The Value of Agricultural Biodiversity in Hungarian Home Gardens: Agri-Environmental Policies in a Transitional Economy[•]

Ekin Birol[*] and Ágnes Gyovai[**]

Paper to be presented at the fourth BIOECON Workshop on
Economic Analysis of Policies for Biodiversity Conservation
28-29August, 2003
Venice International University, Venice, Italy

Abstract:

Agricultural biodiversity is one of the most crucial of environmental riches and it has been eroding at an unprecedented rate in the past few decades. Much of the agricultural biodiversity that remains on farms today can be found on the semi-subsistence farms of developing countries and in the small-scale farms and home gardens located in marginalised areas of more developed countries. This paper looks at policy options for conservation of one such agricultural biodiversity rich agro-ecosystem in the heart of Europe, namely of home gardens in Hungary. The aim of this paper is firstly to draw attention to the fact that these agricultural biodiversity rich micro agro-ecosystems might cease to exist under present agri-environmental policies of Hungary and of the EU. Secondly, the paper aims to assist designing of least cost and most efficient policies for conservation of these home gardens. Choice experiment method is used to estimate the value farmers attach to these home gardens and to the agricultural biodiversity therein. This method allows for investigation of how these values vary with regional and household characteristics. This information further enables identification of those households and regions that attach the highest values to these home gardens, and information as such could help design of least cost and efficient agri-environmental policies that would enable conservation of these agricultural biodiversity rich agro-ecosystems.

Keywords: agricultural biodiversity, on farm conservation, home garden, choice experiment, Hungarian National Agri-Environment Programme, Special Accession Programme for Agricultural and Rural Development

JEL Codes: Q12, Q18, Q26

[•] We gratefully acknowledge the European Union's financial support via the 5th European Framework BIOECON project. We would like to thank Melinda Smale, Tim Swanson, László Podmaniczky, István Már, Andreas Kontoleon, Mitsuyasu Yabe, Riccardo Scarpa, Eric Van Dusen and György Pataki for valuable comments, suggestions and fruitful discussions. All remaining errors are our own.

[*] University College London (UCL), UK and International Plant Genetic Resources Institute (IPGRI), Italy. Corresponding Author. Address: University College London, Department of Economics, Gower Street, London, WC1E 6BT, UK. E-mail: e.birol@ucl.ac.uk

[**] Institute of Environmental Management (IEM), Gödöllo Szent István University and Institute for Agrobotany (IA), Tápiószele Hungary

1. Introduction

Agricultural biodiversity is one of the most crucial of environmental riches, providing the basis of the food or livelihood security of billions of people today, as well as the resources for future agricultural innovations in semi-subsistence as well as commercial farming systems (FAO, 1999). In recognition of its importance, international agreements such as the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture encourage the design of policies that convey economic incentives for farmers to conserve agricultural biodiversity (CBD, 2002).

Much of the agricultural biodiversity that remains on farms today can be found on the semi-subsistence farms of less industrialised countries and in the small-scale farms and home gardens located in marginalised areas of more industrialised nations (Brookfield, 2001; Brookfield *et al.*, 2002; IPGRI, 2003). The agricultural biodiversity rich agro-ecosystems found in the small-scale farms and home gardens of Hungary are an example. The labour intensive, traditional production methods on these privately-owned, homestead fields have persisted throughout the period of state farming and the subsequent transition to market-oriented, large-scale farming. They are rich in crop and livestock species, varieties and breeds, as well as in the soil micro-organisms that result from decades of production without chemicals. These farms play a significant cultural role in Hungarian society, having long provided farm produce that contributes colour, flavour, and nutrients to the diets of both rural and urban people in time periods and locations when markets did not provide them.

The national agricultural and environmental policies and programmes now being developed as Hungary prepares to join the European Union (EU) appear to neglect the importance of these home gardens. In addition, the policies and market structures that will be adopted when Hungary becomes a member of the EU are likely to shift farmers' incentives away from home garden production. Home gardens may cease to exist if agri-environmental policies do not recognize the public and private economic value generated by their multiple functions, much of which is understated in markets.

The aim of this paper is to assist in developing policies and programmes to conserving the agricultural biodiversity in home gardens of Hungary when the benefit-cost ratios are high. High benefit-cost ratios will occur where both the public and private values of the resources are high, in locations of relatively abundant agricultural biodiversity among the farmers who value it most (Smale et al. forthcoming). The choice experiment method, applied through personal interviews with farmers in selected sites of Hungary, provides the empirical basis for assessing the private value of home garden attributes and characterizing the farmers most likely to maintain it.

The next section will consider the possible effects of national and EU agricultural policies on continued sustainable management of these farms and on conservation of agricultural biodiversity therein. Sections 3 and 4 will summarize the data collection and analytical methods used to examine the value of home gardens and of their multiple functions to the farmers who engage in their conservation. Findings are presented in Section 5, and the implications are discussed in the concluding section.

2. Motivation

2.1. Historical Importance of Home Gardens

The dual structure of Hungarian agriculture consists of the large-scale, mechanised farms alongside semi-subsistence, small-scale farms operated with traditional methods. This size structure has persisted since the time of the feudal period through the middle of the 19th century, and through the collectivised agricultural system of the socialist period from 1955 to 1989 (Kovách, 1999; Meurs, 2001). Of the about 10 million people now populating Hungary, it has been estimated that there are nearly 2 million Hungarians producing agricultural goods for their own consumption and as a source of additional income (Már, 2002). There are about 800 000 home gardens in various sizes up to 1 ha (Simon, 2000). The 1996 Microcensus implemented by the Hungarian Central Statistical Office (HCSO) indicates that among people aged 14 and over, 33% were engaged in auxiliary agricultural work, although few relied on agriculture as a main occupation.

Home garden production continues to play a crucial role in the livelihoods of Hungarian households (Hungarian Statistical Monitor, 2000; Simon, 2000; Már, 2002).

Hungarian home gardens, in their present forms, evolved out of the small plots[1] near the dwellings that the households were allowed to cultivate privately during the socialist period, when they played an important role in food security and diet quality. Village level markets are generally lacking or thin in many areas of rural Hungary as a result of high transaction costs and/or discouragement of food and labour market formation during the socialist period. Consequently, rural as well as peri-urban households continue to rely on their home gardens for at least some of the foods they consume.

Production in these home gardens was and still is accomplished with family labour, using labour- intensive and traditional farming practices, ancestral crop varieties and livestock races, generally with limited use of purchased inputs. Consequently, Hungarian home gardens serve as 'small repositories of agricultural biodiversity' (Már, 2002). In addition to agricultural biodiversity, home gardens contribute cultural heritage, food security and diet quality, and in some cases, organic produce. Finally, they contribute to protection of rural settlements and lifestyles by enabling people to remain in the countryside.

2.2. Implications of National and EU Agri-Environmental Policies

The survival of home gardens will depend very much on national and EU agricultural and environmental policies. In line with EU's reformed Common Agricultural Policy (CAP), Hungary's agricultural policy now encourages multifunctionality in agriculture. The notion of multifunctional agriculture is that agriculture should provide a bundle of public goods in addition to private goods (food and fibre). These public goods include, but are not limited to, rural settlement and economic activity, food security, safety and quality, biodiversity, cultural heritage, amenity and recreational values (Romstad *et al.*, 2000; Lankoski, 2000). The concept of multifunctional agriculture is embraced by the EU's reformed Common Agricultural Policy and is stated in the 2078/92 agri-environmental

[1] The average size of a home garden in Hungary is estimated to be 0.5 ha (Már, 2002)

regulation of the EU. Each EU member country, including those that are preparing to become full members in 2004, is expected to encourage production of agricultural public goods through the development of a National Agri-Environmental Programme (NAEP).

In preparation for its entry into the EU therefore, Hungary has developed a NAEP (Juhász, 1999), which was accepted by the Ministry of Agriculture and Regional Development in 2000 and was experimentally launched in 2001. NAEP emphasizes multifunctionality in Hungarian agriculture and proposes that the degree of intensity of agricultural production in a region should depend on its natural and human resources. Through this programme, several areas of Hungary with low agricultural productivity but high environmental value have been designated as environmentally sensitive areas (ESAs). The NAEP seeks to protect these areas as habitats for endangered plant and animal species. Direct payments, training programmes and technical assistance are provided to the farmers who are willing to participate in agri-environmental schemes that promote the use of specified farming methods[2]. Participation is voluntary and is based on a 5-year contract, according to which the farmer is bound to comply with the rules of production that are defined for each scheme. In return the farmer is rewarded by an annual support payment for the contracted period on a hectare or livestock basis. These payments are designed to compensate for possible loss of income and provide an additional 20% incentive to make the scheme attractive and the environmentally friendly farming practices competitive among the farmers. The Hungarian NAEP has calculated the payment amounts according to the methods used to calculate EU support.

The Hungarian NAEP recognises that extensive agricultural methods are the most suitable ones for conserving biodiversity of endangered wildlife and providing multifunctional agriculture, but the role of the agricultural biodiversity found in home gardens has not been elucidated.

Proposed EU agricultural policies designed for accession states also fail to recognise the importance of home gardens in provision of several public goods. The EU has developed a Special Accession Programme for Agriculture and Rural Development

[2] Schemes under NAEP include the agri-environment basic scheme as well as the integrated production, organic production, and wetland schemes. In addition to these schemes, NAEP also has several zonal objective programmes in environmentally sensitive areas, which include integrated, nature protection, landscape protection, soil protection and water protection schemes (Juhász, 1999)

(SAPARD) for countries that will become EU members in 2004. SAPARD considers the dual structure of agriculture that exists in several of the accession states as inefficient and proposes either a) subsidies for transformation of semi-subsistence small farms to commercial farms, or b) direct payments to land-holdings larger than 0.3 ha on the condition that the land is managed in a way compatible with protection of the environment, as suggested by the NAEP of the member country (Commission of the European Communities, 2002). These policies imply that as long as Hungarian NAEP does not include home gardens as a method that supports multifunctional agriculture, and as long as farmers' incentives to cultivate home gardens are shifted towards other forms of agriculture (e.g. commercial, or large scale organic production) home garden production might cease to exist.

Though the benefits of home gardens accrue first to the farmers that cultivate them, they are national, intergenerational and potentially global in natures. Excluding home gardens from any agri-environmental policy that supports multifunctional agriculture could in fact result in loss of agricultural biodiversity as well as economic inefficiencies. Hence, there is a need to assess the values of home gardens and to make recommendations on how policies and programmes for their conservation might be designed. The data and methods summarized next have been applied in order to generate this type of information for policy makers.

3. Background

3.1. Site Description

The three study sites (including 22 settlements) are located in the buffer zones of ESAs identified by the NAEP, where previous collection missions of the Institute of Agrobotany have discovered a number of historical landraces. Sites were purposively selected to represent contrasting levels of market integration and agro-ecological characteristics, which are associated with different farming systems and land-use intensity. The position of these three ESAs can be seen on the map of Hungary in the appendix, and their characteristics are described below and in Table 1.

The three sites are located in Dévaványa, Orség-Vendvidék, and Szatmár-Bereg regions. Dévaványa region is located in the centre of the Hungarian Great Plain. The landscape is flat and consists of a mosaic of cultivated lands and grasslands. Soil and climatic conditions of this region are well suited to intensive agricultural production. Dévaványa region is the most urbanised region among the three selected sites, with the most developed road and other infrastructure and food markets, mainly due to its proximity to the centre of the country and to its higher population density. Unlike the other two selected sites, migration out of this region is not a major problem, though the number of inhabitants is stagnating (Gyovai, 2002). However, the unemployment rate is slightly higher than the Hungarian average at 12.4% (National Labour Centre, 2000). In this ESA, NAEP aims to conserve the rich wildlife (Juhász, 2000).

Orség-Vendvidék region is located in the south-east of Hungary and supports a heterogeneous agricultural landscape with knolls, valleys, forests, grasslands and arable lands. Poor soil conditions render intensive agricultural production methods impossible. Villages in this region are very small both in size and population. Population in Orség-Vendvidék is declining and ageing. Most of the villages are far from towns and hence are isolated (Gyovai, 2002), though the unemployment rate of 4.8% is one of the lowest in the country (National Labour Centre, 2000). In this ESA NAEP encourages undertaking of extensive production methods, which will conservation the landscape for future generations.

Szatmár-Bereg region is situated in the north-east part of the country, and has a landscape with a mosaic of grasslands, forests, arable lands and moors. This region consists of settlements that are small in both area and population. The population is declining and ageing, due to lack of investment in this isolated region distant from the economic centre of the country (Gyovai, 2002). Roads are of poor quality and the regional unemployment rate is very high, at 19% (National Labour Centre, 2000). The NAEP seeks to promote nature conservation in this region by establishing a national park (Juhász, 2000).

The area, population, population density and market infrastructure differ between Dévaványa and the other two regions, where these variables and the number of shops are nearly equal. Dévaványa has more primary and secondary schools than the other two sites, and is the only region where food markets can be found. The number of enterprises and shops tell us the level of urbanisation and also reflects the size of settlements in the regions.

Table 1. ESA characteristics

Variable	Definition	Dévaványa	Orség-Vendvidék	Szatmár-Bereg
Area of the settlement* (in ha)	Area of each settlement in the sample	21964.6 (6439.1)	1636.2 (900.9)	2407 (755.9)
Population*	Population of each settlement	9928.6 (3672)	373.4 (365.9)	659.0 (152.7)
Population density*	Area of settlement / population of settlement	0.44 (0.04)	0.202 (0.102)	0.28 (0.06)
Primary schools*	Number of primary schools in the settlement	2.4 (1.14)	0.36 (0.51)	0.83 (0.41)
Secondary schools*	Number of secondary schools in the settlement	1 (0.71)	0 (0)	0 (0)
Food markets*	Number of food markets in the settlement	1 (0)	0 (0)	0 (0)
Distance to food market	Distance to the nearest settlement with food market in km	0 (0)	19.8 (6.8)	18.35 (3.23)
Enterprises*	Number of enterprises in the settlement	491.2 (306.4)	21.5 (27.8)	22.83 (9.93)
Shops*	Number of shops in the settlement	140.8 (71.0)	4.18 (5.19)	9.67 (3.5)
Unemployment Rate**	Regional unemployment rate	12.4	4.8	19.0

*Source: *TSTAR Database, Hungarian Central Statistical Office, 2001 (Census), **Hungarian National Labour Office (2000). Standard deviation in brackets.*

3.2. Description of households and home garden decision makers

Household lists were compiled for each ESA and a screening questionnaire was sent to identify those with home gardens. The response rate was augmented through key informants and household visits. A total of 322 respondents were interviewed in August 2002.

Table 2 reports the characteristics of the households and home garden decision-makers. The average family size of 3 persons is not statistically different between sites, and children are few (a mean of less than one child per household). Orség-Vendvidék supports a higher percentage of households that have full- and part-time farmers, as compared to Szatmár-Bereg and Dévaványa. Households in Orség-Vendvidék have significantly higher levels of income than those in Dévaványa and Szatmár-Bereg, but the difference between Dévaványa and Szatmár-Bereg is insignificant. On average, households spend approximately the same percentage of their income on food in all three ESAs. Home garden decision-makers are elderly, and a large proportion of them is retired. Tests show that the average age and experience of home garden decision- makers do not differ statistically among the 3 regions. The percentages of off-farm workers and retired people are similar. Szatmár-Bereg has a higher percentage of people with less than 8 years of education than do the other ESAs.

Table 2. Household and home garden decision-maker characteristics by ESA

Variable	Definition	Dévaványa	Orség-Vendvidék	Szatmár-Bereg
			Mean (s.e)	
Family size	Number of people in the family	2.85 (1.13)	3.24 (1.66)	2.86 (1.46)
Children	Number of family members with age =<17	0.36 (0.75)	0.59 (0.87)	0.46 (0.80)
Income*	Exogenous income of the household	70078.95 (28 266.2)	86284.63 (43 375.5)	63250.21 (42 010.4)
Food expenditure as % of income**	Stated % of income spent on food consumption	38.6 (16.1)	37.84 (15.9)	32.03 (10.8)

Age	Average of all decision makers if more than one	57.57 (13.81)	55.47 (13.99)	54.80 (15.14)
Experience	Experience in agricultural production. Average of all decision makers if more than one	39.06 (16.37)	36.08 (18.02)	36.77 (20.14)
			Percent	
Retired	Percentage of decision makers that are retired	64	70	72
Farmer	Percentage of decision makers that are large scale farmers	1	3.6	0
Off farm employment	Percentage of decision makers that have off farm employment	35	28	27
Education	Home garden decision-makers with less than 8 years of education	7	4	20

*Source: Household sample survey, Hungarian on-farm conservation project, 2002. Total sample size=332. *Pairwise t-tests show significant differences in mean income by site at the 1% significance level. **Pearson Chi-square test shows differences in percentages by site at 7% significance level.*

4. The Choice Experiment Method

Since most of the outputs, functions and services that home gardens generate are not traded in the markets, non-market valuation methods must be used to determine the value of their benefits. These benefits primarily accrue to home garden farmers in non-market use values, or utility. The preferences of home garden farmers, who are both producers and consumers, determine the implicit values these farmers attach to home gardens and their attributes (Scarpa *et al*., Forthcoming(a)).

Of environmental valuation approaches, the choice experiment method is most appropriate for valuing home gardens since it allows for estimation not only of the value of the environmental asset as a whole, but also of the implicit value of its attributes (Hanley *et al*., 1998; Bateman *et al*., 2003). This approach is a relatively new addition to the portfolio of stated preference methods, with a theoretical grounding in the Lancaster model of consumer choice (Lancaster, 1966), and an econometric basis in models of random utility (Luce 1958, McFadden 1974). Lancaster proposed that consumers derive satisfaction not from goods themselves but from the attributes they provide. Luce and McFadden partitioned utility into observable and unobservable components, implying inevitable errors in measuring attributes and preferences.

A choice experiment is a highly 'structured method of data generation' (Hanley *et al*., 1998), relying on carefully designed tasks or "experiments" to reveal the factors that influence choice. Experimental design theory is used to construct several profiles of the environmental good in terms of its attributes and levels of these attributes. These profiles are put together in choice sets and respondents are asked to state which profile of the good they prefer in each choice set they are presented with. The first step in design of this choice experiment was therefore to define the Hungarian home garden in terms of attributes and the levels these attributes take. These were identified through a series of informal interviews with farmers in each ESA, and experts at the Institute for Environmental Management at Szent Istvan University and the Institute for Agrobotany (Table 3).

Table 3. Home garden attributes and attribute levels used in the choice experiment

Home garden attribute	Definition	Attribute levels
Crop Species Diversity	The total number of crops that are grown in the garden. A count index of richness of crop species or inter-specific crop diversity.	6 13 20 25
Agro-diversity	Mixed crop and livestock production, representing diversity in agricultural management system	Mixed crop and livestock production vs. Specialised crop production
Organic Production	Whether or not industrially produced and marketed chemical inputs are applied in farm production.	Organic production vs. Non-organic production
Landrace	Whether or not the home garden contains an ancestral crop variety ("landrace" or "traditional variety") that has been passed down from the previous generation and/or has not been purchased from a commercial seed supplier. An indicator of crop intra-specific (within crop) diversity.	Home garden contains a landrace vs. Home garden does not contain a landrace
Self-sufficiency	The percentage of annual household food consumption that it is expected the home garden will supply. This variable is a proxy for the monetary attribute that is needed for welfare estimations.	15% 45% 60% 75%

A large number of unique home garden descriptions (combinations of attributes) could be constructed from this number of attributes and levels[3]. Using the orthogonalisation procedure in SPSS an experimental design was undertaken to recover only the main effects, consisting of 32 pair wise comparisons of home garden profiles. These were randomly blocked to 6 different versions, two with 6 choice sets and the remaining four with 5 choice sets. In face-to-face interviews, each respondent was presented with 5 or 6 choice sets, each with two home gardens and an option to select neither garden. Respondents were generally those responsible for home garden production decision-making. An introductory section explained to the respondents the context in which choices were to be made, described each attribute[4] and explained that the key attributes of home gardens had been selected as a result of prior research and were combined artificially in the choice sets. Respondents were told that their names and individual choices were confidential and that completion of the exercise would provide information to agricultural policy makers in summary form. Overall, a total of 1480 choices were elicited from 277 interviewees.

5. Results

5.1. Comparison of preferences among ESAs

Data were analysed statistically with a basic multinomial logit model (using LIMDEP 7.0 NLOGIT 2.0). This model is used to estimate the attribute values for the entire population represented by the sample and to test whether or not the demand for each attribute is significant and to compare the implied, relative values of attributes. The choice experiment is designed with the assumption that the observable utility function would follow a strictly additive form. The model is specified so that the probability of selecting a particular alternative is a function of attributes of the alternatives and of the

[3] The number of home gardens that can be generated from 5 attributes, 2 with 4 levels and the remaining 3 with 2 levels is $4^2*2^3=128$.

[4] Even though the respondents are all home garden producers and hence are familiar with the good that is being valued (home gardens) each attribute was described by the enumerator so as to enable uniformity in understanding of the attributes among home gardeners. Furthermore, each home garden profile was fixed in size at 0.5 ha.

alternative specific constant. Model specifications (with logarithmic forms for variables with 4 levels) are compared according to higher log-likelihood value criterion. The highest value of the log-likelihood function is found for the specification with the diversity variable in logarithmic form, indicating that the marginal willingness to accept compensation for this attribute is diminishing. Indirect utility received by the home garden attributes take the form

$$V_{ij} = b + b_1 \ln(Z_{diversity}) + b_2(Z_{agro-diversity}) + b_3(Z_{organic}) + b_4(Z_{landrace}) + b_5(Z_{selfsufficiency}) \qquad (1)$$

where b refers to the alternative specific constant and b_{1-5} refers to the vector of coefficients associated with the vector of attributes describing home garden characteristics.

As suggested in the site description, home gardeners in different ESAs may face different trade-offs in production of home gardens and consumption of home garden outputs, with consequences for efficient policy design. Whether or not the set of parameter estimates from all three regions combined (i.e. from the pooled model) is shared across each was tested statistically, and the null hypothesis was rejected with a Swait-Louviere log likelihood ratio test at the 0.5% significance level. When the same test was applied in pairwise comparisons of individual regression parameters, each was found to be significantly different at the 0.5% significance level. These findings provide strong statistical evidence that home gardeners in each ESA have distinct preferences for home gardens and for their attributes.

Table 5. Demand for home garden attributes in each ESA

	Dévaványa			Orség-Vendvidék			Szatmár-Bereg		
Attribute	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat	Coeff.	s.e.	t-stat
Constant	0.050	0.399	0.126	-1.475	0.450	-3.281	-0.685	-1.544	0.123
Crop Species Diversity	-0.031	0.123	-0.248	0.284	0.135	2.106	0.295	0.130	2.277
Agro-diversity	0.504	0.070	7.245	0.256	0.077	3.327	0.414	0.073	5.647
Organic Production	0.293	0.072	4.070	0.116	0.077	1.507	0.158	0.073	2.162
Landrace	0.085	0.065	1.310	0.241	0.071	3.393	0.174	0.067	2.615
Self-sufficiency	0.014	0.003	4.401	0.029	0.004	7.714	0.024	0.035	6.825
Sample size		533			455			499	

r^2	0.10915	0.12533	0.18471
Log likelihood	-521.6492	-430.4925	-446.9454

In Dévaványa ESA, where food markets as well as road infrastructure are fully developed, farmers' demand for either crop species diversity or landraces is insignificant (Table 5). The demand for agro-diversity variable is significant and large in magnitude owing to the complementarity between intensive crop production in the field and animal husbandry in the home garden. There is a significant demand for organic production in Dévaványa. In the isolated region of Orség-Vendvidék, where food markets are absent in the settlements, distance to the nearest towns are great and road infrastructure is poor, the demand for crop species diversity and landraces are each significant and nearly as large in magnitude as the demand for agro-diversity. No demand for organic production is evident, reflecting poor soil quality in this region. In the isolated ESA of Szatmár-Bereg, where market infrastructure is poor, home gardeners demand crop species diversity and landraces. Farmers in this region also place great importance on agro-diversity, perhaps in part because unemployment rates are high and labour intensive animal husbandry practices are less costly in terms of the opportunity cost of time.

5.2. Willingness to accept compensation values for each attribute per ESA

To estimate farmers' willingness to accept (WTA) compensation for home gardens and their attributes, secondary data on the annual expenditure of average Hungarian household on food consumption was combined with the regression coefficients ((HCSO, 2002) to compute

$$W = -1\left(\frac{\hat{b}_{attribute}}{\hat{b}_{monetary variable}}\right) \qquad (2)$$

where W represents the welfare measure (willingness to pay or willingness to accept), which is the marginal rate of substitution between income change and the attribute in question. The monetary attribute of these gardens is a benefit rather than a cost since the property rights of the home gardens and of their outputs and functions reside with the home garden producer-consumers who were surveyed (Freeman, 1993). Therefore, the welfare measure in this choice experiment is willingness to accept (WTA) compensation for a possible loss. Results are shown in Table 6.

Table 6. WTA estimates for each home garden attribute per ESA

Attribute	Dévaványa	Orség-Vendvidék	Szatmár-Bereg
Crop Species Diversity	--	-111	-141
Agro-diversity	-404	-100	-198
Organic Production	-235	--	-76
Landrace	--	-95	-83

**Figures in €, converted from Hungarian Forints (HUF) (1 € = 267.52 HUF, June 2003)*
(--) Demand for the attribute is not statistically significant at 5% level.

The values home garden producer-consumers in each ESA attach to home garden attributes can be seen from the WTA compensation value estimates reported in Table 6. Farmers in Orség-Vendvidék and Szatmár-Bereg regions attach the highest and strongly significant values to inter and intra species crop diversity as well as significant and substantial values to agro-diversity. Therefore it should be expected that these regions would be the ones to target for least cost home garden conservation programmes, such as incentive contracting to encourage continued cultivation of traditional Hungarian home gardens and hence of conservation of the multiple values they entail. The next section reports how farmers might be targeted within ESAs.

5.3. Comparison of preferences across households in each ESA

The demand for home gardens and their attributes depends on the characteristics of the households who manage them. Understanding the social and economic profile of those home gardeners who have the highest demand for agricultural biodiversity helps in the design of conservation programs, and in predicting how certain policies may affect their demand as Hungary enters the European Union.

In random utility models the effects of household characteristics cannot be examined in isolation but as interaction terms with the home garden attributes. Due to multicollinearity problems, it is not possible to include all the interactions between the 20 household and decision-maker characteristics collected in our survey and the five home garden attributes when estimating the conditional multinomial logit equations. (Breffle and Morey, 2000). Variance Inflation Factors were calculated by running "artificial" OLS regressions between each independent variable (i.e. the household and decision-maker characteristics) as the "dependent" variable and the remaining independent variables using STATA 6.0.[5] Those independent variables for which VIF_j >5 indicate clear evidence that the estimation of the characteristic is being affected by multicollinearity (Maddala, 1993). The results of this procedure yield five independent variables with VIF_j =<5: 1) the number of household members with off-farm employment; 2) the experience of the home garden decision maker(s); 3) the percentage of household income spent on food; 4) the number of household members that participate in home garden cultivation; and 5), whether or not the household also cultivates a farm field.

Equation (1) above was then extended to include the 25 interactions between the 5 home garden attributes and the five chosen household and decision-maker characteristics.

$$V_{ij} = b + b_1 \ln(Z_{diversity}) + b_2(Z_{agro-diversity}) + b_3(Z_{organic}) + b_4(Z_{landrace}) + b_5(Z_{selfsufficiency}) +$$
$$d_1(Z_{diversity} \times S_{offfarm}) + d_2(Z_{agro-diversity} \times S_{offfarm}) + ... + d_{25}(Z_{selfsufficiency} \times S_{cultivatefield}) \qquad (1')$$

The estimates with interactions that are significant at 10% significance level and less are reported for each ESA in Tables 7 through 9 below.

In Dévaványa ESA, only the number of family members with off farm employment, food expenditure and whether or not the household also engages in field cultivation or not are have statistically significant effects on the demand for home gardens (Table 7).

Table 7. Effects of household and decision-maker characteristics on demand for home garden attributes in Dévaványa ESA

Variable	Coefficient	s.e.

[5] Variance Inflation Factors (VIF_j) for each such regression are calculated as: $VIF_j = \frac{1}{1-R_j^2}$, where R_j^2 is the R^2 of the artificial regression with the jth independent variable as a "dependent" variable.

Constant	0.91953	0.5220
Crop Species Diversity	-0.6235	0.2657
Agro-diversity	0.5120	0.0724
Organic Production	0.1394	0.0986
Landraces	-0.1819	0.1766
Self sufficiency	0.8729×10^{-6}	0.2316×10^{-5}
Crop species diversity * no of off farm employed household members	-0.0153	0.0070
Crop species diversity * the household cultivates a field	-0.0317	0.0130
Crop species diversity * food expenditure of the household	0.0018	0.0004
Organic Production * no of off farm employed household members	0.1821	0.0711
Landraces * food expenditure of the household	0.0070	0.0041
Self sufficiency * food expenditure of the household	0.791×10^{-7}	0.484×10^{-7}
Sample size	533	
r^2	0.151	
Log likelihood	-486.6	

The demand of Dévaványai households for crop species diversity decreases with the number of household members that are employed off-farm. Households that cultivate a field also prefer lower levels of crop species diversity in their home gardens. These interactions are consistent with the hypothesis that in this region, field crop production and off-farm activities yield higher returns compared to cultivating home gardens rich in crop species diversity.

Households who spend a greater share of their income on food (poorer households) prefer more diverse home gardens. Demand for landraces in the home garden also increase in the household's food expenditure. The interaction between the demand for organically produced home gardens and number of family members who are employed off-farm is also positive. This result can be explained by the fact that organic production can be a costly activity as chemical inputs that are certified as organic cost more than regular fertilisers do, and organic production alone might not produce all that is needed for the household's consumption of the same goods. Households with off-farm income may have more means to purchase organic fertilisers and supplement their production with items purchased from the local markets found in Dévaványa.

In Orség-Vendvidék, the number of family members with off farm employment, food expenditure, and experience of the home garden decision-maker affect the demand for home gardens and their attributes (Table 8).

Table 8. Effects of household and decision-maker characteristics on demand for home garden attributes in Orség-Vendvidék ESA

Variable	Coefficient	s.e.
Constant	-1.8277	0.5109
Crop Species Diversity	0.2739	0.1719
Agro-diversity	0.2636	0.0826
Organic Production	0.3026	0.2492
Landraces	0.4097	0.1070
Self sufficiency	0.7163×10^{-5}	0.209×10^{-5}
Crop species diversity * no of off farm employed household members	0.0115	0.0062
Organic Production * food expenditure	0.011	0.0052
Organic Production * experience	-0.149	0.0046
Landrace * no of off farm employed household members	-0.1351	0.0670
Self sufficiency * food expenditure	0.8×10^{-7}	0.452×10^{-7}
Sample size	448	
r^2	0.147	
Log likelihood	-380.36	

In Orség-Vendvidék, the demand for diversity of crop species increases with the number of household members employed off-farm, though the demand for landraces is negatively associated with the same household characteristic. The more experienced the primary decision-maker, the lower the demand for organic produce from the home garden. Demand for organic produce rises with the food expenditure of the household, perhaps because less wealthy households lack the funds to acquire complementary inputs that are required for non-organic production. Demand for the level of self-sufficiency provided by the garden increases with the share of the food in household expenditures, indicating that poorer households rely more on home garden production for food.

In Szatmár-Bereg region, the demand for home gardens and their attributes is affected significantly by the number of family members with off-farm employment, number of household members participating in the home garden, whether or not the household engages in field cultivation, and the experience of the home garden decision-maker (Table 9).

Table 9. Effects of household and decision-maker characteristics on demand for home garden attributes in Szatmár-Bereg ESA

Variable	Coefficient	s.e.	t-stat
Constant	-0.6705	0.4810	-1.394
Crop Species Diversity	0.2747	0.1410	1.952
Agro-diversity	0.4102	0.1247	3.288
Organic Production	0.0859	0.0788	1.089
Landrace	0.2633	0.0957	2.752
Self sufficiency	0.1512×10^{-4}	0.3170×10^{-5}	4.772
Agro-diversity * no of off farm employed household members	-0.01366	0.0788	-1.735
Agro-diversity * the household cultivates a field	0.2353	0.1574	1.496
Landrace * the household cultivates a field	-0.2470	0.1428	-1.730
Self sufficiency * experience	-0.8548×10^{-7}	0.4551×10^{-7}	-1.878
Self sufficiency * number of home garden production participants	-0.1560×10^{-5}	0.6735×10^{-6}	-2.376
Sample size	434		
r^2	0.192		
Log likelihood	-385.45		

In Szatmár-Bereg region, households cultivating a field also demand agro-diversity in the home garden. However, those households who cultivate fields prefer gardens without landraces. Demand for agro-diversity decreases with the number of household members that are employed off farm, since animal husbandry is a costly activity for them. Demand for the level of self-sufficiency expected from the home garden decreases with the experience of the primary decision-maker. The more experienced decision-makers are generally those who are older, who may choose to retire from home garden production if given the choice. The greater the number of participants in home garden production, the lower the level of self-sufficiency they demand that it provide. Household income and the number of members employed off-farm increase with the number of home garden participants (who are usually adults), and households with higher incomes rely less on the home garden output for their livelihoods.

5.4. Willingness to accept compensation values for selected household profiles

The conditional demand functions reported in Tables 7-9 can be used to calculate the value assigned by the household to home garden attribute (Scarpa, *et a*l., Forthcoming(a)), by modifying Equation (2):

$$W = -1\left(\frac{\hat{b}_{attribute} + d_{atribute} \times S_1 ... + d_{attribute} \times S_5}{\hat{b}_{monetaryattribute} + d_{monetaryatribute} \times S_1 + ... + d_{monetaryatribute} \times S_5}\right) \qquad (2')$$

S_{1-5} is the socio-economic variable in consideration. The compensation that selected types of households are willing to accept for giving up their home gardens are shown in Tables 10 through 12. Three profiles are shown for each region.

The first profile refers to a household of average size, with a relatively high income, two household members working off-farm, and with three members participating in home garden production. This household does not engage in field cultivation and spends 30% of its income on food. The primary decision-maker in the garden has 20 years of experience.

The second profile pertains to a small household with elderly members and no employment outside of the farm and no other farm fields. This household spends 50% of its income on food. Only two of its members work in the garden, and primary decision-maker has 50 years of experience.

The third profile describes a relatively large household whose livelihood is agriculturally-based since its members cultivate at least one field along with the home garden. Five of its members work in the garden, and the household spends 40% of its income on food. The experience of the primary decision-maker in the home garden is 30 years.

In Dévaványa, the positive sign in front of the WTA values indicate that a higher level of crop species diversity is a cost for the home garden producer-consumers in this region, rather than a benefit. The presence of well-functioning food and labour markets in this region renders cultivation of a home garden that is species-rich both unnecessary and costly. Agro-diversity is valued most highly in this regions compared to the other two regions. Agro-diversity, which represents the traditional Hungarian method of integrating crop and livestock production, is valued most highly by the elderly household (profile 2), followed by the farmer household (profile 3). Organic production attribute is valued most highly by the high-income household (profile 1), revealing the luxury good nature of this attribute in Dévaványa. The farm household (profile 3) follows profile 1 in this respect, perhaps due to the complementarity between the outputs and inputs of the field and the home garden. Landraces, which are ancestral or heirloom crop varieties in this context, are valued most highly by the elderly household (profile 2) with longer experience in the garden, followed by the farmer households (profile 3).

Table 10. WTA compensation values for Dévaványa ESA for selected household profiles (in €)

Attribute	Profile 1	Profile 2	Profile 3
Crop Species Diversity	+405	+408	+429
Agro-diversity	-346	-391	-367
Organic Production	-338	-107	-230
Landrace	-19	-128	-71

In Orség-Vendvidék crop species diversity is valued most highly by higher-income households (profile 1), which might be explained by the fact that these households might value home gardens for recreation. Crop species diversity matters least to the elderly household (profile 2), since the cost of one more species might not be worth the effort. Higher-income households value agro-diversity and organically produced home gardens most. Both of these might be explained by the fact that in this region with poor soils and fewer markets animal husbandry and organic production are costly, since each requires purchased inputs (e.g. feed, organically certified fertiliser). In Orség-Vendvidék region, landraces are valued most highly by the elderly (Profile 2).

Table 11. WTA compensation values for Orség-Vendvidék ESA for selected households profiles (in €)

Attribute	Profile 1	Profile 2	Profile 3
Crop Species Diversity	-116	-92	-103
Agro-diversity	-103	-88	-95
Organic Production	-133	-39	-109
Landrace	-55	-137	-99

In Szatmár-Bereg, crop species diversity is valued most highly by the farmer household (profile 3), which also values agro-diversity and organic production the most. Farmers in this region engage in intensive agricultural production that integrates the production in the home garden with field production. And finally, as is the case in both Orség and Dévaványa, in Szatmár-Bereg, the elderly household also values landraces the most.

Table 12. WTA compensation values for Szatmár-Bereg ESA for selected household profiles (in €)

Attribute	Profile 1	Profile 2	Profile 3
Crop Species Diversity	-134	-136	-286
Agro-diversity	-64	-201	-530
Organic Production	-42	-43	-89
Landrace	-127	-138	-17

In general, WTA value estimates for the three household profiles in the three regions disclose four main results. First, crop species diversity has no use value in Dévaványa region, though it is valued highly by all types of households in the other two regions where there are no food markets in settlements and transactions costs are high for participating in the nearest food markets. Second, the agro-diversity attribute is valued most highly in Dévaványa as a result of complementarity between animal husbandry and intensive feed production in fields. Though this traditional Hungarian method of integrated livestock and crop production is especially important for older households, it is also observed among Szatmári households that are younger and farm-based.

Third, the demand for organically produced home gardens show the properties of an Environmental Kuznets curve (EKC). That is, when considering all the three ESAs, those home gardeners who are the poorest and oldest prefer these techniques, reflecting less availability of cash to purchase chemical inputs combined with their experience with labour intensive-input extensive production methods. Younger home gardeners that have off-farm occupations and more education also prefer organic production methods, possibly with organically certified inputs, rather than with no inputs at all. Finally middle-aged, middle-income households prefer non-organic methods, considering the high opportunity costs of their time, their ability and their habit (shaped during the chemical input intensive agricultural collectivisation era) of using chemical inputs.

Fourth, in all three regions, the elderly household with longest years of experience in gardening values landraces the most. This reveals very clearly the fact that Hungarian cultural heritage is now being conserved by the remaining elderly home gardeners.

6. Policy Implications and Conclusions

The aim of this study was to estimate the (use) values associated with traditional Hungarian home gardens and their multiple attributes. Data was collected in personal interviews with a random sample of households in three purposively selected, environmentally-sensitive areas of Hungary. The choice experiment method was applied to investigate farmers' demand for home gardens and their attributes conditional on the characteristics of the regions, households and primary decision-makers in the garden. Statistical analysis enabled the testing of hypotheses about the possible effects of economic change on the value of these attributes to home gardeners, and the profiling of regions and households where different types of conservation programmes would cost less because people would care more about the outcomes.

Overall, the results of the choice experiment support the a priori assumption that home garden attributes and the home garden itself significantly and positively contribute to the utility of producer-consumers in environmentally sensitive areas of Hungary. To the extent that the findings are representative of other rural areas (such as other environmentally-sensitive areas) in Hungary, they confirm that home gardens continue to be a vital institution for that nation[6].

More specifically, the results of the choice experiment reveal that rural people in these environmentally-sensitive areas attach significant and positive values to home gardens and to each of the attributes they embody. Home gardens provide multiple

[6] The value estimates for benefits of home gardens and their attributes are obtained only from home gardeners (who are both producers and consumers). Hence these values can be considered as lower bounds since only the private, use values of home gardens were estimated. If the social (regional, national or global) use and non-use values that these home gardens generate were also taken into account, these value estimates would be expected to be higher. Considering landraces, for example, as Smale, Bellon and Aguirre Gomez (2001) note ' In addition to the private value they [landraces] generate for the farmers who grow them, landraces have social value because plant breeders use them as sources of novel alleles (gene types) or gene combinations to improve the crops that produce the food, feed and fibre on which societies depend.'

benefits, at least to those households that engage in their cultivation. To see if the multi-functional values that are generated by home gardens are shared across regions we explored whether or not, and how, the values people attach to home gardens differs according to the characteristics of the region in which the household is situated. We found that differences between regions, in terms of market integration, infrastructure quality and agro-ecological condition, affect home gardeners' valuation. Our results indicate that in isolated regions that lack food markets, such as Orség-Vendvidék and Szatmár-Bereg, home gardens that are rich in intra- and inter-species crop diversity are highly valued. In Orség-Vendvidék, the region with poor soil quality, organic production methods are not so important. Finally, agro-diversity is most highly valued home garden attribute in Dévaványa, the ESA that supports intensive agricultural production in fields as well as gardens.

In all three ESAs elderly, experienced and retired home garden production decision-makers attached the highest values to cultivation of landraces, otherwise known as 'ancestral,' 'heirloom,' or 'heritage' crop varieties. Organic production was valued most highly by younger, more educated, higher-income households, as well as by those that are older and lower-income, and less so by middle-aged, middle-income households. Demand for agro-diversity varied by ESA, but those home gardeners who are integrated with field production (either by themselves, as in profile 3 in Szatmár-Bereg or due to the regional effects, i.e. Dévaványa) attached very high values to agro-diversity. Also elderly households which are devoted to traditional method of integrated crop and livestock production placed high values on agro-diversity in all three ESAs.

The analysis reveals the characteristics of locations, households, and decision-makers that are important to consider in designing programmes to conserve or enhance the agricultural biodiversity and other attributes of Hungarian home gardens as part of the National Agri-environment Programme. Those home gardeners who now attach the highest values to their gardens would need the least additional public funds as incentives to continue cultivating them (Meng, 1997; Smale et al. forthcoming). These "least cost" sites should be ranked the highest as candidates sites for conservation (Brown, 1991).

In the face of changing economic environment, however, there is insufficient assurance that Hungarian society can indefinitely rely on its rural households to conserve these 'small repositories of agricultural biodiversity' and of other values, such as Hungarian cultural heritage. Hungary is a transitional economy that will soon become a member of the European Union. When that happens, isolated regions are likely to be drawn into markets and the opportunity costs of the labour now used in home garden production will probably rise. If home gardens are valuable to Hungarian society, a commitment must now be made to develop a policy framework to ensure their continuity. The most proximate means to do so is the NAEP, which is structured around farmer contract payments. Other mechanisms for conveying economic incentives to smallholder farmers, such as niche markets, or farmer-owned brands conferred through denomination of geographic origin, producer co-operatives or trademarks, might also be considered.

References

Adamowicz, V., P.C. Boxall, J.J. Louviere, Y. Swait, N. Williams. 2000. "Stated Preference Methods for Valuing Environmental Amenities" in I.J. Bateman & K.G. Willis, *Valuing Environmental Preferences*, Oxford.

Adamowicz, V. and P. Boxall. 2001. 'Future Directions of Stated Choice Methods for Environment Valuation', *Paper prepared for: Choice Experiments: A New Approach to Environmental Valuation April 10, 2001 London, England.*

Bateman, I.J., Carson, R.T., Day, B., Hanemann, W.M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Özdemiroglu, E., Pearce, D.W., Sugden, R. and Swanson, S. 2003. *"Guidelines for the Use of Stated Preference Techniques for the Valuation of Preferences for Non-market Goods*", Edward Elgar, Cheltenham.

Bennett, J.J. and R.K. Blamey. 2001. *"The Choice of Modelling Approach to Environmental Valuation"*. Cheltenham, UK. Edward Elgar Publishing Limited.

Brookfield, H., C. Padoch, H. Parsons and M. Stocking (Eds). 2002. *Cultivating Biodiversity: Understanding, Analysing and Using Agricultural Diversity.* ITDG Publishing, London, England.

Brookfield, H. 2001. *Exploring Agrodiversity.* Columbia University Press, New York.

Brown, G.M. 1991. "Valuation of Genetic Resources". In Gordon H. Orians, Gardner M., Jr. Brown , William E. Kunin and Joseph E. Swierzbinski (Eds) *The Preservation and Valuation of Biological Resources*, University of Washington Press

Commission of the European Countries. 2002.Enlargement and Agriculture: Successfully Integrating the New Member States into the CAP. Issues Paper. Brussels, 30.1.2002 SEC (2002) 95 Final.
http://europa.eu.int/comm/enlargement/docs/financialpackage/sec2002-95_en.pdf

Convention on Biological Diversity. 2002. Secretariat of the Convention on Biological Diversity. United Nations Environment Programme.
http://www.biodiv.org/programmes/areas/agro

FAO. 1999. Multifunctional Character of Agriculture and Land: Conference Background Paper No. 1, Maastricht Sept 1999 Size

Freeman, A. Myrick. (1993). *"The Measurement of Environmental and Resource Values: Theory and Methods"*. Washington, D.C., Resources for the Future.

Greene, W.H. 1997. *Econometric Analysis*, 3rd Edition, Prentice Hall.

Greene, W.H. 1997. LIMDEP Version 7.0 NLogit Version 2.0. Plainview, N.Y.: Econometric Software, Inc.

Gyovai, Á. 2002. "Site and sample selection for analysis of crop diversity on Hungarian small farms". In Smale, M. I. Már and D.I. Jarvis (Eds) *The Economics of Conserving Agricultural Biodiversity on-Farm: Research methods developed from IPGRI's Global Project 'Strengthening the Scientific Basis of In Situ Conservation of Agricultural Biodiversity'*. International Plant Genetic Resources Institute, Rome, Italy.

Hanley, N., R.E. Wright and V. Adamowicz. 1998. 'Using Choice Experiments to Value the Environmental', *Environmental and Resource Economics*, 11, (3-4), pp.413-428

Hungarian Central Statistical Office (HCSO). http://www.ksh.hu/pls/ksh/docs/index_eng.html

Hungarian Central Statistical Office, TSTAR database, 1999.

IPGRI. 2003. Home Gardens and the *In Situ* Conservation of Plant Genetic Resources. http://www.ipgri.cgiar.org/system/page.asp?frame=publications/indexpub.htm

Juhász, I, J. Ángyán, I. Fesus, L. Podmaniczky, F. Tar and A. Madarassy. 2000. *National Agri-Environment Programme: For the Support of Environmentally Friendly Agricultural Production Methods Ensuring the Protection of the Nature and the Preservation of the Landscape*. Ministry of Agriculture and Rural Development, Agri-environmental Studies, Budapest 1999.

Kovách, I. 1999. "Hungary: Cooperative Farms and Household plots". In *Many Shades of Red: State Policy and Collective Agriculture*. Mieke Meurs (Ed.) Boulder: Rowman and Littlefield.

Lancaster, K. 1971. *Consumer demand: a new approach*. New York: Columbia University Press.

Louviere, Jordan J., Hensher, David A., J. D. Swait, W. Adamowicz (2000) *Stated Choice Methods: Analysis and Applications*, Cambridge, Cambridge University Press.

Lancaster, K. 1966. "A new approach to consumer theory". *Journal of Political Economy*, 84, 132-157.

Lankoski, J. (Ed.). 2000. *Multifunctional character of agriculture*. Agricultural Economics Research Institute, Finland. Research Reports 241.

Luce, D. 1959. Individual Choice Behaviour. John Wiley, New York, NY.

McFadden, Daniel (1974) Conditional Logit Analysis of qualitative choice behaviour, in P. Zarembka (ed) (1974) *Frontiers in Econometrics*, Academic Press, N.Y.

Maddala, G.S. 1999. *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.

Már, I. 2002. "Safeguarding agricultural biodiversity on-farms in Hungary" in Smale, M. I. Már and D.I. Jarvis (Eds). *The Economics of Conserving Agricultural Biodiversity on-Farm: Research methods developed from IPGRI's Global Project 'Strengthening the Scientific Basis of In Situ Conservation of Agricultural Biodiversity'*. International Plant Genetic Resources Institute, Rome, Italy.

Meng, E.C. (1997). Land Allocation Decisions and In Situ Conservation of Crop Genetic Resources: The Case of Wheat Landraces in Turkey. Ph.D. Dissertation, University of California Davis.

Meurs, M. 2001. The Evolution of Agrarian Institutions: A Comparative Study of Post-Socialist Hungary and Bulgaria . Ann Arbor: University of Michigan Press.
Meurs, M. 1999. Many Shades of Red: State Policy and Collective Agriculture. Boulder: Rowman and Littlefield.

National Labour Centre. 2000. http://www.ikm.iif.hu/english/economy/labour.htm. Budapest, Hungary.

Romstad, E., A. Vatn, P.K. Rørstad and V. Søyland. 2000. *Multifunctional Agriculture: Implications for Policy Design.* Agricultural University of Norway, Department of Economics and Social Sciences, Report No. 21

Scarpa, R., A. Drucker, S. Anderson, N. Ferraes-Ehuan, V. Gomez, C. R. Risopatron and O. Rubio-Leonel. Forthcoming (a). Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan. Forthcoming in *Ecological Economics.*

Scarpa, R., P. Kristjanson, A. Drucker, M. Radeny, E.S.K. Ruto, and J.E.O. Rege. Forthcoming (b). Valuing indigenous cattle breeds in Kenya: An empirical comparison of stated and revealed preference value estimates. Forthcoming (b) in *Ecological Economics*.

Simon, Á. 2001. *Agricultural Background For the On Farm Project.* Institute for Agrobotany, Tápiószele, Hungary.

Smale, M., Bellon, R.M. and J.A. Aguirre Gomez. 2001. 'Maize Diversity, Variety Attributes, and Farmers' Choices in Southeastern Guanajuato, Mexico.' *Economic Development and Cultural Change*. Volume 50, Number 1, October 2001

Smale, M., M. R. Bellon, D. Jarvis, and B. Sthapit. Economic concepts for designing policies to conserve crop genetic resources on farms. Forthcoming in *Genetic Resources and Crop Evolution.*

Appendix Map of Environmentally Sensitive Areas