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Assessing the benefit of the agroecosystem services: Lithuanian preferences using a latent class approach

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ABSTRACT

This study represents a first analysis of citizens' willingness to pay (WTP) for agroecosystem services in a Baltic country (Lithuania). Since it is part of the European Union, Lithuania applied environmental agriculture schemes to support the production of agroecosystem services by farmers. Therefore, understanding the demand of such services may help policy makers to allocate funds. This study revealed that Lithuanian residents are concerned about environmental problems that may be caused by agriculture. Moreover, while the provision of agroecosystem services is demanded, citizens show very different tastes concerning these services. The application of a latent class model highlights three groups of citizens with different tastes and levels of WTP. Among the ecosystem services tested, the landscape provisions show the highest level of heterogeneity across the class. This study's findings provide quantitative information concerning the demand for improvements in agroecosystem services through agri-environmental protection programmes. The obtained data supports the conclusion that choice experiments are a reliable tool to analyse consumers' preferences related to environmental protection in Lithuania.

1. Introduction

Agricultural ecosystems cover nearly 40% of the world's surface land, and agriculture represents the most common form of land management in the world (Power, 2010). Food, fibre, and fuel production are the overwhelmingly dominant goals of agriculture (Karlsson and Ryden, 2012; Vivithkeyoonvong and Jourdain, 2017). As a managed ecosystem, agriculture plays unique roles in both supply and demand for other ecosystem services (Swinton et al., 2007; Dale and Polasky, 2007; Power, 2010; Huang et al., 2015), revealing the dependence of human well-being on these services (Matzdorf and Meyer, 2014). As Fig. 1 shows, agricultural ecosystems need and provide several ecosystem services, but they also provide disservices (Zhang et al., 2007).

The ecosystem services (ES) framework has recently been highlighted in the literature, proposing a need for better management of the integration of public and private dimensions (Ranganathan et al., 2008; Turner and Daily, 2008; Matzdorf and Meyer, 2014; Rodríguez-Ortega et al., 2014; Bernués et al., 2015; Scholte et al., 2015; Bull et al., 2016; Vivithkeyoonvong and Jourdain, 2017). Such an approach allows for providing economic valuation of ES and also for integrating multiple value domains (Bull et al., 2016). When applied to agriculture, the ES framework focuses on all the direct and indirect benefits that agroecosystems provide to people (Zhang et al., 2007; de Groot et al., 2010; Huang et al., 2015; Rocchi et al., 2017).

According to the Millennium Ecosystem Assessment (2003), ES can be classified into the following four groups:

– Provisioning ES (material or energy outputs),
– regulating ES (biophysical processes providing benefits),
– Supporting ES (processes essential to provide other ecosystem services), and
– Cultural ES (recreational, aesthetic, spiritual benefits).

The last three groups can also be denominated as non-provisioning ES (Millennium Ecosystem Assessment, 2003). Traditionally, agroecosystems have been considered only as a source of provisioning services (Power, 2010). However, agroecosystems also provide a wide range of non-provisioning ES (Millennium Ecosystem Assessment, 2003; Power, 2010; Huang et al., 2015), such as agricultural landscapes (Sayadi et al., 2009; Colombo et al., 2009; Howley et al., 2012), preservation of biodiversity (Zhan et al., 2007), climate regulation (Smith et al., 2008) and flood control (Dominati et al., 2014). All these benefits from agriculture are very important in the context of European Union Common Agricultural Policy (CAP). For example, the second pillar of CAP (Rural

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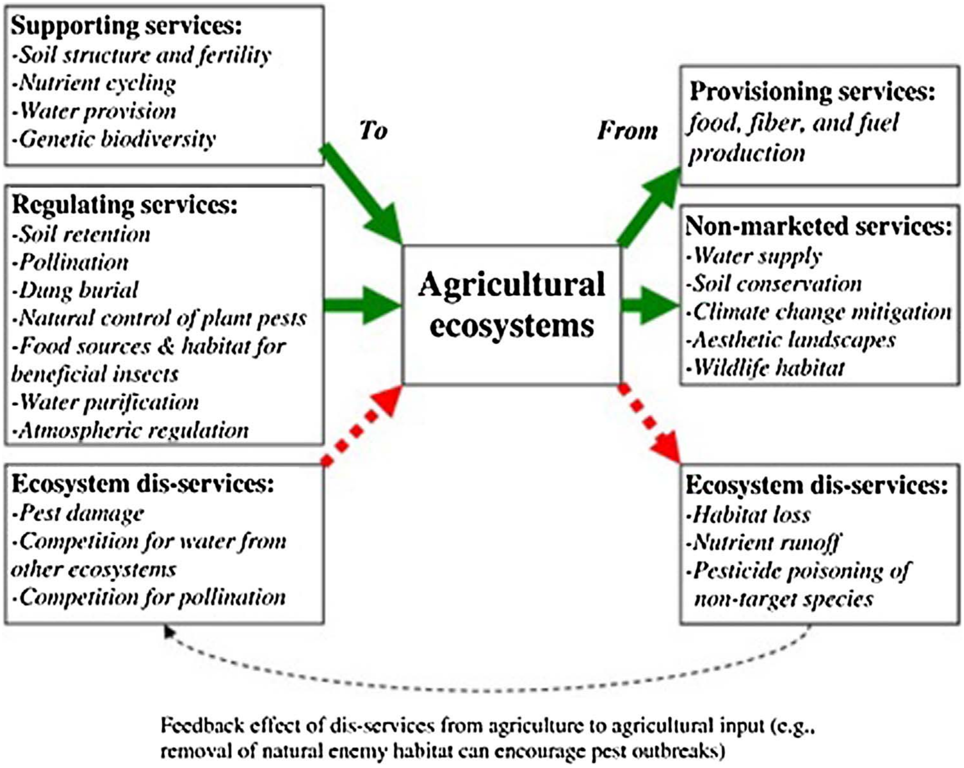

Fig. 1. Ecosystem services and dis-services to and from agriculture. Solid arrows indicate services, whereas dashed arrows indicate dis-services (source: Zhang et al., 2007).

Development Policy) is fully connected with the preservation of these agroecosystem services, and agri-environmental schemes (AES), as Villanueva et al. (2015) stated, are a paradigmatic case of European tools. AES are multiannual and voluntary incentive-based payments to farmers for preserving and enhancing agroecosystem services, which are considered as environmental public goods (Villanueva et al., 2015). They usually consist of per-hectare payments implemented regionally and co-financed by the EU and each of its Member States (Espinosa-Goded et al., 2010; Uthes and Matzdorf, 2013). AES stands out as one of the most significant CAP tools as it has assigned an aggregated expenditure of 22.2 billion EUR (that is, 22% of the budget of the European Rural Development Policy 2007–2013), according to the ECA European Court of Auditors (2011). These agri-environmental programmes are implemented by receiving monetary support from EU citizens who are also the consumers of such services. Because the market for environmental public goods obtained from agroecosystems does not exist, the benefits gained by consumers cannot be feasibly measured employing traditional valuation techniques. The main objective of evaluation of ecosystem services is to address policies and incentives for better management of agriculture (Power, 2010).

In the absence of market values, stated preference methods, such as contingent valuation method (CVM) and choice experiments (CE) in particular, are recommended for measuring the benefits associated with the implementation of multidimensional policies with an impact on the provision of environmental public goods (Adamowicz et al., 1998; Bateman et al., 2002; Bennett and Blamey, 2001). In such an evaluation, hypothetical markets are created to analyse non-marketable goods. Consistently, they are based on the observation of consumer preferences and behaviour concerning these goods.

An overview of scientific literature (Adamowicz et al., 1994; Champ et al., 2012) reveals that the CVM is the most widely used stated preference technique for non-market valuation. Earlier studies of agricultural non-market valuation used CVM to estimate the willingness to pay (WTP) for the amenity values and for environmental benefits from agri-environmental protection (Tsai, 1993; Krumalova, 2003; Kubičkova, 2004; Boody et al., 2005; Yong-Kwang and Chang-Gil, 2006). In some situations, the outputs of the research should be considered as a "complex public good", as in the case of agri-environmental protection programmes (Campbell et al., 2005; Szabó, 2010). Baskaran et al. (2009b) notes that the analysis of different attributes could be important for policy makers to implement the right programmes. The use of CVM in situations where multiple options and several attributes are used is generally considered to be problematic (Jianjun et al., 2013). Literature on this topic states that AES can be considered as a "complex environmental public good", and therefore CE is the best technique to value both the overall good and each of its components (Bennett and Blamey, 2001; Hanley et al., 2001).

Several researchers have analysed consumer preferences for agroecosystem services or multiple functions of agriculture in European Union countries (Køùmalová, 2002; Arriaza et al., 2008; Domínguez-Torreiro and Soliño, 2011; Rodríguez-Entrena et al., 2012) and other developed countries such as Norway (Bernués et al., 2015), US, and New Zealand (Takatsuka et al., 2006; Baskaran et al., 2009a, b). However, there is limited attention in the literature in the case of Baltic countries. Moreover, no research has been carried out in Lithuania so far about consumer preferences for agroecosystem services. In this context, the main objectives of this paper are as follows: 1) to explore the applicability of CE to evaluation of agroecosystem services in Lithuania; 2) to estimate the non-market values of improvements in agroecosystem services within the study area, based on consumers' preferences; and 3) to understand how to use such information about consumer preference for better targeting the national expenditure for AES. The paper is structured as follows: Section 2 describes the main characteristics of Lithuanian agriculture, Section 3 explains the methodology applied in the research, the results of the empirical application are discussed in Section 4, and Section 5 ends the paper by presenting its main conclusions.

2. Case study: the Lithuanian agroecosystem services

Lithuania is a rural nation. Rural areas cover 97% of Lithuania, and approximately one-third of Lithuania's inhabitants live in them. Fig. 2

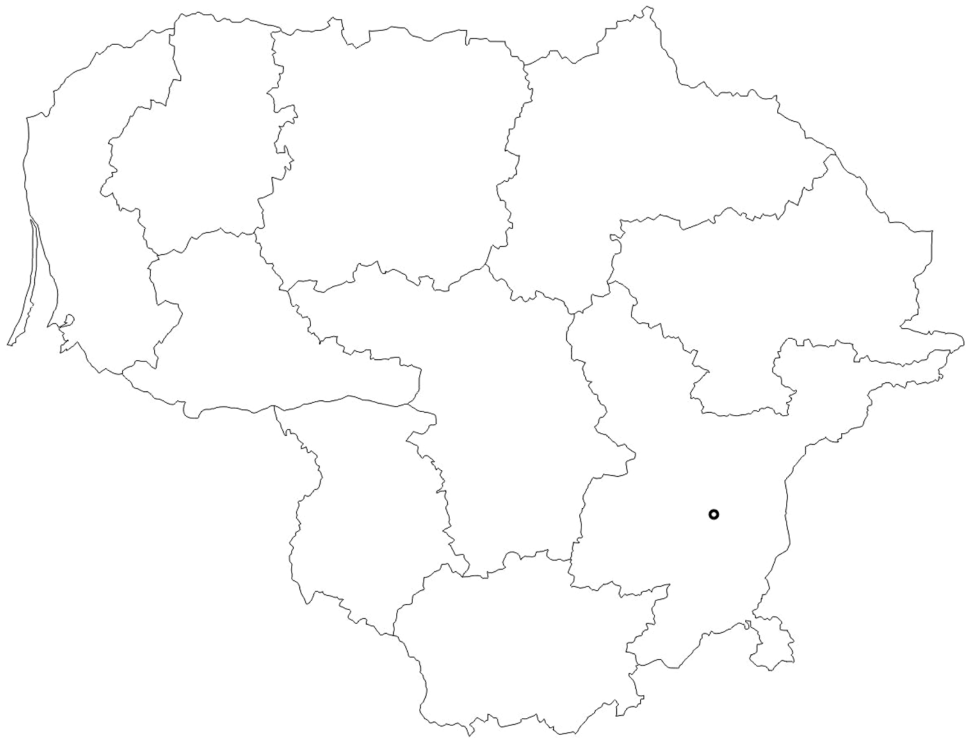

Fig. 2. The survey involve the whole territory of territory of Lithuania is divided into 10 counties. The capital of Lithuania is shown in the map as black circle.

according to data in the Lithuanian Rural Development Programme (2014), the number of rural inhabitants decreased approximately 9.5% between 2008 and 2013.

Among the Baltic states, Lithuania is one of those most highly connected with agriculture. Agricultural land covers more than 60% of the territory of Lithuania, which is more than the EU-27 average that is 51.6% (Ministry of Agriculture of the Republic of Lithuania, 2014). Forests are also widespread and cover approximately one-third of the territory. The main crops in Lithuania are winter and spring cereal (41%), winter and spring rape seed (12%), perennial grassland (40%), and others (legume crops, potato, beetroots, fallow, etc.) (7%) (Dapkiene, 2016). Agriculture affects much of the Lithuanian landscape; for hundreds of years, agriculture has defined the Lithuanian rural environment, and now it also has an exclusive role in creating non-market agroecosystem services. Approximately 53.1% of the surface land is devoted to agricultural land, and arable land covers approximately 49.7% (Lietuvos Respublikos žemės fondas, 2015). Although there are favourable conditions for agricultural development in Lithuania, there are also natural handicaps that reduce land use possibilities. Less favoured areas cover approximately 57.1% of the utilized agricultural area (CEEC AGRI POLICY, 2005). Moreover, 23.3% of Lithuanian territory is classified as High Nature Value (HNV), and HNV farming has been developed in 20.8% of the agricultural area, which contributes greatly to the improvement of biodiversity and preservation of natural species. Organic agriculture is expanding rapidly and significantly: according to Pilipavičius and Grigaliūnas (2014), organic agriculture land doubled its surface between 2005 and 2009.

According to the SWOT analysis included in the Lithuanian Rural Development Programme, (2014), thanks to support from the EU, the agri-environmental conditions of the country are improving. For instance, the schemes from the Rural Development Programme have contributed greatly to the preservation of biodiversity and the enhancement of the agricultural landscape; improvements in the underground water quality are also reported. However, Lithuanian agriculture is working under stable macroeconomic conditions during last years. According to Lithuanian Institute of agrarian economics (2016) the GDP and inhabitants' income are growing; unemployment is decreasing in urban and rural areas. There are good conditions for taking credits.

There is a large focus on the supply side in Lithuanian agriculture. The Lithuanian Institute of Agrarian Economics is responsible for calculating lost income or incurred cost for farmers providing agroecosystem services. Other agencies, such as the National Paying Agency under the Ministry of Agriculture, concentrate on the amounts of support given to farmers according to the different agri-environmental measures. Therefore, understanding the preferences of Lithuanian citizens concerning agroecosystem services will be very useful for better addressing payments to farmers.

3. Materials and methods

3.1. Modelling framework

The choice experiments (CE) technique is an empirical method originally applied in the market research and transport literatures (Chan-Halbrendt et al., 2010). CE allows consumers to express their preferences and choose between alternative hypothetical scenarios that differ in the magnitude of their effects (Lancaster, 1966; Bateman et al., 2002; Bennett and Blamey, 2001; Domínguez-Torreiro and Soliño, 2011). They are based on behavioural models predicting the probabilities of a randomly selected individual choosing each of the available alternatives, described as functions of a set of characteristics. The conceptual foundations of choice experiments rely on Lancaster's Theory of Value (Lancaster, 1966) and Random Utility Theory (RUT) (Thurstone, 1927). CE can be used to determine hypothetical management options. The analysis is based on the evaluation of the utility derived from the choice of the best alternative among a set of multi-attribute management scenarios. The basic assumption is that people seek to maximize utility in each choice situation (McFadden, 1973). Consumers' choices can be modelled as a function of the attributes of the alternatives relevant to a given choice problem (Jianjun, 2013).

The econometric basis for the current choice modelling theory stems from basis for the current choice modelling theory stems from McFadden, 1973, who later extended RUT to multiple comparisons and choices (McFadden and Train, 2000). Following Lancaster (1966), consumers gain their utility not from the whole good but rather from its attributes. According to RUT, the subject chooses the alternative that gives the highest utility. Within this theoretical framework, subjects choose among alternatives according to a utility function with two components, a systematic (i.e., observable) component plus a random term (non-observable by the researcher) (McFadden, 1973). Mathematically,

$$U_{in} = V_{in}(Z_i, S_n) + \varepsilon_{in} \quad (1)$$

where
U_{in} = utility provided by alternative i to subject n,
V_{in} = systematic component of the utility,
Z_i = vector of attributes of alternative i,
S_n = vector of socioeconomic characteristics of the respondent n, and
ε_{in} = random error term.

The multinomial logit (MNL) model is one of the available probabilistic choice models mostly used in CE (McFadden, 1973; Ben- Akiva and Lerman, 1985; Arriaza et al., 2008; Grammatikopoulou et al., 2012). According to the MNL model, the probability that an individual n will choose alternative i (P_{in}) among other alternatives j ($j = 1 \cdots J$) of a set C_n (set of all the alternatives) is expressed by the following equation (McFadden, 1973):

$$P_{in} = \frac{\exp(\mu V_{in})}{\sum_{j \in C} \exp(\mu V_{jn})} \quad (2)$$

where V_{in}/V_{jn} is the systematic component of the utility provided by alternatives i/j, and μ is a scale parameter that is inversely proportional to the standard deviation of error terms and is usually assumed to be equal to one (Ben- Akiva and Lerman, 1985). The MNL model is a basic model, useful as a reference point, but it is limited by several assumptions (Vivithkeyoonvong and Jourdain, 2017). Therefore, researchers developed alternative models. In particular, since the first work of Train (1998), choice models have been developed to take into account heterogeneity in taste and scale. We can divide models addressing heterogeneity into two groups, mixed logit (Chen and Cosslett, 1998; Train, 2003) and latent class approach (LCA) (Hynes et al., 2008; Provencher et al., 2002; Scarpa and Thiene, 2005; Scarpa et al., 2005). While the former is based on a continuous distribution, the latter postulates a discrete distribution of tastes. In this study, we chose the LCA, which allows for splitting the sample into segments called classes. Classes are different one from another, but the members of the same group share the same parameters (Boxall and Adamowicz, 2002). Application of the LCA allows heterogeneous preferences among respondents because the estimated parameters can vary among latent classes. The segmentation derived from the LCA allows policy makers to identify and investigate groups of people with particular preferences (Garrod et al., 2012).

The LCA has been widely used in the context of consumer theory (Hagenaars and McCutcheon, 2002; Kamakura and Wedel, 2004; Wedel and Kamakura, 2000), and several applications in the field of environmental economics have been performed (Aldrich et al., 2007; Birol, 2009; Morey et al., 2006; Garrot et al., 2012). From a mathematical point of view, the LCA discretizes the traditional logit (see Function (1)) and identifies S segments in a population, each with its own characteristics and taste (Scarpa et al., 2005; Swait, 1994). The function $f(\beta)$ is discrete when β has several finite values (β_1, $\beta_2 \ldots \beta_n$). Therefore, the probability Function (2) can be transformed to identify the probability for n, belonging to s, to choose alternative i, as follows:

$$Pins = \exp(\mu_s x_{in} \beta_s) / \sum_{j \in C_n} \exp(\mu_s x_{jn} \beta_s) \quad (3)$$

Marginal probability can be calculated as follows:

$$P_{in} = \sum_{s=1}^{S} \pi_s (\exp(\mu_s x_{in} \beta_s) / \sum_{j \in C_n} \exp(\mu_s x_{jn} \beta_s)) \quad (4)$$

We notice that when $S = \{1\}$, then $\pi_{s=1}$; we again obtain the MNL specification. μ_s is the scale parameter, and although it can vary over segments, it is considered equal to 1.

The number of classes is a latent variable and has to be estimated, but its identification is not part of the maximization process. Thus, the number of segments must be identified before evaluation of the parameters. Several tests can be used to identify the correct number of parameters. The Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) are the most used (Bozdogan, 1987; Posada and Buckley, 2004). The best model for data interpretation is the one with the lowest information criterion values.

3.2. Survey and data collection

The selection of suitable attributes is one of the most crucial points of CE. Therefore, in the present paper, attributes were selected according to an extensive literature overview (Colombo et al., 2005; Zhan et al., 2007; Smith et al., 2008; Colombo et al., 2009; Sayadi et al., 2009; Power, 2010; Howley et al., 2012; Dominati et al., 2014; Huang et al., 2015; Landis, 2017) and to the SWOT analysis of the Lithuanian Rural Development Programme 2014–2020. A first cluster of attributes and levels was tested with two rounds of pilot surveys, and then the following four attributes were selected: reduction of underground water pollution, preservation of biodiversity (wildlife populations), sustenance and improvement of the agricultural landscape, and payment, presented as a household payment (EUR per year for the next 5 years). To facilitate communication with the respondents, we identified environmental problems and their relationship with the human wellbeing for each of the attributes, which was set for three different levels. The lowest level corresponds to the status quo (current), the second level corresponds to a 10% improvement in agroecosystem services, and the highest level corresponds to the level achieving 20% improvement in agroecosystem services (i.e. the best possible performance scenario) (Table 1). The last attribute, the monetary one, is a household payment into the Environmental Fund, which is responsible for the environmental management; the payment is proposed as an annual one, for a period of 5 years.

The choice sets were created as simply as possible to be understandable for all respondents. The definition of the level using percentage followed Colombo et al., 2009.

The choice set used comprised the following three options: the status quo situation and the two alternative options (option A and option B), which represent improved situations. D-efficient fractional factorial design excluding unrealistic cases was adapted for each of the choice questions to make the statistically efficient choice design for the main survey. This experiment was performed with linear D-optimal using SAS© software. The programme created 36 choice sets which were then distributed into four blocks. Table 2 illustrates an example of the choice cards shown to respondents.

Having constructed the questionnaire, two pilot surveys were given to local residents in June and July 2015. A pre-test of the questionnaire was necessary to check for feasibility of the attributes and the levels selected. Based on the results provided by pilot surveys, some amendments in the questionnaire were made. The final survey questionnaire consisted of the following three parts: 1) attitude and knowledge questions focused on the impacts of agricultural activity on the environment and the introduction of the problem to the respondents, 2) the choice sets to identify the preferences of the respondents, and 3) respondent-related socioeconomic questions.

The target population of the study comprised Lithuanian citizens over 18 years old. All local residents were considered to use this type of good. Non-residents (i.e., tourists), who probably could have had a positive WTP for these goods, were not included in the study. Sampling

Table 1
Explanation of the attributes analysed in the CE questions.

Attributes (functions of agriculture)	Levels	ES type/types of agroecosystem services
Reduction of underground water pollution	• Status quo • 10% of the reduction of underground water pollution due to agricultural activity; • 20% of the reduction of underground water pollution due to agricultural activity	*Regulating services* *The quality of drinking water* *(better health, avoided cleaning cost)*
Preservation of biodiversity	• Status quo • 10% improvement by protecting the diversity of wildlife • 20% improvement by protecting the diversity of wildlife	*Supporting services* *Wildlife populations*
Sustenance and improvement of agricultural landscape	• Status quo • 10% improved agricultural landscape • 20% improved agricultural landscape	*Cultural services* *Aesthetic value of the agricultural landscape, Recreation and tourism*
Payment (Household payment into the Environmental Fund, which is responsible for the environmental management (EUR per year for the next 5 years)	• Status quo: 0 EUR/year • Level 1: 12 EUR/year • Level 2: 23 EUR/year • Level 3: 35 EUR/year • Level 4: 46 EUR/year	

for the choice experiments survey was implemented randomly, selecting respondents and asking them to fill in the questionnaire at different events, courses, and public places.

4. Results

4.1. Sampling characteristics

The final survey was performed in October and November of 2015; 600 questionnaires were distributed. The return rate was very high (76%). We collected 460 valid questionnaires, excluding protest responses and surveys partially filled in or with inconsistent answers. The descriptive statistics of the respondents' main demographic characteristics are presented in Table 3. Comparing the demographic profile of respondents with Lithuanian census data, it was found that our sample was representative, stratifying the population by gender and by area of residence. Considering age and education, the sample is not very representative because of a low willingness of older and lower educated individuals who participated in the survey.

Table 4 shows the results of the first part of the questionnaire about respondents' awareness of the environment and agriculture. For more than the 60% of the sample, the impact of Lithuanian agriculture is negative, from slightly harmful to very bad. Respondents were asked how often they worry about several environmental issues linked to agriculture. More than 40% of the respondents stated that they were worried always or very often about the water quality in rivers and lakes, and approximately 75% worried about drinking water quality. Respondents were also asked whether they were aware of the negative environmental effects induced by agriculture and most of the respondents stated that they were aware of some issues related to farming and agriculture in Lithuania.

Table 3
Main demographic and socioeconomic variables of respondents.

Variables	Study sample		General population	
	N	%	N (Thousands)	%
Gender				
Male	179	38.9	1059.4	44.9
Female	281	61.1	1302.3	55.1
Age				
From 18–39	248	53.9	795.3	33.7
From 40–65	198	43.1	1019.3	43.2
Over 65	14	3.0	547.1	23.2
Area of residence				
City	331	72.0	1592.2	67.4
Village	129	28.0	769.4	32.6
Education				
Higher and post-secondary	306	66.5	577.7	40.2
Special upper secondary and secondary	154	33.5	858.7	59.8

Notes: 1) The educational attainment of the population aged 25–64 for 2014; 2) the breakdown of the Lithuanian population by gender, age, area of residence data obtained from the Lithuanian Department of Statistics, 2015.

4.2. Model specification and parameter estimates

The latent class model was run to identify groups of people sharing the same preferences concerning agroecosystem services, and an MNL model was also run as a benchmark. To this aim, we included covariates as class-defining variables. Because the respondents were asked to choose among two unlabelled options and the status quo, we included an effect-coded alternative specific constant (ASC), called SQ, in the utility function. The use of an ASC in case of a status quo option allowed

Table 2
Example of a choice card from the questionnaire.

Attributes	Status quo (No application)	Alternative A	Alternative B
Reduction of underground water pollution	No change – 0	20% reduction	10% reduction
Preservation of biodiversity	No change – 0	10% improvement	No change – 0
Sustenance and improvement of agricultural landscape	No change – 0	10% improvement	10% improvement
Household payment (EUR per year for the next 5 years)	0 EUR	46 EUR	35 EUR
Your choice (choose only one)	☐	☐	☐

Table 4
Attitudes and awareness of the agriculture induced effects on the environment.

How do you rate the impacts of farming on the natural environment (%)?							
Very bad 2.4	Bad 16.5	Slightly harmful 43.3	No impact 6.3	Slightly useful 3.7	Good 20.4	Very good 3.3	Don't know 4.1

How often do you worry about the following environmental aspects in Lithuania (%)?	Always	Very often	Sometimes	Rarely	Never
Water quality in rivers and lakes	9.6	33.7	48.0	7.4	1.3
Drinking water quality	29.8	45.4	20.2	3.9	0.7
Decline in flora populations	3.7	15.4	46.1	31.5	3.3
Decline in fauna populations	3.0	10.9	46.3	33.3	6.5
Formation and sustenance of the landscape	5.0	27.2	44.1	19.3	4.3

Are you aware of the following environmental issues from agriculture (%)?	Yes	No
Use of mineral fertilizers	71.3	28.7
Use of organic fertilizers	56.1	43.9
Use of pesticides	62.2	37.8
Animal urine and faeces leaching to streams and lakes	76.3	23.7
Coastwise buffer strips	68.0	32.0
Management of meadows and wetlands	57.0	43.0
Leaving stubble for the winter	51.3	48.7
Tree buffer strips in the arable land	43.7	56.3

Table 5
Model's variables: meaning and code.

	Variable meaning	code
CE Attributes	Status quo alternative specific constants	SQ
	Reduction of underground water pollution (10%)	WAT_L1
	Reduction of underground water pollution (20%)	WAT_L2
	Preservation of biodiversity (10% improvement)	WILD_L1
	Preservation of biodiversity (20% improvement)	WILD_L2
	Sustenance and improvement of agricultural landscape (10% improvement)	LAND_1
	Sustenance and improvement of agricultural landscape (20% improvement)	LAND_2
	Household payment	PRICE
Socio-economic Characteristics	Age	AGE
	Gender	GENDER
	Level of income	INCOME
	Household dimension	SIZE_H
	Level of education	EDU

to highlight if respondents have a preference for the no-change scenario or for avoiding it (Kenter et al., 2011; Greiner, 2015; Vivithkeyoonvong and Jourdain, 2016). Table 5 reports all the names and codes of the variables included in the models.

Several model specifications were tested that considered different numbers of classes, the absence/presence of socioeconomic variables, and SQ. Table 6 reports the model fitness of each model. The best one is model n.13, a 4-class model, without the SQ variable, which includes socioeconomic variables (AGE, EDU, INCOME, SIZE_H, and GENDER). Model n.13 shows a good fit of the data: in particular, it is the model with the best fits for the Log Likelihood (LL), Akaike Criterion (AIC/N) and McFadden's R-squared. The percentage of correct predictions is lower than the 4-class model without SQ and ASC, but this value alone is not enough for selection. The SQ variable, in all the tested models, gave results categorized as not significant. The expected result was a positive sign because we assumed a preference for the status quo (Kenter et al., 2011; Greiner, 2015). In our case, it seems people who responded were not driven by a preference for or against the status quo.

Table 7 reports the results of the selected model, paired with the MNL results. In the MNL model, all the parameters are significant and with the expected sign. Considering the LCA application, Class I has only parameters deemed not significant and includes 1.1% of the sample. Class I, according to the analysis of socioeconomic attributes, had a higher proportion of younger respondents with higher income. In Class II, which included 19% of the sample, parameters linked to water quality are not significant at all, while the preservation of biodiversity (both levels) and the lower level of agricultural landscape sustenance are significant. Additionally, the monetary attribute is significant, with the expected sign. In this class, we were more likely to find older male respondents with a lower income. Classes III and IV present all the attributes as significant, with the expected sign, except WILD_L1, which is negative in Class IV. Class III includes, in particular, old people.

Table 8 reports the WTPs for each attribute, calculated using the delta method, and its significance. When they are significant, the WTPs of Class II are always lower than the WTPs obtained by the MNL model. On the contrary, the WTPs in Class IV are always higher than the MNL, except for the WILD_L1 attribute. For WILD_L1, we found a negative

Table 6
Models' fitness.

Model	Classes (n.)	SQ	ASC	LL	AIC/N	PSEUDO Rsq	Correct prediction
1	1			−1,996.60	2.052	0.0458	94.88%
2	2			−1,969.16	2.032	0.0822	61.60%
3	3			−1,964.13	2.035	0.0846	81.77%
4	4			−1,959.01	2.038	0.0870	95.66%
5	1	x		−1,996.57	2.053	0.0453	41.78%
6	2	x		−1,968.64	2.033	0.0785	62.21%
7	3	x		−1,957.59	2.031	0.0815	88.89%
8	4	x		−1,952.19	2.035	0.0819	99.09%
9	2	x	x	−1,953.27	2.022	0.0896	64.62%
10	3	x	x	−1,925.47	2.005	0.0952	68.51%
11	4	x	x	−1,926.46	2.018	0.1021	75.02%
12	2		x	−1,930.32	1.997	0.0957	47.52%
13	4		x	−1,839.54	1.931	0.1324	67.33%

Table 7
Latent Class Approach's results.

Attributes (Code)	MNL	LCA			
		Class I	Class II	Class III	Class IV
	(s.e.)	(s.e.)	(s.e.)	(s.e.)	(s.e.)
WAT_L1	0.08422*** (0.00724)	−0.952068 (6015.269)	−0.8730 (0.05881)	0.11180*** (0.01187)	1.68252** (0.76917)
WAT_L2	0.03384*** (0.00409)	3.95807 (2179.221)	0.03286 (0.02219)	0.02910*** (0.00856)	1.55825** (0.71807)
WILD_L1	0.04106*** (0.00824)	−2.22028 (797.8573)	0.10526* (0.05430)	0.05512*** (0.01424)	−0.79533* (0.43169)
WILD_L2	0.03305*** (0.00374)	1.61162 (1310.168)	0.04932* (0.02997)	0.01601*** (0.00805)	1.23569** (0.53893)
LAND_1	0.05227*** (0.00803)	−2.18302 (797.8925)	0.09478*** (0.03402)	0.04612*** (0.01459)	2.95755** (1.35581)
LAND_2	0.02292*** (0.00395)	0.27058 (498.5603)	0.00371 (0.02393)	0.03803*** (0.00718)	0.59217** (0.26989)
PRICE	−0.03099*** (0.00263)	−2.29581 (1509.491)	−0.10846*** (0.03256)	−0.02131*** (0.00456)	−0.24140** (0.11220)
Estimated latent class probabilities		1.1% ***	19% ***	61.1% ***	18.8 ***

***, **, * = = > Significance at 1%, 5%, 10% level.

Table 8
WTPs for each attribute.

Attributes (Code)	MNL	LCA			
		Class I	Class II	Class III	Class IV
	(s.e.)	(s.e.)	(s.e.)	(s.e.)	(s.e.)
WAT_L1	2.72*** (0.26957)	4.15 (184.3433)	0.80* (0.44093)	5.25*** (1.08495)	6.97*** (1.30038)
WAT_L2	1.09*** (0.12649)	1.72 (201.19)	0.30* (0.17146)	1.37*** (0.37757)	6.45*** (1.09149)
WILD_L1	1.32*** (0.25489)	−0.97 (353.3766)	0.97*** (0.33190)	2.59*** (0.75764)	−3.29*** (1.19901)
WILD_L2	1.07*** (0.11001)	0.70 (127.7572)	0.45** (0.18248)	0.75** (0.34082)	5.12*** (0.91869)
LAND_1	1.69*** (0.23825)	−0.95 (343.7058)	0.87** (0.4294)	2.16*** (0.60152)	12.25*** (2.75601)
LAND_2	0.74*** (0.11426)	0.12 (146.6476)	0.03 (0.2259)	1.78*** (0.36324)	2.45*** (0.52616)

***, **, * = = > Significance at 1%, 5%, 10% level.

WTP. This negative WTP is not to be interpreted as a Willingness to Accept compensation, since the framework of the analysis is very different. Class III shows a mixed behaviour between Classes II and IV. Usually, the WTPs of Class III are higher than those for the MNL, but are sometimes close to them; however, in one case (WILD_L2) the value is lower.

Considering the trade-offs among attributes, Class II shows a higher preference for WILD_1 over WILD_2; there is also a trade-off between WAT_L1 and the two levels of preservation of biodiversity. WAT_L1 is preferred over WILD_L2 and but not over WILD_L1. In Class III, the first level of each attribute is preferred to the second one. The most preferred attribute is WAT_L1. In Class IV, the two levels of water attributes show a unitary trade-off. LAND_1 shows a high trade-off over all other attributes.

Finally, as two improvements of agroecosystem services were considered in the study, the compensating surplus (CS) for the different levels of provision considering the attributes (10% and 20% improvements) was estimated for the average respondent. We did not consider WILD_L1 in the estimation because of the negative sign. The CS estimation for the protection programme with the greatest and lowest attribute level was calculated to provide policy makers with quantitative information. The survey was implemented to ensure a representative sample; therefore, the household WTP can be fairly expanded to the population level for calculating the total annual value. The total annual WTP for the protection option with the greatest attribute level amounts to 12.5 million EUR, and with the lowest attribute level amounts to 6.3 million EUR.

5. Discussion

Current rural development policy is focused on the provision of empirically analysed improvements of agroecosystem services. The agri-environmental measures of the Lithuanian Rural Development Programme 2007–2013 (Axis II) and 2014–2020 (priorities 4 and 5) are directly connected with the creation and provision of these environmental goods. However, they overlap with the provision of other environmental goods such as protection against soil erosion and greenhouse gas emissions. According to data from the reports of the national paying agency, the current agri-environmental funding was approximately 130 million EUR during 2015. This funding covers agri-environmental payments received by farmers for environmental protection according to the Lithuanian Rural Development Programme 2007–2013 and 2014–2020. By analysing received agri-environmental payments by farmers, it is evident that the largest proportion of them is paid according to the measure “Payments to farmers in areas with handicaps, other than mountain areas”. Lesser payments were received according to the measure “Agri-environment payments”. Having analysed the distribution of payments according to the schemes of this programme, it is shown that the largest amount of payment was received according the scheme “organic farming”, which accounted for half of all “Agri-environment payments”. The smallest portion of payments was received according to the schemes “Improving the status of water bodies at risk”.

Therefore, these compensation payments are paid to farmers for the lost income or incurred cost of providing environmental public goods. It should be noted that the current agri-environmental policy payments are much higher than the demand of Lithuanian respondents, expressed by their willingness to pay. The reason for this imbalance is that CAP environmental payments are adjusted to the level of the whole of Europe. However, the difference in income in different countries is not taken into account. For example, Danish residents would probably have a higher WTP for the same environmental public goods than Lithuanian residents. Lithuanian residents are concerned about the environmental problems in agriculture, and these goods are in high demand, as the study showed. However, due to the low average income, they are not willing to pay much. The implicit prices can be used to identify which attribute is more important to consumers, which can then be used by policy makers to assign more resources in favour of the attributes that have higher implicit prices (Jianjun et al., 2013).

Our findings regarding consumer preferences for the attributes were in line with previous research. Several researchers showed that the most important attribute for consumers was connected to the reduction of water pollution (Colombo et al., 2005; Takatsuka et al., 2006, Baskaran et al., 2009a, b; Borresch et al., 2009). Although our results show that Lithuanians are concerned about water pollution, the water attribute was most valuable only in Class III, the greatest one, but only for the lower level of pollution reduction. The results of the current study show that the respondents usually have a high WTP for biodiversity, even though it is of little concern to them. Moreover, the WTP for biodiversity varies largely across class and also between the two levels. Class IV shows a high WTP for WILD_L2 in comparison to the other class, although it is one of the lower in Class IV itself. Class III presents the second highest value of the WTP for WILD_1, but WILD_2 has the lowest WTP value. Class II has, in general, the lowest level of WTP, but WILD_1 has the highest WTP level. The results could be due to the misunderstanding of the biodiversity concept as reported by Maduireira et al., 2013, which reported an overestimation of biodiversity because of its intangibility (Soini and Aakkula, 2007; Bernués et al., 2015). Borresch et al. (2009) and Bernués et al. (2015) reported that respondents found the term elusive or even marginal, causing, in those cases an underestimation of biodiversity. The improvement and sustenance of the agricultural landscape presents quite variable values for WTP. Class IV shows the highest value of WTP for LAND_1. In Class III, landscape has both the lowest level of WTP at the first level and the highest at the second. A possible reason for such a result could be an amenity specification bias (Mitchell and Carson, 1989), which can occur due to landscape evaluation. In the literature, several studies found a non-homogeneous demand for landscape since it is a complex good. It is often the individual's background that affects such results (Campbell, 2007; Colombo et al., 2005, 2009; Arnberger and Eder, 2012; Howley et al., 2012).

As supported by literature, the results indicated that socioeconomic characteristics impacted consumer choices for the analysed attributes (Rodríguez-Ortega et al., 2016). For instance, higher educated and younger individuals are more willing to pay for the improvements of agroecosystem services. Similar tendencies were found by other studies (Takatsuka et al., 2006; Arriaza et al., 2008; Baskaran et al., 2009a; Grammatikopoulou et al., 2012; Jianjun et al., 2013; Rodríguez-Ortega et al., 2016). Rodríguez-Ortega et al. (2016) found that men are less willing to pay for improvements in agroecosystem services, as was revealed by the current study. Although this research has not shown any statistically significant interactions of the attributes with income, other studies (Baskaran et al., 2009a) found that respondents from the higher income groups are willing to pay more for improvement of the environmental conditions. Baskaran et al. (2009b) and Arriaza et al. (2008) found that rural and urban respondents have different attitudes regarding ecosystem services, i.e., rural respondents are less receptive than urban respondents to improving the ES attributes. Similarly, rural respondents do not favour more variety of agricultural landscape than urban respondents (Baskaran et al., 2009b; Arriaza et al., 2008). In our study, we tested the variable of rural/urban residence but did not find any clear connection.

Individuals who did not agree to pay for the improvements of agroecosystem services, i.e., who selected the status quo situation in all cards, mentioned the same reasons as in other studies, for example Jianjun et al. (2013), such as stating that the price of suggested agri-environmental programmes is too high for them or that they were uninterested in agri-environmental protection. Another possible reason, as stated by Colombo et al. (2005), could be that respondents think that, currently, the public expenditure share for environmental care is low, but they do not agree to paying more taxes for environmental improvements themselves.

The comparison of the WTP findings of recent studies is problematic due to reasons such as different income levels in different countries, different priorities for agroecosystem services or different levels of the analysed attributes, among other factors. However, the analysis of recent studies showed that Lithuanian consumers have quite a low WTP for improvements in agroecosystem services in contrast to other countries. The WTP is more highly connected with the lower level of income than in other countries because overall results of the study show that all the attributes are important for Lithuanian consumers, but they have little WTP. There has not been any research performed in the context of consumers' preferences for agroecosystem services in such countries as Lithuania. Only after conducting more research in this area can we make deeper conclusions.

6. Conclusions

The present study is the first application of a CE in Lithuania, and it focuses on the preference of residents for agroecosystem services in the country. Since Lithuania is part of the European Union, the study reviewed environmental agriculture schemes to support the production of agroecosystem by farmers. However, the distribution of funding is neither based on the WTP of residents nor on farmers' willingness to accept. This work wanted to understand the preferences of the citizens and their WTPs and to compare those findings to current expenditures.

The study revealed that Lithuanian residents are concerned about environmental problems in agriculture and that the provided goods are in high demand. However, the results of the application of latent class showed a high level of heterogeneity. The results highlighted three groups of citizens, including a bigger group (Class III) with intermediate values, while the other two groups show extreme values. Class II is the group with the lowest level of the WTP. The most valuable attribute is the lowest level of biodiversity preservation (WILD_L1). Class III, the greatest, always shows a higher preference for the lowest level of each attribute. Class IV is the only one with a negative sign for one of the attributes (WILD_L1). Moreover, it is also the only class in which the highest level of an attribute is preferred over the lowest (WILD_2 vs WILD_1), and there is a very high WTP for the landscape (LAND_1). Landscape is the most heterogeneous attribute, which means that payments for maintenance and improvements could be, at the same time, very liked and disliked by the population. The reduction of water pollution has the highest average value. It is also interesting to see that the older and less educated in the sample show the lowest WTP in general. This result may indicate that financial contributions to public education enhancing knowledge about environmental problems and solutions could contribute to better support for environmental protection activities. The estimate of the total WTP for the protection programme with the highest attribute level for the entire population of Lithuania was 12.5 million EUR annually.

This study represents a first analysis of the citizens' willingness to pay for agroecosystem services in Baltic countries and could be useful for policy makers. Due to the country's recent entrance into the European Union, Lithuanian farmers received funding linked to the production of ecosystem services. Understanding the demand may help policy makers allocate funds to the most demanded programmes. Considering the willingness to pay shown here, policy makers can change the current funding distribution. Moreover, Lithuania should seek to better communicate the advantages and level of ecosystem services produced by agriculture.

However, current research might have certain limitations, as it covers only three attributes for the Lithuanian case study (reduction of underground water pollution, preservation of biodiversity and sustenance and improvement of agricultural landscape). So, it is hardly comparable to current agri-environmental policy directed to creation of agroecosystem services. The future step in the research could potentially involve selection of certain attributes which would overlap with one of the agri-environmental policy measures, or inclusion of more attributes into the survey of consumer willingness to pay for agroecosystem services. This could develop clearer conclusions and recommendations for the policymakers.

References

Adamowicz, W., Louviere, J., Williams, M., 1994. Combining revealed and stated preference methods for valuing environmental amenities. Environ. Econ. Manag. 26 (3), 271–292.

Adamowicz, W., Boxall, P., Williams, M., Louviere, J., 1998. Stated preference approaches for measuring passive use values: choice experiments and contingent valuation. Am. J. Agric. Econ. 80 (1), 64–75.

Aldrich, G.A., Grimsrud, K.M., Thacher, J.A., Kotchen, M.J., 2007. Relating environmental attitudes and contingent values: how robust are methods for identifying preference heterogeneity? Environ. Res. Econ. 37, 757–775.
Arnberger, A., Eder, R., 2012. The influence of green space on community attachment of urban and suburban residents. Urban For. Urban Green. 11 (1), 41–49.
Arriaza, M., Gomez-Limon, J.A., Kallas, Z., Nekhay, O., 2008. Demand for non-commodity outputs from mountain olive groves? Agric. Econ. Rev. 9 (1), 5–23.
Baskaran, R., Cullen, R., Colombo, S., 2009a. Estimating values of environmental impacts of dairy farming in New Zealand. N. Z. J. Agric. Res. 52 (4), 377–389.
Baskaran, R., Cullen, R., Takatsuka, Y., 2009b. Estimating the value of agricultural ecosystem services: a case study of New Zealand pastoral farming. Aust. J. Environ. Manag. 16 (2), 103–112.
Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Mourato, S., Özdemiroglu, E., Pearce, D.W., Sugden, R., Swanson, J., 2002. Economic valuation with stated preference techniques: a manual. Edward Elgar, Cheltenham.
Ben- Akiva, M., Lerman, S., 1985. Discrete Choice Analysis. Theory and Application to Travel Demand. MIT Press.
Bennett, J., Blamey, R., 2001. The Choice Modelling Approach to Environmental Valuation, New Horizons in Environmental Economics. Edward Elgar, Cheltenham, UK, Northampton, MA, USA.
Bernués, A., Rodríguez-Ortega, T., Alfnes, F., Clemetsen, M., Eik, L.O., 2015. Quantifying the multifunctionality of fjord and mountain agriculture by means of sociocultural and economic valuation of ecosystem services. Land Use Policy 48, 170–178.
Birol, E., 2009. Optimal management of wetlands: quantifying trade-offs between flood risks, recreation, and biodiversity conservation. Water Res. Res. 45 (11), 1–11.
Boody, G., Vondracek, B., Andow, D.A., Krinke, M., 2005. Multifunctional agriculture in the United States. BioScience 55 (1), 27–38.
Borresch, R., Maas, S., Kim Schmitz, P., Schmitz, M., 2009. Modelling the value of a multifunctional landscape. In: A Discrete Choice Experiment − Contributed Paper Prepared for Presentation at the International Association of Agricultural Economists Conference. August 16–22 Beijing China..
Boxall, P.C., Adamowicz, W.L., 2002. Understanding heterogeneous preferences in random utility models: a latent class approach. Environ. Res. Econ. 23 (4), 421–446.
Bozdogan, H., 1987. Model Selection and Akaike's Information Criterion (AIC): the general theory and its analytical extensions. Psychometrika 52, 345–370.
Bull, J.W., Jobstvogt, N., Bohnke-Henrichs, A., Mascarenhas, A., Sitas, N., Baulcomb, C., Lambini, C.K., Rawlins, M., Baral, H., Zahringer, J., Carter-Silk, E., Balzan, M.V., Kenter, J.O., Hayha, T., Petz, K., Koss, R., 2016. Strengths, weakness, opportunities and threats: a SWOT analysis of the ecosystem services framework. Ecosyst. Serv. 17, 99–111.
Campbell, D., Hutchinson, G., Scarpa, R., 2005. Using choice experiments to value farm landscape improvements: implications of inconsistent preferences. In: Applied Environmental Conference. London.
Champ, P.A., Boyle Kevin, J., Brown, T., 2012. CA Primer on Nonmarket Valuation 3 Springer Science & Business Media.
Chan-Halbrendt, C., Lin, T., Yang, F., Sisior, G., 2010. Hawaiian residents' preferences for miconia control program attributes using conjoint choice experiment and latent class analysis. Environ. Manage. 45, 250–260.
Chen, H.Z., Cosslett, S.R., 1998. Environmental quality preference and benefit estimation in multinomial probit models: a simulation approach. Am. J. Agric. Econ. 80, 512–520.
Colombo, S., Hanley, N., Calatrava-Requena, J., 2005. Designing policy for reducing the off-farm effects of soil erosion using choice experiments. J. Agric. Econ. 56 (1), 81–95.
Colombo, S., Hanley, N., Louviere, J., 2009. Modeling preference heterogeneity in stated choice data: an analysis for public goods generated by agriculture. Agric. Econ. 40 (3), 307–322.
Dale, V.H., Polasky, S., 2007. Measures of the effects of agricultural practices on ecosystem services. Ecol. Econ. 64 (2), 286–296.
Dapkiene, V., 2016. Cereals in agricultural and food sector in Lithuania. Lithuanian Institute of Agrarian Economics. Vilnius 58–65.
Domínguez-Torreiro, M., Soliño, M., 2011. Provided and perceived status quo in choice experiments: implications for valuing the outputs of multifunctional rural areas. Ecol. Econ. 7 (12), 2523–2531.
Dominati, E., Mackay, A., Green, S., Patterson, M., 2014. A soil change-based methodology for the quantification and valuation of ecosystem services from agro-ecosystems: a case study of pastoral agricultural in New Zeland. Ecol. Econ. 100, 119–129.
ECA European Court of Auditors, 2011. Is Agri-environment Support Well Designed and Managed? Publications Office of the European Union, Luxembourg (Special report no 7).
Espinosa-Goded, M., Barreiro-Hurlé, J., Ruto, E., 2010. What do farmers want from agri-environmental scheme design?: a choice experiment approach. J. Agric. Econ. 61, 259–273.
Garrod, G., Ruto, E., Willis, K., Powe, N., 2012. Heterogeneity of preferences for the benefits of environmental stewardship: a latent-class approach. Ecol. Econ. 76, 104–111.
Grammatikopoulou, I., Pouta, E., Salmiovirta, M., Soini, K., 2012. Heterogeneous preferences for agricultural landscape improvements in Southern Finland. Landscape Urban Plann. 107 (2), 181–191.
Greiner, B., 2015. Subject pool recruitment procedures: organizing experiments with ORSEE. J. Econ. Sci. Assoc. 1 (1), 114–125.
Hagenaars, J.A., McCutcheon, A.L., 2002. Applied Latent Class Analysis. Cambridge University Press, Cambridge.
Hanley, N., Mourato, S., Wright, R.E., 2001. Choice modelling approaches: a superior alternative for environmental valuation? J. Econ. Surv. 15 (3), 435–462.
Howley, P., Dnoghue, O.C., Hynes, S., 2012. Exploring public preferences for traditional farming landscapes. Landscape Urban Plann. 104, 66–74.
Huang, J., Tichit, M., Poulot, M., Darly, S., Li, S., Petit, C., Aubry, C., 2015. Comparative review of multifunctionality and ecosystem services in sustainable agriculture. J. Environ. Manage. 149, 138–147.
Hynes, S., Hanley, N., Scarpa, R., 2008. Effect on welfare measures of alternative means of accounting for preference heterogeneity in recreational demand models. J. Agric. Econ. 90 (4), 1011–1027.
Jianjun, J., Chong, J., Thuy, T.D., Lun, L., 2013. Public preferences for cultivated land protection in Wenling city, China: a choice experiment study. Land use Policy 30 (1), 337–343.
Køùmalová, V., 2002. Evaluation of chosen benefits on environment and landscape coming from Czech agriculture? Agric. Econ. Czech 48 (1), 13–17.
Kamakura, W., Wedel, M., 2004. An empirical bayes procedure for improving individual-level estimates and predictions from finite mixtures of multinomial logit models. J. Bus. Econ. Stat. 22 (1), 121–125.
Karlsson, I., Ryden, N., 2012. Rural Development and Land Use The Baltic University Programme. Uppsala University (ISBN 978-91-86189-11-2).
Kenter, J.O., Hyde, T., Christie, M., Fazey, I., 2011. The importance of deliberation in valuing ecosystem services in developing countries- evidence from the Solomon Islands. Glob. Environ. Change 21 (2), 505–521.
Kubičkova, S., 2004. Non-market evaluation of landscape function of agriculture in the PLA White Carpathians. Agric. Econ. 50, 388–393.
Lancaster, K.J., 1966. A new approach to consumer theory. J. Polit. Econ. 74, 132–157.
Landis, D., 2017. Designing agricultural landscapes for biodiversity-based ecosystem services. Basic Appl. Ecol. 18, 1–12.
Lithuanian Institute of agrarian economics, 2016. Agriculture and Food Sector in Lithuania. (Vilnius).
Maduireira, L., Nunes, L., Xavier, R., Loureiro, S., 2013. The valuation of ecosystem services as a tool to support the design and assessment of landscape requalification. A case- study for the NP of Serra da Estrela, Portugal. 19th APDR Congress, place-based policies and economic recovery. University of Minha Braga 20–22 June 2013.
Matzdorf, B., Meyer, C., 2014. The relevance of the ecosystem services framework for developed countries' environmental policies: a comparative case study of the US and EU. Land Use Policy 38, 509–521.
McFadden, D., Train, K., 2000. Mixed MNL models for discrete response. J. Appl. Econ. 15 (5), 447–470.
McFadden, D., 1973. Conditional logit analysis of qualitative choice behaviour. In: Zarembka, P. (Ed.), Frontiers in Econometrics. Academic Press, New York.
Millennium Ecosystem Assessment, 2003. Ecosystem and Human Well-being: Framework for Assessment. Island Press, Washington DC.
Ministry of Agriculture of the Republic of Lithuania, 2014. Lithuania - Rural Development Programme 2014–2020. Lithuania.
Mitchell, R.C., Carson, R.T., 1989. Using surveys to value public goods – the contingent valuation method. Resources for the future: Washington DC.
Morey, E., Thacher, J., Breffle, W., 2006. Using angler characteristics and attitudinal data to identify environmental preference classes: a latent-class model. Environ. Res. Econ. 34 (1), 91–115.
Pilipavičius, V., Grigaliūnas, A., 2014. Lithuanian organic agriculture in the context of european union. In: Pilipavičius, V. (Ed.), Organic Agriculture Towards Sustainability. INTECH.
Posada, D., Buckley, T.R., 2004. Model selection and model averaging in phylogenetics: advantages of akaike information criterion and bayesian approaches over likelihood ratio tests. Syst. Biol. 53 (5), 793–808.
Power, A.G., 2010. Ecosystem services and agriculture: tradeoffs and synergies. Philos. Trans. R. Soc. B 365, 2959–2971.
Provencher, B., Baerenklau, K., Bishop, R., 2002. A finite mixture logit model of recreational angling serially correlated random utility. Am. J. Agric. Econ. 84 (4), 1066–1075.
Ranganathan, J., Raudseppe-Hearne, C., Lucas, N., Irwin, F., Zurek, M., Bennett, K., Ash, N., West, P., 2008. Ecosystem Services; a Guide for Decision-makers. World Resources Institute, Washington, D.C.
Rocchi, L., Paolotti, L., Fagioli, F.F., 2017. Defining agri-environmental schemes in the buffer areas of a natural regional park: an application of choice experiment using a latent class approach. Land Use Policy 66, 141–150.
Rodríguez-Entrena, M., Barreiro-Hurlé, J., Gómez-Limón, J.A., Espinosa-Goded, M., Castro-Rodríguez, J., 2012. Evaluating the demand for carbon sequestration in olive grove soils as a strategy toward mitigating climate change. J. Environ. Manage. 112, 368–376.
Rodríguez-Ortega, T., Oteros-Rozas, E., Ripoll-Bosch, R., Tichit, M., Martín-López, B., Bernués, A., 2014. Applying the ecosystem services framework to pasture-based livestock farming systems in Europe. Animal 8, 1361–1372.
Rodríguez-Ortega, T., Bernués, A., Alfnes, F., 2016. Psychographic profile affects willingness to pay for ecosystem services provided by Mediterranean high nature value farmland. Ecol. Econ. 128, 232–245.
Sayadi, S., Gonzalez, M., Calatrava- Requena, J., 2009. Public preferences for landscape features: the case of agricultural landscape in mountainous Mediterranean areas. Land Use Policy 26, 334–344.
Scarpa, R., Thiene, M., 2005. Destination choice models for rock-climbing in the North-Eastern Alps: a latent-class approach based on intensity of preferences. Land Econ. 85 (3).
Scarpa, R., Willis, K.G., Acutt, M., 2005. Individual specific welfare measures for public goods: a latent class approach to residential customers of Yorkshire Water. In: Koundouri, P. (Ed.), Econometrics Informing Natural Resource Management. Cheltenham, UK, Edward Elgar Publisher.
Scholte, A., van Teeffelen, A., Verburg, P., 2015. Integrating socio-cultural perspectives

into ecosystem service valuation: a review of concepts and methods. Ecol. Econ. 114, 65–78.
Smith, P., Martino, D., Cai, Z., Gwary, D., Janzen, H., Kumar, P., McCarl, B., Ogle, S., O'Mara, F., Rice, C., Scholes, B., Sirotenko, O., Howden, M., McAllister, T., Pan, G., R.Omanenkov, V., Schneider, U., Towprayoon, S., Watternbach, M., Smith, J., 2008. Greenhouse gas mitigation in agriculture. Philoso. Trans. B 363 (1492), 789–813.
Soini, K., Aakkula, J., 2007. Framing the biodiversity of agricultural landscape: the essence of local conceptions and constructions. Land Use Policy 24 (2), 311–321.
Swait, J.R., 1994. A structural equation model of latent segmentation and product choice for cross-sectional, revealed preference choice data. J. Retai. Consum. Serv. 1 (2), 334–344.
Swinton, S.M., Lupi, F., Robertson, G.P., Hamilton, S.K., 2007. Ecosystem services and agriculture: cultivating agricultural ecosystems for diverse benefits? Ecol. Econ. 64 (2), 245–252.
Szabó, Z., 2010. Evaluation of Environmental Impacts of Crop Production, with Particular Focus on Biodiversity External Impacts of an Intensive Farm and an Ecological Farm. Ph.D. Dissertation. pp. 234 (Budapest).
Takatsuka, Y., Cullen, R., Wilson, M., Wratten, S., 2006. Values of ecosystem services on arable land and the role of organic farming. In: Paper Prepared for the 3rd World Congress of Environmental and Resource Economists. Kyoto, Japan on July 3–7, 2006..
Thurstone, l., 1927. A law of comparative judgement. Psychol. Rev. 34 (4), 273–286.
Train, K., 1998. Recreation demand models with taste differences over people. Land Econ. 74, 230–239.
Train, K., 2003. Discrete Choice Methods with Simulation. Cambridge University Press, New York.
Tsai, M.H., 1993. A study of paddy rice fields' external benefit. Op. Water Res. Consort. 1–66.
Turner, R.K., Daily, G.C., 2008. The ecosystem services framework and natural capital conservation. Environ. Res. Econ. 39 (1), 25–35.
Uthes, S., Matzdorf, B., 2013. Studies on agri-environmental measures: a survey of the literature. Environ. Manage. 51, 251–266.
Villanueva, A.J., Gómez-Limón, J.A., Arriaza, M., Rodríguez-Entrena, M., 2015. The design of agri-environmental schemes: farmers' preferences in Southern Spain. Land Use Policy 46 (0), 142–154.
Vivithkeyoonvong, S., Jourdain, D., 2017. Willingness to pay for ecosystem services provided by irrigated agriculture in Northeast Thailand. Int. J. Biodivers. Sci. Ecosyst. Serv. Manag. 13 (1), 14–26.
Wedel, M., Kamakura, W., 2000. Marketing Segmentation: Conceptual and Methodological Foundations, second ed. Kluwer Academic Publishers, Boston.
Yong-Kwang, S., Chang-Gil, K., 2006. Economic valuation of environmentally friendly agriculture for improving environmental quality. J. Rural Dev. 29 (4), 73–86.
Zhang, W., Ricketts, T., Kremen, C., Carney, K., Swinton, S., 2007. Ecosystem services and dis- services to agriculture. Ecol. Econ. 64 (2), 253–260.