# Predictive model for meadow owners' participation in agri-environmental climate schemes in Natura 2000 areas

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## ARTICLE INFO

## ABSTRACT

European semi-natural grasslands maintained through traditional practices are among the most species-rich plant communities within the present-day rural landscape. However, land use change has caused a drastic decline in grassland area. In European agricultural policy, agri-environmental schemes (AES) have been introduced to preserve, enhance and restore biodiversity on European farmland. Goričko Landscape Park (GLP) in Slovenia is Natura 2000 area with the aim to preserve traditional and extensive small-scale farming. Measures to encourage proper management of extensively used meadows in GLP were carried out within the Agricultural Environmental Climate Scheme (AECS). The aims of this research were to identify key factors that might affect an owner's decision to adopt AECS. The data were collected with online and paper versions of a survey completed by 198 meadow owners between April 2015 and April 2016. Owners reported that 41.3% of a total of 368 meadows were involved in AECS. In year 2015, there were 156 officially registered Agricultural Economies from GLP. With 53 analysed meadows (34%), involved in AECS, the confidence level was 95% and the confidence interval was 11. Based on binominal logistic regression factors having a positive significant influence on participation in AECS were, as follows: large meadow area, higher education level and higher knowledge about goals of Natura 2000. Factors that do not statistically significantly contribute to participation in AECS are meadow type, income, age, gender, environmental values, management independence, subsidy rate and knowledge about AECS. Factor having a negative significant influence on participation in AECS was subsidy procedure. To increase the number of participants in AECS and therefore encourage proper management of extensively used meadows, young owners should be encouraged to participate in AECS, because older owners who had completed secondary school were more likely to participate in AECS. There is also a lack of female owners participating in AECS because of their lack of skills and knowledge about AECS. Additionally the subsidy procedure for joining AECS should be simplified. Owners should get more information about AECS and available options and why it even matters to implement AECS. With knowledge about the factors that influence participation in AECS, we can positively affect farmer behaviour, thereby increasing the number of participants in AECS.

## 1. Introduction

Agricultural landscapes harbor an important range of biodiversity, both within crops and in non-crop habitats (Storkey et al., 2011). The biodiversity in agricultural landscapes depends on their natural components, land use and agricultural practices (Jaskulski and Jaskulska, 2012; Batáry et al., 2015). Sustainable development should therefore involve maintaining the equilibrium between the productive, economic and social functions of agricultural landscapes and its ecological functions, including maintaining biodiversity (Jaskulski and Jaskulska, 2012).

In the European agricultural landscape, one can recognize three major processes responsible for loss of biodiversity: (i) the intensification of agriculture, (ii) the abandonment of marginally productive but high nature value farmland, and (iii) the changing scale of agricultural operations (Henle et al., 2008). To address biodiversity loss in Europe, agri-environment schemes (AES) have recently become a primary practical solution because they directly support pro-environmental agricultural management (EEA, 2004; Batáry et al., 2015).

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within the present-day rural landscape and form the habitat of a large number of rare and endangered species (Škornik, 2003; Calaciura and Spinelli, 2008; Pipenbaher et al., 2013); however, modern agricultural practices have resulted in a loss of biodiversity in these habitats across Europe (Cousins et al., 2007; Feehan and O'Connor, 2009; Hooftman and Bullock, 2012; Kaligarič and Ivajnšič, 2014). AES, co-financed by Member States, are the primary mechanisms to prevent the decline in semi-natural grasslands in the European Union. The main goal of these schemes is the maintenance of endangered habitats associated with the Natura 2000 program (hereafter, N2000). The measures are intended to encourage farmers to protect the environment on their farmland by providing financial compensation for carrying out biodiversity-enhancing land-use measures (EEA, 2004).

Grassland owners, hereafter owners, are important decision makers in terms of conservation and management (Birge and Herzon, 2014). According to Lastra-Bravo et al. (2015), the main factors that influence participation in the AES can be classified as follows: (i) the owner's characteristics (age, education, awareness about AES and income type); (ii) attitudes toward conservation and the environment; (iii) financial motivation (e.g. subsidies); (iv) attitudes toward management independence (e.g., owners are more likely to have more independence through managing their meadows without severe restrictions); (v) subjective norms (e.g. neighbours' influence on an owner's decision), and (vi) meadow size.

Support for conservation activities depends on farmers' motivation and attitudes (Walder and Kantelhardt, in press; Snoo et al., 2013). For example, in a study on general public opinion about efficient managent and conservation of extensive meadows »Šorgo et al., 2016«, it was found that residents in Goričko Landscape Park (GLP) support extra payment for farmers who are willing to manage grasslands in the interests of the welfare of protected plant and animal species (e.g. manual hay cutting). Additionally, it was revealed that positive attitudes toward conservation, and belief in a better quality of life in N2000 areas were positive predictors of willingness to participate in measures for preserving biodiversity.

### 1.1. Purpose of the research and research questions

Measures to encourage proper management of extensively used meadows were carried out within the Agricultural Environmental Climate Scheme (AECS). It was recognized that only a small number of potential grasslands in Slovenia are included in AECS. In a previous study (Šorgo et al., 2016) connections between personal characteristics of farmers, grassland characteristics, and actual participation in AECS in GLP were not examined. Therefore, the objectives of our present study were as follows: (i) to identify key factors that might affect a farmer's decision to adopt AECS; and (ii) to provide policy makers with empirical background to design more attractive and friendly AECS for actual and potential participants.

By emphasizing knowledge about the factors that potentially affect participation in AECS (Ajzen, 1991), our research question was as follows: Do (i) meadow characteristics, (ii) the owners's demographic characteristics, (iii) environmental values, (iv) management independence, (v) opinions about subsidies, (vi) subjective norms and (vii) knowledge about AECS and the goals of N2000 have an influence on owner participation in AECS?

Based on our previous research ("Šorgo et al., 2016"), and informed expectations (Fig. 1) our predictions were that participation in AECS will be influenced by: ownership of a particular meadow type (Wolff et al., 2001; Kleijn and Sutherland, 2003); its' area (Damianos et al., 1995; Capitanio et al., 2011; Ruto and Garrod, 2009); source of income (Wossink and van Wenum, 2003; Ruto and Garrod, 2009); education level (Adesina and Zinnah, 1993 and Damianos and Giannakopoulos, 2002), age (Wynn et al., 2001; Bonnieux et al., 1998), gender (Dalen and Halvorsen, 2011); environmental values (Oldfield et al., 2003; Ruto and Garrod, 2009; Barreiro-Hurlé et al., 2010); management

independence (Schenk et al., 2007); subsidy procedure (Peerlings and Polman, 2009; Hejnowicz et al., 2016); subsidy rate (Herzon and Mikk, 2007); self-evaluation about knowledge of AECS (Wilson and Hart, 2000); knowledge about the goals of N2000 (Stenseke, 2009; Suškevičs and Külvik, 2011; Eurobarometer, 2013; Authors); and subjective norms (Wilson, 1996; Damianos and Giannakopoulos, 2002).

## 2. Materials and methods

### 2.1. Goričko landscape park

With an area of $463.5 \, \text{km}^2$, Goričko Landscape Park in Slovenia, hereafter GLP, forms one part of the Trilateral Park: Goričko (Slovenia), Raab (Austria) and Örség (Hungary) (Ivajnšič et al., 2012). The climate is moderate continental or sub-Pannonic, with dry winters. The mean temperature in January is $-2\,^\circ\text{C}$ and in July $19\,^\circ\text{C}$. The annual rainfall is between 730 and 950 mm. Geological substrates are mainly tertiary sediments (Cousins et al., 2014). The GLP is a mixture of forest and open areas. Half of the territory is agricultural land, with a mosaic of fields, grassland, orchards, vineyards, hedges or small groups of trees (Ivajnšič et al., 2012).

There are four grassland habitat types covered by the EU Habitat Directive in the GLP: Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*), and important orchid sites (6210); Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) (6230); Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410); and Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510) (Trčak et al., 2012).

GLP has been a N2000 area since 2002, with the aim of preserving traditional and extensive small-scale farming (Kaligarič et al., 2008; Ivajnšič et al., 2012). However, during the last decade, cover of extensive grasslands decreased by over 30% in the eastern part of the GLP, owing to intensification of agricultural practices or abandonment of mowing (Trčak et al., 2012). Measures toward proper management of species-rich meadows in GLP are carried out under the Agricultural Environmental Climate Scheme (AECS) within the Slovenian AES (Ministry of Agriculture, Forestry and Food of RS, 2015). Agricultural Economies (farms and cooperatives) that want to join AECS have to (i) fulfill obligatory or optional demands for at least five years; (ii) be owners of at least one hectare of agricultural land recorded in the Register of Agricultural Economy; (iii) include at least 0.30 hectar of their agricultural land in the scheme; (iv) attend six hours of the AECS training program and (v) prepare a program of commercial agricultural activities.

AECS in Slovenia include 19 operations, with obligatory and optional demands for farmers (see Ministry of Agriculture, Forestry and Food of RS, 2015). Not all of these operations are relevant for meadow management or can be applied in GLP, so in our study we focused on three AECS operations concerning extensive, species-rich grasslands, as follows: (i) Special grassland habitats with the obligatory requirement 'Mowing or grazing is not permitted before June 30th'; (ii) grassland habitats for butterflies with the obligatory demand, 'Mowing or pasture is not permitted between June 15th and September 15th and (iii) high-trunk meadow orchards.

### 2.2. Sample and sampling

The data were collected through the online survey system 1ka (EnKlikAnketa, 2015) and in paper and pencil format to examine opinions about meadow management, attitudes towards N2000 and meadow usage. Snowball sampling (Noy, 2008) was used in a timeframe between April 2015 and April 2016. The link to the online questionnaire was posted on social media and via e-mail. Respondents were asked to forward the questionnaire link to GLP residents. A paper version of the questionnaire was also prepared for respondents without