The Future of Farmland Preservation Programs: From Retention to Viability and Resiliency

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Abstract

Many jurisdictions and nonprofit organizations in the U.S. have implemented 'farmland' preservation programs. Since 1979, state programs have acquired roughly 76,000 easements/development restrictions (1.25 m acres). Local governments have acquired an additional 1,900 easements (25,000 acres) since 1977. Most of these programs involve the purchase of development rights (PDR). PDR programs tend to establish preservation criteria based on agricultural characteristics, but the public is increasingly interested in agriculture's amenity value. Given the importance of public support for preservation funding, picking farms for success based only on agricultural factors can limit the acceptability of preservation legislation. While the environmental/ecological, economic/market, land use and social characteristics of farmland are of increasing interest to the non-farm public, rarely are they used in setting preservation targets.

This paper presents 'resilience indicators' or characteristics of farmland that might appeal more to the non-farm public and predicts preserved acreage under each indicator scenarios. Gini Coefficients and Ten-County Concentration Ratios are used to evaluate the closeness of projected preserved lands to population centers. A Michigan case study suggest that as the selection criteria moves away from purely agro-economic factors towards ecological, social and consumer goals, priority preservation acreage shifts towards urban locations. Since willingness to pay for preservation is tied to amenity benefits, a future political-economic dilemma is expected as farmers try to develop preservation coalitions for land away from population centers.

Key words: concentration ratio, farmland preservation, Gini Coefficient, selection criteria, sustainability.

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1. INTRODUCTION

Increasingly, U.S. states are adopting farmland preservation as a cornerstone of their agricultural policy (Hellerstein and Nickerson, 2002; Kline and Wichelns, 1996). In the past 25 years, several states have adopted legislation or constitutional amendments to initiate or increase funding for purchase of development rights (PDR) and other farmland preservation programs (AFT 2004a). Local governments and nongovernmental organizations (NGO's) are also very active in this area (AFT 2004b). The rationale appears to be the growing recognition of the long-term benefits of preserving farmland for agricultural and food production purposes. Increasingly, ecological, environmental, amenities, and other quality of life and sustainability concerns are becoming more prominent motives (Kline and Wichelns, 1996; Nelson, 1992; Rosset, 1999).

Agriculture is long known for its critical role in providing food and fiber for society (Hellerstein and Nickerson, 2002). It also plays an important role in providing jobs and economic growth opportunities. The agri-food system produces much of the food that American consumers consume, and that the vast U.S. food distribution system profits from (supermarkets, wholesalers, and restaurants). However, it is also the primary producer of non-food commodities, such as tobacco, cotton, sod and nursery products. The benefits of agriculture go even beyond these. The spillover economic and other benefits are gaining increasing recognition as the industry is becoming better connected to such emerging opportunities and industries as travel, tourism, recreation and neutraceuticals. Agriculture's role in conserving wildlife habitat, maintaining rural integrity, serving as a deterrent to sprawl, and providing a long term source of wealth for rural communities is also increasingly being recognized. Furthermore, as one of the oldest industries, agriculture has intrinsic aesthetic value, which endears it to the public.[1]

The majority of state farmland preservation programs involve PDR. A common feature of these programs is the strong desire to protect agricultural lands for agricultural purposes (see Table 1-1). Most states have developed *Ranking Systems* to enable them to achieve such goals, prioritize their acreage targets, and focus their expenditures on the most desirable lands. For example, Ohio and North Carolina, which focus on agricultural performance oriented factors such as soil quality, water availability, adequacy of weather, isolation of location, land of statewide importance and other farming characteristics, obviously value agriculture for agricultural reasons. Other states target acreage for preservation based on characteristics of surrounding land uses.[2] Obviously, for these states, agricultures compatibility is of interest. Some programs target economic viability by concentrating on such aspects as farm profitability and farm management capacity.[3] Few states, such as Vermont, focus on the protection of natural habitat, historic or archeological features, and public access to trails (VHCB, 2005).

Today, farmers represent less than 1%, and farm families less than 2%, of the general public in the U.S. (U.S. EPA, 2006). The coalitions that support funding for farmland preservation tend to have other motivations beyond pure agricultural interests (Kline and Wichelns, 1996; Hellerrstein and Nickerson, 2002). As suggested by Boody and Krinke (2001), the public is more willing to pay for a more environmentally beneficial agriculture. As has been seen in states such as New Jersey, the farmland preservation lobby included environmentalists, who have both environmental and ecological concerns about agriculture.[4] According to Bromley and Hodge (1990), public concern in developed countries has shifted away from increasing agricultural production and towards protecting and enhancing the quality of the environment.

Therefore, future preservation funding coalitions must include the broader population of state residents, most of whom are also consumers whose views of agriculture are probably not the same as farmers.

In most states, most consumers live in metropolitan areas and have interests in such issues as access to farms through pick your own operations, fresh food supply, inner-city farmers markets, bed and breakfasts, and agro-tourism. If agriculture can provide more of these benefits, it would probably enjoy greater legislative and policy support. Future designs of farmland preservation programs must consider these important features, and may have to incorporate these into their ranking or scoring systems. Currently, however, vary rarely are some of these factors used in setting targets for farmland preservation programs.

This paper explores the emerging goals of society, with respect to land preservation. It reviews and compares the selection criteria of state farmland preservation programs in the U.S. It further identifies emerging economic/market, ecological/environmental, land use and social characteristics which must increasingly be considered for farmland preservation programs to receive greater acceptability. Drawing on the vast literature on agricultural resilience, it then presents a set of farmland preservation priority indicators that are termed 'resilience indicators'. Indicators of public interest in biodiversity, tourism, amenity value of farmland, access to farms, as well as other survival indicators such as market demographics, market ethnic diversity, proximity to consumers, value added potential, and product diversity are advanced. Specific indicators, chosen based on data availability, are used to generate predictions of acreage of farmland that would be preserved by county. The closeness of such lands to population centers were then assessed via two measures: (1) Gini Coefficient; and (2) Ten County Concentration Ratio (CR_{10}). The application of the methodology to the state of Michigan, where policy makers are struggling to expand public support and, therefore, state funding for farmland preservation, suggests that farmer and citizen goals may be diametrically opposed and that the coalition needed to enhance farmland preservation support could be increasingly elusive if amenities important to non-farmers are not addressed.

2. STATUS OF STATE AND LOCAL FARMLAND PRESERVATION PROGRAMS

A brief background on the status of state preservation programs is in order. As shown in Table 2-1 the origin of farmland preservation was 1979, when the state of Connecticut implemented its program.[5] Maryland, Massachusetts and New Hampshire initiated similarly funded programs in 1980, while New Jersey and Rhode Island followed suit in 1985. Vermont and Pennsylvania implemented their programs in the late 1980's, followed by Maine (1990), Michigan (1994) and Colorado (1995), Delaware (1996), California (1997), Kentucky (1998), and New York (1998). Utah and Montana joined the pack in 2000.

Total funding available annually ranges from $0 in Montana, New Hampshire and North Carolina, $1.5 million in Michigan and Kentucky, to a high of $127 million in New Jersey, with $277 million dollars available annually across states. As of 2004, significant farmland had been protected across the nation. According to the American Farmland Trust (AFT, 2004a), some 1.4 million acres have been preserved nationwide through state agencies. The Funding mechanisms vary by state, but the overwhelming majority have adopted bond financing (AFT, 2004a).

The status of local farmland preservation programs across the U.S. is presented in Table 2-2. Earlier adopters in Maryland and New York (Suffolk County, NY and Harford County, MD) implemented their programs in the mid 1970's. Since then, county programs across the country have acquired approximately 434,000 acres, at a total cost of $170 million (AFT, 2004b). State and local programs are often linked as participation at the state level requires local partnership.

In some states, in order to ensure coordination and more local and regional planning, the county, and in some cases, the local township, must either forward the application to the state or must at least endorse it. Table 2-3 provides information on the level and nature of jurisdiction for state and local farmland preservation programs. Despite the fact that most of these programs require applications to the state, a common feature is that the farmers participating in the program must self select.[6] Farmland preservation is a market mechanism designed to provide farmers with market options, as opposed to a regulatory mechanism, for preservation.

State Ranking Systems and Selection Criteria

Demand for farmland preservation often exceeds what state, local or federal resources can accommodate (Johnson, 2007). Selection criteria developed by farmland protection programs to help set priorities and focus resources (Ferguson et al., 1991; Pease et al., 1994). The range of criteria include *purely agricultural production factors* such as farm size, soil quality, proximity to other farms, percent of farm acreage in production, gross sales per year, and farm infrastructure. Other less common features include farm economic profitability and *viability factors* such as acreage of viable agricultural land, location in an agricultural preservation district, the utilization of agricultural management practices, the level and quality of farm management, the reasonableness and feasibility of the preservation, and the level of farmer commitment. Some states account for development pressure, location and other *land use factors*. Fewer states account for *ecological*, *environmental*, and *sustainability factors* such as natural resources protection, the presence of an NRCS conservation plan, the likelihood of intergenerational transfer, the presence of matching funds, the cost of preservation, the existence of local preservation plans (see Table 1-1).[7]

In the next section, we identify resilience factors based on previous work by Holling (1973 and 2001), van der Leeuw (2000), and Milestad and Darnhofer (2003) using Michigan as a case study. Farmland throughout the state is scored on the basis of resilience indicators. High ranking lands are identified based on each indicator in order to observe the spatial distribution of priority farms for preservation under each criteria. Concentration measures are then used to observe the implications of alternative criteria for the spatial distribution of priority farms. The concentration measures allow evaluation of how preservation outcomes might vary as one moves from agro-economic factors toward environmental/ecological, land use, economic/market and social factors.

3. METHODOLOGY

Farmland preservation is an investment of public funds in the future of agriculture, as an industry and in the future quality of life of the non-farm community. The latter, as substantive taxpayers, represent the majority of contributors to the program. For agriculture and farmland preservation to be optimally appealing to the general public and to thrive in the long run, it must convey numerous benefits to the public and reach a state of equilibrium between its goals and those of the public. As a land-based industry with multiple societal benefits, it is intuitive that efforts to protect the land base should take into account the range of services that agriculture provides, not only to farmers, but to the non-farm public.

On one hand, farmers are largely rural or suburban residents, whose activities are located in areas that are generally less dense or are removed from population centers. On the other hand, the spatial distribution of the population in the U.S. is largely one in which non-farmers are mostly located in cities or near-city suburban locations. Presumably, because urban areas tend to have greater population density while non-urban areas tend to have more farmland, the more farmland is preserved near urban or highly populated areas, the more likely it will gain more widespread support. This, of course, is based on the expectation that nearness and proximity are key determinants of public support for farmland preservation (Kline and Wichelns, 1996; Nelson, 1992). Obviously, other factors might include farm sector voice and political clout, public appreciation of preserved farms at remote locations, and state-wide appreciation of the role of agriculture. Therefore, it is assumed that for state farmland preservation initiatives to gain the wide acceptance, it must appeal to a large population base, which is largely concentrated in near urban areas. This approach is at the heart of the methodology used in this paper.

Resilience is an amorphous term that has been used in a number of contexts in the literature. Milestad and Darnhofer (2003) defined it in terms of adaptability, self organization and learning potential. In his various works, Holling (1973, 1994, 1996, and 2001) defines it in terms of reliance and stability. In the context of agriculture, it has been defined to encompasses 'efficient production while providing quality and safety; environmental compatibility and quality of life; adequate fresh produce access by underserved communities; adequate flexibility to withstand market instabilities and uncertainties; adequate production of environmental and scenic amenities; and adequate exploitation of supplemental farm income opportunities.'

For the purpose of this paper, resilience is formally defined as 'a state of agriculture that optimizes survival by optimizing its benefits to the public and to the farm community itself'. In operationalizing our definition of resilience, we evaluate first previous definitions and then extracted suggested characteristics of resilient farms. An earlier definition of resilience was forwarded by Holling (1973) who defined it as the magnitude of disturbance that a system can withstand without a reduced change that results in a different set of dynamics and controls. Van der Leeuw (2000) later defined social-ecological resilience as the capacity to lead a continued existence by incorporating structural change. As suggested by Milestad and Darnhofer (2003), resilience focuses on the capacity to change and adapt in the presence of systematic changes in the business, social and policy environments. Resilience is a precondition for sustainability (Milestad and Darnhofer, 2003). The achievement of sustainability requires the ability to deal with multiple uncertainties in juggling changing objectives.

Carpenter (2001) identified three characteristics of resilient systems: (1) b*uffer capacity* (the ability to withstand uncertainty while maintaining basic functions); (2) o*rganizational capacity,* (the ability of a system to self organize and network in spite of uncertainty) (Holling, 2001); and (3) l*earning and adaptive capacity* (relates to the ability to adapt management and functions through learning and increased intelligence) (Jiggins and Roling, 2000).

As indicated by Milestad and Darnhofer (2003), *buffer capacity* relates to such things as environmental adaptability, product diversity, output flexibility, market flexibility, stewardship, socio-economic management capacity, non-specialization, and flexible ability to build relationships. *Organizational capacity* involves local support networks, with roots in the local community, which can be the basis for strong relationships with stakeholders. Infrastructure such as farmers markets, bed and breakfasts, farm stands, pick your own operations, reliance on local inputs and purchases, and community supported agriculture fall under organizational capacity. Finally, *learning and adaptive capacity* relates to farmers' management approach and learning ability. Such things as feedback mechanisms and learning/communication mechanisms become very important. As indicated by Milestad and Darnhofer (2003), increased specialization, higher productivity, dependence on imported inputs, dependence on distant markets and suppliers, and isolation from next stage processors can detract from resilience.

Obviously, resilience is a complex unobserved indicator with many dimensions. Many of its components are difficult to measure. However, it is not difficult to select the types of factors that can at least contribute to resilience. As indicated in the introduction, efficient food and fiber production is a goal of society, and therefore, a component of resilience. So is quality and safety to consumers. Environmental compatibility is also a factor, as agriculture must be non-threatening to the environment and to quality of life to be resilient. Adequate access to fresh produce for consumers, especially the underserved communities; adequate farm profitability and quality of life for farmers; and flexibility to withstand market instabilities and uncertainties are also relevant factors, as well as environmental and scenic amenities that the public demands. Supplement farm income, through ecotourism and farm-based recreation, can enhance flexibility, and therefore, viability and sustainability. In other words, 'resilience factors' are 'survival factors'. By targeting these, public investment in farmland preservation and the benefits to the farm community can be simultaneously optimized.

Selecting Resilience Indicators

Given the nature of available data, for the purpose of this study, the following resilience factors were identified. The identification process relied on previous work by Tulloch et al. (2003), who list a number of criteria based on their work in New Jersey, and the work of Machado et al. (2006), who focused their work on the bay area/delta region of California.

Agricultural Factors.

Factors such as acres of farmland, soil quality, water availability and climate are important determinants of the basic success and resilience of agriculture. These features are represented in the comprehensive designation of 'prime' and 'unique' farmland and are the foundations of a viable and resilient agriculture.[8] In some states, the unique geography presents a number of regions that are particularly suited for growing specific crops to their full potential.

Economic/Market Factors

At the farm level, economic viability translates into net income and the ability of farm operators to support a family and invest in the future (Adelaja and Rose, 1988). The ability to create and maintain a profit is a clear indication of economic strength. However, agriculture's long-term economic viability is dependent not only on its production efficiency, but also the ability to adapt to fluctuations in physical conditions and market demand.

Farms producing a diversity of agricultural products can more easily adapt to economic and production-related downturns. Thus, diversity in crop, production methods, and farm scale are all characteristics of a resilient agriculture. Innovation in growing and processing is also a positive contributing factor to economic viability (Adelaja, 2000). Many farms are adding to their bottom line by adding value to farm products through processing and packaging. On-farm markets, u-pick operations and agro-tourism all present additional income-generating opportunities for families farming at the urban fringe. The increasing popularity of ethanol is creating a new market for crops like corn. However, it is important to note that innovations must be based on realistic expectations of the land. Not every farm in a state is suitable for growing every crop, and diversity over the state as a whole should be maintained.

Access to fair and stable markets is critical for the viability and resilience of agriculture. For many farms, market access will be through established grain elevators or food processing facilities. Consolidation in the commodity grain handling and food processing industries has reduced the numbers of these facilities in the countryside. Farms in the immediate vicinity of existing elevators and processors have an economic advantage due to lower transportation costs.

Demand for fresh, locally grown vegetables and fruits, as well as meats, eggs and other specialty farm products, is growing. More and more farmers are finding viable opportunities to market their farm products directly to consumers, thus avoiding the wholesale-retail price gap. Farms in physical proximity to population centers have clear advantages in their ability to cost-effectively access direct market and tourism-related opportunities.

Land Use Factors

A resilient agriculture must be capable of maintaining an appropriate land base in the face of developmental pressures. An 'appropriate land base' allows for a diversity of farm sizes covering a range of production scales. An appropriate land base also clusters agricultural activities in order to minimize 'right-to-farm' conflicts and maintain necessary supporting infrastructure such as seed sales, equipment repair, and veterinarian services. Threats to this land base include growth pressure from population centers and competition for land use. Growth in the urban/rural population ratio and the presence of rising land values help to identify areas that are in danger of having farmland converted to other uses. Commitment at the local and regional level to preserving an agricultural land base contributes to the resilience of agriculture.

Ecological/Environmental Factors

Farming is inextricably linked to environmental conditions as well as management practices. The long-term productivity of agricultural systems is also dependent on the natural environment's ability to support the industry's pollution emissions and use of natural resources. Both natural and managed ecosystems provide many benefits to society, collectively called ecosystem services (Daily, 1997). Among these are wildlife habitat, biodiversity and ground/ water recharge. Some farms practices can also reduce the ability of ecosystems to provide these services (Tilman et al. 2002). Many indicators and methods have been proposed to assess ecosystem services provided by agricultural land and agriculture's impact on the environment (Payraudeau and van der Werf, 2005). Environmentally-conscious farming practices contribute to the sustainability of ecosystems that in turn support the agricultural business.

Social Factors

The socio-demographic characteristics of a region also play a role in its ability to maintain a viable agriculture. For example, the income and education of the consumer base can influence demand for specialty and value-added agricultural products. Ethnic diversity within the farming community is important due to the need for migrant labor on farms and to the growing evidence that minority business owners are some of the most resilient in the nation, with the most potential for growing the employment base of a community (U.S. Department of Commerce, 2001). Agricultural land has greater potential of contributing both ecosystem services and aesthetic benefits in areas where human populations are concentrated in urban centers and along major highways. In addition, areas that are tourism destinations stand a greater chance of sustaining agro-tourism operations that cater to recreational travelers and vacationers.

Basic Approach

The basic approach utilized in this study is to evaluate the closeness to highly populated areas of predicted targeted acreage for preservation. In other words, the primary strategy is to determine the acreage of farmland that would be preserved by location under a range of criteria, from basic agricultural criteria to the less standard criteria of economic/marketing, land use, ecological/environmental, and social factors; and to evaluate the closeness of such preserved farms to population centers. To do this, we (1) rank all counties in our study state by population and population density, in order to create a hierarchy of people/population dispersion/ concentration; (2), we identify the location and cost of preserved lands under the conditions of every specific potential indicator or characteristics that the public might be interested in for choosing what farms to preserve (we do this for 22 indicators, reflecting agricultural, economic/marketing, land use, ecological/environmental, and social characteristics); (3) we develop indicators of nearness of preserved land to the highest population clusters in order to determine the proximity of preserved acreage to the highest number of people (we do this with two common indicators from the economic and geographic literature- namely, the Gini Coefficient (G) and the CR_{10}); and (4) we compare these three proximity indexes across various preservation criteria to determine the nearness of preserved acreage to population centers.

Measures

Two measures are used to evaluate the nearness of preserved land to population centers and, therefore, the potential for such lands to benefit a higher percentage of the population: (1) the G, and (2) the CR_{10}. The G is usually used to measure equity in the distribution of a variable. It is applied in this study to measure equitable distribution of preserved farms by population. In other words, the G is estimated to determine the proximity of land preserved to population centers by measuring the relationship between the percentage of land preserved in a county versus the percentage of total state population in that county. This basically provides a framework for assessing the nearness of acreage preserved to population centers. The CR_{10} is also utilized in evaluating proximity of preserved lands to population. It is calculated as the percentage of land preserved that would lie within the top ten most densely populated counties in terms of population.

Gini Coefficient

The G is technically defined as a ratio with values between 0 and 1. Its numerator is the area between the Lorenz curve of the distribution and the uniform (perfect) distribution line. Its denominator is the area under the uniform distribution line. The G generally measures inequality, which in this case, is between the distribution of preserved land and the distribution of the population. In other words, a G of 0 coincides with perfect equality (i.e. preserved lands by county are in the same proportion as population, and hence preserved land are closer to population centers) and 1 corresponds to perfect inequality (i.e. preserved lands are as dispersed from population centers as possible). Obviously, given the fact that agricultural lands tend to be more concentrated outside cities, but generally in metropolitan areas, estimated G representing existing distribution of preserved farm acreage is likely to be closer to 0 than it would be to 1. The AFT (1994) has shown that the majority of productive farmland in the U.S. is under urban influence.

As shown in Figure 3-1, if the area between the line of perfect equality and Lorenz curve is A, and the area under the Lorenz curve is B, then the G is A/(A+B). If the Lorenz curve is represented by the function Y = L(X), then the value of B is:

(1)

$$G = 1 - 2\int_0^1 L(X)dX$$

Equation (1) can be applied to calculate the G. For example, for a population with values y_i, i = 1 to n, that are indexed in non-decreasing order ($y_i \leq y_{i+1}$),

(2)

$$G = \frac{1}{n}(n + 1 - 2\frac{\Sigma_{i=1}^{n}\,(n+1-i)y_i}{\Sigma_{i=1}^{n} y_i})$$

For a discrete probability function $f(y)$, where y_i, i = 1 to n are the points with nonzero probabilities and which are indexed in increasing order ($y_i < y_{i+1}$), then

(3)

$$G = 1 - \frac{\Sigma_{i=1}^{n}\, f(y_i)(S_{i-1} + S_i)}{S_n}$$

where:

(4)

$$S_i = \Sigma_{j=1}^{i}\, f(y_j)\, y_j$$

and

(5) $$S_0 = 0$$

Finally, for a cumulative distribution function $F(y)$ that is piecewise differentiable, has a mean μ, and is zero for all negative values of y, then,

(6) $$G = 1 - \frac{1}{\mu}\int_0^\infty (1 - F(y))^2 dy$$

Ten County Concentration Ratio (CR_{10})

The concentration of preserved land around high population areas is of interest in this study. To measure concentration, the CR_{10} concept is adopted. CR's have been used extensively to measure industrial concentration. CR_{10}, as used in this study, is the total preserved land share within the largest *m* counties in terms of population. To utilize a realistic CR, the contributions of the top ten population counties is chosen as the CR_{10} measure. By definition, CR

(7) $$CR_m = \sum_{i=1}^{m} s_i \ .$$

Therefore, the CR_{10} is:

(8) $$CR_{10} = \sum_{i=1}^{10} s_i \ .$$

A low CR_{10}, of say 1 percent, would suggest that the top ten most populated counties would receive only 1 percent of preserved farmland. This would represent a preservation strategy that maximizes the benefits to non-urban communities (i.e. most of the preserved farmland is away from urban cores). On the other hand, a high CR_{10}, of say 100 percent, would imply that the leading ten counties get a disproportionately high percentage of preserved land.

4. INDICATORS, DATA SOURCES AND MANIPULATION

As indicated above, many of the desirable indicators are difficult to get. For example, to operationalize the network capacity of agriculture, it would be difficult to find data on agricultural networking. In the absence of primary data and information about many resilience variables, such as quality of life for farmers, the strategy used was to gather as much information as possible, especially on measures that are good proxies for the unobserved variables most appropriate for measuring resilience. Nineteen indicators (see Table 4-1) were selected to prioritize land based on the various objectives of the farm and non-farm public. Obviously, the indicators chosen were dependent on the availability of existing data, partly due to the prohibitive cost of gathering new, primary data on many indicators of public interest in farmland.

Selected Indicators

The county was the unit of analysis in this study. The series of indicators chosen were selected to comprehensively reveal the relative resilience of agricultural lands. The raw data for the different indicators were of different types, such as numbers of acres, numbers of different species in an ecosystem, dollars per acre of income, distance ratios, percentages of totals and others. Within each indicator, a simplified score that ranged from 1 to 10 for each county was calculated. The scoring reveals where each county lies with respect to the other counties for a given indicator. A high score, 7 and above, indicated that the county is strong based on a particular resilience measure and a low score, 3 or below, indicates otherwise.

Agricultural Characteristics

The agricultural indicators selected included prime and unique farmland:

Prime Farmland: This is a special category of highly productive farmland. Prime farmland is land on which crops can be produced most efficiently for the least cost and with the least amount of damage to the resource base. Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation and favorable temperature and growing season. The soils have acceptable acidity or alkalinity, acceptable salt and sodium content and few rocks.

They are not excessively erosive. They flood less often and are not saturated with water for a long period of time. All of these characteristics combine to make farming on prime farmland more economically viable and resilient. In order to measure the level of prime farmland available in each county, the percentage of county cropland that is prime farmland was estimated. Information from the State Soil Geographic (STATSGO) database was combined with the amount of agricultural land in the IFMAP/GAP land cover data. The unit of measure for this indicator is percentage, and counties ranged from a high of 90% to a low of 0.0%. A high score indicates that the county has a comparatively high percentage of prime farmland available.

Unique Farmland: According to the USDA definition, unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season and moisture supply needed to produce a sustained high quality and/or high yields of a specific crop in an economic manner when treated and managed according to acceptable farming methods. To determine unique farmland, there was a need to characterize the environmental requirements for all the commodities in the state and match those with the environmental conditions in different parts of the state. This indicator uses an indirect approach to assess the uniqueness of a crop in Michigan based on the number of counties that grow the commodity in the state. This crop uniqueness factor (CUF) was estimated as CUF = 1-[Number counties planting a crop (i)/ 83]. The value 83 in the denominator of this equation comes from alfalfa hay, the crop being grown in all 83 counties. The fewer counties that grow a crop, the more unique the farmland in a county that is able to grow this type of crop. All the CUFs in a county were added and the final sum divided by the number of crops to obtain an average. Counties ranged from an average crop uniqueness factor of 0.00 to 3.70. A high score indicates that the county has a high degree of unique farmland.

Economic/Marketing Characteristics

The economic and market characteristics selected as indicators included farm viability, economic support, value added potential, product diversity, commodity viability, proximity to customers, and livestock local demand:

Farm Viability: A profitable and viable farm helps farmers keep their families on the land and protects against unfettered growth. Viability involves strengthening the business skills of farmers, combined with diversification and environmental integrity. Profitability serves as a proxy for viability in this study, measured as the average pure cash receipts per acre for each county. The farm viability measure was calculated by dividing 'net cash return from agricultural sales for the farm unit' by the total number of harvested acres in the county (from the county summary section of Census of Agriculture). Because 2002 was an unusual year weather-wise and marked by huge losses of fruit crops, 1997 data were used to generate a more representative measure. Counties ranged from a low of -$113.33 per acre to a high of $332.47 per acre. A high score indicates that the average farm in the county is economically viable.

Economic Support: This is measured by the amount of financial assistance provided by the government to the farmer for the sustainable development of the farm. This indicator provides information about the dependence of certain types or areas of agriculture on other monetary sources to achieve viability. Data on government payments per acre of farmland, from the Census of Agriculture 2002, served as the measure of economic support provided by the government to each county. Counties ranged from $0.00 per acre government support to $22.88

per acre in support. The indicator score is in inverse relationship to dollars per acre of support. A high score indicates the average farm in the county has a low level of economic support/reliance.

Value Added Potential: This is measured as the value of a farm's output, compared to the value of the intermediate and final goods produced from those crops. The potential for a farmer to achieve greater profits by adding value through new processes or products can increase agricultural viability. Value added potential by crop are based on the marketing margin in 2000 or 2001 (newest data available) as reported by the USDA, Economic Research Service (USDA ERS). Data on the farm value share of retail price (percent) for specific crops were entered when it was available, while the farm value share of retail cost for commodity group (bakery and cereal products, processed fruits and vegetables, fresh vegetables, fresh fruit) was entered when no data for the specific commodity were available. This marketing margin was aggregated across crops grown in each county. Counties ranged from 0 to 1,547 in aggregate marketing margin. A high score indicates that the average farm in the county has a high value added potential.

Product Diversity: This measure for a farming region measures the variety of agricultural goods produced, including raw commodities, processed goods and products derived from livestock. For this study, it was measured as the number of commodities for which a given county had more than 5% of state total agricultural production in 2002. The commodities for which Michigan is in the top five producers in the nation, and traditional cash crops, were included in this study. Counties ranged from 0 to 19 commodities in which the county had more than 5% of state's total. A high score indicates that there is high product diversity in the county.

Proximity to Farmers' Markets: This is measured by the proximity of markets to farmland. Farmland was obtained from the IFMAP/GAP agricultural land classes which included non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery. The proximity to farmers' markets indicator has two components. The first component is the number of farmers' markets in the county and surrounding counties, providing a measure of accessibility of farmers' markets to producers. The second component is the inverse of the average distance to farmers' markets from the county farmland centroid, providing a measure of proximity. The values from these two components are multiplied to obtain a gravity measure of proximity to farmers' markets. County ratios ranged from 0.00 to 0.098. A high score indicates that there is high proximity to farmers' markets in the county.

Proximity to Food Processors: This is measured by the proximity of processors to farmland. Farmland was obtained from the IFMAP/GAP agricultural land classes which included non-vegetated farmland, row crops, forage crops and orchards/vineyards/nursery. The proximity to food processors indicator has two components. The first component is the number of processors in the county and surrounding counties, providing a measure of accessibility of processors to producers. The second component is the inverse of the average distance to food processors from the county farmland centroid, providing a measure of proximity. The values from these two components are multiplied to obtain a gravity measure of proximity to food processors. County ratios ranged from 0.0 to 0.04. A high score indicates that there is high proximity to food processors in the county.

Proximity to Grain Elevators: This is measured by the proximity of grain elevators to farmland. Farmland was obtained from the IFMAP/GAP agricultural land classes which included non-vegetated farmland, row crops, forage crops and orchards/vineyards/nursery. The proximity to grain elevators indicator has two components. The first component is the number of elevators in the county and surrounding counties, providing a measure of accessibility of elevators to grain producers. The second component is the inverse of the average distance to grain elevators from the county farmland centroid, providing a measure of proximity. The values from these two components are multiplied to obtain a gravity measure of proximity to food processors. County ratios ranged from 0.00 to 0.166. A high score indicates that there is high proximity to grain elevators in the county.

Commodity Viability: Measuring viability by commodity allows us to identify counties where there is a good opportunity for farmers to enhance profitability through diversification of crops. In order to measure the level of commodity viability in each county, data were collected on the total production of those commodities where Michigan is ranked in the top five nationally. Commodities included three main groups: fruits (tart cherries, sweet cherries, apples, plums, grapes and blueberries), vegetables (cucumbers, celery, asparagus, carrots, squash, tomatoes and pumpkins), and field crops (dry beans and sugar beets). Acreage data per county were obtained from the Census of Agriculture 2002. Data on crop yield and commodity prices were obtained from several sources including rotational surveys and MI Statistic tables. The average price per harvested acre for each commodity group was multiplied by the acreage in that group to obtain the commodity viability measure in dollars. Counties ranged from $0.00 to $71,487,000. A high score indicates that the county has comparatively high viability by commodity group.

Proximity to Customers: This measures the closeness or nearness of the farmland or farm products to the customers who generate the final demand for the good. Being close to consumers can cut down on transportation costs and provide greater opportunities for agro-tourism, farm-stand sales and enhanced social networks with the non-farm community. In order to measure the level of proximity to customers in each county in Michigan, information was collected from the index of urban influence developed by the USDA ERS. Michigan counties range from 1 to 12 on the USDA index. A high score indicates that in the county, the distance between the customers and the farmland or farm products is comparatively small.

Livestock Local Demand: Livestock refers to domestic farm animals raised for production. Examples include beef and dairy cattle, sheep and goats, swine and poultry. Livestock demand is a proxy for the demand for crops to feed livestock and land to dispose of their wastes. Greater livestock demand thus creates a greater demand for cropland, and a greater degree of resilience. In order to measure the degree of livestock local demand in each county in Michigan, data was collected on the inventories of the following categories from the 2002 Census of Agriculture; (1) horses and ponies, (2) cattle and calves, (3) beef cows, (4) milk cows, (5) hogs and pigs, (6) sheep and lambs, (7) chicken (layers and broilers). Livestock local demand was calculated by multiplying the inventory of each type of livestock by its corresponding 'Animal Unit' (AU), which is a proxy for the feed demand and manure production of each animal type. Counties ranged from 126 animal units to 134,877 animal units. A high score indicates high livestock local demand.

Land Use Characteristics

Population Pressure: This is the real or perceived threat of the conversion of farmland to other uses, like residential development, as the population of an area grows. As demand for farmland for other uses grows, and land values rise, the farmers are less likely to stay in business (Adelaja & Lake, 2005). Population pressure data are expressed as the change in the ratio of urban to rural population between 1990 and 2000. Data on urban and rural population were acquired from the U.S. Census in 1990 and 2000, and the ratio was calculated by dividing urban population by rural population. The change in urban/rural population over time was then calculated by subtracting the 1990 ratio of urban to rural population from the 2000 ratio.

Counties ranged from -0.56 to 61.60. The scores were calculated on an inverse relationship, with a negative ratio indicating that the rural population is gaining compared to the urban population. A high score indicates high population pressure.

Farm Size Diversity: Diversity in the size of farms indicates a flexibility and resilience of a county's agriculture; flexibility in the sense that it can meet different kinds of demand, and resilience in the sense that it can survive different types of economic hardships as a county. The farm size diversity indicator used here is based on the number of farms in different size ranges/ categories as reported in the US Census of Agriculture 2002. There are 6 broad scales (1-9 Acres, 10-49 Acres, 50-179 Acres, 180-499 Acres, 500-999 Acres and 1000+ Acres) and the degree of disbursement (variation) of farms over all six categories provides a measure of size diversity. County degree of variation ranges from 1.69 to 3.75. A high score indicates high diversity.

Farm Contiguity: The more contiguous farm acreage is the better farmers are able to access inputs, share labor and machinery and avoid right-to-farm conflicts, improving agricultural resilience. Quantification of farm contiguity involves the characterization of the spatial clustering between farm parcels. Due to the lack of an integrated statewide layer of farm parcel information, the clustering of agricultural land use was instead used as an indicator of farm contiguity. Land use clusters of 0.25 miles squared (162 acres) were created from the IFMAP/GAP Michigan Land Cover. Adjacent clusters that contained 10% or more of agricultural land were then merged. Figure 4-1 shows an example of agricultural land clustering for Clare and Clinton counties. IFMAP/GAP agricultural land included the following classes: non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery.

The farm contiguity indicator had two components. The first component was (P), the fraction of the largest agricultural land cluster (i.e. P= size of the largest cluster divided by the total agricultural land). The closer this value was to 1, the more contiguous the agricultural land is. The second component was (N) the inverse of the number of clusters. The smaller the number of clusters, the more contiguous the agricultural land is. The final estimation of farm contiguity (F) was F = [P+ N]/2 where values ranged from 0 to 1 (see Figure 4-2). Counties ranged from a ratio of 0.0561187820 to 1.000000000. A high score indicates high contiguity.

Competition for Land Use: This refers to the danger of farmland loss due to changes in surrounding land uses (i.e. development encroachment and unfettered growth from residential, commercial and industrial expansion). In order to measure the degree of competition of land use in a county, the study team collected the data on the total farmland acreage in 1997 and 2002 from the Census of Agriculture, and calculated the change in total farmland acreage in the given period. Counties ranged from -15,938 acres conversion into agriculture from another use to 18,300 acres loss of agriculture to another use. A high score indicates a high degree of farmland loss, and thus competition of land use.

Current preservation: Agricultural land can include cropland, rangeland, pastureland, forestland and other rural land. Current preservation of farmland refers to the total farmland in acres that is preserved in the county through two state preservation programs. The number of acres preserved through the Agriculture Preservation Fund purchase of development rights program and the PA 116 program was provided by the Michigan Department of Agriculture. A large number of farmland acres preserved in a county indicates a higher resilience factor of remaining farmland. Counties ranged from 710 acres preserved to 434,738 acres preserved. A high score indicates a high percentage of farmland being preserved.

Ecological Characteristics

The sole ecological characteristic selected is biodiversity:

Biodiversity: This refers to the full range of natural variety and variability within and among living organisms and the ecological and environmental complexes in which they occur. A greater degree of biodiversity in a farming community is a measure of agriculture's contribution to natural systems, indicating more sustainable use of the land and provision of environmental services to the surrounding area. In order to measure the level of biodiversity in each county, data were obtained from the Michigan Natural Features Inventory on the number of species of plants and animals found in each county (MNFI, 2001). Counties ranged from having 10 different species to 176 different species. A high score indicates a large variety of species present.

Social Characteristics

The social characteristics selected as indicators included income demographics, ethnic diversity, tourism, and amenity value:

Income Demographics: This indicator is based on statistical data about the median income of the population by county in Michigan. It is an important indicator since the generation of demand for products produced by the farmers depends on the income demographics of the residents of the county. For example, high value organic food is still a luxury good, and a change in income causes a larger change in the demand for luxury goods than normal goods. This relatively elastic demand for high value crops presents an opportunity for farmers to take advantage of income demographics and increase agricultural viability. The median household income for each county, from the US Census of Agriculture 2000, served as a measure of income demographics. Average household income in Michigan counties ranged from $27,071.00 to $69,650.00. A high score indicates a high income among consumers.

Ethnic Diversity: This refers to the diversity among people in a geographic area according to racial, national, tribal, religious, linguistic or cultural origins. There are two major factors explaining the importance of ethnic diversity in this study. Primarily, statistics show that minority-owned and women-owned businesses are some of the most resilient in the nation, with the most potential for growing the employment base of a community (U.S. Department of Commerce, 2001). Moreover, ethnic diversity may create demand for different variety of foods, which gives farmers an opportunity to grow unique, high value crops. In order to measure the degree of ethnic diversity among the people in the different counties, information was gathered on minority farm operators from Census of Agriculture 2002, and used to calculate the ratio of minority farmers to the overall farm operators. This ratio ranged from 0.00 to 0.0959 among Michigan counties. A high score indicates high ethnic diversity.

Tourism: Tourism is a large source of income for Michigan residents. Economically, it is the 3rd most important industry in the state. Based on people's travel habits/patterns/purchases, some counties benefit from tourist activity more than others. The presence of tourism in a county is an opportunity for farmers to expand agro-tourism activities. In order to measure the extent of a county's involvement in tourism and tourist-related business, information was collected on the percentage of market share of pleasure trips from the report, *Michigan at the Millennium* (Ballard et al, 2003). Counties ranged from 0.04% of market share from pleasure trips to 9.48% market share from pleasure trips. A high score indicates that tourism opportunities are strong.

Amenity Value: Agricultural land in Michigan is a major contributor to open space amenities and contributes to the look of the landscape. The method to measure this characteristic included estimating the proportion of agricultural land in relation to other vegetation. Estimates were conducted on buffer areas around roads (0.5 miles) and urbanized areas (5 miles) in order to estimate the contribution of agricultural land to the open space (Figure 4-3). This indicator allows us to better understand how much farmland contributes to scenic views throughout the

State of Michigan, and therefore how much people value farmland for its aesthetic amenities. An increase in the percentage of farmland to natural undeveloped land leads to an increase in the value of farmland as open space/aesthetic value. Michigan counties ranged from 0% agricultural land as part of the undeveloped landscape to a high of 79%. A high score indicates that agriculture highly contributes to open space values.

Data Sources and Manipulation

Data were collected from existing sources ranging from the Census of Agriculture (NASS, 2002) to land use/land cover maps to characterize each county. A list of data sources is provided in Table 4-1. The unit of analysis, or observational level, was the County.

The data utilized to represent different characteristics of agricultural resilience are not always ideal. In addition, it is not possible to represent some characteristics in a mathematical form. For instance, the economic values of the environmental and social benefits of farmland are difficult to quantify.[9] The data were compiled into a spreadsheet with a row for every county in Michigan and a column for every characteristic.

In the first stage, the data collected were ranked using a scoring system ranging from 1 to 10 (1 being least preferred, 10 being most preferred). This compression of the data into scores was accomplished using a mathematical formula that takes the range of data, from the minimum to the maximum, divides it into ten equal ranges and assigns a score of 1 through 10 to those ranges. Any data point falling within the lowest range would receive a score of one and any data point falling within the highest range would receive a score of ten, etc. A matrix of scores with a row for each county and a column for each characteristics (presented in Table 4-2) was produced. This scoring sheet allows us to determine which counties score the highest in terms of resilience.

In the second stage, we converted the scores into percentages so that the score of 0 means that 0% of available farmland would be preserved while the score of 1 meant that 100% of the available farmland would be protected. This yielded information on projected acreage of farmland to be protected. This arrangement obviously ignores local affordability issues, and assumes that funding was fully available for all lands targeted through this methodology to be protected. This approach allows us to observe the special distribution of acreage to be protected.

In the third stage, the projected acres were utilized in the creation of state maps. Using Arc View, county scores determined in the previous analysis were depicted in statewide maps. The maps show where counties score high and low in terms of each characteristic. In looking at these maps, it is easy to see patterns or regions of comparative advantage for different aspects of agriculture. In the fourth stage, the Gini Coefficient and the CR_{10} were used to calculate the concentration of land near more densely populated areas. In using the Gini Coefficient, the trapezoidal approximation method is used, in order to simplify the analysis. Also, for ease of deciphering high and low population communities, the Gini Coefficient is estimated with numbers from high to low.

5. EMPERICAL RESULTS

With 10,142,958 acres of farmland, if all of the farmers in the state agreed to protect their farmland through a program that offered $2,000 per acre (the average cost of farmland preservation in 2003), it would cost approximately $20 billion. This goal is unattainable.

The application of our methodology to Michigan data yielded some interesting results. Examine first the total qualified acreage for preservation, state-wide, under each criterion (see Table 5-1). The most acreage preserved would be through a focus on commodity viability (870,000 acres), followed by product diversity (743,000 acres), value added potential (730,000 acres), amenity value (726,000 acres), prime farmland (710,000 acres), proximity to consumers (706,000 acres), farm contiguity (698,000 acres), and proximity to grain elevators (614,000 acres). The least acreage preserved, state-wide, would be through a focus on tourism (192,000 acres), ethnic diversity (299,000 acres), proximity to food processors (316,000 acres), biodiversity (363,000 acres), farm viability (369,000 acres), and current preservation (370,000 acres). The fact that targeting some of the economic and marketing factors would preserve the most land suggests a high number of farms eligible for targeting for economic success. The fact that prime farmland ranks high (at fifth) suggests the abundance of good soils. It is surprising that projected preservation acreage from such things as proximity to consumers and amenity value score high. This is encouraging to those who favor the preservation of amenity value.

The projected preserved farmland acreage, based on each of the 22 resiliency indicators, is depicted in Figure 5-1. Each cell represents the land that would be preserved utilizing a given resiliency indicator. More darkly shaded areas indicate where more agricultural land would be preserved, based on using the given indicator as a farmland preservation selection criteria. They are ordered (from left to right) as they are listed in Table 4-1. As can be seen, indicators such as commodity viability and product diversity, which are predicted to preserve the most farmland acreage, have the majority of preservation occurring in the lower half of the Lower Peninsula, focusing more heavily on the eastern side of the state. Indicators such as tourism and ethnic diversity are predicted to preserve the least acreage of farmland, but tourism acreage would be more concentrated around urban areas, whereas acreage preserved for ethnic diversity is slightly more dispersed across the state. Nearly all of the indicators would predict preserving a relatively high number of acres in the tip of the ‘thumb’ region of the state, indicating that this farmland is extremely diverse in its amenities and is included in many categories, and the Saginaw Bay region in general has a high concentration of predicted farmland preservation acreage.

Utilizing the predicted farmland acreage based on each resiliency indicator, the Gwere estimated (see Table 5-1). G close to 0 indicate that the preserved farmland would be located relatively proportionate with the population, and as most of the population lives in urban areas, this would indicate that a majority of the farmland would be located near urban areas. Higher G, on the other hand, indicate that preserved land in not distributed proportionately to population, and hence, would be located away from population centers (urban areas).

As shown in Table 5-1, the current farmland preservation program yields the highest G, and therefore, the least concentration of land around population centers. This is not surprising and suggests that as other indicators are brought in, the concentration of preserved land would move towards equitable access to people in more urban communities. The fact that the current program yields the greatest dispersion is cause for concern. It highlights the fact that the current system is still very far from where the general public in Michigan might want it to be. As shown in Table 5-1, some of the agricultural and viability oriented indicators yield the highest G. That is, farm size diversity (0.638), economic support (0.632), livestock local demand (0.628), proximity to food processors (0.613) and commodity viability (.21) yield the least access of farmland to urban residents. On the other hand, using the consumer and urban oriented indicators, one gets the most concentrated acreage of land around urban areas (tourism = 0.500, proximity to consumers = 0.546, biodiversity = 0.546, unique farmland = 0.548, population pressure = 0.549, proximity to farmer markets = 0.552, income demographics = 0.559, and value added potential = 0.577). These results confirm our hypothesis that the concentration of preserved farmland around population centers is endogenous to selection criteria. The Lorenz

Curves for each of the indicators are shown in Figure 5-2. For ease of understanding, the indicators are grouped into the categories of agro-ecological, economic/marketing, social and land use. Obviously the land use category yields the highest population inequity, while the social yields the highest population equity.

Again utilizing the predicted farmland acreage based on each resiliency indicator, the CR_{10} were estimated (see Table 5-1). A high estimated CR_{10} indicates that the land preserved based on the given indicator represents a high proportion of the total preserved land concentrated in the urban parts of the state. As with the G, the current farmland preservation program yields the least equitable distribution of acreage and therefore, the lowest CR_{10}. Tourism, as with the G, yielded the most equitable distribution of acreage and therefore, the highest CR_{10}. The pattern observed for the G was very similar to the pattern for the CR_{10}, with a few exceptions.

6. SUMMARY AND CONCLUSIONS

This paper evaluates the potential that differences in the priorities of urban residents, vis-à-vis traditional farmland preservation stakeholders, could yield differences in preferred location of preserved farmland. Therefore, it evaluates the implications of increasing focus on economic/market, land-use, ecological/environmental, and social priorities on the proximity of resulting preserved land to urban populations. The findings are consistent with a priori expectations and the conclusion of Hellerstein and Nickerson (2002) that the design of preservation programs has implications for the spatial pattern of permanently preserved lands, and hence, the location of preserved rural amenities. In other words, traditional proponents of farmland preservation differ from the general public in their priorities, and these differences imply different preferences in terms of where farmland is preserved.

The G and the CR_{10}s suggest that as society begins to accommodate the interests of the non-farm public in amenities and direct benefit of agriculture to them, the priorities for farmland preservation will shift away from preserving traditional agricultural characteristics, and in the direction of preserving amenities of importance to the non-farm public. These amenities include things like access to tourism, proximity of farms to consumers, biodiversity, unique farmland, population pressure, proximity to farmer markets, income demographics, value added potential and product diversity. One implication of this is that farmers must increasingly compromise and strike a balance between their priorities and those of other preservation stakeholders.

One question that therefore emerges is the extent to which state scoring systems for preserved farmland should be adjusted to accommodate the growing needs of the public. As indicated by Kline and Wichelns (1996), these programs are already shifting their priorities. The question is how quickly must they adjust to enhance the viability of farmland preservation programs, by attracting increased interest of the non-farm public and without compromising too much of their own interests. This raises the issue of a trade-off between the preferences of farmers and their non-farm counterparts and the relative gains and losses to each as one moves the priorities away from farmers' interests. Obviously, the ranking system and the criteria for farmland preservation is a public choice issue, which decision makers must balance by attempting to optimize the ultimate benefit to society as well as generating optimal support for their actions. The fact that many state farmland preservation management boards have a high concentration of farmers suggests that more input from non-farmers may actually be beneficial. While many studies have addresses public support for farmland preservation, and the motivations behind such support, very few have addressed the political economy of optimizing farmland preservation funding. This paper lays a critical foundation and motivation for this new area of research which the authors wish to pursue.

Table 1-1: Farmland Preservation Selection Criteria by State, 2005

	Selection Criteria Code																				
State	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
California	X	X	X		X	X				X											
Colorado																					
Connecticut	X		X	X	X				X							X					
Delaware	X		X	X			X			X											
Kentucky	X	X	X	X	X	X	X		X			X									
Maine														X							
Maryland		X	X	X			X			X											
Massachusetts	X	X		X	X	X				X			X		X						
Michigan	X	X	X			X						X	X			X	X				
New Hampshire																					
New Jersey	X	X	X	X	X	X		X		X							X				
New York		X					X														
North Carolina	X	X	X	X	X				X		X	X			X	X					X
Ohio	X	X	X	X	X	X		X	X		X	X	X	X	X		X	X	X		
Pennsylvania	X		X	X	X	X	X	X						X					X	X	
Rhode Island	X	X	X	X			X	X						X							
Utah	X	X		X				X	X		X		X					X			
Vermont	X	X	X		X	X	X				X										

<u>Key for Selection Criteria</u>:

1. Number of Acres
2. Viable Agricultural Land
3. Proximity to other Farms
4. Soil Quality
5. Developmental Pressure
6. Location
7. Agricultural Preservation District
8. Agricultural Practices
9. Level of Farm Management
10. Commitment
11. Natural Resources Protection
12. Percent of Farm Acreage in Production
13. Gross Sales per Year
14. NRCS Conservation Plan
15. Likelihood of Intergenerational Transfer
16. Cost of Preservation
17. Matching Funding
18. Farm Infrastructure
19. Local Comprehensive Plan
20. Mortgage
21. Reasonableness and Feasibility

Source: Maryland Agricultural Land Preservation Foundation (MALPF). 2005. *Fact sheets about Maryland's Agricultural Land Preservation Program.* Available at http://www.malpf.info/facts.html.

Table 2-1: Status of State Farmland Preservation Programs

State	First Year	Acres Protected	Annual Funds	Funding Sources
California	1997	24,000	$12,000,000	Appropriations, bonds, private contributions, FRPP**
Colorado	1995	226,549	$8,550,000*	Local government contributions, portion of lottery proceeds, FRPP
Connecticut	1979	30,087	$3,231,872	Bonds, local government contributions, FRPP
Delaware	1996	79,649	$14,300,000	Agricultural transfer tax, appropriations, bonds, local government contributions, portion of lawsuit settlement, private/foundation contributions, transportation funding, property transfer tax, FRPP
Kentucky	1998	20,649	$1,500,000	Appropriations, bonds, tobacco settlement funds, FRPP
Maine	1990	4,275	N/A	Appropriations, bonds, credit card royalties, local government contributions, private contributions, FRPP
Maryland	1980	281,545	$30,100,000*	Agricultural transfer tax, bonds, local government contributions, private contributions, real estate transfer tax, federal wetlands conservation fund, FRPP
Massachusetts	1980	55,516	$8,500,000	Bonds, local government contributions, private contributions, transportation, FRPP
Michigan	1994	15,834	$1,500,000	Local government contributions, private/foundation contributions, repayment of tax credits by landowners withdrawing from the state circuit breaker program, FRPP
Montana	2000	9,923	$0	Appropriations, FRPP
New Hampshire	1980	10,938	$0	Appropriations, local government contributions, bonds, FRPP
New Jersey	1985	133,733	$127,825,178	Appropriations, bonds, local government contributions, portion of state sales and use tax, private/foundation contributions, FRPP
New York	1998	14,140	$12,600,000	Bonds, property transfer tax, local government contributions, FRPP
North Carolina	1999	4,412	$0	Appropriations, FRPP
Ohio	1999	15,410	$3,120,000	Bonds, tobacco settlement funds, FRPP
Pennsylvania	1989	295,447	$25,000,000	Appropriations, bonds, cigarette tax, interest on securities, local government contributions, FRPP
Rhode Island	1985	4,382	$2,000,000	Appropriations, bonds, local government contributions, private contributions, property transfer tax, FRPP
South Carolina	N/A	0	$24,185,245*	Deed/recording fees
Utah	2000	26,157	$798,000*	Appropriations, local government contributions, private/foundation contributions, FRPP
Vermont	1987	108,945	$2,100,000	Appropriations, bonds, Farms for the Future pilot program, local government contributions, private/foundation contributions, property transfer tax, transportation funding, FRPP
State Totals		**1,361,591**	**$277,310,295**	

* Annual Funds includes monies available for all land conservation purposes, not just farmland.
** FRPP is the Farm and Ranch Lands Protection Program, federal funding that provides a match to state, local, tribal, and certain non-governmental organizations.

Source: Adapted from American Farmland Trust Fact Sheet (Status of State Purchase of Agricultural Conservation Easements (PACE) Programs). (AFT, 2004b).

Table 2-2: Status of Local Farmland Preservation Programs

State	First Year	Acres Protected	Annual Funds	Funding Sources
California				
Alameda Co.	1992	3,987	$5,000,000	Mitigation fees
Davis City	1988	1,400	$4,250,000	Appropriations, mitigation fees, property tax, state ag. conservation program funds
Marin Co.	1983	14,967	N/A	Bonds, private contributions, FRPP
Sonoma Co.	1992	32,307	$8,000,000	Sales tax, state bonds
Colorado				
Boulder City	1984	1,737	N/A	Bonds, private contributions, sales tax, grants
Douglas Co.	1995	27,808	N/A	Bonds, sales and use tax
Routt Co.	2000	6,027	$694,330	Property tax, FRPP
Georgia				
Carroll Co.	N/A	0	$2,100,000	Sales tax
Illinois				
Kane Co.	2002	2,669	$1,550,000	Gaming revenue, FRPP
Kentucky				
Fayette Co.	2002	13,631	$10,402,883	Appropriations, bonds, state tobacco settlement funding, state match grant, FRPP
Maryland				
Anne Arundel Co.	1992	11,475	N/A	Ag. transfer tax, appropriations, FRPP
Baltimore Co.	1981	27,083	N/A	Ag. transfer tax, appropriations, bonds, private contributions, transportation funding, FRPP
Calvert Co.	1993	10,282	N/A	Ag. transfer tax, appropriations, private contributions, property tax, recording fees, FRPP
Carroll Co.	1980	44,841	$10,413,000	Ag. transfer tax, appropriations, bonds, property tax, FRPP
Frederick Co.	1993	29,330	$12,832,272	Ag. transfer tax, appropriations, deed/recording fee, transportation funding, FRPP
Harford Co.	1977	34,500	N/A	Ag. transfer tax, real estate transfer tax
Howard Co.	1984	19,362	$12,550,000	Ag. transfer tax, bonds, real estate transfer tax, FRPP
Montgomery Co.	1989	13,904	$2,247,000	Ag. transfer tax, appropriations, bonds, state grants, investment income, FRPP
Washington Co.	1992	18,100	$3,100,000	Transfer tax
Michigan				
Peninsula Co.	1996	2,072	$9,112,250	Bonds, property tax, state grants, transportation funds, FRPP
Montana				
Gallatin Co.	2000	646	N/A	Appropriations, bonds, property tax
New Jersey				
Morris Co.	1996	5,014	$8,200,000	Bonds, dedicated county preservation tax, property tax
New York				
East Hampton Twp.	1982	281	N/A	Bonds
Pittsford Twp.	1996	1,060	$0	Appropriations, bonds, FRPP
Southampton Twp.	1980	530	$15,000,000	Bonds, real estate transfer tax
Southold Twp.	1986	1,591	$18,000,000	Bonds, private contributions, property transfer tax, state funding, FRPP

Table 2-2: Status of Local Farmland Preservation Programs (Continued)

Suffolk Co.	1976	8,270	$8,500,000	Appropriations, bonds, sales tax, FRPP
Warwick Twp.	1997	646	N/A	Bonds
North Carolina				
Currituck Co.	N/A	0	$200,000	Appropriations
Forsyth Co.	1987	1,606	$0	Appropriations, state grants, FRPP
Orange Co.	2001	340	N/A	Appropriations, bonds, private loans, property tax, sales tax, FRPP
Rowan Co.	N/A	0	$550,000	Appropriations, FRPP
Pennsylvania				
Buckingham Twp.	1991	3,500	$3,656,740	Bonds, private/foundation contributions, property transfer tax, FRPP
Bucks Co.	1990	8,450	$3,864,568	Bonds, FRPP
Chester Co.	1990	7,386	N/A	Appropriations, bonds, interest from rollback taxes, FRPP
Lancaster Co.	1984	42,416	N/A	Appropriations, bonds, FRPP
Plumstead Twp.	1997	1,626	$2,883,369	Bonds, property tax, FRPP
Solebury Twp.	1998	1,941	$5,000,000	Appropriations, bonds, private contributions, property tax, FRPP
Virginia				
Albemarle Co.	2002	2,455	N/A	Appropriations, private contributions, transient lodging tax
Chesapeake City	N/A	0	$75,000	Appropriations
Fauquier Co.	2004	1,802	$1,500,000	Appropriations, local government contributions, rollback from agricultural use assessment program
James City Co.	2003	139	$1,500,000	Local government contributions, FRPP
Loudoun Co.	2002	1,007	$0	Appropriations, transient lodging tax, FRPP
Virginia Beach City	1997	6,879	$16,324,650	Appropriations, property tax
Washington				
King Co.	1984	12,880	N/A	Appropriations, bonds, FRPP
San Juan Co.	1994	1,117	$0	Bonds, property tax, real estate transfer tax, timber excise tax
Skagit Co.	1998	4,236	$1,420,608	Property tax, state grants, timber excise tax, FRPP
Thurston Co.	1998	940	$0	Property tax
Wisconsin				
Bayfield Twp.	2003	111	$158,000	Property tax, gift from Chamber of Commerce, local government contributions, FRPP
Dunn Twp.	1997	2,131	$1,341,000	Appropriations, bonds, county and state grants, private/foundation contributions, property tax, FRPP
State Totals		**434,482**	**$170,425,670**	
**FRPP is the Farm and Ranch Lands Protection Program, federal funding that provides a match to state, local, tribal, and certain non-governmental organization.				

Source: Adapted from American Farmland Trust Fact Sheet (Status of Local Purchase of Agricultural Conservation Easements (PACE) Programs). (AFT, 2004a)

Table 2-3: State Farmland Preservation Programs: Basic Characteristics

State	Department	Self-select	State Application	County Application	Local Application	Web Site
California	Department of Conservation	X	X			http://www.consrv.ca.gov/DLRP/
Colorado	Colorado Cattlemen's Ag. Land Trust					http://www.ag.state.co.us/
Connecticut	Farmland Preservation	X	X			http://www.ct.gov/doag/cwp/view.asp?a=1368&q=259136
Delaware	Delaware Ag. Lands Preservation Program	X	X			http://www.state.de.us/deptagri/aglands/lndpres.shtml
Kentucky	Environmental Outreach	X	X			http://www.kyagr.com/enviro_out/pace/
Maine	Land for Maine's Future	X	X			http://www.state.me.us/spo/lmf/factsheets/farmlandprotection.php
Maryland	Ag. Land Preservation Program					http://www.malpf.info/facts.html
Massachusetts	Ag. Preservation Restriction Program		X			http://www.mass.gov/agr/landuse/APR/index.htm
Michigan	Farmland & Open space Preservation Program	X	X			
New Hampshire	Ag. Land Preservation Program	X	X			http://www.gencourt.state.nh.us/rules/agr700.html
New Jersey	New Jersey Ag. Development Committee	X		X	X	http://www.state.nj.us/agriculture/sadc/overview.htm
New York	Department of Ag. and Markets					http://www.agmkt.state.ny.us/AP/agservices/farmprotect.html
North Carolina	Conservation Trust for North Carolina	X	X			http://www.ctnc.org/
Ohio	Ohio Department of Ag.		X	X		http://www.ohioagriculture.gov/pubs/divs/farm/curr/farm-p-index.stm
Pennsylvania	Bureau of Farmland Preservation		X	X		http://www.agriculture.state.pa.us/agriculture/cwp/view.asp?q=128859
Rhode Island	Farm Forest & Open Space Protection Program	X	X			http://www.dem.ri.gov/programs/bnatres/forest/pdf/citgui03.pdf
Utah	Utah Critical Ag. Land Conservation Fund	X	X			http://ag.utah.gov/pressrel/CRLCCriteria.pdf
Vermont	Vermont Housing & Conservation Board		X		X	http://www.vhcb.org/conservation.html

Table 4-1: Indicators and Data Sources

Indicator	Source
Agricultural/Ecological Characteristics	
1. *Prime Farmland*	State Soil Geographic Database (STATSGO).
2. *Unique farmland*	U.S. Census of Agriculture, 2002, Tables 24 to 33 (harvested acreage).
3. *Biodiversity*	Michigan Natural Features Inventory. Michigan County Element Lists. March 2001.
Economic Characteristics	
4. *Farm Viability*	U.S. Census of Agriculture, 1997, Table 4.
5. *Economic Support*	U.S. Census of Agriculture, 2002, Table 5.
6. *Value Added Potential*	United States Department of Agriculture, Economic Research Service (USDA ERS).
7. *Product Diversity*	U.S. Census of Agriculture, 2002, Tables 24-34.
8. *Proximity to Farmers' Markets*	Farmers' Market Locations (Dr. J. Bingen), IFMAP/GAP Michigan Land Cover (classes: non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery).
9. *Proximity to Food Processors*	Food Processor Locations (Dr. J. Bingen), IFMAP/GAP Michigan Land Cover (classes: non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery).
10. *Proximity to Grain Elevators*	Grain dealer locations by City (Dr. J. Bingen), IFMAP/GAP Michigan Land Cover (classes: non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery).
11. *Commodity Viability*	U.S. Census of Agriculture, 2002, Tables 25 to 33 (harvested acreage); MASS 2001-2002 Vegetable Rotational Survey; MASS 2003-2004 Fruit Rotational Survey; Michigan Agricultural Statistics 2002-2003.
12. *Proximity to Customers*	United States Department of Agriculture, Economic Research Service (USDA ERS).
13. *Livestock Local Demand*	U.S. Census of Agriculture, 2002, Table 11 through 16 and Table 22.
Social Characteristics	
14. *Income Demographics*	U.S. Census of Population and Housing, 2000.
15. *Ethnic Diversity*	U.S. Census of Agriculture, 2002, table 41 through table 50.
16. *Tourism*	Ballard, C., P. Courant, D. Drake, R. Fisher and E. Gerber (eds.) *Michigan at the Millennium: A Benchmark and Analysis of its Fiscal and Economic Structure*. Michigan State University Press, East Lansing, 2003.
17. *Amenity Value*	IFMAP/GAP Michigan Land Cover. Agriculture classes included non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery. Natural vegetation classes included all forest classes and the herbaceous open land. Urbanized areas from U.S. Census Bureau, and Michigan roads from Michigan Center for Geographic Information.
Land Use Characteristics	
18. *Population Pressure*	U.S. Census of Population and Housing, 1990 and 2000.
19. *Farm Size Diversity*	U.S. Census of Agriculture, 2002, Table 8.
20. *Farm Contiguity*	IFMAP/GAP Michigan Land Cover. Agriculture classes included non-vegetated farmland, row crops, forage crops, and orchards/vineyards/nursery.
21. *Competition of Land Use*	U.S. Census of Agriculture 1997 and 2002, Table 8.
22. *Current preservation*	Farmland and Open Space Preservation Program, Michigan Department of Agriculture.

Table 4-2: County Scores based on Resiliency Indicators (ranges from 1-10)

County	Prime Farmland	Unique Farmland	Biodiversity	Economic support	Value added Potential	Proximity to customers	Livestock local demand	Income demographics	Ethnic diversity	Tourism	Amenity value	Farm size diversity	Farm contiguity	Competition of land use	Current preservation	Product diversity	Commodity viability	Farm viability	Population pressure	Proximity to food processors	Proximity to grain elevators	Proximity to farmer markets
Alcona	6	2	2	9	2	3	2	2	2	1	2	3	2	5	1	3	7	2	2	0	2	3
Alger	4	1	5	6	0	3	1	3	2	2	1	4	3	5	1	1	6	2	0	0	1	3
Allegan	6	7	7	4	8	7	10	5	4	3	8	4	6	4	3	9	9	4	4	9	5	7
Alpena	5	3	3	7	7	4	2	3	2	2	3	3	4	5	1	8	8	1	5	0	0	2
Antrim	2	5	2	8	7	3	1	4	4	2	4	3	2	5	1	8	8	3	0	7	1	4
Arenac	5	2	2	4	5	5	2	2	3	1	5	4	3	5	2	7	9	3	0	0	3	2
Baraga	4	1	2	10	0	3	1	3	3	1	2	7	3	6	1	2	7	1	0	0	0	2
Barry	7	3	4	4	7	9	4	5	3	1	7	5	6	5	2	8	7	2	3	5	7	6
Bay	9	5	2	6	7	9	2	4	3	2	9	7	8	6	4	8	9	3	5	2	7	4
Benzie	1	4	2	8	6	4	1	3	2	2	2	4	3	6	1	7	8	3	0	6	0	4
Berrien	9	10	10	3	9	9	2	3	4	4	8	4	6	3	2	10	10	4	6	6	2	2
Branch	7	4	3	3	5	7	4	4	3	1	9	5	10	5	4	6	9	3	4	2	6	3
Calhoun	8	4	4	4	8	9	4	4	2	2	7	4	8	3	4	9	8	2	7	2	7	3
Cass	7	5	8	4	7	9	4	4	4	2	8	6	10	5	4	8	9	3	4	10	3	4
Charlevoix	4	4	3	9	4	2	1	4	5	2	3	5	2	6	1	5	8	2	0	2	1	2
Cheboygan	3	2	4	7	5	2	2	3	2	3	2	7	1	5	1	6	7	2	0	2	1	3
Chippewa	2	2	8	9	3	4	2	3	5	4	3	5	3	4	1	4	8	1	5	0	0	2
Clare	6	3	2	7	4	3	2	2	2	2	3	3	4	5	1	5	7	2	4	0	4	3
Clinton	9	3	3	3	5	9	7	7	3	1	9	6	10	7	4	6	8	3	5	3	10	6
Crawford	2	1	3	10	1	1	1	2	1	2	1	4	1	6	1	2	7	0	7	2	2	3
Delta	4	2	5	8	4	4	2	3	2	2	2	5	2	5	1	5	8	2	5	0	1	2
Dickinson	3	1	2	7	1	4	1	3	2	2	2	7	1	6	1	2	7	1	6	0	1	2
Eaton	8	3	2	5	4	9	3	6	2	1	9	6	10	6	3	5	8	2	5	3	8	6
Emmet	2	3	3	9	6	2	2	4	3	2	3	4	2	5	1	7	7	2	3	2	1	2
Genesee	8	6	1	6	8	9	2	4	3	2	6	2	7	9	2	10	8	1	6	2	8	8
Gladwin	6	2	1	6	5	6	2	2	2	1	3	2	4	5	1	6	8	2	0	0	4	4
Gogebic	2	1	3	10	0	2	1	1	1	2	1	1	2	6	1	1	6	0	0	0	0	0
Grand Traverse	2	5	2	6	7	4	2	5	3	7	4	5	2	5	1	8	9	3	5	5	2	5
Gratiot	9	4	2	9	7	7	5	3	2	1	10	6	10	5	6	8	10	3	4	4	10	7
Hillsdale	8	4	3	2	5	6	5	4	3	1	8	5	8	2	3	6	7	3	3	0	5	3
Houghton	1	3	3	9	3	4	1	2	1	2	1	4	1	6	1	4	7	1	6	0	1	0
Huron	10	3	3	3	7	2	10	3	2	2	10	8	7	7	10	8	10	4	2	0	5	2
Ingham	8	6	3	4	7	9	3	4	4	4	8	3	6	2	3	8	8	2	4	0	6	5
Ionia	8	3	4	3	5	9	6	4	4	1	9	6	6	7	3	6	8	2	5	0	9	7
Iosco	7	3	3	5	5	2	2	2	6	2	2	5	3	6	1	6	7	2	5	0	2	2
Iron	2	1	2	10	1	3	1	2	5	1	2	4	1	6	1	2	7	1	5	0	0	2
Isabella	7	3	1	6	6	4	4	3	2	4	8	5	6	1	3	8	8	3	4	0	7	4
Jackson	5	6	6	4	7	9	4	5	3	2	6	4	6	6	2	8	8	1	5	0	10	7

Table 4-2: County Scores based on Resiliency Indicators (ranges from 1-10) (Continued)

Kalamazoo	8	4	9	5	6	9	3	4	3	3	6	4	6	5	2	7	8	7	6	7	5	5
Kalkaska	1	1	2	9	1	4	1	3	1	1	2	5	2	5	1	2	6	2	4	7	2	3
Kent	7	6	6	1	8	9	5	5	3	4	6	4	5	4	2	9	9	5	6	7	8	8
Keweenaw	1	1	8	10	0	4	1	2	1	2	1	2	0	6	1	1	0	0	0	0	0	0
Lake	3	1	2	8	1	5	1	1	3	2	2	3	2	5	1	2	6	1	0	8	2	3
Lapeer	7	6	2	5	8	10	3	6	2	1	7	4	8	6	2	9	9	2	4	0	7	7
Leelanau	2	5	3	4	6	4	1	5	2	2	4	4	4	6	1	7	9	4	3	8	0	2
Lenawee	10	5	5	1	9	7	4	5	2	1	10	6	8	6	6	10	9	3	4	0	6	3
Livingston	6	4	4	5	6	10	2	10	2	1	5	2	5	8	2	7	8	2	6	0	5	10
Luce	3	1	3	10	0	3	1	2	1	1	1	10	1	6	1	1	6	6	6	0	0	2
Mackinac	2	1	7	8	1	3	1	2	4	5	2	3	3	6	1	2	6	1	0	0	0	2
Macomb	9	8	3	5	8	10	1	6	1	2	5	3	10	6	1	9	9	5	8	0	3	7
Manistee	2	3	3	8	5	3	1	3	4	2	2	4	3	5	1	6	9	2	4	9	1	3
Marquette	4	2	6	8	4	4	1	3	1	2	1	5	1	5	1	5	7	1	3	0	1	3
Mason	6	5	3	7	8	2	2	3	2	2	4	4	4	5	2	9	9	3	2	8	2	1
Mecosta	5	4	2	7	4	7	3	3	4	1	4	2	5	6	2	5	8	2	0	2	5	4
Menominee	4	1	3	5	2	4	3	3	4	1	3	5	3	5	2	3	7	2	0	0	1	3
Midland	8	2	1	5	6	7	2	6	3	1	4	5	4	8	2	7	8	2	4	2	8	4
Missaukee	4	1	1	4	1	4	4	3	4	1	4	5	4	5	2	2	6	4	0	5	1	3
Monroe	8	7	6	3	8	9	2	6	4	2	9	4	7	6	3	9	9	4	6	0	4	7
Montcalm	4	5	3	5	7	6	4	3	3	1	7	5	6	1	3	9	9	3	2	4	8	6
Montmorency	6	1	2	8	2	3	1	2	2	1	2	2	2	5	1	3	7	2	0	0	1	3
Muskegon	6	4	5	4	7	9	3	3	3	3	4	3	5	5	2	8	9	5	5	8	4	6
Newaygo	5	6	4	4	9	9	5	3	3	1	4	5	4	4	2	10	9	3	4	9	4	6
Oakland	5	3	6	8	6	10	1	9	4	5	3	2	5	6	1	7	8	2	8	0	4	10
Oceana	3	6	3	6	9	5	2	3	4	2	5	5	5	5	2	10	9	3	0	5	2	3
Ogemaw	7	2	2	4	3	2	3	2	4	2	3	5	2	6	2	4	7	2	0	0	2	2
Ontonagon	2	1	3	9	2	3	1	2	2	1	2	5	2	6	1	3	6	1	0	0	0	1
Osceola	4	1	1	6	2	3	3	3	3	1	4	4	3	5	2	3	7	2	4	2	4	3
Oscoda	5	1	2	9	1	1	1	1	10	1	1	4	3	6	1	2	7	2	0	0	2	3
Otsego	2	2	2	8	2	2	1	4	1	2	2	8	3	6	1	3	7	1	5	3	2	3
Ottawa	5	8	3	2	8	9	8	7	3	3	8	4	6	4	2	9	9	10	6	3	3	5
Presque Isle	5	2	3	8	5	3	2	2	4	1	2	4	3	4	1	6	8	2	0	0	1	2
Roscommon	3	1	2	10	0	2	1	2	5	2	1	6	2	6	1	1	6	2	5	0	2	2
Saginaw	8	6	2	4	8	9	2	4	4	5	8	7	6	10	6	9	9	3	1	0	8	7
Sanilac	9	6	1	3	7	8	2	3	3	1	10	6	10	6	8	8	9	3	4	0	7	3
Schoolcraft	3	3	4	10	0	3	3	2	10	1	1	8	2	6	1	1	7	1	0	0	1	2
Shiawassee	8	5	2	4	4	7	8	4	2	1	9	7	10	8	3	5	8	2	5	2	9	8
St. Clair	9	1	6	7	7	10	1	5	2	2	6	4	5	8	2	9	8	2	5	0	5	3
St. Joseph	5	2	6	3	6	7	3	4	3	1	9	7	8	7	4	7	9	3	5	7	4	3
Tuscola	8	4	2	4	5	6	3	4	2	1	8	6	6	5	7	7	10	3	4	2	8	5
Van Buren	6	7	6	5	6	9	2	4	7	2	7	5	6	7	3	7	9	5	4	6	4	5
Washtenaw	7	6	8	5	6	9	3	7	4	3	7	4	6	4	2	7	8	2	6	0	6	9
Wayne	6	6	7	8	6	10	1	4	9	10	3	1	7	4	1	7	8	6	10	0	5	6
Wexford	2	2	2	9	3	4	1	3	2	2	3	4	2	3	1	4	7	2	0	7	2	2

Table 5-1: Projected Preserved Acreage and Concentration Measures under 23 Preservation Scenarios

Category	Indicator	Projected Total Preserved Farmland (in acres)	Rank of Preserved acreage	Gini Coefficient	Gini Rank	CR_{10}	CR_{10} Rank
Land Use	Current preservation	369,547	17	64.56%	22	12.14%	22
Land Use	Farm size diversity	511,482	11	63.79%	21	12.42%	21
Economic/Market	Economic support	445,699	13	63.19%	20	13.51%	18
Economic/Market	Livestock local demand	385,318	16	62.79%	19	12.73%	20
Economic/Market	Proximity to food processors	315,850	20	61.32%	18	13.31%	19
Economic/Market	Commodity viability	869,880	1	60.68%	17	14.85%	15
Social	Amenity value	725,910	4	60.24%	16	14.24%	16
Land Use	Farm contiguity	698,487	7	60.15%	15	13.99%	17
Land Use	Competition of land use	544,574	9	60.07%	14	16.19%	12
Social	Ethnic diversity	299,374	21	59.38%	13	17.44%	7
Agricultural/Ecological	Prime Farmland	709,630	5	58.96%	12	15.50%	14
Economic/Market	Proximity to grain elevators	613,678	8	58.38%	11	16.09%	13
Economic/Market	Farm viability	369,285	18	58.28%	10	18.97%	5
Economic/Market	Product diversity	743,412	2	57.73%	9	16.96%	11
Economic/Market	Value added Potential	730,925	3	57.70%	8	17.05%	10
Social	Income demographics	415,739	15	55.87%	7	17.98%	6
Economic/Market	Proximity to farmer markets	523,715	10	55.20%	6	20.26%	3
Land Use	Population pressure	453,569	12	54.94%	5	17.28%	9
Agricultural/Ecological	Unique Farmland	443,840	14	54.83%	4	20.37%	2
Agricultural/Ecological	Biodiversity	362,908	19	54.62%	3	17.29%	8
Economic/Market	Proximity to customers	706,351	6	54.57%	2	19.17%	4
Social	Tourism	191,937	22	50.04%	1	28.92%	1

Figure 3-1: Hypothetical Lorenz Curve

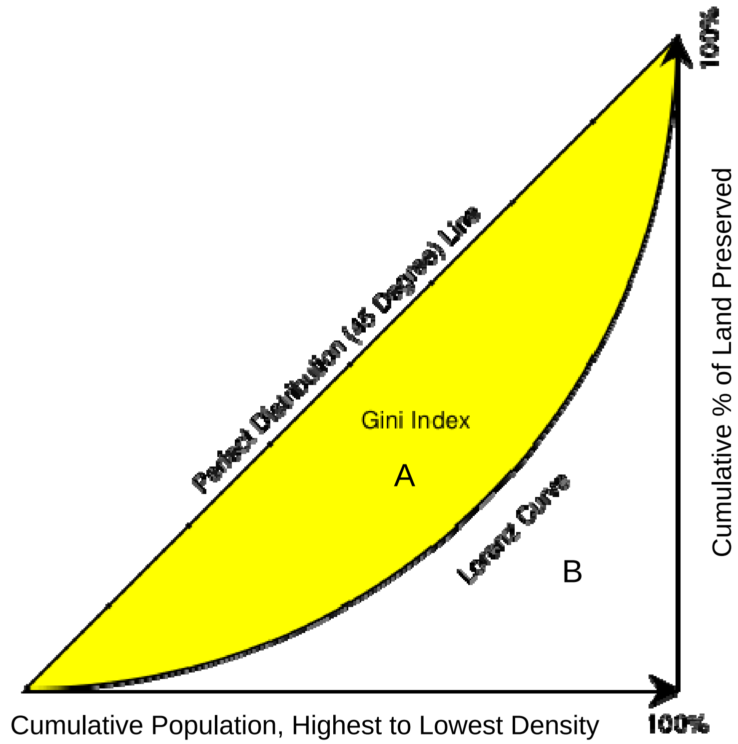


Figure 4-1: Clusters of Agricultural Land Use

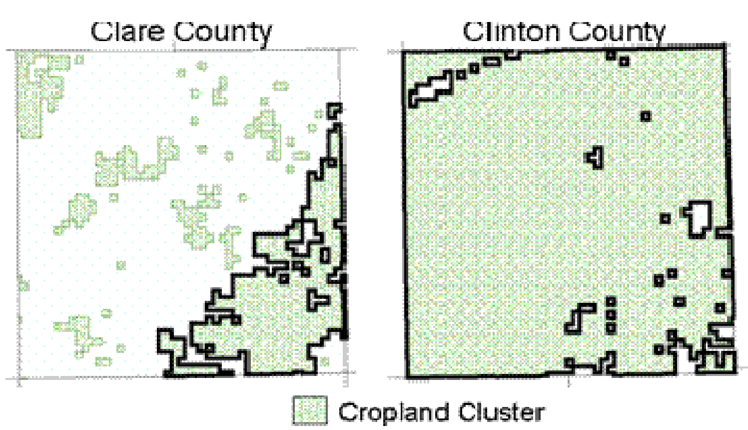
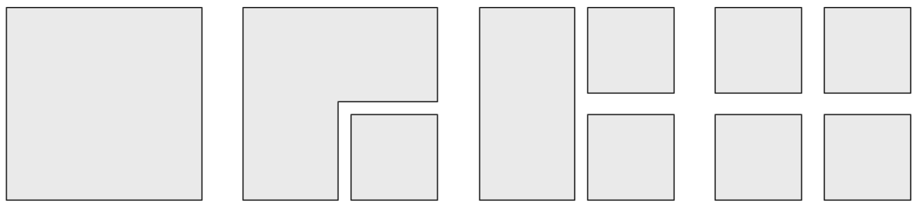
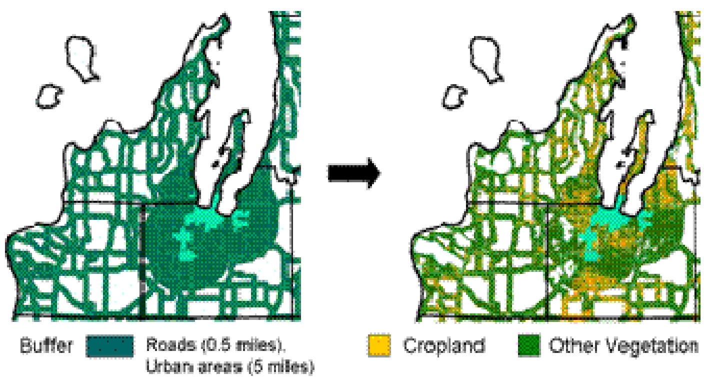


Figure 4-2: Estimation of the Farm Contiguity



P	1.00	0.75	0.50	0.25
N	1.00	0.50	0.33	0.25
F	1.00	0.38	0.17	0.06

Figure 4-3: Contribution of Agricultural Land to Open Space



Cumulative Population, Highest to lowest density

Figure 5-1: Concentration of Preserved Acreage under Alternative Indicator Scenarios

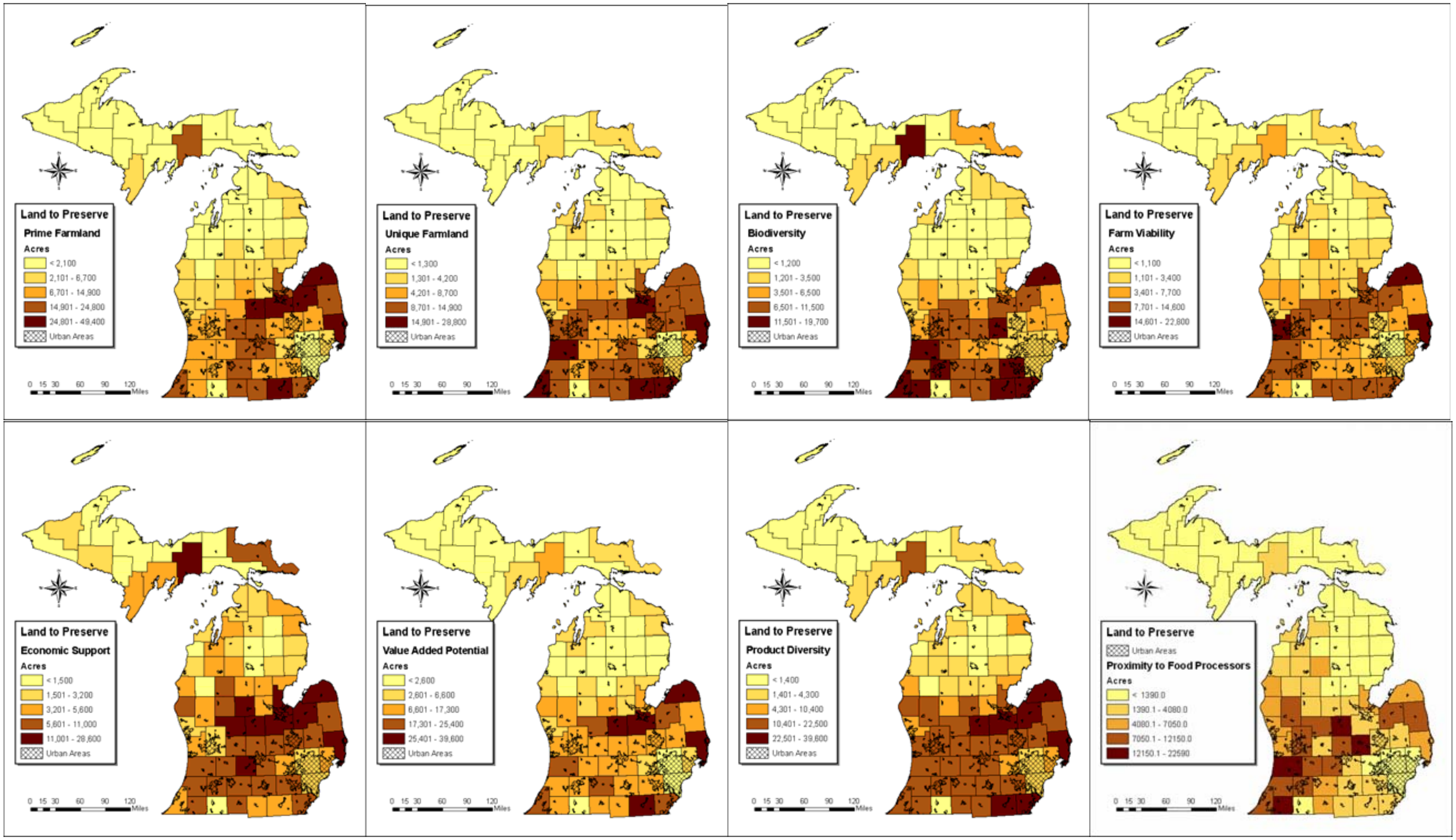


Figure 5-1: Concentration of Preserved Acreage under Alternative Indicator Scenarios (Continued)

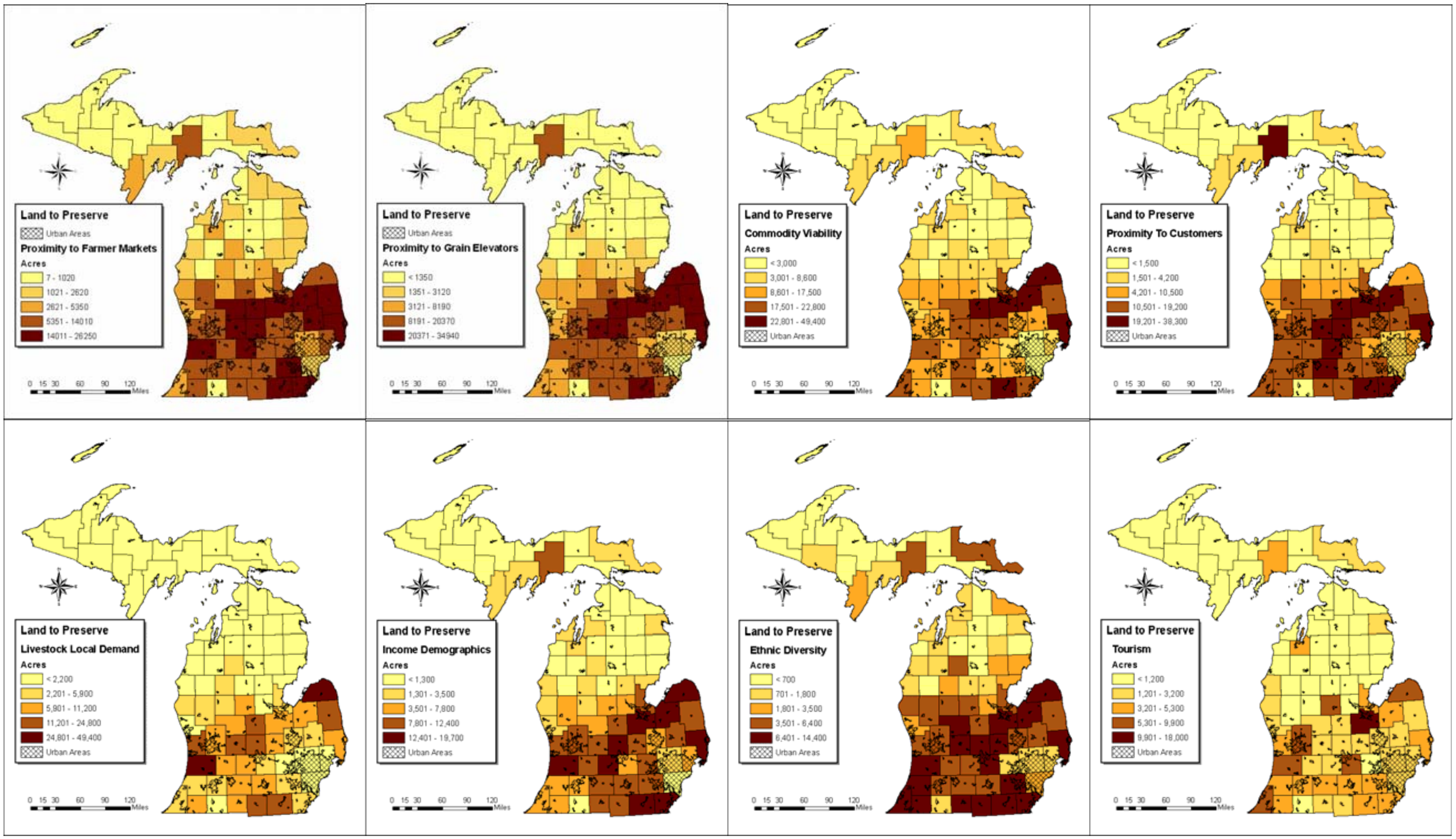


Figure 5-1: Concentration of Preserved Acreage under Alternative Indicator Scenarios (Continued)

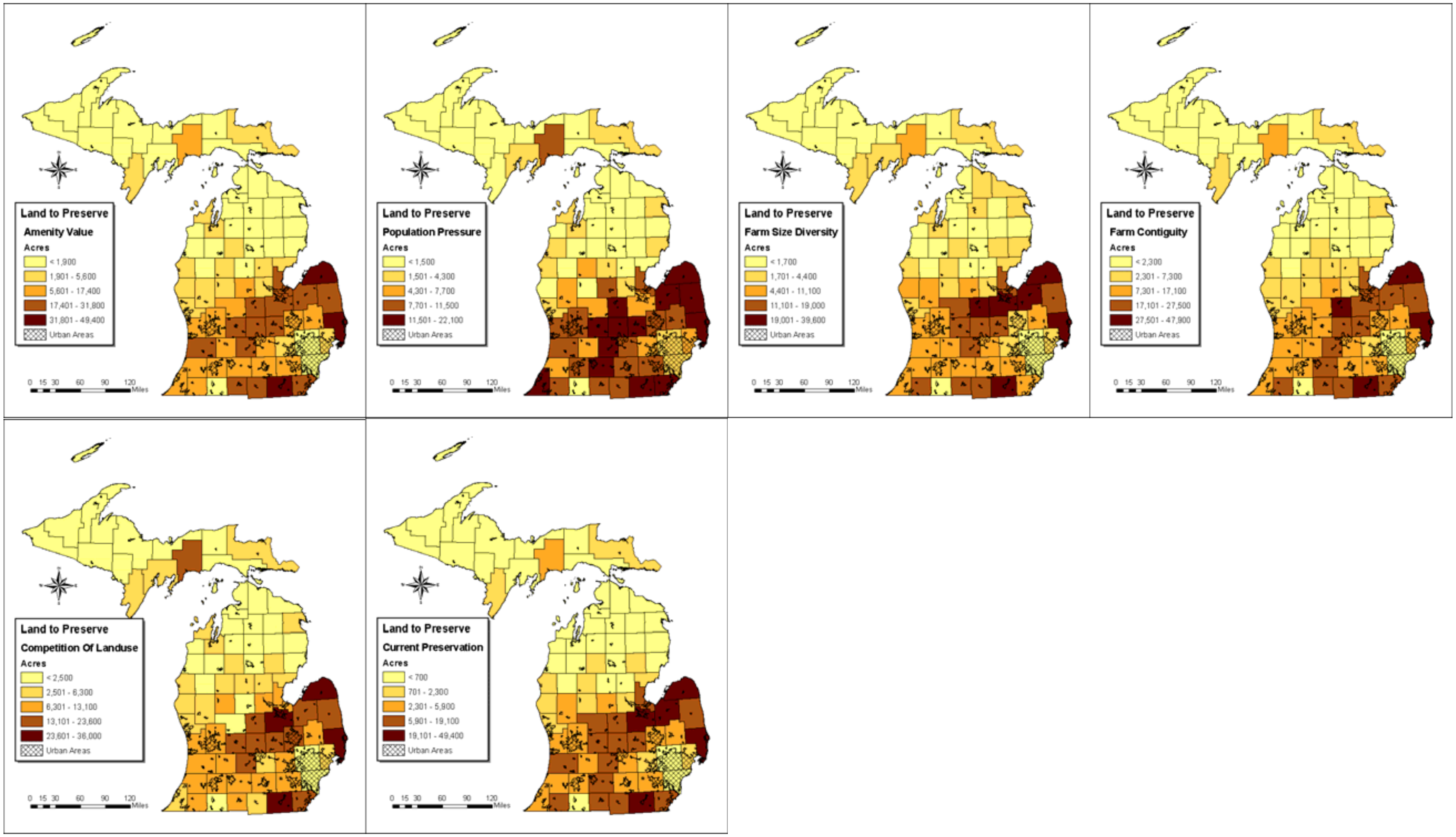
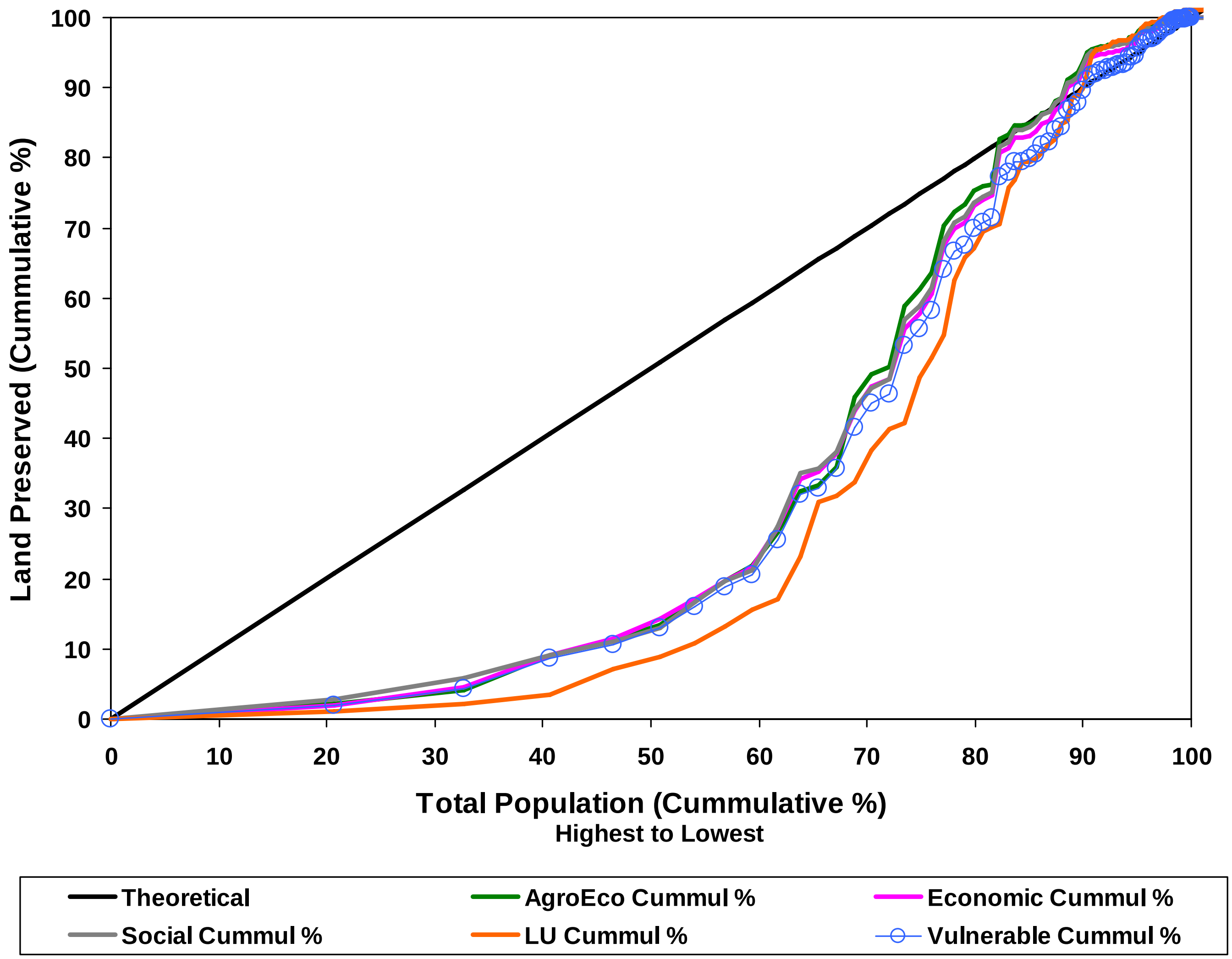


Figure 5-2: Cumulative Population and Farmland Preserved



Endnotes

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[1] Productive and viable farms can only survive or be sustainable if they are compatible with other land uses and are valued by the general public. Therefore, the criteria for preservation must at least consider goals beyond agricultural performance and viability.

[2] For example, Maryland's Agricultural Land Preservation Foundation chooses farms that will add to existing preservation areas, increasing the size of contiguous blocks of preserved land (MALPF, 2005).

[3] New Jersey and California fall into this category.

[4] The Garden State Preservation Trust, which provides $98 million per year for land preservation, was the direct outcome of lobbying by conservationists and environmentalists, working closely with farmers.

[5] Connecticut finances its program through a state bond which has now protected over 30,000 acres.

[6] Farmers must choose to participate, in most states. The voluntary nature of these programs is perhaps in recognition of the fact that to be effective, preservation programs must attract farmers that have a long term interest in farming.

[7] For example, Massachusetts recognizes the importance of both land retention and farm viability. Its Farm Viability Enhancement Program couples preservation through non-development covenants with support for the underlying farm infrastructure through guided business planning. Funds are made available to farms that submit successful applications based on specific intergenerational, land mass, economic, diversification, value added, operator experience, environmental and productivity objectives. Professional expertise is then offered to selected farms to help develop and implement a sustainability plan, using funds provided by the state (MDAR, 2005).

[8] Prime farmland is so designated because it has the soil quality, growing season and moisture supply needed to economically produce sustained yields of crops when treated and managed according to acceptable farming methods.

[9] This framework is based upon a static approach which does not allow for the assessment of how agriculture might be affected in the future by changes in demand, markets, cost of complementary goods, and a host of other factors.

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