Conference Paper

Center for International Food and Agricultural Policy

Research, Food and Nutrition, Commodity and Trade,
Development Assistance, Natural Resource and Environmental Policy

Factors Affecting Farmers' Participation in Agri-Environmental Measures: Evidence from a Case Study

by

Edi Defrancesco,* Paola Gatto, * Ford Runge** and Samuele Trestini*
*University of Padova; **University of Minnesota

Center for International Food and Agricultural Policy
University of Minnesota
Department of Applied Economics
1994 Buford Avenue
St. Paul, MN 55108-6040
U.S.A.

Paper presented at the 10th Joint Conference on Food, Agriculture and the Environment,
Duluth, Minnesota, August 27-30, 2006.

Factors affecting farmers' participation in agri-environmental measures: evidence from a case study[1]

Edi Defrancesco, Paola Gatto, Ford Runge and Samuele Trestini
Department of Land and Agro-forestry Systems, University of Padova
Department of Applied Economics, University of Minnesota

Summary

Starting from the McSharry reform in 1992, environmental conservation and minimization of negative agricultural impacts through adoption of agri-environmental farming practices have gained momentum within the European Common Agricultural Policy (CAP). Agenda 2000 and the recent issuing of Regulation 1698/2005 – with its strong accent on CAP's second pillar – have further emphasized the need to reduce environmental risks within the context of sustainable and integrated rural development. Nowadays, agri-environmental measures are the only compulsory measure for Member States in the Rural Development Programs. The result of this shift in CAP objectives is the increased agri-environmental spending in the total EU agricultural budget and the parallel growth in farmland enrolled in agri-environment measures throughout Europe in the last decade. Since the start of the new policy trend, the EU has invested considerable effort in monitoring and evaluating its impacts on the various environmental items and progress has been made. However, less is known so far on the factors inducing farmers' participation in the agri-environmental programs. This paper aims to explore this field taking the Veneto Region of Italy as a case study. The framework for the analysis is represented by the four main agri-environmental actions in place in the Veneto Region in the period 2000-2006, with their main objectives, eligibility criteria, ranking priorities and budget assigned. Farmers' behavior has been explained via farm characteristics, farmland structure, as well farmers' socio-economic profile, attitudes and perceptions towards agri-environmental measures. These variables have been collected in a survey of participating and non-participating farmers. This is crucial information that can affect policy success and therefore needed for further policy design.

Keywords: agri-environmental schemes, farmers' participation, attitudes

[1] This research is linked to the Project SSPE-CT-2003-502070 ITAES Integrated Tools to design and implement Agro Environmental Schemes financed by the EU under the VI Framework Programme, coordinated by the Institut National de la Recherche Agronomique (INRA-ESR, Rennes), France. Authors thank the Agricultural Planning Division staff of the Veneto Region for advice in the sample-design stage and Filippo Chiozzotto, Elena dalla Valle, Cristian Bolzonella, Gianluca Schievano and Andrea Ballarin for data collection.

1. Introduction

In the Old World, the present feature of the rural space is the result of millennia of human activities and as such is perceived as a 'cultural landscape' (Hodge, 2000), where rural values – including a mixture of man-made, natural and human capital – are considered as joint products of farming and forestry practices. Merlo *et al.* (1995) have argued that countryside stewardship – i.e. the right/duty of the landowner to manage and conserve the rural estate and its environment – is historically rooted in European culture: it has been entrusted to agriculture and forestry since Roman times and continued through the Medieval ages, inspiring St. Thomas Aquinas' scholastic philosophy. This multifunctional conception of agriculture implies that public goods – e.g. watershed management, erosion control, scenic values, recreation and amenity, conservation of cultural heritage, wildlife and habitats – are delivered together with private goods like food and fiber.

In recent decades, however, market-driven agricultural processes have somewhat altered the balance between commodity and non-commodity outputs. Although the total share of land under agriculture and forestry has not changed considerably, the number of farm holdings has reduced. Agriculture has concentrated in the more fertile and accessible areas, where intensification allows higher yields per unit of land, while agricultural and silvicultural activities in remote and marginal areas have shifted to more extensive uses or often been abandoned. Countryside stewardship provision has declined, and agriculture has sometimes been blamed for rural landscape simplification, biodiversity losses and environmental degradation (Burrell, 2001).

Conversely, the social demand for public goods from agriculture has steadily increased in the last decades throughout Western Europe, as a result of high income elasticities associated with improved living standards, along with food safety and animal welfare concerns.

Following the change in consumers' demand and the need to re-shape the approach to agricultural policies, countryside stewardship and minimization of negative agricultural impacts have gained momentum within the European Common Agricultural Policy (CAP). This new trend started with the 1992 McSharry reform, when 'accompanying measures' (Council Regulation (EEC) 2078/1992) were introduced to support agri-environmental commitments. With Agenda 2000 a new 'European Model of Agriculture' was launched, giving official formalization to multifunctional agriculture (Potter and Burney, 2002). Agenda 2000 for the first time included agri-environmental concerns within Rural Development Programs (RDPs) (Council Regulation 1257/1999), stressing the idea that agriculture can contribute to the general viability of rural areas. The recent issuing of Council Regulation (EC) 1698/2005 – with its strong accent on CAP's second pillar – has further emphasized the need to reduce environmental risks within the context of sustainable and integrated rural development. The rationale of this approach – a 'paradigm' now in European policies (Coleman, 1998) – is inflaming the debate in the WTO arena and is questioned in the New World, where interactions between agriculture and environment are more perceived as generating agri-environmental bads rather than goods (Hodge, 2000; Glebe, 2003; Boatto and Defrancesco, 2004). Runge (1999) has warned of the risk of using the multifunctional argument to disguise trade-protectionism policies. This can further distort production processes, changing multifunctionality into 'multi*dys*functionality' (Runge, 1999, p. 27). Also European commentators like Colman (1994) are skeptical about agri-environmental payments to the extent that they can undermine farmers' ethical commitment to stewardship.

The result of this shift in CAP objectives – acknowledging the need for more balanced agriculture in time and space – is a growth in agri-environmental spending in the total EU agricultural budget – from about 100 million euros in 1993 to over 2 billion in 2003. Sweden has devoted nearly 90% of its RDP budget to agri-environmental measures, Italy more than 60%, with a European average ranging between 45 and 50%. In parallel, the farmland enrolled in agri-environment measures has also increased in the last decade, reaching today as much as 25% of the Utilized Agricultural Area (UAA) in the 15 older Member States (European Commission, 2005). Agri-environmental measures are now considered by the EU as one of the key-elements of Rural Development to such an extent that they are the only scheme which has to be compulsorily included in all new RDPs of the Member States.

Farmers – i.e. the stewards of the rural space – are the natural targets for such policies. The EU policy mechanism is therefore based on payments to farmers enrolling in measures implying provision of environmental goods or limitations in the production of environmental bads. These schemes are applied through five to seven-year contracts specifically designed by Member States according to the EU strategic guidelines, but following the subsidiarity principle in order to allow better targeting, tailoring and enforcement strategies (Lactacz-Lohmann, 2001). Farmers are free to decide whether to enter such programs and the incentive for participation is represented by a compensation of additional costs plus income losses entailed in the contract.

Owing to the increased budget expenditure, the EU has devoted considerable effort to monitoring and evaluating the policy effects on the actual provision of environmental services since Agenda 2000 and progress has been achieved. However, less is known on the determinants inducing farmers' decision on whether to participate in such schemes (Pietola and Lansink, 2000; Vanslembrouck *et al.*, 2002; Wossink and van Wenum, 2003), while this is a crucial factor in terms of overall uptake and therefore policy success (European Commission, 2005).

This paper aims to explore the rationale of the farmers' decision-making process taking the Veneto Region of Italy as a case study. It is structured in six sections. Section 2 gives a brief description of the case-study area along with the main features and objectives of regional rural development policies with specific reference to the most relevant agri-environmental measures (AEMs) in Veneto in the period 2000-2006. Section 3 presents and discusses the existing literature on the factors affecting participation in the schemes, taking into account the influence of farmers' attitudes within the theory of reasoned action. The survey design – which has included participating and non-participating farmers – and the sample characteristics are dealt with in Section 4. Eligibility criteria, ranking priorities and budget assigned in the Region are the main constraints of the problem. Results of the work are discussed in Section 5. Finally, Section 6 draws the main conclusions on the research and provides some policy recommendations in the light of the guidelines of the new Regional RDP 2006-2013, currently under discussion.

2. Agriculture, Environment and Agri-environmental Policies in the Veneto Region

The Veneto Region of north-eastern Italy has a precise institutional and geographic identity. According to the Italian Constitution, institutional-administrative setting and devolution rules, Regions have legislative power over a wide range of matters, including agricultural policies. As such, each Region in Italy designs and approves its own rural development policy in line with the European Union (EU) and national general principles. Geographically, the territory of the Veneto Region is quite diversified: the southern part – the Po Valley – is completely flat. Further north, an intermediate hilly and pre-Alpine belt crosses the Region from west to east. The northern most part of Veneto is a vast Dolomite area, with high Alpine peaks and glaciers. Due to this heterogeneous morphology, agricultural development in Veneto is rather uneven: on the flat plain agriculture is highly productive and integrated with the agro-food system. It is mainly arable land, with maize, soybean and wheat being the most important crops. Here in the lowlands, rural space is constricted by a growing demand for land for urban and industrial uses. Detriment of water quality (and quantity), soil pollution, landscape simplification, and eutrophication of the Venice Lagoon waters are the main concerns, also ascribable to agricultural processes paying the price of farm destructuration and growing use of contractors (Merlo and Manente, 1994). The foothills are an important aquifer recharge area. Due to the geology of the area, groundwater flowing from the mountains surfaces along a belt crossing the northern Po Valley from west to east. This area is the most important source of drinking water for the whole Po Valley. The status of areas designated as aquifer recharge belt is assigned to particular zones of the northern flatland and hills by a specific Regional Act (DGRV 3733/92). The hilly areas are well-known as outstanding 'cultural' landscapes, with chestnut and olive groves, and vineyards where renowned Italian wines are produced. In the Pre-Alps and Alps the predominant activity is dairy farming. Meadows, grasslands and grazings are the most common land use together with forestry. The main problems for these areas are caused by the strong pressure on natural resources from tourist development in the busy Alpine resorts. In contrast, depopulation and abandonment of active agriculture in the more remote and marginal valleys has occurred, leading to soil erosion, closing of open spaces by spontaneous expansion of shrubs (perceived as negative), biodiversity impoverishment and generalized loss of cultural and traditional rural values.

Following the rural development principles embodied in the European Regulations and taking into account the problems at stake, the Regional Administration has devised and approved the Regional Rural Development Program 2000-2006 (from now on Regional RDP). This embraces a number of schemes, amongst which agri-environment has a very important role: Regional RDP data show that AEMs have absorbed as much as 32% of the total expenditure (Regione Veneto, 2001 and following years), i.e. around 170 million euros (including the existing schemes under the previous Reg. (EEC) 2078/92 measures still in place). According to the philosophy of a multifunctional agriculture model, AEMs in Veneto include several objectives simultaneously: primary and secondary, stated and un-stated, short and long-term (Gatto and Merlo, 1999). Preservation of quality and quantity of water and soil, maintenance of the rural landscape and environment, upkeep of mountain areas and diversification of farm activities are the most important. Based on these objectives, a detailed set of measures has been designed and proposed to farmers (Table 1). The first call for contracts to start in 2001 was open to applications for all AEMs, while the following ones – mainly for budget availability reasons – only included some AEMs. The result of the RDP implementation in the quinquennium 2001-2005 is presented in Table 1, reporting uptake in terms of number of new contracts per year and Total number of Agri-Environmental Contracts (TAEC).

Table 1 – AEMs in the Veneto Region: main objectives and uptake in terms of number of new contracts per year and Total number of Agri-Environmental Contracts (TAEC), 2001-2005

Main objectives	**AEM name**	**Acronym**	**Number of new contracts**					
			2001	2002	2003	2004	2005	TAEC
Reduction of inputs; preservation of water quality and quantity; preservation of soil quality and reduction of soil erosion	Input reduction/Integrated farming	AI	301*	0	0	0	0	301
	Buffer strips	FT						
	Energy crops	CE						
	Organic farming	AB	146	0	0	0	0	146
	Cover crops	CC	0	0	0	0	0	0
	Conservation of grassland and conversion of arable land to grassland in the aquifer recharge belt	PPS	346	1,464	0	0	0	1,810
Conservation of areas of landscape value and prevention of soil erosion	Conservation and upkeep of grassland and grazings in the uplands (steep slopes)	PP	186	1,080	561	0	270	2,097
Maintenance and enhancement of biodiversity and features of the rural landscape	Restoration and conservation of biotopes and wetlands	BZU	232	9	0	0	0	241
	Hedgerows and thickets	SB						
	Rural landscape features	PR						
	Set-aside	MR	0	0	0	0	0	0
Conservation of biodiversity	Genetic diversity of domestic animal breeds	RE	149	0	88	0	0	237
	Genetic diversity of cultivated plant species		0	0	0	0	0	0
	Measures to favor wildlife	FS	162	0	0	0	0	162
Total			**1,522**	**2,553**	**649**	**0**	**270**	**4,994**

Source: Regione Veneto (2001) and following years

* The number of contracts is provided here in an aggregated way for the three measures AI, FT, CE and it is not possible to distinguish amongst measures. However, in terms of area, AI covers 99% of the total aggregated area under contract for the same three measures.

The information in terms of number of contracts is not however enough to explain compliance with AEMs objectives. Table 2 reports uptake in terms of Total Area under Agri-Environmental measures (TAEA) in the quinquennium 2001-2005, showing that Measure PP *Conservation and upkeep of grassland and grazings in the uplands (steep slopes)*, Measure AI *Input reduction* and Measure PPS *Conservation of grassland and conversion of arable land to grassland in the aquifer recharge belt* rank first, second and third respectively in terms of hectares.

Relatively speaking, the total area under the agri-environmental scheme of the Veneto Region covers 15% of UAA of registered commercial farms having UAA greater than or equal to 1 hectare. However, the distribution of uptake is uneven over the regional territory: as a whole the share of area under contracts is 8% of UAA in the lowlands, 26% in hilly areas and as much as 63% in the mountainous areas (Regione Veneto, 2006b). In addition, amongst the most significant measures, AI, AB and PPS have been implemented mainly in the lowlands (87.6%, 87.2% and 80.6% respectively), whereas the area under PP is located almost completely in the mountains.

Information on expenditure and average premium per hectare completes the AEMs picture. Distribution of financial resources follows a different pattern from area uptake, reflecting differences in the dosage of the average premium per hectare amongst AEMs (Table 2). In Veneto, as in the rest of Italy and other European countries, the amount of premium is fixed and established in a top-down approach by the authority in charge of policy design. As such, it is not negotiable by the individual farmer. The basic rationale behind the amount of premium is that it should cover additional costs and income losses entailed in compliance with the measure prescriptions. The level of premium is sometimes increased in order to reflect the fine-tuning of the policy design, e.g. tailoring towards specific areas where operating conditions are more difficult or to encourage aggregated participation by more than one contiguous farms.

Table 2 – AEMs in the Veneto Region: uptake in terms of Total Area under Agri-Environmental measures (TAEA) 2001-2005, expenditure shares and average premium/ha

AEM name	Acronym	TAEA at 31.12.2005 (hectares)	% of expenditure	Average premium/ha
Input reduction/Integrated farming*	AI	37,411	47.6	402
Buffer strips*	FT	133	1.3	2,982
Energy crops*	CE	1	0	900
Organic farming	AB	5,680	11.1	615
Cover crops	CC	103	0.1	271
Conservation of grassland and conversion of arable land to grassland in the aquifer recharge belt	PPS	7,690	11.0	452
Conservation and upkeep of grassland and grazings in the uplands or on steep slopes	PP	48,904	15.9	105
Restoration and conservation of biotopes and wetlands	BZU	109	0.2	469
Hedgerows and thickets	SB	1,333	11.2	2,662
Rural landscape features	PR	31	0.2	2,223
Set-aside	MR	51	0.1	596
Genetic diversity of domestic animal breeds	RE		0.0	
Genetic diversity of cultivated plant species		0	0.0	n.a.
Measures to favor wildlife	FS	311	1.3	1,337
Total		**101,757****	**100.0**	

Source: Regione Veneto, 2006 b

* With respect to the number of contracts, the information on uptake is more precise, allowing uptake for single measures to be distinguished.

** This figure also includes Reg.(EEC)2078/92 contracts still operating in the quinquennium 2001-2005.

3. Modeling farmers participation in agri-environmental measures

In recent times, research on the determinants of farmers' participation in AEMs has received increasing attention, thanks also to the growing EU share of expenditures in agro-environmental policies and consequent need for feed-back data. Progress has been rapid, if back in 2000 Falconer admitted that 'policy-makers had still limited experience of farmers' response to environmental incentive schemes particularly in the Southern EU member states' and Vanslembrouck *et al.* (2002) stated that 'analysing farmers' willingness to participate is a rather new research area', while Mann in 2005 acknowledged that 'the connection between farm size and the uptake of agri-environmental schemes has been well explored'.

Mann's statement is in fact consistent with the appearance of the first works on farming-related environmental issues in Europe, stemming from the works of Ruth Gasson in the '70s (see e.g. Gasson, 1973). Investigations along this line – mostly focusing on exploring socio-economic and structural factors, including farm size – continued through the '80s and '90s and led to a rather conspicuous bulk of literature – see e.g. Falconer (2000) for a review. More recently, the field of exploration has broadened to other aspects and researchers have also devoted their efforts towards more quantitative modeling, where previous studies had provided descriptive approaches (Wilson and Hart, 2001). Today, there seems to be a consensus in the literature on the fact that participation in voluntary schemes also depends on farmers' attitudes and behavioral responses (Wilson, 1996), as well as AEMs fitting to farming systems (Wynn *et al.*, 2001).

The evolution in the approach to the problem can be understood by taking a closer look at the conceptual modeling of agri-environmental participation. Starting from simpler frameworks such as Brotherton's (1989) classification of 'scheme factors' and 'farmers factors', more sophisticated behavioral approaches have been proposed, paying attention to a number of farmers' individual stances such as motivations, values and attitudes. Reference is made to microeconomic models based on the theory of reasoned action as conceptual framework (Ajzen and Fishbein, 1980; Ajzen, 1988). This approach assumes that the behavioral intentions of an individual are directly related to his/her attitudes. Vanslembrouck *et al.* (2002) used a conceptual model based on 'decision-subject characteristics' (i.e. product and market) and 'decision-maker characteristics' (i.e. belonging to the farm and to the individual: age, education and environmental attitude). According to Wilson (1996), 'external factors' like scheme features, amount of premium, degree of fitting of the contract to the farm organization, social context and 'internal factors' like farm structural features, and finally farmer's specific characteristics, like motivations, attitudes and level of information are equally important. Wynn *et al.* (2001) proposed the following classification of factors in order to explain farmer entry into the Environmentally Sensitive Area Scheme in Scotland: i) physical farm factors; ii) farmer characteristics; iii) business factors and iv) situational factors.

Amongst farm structural factors – e.g. farm size, farm type, labor, stocking rates – farm size is considered one of the most important determinants by many Authors. However, research results are not always consistent. In their analysis of environmental uptake in Thessaly, Damianos and Giannakopoulos (2002) found out that the larger the farm size, the higher the participation rate. Vanslembrouck *et al.* (2002) studying participation in Flanders and Wallonia showed the opposite, that small and average-sized farms participated more than big ones. Mann's study on Swiss extensification schemes (2005) proved that expanding farms are less likely to participate than shrinking farms, while Wynn *et al*. (2001) and Dupraz *et al.* (2002) concluded that total farm size is not an important variable to explain participation. Farming type has proved to have an influence on participation, too: for example Wynn *et al.* (2001) underlined how farms with a high share of cropping land crops in UAA are less likely to join ESA extensification schemes.

Farmers' characteristics also play a role in determining their agro-environmental responses. Age has been assumed by most of the cited studies as a significant variable to the extent that young farmers are deemed to be more willing to take risks and are therefore more open to change, including entering AEMs. This hypothesis has been confirmed by the findings of Wynn *et al.* (2001) and Bonnieux *et al.* (1998). However, family life cycle – meant as having a successor – has not provided meaningful indications (Wynn *et al*., 2001; Vanslembrouck *et al.*, 2002). Education, as a critical indicator of the quality of human factors, generally encourages participation (Wilson, 1996; Delvaux *et al*., 1999 and Dupraz *et al.*, 2002).

Wynn *et al.* (2001) considered tenure status and proportion of total income derived from farming activities amongst business factors. However, tenure status – meant as the proportion of land area owned and implying the possible influence of landlords on the entry decision – was significant only in two specific situations with opposite results.

Situational factors include a wide range of determinants, mostly linked to the interface of farmers with the policy characteristics: in general the amount of information about the policy received by the farmer should support his/her participation, as well as imitation of neighbors' participation (Drake *et al.*, 1999; Wynn *et al.* 2001 and Damianos and Giannakopoulos, 2002). Wynn *et al.* (2001) and Vanslembrouck *et al.* (2002) underline that the easier the fitting of the AEMs to the farm characteristics, the more probable is participation. Advisors' negotiating skills can also foster participation.

Finally, there are a number of factors that can be ascribed to individual behavior and perceptions. Previous participation in agri-environmental measures can be used as a proxy for familiarity and environmental concerns (Drake *et al.,* 1999), while attitudes towards environment *per se* can be stated through adoption of environmentally-friendly practices without payment in the past, or membership of environmental trusts. The literature on these aspects partially agrees on their positive effect, although admitting that the picture on the impact of farmers' environmental interests is not entirely clear (Wynn *et al*., 2001), seeming to affect more the speed of entry rather than the probability.

Focusing on farmer's attitudes towards environmental protection, Morris and Potter (1995) proposed a 'participation spectrum' that classifies farmers in four groups: i) *active participants*, who adopt voluntary

AEMs for both environmental protection and financial reasons (Wilson and Hart, 2001); ii) *passive adopters* who enter agri-environmental measures mainly for financial reasons; iii) *conditional non-adopters* who would participate under some circumstances (e.g. easier-to-fit measures and higher payments) and iv) *resistant non-adopters*, against the adoption of AEMs. This classification was criticized in the case of non-fixed maximum payment ceilings (Wilson, 1996; Falconer, 2000). However, it is still useful in the investigation of factors affecting low uptake rates observed in certain AEMs by providing suggestions to decision-makers in relation to how measures can be made more attractive for at least one of the first three groups. In conclusion, the literature confirms that i) business factors, ii) farm structure, iii) farmers' characteristics, iv) farmers' attitudes and v) farmers' situational factors interplay in the farm response to agri-environmental policies. However, gaps remain since published studies have provided no uniform clear-cut results in terms of direction of impact of the different factors. Modeling entrants' and non-entrants motivations underlying AEMs uptake is therefore still an open question and a challenge to research (Willock *et al*., 1999; Morris, 2004), especially in Italy where this is a rather new research field.

Looking at the behavior typology taken into consideration, methodological approaches to farmers' attitudes in the literature can be framed in two groups, i.e. those based on stated – intentional or contingent – behavior (Drake *et al*., 1999 and Vanslembrouck *et al.,* 2002) and those based on observed – real world – behavior (Damianos and Giannakopoulos, 2002; Wynn *et al.,* 2001). The present study is based on observation data.

Discrete choice models are generally used to analyze farmers' behavior within a utility maximization framework, where the observed choice is considered an expression of a continuous latent variable reflecting the propensity to choose a specific option amongst diverse alternatives. The basic assumption here is that farmer's choices are driven by a random utility model. In this context, binary choice logit/probit models, i.e. participation/non-participation in AEMs in general or to a specific one have been used by Dupraz *et al*., 2003; Damianos, 2002; Wossink and Wenum, 2003, Vanslembrouck *et al*., 2002, amongst others. Conversely, a multiple-choice decision-making process using multinomial models to investigate both the non-entry decision and participation in different AEMs has been employed by Authors like Wynn *et al*., 2001 and Dupraz *et al*., 2002. The literature also reports studies that model the intensity of participation in AEMs in terms of number of hectares involved by using Tobit models (Damianos, 2002; Wossink and Wenum, 2003), or the relative speed of entry using duration analysis (Wynn *et al*., 2001).

In this paper two multinomial logit models have been estimated (Greene, 2000). The first one – *Measures Participation Model* – explores how the structural and business characteristics of the farm, the farmer's general attitudes towards his farm and his opinions on the financial and technical characteristics of the proposed AEMs affect his behavior. In particular, the model explains the probability of non-participation ($j=0$) or participation in one specific AEM among those analyzed in the case study: low-input farming ($j=1$), grassland maintenance in aquifer recharge belt ($j=2$) or grassland maintenance in the uplands ($j=3$) (see next section for a more detailed description of the selected measures) and has been normalized with respect to not participating at all in the regional AEMs.

$$\Pr(Y_i = j) = \frac{\exp(\beta_j^{'} X_i)}{\sum_{k=0}^{3} \exp(\beta_k^{'} X_i)} \qquad J=0,1,2,3 \qquad (1)$$

where:

$Pr(Y_i=J)$ probability that *i-th* farmer belongs to the *j* subgroup

X_i matrix of farmer's attributes and farm's characteristics

To remove the indeterminacy, the model has been normalized with the usual assumption $\beta_0=0$, i.e. with respect to not participating at all in the regional AEMs.

As has already been pointed out, model (1) analyses the observed farmers' behavior towards specific AEMs. The estimated parameters and derived marginal effects help agri-environmental decisional stakeholders to understand who participates in a particular measure in comparison with who does not, highlighting structural, economic and personal factors affecting the decision. The results can help policy-makers to fine-tune the specific features of a measure in order to increase the rate of participation, if this is a policy goal.

Taking into account that AEMs are not based on the one-size-fit-all approach, but can be tailored to area, farm and/or farmer characteristics, etc., it could be useful to explore the 'intensity' of the adopting or not-adopting behavior in greater detail, according to the proposed ‘participating spectrum’. In this case, the results would suggest to policy-makers how they could design more appealing and more targeted measures. The second model – *Participating Spectrum Model* – helps to reach this goal. Indeed, it describes the factors conditioning the farmer’s behavior as an active participant in AEMs (j=3) or alternatively, as passive adopter (j=2), conditional non-adopter (j=1) or resistant non-adopter (j=0), according to Morris and Potter (1995) classification.

The model has a formal structure similar to (1) and has been normalized assuming the resistant non-adopter participants’ group as the base group. In this case, the explanatory variables describe: i) the farmer from a socio-economic point of view (e.g. education, gender, household income level, part-time activities); ii) his attitudes towards the environment; iii) the influence on farmer’s behavior of his neighbors’ attitudes towards environmental protection and their active participation in AEMs and iv) the role played by different sources of information, the social context and other situational factors. Maximum likelihood estimates of models have been done using NLOGIT 3.0.

4. Survey design and sample characteristics

The case study focuses on the four most relevant AEMs in place in the Veneto Region, based on number of contracts, uptake in terms of area and expenditure allocated:

(i) *AI Input reduction*, which represents 6.0% of TAEC (Total number of Agri-Environmental Contracts), 36.8% of TAEA (Total Area under AEMs) and 47.6% of expenditure

(ii) *AB Organic farming*, with 2.9% of TAEC, 5.6% of TAEA and 11.1% of expenditure

(iii) *PPS Grassland conservation in the aquifer recharge belt*, with 36.2% of TAEC, 7.6% of TAEA and 11.0% of expenditure

(iv) *PP Grassland conservation in the uplands*, with 42.0% of TAEC, 48.1% of TAEA and 15.9% of expenditure.

In relative terms, it can be noted that contracts involving grassland maintenance and/or conversion – i.e. measures PPS and PP – together represent 78.2% of the TAEC and 55.1% of the TAEA, while measures AI and AB are less important in terms of contracts and hectares involved. Measure SB on *Planting and maintenance of hedgerows and thickets* – as significant as AB and PPS in terms of expenditure – was not considered because it is a complementary measure undertaken mostly in connection with the main measures AI, AB and PPS.

Design characteristics, uptake, eligibility criteria and addressees, spatial targeting and tailoring, and priorities assigned are briefly discussed below for each of the four chosen measures:

(i) *AI Input reduction.* Farmers, as well as public landowners or land managers throughout the Region have access to this AEM. The whole farm UAA, with a minimum of 1 hectare, has to enter the agreement for five years. Farms located in special target areas, i.e. National and Regional Parks, Sensitive Areas, Nature 2000 Areas, aquifer recharge belt and Venice Lagoon catchment area are given priority over the others. Prescriptions refer mainly to the criteria of integrated pest management, reduced use of fertilizers and other chemical inputs, crop rotations. Protocols are established for the use of manure, crop irrigation and tilling. Farms under contract must adopt a Farm Agri-environmental Plan, and have to enter a program of technical advice and extension. Premium levels depend mainly on type of crop and range from 295 euro/ha for annual crops to 720-800 euro/ha for perennial crops. Aggregated participation of at least 15 farms and 500 hectares is granted an additional premium of 50 euro/ha. There was only one call for this AEM in the period 2000-2006, i.e. in the first year for contracts to start in 2001.

(ii) *AB Organic farming*. There is no spatial targeting for this measure: all farmers (private and public) are eligible and no priorities have been assigned to specific target areas. Priority is only assigned to farmers undertaking other AEMs at the same time. There is a minimum area of 1 hectare as in AI and the prescribed contract length is similar. Contractual requirements allow holders to manage organically only part of the farm, provided that they adopt input reduction practices (AI) on the remaining non-organic crops. Organic farming practices are established according to Council Regulation (EEC) No 2092/91 and adhesion to technical advice and extension program is compulsory. Premium levels depend on crop types and are higher for those farmers who shift to organic farming for the first time with respect to maintenance: the minimum level is 480 euro/ha for maintenance of organic annual crops to 810-900 euro/ha for maintenance and conversion of perennial crops (e.g. olive groves, vineyards and orchards). Additional premiums for aggregated participation are awarded. As with AI, there was only one call for this AEM in 2000.

(iii) *PPS Grassland conservation in the aquifer recharge belt* is aimed mainly at maintaining drinking water quality through a reduction in the quantity of pesticides and herbicides. Grants are given to farmers who agree to convert annual crops into permanent grassland or to conserve/restore abandoned grassland. Again, farms in National and Regional Parks and Nature 2000 areas within this belt are given priority over farms not in designated areas. Main AEM prescriptions imply the ban on fertilizer and pesticide use, control of the use of nitrogen, management practices that take wildlife and the conservation of landscape features into account. Premiums range from 450 euro/ha for conservation of existing grasslands to 600 euro/ha for conversion. There were two calls for this AEM during the period 2000-2006, i.e. for contracts to start in 2001 and 2002.

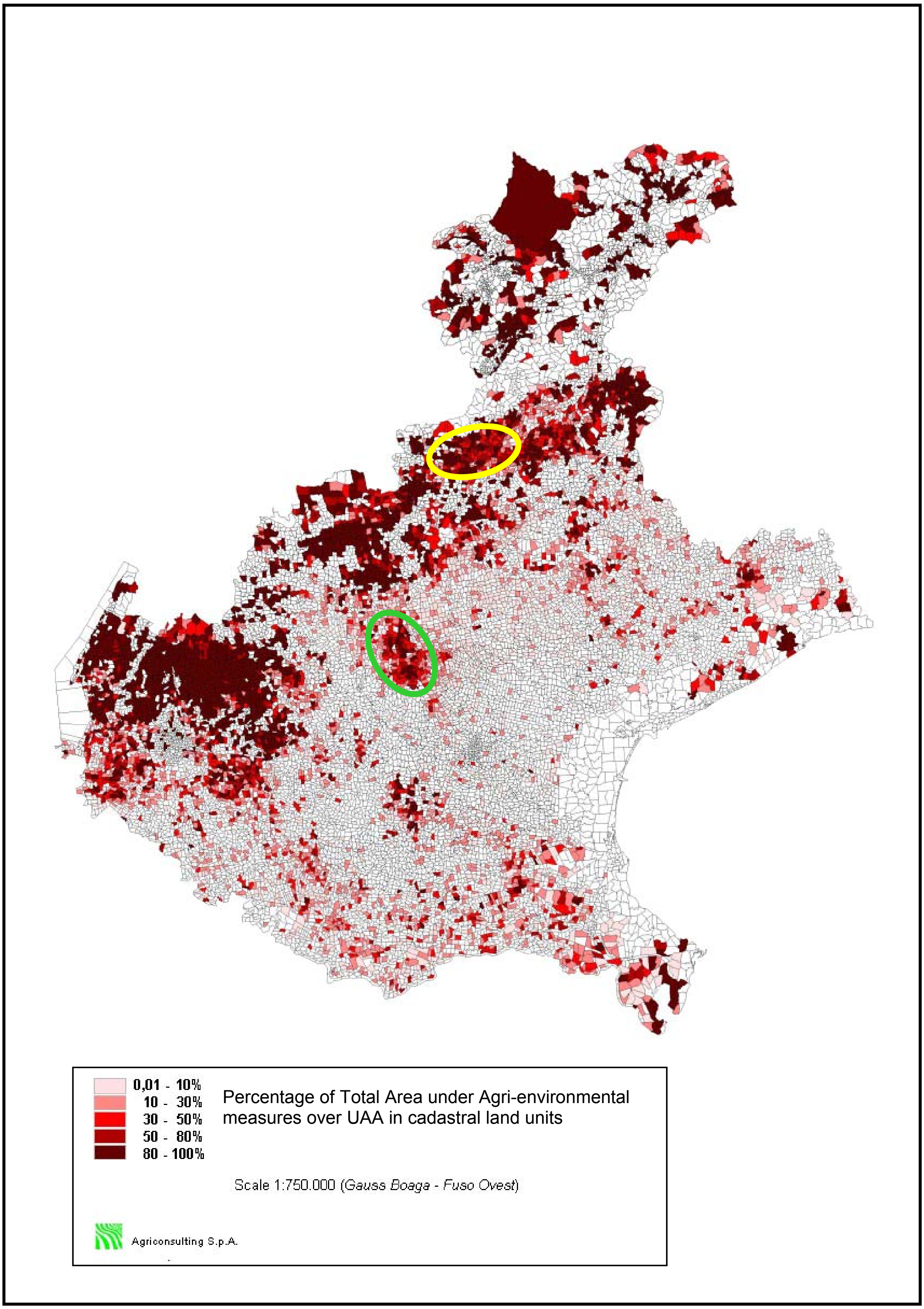
(iv) *PP Grassland conservation in the uplands* is mainly aimed at maintenance of agricultural practices – both environmentally and economically sustainable – in areas where abandoning of traditional farming activities threatens soil stability, with the consequent danger of erosion. As with measure PPS, farmers – including public bodies – located in areas with steep slopes and willing to enter the program receive annual payments for conservation and upkeep of grassland and grazings. Regional and National Parks and Nature 2000 areas again receive preference. Measure protocols include erosion control practices, maintenance of farm roads and footpaths, a fertilizer ban and minimum and maximum stock densities (i.e. from 0.4 to 1.4 livestock units/ha). Premiums are differentiated according to whether the action is directed towards conservation or upkeep and are dosed according to steepness of slopes. The lowest premium is 45 euro/ha, the highest 173 euro/ha. Following specific Veneto Region policy objectives, the call for this AEM has been opened four times in the period 2000-2006.

For the purpose of this research, measures AI and AB have been merged together under the heading *Low input measures* for two main reasons: i) the total number of new organic farming contracts is rather low with respect to total regional uptake; and, above all, ii) the two measures are intrinsically joint by policy design, since AB carried out only in part of the farm requires AI on the remaining UAA. The study has also taken into account only contracts signed under the present Regional RDP, i.e. from November 2000 to December 2005, while contracts ongoing up to 2003 but referring to commitments made under the previous Reg. (EEC) 2078/92 have been excluded, being based on different requirements and unit payments.

The main thread of our research was to focus on farmers' attitudes to and perceptions of participation in AEMs, in addition to farm structure and profitability, as indicated in the most recent literature. It was therefore important that sample areas were rather homogeneous in terms of farming type. Besides, sample areas with participation rates above the regional average of 15.1%, would allow us to obtain a sufficient number of observations amongst both participants and non-participants even with a relatively small sample size. With this in mind, we chose the following two sample areas: i) an area located in the uplands, to the west of the town of Belluno, along the Piave River, marked by the yellow ellipse in Figure 1 and ii) an area located in the aquifer recharge belt, namely the north-western Padova Province - south-eastern Vicenza Province, marked by the green ellipse in Figure 1. The latter is characterized by widespread grasslands related to a Protected Designation of Origin (PDO) cheese production chain.

A random sample of 141 family farms – including participants and non-participants – was selected in the two areas. However, only 139 valid cases of family farms are considered in this work, with 2 – undertaking only other minor AEMs – being excluded. The share of non-participants in the sample is 45.3%, while 11.5% of the sampled farmers are committed to low-input contracts and 43.2% to grassland contracts either in the lowlands (14.4%) or uplands (28.8%).

Source: Regione Veneto (2006)



Source: Regione Veneto (2006)

Figure 1. AEMs uptake in terms of area in the Veneto Region and in the areas selected for analysis

The survey has been carried out by means of a questionnaire filled in during direct interviews on the farms in the period December 2005-April 2006. The questionnaire has been designed within the ITAES project, by the team working at INRA in Rennes. The testing of the questionnaire format and interviews have been done contemporarily in the nine EU countries participating in the ITAES project: France, The Netherlands, Belgium, United Kingdom, Germany, Italy, Ireland, Finland and Czech Republic.

In brief, the different sections of the questionnaire are aimed at collecting information on: i) farm structure, land use, farm typology and socio-demographic characteristics of farmers' household; ii) AEMs in place in the farm (if any), features and reasons for participation or rejection of participation; iii) farmer's opinions on AEMs administration and management on the farm; iv) assessment of holder's environmental awareness and social capital and, finally; v) range of total family income and share from farming activities.

5. Results and discussion

Starting from the analysis of the different factors affecting farmers' AEMs behavior that have been described previously, Table 1 shows the groups of factors that have been considered in our work, focusing only on the significant variables of the estimated models. Having included only family farms in the sample, the total household income and its on-farm/off-farm shares have been considered amongst the *business factors,* instead of farm income. *Farm structure* characteristics: i) total family labor per hectare has been considered as a measure of farm intensification and as an expression of a efficient use of family labor; ii) the intensity level of farming activities has also been described by using two proxies; the first takes into account land use, the second livestock activity and iii) the total labor supply and share of rented UAA have been included as measures of structural factors that could limit the participation in AEMs. Amongst *farmer's characteristics* general education and gender have been taken into account, as well as farmer's 'active' business management approach that has been measured by two objective proxies: having invested or not in the past and having increased farm size in the past 5 years. The farmer's age has been substituted by a more comprehensive, but subjective, variable – the future farm's perspectives in the medium run – that also takes into account the intergenerational farm life-cycle. Amongst the variables describing *farmer's attitudes towards the environment and the AEMs,* proxies of three factors determining farmers' intentional behavior - according to Beedell and Rheman (1996) - have been considered: personal attitude or behavioral beliefs (i.e. farmer's positive or negative evaluation of environmentally-friendly behavior), perceived behavioral control or control beliefs (i.e. how easy or difficult it is to adopt conservation-oriented practices) and subjective norms or normative beliefs (i.e. the perceived social pressure to behave in an environmentally friendly way). In particular, the following variables have been taken into account: i) environmentally friendly approach to farming without public incentives or constraints in the past, as a proxy of farmer's awareness of the environment *per se* (personal attitude); ii) participation in past AEMs under Reg. (EEC) 2078/92 explaining both already expressed positive attitudes towards voluntary AEMs and a personal knowledge of the constraints on his/her farming activity and the transaction costs generated by the agri-environmental programs (perceived behavioral controls); iii) subjective farmer's evaluation of the proposed AEMs are based on his/her opinion on how easy they are to implement and whether the public *premium* fully covers the incurred costs (perceived behavioral controls) and iv) the perceived social pressure on farming practices, expectations of more restrictive legislation on environment protection and other neighbors' opinions on AEMs have been considered as proxies of subjective norms. Finally, amongst the *situational factors* - describing the farmers' information and advice sources - the role played by other farmers and farming magazines has been highlighted, as this resulted as more relevant for interviewed farmers than other more structured or well-targeted sources of information.

Table 3 – Description of the variables included in the models

Variable	Description	Unit
Business factors and household income		
HOUSINC	Total household income after taxes less than 5,000 Euro 5,000-10,000 Euro 10,000-20,000 Euro 20,000-35,000 Euro over 35,000 Euro	 1 2 3 4 5
INCFARM	Share of total household income from farming	Percentage
INCPENS	Share of total household income from pensions	Percentage
INCOFF	Share of total household income from off-farm employments	Percentage
Farm structure		
OREFHA	Family total labor per hectare	Hours/ha
QSAUAFF	Rented area as percentage of total UAA	Percentage
AWUTOT	Total farm labor supply per year (family and non-family labor)	AWU
REDDXZON	Share of permanent crops and arable land on total farm UAA in hilly or mountain areas	Percentage
NLIVEXP	Grassland without livestock on farm	0=no, 1=yes
Farmer's characteristics		
HIGHEDU	Farmer's education level (at least secondary school)	0=no, 1=yes
FEMALE	Farmer's gender	0=male; 1=female
INVEST	Farm investments (buildings and machinery) in the past 5 years	0=no, 1=yes
CHUAA2	Farm total area has increased in the past 5 years	0=no, 1=yes
FUTURO	Farmer's opinion on farm's future (within the next 10 years) sold for non-agriculture purposes sold/rented out for agriculture purpose managed by a family member or other relative farmer will continue business as usual farmer will continue with new investments	 1 2 3 4 5
Farmer's aptitudes towards the environment and agri-environmental measures		
ENVOL	Environmentally friendly farming practices have been adopted in the past without payment	0=no, 1=yes
EFF2078	Farm participation in past agri-environmental program (Reg. (EEC) 2078/92)	0=no, 1=yes
ARGIM1	Public image of agriculture is important for farmer's decision to participate or non-participate	0=no, 1=yes
PERFARM	Other farmers' opinions on agri-environmental measures	1=positive else 0
ARGLEG1	Forthcoming more restrictive legislation expectation is important for farmer's decision to participate or non-participate	0=no, 1=yes
COMPNS	The financial compensation is sufficient to cover the measure's extra costs	0=no, 1=yes
APPLIC	Measures can be easily implemented on the farm	0=no, 1=yes
Farmer's situational factors		
TAFARM	Farmer gets his technical advice from other farmers	1=often; 2=sometimes; 3=never
LETT1	Household reads farming magazines	0=no, 1=yes

Measures Participation model

Table A1 in the Appendix shows the results for the estimation of a multinomial logit *Measures Participation* model, Table A2 reports the marginal effects of the independent variables on each subgroup computed at the means of the latter, and the frequencies of actual and predicted outcomes in each subgroup are compared in Table A3. The model correctly classifies 77.7% of observations, ranging from a minimum of 50% in grassland conservation in the aquifer recharge belt subgroup to 90.7% in the non-participating one (pseudo R^2=0.568).

Table 4 reports summary statistics on the variables included in the model, and Table 5 summarizes the model estimates showing the sign of the significant marginal effects of the variables on the probability of participating in each measure or non-participation.

In order to better understand the estimated model results, it should be pointed out that the non-participating farms' mean UAA (23.6 ha) is higher than in the other subgroups, mainly in regard to the low-input measure participating one (12.9 ha). In the former group there are widespread intensive, mixed farming activities, whilst the latter farms are more specialized in permanent and field crops. The grassland conservation measure is mainly among farms producing field crops and milk, but permanent crops are also present in lowland and hilly areas. As expected, the *business factor* in the model plays a negative effect on the farmers' marginal participation in all AEMs, while it increases, at the margin, the probability of non-participating. Indeed, extensification of the activity is more difficult to implement by households with no or low off-farm income. *Structural factors* are also important in affecting farmer's decision, but the direction of their effects is not uniform among the different measures. The share of rented UAA and total farm labor supply - acting as constraints to participation - have the expected signs for the non-participating group, but only the latter is significant. On the other hand it can be observed that: i) a significant marginal negative effect of the share in rented UAA is observed in grassland conservation in the aquifer recharge belt group, i.e. in lowlands and hilly areas where conversion from arable land to grasslands involves both tenant and landlord decisions, affecting land use in the long run; the observed positive marginal effect for the same measure in the uplands is related to different land use in marginal areas, where farmers are often tenants of pre-existing farm areas; ii) a high ratio of family labor over UAA increases the marginal probability of non-participation in any AEM; actually, this variable expresses both a measure of farming intensification and an indirect signal of a efficient use of family labor (i.e. relatively speaking, a low level of family labor's hidden unemployment). Similarly, the proxies of farming intensity, in terms of crops and livestock production, have the expected, significant signs in the grassland maintenance groups and in the non-participating one. It is also interesting to note that the higher the intensity of the farming activity - expressed in terms of gross operating margin per hectare - the higher is the cost of adopting an AEM, both in terms of income loss and difficulties in adjusting current farm management to meet AEM requirements. In fact, the mean gross operating margin per hectare in non-participating groups (2,100 euro/ha) is almost twice that in participating ones, where the average unit margin ranges from 1,200 to 1,400 euro. *Farmer's business* investment-oriented *approach*, if expressed in terms of increased farm size, negatively affects participation in AEMs, while past investments in building and machinery have a positive effect on participating in grassland maintenance in the uplands. In marginal areas both behaviors can be considered the results of a positive aptitude towards maintaining farming activities. The marginal effects of the three variables describing *farmers' aptitudes to AEMs* and, in particular, their perceived behavioral control (i.e. to have already subscribed to AEMs contracts in the past, to consider the measure requirements clear and easy to implement, to evaluate the AEM *premium* able to cover its related direct and indirect costs) have the expected signs for each subgroup.

In conclusion, the model results substantially confirm that farm structure and type of farming, as well as business management approaches are relevant in conditioning the uptake of AEMs by farmers. In general, intensive types of farming, an investment-oriented managerial behavior and a farmer working full-time (i.e. the strong dependency of household income on farming economic results) do not favor participation in AEMs. It should also be noted that our results do not show the positive links between farm size and participation in AEMs, already highlighted in the literature. As expected, past active experience of AEMs as well as a positive perception of the implementability of the measure's prescriptions and financial aspects are relevant in stimulating the adoption of all AEMs.

Table 4 – Summary statistics on *Measures Participation Model* variables

Variable	Statistic	Non-participating	Low-input measure	Grassland conservation in aquifer recharge belt measure	Grassland conservation in the uplands measure
% in each group (n=130[a])	%	45.3	11.5	14.4	28.8
INCFARM	Mean (st. dev.)	0.56 (0.32)	0.29 (0.18)	0.41 (0.25)	0.37 (0.33)
OREFHA		203.0 (243.2)	264.2 (240.0)	157.7 (148.0)	135.7 (126.8)
QSAUAFF	Mean (st. dev.)	0.35 (0.36)	0.10 (0.25)	0.18 (0.26)	0.51 (0.38)
AWUTOT	Mean (st. dev.)	2.4 (1.3)	2.5 (1.0)	2.2 (0.6)	1.8 (1.1)
REDDXZON	Mean (st. dev.)	0.42 (0.44)	0.53 (0.48)	0.28 (0.40)	0.07 (0.13)
NLIVEXP	% of yes	16.7	43.8	60.0	45.0
INVEST	% of yes	61.1	31.3	60.0	72.5
CHUAA2	% of yes	44.4	6.3	20.0	20.0
EFF2078	% of yes	7.9	62.5	50.0	37.5
COMPNS	% of yes	13.0	56.3	45.0	40.0
APPLIC	% of yes	25.9	93.8	95.0	85.0

[a] Number of observations lower than the sample size due to missing values in some variables

Table 5 – Multinomial logit *Measures Participation* Model: significant marginal effects[a] and signs in each subgroup

Variable	Non-participating		Low-input measure		Grassland conservation in aquifer recharge belt measure		Grassland conservation in the uplands measure	
INCFARM	+	***	-	**	-		-	***
QSAUAFF	+		-	*	-	***	+	***
OREFHA	+	***	-	*	-	***	-	**
AWUTOT	-	***	+	**	+		+	
REDDXZON	+	***	-		-	**	-	***
NLIVEXP	-	***	+		+	***	+	**
INVEST	+		-	*	-		+	**
CHUAA2	+	***	-	**	-	**	+	
EFF2078	-	***	+	*	+	***	+	
COMPNS	-	***	+	**	+	***	+	
APPLIC	-	***	+		+	***	+	***
Log L= -71.433 n= 130 McFadden pseudo R^2= 0.568								

[a] *** p<0.05; ** p<0.1; * p<0.2

Participating Spectrum model

In order to estimate the *Participating Spectrum* model, farmers have been classified into the four Morris and Potter (1995) groups, taking into account their answers to a specific question asking them to indicate if a set of proposed reasons have been relevant in their choice to participate or non-participate in AEMs. Their opinions on a set of related control questions have been also considered. In particular, we have defined : i) *active participants*, who also adopt voluntary AEMs for environmental protection reasons (33.1% of the farmers' sample); ii) *passive adopters* who enter AEMs mainly for financial reasons (21.6%); iii) *conditional non-adopters* who do not participate in any proposed measures mainly for financial reasons or, who - being adopters of past AEMs (Reg. (EEC) 2078/92) - do not participate in current ones for technical and/or financial reasons (e.g. less easy-to-fit measures and lower payments) (26.6%) and iv) *resistant non-*

adopters, non-participants neither for financial reasons nor for difficulties in implementing the measures (18.7%). Interestingly, according to this classification, a relevant number of non-participating farmers (58.7%) act as conditional non-adopters (i.e. they could participate in better tailored AEMs), while over 60% of the farmers entering the 2000-06 AEMs are active participants. The latter signed 68.8% of the low-input measure contracts, and 55-60% of the grassland maintenance ones. Resistant non-adopters' average farm size is the highest (29.3 ha), with dairy and horticultural farming, while conditional non-adopters have a smaller average farm size (17.6 ha), with mixed farming, where AEMs involving the whole farm's activities are generally more difficult to implement. The mean passive adopter manages a farm with the smallest average farm size (15.5 ha), mainly dairy and field crops oriented. On the other hand, active adopters (21.4 ha as average farm size) can be found both on dairy farms and on those cultivating field and permanent crops.

Tables A4-A6 in the Appendix show the *Participating Spectrum* model estimates and diagnostics. The model gives satisfactory predictions of farmers' participating-non-participating behavior. It correctly predicts 67.8% of cases, ranging from a minimum of 60% in the passive-adopters group to a maximum of 73.9% for the active-adopters one.

Similarly to the previous model discussion, Table 6 shows summary statistics on the variables included in the model, and Table 7 reports the sign of the significant marginal effects of the explanatory variables in each subgroup (pseudo R^2=0.418). Also the *Participating Spectrum* model results confirm that the household income level and its degree of dependence on farming activity plays an important role in conditioning farmer's expressed behavior and his attitude towards AEMs. In particular, the level of total household income and the share gained from off-farm activities or pensions play an important role in conditioning resistant non-adopters behavior, with a positive sign and negative ones respectively. In other words, resistant non-adopters seem to have a stronger market-oriented farming approach than the other groups. The most intensive type of farming observed in this group confirms this result: the mean gross operating margin equals 3,150 euro/ha in this subgroup, while it is around 1,525 in conditional and passive ones and 1,200 in active; similar results can be observed in terms of labor/area ratio. As expected, 58% of organic farms in the sample are managed by active adopters. It is also interesting to note that income from pensions can be found more frequently in the two adopters' groups, mainly in the active one. In other words, there is evidence that a more elderly family structure and a more widespread part-time weaken the link between farming activity and total income in the two adopters' groups. Noticeably, the highest average farmer age is observed (over 55 years old) in the active participants group and in conditional non-adopters, while the average resistant is 49 years old and the passive one 51.6.

With regard to farmer characteristics, the model marginal results show that a higher education level does not positively affect a participating behavior, whereas it characterizes resistant non-adopters. This is probably due to the fact that a larger share of younger farmers is observed in the resistant group. Female gender positively affects conditional non-adopters behavior, but this should be interpreted with caution because of the low number of female farmers in the sample. More interestingly, and confirming the market orientation of the farm, positive expectations of their farm's medium-term perspectives are widespread among resistant farmers, while negative views on the farm's future life-cycle characterizes passive adopters. More precisely, Table 6 shows that the majority of resistant farmers (57.7%) plan to manage personally their farm for the next 10 years, with an investment-oriented approach, while a non-farming near future is more frequently seen in the eyes of conditional non-adopters and passive participants, but not of active ones. The latter try to integrate their environmentally friendly approach into their farming business by way of environmentally-based market recreational activities (32.6% of them over a total frequency of 23%).

Farmer's attitudes towards the environment *per se* and AEMs significantly affect their behavior. Personal environmental attitudes – measured as past experience with environmentally friendly farming practices without payments – have the expected signs among the different groups. It should also be noted that the share of farmers who are members of environmental protection associations drops from 8.7% in the active farmers group to zero in resistant non-adopters. Variables describing farmer's subjective normative beliefs towards the environment generally have the expected sign in each group. The active participant group is particularly sensitive to society's opinion on farming activity, while for the other groups of farmers a significant negative sign is observed for this variable. Taking the next-door society into account, and more particularly neighboring farmers, their opinion on the AEMs positively affects passive and, above all, active farmers' behavior, while the conditional non-adopters group shows the lowest percentage of farmers affected by other farmers' opinions. The non-participating behavior of the latter is also determined by their expectations on future, more restrictive prescriptions of AEMs. This result is clearer if we consider that among the majority of conditional non-adopters the perceived behavioral control factors do not favor participating behavior. Actually, this group has the fewest farmers expressing positive opinions on AEMs (only 18.9% of farmers consider the AEMs easy to implement, only 10.8% agree that the expected environmental results are clear and for 8.3% of them the payments do not fully cover the AEMs incurred costs). Noticeably, both resistant non-adopters and, more especially conditional ones, are reluctant to request technical information from neighboring farmers and/or external agronomists, preferring their input providers advice and/or to read farming magazines. On the other hand, the ‘information environment’ of adopters is more open to exchange of opinions with the other farmers.

Table 6 – Summary statistics on *Participating Spectrum Model* variables

Variable	Statistic	Resistant non-adopters	Conditional non-adopters	Passive adopters	Active adopters
% in each group (n=139)	%	18.7	26.6	21.6	33.1
HOUSINC	% of 1	3.8	8.1	10.0	10.9
	% of 2	23.1	24.3	36.7	19.6
	% of 3	15.4	40.5	20.0	37.0
	% of 4	26.9	16.2	16.7	21.7
	% of 5	30.8	10.8	16.7	10.9
INCPENS	Mean	0.11	0.18	0.27	0.28
	(st. dev.)	(0.24)	(0.29)	(0.38)	(0.33)
INCOFF	Mean	0.24	0.30	0.44	0.31
	(st. dev.)	(0.27)	(0.32)	(0.35)	(0.33)
HIGHEDU	% of yes	61.5	51.4	30.0	52.2
FEMALE	% of female	26.9	5.4	33.3	10.9
FUTURO	% of 1		2.7	3.3	
	% of 2	3.8	5.4	6.7	4.3
	% of 3	3.8	5.4	20.0	6.5
	% of 4	34.6	73.0	60.0	67.4
	% of 5	57.7	13.5	10.0	21.7
ENVOL	% of yes	11.5	32.4	53.3	23.9
ARGIM1	% of yes	3.8	10.8	3.3	45.7
ARGLEG1	% of yes	7.7	27.0	6.7	26.1
PERFARM	% of positive	34.6	13.5	53.3	60.9
TAFARM	% of often	3.8		6.7	2.2
	% of sometimes	23.1	32.4	46.7	41.3
	% of never	73.1	67.6	46.7	56.5
LETT1	% of yes	84.6	94.6	80.0	87.0

Table 7 – Multinomial logit *Participating Spectrum Model*: significant marginal effects[a] and signs in each subgroup

Variable	Resistant non-adopters		Conditional non-adopters		Passive adopters		Active adopters	
HOUSINC	+	**	-		+		-	
INCPENS	-	**	-	***	+		+	***
INCOFF	-	***	-	***	+	***	+	***
HIGHEDU	+	**	+		-	**	-	
FEMALE	+	*	-		+	***	-	*
FUTURO	+	***	-		-	**	+	
ENVOL	-	**	-		+	***	+	
ARGIM1	-	***	-	*	-	***	+	***
ARGLEG1	-		+	**	-	**	+	
PERFARM	-		-	***	+	*	+	***
TAFARM	+		+	**	-		-	*
LETT1	-		+	***	-	*	-	*
Log L= -110.252 n=139 McFadden pseudo R^2=0.418								

[a] *** p<0.05; ** p<0.1; * p<0.2

6. Concluding remarks

The paper has examined the more relevant AEMs to which farmers in the Veneto Region could voluntary subscribe in the period 2000-2006 under the regional RDP, receiving a pre-set payment for each one: i) low-impact measure, supporting organic farming and/or environmentally-friendly, input reduction-based practices; ii) conservation of grassland or conversion of arable land to grassland in the aquifer recharge belt measure and iii) the latter measure applied in the uplands (steep slopes). In general, eligibility criteria, compatibility and complementarity amongst measures, priorities established on different grounds, often overlap, producing a very complex – sometime even puzzling – picture, where the 'good intentions' regarding tailoring and choice of enforcement strategy have not always produced the desired results. Indeed, for example, measure (ii) has been subscribed to only on marginal grassland but very few arable land conversion has taken place (Regione Veneto, 2006b), while measure (iii) has been perceived, in most cases, as a farm income integration, mainly in mountain areas, instead of a 'real' AEM.

On the other hand, regional policy-makers are now trying to learn from past experience when designing the new 2007-2013 regional RDP, where, according to the EU decision, AEMs will also play a more relevant role in financial terms than the present program. Exploring not only structural and socio-economic factors affecting the farmers decision to participate or not in AEMs, but also their attitudes and beliefs towards the environment *per se*, the AEMs and society's needs in general, can help policy makers to define better tailored and more targeted measures in order to improve the farmers' rate of adoption of the AEMs.

This paper contributes towards reaching this goal by estimating two models that can describe farmers' behavior and attitudes towards AEMs. In particular, the *Measures Participation Model*'s estimated marginal effects clearly show that intensive farming, investment-oriented managerial behavior as well as the strong dependence of household income from farming activities results do not favor the uptake of any AEM,. These structural and economic factors act as constraints limiting participation. The *Participating Spectrum Model* – focusing on an entering spectrum ranging from passive resistant to active participating behavior, clearly confirms how mainly market-oriented farms, generally managed by highly-educated and relatively young farmers, with investment perspectives in their farm, are more reluctant to subscribe to AEMs contracts in any condition.

On the other hand, a farmer's perceived control beliefs (i.e. past experience in AEMs and positive evaluation of the measure in financial and easy-to-fit terms), as well as his personal attitudes towards environmental protection stimulate him to take up AEMs. The second estimated model also emphasizes how a farmer's normative beliefs, namely the opinions of society as a whole and even more so of neighboring farmers' are relevant for active adopters but also play a role in the case of passive participants.

Finally, some suggestions can be made to policy-makers from the results of the analysis, in order to help them to better tailor and target the new AEMs measures. Briefly:

(i) it appears difficult to involve resistant non-participants in future voluntary-based AEMs. A mixed alternative policy seems more appropriate for them. It would be based on command and control systems - imposing minimal environmentally friendly practices - as well as - under some circumstances - on public action aimed at stimulating voluntary eco-labelling and certification schemes that can internalize the over-the-minimal-standard provision of environmental non-market benefits into the market of differentiated goods;

(ii) conditional non-participating farmers might be ready to adjust their farming to new, better tailored, AEMs requirements. However, their generally mixed type of farming limits their capacity to adapt the agro-environmental prescriptions to certain productions, when the former are too different from their business-as-usual farming practices or expose them to risks of income loss unsustainable for their business. On the other hand, more flexible AEMs schemes - e.g. relaxing the whole farm approach of many 2000-2006 AEMs – as well as better fine-tuned payments estimates - could help conditional non-adopting farmers to participate in AEMs. Conditional non-participants do not take into account society's opinions on environmental protection and they do not make use of the 'informal information and advice network' established among farmers for their technical assistance. Considering also that this group is characterized by a below average farm size as well as an above average farmer's age, individual information provision and technical-administrative advice is probably needed. Also a more diffuse information provision on AEMs - focusing on their technical farming requirements and financial and administrative aspects and on examples of their possible cost implications – might also propel many of them into the AEMs adopters groups. Based on the satisfactory experience already observed in several Northern EU countries and in some new member states, the '*vis-à-vis* mentoring' instrument - based on an active role played by individual farmers in information provision and advice to others - could be experimented in the region;

(iii) an improved environmental awareness of passive adopters in their farming activity could be obtained by the regional policy-makers improving the effectiveness of the informal neighboring farmers' information and advice network that many passive adopters already appreciate and refer to;

(iv) finally, some suggestions for improving the AEMs schemes can also be drawn for active participants. Most of these are elderly farmers, with a traditional, more extensive approach to farming (i.e. AEMs are relatively easy for them to implement because no relevant changes are required to their farm management), they generally have no successors to run the farm and their income needs are not strictly related to farm activities. Younger, environmental protection-oriented farmers also form part of this group. They try to internalize the provision of environmental goods into their activities by organic farming and/or diversifying their activities. They are all strongly motivated and influenced by society's opinions and environmental needs and do not seem to suffer from the lack of information and advice on AEMs. In order to increase the number of active participants, regional policy-makers could better emphasize the relevant social role played by marginal farmers in environmental protection, as well as remove some constraints limiting access to the AEMs to the smallest and marginal farms.

References

Ajzen I. (1988) *Attitudes, personality and behaviour.* Dorsey Press, Chicago.

Ajzen I. and Fishbein M. (1980) *Understanding attitudes and predicting social behaviour.* Prentice Hall, Englewood Cliffs, New Jersey.

Beedell J.C. and Rheman T. (1996) A meeting of minds for farmers and conservationists? Some initial evidence on attitudes towards conservation from Bedfordshire. *Farm management*, 9(6), pp. 305-313.

Boatto V. and Defrancesco E. (2004) Dal protezionismo alla liberalizzazione dei mercati agroalimentari. in: E. Defrancesco (ed.) L*a liberalizzazione degli scambi dei prodotti agricoli tra conflitti e accordi. Il ruolo dell'Italia*. Atti del XL Convegno di Studi della Società Italiana di Economia Agraria, SIDEA. Milan, FrancoAngeli, pp. 73-134.

Bonnieux F., Rainelli P. and Vermersch D. (1998) Estimating the supply of environmental benefits by agriculture: a French case study. *Environmental and Resource Economics*, 11, pp. 135-153.

Brotherton I. (1989) Farmer participation in voluntary land diversion schemes: some observation from theory. *Journal of Rural Studies*, 5, pp. 299-304.

Burrell A. (2001) *Synthesis of the evidence of the possible impact of commodity price decreases on land use and commodity production, and the incidence on the provision of non-commodity output*, OCSE Workshop on Multifunctionality, Paris, 2-3 July 2001.

Colman D. (1994) Ethics and externalities: agricultural stewardship and other behaviour. J*ournal of Agricultural Economics*, 45 (3), pp. 299-311.

Coleman W. (1998) From protected agriculture to market liberalism: paradigm change in agriculture. *Journal of European Public Policy*, 5, pp. 632-651.

Council Regulation (EEC) No 2092/91 of 24 June 1991 on 'Organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs'. *Official Journal of the European Community* L 198 , 22/07/1991, pp. 0001 – 0015.

Council Regulation (EEC) No 2078/92 of 30 June 1992 on 'Agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside'. *Official Journal of the European Community L215, 30/07/1992, pp.0085-0090*

Council Regulation (EC) No 1257/1999 of 17 May 1999 on 'Support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and amending and repealing certain Regulations'. *Official Journal of the European Community*, L 160/80, 26/6/1999.

Council Regulation (EC) No 1698/2005 of 20 September 2005 on 'Support for rural development by the European Agricultural Fund for Rural Development (EAFRD)'. *Official Journal of the European Community*, L 227/1, 21/10/2005.

Damianos D. and Giannakopoulos N. (2002) Farmers' participation in agri-environmental schemes in Greece, *British Food Journal*, 104 (3/4/5), pp. 261-273.

Delvaux L., Henry de Frahan B., Dupraz P. and Vermersch D. (1999) Adoption d'une MAE et consentement à recevoire des agricolteurs en region wallone. *Economie Rurale*, 249, pp. 71-81.

Drake L., Bergström P. and Svedsäter H. (1999) Farmers' attitudes and uptake. In: G. Van Huylenbroeck and M. Whitby (eds.) (eds.) *Countryside Stewardship: Farmers, Policies and Markets*. Elsevier Science Ltd., pp. 89-111.

Dupraz P., Vanslembrouck I., Bonnieux F. and Huylenbroeck G. (2002) *Farmers' participation in European agri-environmental policies*, X EAAE Congress on Exploring Diversity in the European Agri-Food System, Zaragoza, Spain, 28-31 August 2002.

Dupraz P., Vermersch D., De Frahan B.H. and Delvaux L. (2003) The environmental supply of farm households, *Environmental and Research Economics*, 25, pp 171-189.

Falconer K. (2000) Farm-level constraints on agri-environmental scheme participation: a transactional perspective, *Journal of Rural Studies*, 16, pp.379-394.

Fraser R. (2004) On the use of targeting to reduce moral hazard in agri-environmental schemes. *Journal of Agricultural Economics*, 55 (3), pp. 525-540.

Gatto P. and Merlo M. (1999) The economic nature of stewardship: complementarity and trade-offs with food and fibre production in:. G. Van Huylenbroeck and M. Whitby (eds.) *Countryside Stewardship: Policies, Farmers and Markets*. Elsevier Science Ltd., pp. 21-46.

Gasson R. (1973) Goals and values of farmers, *Journal of Agricultural Economics*, 24, 521-542.

Glebe T.W. (2003) Multifunctional agriculture: how 'green' is the 'European model of agriculture'? *Discussion Paper 01-2003*, Technische Universitat Munchen, Environmental Economics, Resource Economics and Agricultural Policy Research Group, pp. 1-27.

Greene W.H. (2000) *Econometric analysis, fourth edition*, Prentice Hall International Inc., New York.

Hodge I. (2000) Agri-environmental relationships and the choice of policy mechanisms. *The World Economy,* 23 (2), pp. 257-273

Lactacz-Lohmann U. (2001) *A policy decision framework for devising optimal implementation strategies for good agricultural and environmental policy practices*. COM/AGR/CA/ENV/EPOC (2000)56/FINAL Paris: OECD, pp. 1-33.

Mann S. (2005) Farm size growth and participation in agri-environmental schemes: a configural frequency analysis of the Swiss case. *Journal of Agricultural Economics*, 56 (3), pp. 373-384.

Merlo M. and Manente M. (1994) Consequences of common agricultural policy for rural development and the environment. *European Economy – Reports and Studies* (5), pp. 133-164.

Merlo M., Ferro O. and Povellato A. (1995) Valuation and remuneration of countryside stewardship performed by agriculture and forestry. In: G.H. Peters and D.D. Hedley (eds.) *Agricultural competitiveness: market forces and policy choice*. Proceedings of the 22nd International Conference of Agricultural Economists Harare, Zimbabwe, 22-29 August 1995. Dartmouth: Oxford, pp. 415-435.

Morris C. (2004) Networks of agri-environmental policy implementation: a case study of England's countryside stewardship scheme, *Land Use Policy*, 21, pp. 177-191.

Morris C. and Potter C. (1995) Recruiting the new conservationists: farmers' adoption of agri-environmental schemes in the U.K., *Journal of Rural Studies*, 11 (1), pp. 51-63.

Peerlings J. and Polman N. (2004) Modelling the choice for agri-environmental schemes (AES). *90th EAAE Seminar on Multifunctional Agriculture, Policies and Markets: understanding the critical linkage*. Rennes, 28-29 October, 2004.

Pietola K. and Oude Lanksin (2001) Farmer response to policies promoting organic farming technologies in Finland. *European Review of Agricultural Economics*, 28 (1), pp. 1 – 15.

Potter C. and Burney J. (2002) Agricultural Multifunctionality in the WTO – legitimate non-trade concern or disguised protectionism ? *Journal of Rural Studies* 18, pp. 35-47.

Regione Veneto (2001) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2002) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2003) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2004) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2005) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2006a) *Relazione Annuale del Piano di Sviluppo Rurale alla Commissione Europea*, Venezia

Regione Veneto (2006b) *Valutazione del piano di sviluppo rurale 2000-2006 della Regione Veneto. Aggiornamento rapporto di valutazione intermedia* (dicembre 2005), Venezia.

Runge C. Ford (1999) *Beyond the green box: a conceptual framework for agricultural trade and the environment*. Working Paper WP99-1. Centre for International Food and Agricultural Policy. University of Minnesota, St. Paul, Minnesota U.S.A. pp. 1-31.

Vanslembrouck I., van Huylenbroeck G. and Verbeke W. (2002) Determinants of the willingness of Belgian farmers to participate in agri-environmental measures. *Journal of Agricultural Economics*, 53 (3), pp. 489-511.

Willock J., Deary I.J., McGregor M.J., Sutherland A., Edwards-Jones G., Morgan O., Dent J.B., Grieve R. and Gibson G.J. (1999) The role of attitudes and objectives in farmer decision making: business and environmentally-oriented behaviour in Scotland. *Journal of Agricultural Economics*, 50 (2), pp. 286-303.

Wilson G.A. (1996) Farmer environmental attitudes and ESA participation. *Geoforum*, 27 (2), pp.115-131.

Wilson G.A. and Hart K. (2001) Farmer participation in agri-environmental schemes: towards conservation-oriented thinking? *Sociologia ruralis*, 41 (2), pp. 254-274.

Wossink G.A.A. and van Wenum J.H. (2003) Biodiversity conservation by farmers: analysis of actual and contingent participation. *European Review of Agricultural Economics*, 30 (4), pp. 461 – 485.

Wynn G., Crabtree B. and Potts J. (2001) Modelling farmer entry into the environmentally sensitive area schemes in Scotland. *Journal of Agricultural Economics*, 52 (1), pp. 65-82.

Appendix

Table A1 - *Measures Participation Model* estimated coefficients

Variable	Coefficient	SE	b/SE	Sign.
	Prob(Y=1) Low-input measure			
INCFARM	-9.9119	3.2832	-3.0190	0.0025
QSAUAFF	-2.9348	2.2915	-1.2810	0.2003
OREFHA	-0.0110	0.0309	-3.5510	0.0004
AWUTOT	1.8198	0.6257	2.9080	0.0036
REDDXZON	-6.7613	2.1766	-3.1060	0.0019
NLIVEXP	2.6185	1.3527	1.9360	0.0529
INVEST	-2.2099	1.1701	-1.8890	0.0589
CHUAA2	-4.1842	1.6186	-2.5850	0.0097
EFF2078	3.7486	1.3675	2.7410	0.0061
COMPNS	4.0172	1.2624	3.1820	0.0015
APPLIC	5.6716	1.6333	3.4730	0.0005
	Prob(Y=2) Grassland conservation in aquifer recharge belt measure			
INCFARM	-5.5603	2.4704	-2.2510	0.0244
QSAUAFF	-3.1295	1.8725	-1.6710	0.0947
OREFHA	-0.0117	0.0309	-3.7940	0.0001
AWUTOT	1.0450	0.5483	1.9060	0.0567
REDDXZON	-8.6972	2.3323	-3.7290	0.0002
NLIVEXP	3.9482	1.2714	3.1050	0.0019
INVEST	-1.2591	1.0438	-1.2060	0.2277
CHUAA2	-2.8304	1.2261	-2.3080	0.0210
EFF2078	3.6528	1.2707	2.8750	0.0040
COMPNS	3.3243	1.2175	2.7300	0.0063
APPLIC	6.2984	1.5832	3.9780	0.0001
	Prob(Y=3) Grassland conservation in the uplands measure			
INCFARM	-10.7294	2.6984	-3.9760	0.0001
QSAUAFF	3.1587	1.8686	1.6900	0.0909
OREFHA	-0.0108	0.0314	-3.4300	0.0006
AWUTOT	1.0472	0.5363	1.9530	0.0509
REDDXZON	-15.3248	3.2033	-4.7840	0.0000
NLIVEXP	4.0641	1.3342	3.0460	0.0023
INVEST	0.3930	1.0833	0.3630	0.7168
CHUAA2	-1.2241	1.0958	-1.1170	0.2640
EFF2078	3.0424	1.3058	2.3300	0.0198
COMPNS	2.8456	1.2053	2.3610	0.0182
APPLIC	6.7301	1.5709	4.2840	0.0000

Table A2 – *Measures Participation Model*: marginal effects of independent variables in each subgroup

Variable	Coefficient	SE	b/SE	Sign.	Mean of X
Prob(Y=0) Non-participating					
INCFARM	1.8105	0.5356	3.3810	0.0007	0.4450
QSAUAFF	0.2829	0.3925	0.7210	0.4710	0.3414
OREFHA	0.0026	0.0007	3.7360	0.0002	182.8111
AWUTOT	-0.2728	0.1097	-2.4880	0.0129	2.2021
REDDXZON	2.3578	0.5369	4.3910	0.0000	0.3047
NLIVEXP	-0.8552	0.2620	-3.2640	0.0011	0.3538
INVEST	0.2174	0.2234	0.9730	0.3303	0.6077
CHUAA2	0.5978	0.2360	2.5330	0.0113	0.2846
EFF2078	-0.7996	0.2416	-3.3100	0.0009	0.3077
COMPNS	-0.7589	0.2356	-3.2220	0.0013	0.3154
APPLIC	-1.4451	0.3573	-4.0450	0.0001	0.6308
Prob(Y=1) Low-input measure					
INCFARM	-0.5820	0.3367	-1.7290	0.0839	0.4450
QSAUAFF	-0.2584	0.1973	-1.3100	0.1903	0.3414
OREFHA	-0.0004	0.0003	-1.5570	0.1194	182.8111
AWUTOT	0.1271	0.0738	1.7230	0.0849	2.2021
REDDXZON	-0.0152	0.1520	-0.1000	0.9201	0.3047
NLIVEXP	0.0256	0.1064	0.2410	0.8098	0.3538
INVEST	-0.1931	0.1224	-1.5770	0.1147	0.6077
CHUAA2	-0.3023	0.1692	-1.7870	0.0740	0.2846
EFF2078	0.1811	0.1396	1.2970	0.1946	0.3077
COMPNS	0.2274	0.1312	1.7330	0.0832	0.3154
APPLIC	0.1939	0.1552	1.2490	0.2116	0.6308
Prob(Y=2) Grassland conservation in aquifer recharge belt measure					
INCFARM	-0.1552	0.4635	-0.3350	0.7378	0.4450
QSAUAFF	-0.7778	0.3185	-2.4420	0.0146	0.3414
OREFHA	-0.0015	0.0005	-2.7200	0.0065	182.8111
AWUTOT	0.0924	0.0942	0.9810	0.3266	2.2021
REDDXZON	-0.6874	0.4170	-1.6480	0.0993	0.3047
NLIVEXP	0.5139	0.2323	2.2120	0.0270	0.3538
INVEST	-0.2158	0.1771	-1.2180	0.2231	0.6077
CHUAA2	-0.3827	0.2237	-1.7110	0.0870	0.2846
EFF2078	0.4676	0.2142	2.1830	0.0291	0.3077
COMPNS	0.3963	0.2001	1.9800	0.0477	0.3154
APPLIC	0.7439	0.3000	2.4800	0.0131	0.6308
Prob(Y=3) Grassland conservation in the uplands measure					
INCFARM	-1.0733	0.3821	-2.8090	0.0050	0.4450
QSAUAFF	0.7533	0.2915	2.5840	0.0098	0.3414
OREFHA	-0.0007	0.0004	-1.6660	0.0957	182.8111
AWUTOT	0.0532	0.0645	0.8250	0.4092	2.2021
REDDXZON	-1.6552	0.4780	-3.4630	0.0005	0.3047
NLIVEXP	0.3157	0.1836	1.7190	0.0855	0.3538
INVEST	0.1914	0.1334	1.4340	0.1515	0.6077
CHUAA2	0.0873	0.1371	0.6360	0.5245	0.2846
EFF2078	0.1509	0.1560	0.9680	0.3332	0.3077
COMPNS	0.1353	0.1374	0.9840	0.3249	0.3154
APPLIC	0.5073	0.2124	2.3890	0.0169	0.6308

Table A3 - *Measures Participation Model:* frequencies of actual and predicted outcomes

		Predicted				
		0	**1**	**2**	**3**	**Total**
Actual	**0**	49	1	0	4	54
	1	2	11	2	1	16
	2	2	3	10	5	20
	3	4	3	2	31	40
	Total	57	18	14	41	130

Table A4 - *Participating Spectrum Model* estimated coefficients

Variable	Coefficient	SE	b/SE	Sign.
	Prob(Y=1) Conditional non-adopters			
Constant	8.0095	3.8575	2.0760	0.0379
HOUSINC	-0.8221	0.3525	-2.3320	0.0197
INCPENS	0.7320	1.6061	0.4560	0.6486
INCOFF	2.0207	1.6939	1.1930	0.2329
HIGHEDU	-0.9518	0.8194	-1.1620	0.2454
FEMALE	-2.6833	1.1129	-2.4110	0.0159
FUTURO	-1.8544	0.6685	-2.7740	0.0055
ENVOL	1.3599	0.9192	1.4790	0.1390
ARGIM1	4.7787	1.7842	2.6780	0.0074
ARGLEG1	2.1586	1.1125	1.9400	0.0523
PERFARM	-0.8324	0.5622	-1.4810	0.1387
TAFARM	-0.0999	0.7132	-0.1400	0.8886
LETT1	2.6532	1.2124	2.1880	0.0286
	Prob(Y=2) Passive adopters			
Constant	10.8997	3.7918	2.8750	0.0040
HOUSINC	-0.4857	0.3795	-1.2800	0.2006
INCPENS	3.7291	1.7434	2.1390	0.0324
INCOFF	6.1819	1.9351	3.1950	0.0014
HIGHEDU	-2.2992	0.9256	-2.4840	0.0130
FEMALE	0.0751	0.9729	0.0770	0.9385
FUTURO	-2.2355	0.7019	-3.1850	0.0014
ENVOL	2.6497	0.9602	2.7590	0.0058
ARGIM1	3.5118	2.1284	1.6500	0.0989
ARGLEG1	-0.0072	1.4528	-0.0050	0.9961
PERFARM	0.8687	0.5799	1.4980	0.1342
TAFARM	-1.0659	0.8157	-1.3070	0.1913
LETT1	-0.0302	1.2115	-0.0250	0.9801
	Prob(Y=3) Active adopters			
Constant	9.2390	3.8523	2.3980	0.0165
HOUSINC	-0.6783	0.3776	-1.7960	0.0724
INCPENS	5.1420	1.7347	2.9640	0.0030
INCOFF	5.7137	1.9068	2.9960	0.0027
HIGHEDU	-1.3817	0.8595	-1.6080	0.1079
FEMALE	-2.9365	1.2327	-2.3820	0.0172
FUTURO	-1.6689	0.7054	-2.3660	0.0180
ENVOL	1.8544	0.9582	1.9350	0.0530
ARGIM1	7.8694	1.8207	4.3220	0.0000
ARGLEG1	1.5206	1.2078	1.2590	0.2080
PERFARM	0.8967	0.5894	1.5210	0.1282
TAFARM	-1.1952	0.7542	-1.5850	0.1131
LETT1	0.2377	1.1291	0.2100	0.8333

Table A5 – *Participating Spectrum Model*: marginal effects of independent variables in each subgroup

Variable	Coefficient	SE	b/SE	Sign.	Mean of X
Prob(Y=0) Resistant non-adopters					
Constant	-0.5526	0.2524	-2.1890	0.0286	
HOUSINC	0.0413	0.0228	1.8090	0.0704	3.0935
INCPENS	-0.2086	0.1253	-1.6650	0.0959	0.2223
INCOFF	-0.2790	0.1390	-2.0070	0.0448	0.3219
HIGHEDU	0.0859	0.0503	1.7060	0.0880	0.4892
FEMALE	0.1363	0.0868	1.5700	0.1163	0.1727
FUTURO	0.1108	0.0511	2.1690	0.0301	4.0072
ENVOL	-0.1116	0.0655	-1.7030	0.0885	0.3022
ARGIM1	-0.3632	0.1446	-2.5120	0.0120	0.1942
ARGLEG1	-0.0857	0.0693	-1.2370	0.2160	0.1871
PERFARM	-0.0206	0.0304	-0.6780	0.4979	0.2230
TAFARM	0.0495	0.0462	1.0710	0.2842	2.5755
LETT1	-0.0573	0.0648	-0.8840	0.3766	0.8705
Prob(Y=1) Conditional non-adopters					
Constant	-0.1708	0.5245	-0.3260	0.7447	
HOUSINC	-0.0535	0.0517	-1.0350	0.3005	3.0935
INCPENS	-0.7454	0.2728	-2.7330	0.0063	0.2223
INCOFF	-0.6875	0.2494	-2.7570	0.0058	0.3219
HIGHEDU	0.1135	0.1199	0.9470	0.3438	0.4892
FEMALE	-0.1679	0.2069	-0.8110	0.4171	0.1727
FUTURO	-0.0397	0.0755	-0.5260	0.5991	4.0072
ENVOL	-0.1113	0.1258	-0.8840	0.3765	0.3022
ARGIM1	-0.2568	0.2016	-1.2740	0.2026	0.1942
ARGLEG1	0.2458	0.1328	1.8510	0.0642	0.1871
PERFARM	-0.3424	0.0815	-4.2020	0.0000	0.2230
TAFARM	0.1988	0.1115	1.7830	0.0746	2.5755
LETT1	0.5236	0.2055	2.5480	0.0108	0.8705

(continue)

Table A5 (cont.)– *Participating Spectrum Model*: marginal effects of independent variables in each subgroup

Variable	Coefficient	SE	b/SE	Sign.	Mean of X
		Prob(Y=2) Passive adopters			
Constant	0.4258	0.3544	1.2020	0.2295	
HOUSINC	0.0287	0.0393	0.7310	0.4647	3.0935
INCPENS	0.0898	0.1924	0.4670	0.6407	0.2223
INCOFF	0.3397	0.1689	2.0110	0.0443	0.3219
HIGHEDU	-0.1776	0.0973	-1.8260	0.0679	0.4892
FEMALE	0.4035	0.1515	2.6630	0.0077	0.1727
FUTURO	-0.0947	0.0525	-1.8050	0.0711	4.0072
ENVOL	0.1684	0.0865	1.9460	0.0517	0.3022
ARGIM1	-0.3920	0.2022	-1.9380	0.0526	0.1942
ARGLEG1	-0.2462	0.1391	-1.7700	0.0767	0.1871
PERFARM	0.1009	0.0652	1.5480	0.1216	0.2230
TAFARM	-0.0546	0.0826	-0.6610	0.5086	2.5755
LETT1	-0.1694	0.1318	-1.2850	0.1989	0.8705
	Prob(Y=3) Active adopters				
Constant	0.2975	0.5694	0.5230	0.6013	
HOUSINC	-0.0165	0.0609	-0.2720	0.7860	3.0935
INCPENS	0.8642	0.3041	2.8420	0.0045	0.2223
INCOFF	0.6268	0.2798	2.2400	0.0251	0.3219
HIGHEDU	-0.0218	0.1342	-0.1620	0.8712	0.4892
FEMALE	-0.3719	0.2450	-1.5180	0.1290	0.1727
FUTURO	0.0236	0.0869	0.2720	0.7859	4.0072
ENVOL	0.0546	0.1417	0.3850	0.7003	0.3022
ARGIM1	1.0121	0.2212	4.5750	0.0000	0.1942
ARGLEG1	0.0861	0.1594	0.5400	0.5891	0.1871
PERFARM	0.2621	0.0982	2.6690	0.0076	0.2230
TAFARM	-0.1937	0.1206	-1.6060	0.1083	2.5755
LETT1	-0.2969	0.1990	-1.4920	0.1357	0.8705

Table A6 - *Measures Participation Model:* frequencies of actual and predicted outcomes

		Predicted				
		0	**1**	**2**	**3**	**Total**
Actual	**0**	17	6	2	1	26
	1	3	25	2	7	37
	2	2	5	18	5	30
	3	2	4	6	34	46
	Total	24	40	28	47	139