The economic value of high nature value farming and the importance of the Common Agricultural Policy in sustaining income: the case study of the Natura 2000 Zarandul de Est (Romania)

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The economic value of high nature value farming and the importance of the Common Agricultural Policy in sustaining income: the case study of the Natura 2000 Zarandul de Est (Romania)

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Abstract

This study assesses the economic value of land use changes in the Zarandul de Est (Romania) Natura 2000 site, applying the ecosystem services approach proposed by the TESSA toolkit. The aim is to provide support to decision-making in the context of high nature value farming, debating the contribution of public subsidies and agri-environmental schemes to farmers' income. Local and global agroforestry ecosystem services are compared under two different land use scenarios: 1) land abandonment followed by natural afforestation; 2) sustainable cattle grazing in semi-natural grasslands. The scenario analysis shows that an improved use of pasture land determines a relevant increase in net economic value. However, direct and rural agro-environmental payments applied to high value nature farming are necessary to provide viable financial support to farmers and achieve the economic impacts described by the ecosystem services approach. Under the 2007-2013 rules, Common Agricultural Policy payments show to be equal to 130% of the household income and able to cover the full cost of the average farm in Zarand, a figure similar to other European marginalised areas. This result suggests that public support, in the absence of a full implementation of payment for ecosystem services schemes, is necessary to limit socio-economic deprivation of European marginalised farming systems. However, without reaching smallholders (farmers holding <1ha) and commoners (farmers using common grassland) who are both currently excluded, the current state agricultural payments shows limited impacts in sustaining the resiliency of the Zarand socio-ecological system. As alternatives to CAP payments, income diversification strategies (e.g. ecotourism, incentives to re-wilding) are proposed as well as the required conditions under which they can be applied, and in what terms these strategies can sustain the strict requirements of halting biodiversity loss in Natura 2000 sites.

Keywords

Farm economics, CAP payments, Ecosystem services, High Nature Value Farming, Economic value

Highlights

- TESSA is implemented in the Zarand Natura 2000 site to assess agricultural ecosystem services under different scenarios
- Benefits from natural afforestation are compared to provisioning services from farming
- Pasturing generates high economic value but CAP payments need to support farmers' income
- PES-like schemes can diversify income and reduce the burden of CAP

1. Introduction

Agricultural landscapes naturally provide a number of ecosystem services including soil fertility, water and climate regulation, and aesthetic and cultural benefits (Swinton et al., 2007; Cooper et al., 2009; de Groot et al., 2010; Power, 2010). These services are typically undervalued, as they are provided free of charge as typical public goods (Turner and Daily, 2008) and because markets fail to adequately signal their true value (Ribaudo et al., 2010). This undervaluing is often considered a key factor in the decline, degradation, and in some cases irreversible loss of ecosystems and biodiversity. For these reasons, recent studies have called for increased attention to developing approaches for ecosystem services and biodiversity valuation, and better understanding of reciprocal relationships between biodiversity and services (Bennet et al., 2009). Commodification of nature is one of these approaches. While not commonly accepted by scientists and conservationists (McCauley, 2006; Turnhout et al., 2013), it permits the possibility of embedding services protection into a market context (TEEB, 2010; UK-NEA, 2011), and to facilitate long-term behavioural changes towards nature conservation (Burton and Schwartz, 2013).

In the EU, services provided by agricultural landscape are incentivised through participation in a voluntary market, created under the EU Common Agricultural Policy (CAP), to support rural development and deliver environmental public goods (Defra, 2009). However, this market is not yet temporally and spatially tailored to deliver specific environmental outcomes (e.g. supporting regulating services), but rather to address “management-based” strategies expected to produce public goods by compensating the opportunity cost of low-intensity agricultural practices via CAP payments (Hanley et al., 2012; Burton and Schwartz, 2013). Although examples of “outcome-based” markets of public goods have been implemented for the preservation of species-rich meadows (Oppermann and Briemle, 2002), the reproduction of large carnivores such as lynx and wolverines (Zabel and Hom-Muller, 2008) and the management of landscapes such as peatland (Bonn et al., 2014), these are mainly supported by action-based payment schemes. The latter have the advantage of being easily implemented and monitored and accepted by farmers, although they are not always recognised as providing evidence of biodiversity conservation (Kleijn et al., 2004; Reed et al., 2014; Pe'er et al., 2014; Viaggi et al., 2015).

In this study, the evaluation of CAP support to farmers' income is carried out in the Natura 2000 site Zarandul de Est (Romania) and compared with the value of relevant ecosystem services provided by high nature value farming that support farmers' livelihoods, following the approach proposed by the TESSA toolkit (Peh et al., 2013). TESSA enables relatively rapid and inexpensive assessment by non-experts. It can be used to emphasise the consequences of potential changes in land management on ecosystem services provision and biodiversity, and to consider the equity implications of decisions (Birch et al., 2014). Furthermore, it engages directly with local partners and stakeholders in and beyond the site to build collective capacity and facilitate the embedding of bottom up decisions into planning (Hauck et al., 2013), build capacity in ecosystem services valuation, identify key ecosystem services, assess their values under alternative scenarios, and facilitate the formulation of recommendations to policy makers on how to achieve sustainable outcomes (Menzel and Teng, 2009). We projected land use scenarios in a 10 year horizon and reported welfare measure of ecosystem services (Hal, 2006). In other terms, we assessed the economic value (producer surplus) that can be generated for producers (as described in section 2.5) under different scenarios (described in section 2.4 and quantified in Tables 6 and 7). Ecosystem services valuations have already focused on marginalised regions (areas with unfavourable economic conditions that used to be better off, but are presently characterised by depressed socio-economic conditions) that support a healthy agro-tourism market in western (PEGASUS, 2017; Hegarty and Przezborska, 2005) and eastern European countries (Popa, 2014; 2016; Iorio and Corsale, 2010). Moreover, investigation of different management scenarios for the provision of forest services has been proposed in Romania (Popa et al., 2013). Considering the paucity of research exploring social impacts of agri-environment schemes (Mills, 2012), the contribution of this paper to the literature is to present an analysis of the economic value that agro-forestry ecosystems services provide to smallholders, along with implications for landscape connectivity and wildlife conservation. Results can be used to raise awareness of the value of agriculture, to illustrate how the implementation of an ecosystem services approach requiring limited human and financial resources can be used to inform the local decision-making system, as already proposed for other low-income countries (Birch et al. 2014; Thapa et al. 2016; Peh et al. 2014a), and to elucidate the impact that Pillars I and II of the CAP have on income security and on making land use sustainable (economically viable).

In this study, we support the hypothesis that income in marginalised areas can be sustained by CAP subsidies and other incentives to cover the cost of production, alleviate conditions of poverty, and indirectly deliver environmental public goods. Conversely, the alternative strategy of adopting markets for ecosystem services (e.g. PES-like schemes) is not sufficiently mature to provide a stable income to marginalised farmers, although it has been shown to efficiently reward some systems characterised by high biodiversity (Burton and Schwarz, 2013; Keenleyside et al., 2014). Examples of mountain farming systems in Europe that are unable to sustain multiple uses to diversify income, but strongly depend on support from the rural development compensation scheme (second pillar of the CAP), are given by O'Rourke et al. (2016). Three key aspects facilitate the promotion of management-based payments supported by the CAP. First, public subsidies and agro-environmental payments are easier to administer and of higher social acceptability (Wynne-Jones, 2013), even though they do not necessarily guarantee biodiversity protection and provision of regulating services (Pe'er et al., 2014; Viaggi et al., 2015). Second, private market schemes selling ecosystem services do not generate or enhance public goods and various non-monetary forms of capital where farming is not profitable and the farmer decides to cease any activity (Strijker , 2005; Burton and Schwarz, 2013), as commonly happens in marginalised mountain areas. Third, under reduced subsidisation, it is projected that marginalised land in Europe will be abandoned over the next 20-30 years because of non-adequate marginal return (Keenleyside and Tucker, 2010; Renwick et al., 2013). This in turn has detrimental social consequences in areas where low-intensity farming contributes to local livelihoods and the maintenance of priority habitats (Caballero et al., 2007).

Following these considerations, this paper first presents the economics of high nature value farming in the study region of Zarandul de Est (Romania), then compare two scenarios of land management, and finally demonstrates the importance of direct subsidies (CAP Pillar I) and environmental compensations in sustaining costs of farming, increasing the resilience of farm businesses and indirectly providing an environmental dividend. A rapid calculation with the 2007-2013 CAP payments and the 2014-2020 rules is provided in comparison with rural contexts in Western Europe. Finally, some forms of PES-like schemes for diversifying income are suggested, and considerations for biodiversity conservation are provided. Although the scenario analysis proposed cannot illustrate how to minimize conflicts between wildlife protection and enhancement of agricultural production, it nonetheless provides additional information for decision-makers, showing trade-offs between services supplied and the targeted beneficiaries.

2 Methods

2.1 Site context

The Zarandul de Est Natura 2000 site (ROSCI0406) in the Carpathian Mountains of Romania covers 20,315 hectares (203 km²) and hosts approximately 750 households distributed between the communities of Rosia, Troas and Almasel. Figure 1 depicts the site in the context of the Apuseni corridor, a network of Natura 2000 protected areas in the Apuseni chain of Transylvania, forming part of the Western Carpathians.

FIGURE 1 HERE

Most of the Zarand region is scarcely populated, and the area is dominated by a complex of largely natural ecosystems with an exceptional diversity: a landscape of old growth forests, semi-natural deciduous (52%) and coniferous woodland (16%), lakes, rivers, valley wetlands, cliffs and caves. The site is rich in ancient and pristine forests, with many undisturbed areas containing significant fallen dead wood, and is an important habitat for a range of species including the Rosalia longicorn (*Rosalia alpina*). Floodplain woodland, increasingly scarce across Europe, supports key species such as the rare and internationally protected carabid *Carabus variolosus*. In total, over 77% of the area is forested, with much of the remaining land characterised by pastoral (5.5%) and other agricultural uses (4%)[1].

The most recurrent farming systems in Romania are semi-natural grassland for livestock grazing and small-scale farms with a mix of hay meadows arable land and a mosaic of landscape features (Keenleyside et al., 2014). These systems account for over 80% of the landscape features in Zarand and are characterised by a strong trade-off between high biodiversity and low productivity sustained by traditional farming methods that contribute to high regional diversity alongside food production. In technical terms, they are called high nature value farming systems (Paracchini et al., 2007; Beaufoy and Cooper, 2008; Pienkowski, 2011; Price, 2012).

Agricultural land has traditionally been used for small-scale and low input farming, which supports floristically diverse hay meadows and arable fields and allows large carnivores to move through the landscape. These are semi-natural habitats that need to be regularly mowed

[1] Information on the Zarandul del Est Natura 2000 site is available at http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=ROSCI0406; consulted in June 2017

and manured in a non-intensive manner (ENRD; 2010; Calaciura and Spinelli, 2008). Nevertheless, a homogenous implementation of EU agricultural policies has incentivised the shift to more efficient productive systems, driving land degradation and large-scale reduction of biological diversity (Stoate et al., 2001). The latter is manifested by the impoverishment of plant communities through over-fertilisation. Floral species in the lowlands such as *Alopecurus pratensis* and *Sanguisorba officinalis* are lost where grasslands are replaced by intensive agriculture, and in the highlands where hay meadows are abandoned to natural afforestation (Baur et al., 2006). Finally, amongst the Natura 2000 priority habitats, we must mention the loss of typical temperate forests due to intensive timber logging (not driven by the CAP), such as the Tilio-Acerion forests (9180) and Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0).

The main stakeholders in the area are small landowners. Land ownership is highly complex, and land has been and continues to be restituted to the original owners following collectivisation under the previous communist regime. Accurate ownership data is not available in Zarand, but it would be reasonable to assume values close to the average of the whole nation where nearly 54% of the land is public, 43% is privately owned, and 3% is administered by community organisations (Page and Popa, 2013). In addition to landowners, local and national authorities, the Natura 2000 custodian in charge of coordinating stakeholder views and management measures, namely the local environmental NGO "Association Zarand", is a key target stakeholder. Local small-scale associations, primarily of beekeepers and milk farmers, are also important stakeholders and their concerns have been considered at all stages of the scenario formulation under the ecosystem services assessment.

2.2 Overall approach to ecosystem services evaluation

This study applies a recently-developed toolkit (TESSA - URL: http://www.bird life.org/datazone/info/estoolkit) that aims to assess and monitor ecosystem services at site level, without substantial technical expertise and financial resources (Peh et al., 2013). The TESSA toolkit (version 1) presents a series of charts to guide practitioners through the valuation of 5 main terrestrial ecosystem services (carbon sequestration, recreational values, cultivated crops, non-timber forest products, and water related services). It uses well-known approaches simplified to overcome the difficulties that non-experts may find, especially at the interface between biophysical assessment and monetary quantification. The toolkit suggests how to carry out a rapid appraisal, when it is convenient to move to a full assessment, and how to communicate and present results. Because the aim is to help planning, TESSA introduces the need to choose alternative scenarios against which ecosystem services must be valued and compared with respect to a baseline (Peh et al., 2014a). Suggestion is for alternative land uses or management typologies occurring within or outside the area of interest. In this way the scenario analysis becomes a comparison between two or more states, driven by stakeholder desires, expectations, or policy measures already occurring in the landscape of interest (McKenzie et al., 2012).

Although alternative tools to TESSA for identifying, measuring and valuing ecosystem services exist, the majority are technical, expensive and often not oriented to capture stakeholder opinions (Bagstad et al., 2013). A number of tools and methods have been developed to assess, quantify and value ecosystem services based on complex benefit transfer from global to local scale (Seppelt et al., 2011) or economic analysis integrated into GIS such as InVest (Tallis et al., 2013), or ARIES (Villa et al., 2009). However, notwithstanding successes achieved in engaging with policy makers and in driving decision-making (Ruckelshaus et al., 2013), these tools need a considerable amount of data and none enable site-scale data collection under limited technical knowledge and investment constraints

(Birch et al., 2014; Thapa et al., 2016; Peh et al., 2014a). Conversely, TESSA provides inexpensive assessments by non-experts of the magnitude, monetary values, and distribution of ecosystem services by sites, with an understanding of the consequences for stakeholders of potential changes and implications in land use management (Birch et al., 2014; Thapa et al., 2016).

2.3 Methodology adopted for valuing ecosystem services at Zarand

Local stakeholders in the forestry and agriculture sector as well as local decision-makers identified in a workshop those services that were most socially and economically important for the Zarand community. The final choice fell on provisioning services such as agricultural products, wild goods and livestock, and regulating services such as changes in carbon sequestration under natural afforestation and forest clearance scenarios (Benbow et al., 2015). Soil erosion control, water supply, and flooding regulation were not felt a priority as similarly observed in other studies on the importance of ecosystem services in Romania's rural cultural landscape (Hartel et al., 2014), and therefore were not object of valuation in this study.

Five yields (maize, hay, potatoes, onions and apples) and five livestock (pigs, poultry, cows, sheep and bees) were chosen from key interviews with local producers and valued applying the market price method (Carson and Bergstrom, 2003). A questionnaire survey was carried out to estimate the level of production, the range of local market prices, and the inputs and costs needed to grow each product (capital and running costs were considered). In addition, a specific questionnaire for non-cultivated goods was designed to assess costs and benefits of collecting forest products such as fuel wood, mushrooms, berries, and medicinal plants, with information on quality and area of the forest explored, and distance from home where these goods are collected. Timber was excluded from the questionnaire, as any subsistence collection of timber for personal use is actually illegal. The collection of these data was needed considering the absence of secondary information at local scale.

Fifty-one households, 7% of the entire population, were interviewed. We generated random numbers that were assigned to each household and then sampled every 10th unit following the systematic sampling approach. This strategy was favoured by the specific layout of the villages where all households are located along a linear path, the main road of the village (for more details see Benbow et al., 2015). All the services were valued in monetary units (RON 2014 constant prices)[2] per unit of area and per household, and for the whole community to provide a comparative baseline for the scenarios analysis.

In the analysis of economic value, agricultural payments received by farmers under the CAP were excluded, as these would distort the economic value of production (producer surplus) to farmers (Bateman et al. 2011) and would prevent assessment of the impact of public support on farmers' incomes. In addition, the value of unpaid manual labour (remuneration of land owner and household collaborators), generally omitted from reported costs but representing a real cost to the production of cultivated goods, was included as in Peh et al. (2014b) to estimate the net socio-economic value of the production.

Land cover change was analysed through Landsat images over the last 25 years (Table 1). The carbon sequestration rate in temperate forests (estimated at 1.41 tCO2e/ha/yr following IPCC (2006)) and more specific carbon emission rate in the Zarand logged deciduous forest (estimated at 7.1 tCO2e/ha/yr by Citroen (2013))[3] were used to assess changes in carbon sequestration under natural afforestation and forest clearance, compared to the IPCC tier 1 approach suggested by TESSA. This more specific valuation was possible owing to the

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[2] In 2014 RON 1 was equivalent to EUR 0.223.

[3] The unit tCO_2e – or tonnes of carbon dioxide equivalent – includes all greenhouse gases and not just carbon dioxide. Other gases are converted into a 'carbon dioxide equivalent' that takes into account their persistence in the atmosphere and their per-unit contribution to the greenhouse effect (their radiative forcing), relative to carbon dioxide. This estimate is obtained from the forest sample assessed as part of this study (Citroen, 2013), which estimated sequestration at 25,897 tCO_2e across 3,655ha.

availability of a carbon forest manager in the research team. At the carbon price recorded in the 2013 compliance market (US$10/tCO2)[4], the value of carbon lost through logging and accumulated through growth that was used in the scenario analysis was estimated at RON 276/ha/yr and RON 55/ha/yr, respectively. Carbon sequestration from arable and pasture land were not included due to lack of data on biomass variation (increment and/or decrement) and impact of grazing on above ground biomass in the land uses proposed by the scenarios analysis, but it is plausible to assume that this service is secondary compared to the CO2 sequestration of forest.

2.4 Scenario analysis

Valuation relies on the analysis of the two following scenarios: 1) natural afforestation of abandoned areas; 2) conversion of abandoned land to semi-natural grassland. The former was suggested by stakeholders, assuming the failure of the current policy measures, and determined in a "technocratic" manner as a linear progression of the past 24 year land use changes (Table 1); the latter was formulated following an internal discussion with the local NGO "Zarand Association" that engaged local stakeholders and captured says on likely alternatives to land abandonment. The aim of proposing these two scenarios is to raise awareness of the economic value that different ecosystem services in the Zarand agroforestry ecosystem can generate and to provide economic figures to aid decision-making.

Unlike the simplified scenario analysis suggested by the TESSA toolkit (Peh et al. 2014a), based on a 'snapshot' in time, we have projected scenarios into the future (10 year horizon), and reported estimates using constant prices (in RON, 2014 currency), discounting at 5% rate to make a comparison with the baseline (farm economic values in 2014). A constant marginal value of each ecosystem service is used in adjusting the ecosystem services valued under the

[4] Reported by www.ecosystemmartekplace.com

baseline to reflect changes in household farming and land use conditions described in the two land use scenarios.

TABLE 1 HERE

2.4.1 Business as Usual Scenario: natural afforestation of abandoned land

This scenario is based on the evidence that the current CAP rules are unable to support rural development in Zarand: land continues being abandoned; the ability of the remaining ageing population to farm intensively is reduced; and environmentally low-impacting farming activities, showing opportunity costs in terms of a reduced production compared to more intensive farming systems, are not adequately supported. A linear projection of land use variation into the near future (next 10 years) is assumed based on the existing changes observed over the 24-year period from 1990 to 2014. A natural afforestation in the whole Zarand area (20,000 ha) of nearly 1,200 ha is assumed as well as a loss of 220 ha of grassland and nearly 140 ha of arable land. The latter figure can be considered a proxy of the arable land that is likely to be lost mainly by smallholders (those who own a plot of land <1 ha), without excluding the possibility of loss by farmers holding a standard farm of 2-3ha. The loss of this area reflects the impossibility of the current CAP to reach nearly 30% of subsistence farmers.

2.4.2 Alternative Scenario: conversion of abandoned land to semi-natural grassland

This scenario builds on a re-distribution of abandoned land to smallholders and a more efficient use of collectivised land, to support traditional farming in grassland habitats and hay meadows, by slightly increasing the average number of livestock units (cows) from 1.8 to 3 units per farmer, equivalent to 1 livestock unit per ha, and reducing land underutilization[5]. We assume that the conversion of abandoned land to sustainable pastureland for an area of 330 ha can occur first within the Rosia Valley. The re-distribution of land to farmers, commoners and smallholders (the latter in the number of approximately 100) would facilitate people to remain and increase the supply for high nature value farming (by giving them more chances of being eligible for CAP payments). This would benefit in total nearly 200 farmers. The increase in deciduous forest is limited in this scenario to 870 ha. Moreover, to be effective, this scenario builds on the development of market strategies to stimulate access to markets, such as the construction of a new milk collection point and valorisation of local produce (e.g. jam, chutney). The implementation of market infrastructure only to the Rosia valley justifies the reason why this scenario is not relevant yet for the remaining valleys. However, results could be used by decision-makers to justify if more investments and connection to markets are suitable for the most remote places in Zarand.

2.5 Quantification of agricultural benefits

The quantification of agricultural benefits is assessed in two different ways, considering both the economic value and income to farmers. Economic value (or economic benefit of produce - producer surplus) is the difference between the potential income (if the produce were sold entirely in the local market at current local prices) and the cost of production (we have included the agriculture labour cost as if farmers were receiving a salary for the hours they worked). These values are reported in section 3.2. The term income refers to the revenue that farmers receive from selling agricultural produce, distinguishing between agriculture, livestock, secondary (or derived) production from livestock, and wild goods. Income and costs of achieving this production are assessed in section 3.3. Comparison of scenarios

[5] The raise of 1 unit of livestock per ha is economically sustainable through the support of other members of the households as verified by direct interviews

(reported in section 3.4) is carried out assessing economic values in 10 year time at current price (2014 RON) and discounted at 5% rate. These values, being the net benefits of services provided by different scenarios, can be used by decision-makers to make comparisons with different strategies and costs of land use change. In all the valuations performed, we have used average prices and costs without providing sensitivity analysis. Considering that unit values reported for all villages are very close, results cannot be significantly affected by the small differences recorded in prices and production. Finally section 3.5 describes the impacts that CAP has on income and the proportion of costs that can be covered by public payments.

3 Results

3.1 Household descriptive statistics

The typical household size is small (3.18 people) and only 29% of respondents have children under 16, indicating a generally ageing population. This is further highlighted as 63% of households are headed by people older than 60, while younger farmers (under 48) comprise less than 12% of the sample. The respondents are generally male (78%) with secondary and high school education being the highest level achieved in 60% of households, while only 4% of respondents report a higher level degree. Income levels are generally low: more than 70% have a monthly income in the range of RON 1,000-2,000 (on average RON 10,000/year/household), and just 4% of households earn an average monthly income of RON 2,000 - 4,000. The difficulty to generate incomes is reflected in the low standard of housing, with typical houses having basic levels of sanitation. Half of the houses lack piped water supply, and only one third of houses have indoor flushing toilets. All respondents declared to use wood to heat the house and 51% stated wood as the primary fuel source for cooking, indicating heavy reliance on forestry products. A further 45% use a combination of gas and wood for cooking, while only 4% use exclusively gas.

3.2 Economic value of agriculture production (baseline)

Agricultural products in the three valleys are predominantly for internal consumption (75%); only a limited number of households is operative on the local market of maize (14%) and hay (20%). A significant number of farmers (25%) still produce for subsistence because of lack of adequate income to access food to local markets.

The average size of the farms is 2.6 ha, with very few farmers reporting any rented land area (0.15 ha). Hay is the most abundant crop variety planted on 1.44 ha of land, while maize occupies 0.5 ha of the farm. The remaining farmland is a small orchard where mainly onions and fruits are produced. In 27% of the holdings sampled the size of the farm (<1ha) limits the possibility to have access to payments under the CAP and consequently the possibility of at least partially covering the costs of production.

Agricultural produce generates a mean economic value of RON 12,500/household/yr (approx. € 2,800). Table A in the Appendix provides a detailed breakdown of these values by crop and livestock. For livestock and derived livestock products (milk, cheese, eggs, etc.), the economic values are robustly positive. There are uncertainties on the statistical net benefits of some crops: hay most likely has a negative value once all costs of production (including the farmers' labour costs) are included in the analysis as also observed by McGinlay et al. (2017).

Across the three communities, the average farmer holds 28 chickens, 2.5 pigs and 1.55 cows. The higher number of cows in the Rosia valley (1.87), and the vicinity to a market, has already supported the placement of the new milk collection facility to aid milk commercialisation. Nearly all livestock is used for internal consumption and only 10% of farmers sell it in a very limited quantity. Anova test (performed using the free software GNU

PSPP[6]) shows that effort in the livestock management is related to household income. In particular, households with lower incomes rely more on cows than other livestock ($F = 2.71$, $p =< 0.05$). In addition, lower income households are more dependent on some derived products, in particular eggs in both summer ($F = 4.14$, $p =< 0.05$) and winter ($F = 6.79$, $p =< 0.005$) seasons.

The survey on wild good collection shows that a net benefit of nearly RON 1,650/year/household is generated (Table 2). Mushrooms are found to be the most commonly targeted foraged good, because this is the only one which has a potential market (25% of this harvest is sold locally) in any of the villages, with 24 kg/household collected per year. On average, people spend a total of approximately 5 days per year searching for any foraged goods. However, effort is found to be considerably higher in the Almasel valley, where farmers search for both fruits ($F = 4.52$, $p =< 0.05$) and medicinal plants ($F = 4.52$, $p =< 0.05$). This may be explained by the fact that Almasel is the most remote valley of the three with limited road access to markets, so people here are forced to rely more on local goods.

TABLE 2 HERE

3.3 Direct income and cost of agriculture production and livestock

The figures presented in the previous section show a picture of the economic value that the typical Zarand farm generates. However, only part of these figures is captured (as financial benefits) through sales. From the survey, it is evident that income generated per household by direct sales of livestock is RON 740/year/household, 55% arising from pigs and the remaining 45% from cows. Looking at the derived production from livestock, main marketed products are eggs, milk, cheese, and cream; 15%, 11%, 5%, and 5% of these products are

[6] Available at https://www.gnu.org/software/pspp/

sold in the local villages, respectively, while only 2% of the sample sells milk to external markets. Income generated by derived production is RON 1,220/year/household, with revenue share as shown in Figure 2. A minor income is provided by selling mushrooms and fruits (additional RON 70/year/household). In total, the income generated by selling livestock and derived products is around RON 2,000/year/household (equivalent to RON 770/ha), 16% of the economic value of the total produce. Agriculture production is mainly consumed internally and provides forage for livestock, and is therefore not added to the livestock income to avoid double counting.

FIGURE 2 HERE

If we look at the direct costs of production (in this analysis we exclude the unpaid labour), we observe that on average each household spends nearly RON 900 for crop production and RON 1,600 for livestock rearing (see Table 3 and Table 4, respectively). In total, the estimated direct costs of production per year for the typical smallholder are RON 2,500, equivalent to RON 960/ha. This is in the order of magnitude of the revenue generated by the farm, although from our sample expenses are slightly greater than incomes.

TABLE 3 HERE

TABLE 4 HERE

3.4 Economic valuation by scenario analysis

The BAU scenario is accompanied by negative values for all the services, except for forest products. At the end of the ten-year projection (in 2024), each household faces a net present loss (negative economic benefit) of only RON 78/year (expressed in 2014 currency- see Table 5). However, excluding the potential benefits arising from wild goods, farming services show a big decrease of RON 1,400/household (including both reduced benefits from livestock and derived production).

TABLE 5 HERE

The situation is different when we consider the alternative scenario. Each holder in the Rosia valley records a net present value (benefit) in ten years arising from pasture related business (livestock and derived product) of nearly RON 2,800/year (in 2014 currency – see Table 6).

TABLE 6 HERE

While these results refer to changes at the household and village scales, Table 7 shows the economic values aggregated by services and broken down by the scale of impact on beneficiaries (divided in local provisioning and global regulating services - the latter not considered in the Tables 5 and 6). The business as usual scenario (Table 7A) shows a negative variation of 14% (RON -51, 440) in local (provisioning) services with respect to the variation of the sum of the value of all the services assessed (RON 353,743), but 114% increase in global regulating services caused by carbon sequestration from afforestation of abandoned land. Without taking any action, the BAU scenario delivers a picture of economic loss of over RON 1,000,000 in the three valleys for the main agricultural produce (cereal crops, livestock and derived products), nearly totally compensated by the increase of potential benefits from wild forest goods. Positive gains for this scenario can be reached only by including the climate regulation service from forest. In the alternative scenario (only affecting the Rosia Valley) (Table 7B), a much higher benefit with respect to the baseline is found, equal to nearly RON 2,800/year per household. We are expecting benefits over RON 1,000,000/ year over the entire valley. Of this relevant change, only a slight increase is due to the global services (22%), while the remaining 78% is given by changes in local provisioning services, thus capable to generate an economic impact to the community. It is evident from these figures that if the right investments to facilitate market connections with the Almasel and Troas valleys were provided, similar benefits would accrue to the Zarand communities living in the Almasel and Troas valleys. For the estimated 380 households living in the latter two valleys, we are expecting a benefits over RON 1,000,000/year. Overall, the agricultural benefits for the entire community in 2024 at current prices would be over RON 2,000,000/year compared to the BAU.

TABLE 7 HERE

3.5 Comparison between CAP payments, farm income, cost of farming and economic value

In 2013, under the implementation of the 2007-2013 CAP rules (Beaufoy and Marsden, 2013), the average Zarand farm received subsidies and agri-environmental payments for nearly RON 1,000/ha/year. The total direct cost of farming has been estimated at RON 960/ha/year (Table 3 and Table 4), and therefore the maximum amount that can be claimed under the 2007-2013 CAP regime is aligned with the full cost of production. Sales from the produce would then generate net profits. Considering that 75% of household produce for internal consumption and 25% for subsistence, CAP payments represent a reasonable support to keep the farm economically viable.

The above numbers suggest that the current CAP, if addressed to the additional pasture land of 330 ha, would stimulate net economic value of RON 1,000,000/year (as deduced from

Table 7B). This is equivalent to RON 3,000/ha/year, a value that is three times higher than the current payments, justifying the policy support. Under the CAP 2014-2020, the typical 2.6 ha farmland in Zarand claiming both direct and agri-environmental payments could receive a support of nearly € 700 (equal to RON 3,000 or RON 1,200/ha), an amount higher than that subsidized in the previous CAP regime[7].

To allow 100 smallholders in the Rosia valley to operate, under the current CAP payments for RON 100,000 should be diverted to this category. This could be achieved by amending the CAP rules or distributing to farmers part of the 330ha land intended for natural afforestation under the BAU scenario, as described in the alternative scenario, to increase the critical mass of land possessed by smallholders and facilitate their eligibility to the CAP.

4 Discussion

Agriculture is the dominant sector in European mountain communities and the Zarand Natura 2000 site is no exception. It is vital to the protection of a mosaic landscape, and a key component of households' wellbeing. In our case study it is evident that land abandonment has a considerable opportunity cost, quantified at RON 2,800/year/ household.

Because some crops generate negative economic value when labour cost is included in the valuation, and direct costs of farming in Zarand exceed revenues as already found in subsistence farms in Eastern (Hubbard et al., 2007) and Western European mountain areas (O'Rourke et al., 2016), sustaining agriculture through subsidies or income diversification strategies is an inevitable consequence of the low productivity generated by high nature value

[7] The CAP 2014-2020 (EC, 2014) shows single payment schemes for the first 5 ha ranging from € 170/ha in 2015 to € 190/ha in 2020, but no extension below 1 ha holdings seems to be provided as occurred for the previous regime. Measures planned under the rural development programme in mountain areas or zone with significant handicaps in the order of € 100/ha are planned (from 1 to 50 ha, with reduction applied for larger extensions). Pillar 2 subsidies of permanent grassland for € 124/ha are reiterated, and organic crop production on arable land (including forage production) sustained with € 162/ha.

farming. While it is recommended to promote a more efficient use of public resources to stimulate the production of supporting and regulating services for the community (Bird Life International et al., 2009; Gibbons et al., 2011), applications in Romania aimed at promoting services for the community under more efficient output-based payments (PES scheme as proposed by Wunder, 2015) are only under piloting phase (Fundatia Adept, 2016[8]). Furthermore, several challenges are facing the few PES schemes implemented in Europe such as scientific uncertainty, pricing of ecosystem services, the right moment of payment, increased risk to land managers, and compliance with World Trade Organisation regulations (Reed et al., 2014). Conversely, incentives directly paid for management-based practices on the assumptions that public benefits will be delivered (Gibbons et al., 2011; Glenk et al., 2014) can provide both equitable and effective support for a viable traditional farming in those social-ecological systems where high value biodiversity conservation is a limiting factor to production, and diversification strategies to income is not easily enforceable (Sutcliffe et al., 2015; McGinlay et al., 2017).

The following sections discuss the impacts of the CAP on the economic viability of the farms and then propose alternative strategies to diversify farming income. The potential dichotomy between wildlife protection under the BAU scenario and the socio-economic enhancement provided by the natural grassland restoration are considered in the last section.

4.1 Impacts of public subsidies

Results show that the BAU scenario, driven by the lack of effective income-supporting policies, would see part of the local communities endure persistent declines in economic value from agricultural practice. Building on the findings that traditional agriculture may attract higher local economic value than the services provided by new afforested areas, a

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[8] Preliminary information on new PES for grassland habitats available at http://www.fundatia-adept.org/?content=rbaps. Consulted in July 2017

bigger effort is needed to avoid the exclusion of marginalised farmers from being subsidised. To achieve this aim, maintaining traditional farming methods (low/no tillage, no chemical fertiliser, reduced livestock pressures, limited bushes/trees cutting, etc.) in areas of high nature value (Paracchini et al., 2007; Beaufoy and Cooper, 2008; Pienkowski, 2011; Price, 2012) should be prioritised in policy design to contribute to high regional diversity and smallholders income, not only in the Carpathians (Page et al., 2011), but also in similar alpine areas (O'Rourke et al., 2016). If high nature value farming in semi-natural grassland was more integrated into eligible payment schemes (EEA 2009), this would facilitate a better inclusion of socio-economic practices in the protection of Natura 2000 habitats (ENRD, 2010; Halada et al., 2011), overcoming the absence for many Natura 2000 areas of a management plan (Beaufoy and Marsden, 2013).

However, the protection of high nature value farming depends on how Member States define support to income and eligibility criteria of agri-environmental schemes. Under the CAP 2007-2013, 72% of holdings and over 20% of Romania's utilized agricultural area in high nature value farms were not eligible for CAP payments, owing to uncertain interpretation of CAP rules, a common issue in several EU countries (Beaufoy et al., 2011). These include farmlands based on communes with less than 50% permanent grassland, holdings with more than 50 trees or large rocks per hectare and under municipality ownership (Beaufoy and Marsden, 2013), and in many cases holdings under one hectare (Redman, 2010) because of the limited administrative capacity of the authorities to deal with the enormous number of additional applications.

In Romania the adoption of these parameters has excluded nearly 2.5 million ha of grassland from public support (50% of the total area estimated by Corine land cover map - Fundatia Adept, 2016) contributing, among others, to the underutilisation of land and abandonment. As observed for other high nature value farmlands in the Carpathians (Lieskovský et al., 2015), Zarand smallholders with less than 1 ha ineligible for direct subsidies represent approximately 30% of the population (over 200 households). In the Rosia valley alone this is equivalent to approximately 100 smallholders. In addition to direct payments, agri-environmental measures, linked to environmental targets like biodiversity conservation, climate protection or pollution mitigation (Hill, 2012; Olmeda et al., 2013; 2014), can be added to compensate for handicaps resulting from environmental restrictions. However, the rigid application of CAP rules has in many EU countries (Romania is no exception) homogenized the natural heterogeneity of the rural landscape due to clearance of scrub and the synchronization of mowing dates (Sutcliffe et al., 2015) with negative effects on biodiversity.

The homogenisation, underutilisation and in turn abandonment of both grassland and arable land (Table 1), could be reverted if livestock pressure, within the limits of the maximum carrying capacity of grasslands, were subsidized. This would require a redistribution of abandoned land to commoners (associations managing common land) and to private holders, and amended rules for a broader access to direct payments (Lieskovský, et al., 2015). The proposed land use change in the Rosia valley shows that greater common unutilised lands, if subsidised for higher cattle grazing pressure, could secure net incremental economic value quantified at RON 2,800/year/household (nearly RON 1,050/ha/year for the average farm of 2.6 ha), 25% higher than the baseline and equivalent to the CAP 2007-2013 payments provided to small eligible farmlands (Beaufoy and Marsden, 2013). Although this result applies to the Rosia valley, it could be linearly extrapolated to the other valleys in Zarand (considering the homogeneity of environmental and socio-economic conditions). Nearly 800 ha of land should be converted to pasture to provide the same level of benefits quantified for the entire Rosia valley (RON 1,000,000/ year) and the total cost for the CAP would be estimated at RON 800,000/year. If all the smallholders were able to apply for CAP, they could offset the cost of production with national payments and gain from sales. However, the possibility of a net positive income depends on the availability of market infrastructures that facilitate the sale of the produce.

The CAP payments received by the average Zarand farm are of the same order of magnitude of the total cost of farming (estimated at less than RON 1,000/ha/year) and equal to 130% of the gross agricultural income. The latter percentage is also aligned to figures recorded for livestock grazing in Western Europe. In the UK, for example, payments contribute to 146% of the gross income (Defra, 2013). The above figure is also recorded in other areas of the Carpathians (Matei et al., 2016), but inferior to the support provided to the bigger farms at national scale (equivalent to 30% of the net income - Matthews, 2012). This condition similarly experienced in the EU-27 (Keenleyside et al., 2014) shows the unbalanced support of the CAP in favour of highly productive agricultural systems.

Notwithstanding the mentioned benefits and the appreciation in the 2007-2013 CAP regime (Matei et al., 2016), it is evident that additional resources to sustain high nature value farming are needed to involve more smallholders and to keep traditional farming alive.

Using the 2007-2013 CAP rates and the average benefits per hectare calculated for farmers eligible to receive a public support, a rough estimate of additional direct and agri-environmental payments to those farmers excluded in Zarand (200 smallholders) would require nearly RON 200,000/year. For the Rosia valley, RON 100,000/year are required to let smallholders have the possibility to economically farm their land. These figures do not consider the costs of restoration from abandoned to pasture land, and the increased monitoring and transaction costs for dealing with a greater number of dispersed smallholders.

The new 2014-2020 CAP regime dedicates more resources than the previous scheme (EC, 2014). However, limited improvements in the definition of the eligibility of smallholders to CAP have been made, leaving uncertainty in the definition of permanent grassland, in the inclusion of pastures with shrubs and trees, and in the size of the smallest holdings as conditions that could determine higher direct support payments for farmers (Sutcliffe et al., 2015; McGinlay et al., 2017). Furthermore, the impact on farmers' income depends on complementary measures accompanying direct payments such as advisory services and help for knowledge transfer and information. It is recognised that education is a limiting factor, as well as scarce information and administrative support to farmers (Mikulcak, 2011; Mikulcak et al., 2013). Secondly, it is important to improve the infrastructures facilitating the connection of local produce to the main markets (Fundatia Adept, 2016), reducing the number of intermediaries and marking prices up to reflect added environmental value of traditional produce. The LEADER approach under Pillar 2 has a strong potential to use local action groups to deliver innovative projects to train farmers, to implement beneficial land management at a landscape scale, and to develop and implement high nature value farming and Natura 2000 management plans (Cooper et al, 2006).

4.2 Alternative strategies for enhancing agro-forestry ecosystem services

An example of a complementary strategy for sustaining rural communities' income is the business model implemented in Austria as a price premium for milk to integrate CAP rural payments. This model could be exported to Zarand; a recent stated preferences survey has shown that UK citizens are willing to pay for the conservation of large carnivores by paying a price premium of 6.1% for carnivore-friendly food products originating in the region[9] (MSc thesis, unpublished data). This might indirectly suggest that different experiences of ecotourism, either through direct visits to the Zarand area or better publicity and promotion of the Zarand carnivore populations, could help levy additional funds for conservation activities

[9] An Economic Valuation of Ecosystem Services in Zarand, Romania: A Contingent Valuation and Mapping Approach Dissertation submitted in part completion of the requirements for the degree of Master of Science in the Department of Geography and Environment of the London School of Economics and Political Science (2013) – Unpublished.

in the region. Examples from other areas of the Carpathians (Iorio and Corsale, 2010), European (Hegarty and Przezborska, 2005) and North American rural areas (Arroyo et al., 2013) show that families have been turning to tourism as an economic diversification strategy. However, not in all socio-economic contexts is this possible if for environmental constraints the tourist season is too short, infrastructures are poor, and households do not have income and interest to capitalise on tourism (O'Rourke et al., 2016).

Alternatively, considering the profitability of marginal land for energy crop production (Turley et al., 2010), it has been suggested to use high nature value farmland, but mainly under declining socio-ecological conditions where farming is poorly linked to any cultural aspects of the community, for bio-fuel crops production as a source of income diversification (Dauber et al., 2012; Strohbach et al., 2015). Another strategy is the implementation of a PES-like scheme, as suggested by Merck and Pereira (2015), based on public subsidies specifically targeted to "re-wilding" and not connected to any farming activities. This option can support farmers in those areas where it is difficult to generate income from sales and where it is considered as priority the development of ecosystem to climax. This way of spending public money seems ecologically-driven to re-establish several ecosystem services (Cerqueira et al., 2015) rather than supported by a socio-ecological assessment of the ecosystem. The previous two strategies can be seen as a way of decoupling the economic viability of the farms from traditional payments provided by the CAP (Fischer et al., 2012), but they seem to work against the requirements of the Habitat Directive of halting biodiversity loss and strictly protecting those habitats that over decades have been shaped by traditional agricultural practices (92/43/EEC art.6). Overall, these alternative strategies would help overcome the likely negative effects for farmers to rely on external financial support, consequently lowering the risk of a reduced motivation for cultivation (Fischer et al., 2012).

4.3 Ecosystem services and biodiversity conservation dichotomy

Although this research has focussed on the economic impacts of valorising high nature value farming under subsidisation of rural activities, a final consideration is about the role that the BAU scenario may play for wildlife conservation. Natural afforestation with consequent loss of related provisioning and cultural services provided by agriculture can determine a relevant change in Natura 2000 biodiversity (Beaufoy and Marsden, 2013), but the implementation of the BAU scenario could have positive implications for wildlife management (Cerqueira et al., 2015). Under a different perspective more appealing to conservationists (and tourists), the provision of an ecological corridor for large carnivores can be viewed as more important than a direct support to households' incomes. Increasing forest areas is likely to provide additional scope for connectivity and more cover for wolves and bears to move freely through the landscape, minimising conflicts with humans. However, in patches of land where agricultural services overlap with sites of biodiversity importance, ecosystem service valuation might not necessarily strengthen the case for biodiversity conservation. There is not a unique paradigm for distilling cases for better biodiversity conservation (Schroter et al., 2014; Mace et al., 2011), and win-win cases between provisioning ecosystem services and biodiversity are not very common (Chan et al., 2006; Cimon-Morin, 2013; Schneiders et al., 2012). Therefore, it is important to further explore the implications of biodiversity conservation within the ecosystem services approach and to consider elements of biodiversity conservation in future land management plans, possibly agreed on by stakeholders under a participatory approach to achieve more inclusiveness of a diversity of values into local decisions (Kenter et al., 2011; Jobstvogt et al., 2014).

5 Conclusions

This study has adopted the TESSA (Peh et al., 2013) approach for the valuation of a series of ecosystem services provided by the agro-forestry landscape of the Natura 2000 site Zarandul de Est under plausible management land use scenarios proposed by local stakeholders. Considering the similarities with other communities in the Carpathians and the Alps, findings of this study can be generalised to start a discussion on the benefits that different uses of land generate and to support local policy and decision-making.

The results, supported by other European case studies, show that net economic value of farming to households (even without considering public goods produced by agriculture) are substantially higher than public cost of subsidising farming. However, marginalised farmers are only slightly able to convert economic value into a financial flow (income), owing to restrictions to market access, poor infrastructures and in some cases limited availability of capitals. The implementation of payment schemes selling provisioning or regulating ecosystem services provided by high nature value farming, such as water and carbon regulating services (Postel and Thompson, 2005), does not seem to be a concrete option yet to replace the current CAP as the importance of these services is not always recognised (Hartel et al., 2014) and because of the difficulties of implementing a market for these services. In the short term, the easiest and most accepted way to raise income generated by farming is to use public subsidies and participate to agro-environmental schemes. Operating costs in marginalised areas are commonly higher than economic value, thus direct payments are a vital source of income to offset poor business returns. In Zarand this external support represents more than 100% of farm income and similar results have been recorded in other marginal farming areas of Europe, showing the limited profitability of Zarand agriculture, but also its important role in sustaining community livelihoods and the resilience of the social-ecological fabric of sensitive areas such as agroforestry landscapes within Natura 2000 sites

(Mills, 2012). To achieve this aim general ideas for a new CAP in marginalised areas are proposed as follows:

1. Agri-environment options should encourage cattle grazing in traditionally managed common land and all pastures with scrub and tree cover that are in legal grazing use. Hay meadows would also be included whether grazed or not;
2. Changes should be made to management contracts to allow a vast number of smallholdings to receive funds;
3. Restructuring and amalgamation of holdings should be considered to allow smallholders to benefit from an expansion of farm size in order to achieve a critical mass of land and apply for CAP payments;
4. The CAP should support traditional farmers to sell their produce within local markets: this includes physical infrastructure, negotiating prices and marketing higher value local produce;
5. Both wildlife tourism and export of high value-added produce should be supported, however, financial mechanisms to capture the international benefits from wildlife protection need to be studied.

The above strategies if implemented over long term, would support a concept of high nature value farming that makes agricultural products more profitable through regional marketing, reducing the opportunity costs of traditional grazing practices, but also valuing the real social benefits of delivering public goods (regulating and cultural services) at landscape scale.

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7 Appendix

Table A- Economic value (RON/household/year) of the main produce from Zarand smallholders. The table reports observations used, the average value and the 95% confidence interval. Agricultural produce benefits are also valued per unit of area (*in italics*) - 1 ari = 1/100 ha. In **bold** it is reported the total value of livestock and their derived products.

			95% Confidence Interval for Mean	
Product	**N. samples**	**Average**	**Lower Bound**	**Upper Bound**
Maize	51	338.32	-122.32	798.95
Maize per ari	*44*	*1.7*	*-3.94*	*7.34*
Potatoes	51	843.03	590.73	1,095.33
Potatoes per ari	*51*	*107.79*	*60.78*	*154.79*
Hay	51	-69.74	-314.2	174.71
Hay per ari	*42*	*-6.02*	*-30.79*	*18.76*
Apples	51	291.75	0.62	582.89

Apples per tree/yr	*51*	*95.81*	*-44.46*	*236.07*
Onions	51	98.09	71.95	124.24
Onions per ari	*46*	*77.5*	*-7.09*	*162.09*
Pigs	51	1,308.34	683.89	1,932.79
Poultry	51	459.41	335.76	583.05
Cows	51	1,669.4	516.34	2,822.47
Goats	51	95.77	14.54	177
Hives	51	1,016.38	82.75	1,950
All livestock	**51**	**4,549.29**	**2,219.22**	**6,879.37**
Milk	51	3,232.97	1,824.28	4,641.67
Cheese	51	394.89	200.19	589.59
Cream	51	301.57	118.72	484.42
Eggs	51	2,321.87	1,860.65	2,783.1
Honey	51	197.06	-56.98	451.1
All derived products	**51**	**6,448.37**	**4,535.54**	**8,361.2**

8. References

Arroyo, C.G., Barbieri, C., Rich, S.R., 2013. Defining agritourism: A comparative study of stakeholders' perceptions in Missouri and North Carolina. Tour Manage 37, 39-47.

Bagstad, K.J., Semmens, D.J., Waage, S., Winthorp, R., 2013. A comparative assessment of decision support tools for ecosystem services quantification and valuation. Ecosyst Serv 5, 27-39.

Bateman, I.J., Mace, G.M., Fezzi, C., Atkinson, G., Turner, K., 2011. Economic analysis for ecosystem service assessments. Environmental Resource Economics. 48:177–218.

Baur, B., Cremene, C., Groza, G., Rakosy, L., Schileyko, A.A., Baur, A., Stoll, P., Erhardt, A., 2006. Effects of abandonment of subalpine hay meadows on plant and invertebrate diversity in Transylvania, Romania. Biol Conser 132 (2), 261-273.

Beaufoy, G., Jones, G., Kazakova, Y., McGurn, P., Poux, X., Stefanova, V., 2011. Permanent Pastures and Meadows under the CAP: the situation in 6 countries. European Forum for Nature Conservation and Pastoralism (EFNCP) and the Grasslands Trust, Derwentside.

Beaufoy, G., Marsden, K., 2013. CAP reform 2013. Last chance to stop the decline of Europes's High Nature Value farming. Consulted on 1 May 2017. Available at http://www.wwf.eu/?uNewsID=204317

Beaufoy, G., Cooper, T., 2008. Guidance document to the Member States on the application of the High Nature Value impact indicator. Report Prepared for European Evaluation Network for Rural Development: Brussels. Available at http://enrd.ec.europa.eu/enrd-static/fms/pdf/6A6B5D2F-ADF1-0210-3AC3-AD86DFF73554.pdf. Consulted in May 2017

Benbow S, Barbu A, Szekeley-Sitea A, Martino S., Rhodes J., 2015.Valuing Biodiversity and Ecosystem Services in the Zarand dul Este Natural 2000 site, Romania. Experience, Results and Recommendations from the Application of the Ecosystem Service Approach. Fauna & Flora International, Cambridge, UK. Unpublished. Available contacting the corresponding author at sophie.benbow@fauna-flora.org.

Bennet, E.M., Peterson G.D., Gordon L.J., 2009. Understanding the relationships among multiple ecosystem services. Eco Lett 12, 13994-1404.

Birch J.C., Thapa I., Balmford, A., Bradbury R.B., Brown, C., Butchart, H.M.S, Brown, C., Butchart, S.H.M., Gurung, H., Hughes, F.M.R., Mulligan, M., Pandeya, B., Peh, K.S.H., Stattersfield, A.J., Walpole, M., Thomas, D.H.L., 2014. What benefits do community forest provide, and to whom? A rapid assessment of ecosystem services from a Himalayan forest, Nepal. Ecosyst Serv 8, 118-127.

Birdlife International, European Environment Bureau, European Forum on Nature Conservation and Pastoralism, International Federation of Organic Agriculture Movements – EU Group, WWF. 2009. Proposal for a New Common Agricultural Policy. Available at cap2020.ieep.eu/vision/NGO-CAP-proposal.pdf. Consulted on 2nd May 2016.

Bonn, A., Reed, M.S., Evans, C.D., Joosten, H., Bain, C., Farmer, J., Emmer, I, Couwenberg, J., Moxey, A., Artz, R., Tanneberger, F., von Unger, M., Smuth M., Birnie, D., 2014. Investing in nature: developing ecosystem services markets for peatlands restoration. Ecosystem Services 9, 54-65.

Burton, R.J.F., Schwartz, G., 2013. Result oriented agri-environmental scheme and their potential for promoting behavioural changes. Land Use Policy30(1), 628–641.

Caballero, R., Riseth, J.A., Labba, N., Tyran, E., Musial, W., Molik, E., Boltshauser, A., Hofstetter,P., Gueydon, A., Roeder, N., Hoffmann, H., Moreira, M.B., Coelho, I.S., Brito, O., Gil, A., 2007. Comparative Typology in Six European Low Intensity Systems of Grassland Management. Adv Agron 96, 351-420.

Calaciura, B., Spinelli, O., 2008. Management of Natura 2000 habitats. 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites). Technical Report 2008 12/24. European Commission.

Carson, R. M., Bergstrom, J.C., 2003. A Review of Ecosystem Valuation Techniques. Working paper FS03-03. University of Georgia.
Available at https://ageconsearch.umn.edu/record/16651/files/fs0303.pdf. Consulted in August 2017.

Cerqueira, Y., Navarro, L.M., Maes, J., Marta-Pedroso, C., Honrado, J.P., Pereira, H.M., 2015. Ecosystem services: the opportunities of re-wilding in Europe. In Pereira and Navarro (eds), Re-wilding European landscapes, pages 47-66.

Chan, K.M.A., Shaw, M.R., Cameron, R.D., Underwood, E.C., Daily, G.C., 2006. Conservation planning for ecosystem services. PLOS Biol 4 (11), 2138-2152.

Cimon-Morin, J., Darveau, M., Poulin, M., 2013. Fostering synergies between ecosystem services and biodiversity in conservation planning: a review. Biol Conser 166, 144-154.

Citroen S., 2013. Romania rapid carbon assessment. Technical report. Unpublished. Fauna & Flora International. Cambridge. Contact Samantha.citroen@fauna-flora.org to have a copy of the report.

Cooper, T., Baldock, D., Rayment, M., Kuhmonen, T., Terluin, I., Swales, V., Poux, X., Zakeossian, D., Farmer, M., 2006. An Evaluation of the Less Favoured Area Measure in the 25 Member States of the European Union. A report for DG Agriculture. Institute for European Environmental Policy, London. Available at https://ec.europa.eu/agriculture/evaluation/rural-development-reports/2006-lfa_en. Consulted in May 2017.

Cooper, T., Hart, K., Baldock, D., 2009. The Provision of Public Goods through Agriculture in the European Union, Report Prepared for DG Agriculture and Rural Development. Contract No 30-CE-0233091/00-28, Institute for European Environmental Policy: London. Available at https://ieep.eu/uploads/articles/attachments/fed6141c-7490-4561-9ca2-838a22b96539/final_pg_report.pdf?v=63664509725 consulted in June 2017

Dauber, J., Brown, C., Fernando, A.L., Finnan, J., Krasuska, E., Ponitka, J., Styles, D.,Thrän, D., Van Groenigen, K.J., Weih, M., Zah, R., 2012. Bioenergy from “surplus” land: environmental and socio-economic implications. BioRisk 7, 5–50.

Defra, 2013. Farm Business Income by type of farm in England, 2012/13. National Statistics Publication.

Defra. 2009. Agriculture in the United Kingdom 2009. Defra, London.

De Groot, R.S., Alkemade, R., Braat, L., Hein, L., Willemen, L., 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecol Complex 7, 260-272.

EC, 2014. Romania CAP 2014-2020. Available at ec.europa.eu/agriculture/cap-in-your-country/pdf/ro_en.pdf. Page consulted in April 2017.

ENRD, 2010. Semi-subsistence farming in Europe: concepts and key issues. Background paper prepared for the seminar "Semi-subsistence farming in the EU: Current situation and future prospects" Sibiu, Romania, 21st - 23rd April 2010. European Network for Rural Development, Brussels.

EEA (European Environment Agency), 2009. Distribution and targeting of the CAP budget from a biodiversity perspective, EEA Technical Report no. 12/2009.

Fischer, J., Hartel, T., Kuemmerle, T., 2012. Conservation policy in traditional farming landscapes. Conser Lett 5, 167–175.

Fundatia Adept, 2016. Rural Development and High Nature Value Farmlands in Romania: a project funded by the Swiss-Romanian Cooperation Programme. Available at http://www.fundatia-adept.org/?content=hnvf. Page consulted in May 2016.

Gibbons, J., Nicholson, E., Milner-Gulland, E.J., Jones, J., 2011. Should payments for biodiversity conservation be based on action or results? J Appl Ecol 48, 1218-1226.

Glenk, K., Schaafsma, M., Moxey, A., Martin-Ortega, J., Hanley, N., 2014. A framework for valuing spatially targeted peatland restoration. Ecosyst Serv 9, 20-33.

Hal, V. R., 2006. Intermediate Microeconomics: A Modern Approach (7th ed.), W.W. Norton & Company, ISBN 978-0-393-92702-3.

Halada, L, Evans, D, Romão, C., Petersen, J-E., 2011. Which habitats of European importance depend on agricultural practices? Biodivers Conserv 20(11), 2365-2378.

Hanley, N., Banerjee, S., Lennox, G., Armsworth, P., 2012. How should we incentivise private landowners to produce more biodiversity? Oxford Rev Econ Pol 28, 93-113.

Hartel, T., Fischer, J., Campeanu, C., Milcu, A.I., Hanspack, J., Fazey, I., 2014. The importance of ecosystem services for rural inhabitants in a changing cultural landscape in Romania. Ecol Soc 19(2):42.

Hauck, J., Gorg, C., Varjopuro, R., Ratamaki, O., Jax, K., 2013. Benefits and limitations of the ecosystem services concept in environmental policy and decision-making: some stakeholder perspectives. Environ Sci Policy 25, 13-21.

Hegarty, C., Przezborska, L., 2005. Rural and agri-tourism as a tool for reorganising rural areas in old and new member states — a comparison study of Ireland and Poland. IJTR 7(2), 63-77.

Hill, B., 2012. Understanding the Common Agricultural Policy. Earthscan, New York.

Hubbard C., Podruzsik, S., Hubbard, L.J., 2007. Structural changes and distribution of support in Hungarian agriculture following EU accession: a preliminary FADN analysis. Paper presented at the 104th IAAE-EAAE seminar Agricultural Economics and Transition: What was expected, what we observed, the lessons learned. Budapest, Hungary, 6-8 September 2007.

Iorio, M., Corsale, A., 2010. Rural tourism and livelihood strategies in Romania, J Rural Stud 26, 152–162.

IPCC, 2006. 2006 IPCC guidelines for national greenhouse gas inventories: In Eggleston, H.S., Buedia, L., Miwa, K., Ngara, T., Tanabe, K., (eds). Agriculture, forestry and other land use. Prepared by the national greenhouse gas inventory programme, vol. 4, institute for global environmental strategies, Hayama, Japan.

Jobstvogt, N., Watson, V., Kenter, O.J., 2014. Looking below the surface: The cultural ecosystem service values of UK marine protected areas (MPAs). Ecosyst Serv 10, 97–110.

Keenleyside, C., Tucker, G.M., 2010. Farmland abandonment in the EU: an assessment of trends and prospects. Report prepared for WWF. Institute for European Environmental Policy, London.

Keenleyside, C, Beaufoy, G, Tucker, G, and Jones, G., 2014. High Nature Value farming throughout EU-27 and its financial support under the CAP. Report Prepared for DG Environment, Contract No ENV B.1/ETU/2012/0035, Institute for European Environmental Policy, London.

Kenter, O.J., Hyde T., Christie, M., Fazey I., 2011. The importance of deliberation in valuing ecosystem services in developing countries—Evidence from the Solomon Islands. Glob Environ Change 21, 505–521.

Kleijn, D., Berendese, F., Smith, R., Gilissen, N., Smith, J., Brak, B., et al., 2004. Ecological effectiveness of agri-environment schemes in different agricultural landscapes in the Netherlands. Conserv Biol 18(3), 775-786.

Lieskovský, J., Bezak, P. Spulerova, J., Lieskovský, T., Koleda, P., Dobrovodska, M., Bürgi, M., Gimmi, U., 2015. The abandonment of traditional agricultural landscape in Slovakia – Analysis of extent and driving forces. J rural stud 37, 75-84.

Mace, G., Bateman, I., Albon, S., Balmford, A., Brown, C., Church, A., Haines-Young, R., Pretty, J., Turner, K., Vira, B., and Winn, J., 2011. Chapter 2: Conceptual Framework and

Methodology. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, UNEP-WCMC, Cambridge.

Matei, E., Vasilcu, D., Manea, G., Cocoş, O., Cuculici, R., Vijulie, G., Matei. D., 2016. Semi-subsistence Farming Development in a Carpathian Declining Mining Area. A Microscale Study of Landowners' Perception: Stulpicani Commune, Romania. Procedia Environmental Sciences 32, 352-363.

Matthews, A., 2012. FADN data highlights dependence of EU farms on subsidy payment. Available at http://capreform.eu/fadn-data-highlights-dependence-of-eu-farms-on-subsidy-payments/.

Web page consulted in June 2016.

McCauley, D.J. 2006. Selling out on nature. Nature, 443, 27-28.

McGinlay, J., Gowing, D.J.G., Budds, J., 2017. The threats of abandonment in socio-ecological landscape: farmers' motivations and perspectives on high nature value grassland conservation. Environ Sci Policy 69, 39-49.

McKenzie, E., Rosenthal, A., Bernhardt, J., Girvetz, E., Kovacs, K., Olweron, N., Toft, J., 2012. Developing Scenarios to Assess Ecosystem Service Trade-offs: Guidance and Case Studies for InVEST Users. World Wildlife Fund, Washington, D.C.

Menzel, S., Teng, J., 2009. Ecosystem services as a stakeholder-driven concept for conservation science. Conserv Biol 24(3), 907-909.

Merck, T., Pereira, H.M., 2015. Reshaping agri-environmental subsidies: from marginal farming to large-scale re-wilding. Basic Appl Ecol 16, 95–103.

Mikulcak, F., 2011. EU Common Agricultural Policy: Handy CAP or handicap for Romania? Available at https://ideas4sustainability.wordpress.com/2011/11/29/eu-common-agricultural-policy-handy-cap-or-handicap-for-romania/. Page consulted in April 2016.

Mikulcak, F., Newig, J., Milcu, A.I., Hartel, T., Fischer, J., 2013. Integrating rural development and biodiversity conservation in Central Romania. Environ Conserv 40,129–137.

Mills, J. 2012. Exploring the social benefits of agri-environment schemes in England. J Rural Stud 28, 612-622.

Olmeda, C., Keenleyside, C., Tucker, G., Underwood, E., 2013. Farming for Natura2000. Guidance Document. European commission. Available at http://ec.europa.eu/environment/nature/natura2000/management/docs/FARMING%20FOR%20NATURA%202000-final%20guidance.pdf. Consulted in April 2017.

Olmeda, C, Keenleyside, C, Tucker, G M and Underwood, E., 2014. Farming for Natura 2000. Guidance on how to integrate Natura 2000 conservation objectives into farming practices based on Member States good practice experiences. (In preparation, under Contract No. 07.0307/2010/580710/SER/B3 for European Commission, Brussels.)

Oppermann, R., Briemle, G., 2002. Blumenwiesen in der landwirtschaftlichen Forderung, Naturschutz und Landschaftsplannung 34, 203-209.

O'Rourke, E., Charbonneau, M., Poinsot, Y., 2016. High nature value farming systems in Europe: case studies from the Atlantic Pyrenees, France and the Kerry Uplands, Ireland. J Rural Stud 46, 47-59.

Page, N., Popa, R., 2013. Family farming in Romania. Available at ec.europa.eu/agriculture/consultations/family-farming/contributions/adept_en.pdf. Consulted on 14th May 2016.

Page, N., Popa, R., Gherghiceanu, C., Balint, L., 2011. Linking High Nature Value Grasslands to Small-Scale Farmer Incomes: Târnava Mare, Romania. In Mountain hay meadows: hotspots of biodiversity and traditional culture, Ed. Barbara Knowles, Society of Biology, London. ©Pogány-havas Association 2011. Available at http://www.mountainhaymeadows.eu/online_publication/14-linking-high-nature-value-grasslands-to-small-scale-farmer-incomes-tarnava-mare.html.

Paracchini, M.L., Terres, J.M., Petersen, J.E., Hoogeveen, Y., 2007. High Nature Value farmland and traditional agricultural landscapes. Open opportunities in the development of rural areas, In Pedroli, B., Van Doorn, A., De Blust, G., Paracchini, M.L., Wascher, D. & Bunce, F. (Eds.), Europe's living landscapes. Essays on exploring our identity in the countryside, KNNV.

Pe'er, G., Dicks, L.V., Visconti, P., Arlettaz, R., Baldi, A., Benton, T.G., Collins, S., Dieterich, M., Gregory, R.D., Hartig, F., Henle, K., Hobson, P.R., Kleijn, D., Neu-mann, R.K., Robijns, T., Schmidt, J., Shwartz, A., Sutherland, W.J., Turbe, A., Wulf,F., Scott, A.V., 2014. EU agricultural reform fails on biodiversity. Science 344, 1090–1092.

PEGASUS, 2017. Key emerging findings from the Pegasus project. PEGASUS EU-level workshop on emerging lessons on public goods and ecosystem services for policy and practice. Brussels, 22 June 2017.

Peh, K.S., Balford, A.P., Bradbury, R.B., Brown, C., Butchart, S.H.M., Hughes, F.M.R., Stattersfield,A., Thomas, D.H.L., Walpole, M., Bayliss, J., Gowing, D., Jones, J.P.G., Lewis, S.L., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J.R., Turner, K., Vira, B., Willcock, S., Birch, J., 2013. Tessa: a toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. Ecosyst Serv 5, 51-57.

Peh, K.S., Balford, A.P., Bradbury, R.B., Brown, C., Butchart, S.H.M., Hughes, F.M.R., Stattersfield,A., Thomas, D.H.L., Walpole, M., Bayliss, J., Gowing, D., Jones, J.P.G., Lewis, S.L., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J.R., Turner, K., Vira, B., Willcock, S., Birch, J., 2014a. Toolkit for Ecosystem Services Site-based assessment v1.2. Unpublished, but available from the author upon request.

Peh, K.S, Balmford, A., Field, R.B., Lamb, A., Birch, J.C., Bradbury, R.B., Brown, C., Butchart, S.H.M., Lester, M., Morrison, R., Sedgwick, I., Soans, C., Stattersfield, A.J., Stroh, P.A:, Swetnam, R.D., Thomas, D.H.L., Walpole, M., Warrington S., Hughes, F.M.R., 2014b.

Benefits and costs of ecological restoration: Rapid assessment of changing ecosystem service values at a U.K. wetland. Ecol Evol 20(4), 3875- 3886.

Pienkowski, M., 2011. The nature conservation value of low-intensity farming systems. European Forum on Nature Conservation and Pastoralism. Available at http://www.efncp.org/download/Pienkowski1998.pdf. Consulted in June 2017.

Popa, B., Pascum M., Niya, D.M., Borz, S.A., Codreanu, C., 2013. The value of forest ecosystem services in Romanian protected areas. A comparative analysis of management scenarios. Bulletin of the Transilvania University of Braşov Series II: Forestry • Wood Industry • Agricultural Food Engineering • Vol. 6 (55) No.2, 53-62.

Popa B., 2014. Possible scenarios of ecotourism evolution in the republic of Moldova from the perspective of ecosystem services. Bulletin of the Transilvania University of Braşov Series V: Economic Sciences • Vol. 7 (56) No. 1, 131-138.

Popa, B., 2016. Ecosystem services valuation using targeted scenarios analysis - ecosystem services values for decision making. Habilitation thesis. Unpublished. Available at http://www.unitbv.ro/Portals/31/Abilitare/Teze/Teza/05-POPA-Teza%20de%20abilitare%20ENG.pdf

Postel, S.L., Thompson, B.H., 2005. Watershed protection: Capturing the benefits of nature's water supply services. Nat Resour Forum 29(2), 98-108.

Power A., 2010. Ecosystem services and agriculture: tradeoffs and synergies. Philos Tr Soc B 365, 2959-2970.

Price, M., 2012. High Nature Value Farming in Europe. 35 European countries – experiences and perspectives. In Oppermann, R, Beaufoy, G, Jones, G.(eds). Verlag Regionalkultur, 2012, 544 pages, Ubstadt-Weiher, Germany.

Redman, M., 2010. Securing Public Benefits from Subsistence Agriculture in Romania: Assessing the Impact of Rural Development Policies. Centre for Ecological Engineering, Tartu, Estonia.

Reed, M.S., Moxey, A., Prager A., Hanley, N., Skates, J., Bonn, A., Evans, C.D., Glenk, K., Thomson, K., 2014. Improving the link between payments and the provision of ecosystem services in agri-environment schemes. Ecosyst Serv 9, 44-53.

Renwick, A., Jansson, T., Verburg, P.H., Revoredo-Giha, C., Britz, W., Gocht, A., McCracken, D., 2013. Policy reform and agricultural land abandonment in the EU. Land Use Policy 30, 446-457.

Ribaudo, M., Greene, C., Hansen, L., Hellerstein, D., 2010. Ecosystem services from agriculture: steps for expanding markets. Ecol Econ 69, 2085-2092.

Ruckelshaus, M., McKenzie, E., Tallis, H., Guerry, A., Daily G., Kareiva, P., Polasky, S., Ricketts, T., Bhagabati, N., Wood, A. S., Berhardt, J., 2013. Notes from the field: lessons learned from using ecosystem services approaches to inform real world decisions. Ecol Econ 115, 11–21.

Schneiders, A., va Daele, T., van Landuyt W., van Reeth, W., 2012. Biodiversity and ecosystem services: complementary approaches for ecosystem management? Ecol Indic 21, 123-133.

Schroter, M., van der Zanden, E.H., van Oudenhoven, A.P.E., Remme, R.P., Serna-Chavez, H.M., de Groot, R.S., Opdam, P., 2014. Ecosystem Services as a Contested Concept: A Synthesis of Critique and Counter-Arguments. Conserv Lett 7(6), 514–523.

Seppelt, R., Dormann, C.F., Eppink, F.V.,lautenbach, S., Schmidt, S., 2011. A quantitative review of ecosystem services studies: approaches, shortcomings and the road ahead. J Appl Ecol 48, 630-636.

Stoate C, Boatman ND, Borralho RJ, Carvalho CR, de Snoo GR, Eden, P., 2001. Ecological impacts of arable intensification in Europe, J Environ Manage 63 (4), 337–65.

Strijker, D., 2005. Marginal lands in Europe-causes of decline. Basic Appl Ecol 6, 99-106.

Strohbach M.W., Kohler M.L., Dauber J., Klimek S. 2015. High Nature Value farming: From indication to conservation. Ecolog Indic 57, 557-563.

Sutcliffe, L., Akeroyd, J., Page, N., Popa, R. 2015. Combining approaches to support high nature value farmald in Southern Transylvania, Romania. Hacquetia 14(1), 53-63.

Swinton, S.M., Lupi, F., Roterbton G.P., Hamilton S.K., 2007. Ecosystem services and agriculture: cultivating agricultural ecosystems for diverse benefits. Ecol Econ 64(2), 242-252.

Tallis, H.T., Ricketts, T., Guerry, A.D., Wood, S.A., Sharp, R., Nelson, E., Ennaanay, E., Wolny, D., et al., 2013. InVEST 2.5.3 User's Gude. Thenatural Capital Project, Stanford. http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/ consulted in June 2017.

TEEB, 2010. The economics of ecosystem services and biodiversity. Mainstreaming the economics of nature: a synthesis of the approach, conclusion and recommendations. Available at http://www.teebweb.org/publication/mainstreaming-the-economics-of-nature-a-synthesis-of-the-approach-conclusions-and-recommendations-of-teeb. Consulted in July 2017.

Thapa I., Butchart, H.M.S., Gurung, H., Statterfield, A.J., Thomas H.L.T., Birch, J.C., 2016. Using information on ecosystem services in Nepal to inform biodiversity conservation and local to national decision-making. Oryx 50(1), 147-155.

Turley, D., Taylor, M., Laybourn, R., Hughes, J., Kilpatrick, J., Procter, C., Wilson, L., Edgington, P., 2010. Assessment of the availability of 'marginal' and 'idle' land for bioenergy crop production in England and Wales. DEFRA project NF0444 report. http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16267 consulted in May 2017.

Turner,R.K., Daily, G.C., 2008. The ecosystem services framework and natural capital conservation. Environ Resource Econ 39, 25-35.

Turnhout, E., Waterton, C., Neves, K., Buizer, M., 2013. Rethinking biodiversity: from goods and services to "living with". Conserv Lett 6, 154-161.

UK NEA, 2011. The UK National Ecosystem Assessment: Synthesis of the Key Findings. UNEP-WCMC, Cambridge. http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx. Consulted in May 2017.

Viaggi, D., Signorotti, C., Marconi, V., Meri Raggi, M., 2015. Do agri-environmental schemes contribute to high nature value farmland? A case study in Emilia-Romagna (Italy). Ecol Indic 59, 62-69.

Villa, F., Croni, M., Bagstad, K., Johnson, G., Krivov, S., 2009. ARIES (Artificial intelligence for ecosystem services): a new tool for ecosystem services assessment, planning, and valuation. In Proceeding of the 11th Annual BIOECON conference on economic instruments to enhance the conservation and sustainable use of biodiversity, Venice, Italy, September, 2009.

Wunder, S., 2015. Revisiting the concept of payments for environmental services. Ecol Econ 117, 234-243.

Wynne-Jones, S., 2013. Connecting payments for ecosystem services and agri- environment regulation: an analysis of the Welsh Glastir scheme. J Rural Stud 31, 77–86.

Zabel, A., Holm-Muller, 2008. Conservation performance payments for carnivore conservation in Sweden. Conserv Biol 22, 247-251.

Figure
Figure 1

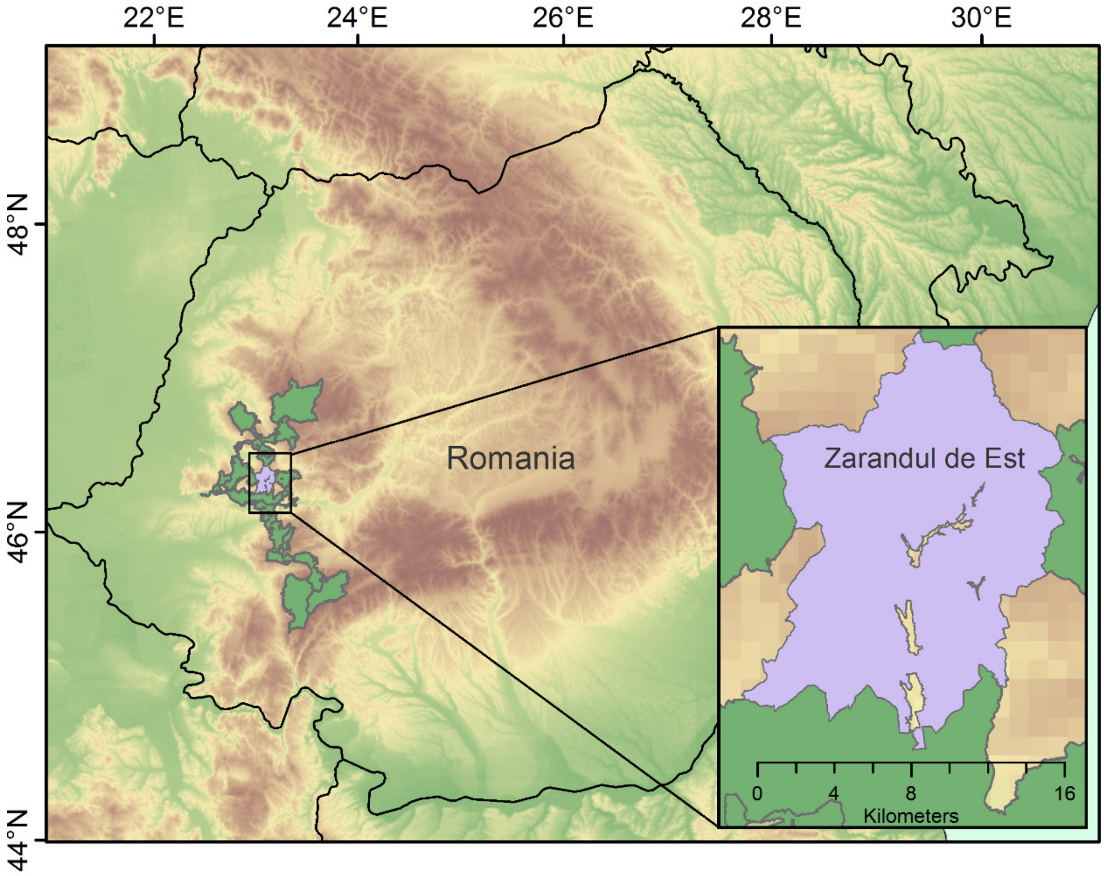

Figure 1: Location of Zarandul de Est Natura 2000 site in the Carpathians and position with respect to the Apuseni Forest Corridor (network of Natura 2000 areas drawn in dark green in the big frame). Source: our elaboration from public data on land elevation provided by the European Environmetal Agency - https://www.eea.europa.eu/data-and-maps/data/digital-elevation-model-of-europe

Figure 2

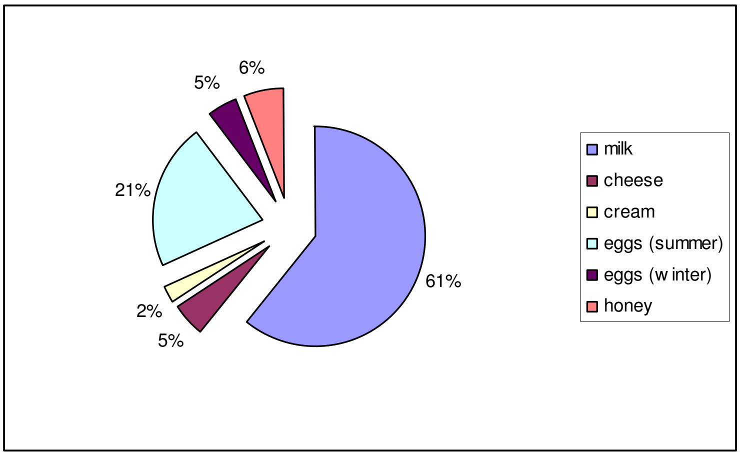

Figure 2: Income share (RON/household) from secondary products. More than 80% of the income share is provided by milk and eggs.

Tables

Table 1: Land use cover change over a 24 year period from 1990 to 2014 at Zarand

Land cover category	Land cover lost (ha)	Land cover gained (ha)	Net change (ha)	Mean net change per annum (ha/yr)
Bare rock	747.96	0.06	-747.91	-31.2
Cereal crops	373.69	33.40	-340.29	-14.2
Coniferous forests	47.43	0.00	-47.43	-2.0
Deciduous forests	438.37	3492.62	3054.25	127.3
Pasture	1780.64	1221.25	-559.39	-23.3
Water bodies	0.33	0.24	-0.09	-0.0
Other crops	1537.36	178.22	-1359.14	-56.6

Table 2: Economic value (RON/household/year) of wild goods stated as important by smallholders

		95% Confidence Interval for Mean	
Net value (gross value-cost)	**Mean**	**Lower Bound**	**Upper Bound**
Fuel wood	940.99	553.29	1,328.68
Mushrooms	582.63	233.8	931.46
Fruits	102.89	19.28	186.5
Medicinal Plants	21.07	1.59	40.54

Table 3: Average cost per household of agricultural production (RON/household/year)

Agricultural product	
Corn	639
Potatoes	270
Hay	27
Apple	3
Onion	23
Total	**962**

Table 4: Average cost per household of livestock rearing (RON/household/year)

Livestock	*Lost product*	*Feeding*	*Capital (depreciation)*	*Total*
Pigs	31	105	441	577
Poultry	160	66	85	311
Cows	0	34	145	179
Goats	0	2	15	17
Hives	124	48	387	559
Total	**315**	**255**	**1073**	**1643**

Table 5: Change in ES values per household and for the three valleys implementing the BAU scenario compared to the baseline (the 2014 survey). Values are expressed in 2014 RON/year

Change in value per household – in 2024	RON/year	Total change in value for the three valleys- in 2024	RON/year
Arable agriculture	-38	Arable agriculture	- 28,500
Livestock	- 716	Livestock	-537,000
Derived products from livestock	- 710	Derived products from livestock	-532,500
Forest products	1,386	Forest products	1,039,500
Total	**-78**	**Total**	**-58,500**

Table 6: Change in ES values per household and for the Rosia valley implementing the grazing expansion scenario compared to the baseline (the 2014 survey). Values are expressed in 2014 RON/year

Change in value per household in Rosia Valley	**RON/year**	**Change in value for Rosia Valley**	**RON/year**
Cattle	774	Cattle	286,380
Milk	1,499	Milk	554,630
Cheese	183	Cheese	67,710
Cream	140	Cream	51,800
Wood	162	Wood	59,940
Fungi	23	Fungi	8,510
Fruits	5	Fruits	1,850
Total	**2,786**	**Total**	**1,030,820**

Table 7: Change in the ecosystem services value provided by the Zarand ecosystem under the BAU (A) and the alternative (B) scenarios at local and global levels (local forest services relate to provision of non-cultivated wild goods, and global forest services relate to CO2 sequestration)

A: Change in the ES at Zarand by beneficiaries under the BAU in 10 year time from the baseline – expressed in 2014 RON/year- discount rate 5%			
Goods or services/beneficiaries	*Local*	*Global*	*Total*
Forest	1,040,000	405,182	1,445,182
Cereal Crop (maize)	-22,100	0	- 22,100
Pasture (livestock+ derived product)	-1,069,340	0	- 1,069,340
Total	-51,440	405,182	353,742
% change with respect to the total absolute variation	**- 14**	**114**	100.00
B: Change in the ES in the Rosia valley (only) by beneficiaries under the alternative scenario in 10 year time from the baseline – expressed in 2014 RON/year- discount rate 5%			
Goods or services/beneficiaries	*Local*	*Global*	*Total*
Forest	70,560	293,757	364,317
Cereal Crop (maize)	0	0	0
Pasture (livestock+ derived product)	960,213	0	960,213
Total	1,030,773	293,757	1,324,530
% change with respect to the total absolute variation	**78**	**22**	100.00