provision of open space, green space and scenic view sheds. In order to protect farmland and to control urban sprawl, social planners can avail themselves of regulatory, incentive-based or participatory techniques (Lynch 2008), although in practice they employ a mixture (hybrid), depending on local particularities. Table 3 lists typical programs [for more detail and State participation see Hellerstein *et al.* (2002)]. These programs have different strengths and weaknesses, which have been widely reported in the literature (Hellerstein *et al.* 2000; Blandford and Boisvert 2008). Perhaps the most widely known programs are the Agricultural Protection Zoning (APZ) and the Purchase of Agricultural Conservation Easements (PACE). The APZ does not require major financial resources as it is based on spatial regulation by local planners. PACE programs, in contrast, compensate landowners financially for providing open space, and for this reason they are less commonly used. Nevertheless, more than 1.6 million farmland acres nationally have been conserved in this manner. Here the Federal FPP is critical for the financial viability of these programs in different States. Given the financial requirements of PACE, the question arises of how and when to implement these programs. Each State has different rules when making decisions about what farmland to protect, based primarily on an array of options provided in the USDA's *Land Evaluation and Site Assessment* (LESA). In Pennsylvania, for exam-

ple, soil productivity, farmland viability, clustering potential and development pressures are weighted differently to rank land to be protected. The weight given to the amenity provision role of farm protection varies by State, which makes any evaluation of PACE program benefits across the US difficult. Additionally, in evaluating FPP programs it is important to assess the real amenity gains provided by farmland for local people. As discussed in Box 1, preserved agricultural land does not necessarily create amenities benefits for certain regions.

Table 3. Selected FPPs managed by State and local governments.

Program	Main objectives	Coverage
Agricultural District Laws	Allows farmers to designate areas where agriculture is encouraged and protected. The laws are authorized by state legislatures and implemented at the local level.	16 states
Purchase of Agricultural Conservation Easements (PACE)*	Pays farmers to protect their land from development. It usually pays the difference between the value of the land in agriculture versus its potential highest and best use.	19 states
Right-to-Farm Laws	State right-to-farm laws protect farmers and ranchers from nuisance lawsuits.	All states
Circuit Breaker Tax Relief Credits*	Circuit breaker programs offer tax credits to offset farmers' property tax bills	4 states
Differential Assessment Laws	Appraises farmland at its value in agriculture, instead of its full market value. Enacted by states and implemented by local levels.	31 states
Agricultural Protection Zoning (APZ)	Segments counties, cities, townships and towns into land devoted to specific uses. Designates areas where farming is the main land use.	All states
Transfer of Development Rights (TDR)*	Allows transfer of a right to develop one parcel of land to a different parcel. Generally established through local zoning ordinances.	22 states

Source: Authors, using information from Hellerstein et al. (2002) and ERS (2008).

(*) denotes programs not directly based on regulatory techniques.

Since PACE programs result in long term restrictions on development, they are considered to be more effective in protecting farmland and providing intended benefits than agricultural zoning or other land use controls. However, the actual effect of the PACE on land conversion rates and patterns is uncertain given that PACE programs may simply shift development pressures elsewhere, thereby undermining goals to conserve natural amenities (ERS 2008). In this line, when evaluating overall efficiency of these programs in particular areas it is important to consider the uncertainty created by urban sprawl. The use of PACE could increase demand for urban land because of the open space provided: the higher the levels of amenity the higher the demand for development. This means that over time the effectiveness of FPP could diminish as land parcels become increasingly isolated.

Another issue in evaluating PACE programs is that protection does not always mean a lack of urbanization. Hellerstein et al. (2002) argue that in many cases protected acres have become low-density residential areas, which affects the provision of scenic views or the maintaining of farms as cultural heritage overall. These authors point out that it is not uncommon for protected areas to become sites for the establishment of mansions that use the open space as private gardens rather than as farmland.

The influence of private organizations and the price and income support program

In evaluating the effect of public programs on land conservation, it is important to incorporate the influence of private organizations. Across the US several key institutions directly or indirectly conserve land or promote the protection of particular areas. Table 4 describes some of these entities and represents the importance that they get through approximate number of its members. The WWF's conservation activities in the Northern Great Plains, for example, may directly affect the wellbeing of the citizens in the area.

Table 4. Selected private organizations involved in land conservation

Institution	Primary objective	Approx. # of members in the US	Notes
American Farmland Trust	Promotion of farmland conservation	Operates via donations	Operates politically for the conservation of land at State and local levels.
National Parks Conservation Association	To support and enhance the conservation of American National Parks.	400,000	Operates as a citizen's watchdog of the national parks system in the US.
The Nature Conservancy*	To preserve land with ecological/biodiversity value	1 million	Has protected more than 17 million acres in the US.
The Sierra Club	Protection of communities and wild places	1.3 million	Operates as grassroots environmental organization.
The Trust for Public Land	To support agencies and communities to protect land	Operates via donations	Involved in the protection of more than 2.5 million US acres.
World Wildlife Fund (WWF)*	Conservation of nature via protection and promotion	1.2 million	Three of out 19 of its priority conservation zones are located in the US.

Source: Wu (2008) and respective institution's web pages.

Note: Except for the US and Canada the WWF is globally named World Wide Fund for Nature.

*International organizations.

These private institutions become self-selected groups of private decision-makers providing natural amenities, which can encourage efficient provision of rural amenities in particular areas – since conservation is chosen by consumers represented by the respective NGO. These organizations become relevant entities that organize communities and provide support in the establishment of programs like the PACE in many rural areas across the US. The considerable relevance of these institutions in land protection is evident from figure 3, where trusts often become more important than the government itself – in addition to benefiting potentially from the Federal FPP, these trusts also receive donations of land or charitable contributions of development rights from landowners. On the other hand, groups such as The Nature Conservancy invest millions of private dollars in the protection of land in areas where the US government may or may not be intervening. In this way, public and private interests often interact in the process of protecting land.

An important rural non-land-based policy used in the US, as well as in some other OECD countries that indirectly affects the efficiency of conservation programs and therefore the provision of natural amenities, is the farm price and income support program. This program is indirectly, but importantly, related to natural amenities to the extent that it increases the profitability of agriculture and artificially generates demand for farmland. Some researchers argue that it is better to focus only on these kinds of programs to preserve countryside and provide amenities, since the transaction costs involved are much lower compared to those arising in agri-environmental programs: it is easier to gauge acreage and output rather than environmental management (Abler 2005). However, negative externalities of agriculture are a concern in amenities provision (Box 1), where this kind of programs can be seen as detrimental for rural amenities and thus development: commodities-based farm program payments create an incentive towards practicing more intensive agriculture or it can provide incentives to expand production on land with high amenity values,

Negative externalities have expanded significantly in several regions in recent decades as the intensity of agricultural production has increased and forested land has in some cases been brought into cultivation. Thus farm price and income support programs may to some extent indirectly affect the supply of disamenities. This type of program may artificially maintain agriculture in regions where other kinds of land use would improve the provision of natural amenities (forests, wetlands, etc.). On the other hand, while farmers are compensated for the commodities they produce, there is no market for the quantity and quality of amenities they provide. In this sense the price and income support program funds public scenic vistas in regions with scarce farmland, by way of complementing farm income in the absence of compensation from non-rival and non-excludable amenity supplies.

On what side of the coin the program price and income support program operates depends on the perception that people have of farmland in the region (Box 1). Thus, it can be argued that this program is beneficial in settings where farmland is valued by neighborhoods, while its use should be re-evaluated when farmland becomes a disamenity for people in the area. On this topic McGranahan and Sullivan (2005) and Goetz and Debertin (1996, 2001) find that counties that proportionately received more funds from the program also lost more population (this corresponds primarily to counties in the Great Plains). In this situation of already extensive cropland use, more extensive farming is not likely to be an amenity.

IV. How should we value natural amenities and evaluate land-based policy?

The question of improving the performance and evaluation of land conservation policies has been widely examined within the OECD in recent years (OECD 2005, 2008). Within this discussion researchers have proposed different approaches to obtaining more accurate evaluations and improving program efficiency. Wu (2004) states that planners have four main targeting strategies to implement conservation policy objectives: benefit-cost (used by the CRP through the use of the EBI), benefit-maximizing (used by the EQIP program), benefit targeting and cost targeting. Among these alternatives Wu et al. (2001) claim that if the policy objective is to maximize social welfare from conservation the benefit-cost targeting approach should be implemented. So, it is not rare to observe that cost-benefit analyses are increasingly demanded by legislators to discern the efficacy of policy (Eagle 2004).

Evaluating the benefits and costs of land-based policies in terms of environmental amenity services and their consequent effects in community socioeconomic factors is challenging. One approach would be to extend the analyses of growth discussed in section II to incorporate the extent to which county land was involved in program contracts as an independent variable (even more specifically, for the case of the CRP, we could use only land that received high points for wildlife habitat enhancement, for example). Conservation programs could affect jobs directly, by attracting hunters, birdwatchers and other recreation visitors, and indirectly, by attracting new residents drawn by quality-of-life opportunities. An advantage of this approach is that the assessment takes into account local negative spillovers. However, even for major programs such as the CRP, program effects might be difficult to isolate in a broad analysis of rural counties. Beginning with Isserman and Rephann (1995), a number of studies have attempted to isolate program effects through quasi-experimental design wherein each “treatment” county is matched as closely as possible with a non-treatment county and differences among the pairs are taken as treatment effects. This approach was taken in a recent study of whether the CRP, in taking land out of production, reduced local employment levels (Sullivan *et al.* 2004). A problem in this study was that, since the CRP program is pervasive, there were few close matches with counties having low participation. An additional problem is that the impact of a program is likely to depend on context. Thus, for example, and as noted above mixed landscapes are most favored in the CRP’s EBI, so wildlife preservation may be less influential where there is already considerable land cover providing wildlife habitat. But the central drawback is that most conservation programs use quasi experimental design, therefore effects may not be discernible. It is generally likely that evaluation would have to focus more narrowly on the projects themselves, on recreation jobs generated and/or gains in amenities for the local population based on amenity values.

The introduction of amenity-enhancement as an additional desired outcome for agri-environmental programs creates several new issues. First, as they are non-market goods, the value of amenities created must be assessed indirectly. Instruments used to estimate non-market values provided by amenities in local contexts include contingent valuation [especially willingness to pay (WTP) assessments], conjoint analysis and contingent behavior; these are known as stated preferences methods. Additionally, revealed preference techniques such as the hedonic price and the travel cost methods and new methods such as choice experiments, distance-decay valuation and spatial analyses have complemented empirical work of amenity valuation (Duke and Johnston 2009). Among these last, the role of distance in valuation techniques is important since amenity benefits (or costs) often extend beyond boundaries of a political unit such as counties and even States (Goetz 2007). All of these methods and techniques have been discussed and validated in many studies and become broadly accepted by Federal, State and local government and courts across the US as reliable assessments of non-market value from natural amenities (Freeman 2003). However, while the results of any given study are likely to be of questionable generalizability, meta analyses should yield reasonable general estimates.

Second, there is a serious debate in the environmental literature as to whether amenity values conflict with conservation goals (Gobster *et al.* 2007). For instance, marshes provide valuable services enhancing water quality, but may have little visual appeal compared to lakes. Nassauer (1992) has argued that signage indicating a site’s ecological purpose enhances its appeal, but these types of issues remain to be resolved as it is not clear to what extent amenity values are mutable.

Third, the value of a given conservation measure may depend considerably on how the land is managed and where it is located. For instance, a study of alternative riparian buffers (trees or grass, straight or meandering water ways) found considerable preference for some trees and meandering water ways (Kenwick *et al.* 2009). In this case, there was broad agreement between farmers and naturalists, but an additional complication is that farmers and others typically disagree on what constitutes an attractive landscape (Natori and Chenoweth 2008). In order to deal with this issue the estimation of WTP has perhaps been the most common valuation technique of non-market amenities [see Bergstrom and Ready (2009) for a survey of key studies]. However, the WTP procedure is not without issues. One question is whether people report their actual willingness-to-pay. In practice, the value respondents place on a given natural resource has been found to vary considerably, by 300 to as much as 2000 percent (Eagle 2004). Thus, when policy makers evaluate people’s perception of conservation programs, amenity value research may not offer much guidance since the preservation process per se is valued differently by individuals: is a fact that, for example, farmers like farmland more than others (Natori and Chenoweth 2008). In this line, although the me-

thod itself raises questions, the emerging area of neuro-economics (Camerer *et al.* 2005) may offer potentially valuable new insights in WTP assessments.

Fourth, migration patterns, housing valuation and landscape aesthetics research consistently indicate that varied landscapes are preferred over landscapes dominated by a single type of cover (McGranahan 2008), so that conservation policies that shift land cover in a given direction may add to amenity value in one situation but detract in another. This needs to be incorporated into evaluation methods.

When we focus the evaluation in land-based policy of State and local programs, the task becomes more cumbersome and less tractable. First, the US has more than 16,500 townships/towns and 19,000 municipalities scattered across 3,034 counties and 50 States. Although a smaller size of government may be associated with more efficient land use policies (Grassmueck *et al.* 2008), these large numbers make it nearly impossible to generalize the performance of local land-based policies. Second, different types of programs are developed by local governments concurrently (hybrid techniques), which increases the difficulty of evaluating amenity-related policy impacts on socio-economic factors, and raises even more questions about transferring results across communities.

Amenity values are highly site-specific and therefore transferring values may be effective only when preservation sites and scale of preservation are similar. Additionally it is extremely expensive to use case study research for each policy implemented. This raises the challenge of how to create statistical models that accurately appraise and capture the variety of preferences that people have in different regions, challenges that become more complex when we consider the role that passive non-user beneficiaries play in the provision of amenities (e.g., how to evaluate the role of scenery viewing?). Models should incorporate socio-economic indicators that capture both direct (landowner) and non-user (neighbors, visitors) beneficiaries. Given these complexities (exacerbated for State and local programs), we argue that land-based policy evaluation related to natural amenities provision must consider a homogeneous process across regions and over time. One such scheme is outlined in figure 4.

Figure 4 can be summarized as follows: first, regions under study must be “similar” over time so that comparable baselines are available to evaluate policy outcomes. In the US these can be formed by counties, groups of counties or particular regions such as watersheds or river basins. Second, amenity values and relevant indicators must be measured in period t before the specific conservation program is implemented. And finally, during and after policy implementation (period $t+1$) a reassessment of amenity values and indicators should be undertaken, in the same geographic area to compare gains or losses relative to the baseline.

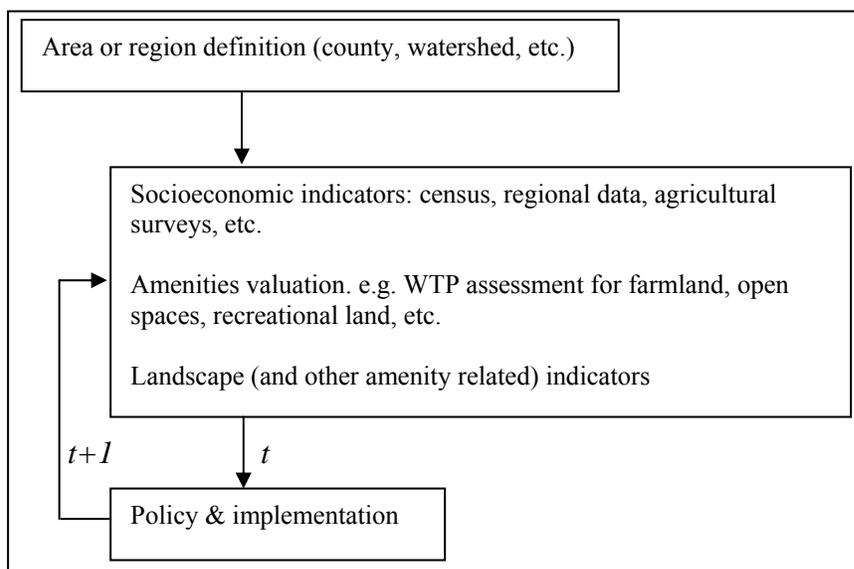


Figure 4: Proposed process for evaluation of effect of land-based policies on amenities and socioeconomic factors.

The difficulty of such a process lies primarily in the assessment of amenity values and in the incorporation of amenity indicators. The valuation of amenities should be based on a similar technique across time and space. Thus, after consultation with experts, planners must agree on one particular technique and promote its use; ideally the valuation assessment would also be carried out over similar demographic samples. Unfortunately the use of landscape and amenity related indicators for evaluation is relatively uncommon in the US. Many OECD countries use different indicators to evaluate the conditions, contributions and functionality that landscape and other land-based amenities may have over particular areas (OECD 2001, 2004, 2008). The incorporation of these kinds of indicators to measure conservation policy outcomes is a challenge that would be needed if better and more consistent estimates of amenity endowments on rural as well as urban areas are to be obtained.

Econometric modeling to aggregate final results could be an acceptable approach for general (national or State) evaluations, although the omission of variables and use of non-spatial implicit models can bias results (Bayesian Model Averaging and Geographic Weighted Regression approaches may to some extent resolve these problems). As mentioned before, conservation programs such as the CRP can be used as independent variables explaining socioeconomic indicator changes over time (the amenity indicators can be also considered as covariates). However, given that conservation efforts often depend on socioeconomic features (for example areas with high migration can demand more land conservation), reverse causality must be considered. We are not aware of previous work that takes this approach. In addition, other land-focused initiatives (such as land trusts) and other policies affecting land use (such as the income support program) need to be incorporated as controls.

Finally, it is important to consider the increasing role of Geographic Information Systems (GIS) and its related computational software as fundamental tool in land-based policy evaluation. The increasing use of this tool in econometric studies has allowed more comprehensive and consistent spatial analyses, where the US is in a relatively good position given the rich existing data from satellite imaging. The task is to incorporate more amenity-related measures into this kind of analysis by more fully using this increasingly available resource.

V. Conclusion

Research suggests that environmental amenities have a strong bearing on rural wellbeing and where people choose to live. Thus, the potential effects of land-based policies on the provision of local amenities become an important issue. If one wanted to take evaluation of Federal and State/local conservation and protection programs in their role as amenity provider, overall outcomes would need to be considered. Thus, for example, the spatial spillover effect of the CRP could be addressed for overall evaluation of this program, since former non-agricultural land may be transformed to crop production with a consequent loss of local amenities and environmental quality. In this context it is important to assess the values that local residents and visitors attach to farmland or water bodies in particular areas. The accurate measurement of amenity values becomes critical for developing effective policy, especially when using cost-benefit analyses.

Federal agri-environmental programs in the US have led to the retirement and conservation of productive land (especially farmland) over the last decades. These land-based initiatives have changed the landscapes of many areas as they altered land use composition and cover. Even so, US policies to date do not consider the provision or improvements of amenities among program objectives. Amenity values have been extensively studied in the consideration of programs to preserve farmland, particularly in ex-urban areas. However, amenity value research has generally not carried over into the study of the environmental policies affecting land cover in more rural areas. Consequently, indicators or formal assessments of amenities affected by many agri-environmental programs are unreported.

If amenity outcomes are to be considered in the evaluation of conservation programs, more research is needed to give amenity components of evaluation equal footing with environmental benefit assessments. If amenities were to be included among program outcomes, five main factors could be considered by planners when implementing and evaluating these: 1) non-market valuation of amenities, where

revealed and stated preferences are included in economic assessments; 2) where and when amenity values may conflict with conservation goals; 3) assessment of amenity impacts in non-targeted areas since spatial spillovers are likely; 4) control for the influence of private organizations and interventions of other policies that may affect land cover (like the income support program); and 5) variation of amenity impacts according to land management and location, as policies that alter land composition may increase amenity value in some cases, but could detract in others.

The link between program outcomes, amenity effects and socioeconomic change could be considered and analyzed in future investigations and evaluations of land-based policies. Along these lines the use of amenity indicators proposed and used by some countries of the OECD could be considered in equal terms with socioeconomic indicators and amenity valuation of local residents and visitors. These measurements must be assessed over time (and over same predefined areas of study) in order to establish gain or losses from policy in particular and aggregated effects over environmental amenities and consequent socioeconomic changes in general.

References

- Abler, D. (2005) Multifunctionality, Land Use and Agricultural Policy. In: Goetz, S., Shortle, J. and Bergstrom, J. (eds) *Land Use problems and Conflicts*. Routledge, New York, NY.
- Bergstrom, J., and Ready, R. (2009) What have we learned from over 20 years of farmland amenity valuation research in North America? *Review of Agricultural Economics* 31(3), 21-49.
- Blandford, D. and Boisvert, R. (2008) *Multifunctional Agriculture: A View from the United States*. Working paper. (http://merlin.lusignan.inra.fr:8080/eaee/website/pdf/112_Blandford)
- Camerer, C., Loewenstein, G. and Prelec, D. (2005) Neuroeconomics: How neuroscience can inform economics. *Journal of Economic Literature* XLIII, 9-64.
- Cattaneo, A., Hellerstein, D, Nickerson, C., and Myers, C. (2006) *Balancing the Multiple Objectives of Conservation Programs*. Economic Research Report 19. Economic Research Service, US Department of Agriculture, Washington, DC.
- Cho, S., Kim, S., Clark, C. and Park, W. (2007) Spatial Analysis of Rural Economic Development Using a Locally Weighted Regression Model. *Agricultural and Resource Economics Review* 36(1), 24-38.
- Cochrane, N. and Wojan, T. (2008) Transatlantic similarities and contrast in rural development policies. *EuroChoices* 7(1), 20-26.
- Dearien, C., Rudzitis, G., and Hintz, J. (2005) The Role of Wilderness and Public Land Amenities in Explaining Migration and Rural Development in the American Northwest. In: Green, G., Deller, S. and Marcoullier, D. (eds) *Amenities and Rural Development, Theory, Methods and Public Policy*. Edward Elgar, UK & MA.
- Deller, S., Tsai, T., Marcoullier, D., and English, D. (2001) The Role of Amenities and Quality of Life in Rural Economic growth. *American Journal of Agricultural Economics* 83, 352-365.
- Deller, S., Marcoullier, D. and Lledo, V. (2005). Regional Growth with a Focus on Amenities. In: Green, G., Deller, S. and Marcoullier, D. (eds) *Amenities and Rural Development, Theory, Methods and Public Policy*. Edward Elgar, UK & MA.
- Deller, S. and Lledo, V. (2007) Amenities and Rural Appalachia Economic Growth. *Agricultural and Resource Economics Review* 36(1), 107-132.
- Disart, J. and Marcoullier, D. (2005) Impact of Outdoor Recreation Facilities on Remote Rural Income Growth. In: Green, G., Deller, S. and Marcoullier, D. (eds) *Amenities and Rural Development, Theory, Methods and Public Policy*. Edward Elgar, UK & MA.
- Duke, J. and Johnston, J. (2009) Multifunctionality and Land Use Policy: An Application of Nonmarket Valuation to Urban Fringe Farm and Forest Preservation. In: Goetz, S. and Brouwer, F. (eds) *New Perspectives on Agri-environmental Policies; A Multidisciplinary and Transatlantic Approach*. Routledge: Taylor & Francis Group, Oxon, UK.
- Eagle, S. (2004) Environmental amenities, private property, and public policy. *Natural Resources Journal* 44, 425-444.

- ERS (2008). *Conservation Policy: Farmland and Grazing Land Protection Programs*. Briefing Room, Economic Research Service, US Department of Agriculture, Washington, DC. (<http://www.ers.usda.gov/Briefing/ConservationPolicy/farmland.htm>)
- Freeman, A. (2003) *The Measurement of Environmental and Resources Values: Theory and Methods: Second Edition*. Resources for the Future, Washington, DC.
- Gobster, P., Nassauer, J., Daniel, T., and Fry, G. (2007) The shared landscape: What does aesthetics have to do with ecology? *Landscape Ecology* 22, 959-972.
- Goe, W. and Green, G. (2005) Amenities and change in the well-being of nonmetropolitan localities. In: Goetz, S. and Brouwer, F. (eds) *New Perspectives on Agri-environmental Policies; A Multidisciplinary and Transatlantic Approach*. Routledge: Taylor & Francis Group, Oxon, UK.
- Goetz, S. (2007) The Economic Case for State-Level Land Use Decision-Making. *Journal of Regional Analysis and Policy* 37(1), 20-24.
- Goetz, S. and Debertin, D. (1996) Rural population decline in the 1980s: Impacts of farm structure and Federal farm programs. *American Journal of Agricultural Economics* 78, 517-529.
- Goetz, S. and Debertin, D. (2001) Why farmers quit: A County-level analysis. *American Journal of Agricultural Economics* 83(4), 1010-1023.
- Grasmueck, G., Goetz, S. and Shields, M. (2008) Youth out-migration from Pennsylvania: The roles of government fragmentation vs. the Beaten path effect, *Journal of Regional Analysis and Policy*. 38(1), 77-88
- Gustafson, E., Hammer, B., Radeloff, V., and Potts, R. (2005) The relationship between environmental amenities and changing human settlement patterns between 1980 and 2000 in the Midwestern USA. *Landscape Ecology* 20, 773-789.
- Hellerstein, D., Nickerson, C., Cooper, J., Feather, P., Gadsby, D., Mullarkey, D., Tegen, A. and Barnard, C. (2002) *Farmland protection: the role of public preferences for rural amenities*. Agricultural Economic Report No. 815, Economic Research Service, US Department of Agriculture, Washington, DC.
- Irwin, E. (2002) The effects of open space on residential property values. *Land Economics* 78(4):465-480.
- Irwin, E., Nickerson, C., and Libby, L. (2003) What are farmland amenities worth? *Choices* (Third Quarter), 21-3.
- Irwin, E., Randall, A. and Chen, Y. (2007) Environmental Amenities as a Driver of Regional Growth. In Wu, J., Barkley, P. and Weber, P. (eds) *Frontiers in Resource and Rural Economics: Human-Nature, Rural-Urban Interdependencies*. Resources for the Future Press, Washington, DC.
- Isserman, A., and Rephann, T. (1995) The economic effects of the Appalachian Regional Commission. *Journal of the American Planning Association* 61 (3): 345-364.
- Kenwick, R., Shammin, Md. and Sullivan, W. (2009) Preferences for riparian buffers. *Landscape and Urban Planning* 91, 88-96.
- Koo, K., Marcouiller, D. and Deller, S. (2005) Natural Amenities and Rural Development: Understanding Spatial and Distributional Attributes. *Growth and Change* 36(2), 273-297.
- Lambert, D., Sullivan, P. and Claassen, R. (2006) Land retirement and working-land conservation structures: A look at farmers' choices. *Amber Waves*, 4(3): 16-21.
- Lewis, D., Hunt, G. and Plantinga, A. (2002) Public conservation land and employment growth in the northern forest region. *Land Economics* 78(2), 245-259.
- Lewis, D., Hunt, G. and Plantinga, A. (2003) Does public land policy affect local wage growth? *Growth and Change* 34(1), 64-86.
- Lynch, L. (2008) *Land-use Policy-Agriculture and Urbanization*. Transatlantic Land-use Conference Policy Brief 4. The Northeast Regional Center for Rural Development. University Park, PA. (<http://nercrd.psu.edu/TALUC/TALUC4.pdf>)
- McGranahan, D. (2008) Landscape influence on recent rural migration in the U.S. *Landscape and Urban Planning*. 85(3-4), 228-240.
- McGranahan, D. and Sullivan, P. (2005) Farm programs, natural amenities, and rural development. *Amber Waves* 3(1), 28-35.
- McGranahan, D. and Thomson, K. (2008) Environment, land use and amenities: The new dimension of rural development. *EuroChoices* 7(1), 30-37.
- Nassauer, J. (1992) Culture and changing landscape structure. *Landscape Ecology* 10(4), 229-237.
- Natori, Y. and Chenoweth, R. (2008) Differences in rural landscape perceptions and preferences between farmers and naturalists. *Journal of Environmental Psychology* 28, 250-267.
- NRCS (2009). Natural Resources Conservation Service Programs. <http://www.nrcs.usda.gov/programs/>

- Organization for Economic Cooperation and Development. (2001). *Environmental Impacts of Agriculture*. Paris.
- Organization for Economic Cooperation and Development. (2005). *Evaluating Agri-Environmental Policies. Design, Practice and Results*. Paris.
- Organization for Economic Cooperation and Development. (2008). *Environmental Performance of Agriculture in OECD Countries since 1990*. Paris.
- Palmquist, R., Roka, F., and Tomislav, V. (1997) Hog operations, environmental effects, and residential property values. *Land Economics* 73(1), 114-124.
- Partridge, M., Rickman, D., Ali, K. and Rose Olfert, M. (2008) The geographic diversity of U.S. nonmetropolitan growth dynamics: A geographically weighted regression approach. *Land Economics* 84(2), 241-266.
- Pagoulatos, A., Goetz, S., Debertin, D. and Johannson, T. (2004) Interactions between economic growth and environmental quality in U.S. Counties. *Growth and Change* (35(1), 90-108.
- Rappaport, J. and Sachs, J. (2003). The United States as a coastal nation. *Journal of Economic growth* 8, 5-46.
- Ready, R. and Abdalla, C. (2005) The amenity and disamenity impacts of agriculture: Estimates from a hedonic pricing model. *American Journal of Agricultural Economics* 2(5), 314-326.
- Rupasingha, A. and Goetz, S. (2004) County amenities and net migration. *Agricultural and Resource Economics Review* 33(2), 245-254.
- Schmidt, L., and Courant, P. (2006) Sometimes close is good enough: The value of nearby environmental amenities. *Journal of Regional Science* 46(5), 931-951.
- Sullivan, P., Hellerstein, D., Hansen, L., Johansson, R., Koenig, S., Lubowski, R., McBride, W., McGranahan, D., Roberts, M., Vogel, S. and Bucholtz, S. (2004) *The Conservation Reserve Program, Economic Implications for Rural America*. Agricultural Economic Report 834, Economic Research Service, US Department of Agriculture, Washington, DC.
- Wu, J. (2000) Slippage effects of the conservation reserve programs. *American Journal of Agricultural Economics*, 82, 979-992.
- Wu, J. (2004) Using sciences to improve economic efficiency of conservation policies. *Agricultural and Resource Economics Review* 33(1), 18-23.
- Wu, J. (2008) *Land Use Changes: Economic, Social and Environmental Impacts*. Transatlantic Land use Conference Policy Brief No. 1 . The Northeast Regional Center for Rural Development. University Park, PA. (<http://nercrd.psu.edu/TALUC/TALUC1.pdf>)
- Wu, J., Zilberman, D., and Babcock, B. (2001) Environmental and distributional effects of conservation targeting strategies. *Journal of Environmental Economics and Management* 41, 333-350.
- Wu, J. and Mishna, S. (2008). Natural Amenities, Human Capital, and Economic Growth: An Empirical Analysis. In. Wu, J., Barkley, P. and Weber, B. (eds). *Frontiers in Resource and Rural Economics*. RFF Press, Washington DC.