The importance of agricultural objectives – summary of studies

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Abstract

This paper summarizes information on the importance of the objectives of agriculture and agricultural policies based on previous studies. We focus on studies that examine stakeholder preferences and provide relative weights for the economic, social and environmental dimensions of sustainability. Descriptive and meta-analysis are used to evaluate the 34 identified studies. The findings show the equal importance of the economic, social and environmental objectives of agriculture, but also that the general public emphasizes social values, while economic considerations are highlighted in nation-wide studies. Of the environmental objectives, those pertaining to sustainable resource management have received most weight.

Keywords: agriculture, multifunctionality, objectives, sustainability, weighting

1. Introduction

Various and sometimes conflicting expectations are often placed on agricultural production, such as ensuring food security, providing rural employment, producing organic and local food, protecting the environment and landscape, as well as strengthening the competitiveness of domestic production. These expectations are based on society's values and norms, and reflect economic, social and environmental considerations. Achieving all objectives simultaneously is challenging, especially when public resources allocated to agriculture are being reduced (EC 2013). Thus, it is important to analyse how the different objectives set for agricultural production are viewed and weighted among stakeholders, i.e. citizens, farmers and experts.

Systematic evaluations of agricultural and rural policy objectives are needed for developing consistent agricultural policies and policy tools. This is the case particularly for environmental policy that is in many European countries a collection of more or less coordinated instruments that address specific questions. Typically, national policy measures are used to complement the European Union Common Agricultural Policy (CAP), which complicates the objective setting. Policy changes are difficult, as there is no clear understanding of the relative importance of different objectives of agriculture.

Despite the stagnated policy tools, consumer tastes and citizen expectations are changing in response to accumulating knowledge and trends. Citizen and consumer-oriented food and rural policies have been emphasised in international discussion of agricultural policy (ENRD 2010; Van Tongeren 2008). However, consumers' heterogeneous voice is largely ignored in agricultural policymaking and production. As farmers and experts tend to be strongly represented and get their voices heard in policy processes, it is useful to know if and how the preferences of the general public differ from those of farmers and experts.

Several studies, including the Eurobarometer (EC 2014), have focused on citizen or consumer preferences for policy objectives. In the previous literature, the objectives of agriculture and rural policies have been discussed using the concepts of multifunctionality (e.g. Arovuori & Kola 2005, Gomez-Limon et al. 2012, Domínguez-Torreiro et al. 2013) and sustainability (Sydorovych & Wossink 2008, Salazar-Ordonez et al. 2013). Some of the studies have focused only on the environmental objectives of agriculture from the policy point of view (e.g. Bartolini et al 2011) or using the concept of ecosystem services (Dale & Polasky 2007). Hall et al. (2004) reviewed studies of public preferences conducted in UK and US, evaluating the methods and illustrating the results of individual studies. Furthermore, Johnston & Duke (2009) performed a meta-analysis of willingness to pay for multifunctional agriculture in general. However, to the best of our knowledge, there are no systematic reviews or analyses of the previous literature focusing on the relative importance of agricultural or rural policy objectives. Separate studies provide snapshots of the weights of policy objectives, but it is interesting to take stock of the literature as a whole and to examine the possible differences in the importance of agricultural policy objectives among the stakeholders.

In this study, we review and summarize existing literature using descriptive analysis and meta-analytic techniques to examine the importance of agricultural and rural policy objectives and to build a framework for the objective categories. We focus on studies that examine public, farmer and expert preferences for agricultural policy by studying the relative importance (i.e. weight) of the economic, social and environmental objectives of agriculture. We analyse the weights of various objectives in agriculture in regional or national studies and define which factors explain the relative importance of agricultural objectives. The aim is to facilitate the discussion on the targets of the CAP, as well as, national agricultural and agri-environmental policies.

Meta-analysis refers to methods and techniques that summarize the results of empirical studies (Glass 1976), and has been extensively used in environmental and resource economics since the early 1990s. Meta-regression is the predominant method of analysis, allowing the examination of heterogeneity across studies and the effects of explanatory variables on the distribution of objectives. Meta-analysis can serve three general purposes: research evaluation and synthesis, hypothesis testing, and results transfer (Smith and Pattanayak 2002). Our emphasis is on evaluating and summarizing existing research on the policy objectives of agricultural and rural policies. As the data of weights is of compositional in nature, i.e. the weights sum to one and are dependent of each other, we use compositional data methods in the statistical analysis.

The paper is organized as follows. Section 2 describes the data and the methods used in the analysis. Section 3 presents the results of the descriptive and meta-analysis and section 4 provides discussion and conclusions.

2. Data and methods

2.1 Study searches and data set

As the aim was to study the relative importance of different agricultural objectives, the initial foci of the study search were the public and/or stakeholder preferences for agricultural multifunctionality and for environmental amenities or objectives in agriculture. The search for studies was conducted in the autumn of 2013 using the databases Academic Search Complete (EBSCO), Web of Knowledge (ISI), SCOPUS (Elsevier), AGRIS and Google Scholar[1]. Several relevant studies were also found by following the references in the articles located by the keyword searches.

A total of 34 empirical studies with 70 observations were found (see Appendix A). The studies included in the data set reported the views of citizens, farmers or experts on the importance of different aspects of agricultural multifunctionality and agri-environmental issues and presented the relative weights for these aspects. Most studies contained several observations: from various study areas, using different methods or representing various levels of function generality.

[1] At the first stage, the keywords included different combinations of the following: agricultural multifunctionality / multifunctional agriculture / sustainable agriculture; aspects / attributes / weights; attitu des / preferences / perceptions / demand; citizen / public / societal / social / consumer. At the second stage, keywords were modified to include: environmental / agri-environmental / ecological; functions / benefits / objectives / concerns; policy / multi-criteria / ahp (analytic hierarchy process).

2.2 Dependent variable: the weight of agricultural objectives

Most of the studies utilized the Analytic Hierarchy Process (AHP) (Saaty 1980), which produces relative weights (shares of importance) for each investigated aspect. The representation of respondent preferences as relative shares of importance was considered purposeful, and consequently any study results derived by some other method were converted into this ("normalised") form. This was the case with studies that used scales to determine, for example, whether some function was "not", "somewhat", "rather" or "very" important. These response options were assigned with importance points 0, 1, 2 and 3, respectively, allowing the calculation of an importance score for each function. Dividing each function importance score by the sum of importance scores yielded the normalised weights. Some studies asked the respondents to choose the most important function or to state all valued functions, in which case the normalisation involved only dividing each option percentage by the sum of all option percentages.

The studies were found to be heterogeneous in terms of the focus and scope of the weighting. Many studies reported preferences for general dimensions of agricultural multifunctionality (economic, social and environmental) and some studies concentrated solely on the environmental functions of agriculture. In order to make better use of the available data, two separate data sets were prepared for analysing the relative weights assigned to the dimensions of 1) general agricultural multifunctionality (MF) and 2) environmental issues in agriculture (ENV). The same study could be included in both data sets.

For the multifunctional data (MF), three weight categories were established: economic, social and environmental. These categories recur in the literature on multifunctional agriculture (including the investigated studies) and match the traditional definition of sustainable development. The economic category was defined to include the aspects of private profitability and quality of production as well as rural employment and income. The social category encompassed rural lifestyle and cultural heritage, food security and animal welfare. The environmental category consisted of sustainable resource management, biodiversity and landscape. The allocation of the weights reported in the studies to the three categories was mostly straightforward and only involved consideration in some cases where the objective had characteristics pertaining both to economic and social aspects.

For the agri-environmental data set (ENV), three weight categories were formed: biodiversity, landscape and sustainable resource management (including water management, soil protection and air and climate protection). The rationale behind merging the aspects of resource management into one category was that most preference observations did not include distinct weights for water, soil and air but only reported the weight of a more general resource category. Weights from observations concentrating solely on environmental functions were included in this data sets in their original (normalized when needed) values. In contrast, if a preference observation reported both environmental and general weights (and was thus included in both data sets), the relative (internal) weights of environmental functions were obtained by dividing each reported environmental weight by the sum of all reported environmental weights.

2.3. Independent variables

For the purpose of analysing the data, detailed characteristics of each study were collected and added to the data sets. These were features that could potentially explain the observed weights and their differences across studies, including characteristics of the publication (type), study year, study area (continent, geographical scope, GDP per capita, population density, land share of agriculture) and survey design (target group, sample size, weighting focus).

Some socio-economic data on the study areas that was not available in the study reports, i.e. GDP per capita, population density and land share of agriculture, were gathered from different sources and added to the data set[2]. For regional level studies appropriate regional data was used, with the exception of two study areas (in Iran and Senegal) where regional data was not available. To express the per capita GDPs in constant purchasing power parity (PPP) international dollars, they were first converted to constant 2005 currencies using consumer price indices for each country and then adjusted by the PPP conversion factors using data from the World Bank.

2.3 Statistical analysis

In the descriptive part we reviewed the literature to obtain a more comprehensive understanding of the studies on the different objectives of agricultural policies. For this purpose, we used summary tables and figures to describe the distribution of the variables in our data sets. The qualitative analysis also provided descriptive statistics for the selection of variables available for the meta-regression analysis.

As the dependent variable constitutes of the weights of the agricultural objectives, it is a composition, i.e. its components are strictly positive, sum up to a constant and carry only relative information. A composition is a vector, where the elements are denoted as components. The term composition is used to highlight its special nature. Because components carry only relative information, standard statistical analyses are not suitable for compositional data (Aitchison 1986). Compositional data can be analyzed by choosing a proper multivariate scale. We have used the Aitchison geometry (Aitchison 1986). An important operation in the Aitchison geometry is perturbation, which for a D-part composition y and a D-vector x is defined as

$$y \oplus z = \mathcal{C}(y_1 z_1, \dots, y_D z_D), \quad (1)$$

where $\mathcal{C}$ is the closure operation defined as

$$\mathcal{C}(y) = \frac{y}{1^T y}. \quad (2)$$

The interpretation of a compositional regression model differs from the interpretation of a traditional regression model. The model intercept is interpreted as the expected composition at the baseline level of the explanatory variable. For numeric explanatory variables the slope is interpreted as the perturbation applied to the composition if the explanatory variable increases one unit. For a single main effect ANOVA model, the main effect constant is interpreted as the increment (as perturbation) on average response from the first to the second level.

Coordinate representation is a crucial concept in analyzing compositional data. Because absolute size is irrelevant for compositional data as interest lies in the relative proportions between the weights, a transformation on the data must be performed. We used the isometric logratio (ilr) transformation (Egozcue 2003), which allows the compositions to be presented in an orthogonal coordinate system.[3] Furthermore, transformations allow the use of classical statistical analysis, such as explanatory data analysis and linear regression.

[2] Sources included Eurostat, USDA Census, the Italian National Institute of Statistics (Istat) and World Bank.

[3] The specifics of the ilr transformation are not presented here; rather the interested reader is encouraged to see, for example, Egozcue (2003) and Boogart (2013).

In the following we discuss the main data analytical tools used in analyzing the compositional data. Let Y denote the compositional response matrix. That is, Y is an $N \times D$ matrix, where for each composition (row) $y_i, \sum_{j=1}^{D} y_{ij} = 1$ and $y_{ij} \in \mathbb{R}^+ (i = 1, \dots, N; j = 1, \dots, D)$. For MF and ENV data, the number of compositions are $N = 30$ and $N = 33$, respectively. For both data, the number of components is $D = 3$. As a measure of central tendency of Y we use the compositional mean defined as

$$\bar{y} = \mathcal{C}\left[\exp\left(\tfrac{1}{N}\sum_{i=1}^{N} \ln(y_i)\right)\right]. \quad (3)$$

The variation of the components can be examined using the variation matrix (Aitchison 1986) whose elements are defined as

$$\tau_{ij} = var\left(ln\frac{y_i}{y_j}\right)\ (i = 1, \dots, D-1; j = i+1, \dots, D). \quad (4)$$

To help in the interpretation of the variation matrix, Aitchison (1997) suggested considering the transformation

$$\rho_{ij} = \exp\left(-\frac{\tau_{ij}^2}{2}\right), \quad (5)$$

which can interpreted as a correlation coefficient.

In addition to exploratory data analysis, we fit a linear regression model of the form

$$ilr(y_i) = ilr(a) + \sum_{j=1}^{k} X_{ij} ilr(b_j) + ilr(\varepsilon_i)\ (i = 1, \dots, N), \quad (6)$$

where j denotes the variable index, i denotes the composition, ilr denotes the ilr transformation and ε is a compositional random variable with null compositional expectation (neutral element) $\mathbb{I} = \frac{1,\dots,1}{D} = (1,1,1)/3$ and a clr-covariance matrix Σ. We assume that $\varepsilon_i \sim N_S^D(1, \Sigma)$ (see Aitchison (1986) for details). Thus $k = 2$ for the model corresponding to the MF data ($j = 1$ corresponds to NATIONAL and $j = 2$ corresponds to CITIZEN) and $k = 1$ for the model corresponding to the ENV data ($j = 1$ corresponds to YEAR). We performed the bulk of the statistical analyses using the R software (R core team 2013) and the package *compositions* (Boogart 2013b).

3. Results

3.1 Descriptive statistics of the data

Descriptive statistics of the studies are presented in Table 1. A clear majority of the observations were published in peer-reviewed journals. The most common study area was Europe with more than three-fourths of the observations, followed by North America, and geographical scope was predominantly regional. Roughly half of the observations reported the preferences of citizens, one-third those of experts and the rest those of farmers. Almost half of the observations were from study designs with samples of 100-1000 individuals and a little less from those with smaller samples. In most observations the focus was on agricultural multifunctionality or policy objectives; other recurring foci were environmental or sustainability criteria, rural multifunctionality and landscape functions. Analytical Hierarchy Process was the predominant weighting method followed by the (normalised) share of stated importance; only in Schmitz et al. (2003) the weights were derived from the estimation coefficients.

Table 1. Summary statistics for all observations (n=70)

Statistic		Number	%
Publication type			
	Journal article	59	84.3
	Discussion paper	4	5.7
	Survey report	5	7.1
	Data set	2	2.9
Continent			
	Europe	54	77.1
	North-America	10	14.3
	Asia	4	5.7
	Africa	2	2.9
Geographic scope			
	National	18	25.7
	Regional	45	64.3
	Local	7	10.0
Population density			
	Below 100 inhabitants per km²	44	62.9
	100 inhabitants per km² or above	26	37.1
Land share of agriculture			
	Below 50 %	33	47.1
	50 % or above	37	52.9
Target group			
	Citizens	33	49.3
	Farmers	11	16.4
	Experts	23	34.3
Sample size			
	Below 100	28	40.0
	100 - 1000	33	47.1
	1000 or above	9	12.9
Weighting focus			
	Agricultural multifunctionality	18	25.7
	Rural multifunctionality	5	7.1
	Land(scape) functions	4	5.7
	Sustainability (general) criteria	8	11.4
	Environmental criteria	10	14.3
	Policy objectives	22	31.4
	Other	3	4.3
Weighting method			
	Analytical Hierarchy Process	41	58.6
	Direct point allocation	11	15.7
	Importance share (normalised)	16	22.9
	Estimation coefficients	2	2.9

3.2 Multifunctional and environmental objectives of agriculture

The mean weights for the economic, environmental and social components of agriculture obtained in the studies turned out to be remarkably even (see the left panel in Figure 1). In Figure 1, every point in the equilateral triangle represents an observation, i.e. a different composition of the three multifunctionality weights (economic, environmental and social).

The further away the representative point is from the opposite side, the larger the component is. The left panel of Figure 1 illustrates that all components of agricultural multifunctionality have received relatively similar weights in the studies, and that the compositional mean, marked with a red dot, is close to the centre of the triangle. There are also no obvious clusters of compositions in the triangle.

To examine the component-wise variation for all compositions, we present the correlation matrix $cor(Y)_{MF}$ with ρ_{ij} elements. The correlation matrix for the multifunctionality data is

$$cor(Y)_{MF} = \begin{pmatrix} 1 & 0.878 & 0.798 \\ 0.878 & 1 & 0.916 \\ 0.798 & 0.916 & 1 \end{pmatrix},$$

which reflects how the component-wise proportions vary through all compositions. The diagonal of $cor(Y)_{MF}$ is all ones, since in the diagonal we compare two identical compositions whose component-wise proportions are identical. All other correlations are quite large, which means that component-wise proportions vary quite little from composition to composition.

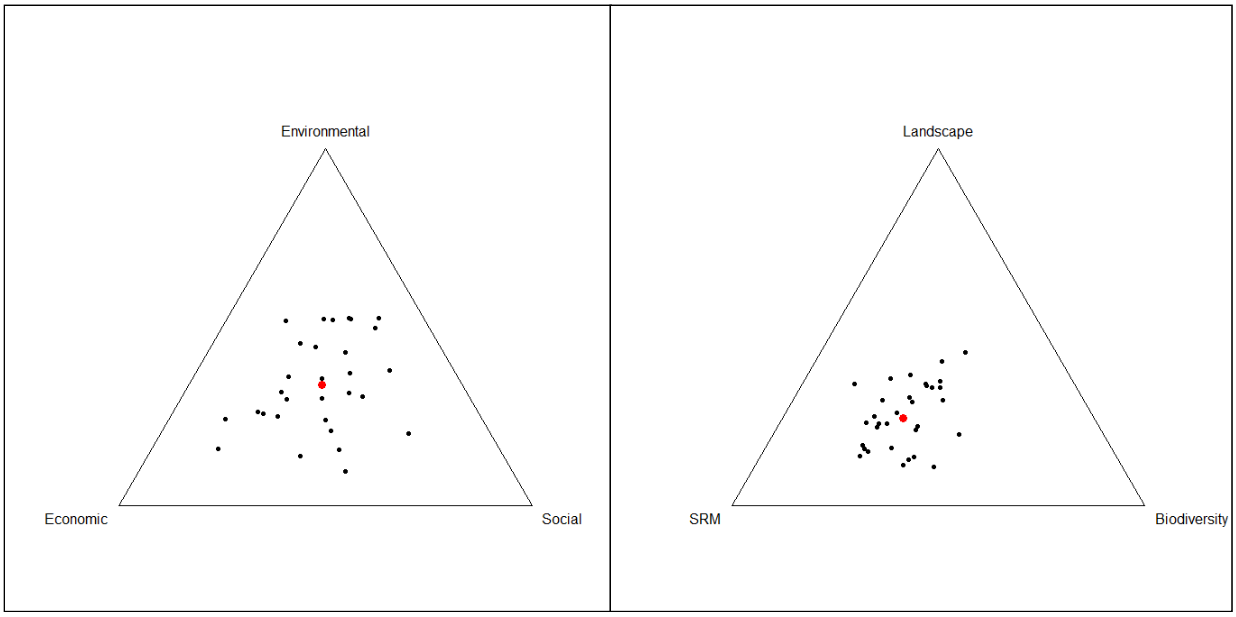

Figure 1. Triangle plot of the multifunctionality data (n=30) (left panel) and the environmental data (n=33) (right panel) with the compositional mean (red dot)

The right panel of Figure 1 presents the compositions of the environmental data (ENV), i.e. landscape, biodiversity and sustainable resource management (SRM). The right panel of Figure 1 illustrates that the weights given to sustainable resource management are typically larger than those given to landscape or biodiversity. The domination of sustainable resource management is partly explained by the procedure described in section 2.2.: observations that differentiated between various dimensions of SRM were included to the data set by summing up the weights for water management, soil, air and climate protection and “other” to form the sustainable resource management weight category. The inclusion of many resource-related options in the survey may have inclined the respondents to assign more total weight to sustainable resource objectives relative to the biodiversity and landscape objectives.

Let $cor(Y)_{ENV}$ denote the correlation matrix with ρ_{ij} elements corresponding to the ENV data. This correlation matrix is

$$cor(Y)_{ENV} = \begin{pmatrix} 1 & 0.983 & 0.946 \\ 0.983 & 1 & 0.967 \\ 0.946 & 0.967 & 1 \end{pmatrix},$$

which shows that the off-diagonal correlations are very close to one. This means that the component-wise proportions are roughly equal through all compositions.

3.3 Meta-regression analysis

Table 2 presents the descriptive statistics for the variables used in the regression analysis. The dependent variable for the multifunctionality data is the composition consisting of the economic, social and environmental components, and for the environmental data it is the composition consisting of the landscape, biodiversity and sustainable resource management components. We fitted several models for both the multifunctional and environmental data, but only found variables NATION and CITIZEN significant in the multifunctionality data and variable YEAR significant in the environmental data. The frequencies of the groups for NATION are (Local/Regional)=19 and (National)=11, and for CITIZEN (Citizen)=17 and (Farmer/Expert)=13. We gave each composition an equal weight in the regression analysis.

Table 2. Summary statistics for the compositions and explanatory variables used in the regression analysis

Multifunctionality data (n=30)		
Variable	Description	Compositional mean
W_ECONOM	Weight of the economic component	0.338
W_SOCIAL	Weight of the social component	0.324
W_ENVIRO	Weight of the environmental component	0.338
NATION	1 if the geographic scope is national, 0 if regional/local	0.370
CITIZEN	1 if the target group is citizens, 0 otherwise	0.570
Environmental data (n=33)		
Variable	Description	Compositional mean
W_SUSTRE	Weight of sustainable resource management	0.462
W_BIODIV	Weight of biodiversity	0.245
W_LANDSC	Weight of landscape	0.293
YEAR	Study year, continuous, from 0 (2000) to 11 (2011)	

Tables 3 and 4 show the main regression results for the multifunctionality and environmental data. For MF (Table 3), we interpret the constant as the expected composition for the baseline level (geographic scope is local or regional study and the target group farmers or experts). Parameters corresponding to NATION and CITIZEN are interpreted as the increments on average response from the baseline to levels Nation and Citizen, respectively. In the interpretation one may compare the estimated composition parameters to the neutral element $\mathbb{I}$. That is, any component greater than $1/3$ can be seen as having an increasing effect and any component value smaller than $1/3$ can be seen as having a decreasing effect on the dependent variable. NATION has the largest component for the economic component, and the values are less than $1/3$ for social and environmental components. Thus, in nation-wide studies the weight of the economic element is larger than in local or regional studies. For CITIZEN, the social element increases whereas the other components decrease, indicating that the weight of the social element is higher when the preferences of citizens are in question.

For ENV, the slope of YEAR is interpreted as the yearly increase of the composition. For YEAR=0, the constant has the largest component for sustainable resource management. The slope estimate shows that each component is very close to $1/3$. However, since the biodiversity component is greater than $1/3$, it increases slightly through time.

Table 3. Linear regression results for the multifunctional data

Dependent	(Economic, Social, Environmental)		
Variable	Coefficient	F statistic	Pr(>F)
Constant	(0.335, 0.270, 0.395)	0.11	0.90
NATION	(0.452, 0.317, 0.231)*	2.86	0.08
CITIZEN	(0.259, 0.442, 0.299)*	2.90	0.07
Adjusted R^2	0.12		
N	30		
Variables are significant at the * 10% level			

Table 4. Linear regression results for the environmental data

Dependent	(SRM, Biodiversity, Landscape)		
Variable	Coefficient	F statistic	Pr(>F)
Constant	(0.496, 0.254, 0.250)***	26.7	0.00
YEAR	(0.326, 0.343, 0.330)**	4.50	0.02
Adjusted R^2	0.05		
N	33		
Variables are significant at the ** 5% level, *** 1% level.			

4. Discussion and conclusions

This review identified 34 studies on the relative importance of agricultural policy objectives among farmers, experts and the general public. Altogether, the importance of economic, social and environmental objectives of agriculture was on a similar level. The results indicate that the public emphasizes social values, and economic considerations are highlighted in nation-wide studies. The social objectives are more prominent in the data due to a large share of studies examining citizen perspectives. Of the environmental objectives of agriculture, those pertaining to sustainable resource management have received most weight. The importance of objectives related to biodiversity seems to have increased during the recent years.

Incorporation of studies with different focus broadens the range of available data somewhat but also entails challenges. Converting observations from studies heterogeneous in their goals, as well as methods, into a comparable form necessitates choices and compromises in the treatment of the data. As the data set for the present summary was compiled to be rather inclusive, any results should be considered tentative only. In addition, the number of observations and the compositional nature of the data caused some restrictions in the analysis.

Despite the limitations, the findings indicate that some studies have addressed multifunctionality and sustainability, and some have focused solely on environmental targets of agriculture. Although the general aim of the study was to analyse the agricultural objectives observed in various policy discussions, interestingly, the discussion of multifunctionality and sustainability formed one uniform set of studies. This leads to the conclusion that the concepts of multifunctionality and sustainability go hand in hand in agricultural issues.

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Appendix A. Studies included in the data sets

Study no.	Author(s) and publication year	Country	Weighting focus	Number of obs.
1	Miškolci, S. (2008)	Czech Republic	Agricultural multifunctionality	2
2	Aizaki, H., Sato, K. & Osari, H. (2006)	Japan	Agricultural and rural multifunctionality	1
3	Gómez-Limón, A., Vera-Toscano, E. & Rico-González, M. (2012)	Spain	Rural multifunctionality	2
4	Kallas, Z., Gómez-Limón, A. & Hurlé, J. B. (2007)	Spain	Agricultural multifunctionality	1
5	Moran, D., McVittie, A., Allcroft, D. & Elston, D. (2007)	UK	Agri-environmental policies	3
6	Duke, J. & Aull-Hyde, R. (2002)	USA	Farmland preservation functions	2
7	Arriaza, M. & Gómez-Limón, A. (2011)	Spain	Agricultural multifunctionality	2
8	Yrjölä, T. & Kola, J. (2004)	Finland	Agricultural issues	2
9	Schmitz, K., Schmitz, P. & Wronka, T. (2003)	Germany	Landscape functions	2
10	Salazar-Ordóñez, M., Rodríguez-Entrena, M. & Sayadi, S. (2013)	Spain	Sustainability criteria	2
11	BMRB International for Royal Society for the Protection of Birds (2002)	UK	Rural multifunctionality	1
12	Gómez-Limón, A. & Atance, I. (2004)	Spain	CAP objectives	2
13	Gómez-Limón, A. & Arriaza, M. (2013)	Spain	Rural multifunctionality	2
14	TNS Opinion & Social for Directorate General for Agriculture and Development (2010)	Bulgaria	CAP objectives	3
15	Qiuzhen, Z. & Sumelius, J. (2006)	China	Agricultural multifunctionality	1
16	Arovuori, K. & Kola, J. (2005)	Finland	Agricultural multifunctionality	1
17	Arovuori, K. & Kola, J. (2006)	Finland	Agricultural multifunctionality	1
18	Miškolci, S. & Bendová, R. (2006)	Czech Republic	Agricultural multifunctionality	2
19	Lubben, B., Bills, N., Johnson, J. & Novak, J. (2006)	USA	Farm Bill Goals	1
20	Wytrzens H. K., Vogel S., Maurer O., Sargl M. & Sapelza W. (2006)	Italy	Multifunctionality of grassland agriculture	2
21	Kallas, Z., Baba, Y. & Rabell, C. (2012)	Senegal	Multifunctionality in rice farming	2
22	Rezaei-Moghaddam, K. & Karami, E. (2006)	Iran	Sustainability criteria	2
23	Mawapanga, M. & Debertin, D. (1996)	USA	Farming objectives	2
24	Sydorowych, O. & Wossink, A. (2008)	USA	Environmental criteria	3
25	Soini, K., Vaarala, H. & Pouta, E. (-)	Finland	Environmental issues	1
26	Tienhaara, A, Ahtiainen, H. & Pouta, E. (-)	Finland	Environmental issues	1
27	Bartolini, F., Gallerani, V. & Viaggi, D. (2011)	Belgium	Agri-environmental schemes	10
28	Vesterager, J. P., Teilmann, K. & Vejre, H. (2011)	Denmark	Environmental issues	2
29	Knickel, K. & Kasperczyk, N. (2009)	Germany	Environmental criteria	1
30	Mortimer, S., Mauchline, A., Park, J., Finn, J. & Edwards, D. & Morris, J. (2010)	UK	Environmental criteria	1
31	Ziolkowska, J. (2008)	Poland	Agri-environmental measures	3
32	Parra-López, C., Calatrava-Requena, J. & de-Haro-Giménez, T. (2008)	Spain	Multifunctionality in olive systems	2
33	van Calker, K., Berentsen, P., Giesen, G. & Huirne, R. (2008)	The Netherlands	Sustainability criteria in dairy farming	3
34	Dunlap, R., Beus, C., Howll, R. & Waud, J. (1992)	USA	Sustainability criteria	2