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Potential Non-Market Benefits of Colorado's Agricultural Lands: A Review of the Literature

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"About half of the state's lands are owned by farmers and ranchers."

"Nearly 1.5 million acres of Colorado agricultural land were converted to other uses between 1992 and 1997."

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1. Introduction

The state of Colorado is in a period of uncommon prosperity and economic growth. Five of the ten fastest growing counties in percentage terms in the United States are found in Colorado (Edelman et al., 1999). Colorado's population increased by 1/4 to more than 4 million between 1990 and 1999 (CDLG, 1999). The Denver Metro Area has increased in size by 500 mi² since 1987 (USDA, 1999). However, while most sectors of the Colorado economy are rapidly expanding, the agricultural sector is experiencing a period of low profits, aging landowners, consolidation and vertical coordination. In this climate of disparate economic opportunity, land (and other natural resource) use and planning pose particular challenges to the people and communities of Colorado.

Not all of Colorado's population growth has been in urban areas. Sustained growth in the majority of the Colorado economy combined with challenging times for the agricultural economy have resulted in the conversion of millions of acres Colorado's agricultural land into residential and commercial properties over the past two decades. Nearly 1.5 million acres of Colorado agricultural land were converted to other uses between 1992 and 1997 (USDA, 1999). Much of the land use pattern associated with this conversion has been sprawl-like development. Sprawl can have adverse long-term effects on the state's economic, environmental and social health.

Among the engines of Colorado's remarkable growth include its unique natural amenities. While some 40% of Colorado are held publicly, about half of the state's lands are owned by farmers and ranchers (1997 Colorado Census of Agriculture, 1999). Farm and ranch land not only provides inexpensive and high quality food for Coloradoans, it also provides a number of other benefits to society that do not commonly enter directly into market transactions, but are important to our way of life, just the same.

Too often communities are presented with a false dichotomous choice between economic growth and environmental protection. Successes in attaining and sustaining community health

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depend on recognizing the economic and non-economic contributions that undeveloped land already makes to the well being of Colorado (Western Governors' Association, 1998). As sprawl increases the scarcity of open space, maintenance of lands in productive agriculture can be a part of the solution.

The purpose of this literature review is to discuss the public benefits provided by agricultural land. We focus upon benefits that are not directly measured in the market place and, therefore, are not providing monetary compensation to landowners who provide these benefits. We review:

1. The types of economic and non-economic benefits provided by agricultural lands (e.g., open-space);
2. The numerous techniques used to quantify these benefits;
3. A synthesis of the economic valuation studies performed to date, many of which have not been reported previously in the published literature;
4. A tabulation of the market transaction values for the non-market benefits of agricultural lands in Colorado.

2. Economic benefits and financial returns from agricultural lands

There are two main categories of benefits from preserving agricultural land: food and fiber production and the production of "public" or "quasi-public" benefits. Food and fiber produced for human sustenance are private goods efficiently traded in the marketplace. The other benefits produced from agricultural land do not enter so easily or effectively into traditional markets. This relationship is illustrated in Figure 1.

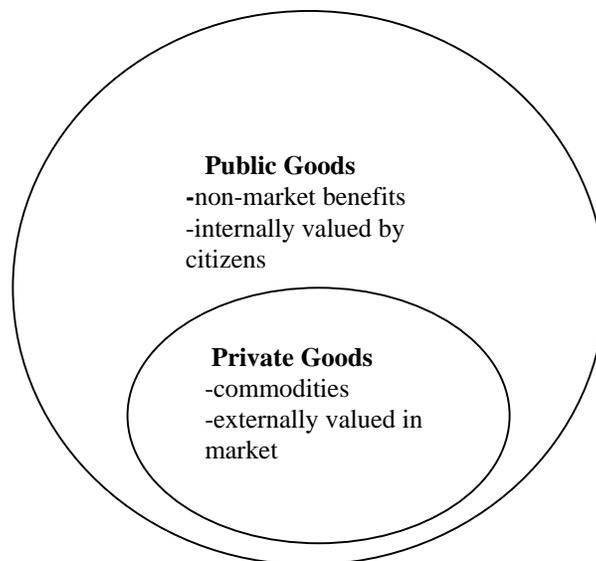


Figure 1
Total Value of Agricultural Lands

The total value of agricultural lands to society is the sum of their private good market values and their "public good" non-market values such as open space.

Many of the public goods provided by agricultural lands are, to a degree, non-excludable; meaning that once they are provided, it is impossible, or very costly to exclude anyone from enjoying them. They are also non-consumptive, meaning that one person's enjoyment of the good does not diminish its availability for others (Western Governors' Association, 1998).

Public goods produced from agricultural lands include:

- Water absorption/flood risk mitigation;
- Open space;

- Habitat for some wildlife species;
- Scenic viewscape and pastoral scene provision to non-residents (Rose, 1984).

To the extent that private interests can capture the non-exclusive and non-consumptive aspects of public goods, the goods provided take on quasi-public good attributes. For example, non-agricultural real estate values can capture some of the open space, viewscape, habitat, and rural lifestyle benefits provided by adjacent agricultural lands; Commuting suburban and rural residents benefit from these public goods and services provided by agriculturalists without paying the landowner. However, dust, slow farm machinery on roads, non-point source pollution issues, and odor are quasi-public “bads” produced by agricultural practices that sometimes partially offset the (quasi-) public goods provided by agricultural lands. Quasi-public goods provided include offering privacy and scenic vistas exclusively enjoyed by private properties near open spaces such as farm and ranch land.

The marketplace under-supplies public goods because they are non-excludable, making it nearly impossible for farmers to charge the public for the open space benefits provided from their farm and ranch land or for the public to privately express its desire for the farmer to continue to provide these social benefits. Open space can also be produced of resources that are owned and managed in common (e.g., parks, game reserves, forestland), rather than privately, by some defined groups of co-owners (e.g., a homeowner’s association, city or county residents, members of a special interest organization). In the case of wildlife, open space produces both public goods (e.g., birds and wildlife viewing) and privately consumable resources (e.g., hunting and fishing) (Nelson, 1990). The non-consumptive nature of the public goods provided by agricultural lands suggests that farm and ranch land has the most open space and viewscape value, in close proximity to urban areas, highways, scenic by-ways, and trail systems since this is where the greatest number of people will see the open space and appreciate the viewscape provided by farm fields or pastoral scenes.

1. Techniques used to quantify and qualify the benefits of agricultural open space

In general, techniques for the quantitative valuation of the non-market benefits of agricultural lands (e.g., open-space, wildlife habitat, and clean air, recreation, flood control, scenic views, biological diversity, quality of life, rural character, etc) can be grouped into three types:

- Actual market transactions by governments or private not-for-profit land trusts to preserve agricultural land as open space;
- Related market transactions such as land or house price differentials adjacent to or nearby agricultural lands;
- Social science research methods that probe public perceptions using both quantitative and qualitative survey techniques.

Market transactions by governments or land trusts to preserve open-space include fee simple land purchases, purchase of development rights (PDR) or agricultural conservation easement (PACE) programs, and transfer or trade of development rights (TDR) programs. Land trusts use conservation easements in a variety of ways to protect land in a private, voluntary and non-regulatory manner (Western Governors’ Association, 1998). Conservation easements are legal agreements, voluntarily entered by a property owner and a qualified conservation organization such as a land trust. The easement (usually) permanently limits a property’s uses in order to protect its non-market and quasi-market values. Advantages of these agreements include:

- a) Leaving the property in the ownership of the landowner who may then continue to live on it, sell it, or pass it on to heirs;
- b) Reducing estate tax liability which can make a significant difference in heirs’ decision to keep the land in agriculture or to sell out to commercial or residential development interests;
- c) Providing landowners with income tax benefits;
- d) Providing flexibility to meet particular needs of the landowner while protecting the property’s resources;
- e) Remaining in force if the land changes hands, ensuring that restrictions are followed;
- f) Allowing public values to be expressed for public good attributes of private lands; and
- g) Providing indirect or direct benefits to the provider of those public goods.

Hedonic price models relate land attributes to the price of land (McLeod et al., 1999). The method is based on the premise that land sold in the market is made up of different bundles of attributes or characteristics. The hedonic model disaggregates the total price of land to the natural and constructed features of a property. Sales data can be used to analyze the effects that different natural resource characteristics have on the price of agricultural lands and vice-versa. Public and quasi-public benefits of land in agriculture and other forms of open-space such as forest and wetlands to nearby residents will therefore be reflected in real estate price differentials.

A survey technique referred to as the contingent valuation method (CVM) estimates non-market values by constructing a hypothetical market for the environmental amenity, and then asks people what they would pay for it.²

4. Data sources

The studies reviewed here were located by a search of several bibliographic databases and by contacting several land trust coalitions in order to access both the formal, peer-reviewed and the gray literature in this area. Note that several reports included in this review are not available in the published literature since they are contract reports, proceedings papers and dissertations.

5. Assumptions, Mechanisms, and Results

Estimating the non-market value of Colorado's agricultural land presents several challenges. First, agricultural land and open space typically provides several functions simultaneously. Second, different types of value are measured by different methodologies and expressed in different units. Converting to a standard unit (such as dollars) is sometimes difficult, imprecise, and not always possible with existing data. It can be argued that unidimensional measures, including monetary measures, cannot capture total value in a meaningful way and that there are aspects of agricultural land values that simply cannot be captured at all. Thus, it is argued that any number, no matter how carefully calculated, may result in underestimation of the full range of agricultural land values. Accepting these shortcomings of economic valuation as a decision-making tool, we proceed to carry out the analysis to our best abilities with attention to these concerns.

5.1 Assumptions

All of the papers discussed in this literature review assume that private land not preserved in agriculture, or some other form of open space such as parks, will eventually succumb to the pressures of sprawl and development. Although this assumption may be appropriate to the Front Range, it may not necessarily hold true for the Eastern Plains and West Slope.

5.2 Agricultural Land—Open Space Benefits

The following list of mechanisms briefly discusses how agricultural land and open space contribute to the production of public goods and quasi-public goods. The categories of mechanisms listed are not necessarily mutually exclusive.

Market Related: agricultural land and open space provide positive economic benefits by supporting tourism; encourages more cost-efficient development; allows nature to provide valuable services as nutrient recycling (Wallace and DeRuiter, 1996). In general, users of parks and conservation lands generate a high level of economic activity (Western Governors' Association, 1998).

Wetland preservation: agricultural land protects arable soils and water resources (McLeod et al., 1999) and promotes biodiversity that may not be available in purely urban settings (Rosenberger and Walsh, 1997). Wetland protection of on agricultural lands can help communities reduce the costs of water filtration, flood control, and wastewater management (Western Governors' Association, 1998).

Land Use: agricultural land and open space reduce fragmentation of the landscape and thus the negative ramifications that are associated with it for wildlife and aesthetic resources as well as reducing infrastructure costs to county governments and service districts (Wallace and DeRuiter, 1996).

²For a more complete discussion of CVM, see Loomis and Walsh (1997).

- Viewshed:** agricultural land protects vistas from becoming a patchwork of roads, fences, houses, sheds, and transmission lines, especially as ranches are subdivided; increases resale value of land and improves quality of life (McLeod et al., 1999).
- Wildlife Habitat:** agricultural land and open space provide food and cover to wildlife species; fragmentation can irreversibly limit the future suitability for wildlife habitat (Wallace and DeRuiter, 1996).
- Wildlife corridor:** open space allows animals to maintain their migratory and non-seasonal movement patterns improving the genetic fitness of wildlife populations.
- Biodiversity:** agricultural land and open space aid in maintaining a balanced ecosystem; promote the potential economic, scientific, and medical benefits of certain species that remain unknown (Rosenberger and Walsh, 1997).
- Threatened and Endangered Species (T&E):** agricultural land may help protect some T&E species from extinction by increasing their survival and reproductive rates.
- Ranch and Farm:** ranchlands and farmlands themselves may be important for heritage value, both culturally and naturally (Rosenberger and Walsh, 1997).
- Air quality:** agricultural land and open space maintain a higher quality of air that would otherwise result from greater automobile use and industrial activity (McLeod et al., 1999)
- Option Value:** agricultural lands are important for the production of food and fiber necessary to guard against future political, economic and natural uncertainties (McLeod et al., 1999); guards against the fragmentation of land which can irreversibly limit future agricultural production alternatives and opportunities (Wallace and DeRuiter, 1996).
- Water Quality:** agricultural land and open space may prevent the decline of water quality caused by inappropriate rural development (i.e. downstream users may be affected by upstream activities such as inappropriate placement of septic tanks).
- Lifestyle:** maintenance of agricultural land and open space contributes to quality of life. This is a characteristic of those things that make a sense of community out of a number of dwellings. Long-term economic growth will take place where there is a high quality of life. Ensuring and enhancing quality of life are at the core of agricultural land preservation and community/regional planning efforts Colorado (Western Governors' Association, 1998). For example, access to parks, open space and the recreational opportunities that they provide helps to encourage a physically active lifestyle. This lifestyle improves general health and wellness and saves communities and businesses healthcare costs (Wallace and DeRuiter, 1996).
- Access to Public Lands:** agricultural land fragmentation reduces traditional informal arrangements for access to public lands. Because of reduced access across new residential properties, congestion and over-use may result at remaining public entry points (McLeod et al., 1999)
- Development/Property Value:** open space increases property values and local tax revenues; provides new business opportunities; attracts tourists generating new expenditures; reduces public expenditures by decreasing the costs associated with infrastructure provision, as well as flooding and other natural hazards. Houses adjacent to or nearby greenways have also been shown to sell for higher prices than those further away (Western Governors' Association, 1998). Higher density development spurred by preservation of open space and land in agriculture reduce the cost of new government services, including schools, water, trash removal, sewers, policing, and fire protection—the primary burdens on local government budgets.

5.3 Results

Table 1 provides a tabulation of the number of studies on the different benefits that agricultural lands and open space may provide in particular locations.

Table 1

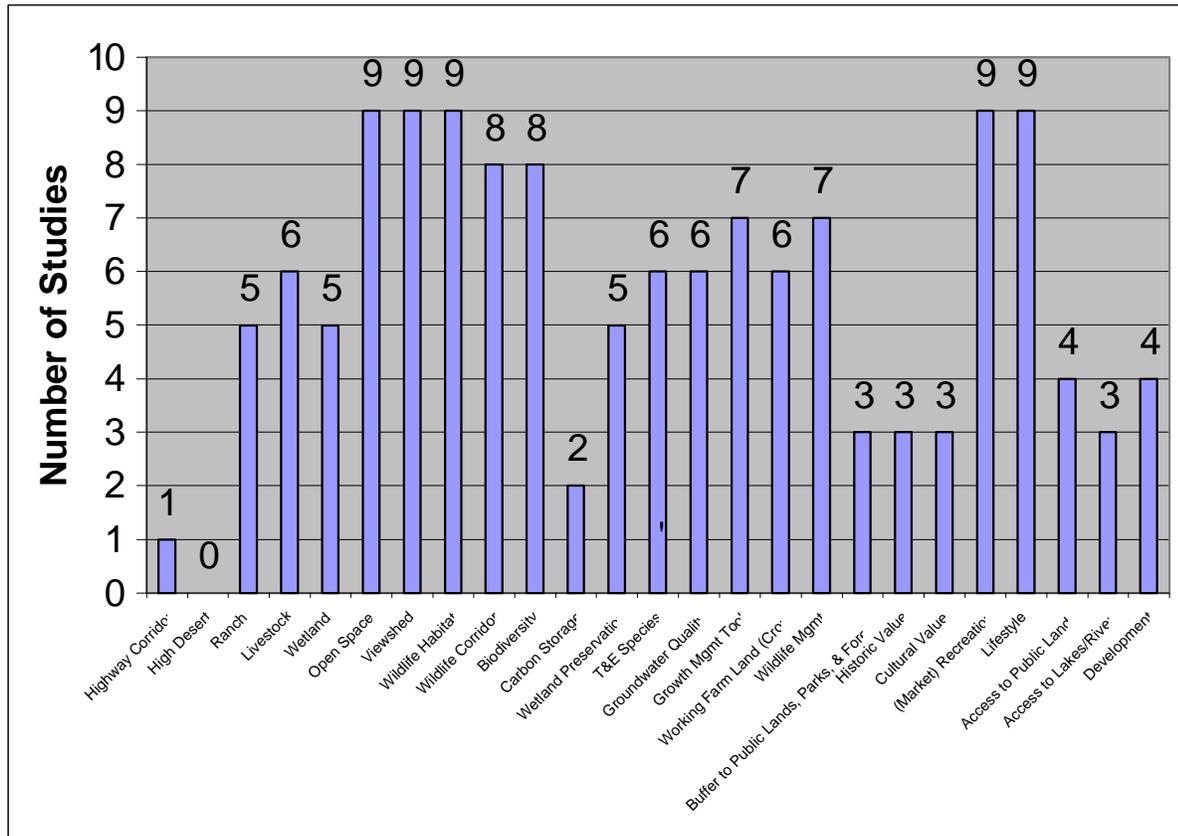


Table 2 summarizes the market transaction values of restricting lands from residential or commercial/industrial development. Sufficient data exist to allow calculation of the average purchase price per acre of land in three geographic regions in Colorado. These transactions include the state government sponsored and lottery funded, Great Outdoors Colorado Land Trust (GOCO) and Private Land Trusts. The Colorado Coalition of Land Trusts (CCLT) reports an additional 34 Land Trusts that protected some 518,209 acres on 686 parcels in 1998. Table 2 shows that protecting open space and wildlife were two of the most common reasons for these GOCO transactions, but that the principal reasons for land preservation efforts vary substantially across the state.

6. Policy Implications

A sizable proportion of the societal value of agricultural lands stems from public goods produced from these lands. These benefits include open space, wildlife habitat, and scenic vistas. Private land owners provide these public benefits as well as the private economic returns produced by agricultural commodities. Landowners are only compensated for, and therefore, can only be expected to actively manage for, the private returns of agricultural lands in the absence of public policy to encourage them to consider societal values. In areas where the development pressure is high, such as the Front Range, the incentives for owners of agricultural land to convert to other uses is increasing. Where the societal benefits from preserving these agricultural lands as open space exceed the private benefits of its conversion, action in the form of public policy incentives to preserve these lands may be needed. When distributional issues and uncertainty about the future are taken under consideration, it may be in the best interests of the locality, region, or state to ensure continued production of the public benefits of agricultural lands. Regulatory or zoning alternatives are also available public policy tools for conserving open space, but may be considered unfair by land owners who had anticipated reaping the development value in the future.

Table 2: Market transaction values of restricting Colorado lands from development

	<u>Eastern Plains</u>	<u>Front Range</u>	<u>West Slope</u>	<u>Mountains</u>
Total # Purchases	1	51	6	14
Total Number of Easements	2	3	2	5
Total Acres	3080	18,999	18,849	82,364
Total Cost	26,844,492	274,349,110	35,800,125	65,369,972
Average \$/Acre For Purchase ¹		26,582	1,889	3,577
<u>Percent of Transactions including the following land features or uses</u>				
Highway Corridor		0.00%	7.40%	0.00%
High Desert		0.00%	0.00%	0.00%
Ranch		33.30%	1.90%	31.60%
Livestock		33.30%	1.90%	31.60%
Wetlands		33.30%	16.67%	31.60%
Open Space		66.70%	53.70%	63.20%
Viewshed		66.70%	33.30%	36.80%
Wildlife		100.00%	38.90%	73.70%
Biodiversity		66.70%	31.50%	57.90%
Growth Management Tool		66.70%	31.50%	47.40%
Working Farmland		33.30%	1.90%	26.30%
Wildlife Management		100.00%	35.20%	57.90%
Buffer to Public Lands, Parks, & Forests		0.00%	31.50%	15.80%
Historic Value		0.00%	7.40%	10.50%
Cultural Value		0.00%	7.40%	5.30%
Market Recreation		66.60%	33.30%	31.60%
Lifestyle		66.70%	46.30%	42.10%
Access to Public Lands		33.30%	29.60%	21.10%
Access to Lakes/Rivers		33.30%	14.80%	10.50%

¹ Front Range n=39; Western Slope n=5; Mountains n=12. Source: Table developed from data provided by John Covert.

7. Conclusion

The value of agricultural lands should be recognized not only for its market values, but also for the non-market values. Studies suggest that keeping lands profitable in agriculture can be the basis for protecting landscapes as open space and wildlife habitat. However, encouraging this level of cooperation from agricultural landowners requires foresight and proaction from local and state governments. The strategic preservation of selected areas of agricultural open space could occur through financial or tax incentives that would secure landowner cooperation, and through coordinated regional land use planning agreements to maintain key agricultural lands as open space in rapidly developing areas. Colorado has a long tradition of public-private partnerships for public lands management. The time is ripe for analogous arrangements to guide the stewardship of the state's private lands.

8. Acknowledgements

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