

Profitability of farms receiving subsidies for protection of semi-natural and natural grasslands habitats in the Slovak Republic

Ziskovosť fariem poberajúcich dotácie na ochranu biotopov poloprírodných a prírodných trávnych porastov v Slovenskej republike

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ABSTRACT

For maintenance of biodiversity, mainly in sites of European importance and in high natural value areas, is important the management of selected semi-natural and natural grasslands (SNaNG). In the first part of the paper we define SNaNG habitats in 7 categories (A-G), grouping several types of habitats. The categories were defined due to financing under the Rural Development Programme (RDP). Then, we provide their management conditions for 2014-2020, applied since 2015. The conditions must be applied by farms in order to claim subsidies within the submeasure protection of SNaNG habitats. The support belongs to the non-project measures of the RDP. In the last part of paper, we evaluated and analysed selected two financial ratios of profitability (return on equity and basic earning power) of a set of farms in Slovakia in year 2019. The farms are divided into two groups (supported farms receiving subsidies for protection of SNaNG habitats and unsupported farms without these subsidies) on the base of the Logit model. The data used for the analysis were obtained from the Information letters of the Ministry of Agriculture and Rural Development of the Slovak Republic (MARD SR). The supported farms proved lower profitability in both ratios, but only in return on equity has been statistically significant difference (at the 90% confidence level). We can conclude that the subvention for protection of SNaNG habitats should be increased as the SNaNG habitats are also vital for non-productive ecosystem services (ES).

Keywords: grasslands habitats, support policy, profitability, ecosystem services, farms

ABSTRAKT

Pre udržanie biodiverzity, najmä v lokalitách európskeho významu a v oblastiach s vysokou prírodnou hodnotou, je dôležitý manažment vybraných poloprírodných a prírodných trávnych porastov (PaP TP). V prvej časti príspevku definujeme biotopy PaP TP v 7 kategóriách (A-G), v ktorých sú zoskupené rôzne typy biotopov, pričom tieto kategórie boli vytvorené pre potreby financovania v rámci Programu rozvoja vidieka (PRV). Následne uvádzame podmienky ich obhospodarovania platné pre obdobie rokov (2014-2020), a ktoré sú uplatňované od roku 2015. Tieto podmienky musia splniť farmy, aby mali nárok na dotácie v rámci podopatrenia ochrana biotopov PaP TP, ktoré sú súčasťou neprojektových opatrení PRV. Tieto podpory sú súčasťou neprojektových opatrení PRV. V poslednej časti príspevku hodnotíme a analyzujeme dva vybrané finančné ukazovatele rentability (rentabilita vlastného kapitálu a rentabilita celkového kapitálu) v súbore fariem na Slovensku za rok 2019. Farmy boli rozdelené do dvoch skupín (farmy poberajúce dotáciu na ochranu biotopov PaP TP a farmy nepoberajúce tieto dotácie) na základe Logit modelu. Dáta použité pre analýzu boli získané z Informačných listov Ministerstva pôdohospodárstva a rozvoja vidieka (MPRV SR). Podporené farmy vykazovali nižšiu rentabilitu v oboch sledovaných ukazovateľoch, ale iba rentabilite vlastného kapitálu bol štatisticky preukazný rozdiel (na úrovni spoľahlivosti 90%). Preto môžeme konštatovať, že podpora na ochranu biotopov PaP TP je nedostatočná a mala by sa zvyšovať aj vzhľadom na to, že biotopy PaP TP plnia aj ďalšie mimo produkčné ekosystémové služby (ES).

Kľúčové slová: biotopy trávnych porastov, podporná politika, rentabilita, ekosystémové služby, farmy

INTRODUCTION

Slovakia is rich in diversified natural conditions and, consequently, displays rich diversity of flora and fauna. Holúbek et al. (2007) stated that permanent grasslands (PG) are rich in flora in our conditions - permanent pasture and meadows. According to Krajčovič et al. (1968), these are located from lowlands to subalpine zones, from wet to dry habitats. They are crucial for the structure of agricultural land and from the perspective of area they are second only to arable land. Permanent grasslands have many advantages in nowadays preferred low-input agricultural management system (Holúbek and Ložek, 2014). Ružičková and Kalivoda (2007) stated that the quality of PG as habitats in relation to plant communities and species is significantly affected by management system and intensity. A habitat is a smallest natural area or territory providing conditions for the life of an organism. In order to provide such conditions, it has to possess certain qualities and factors and provide a natural living space to sustain an animal or a plant or any organism (Jendrišáková, 2016).

In Slovakia, there are 66 habitats of European significance, 23 of which are priority habitats from the viewpoint of the European Community. To preserve biodiversity, it is necessary to strictly define, protect, and monitor agricultural and forest areas of high natural value, and to raise awareness of their importance (Jendrišáková, 2016). On the basis of the Updated National Biodiversity Strategy 2020 (Ministry of Environment of the Slovak Republic, 2013), the government decided to remove or mitigate the imperfections in isolated protection of selected species and habitats, while using the financial support from the Rural Development Programme, including the Natura 2000 network. Chrastinová (2013) states that subsidies are important for covering the farm investment needs, ensuring their income stability, and compensating part of their costs, which stimulates the farm economy. This is especially true for farms in less-favoured areas, as well as to subsidies for the protection and sustainability of biodiversity.

Benefits, which people can receive from ecosystems were called as ecosystem services (ES) in project Millennium Ecosystem Assessment (Carlos, et. al., 2005). The Updated National Biodiversity Strategy 2020 (ME SR, 2013) states that ES represent benefits and rewards provided by ecosystems, such as water, food, timber, soil formation, air and water purification, and pollination. An ecosystem is understood as a basic unit of a functioning Earth's biosphere, a system of plants and animals connected to all physical and chemical parts of environment, forming together an independent unit. There is a transfer and circulation of matter, energy, and information in an ecosystem. The quality and rate of ES is based on the condition of nature. Biodiversity and healthy ecosystems represent a basic condition for provision of ecosystem services. The modern history of understanding ecosystem services of natural services dates back to 1970s and the Westman's work (1977) on value and pricing of natural values. The term ecosystem services was settled in 1981 and became a part of scientific literature (Ehrlich and Ehrlich, 1981). The modern dissemination of the term ecosystem services was applied in the papers on nature protection and social and economic sciences by Daily (1997) „*Introduction: What are ecosystem services?*“ and „*Natures services: Societal Dependence on Natural ecosystems*“. The conference of the European Grassland Federation in Norway was focused on the multifunctional role of grasslands in European bioeconomy. The work of Planteroux et al. (2016) is important in this context. The assessment of ecosystem services provided by SNaNG in Slovakia was carried out by Holúbek et. al (2018) on the basis of the methodology by Hönigová et al. (2012). At the same time, they also dealt with financing grasslands through RDP in 2010-2016 and 2010-2014 (Holúbek, et al., 2016). The European Commission (2019) issued the study, whose objective is to carry out “an evaluation of the impact (direct and indirect) of the 2014-2020 CAP on habitats, landscapes, and biodiversity”.

It is necessary to evaluate the current situation in support mechanisms in Slovakia more thoroughly, as they shall be designed as a compensation for income losses due to decreased production and additional costs arising from the conditions necessary for adequate management methods. Simultaneously, the support mechanisms shall also respond to possible cost reduction. The compensation of revenue and saving costs shall be reflected in profitability of farms. Therefore, the goal of the paper is to assess profitability of farms receiving subsidies for protection of semi-natural and natural grasslands habitats in Slovak Republic.

MATERIALS AND METHODS

The background data for the paper come from the official sources published on the Ministry of Agriculture and Rural Development of the Slovak Republic (MARD SR) websites, and the Agricultural Paying Agency (APA) data. Based on them, we defined the SNaNG habitats in 7 categories (A-G), together with their management conditions (applicable since 2015). The conditions must be met by the farms in order to receive support from the submeasure protection of SNaNG habitats within the framework of non-project measures of the RDP. In the final part, we evaluated the profitability of selected individual farms. From Information letters of MARD SR were obtained individual data of farms for evaluation of selected ratios of profitability (ROE and BEP) for year 2019. Data included 1552 observations with 281 supported and 1271 unsupported farms.

In order to eliminate the selection bias there was applied the propensity score matching approach for comparison of supported farms receiving subsidies for protection of SNaNG habitats and unsupported farms. The analysis consisted of the following four steps:

1. Propensity score matching was applied to create group of subjects with similar character to supported farms. Propensity score was generated using Logit model in form:

$$\ln\left(\frac{P}{1-P}\right) = \beta_0 + X_i\beta_i + e_i \quad (1)$$

where:

P – is the value of estimated propensity score

β_i – estimated parameters of logit model

β_0 – intercept, estimated parameters of logit model

e_i – random error

X_i – explanatory variables of logit model, factors which should ensure similar character of farms. In the model there were used the following four explanatory variables:

- I. Ratio of plant production sales to total sales. The total sales are plant production sales together with animal production sales. The indicator was chosen to select the farms of similar production focus.
 - II. Ratio of grasslands area to utilised agricultural area (UAA) according to the Land Parcel Information System (LPIS). The indicator was chosen to select the farms with similar representation of grasslands.
 - III. Ratio of total capital to UAA according to the LPIS to select the farms with similar assets per hectare of UAA.
 - IV. Ratio of areas with natural handicaps to the UAA according to the LPIS to select the farms with similar representation of areas with natural handicaps.
2. Based on results of Logit model in step 1 was generated propensity score. Supported farms were matched with unsupported farms with the most similar value of propensity score. Matched samples were almost the same regarding average values of explanatory variables in logit model. Matching procedure eliminated selection bias. In further analysis were matched samples used in statistical comparison of profitability ratios (ROE and BEP) between supported and unsupported farms:

$$\text{Return on equity (ROE)} = \frac{\text{EAT}}{\text{Equity}} * 100 \quad (2)$$

$$\text{BEP} = \frac{\text{EBIT}}{\text{Total assets}} * 100 \quad (3)$$

where:

- I. ROE (return on equity) - this indicator represents the ratio of EAT to equity. The indicator characterises appreciation of equity. The value should exceed the return on alternative, equally risky investments, or

return on riskless investments, such as investments in securities guaranteed by the state. EAT is one of categories of profit and means – earnings after taxes. It is a final effect of business activities from the perspective of owners. It is a profit to be distributed among owners (shareholders) and the enterprise (retained earnings).

II. BEP (basic earning power) – in the numerator of indicator is located EBIT and in the denominator is located total assets (Tóth et al., 2019). The indicator is used primarily for comparison of companies with different capital structure and tax burden over the time. EBIT is another of profit categories and means earnings before interest and taxes.

For valuation of farm profitability indicators were used basic descriptive statistics (lower quartile, median and upper quartile).

3. For testing of data normality were selected Shapiro-Wilk (Shapiro and Wilk, 1965) and goodness of fit test (Shephens, 1974) as special case of the Kolmogorov-Smirnov test of normality. According to results of (at the 95% confidence level), was hypothesis about normal distribution of data rejected in all conducted tests, which suggest using of nonparametric method for comparison of both profitability indicators of supported and unsupported farms.
4. As the adequate non-parametrical method for comparison of matched samples was used Mann-Whitney method (Mann and Whitney, 1947), which compares the medians of profitability indicators (BEP, ROE) of supported and unsupported farms (Rábek, et al., 2021).

Processing of data and analytical procedure was conducted in SAS 9.04 software.

RESULTS AND DISCUSSION

Semi-natural and natural grasslands (SNaNG) habitats and their management

In 2004, Slovakia accessed the European Union, with the main goal in the field of nature protection to create the

coherent European network of protected areas NATURA 2000. All member states should prepare the necessary programmes to achieve this goal. In 2005 was written handbook for Natura 2000 protection programmes (Polák, Saxa, 2005), in which is written, that the goal of creating the system of protected areas NATURA 2000 is improving or maintaining the favourable state of European significance habitats, as well management for non-forest habitats (Valachovič, 2005). They claim that the SNaNG habitats can be found in diverse development stages evolved through long-term grazing (hundreds of years). Habitats management (including mowing and grazing) is necessary to maintain their favourable state. By the accession of Slovakia to the EU we also undertook to accept the measures of the CAP. To receive support within the non-project measures of the RDP, which is the second pillar of the CAP, there were defined seven new categories of SNaNG habitats (A-G), as well as their specific management conditions (Holúbek et. al, 2018):

- A. Thermophilic and xerophilous grasslands (Tr1, Tr2, Tr3, Tr4, Tr5)
- B. Mesophile permanent grasslands (Lk1, Lk3, Tr8b)
- C. Mountain meadows (Lk2)
- D. Hydrophilous vegetation of lower areas (Lk7, Lk9, Lk10, Lk11, S11, S14)
- E. Lowland alluvial meadows (Lk8)
- F. Hydrophilous vegetation of higher areas, peat and molinia meadows (Lk4, Lk5, Lk6, Ra3, Ra5, Ra6, Ra7, S12)
- G. High mountain grasslands (Tr8a, A11, A13, A16, A18).

In the parentheses there are codes responding to the habitats as given in the National Catalogue of Habitats in Slovakia (Stanová, Valachovič, 2002).

The support for protection of SNaNG habitats can be received only after the given management method relevant to the type of permanent grasslands is applied. The conditions were slightly altered in individual programming periods, while according to the Guide for Applicants to Support the Selected Non-Project Measures of the RDP 2014-2020 (Agricultural Paying Agency,

2015). The following conditions under the measure protection of SNaNG habitats has been applicable since 2015:

Application of fertilizers and plant protection products:

- Do not apply mineral fertilizers and slurry in grassland habitats
- Limit the use of organic fertilizers according to the grassland categories (B, C); the maximum dose of organic fertilizers is 50 kg N/ha biannually (faeces of grazing animals are not calculated into the limit)
- Do not apply plant protection products on the whole habitat area.

Cutting methods:

- Deadline for the first cutting is July 30, it can be changed with authorization of the nature protection authority)
- Cutting twice a year at most for the categories B, C, D, and E, once a year for A and G; manual cutting or cutting with help of light machinery for the categories A, C, F, and G. Direction of cutting: from the middle to the sides or from one side of the property to the other.

Grazing conditions:

- No grazing in the type F
- Aftermath grazing allowed after the first cutting in the categories C and E with 0.3 livestock unit (LU) at most
- Stick to the principles of environmentally responsible corralling (10 m² per LU, transferring corrals on daily basis), when grazing young bovine animals, night corralling is allowed with authorization of nature protection authority
- Grazing livestock so that habitats are not harmed, 0.3 to 1.9 LU/ha of habitat on grazing areas between May 1 and October 31; fence systems are allowed, while the livestock units per ha shall be calculated to the fenced area.

Additional obligations:

- Overseeding with the same type of grass only, according to the habitat
- Prohibition of using disc ploughs, tillage, and

dewatering of grasslands; mulching allowed only twice within the project period in order to stop the dissemination of unfavourable trees

- Taking part in a course on proper implementation of the conditions within the first year of the obligation
- The course shall be taken by an applicant or his/her employee, it shall last at least 14 hours. The certificate shall be sent to the paying agency within 10 days of its issuance.

A supported farm shall be of at least 1 ha of area (a supported habitat according to the LPIS).

The assessment of profitability of farms receiving subsidies for protection of SNaNG habitats in 2019

According to the Guide for Applicants to Support the Selected Non-Project Measures of the RDP 2014-2020 (Agricultural Paying Agency, 2015), the subsidies for protection of SNaNG habitats can be combined with the submeasure "Natura 2000 subsidies – permanent grasslands" and the measure "Ecological agriculture – permanent grasslands", with no double funding allowed (Table 1). However, these have been applied since 2015.

The Table 1 shows that in the categories (A, C, F, G) of SNaNG habitats the basic protection payment is at the level of 174.00 EUR, while in the categories (B, D, E) the basic protection payment is 87.33 EUR, which is approximately a half. In combination with the submeasure "Natura 2000 subsidies – PG", the combined payment for the categories (A, C, F, G) reaches 190.51 EUR, which is by almost 100 EUR less than in the categories (B, D, E). In combination with the measure "Ecological agriculture – PG", the combined payment for the categories (A, C, F, G) is at the level of 246.70 EUR, and in categories (B, D, E) it is 155.90 EUR. The data above mean that the combination with ecological agriculture is more beneficial, especially in the categories A, C, F, and G. Thus, the measure contributes to improving biodiversity and ecological stability. In 2021 and 2022, there are still applied basic payments per hectare according to the period 2014-2020 (Agricultural Paying Agency, 2021).

Table 1. Payments for protection of SNaNG habitats according to the categories (A-G) in EUR/ha

Basic payment for protection of SNaNG habitats in categories (B, D, E)	87.33
Payment in combination of SNaNG habitats protection in categories (B, D, E) and "Natura 2000 subsidies – PG"	91.70
Payment in combination of SNaNG habitats protection in categories (B, D, E) and "Ecological agriculture – PG"	155.90
Basic payment for protection of SNaNG habitats in categories (A, C, F, G)	174.00
Payment in combination of SNaNG habitats protection in categories (A, C, F, G) and "Natura 2000 subsidies – PG"	190.51
Payment in combination of SNaNG habitats protection in categories (A, C, F, G) and "Ecological agriculture – PG"	246.70

Note: Agricultural Paying Agency, own processing

SNaNG - semi-natural and natural grasslands

PG - permanent grasslands

ha – hectare

The level of support shall be designed as a compensation for income losses due to decreased production and additional costs arising from the conditions necessary for adequate management methods. Simultaneously, the support mechanisms shall also respond to possible cost reduction due to saving (no application of fertilizers and plant protection products etc.). The compensation of revenues and savings shall be reflected in farm profitability. Eventually, the farms receiving subsidies for protection of SNaNG habitats (supported) those adhering to the conditions of management protecting the SNaNG habitats, should reach similar profitability as farms without the same subsidies (unsupported) and, consequently, no need to adhering to the habitat protection conditions.

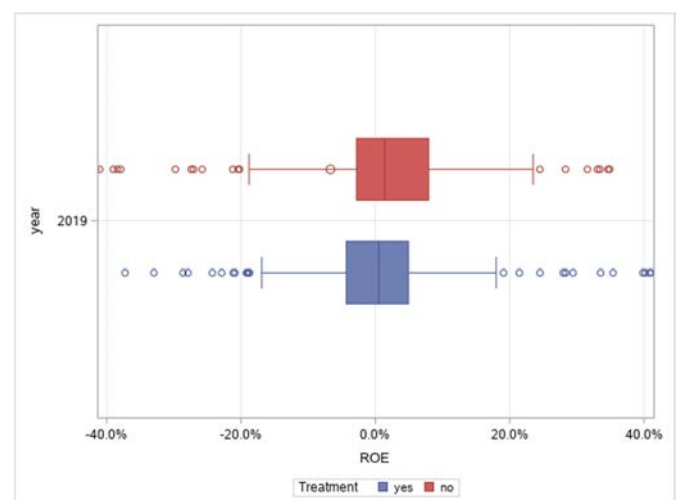
We evaluated the profitability by using two ratios (indicators) - return on equity (ROE) and basic earning power (BEP) in 2019. The ROE indicator characterises appreciation of equity and the BEP indicators characterises appreciation of all capital (asset) of farms. Individual data for evaluation of selected both ratios of profitability of set of farms were obtained from MARD SR (Information letters). Data included 1552 observations with 281 supported and 1271 unsupported farms in Slovakia. Propensity score matching was applied to create group of 281 farms with similar character to supported farms. Propensity score was generated using Logit model (see chapter MATERIALS AND METHODS).

After matching we used statistical comparison of profitability ratios between unsupported and supported farms. First was return on equity (ROE). Supported farms achieved lower ROE than unsupported farms by comparison in all descriptive statistics in year 2019 (Table 2), which is better observed in Figure 1.

Table 2. ROE in % of unsupported and supported farms in 2019

Farms	Count	Median	Upper Quartile	Lower Quartile
unsupported	281	1.40%	7.90%	-2.80%
supported	281	0.50%	4.90%	-4.30%

Note: Information letters of MARD SR, own processing

**Figure 1.** Box plot analysis of ROE in 2019

Note: Table 2, own processing

The results of P-values of both tests of normality were lower than 0.05, so we could reject the assumption of normality at the 95% confidence level, and so we used for testing of difference between supported and supported farm the Mann - Whitney W test. P-value of this test was 0.0753, so we can state, that statistically significant difference was between the ratios ROE of supported and unsupported farms only at the 90% confidence level.

The same analysis we did for BEP ratio. In 2019 supported farms in Slovakia achieved again lower basic earning power (BEP) than unsupported farms by comparison in all descriptive statistics (Table 3), which is also documented in Figure 2.

Table 3. BEP in % of unsupported and supported farms in 2019

Farms	Count	Median	Upper Quartile	Lower Quartile
unsupported	281	1.10%	3.40%	-1.10%
supported	281	0.80%	2.90%	-2.30%

Note: Information letters of MARD SR, own processing

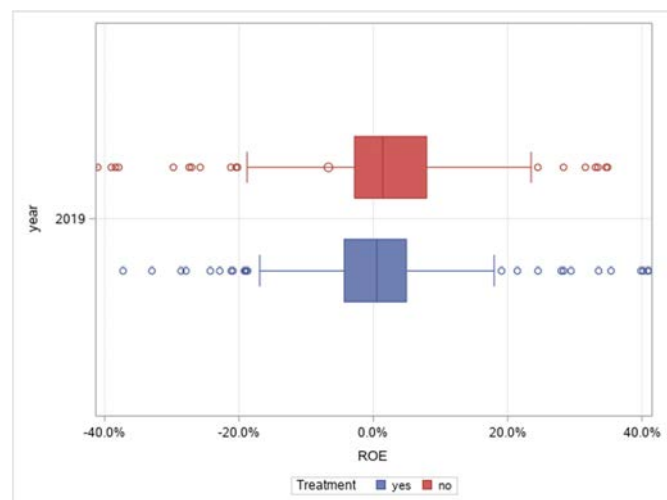


Figure 2. Box plot analysis of BEP in 2019

Note: Table 3, own processing

The P-values of both tests for normality (Shapiro-Wilk test and the goodness of fit test) were lower than 0.05, so we could reject the normality of data at the 95% confidence level. The P-value of Mann - Whitney W test was 0.1784, so we can state, that statistically significant difference was not between the ratios BEP in year 2019.

We can deduce from the comparison of profitability ratios between supported and unsupported farms, that the support in year 2019 was relative sufficient and could compensate differences in income and costs of farms, which complied with the conditions for protection of SNaNG habitats. In general, the profitability of all farms (supported and unsupported) is at a low level. Subsidies for protection of SNaNG habitats should be increased, because as grasslands habitats - as parts of agricultural systems and rural countryside - contribute to the economic value as well as to rural amenities (SET). They provide non-market benefits and positive externalities, which can be assessed through methods based on preferential economic evaluation or integrated optimization models (Lehman, Hediger, 2004, Holúbek, Ložek, 2014). The works by Holúbek et al. (2007), Rychnovská et al. (1985) and Krajčovič et al. (1968) are significant for pasture farming sciences in Czech and Slovak conditions. The assessment of ecosystem services (ES) provided by SNaNG was carried out by Holúbek et al. (2018), who based on special methodology (Hönigová et al., 2012) calculated the value of ES for all seven categories of habitats (A-G) for 2010-2016 as reaching the amount of 4 058.5 million EUR, and annually 579.8 million EUR. In 2019, there was prepared the Catalogue of Ecosystem Services in Slovakia (Mederly et al., 2019), and the monograph „Value of ecosystems and their services in Slovakia“ was published in 2020 (Černecký et al., 2020). Theoretically these methodologies could allow us to calculate the current value of ES of SNaNG habitats in Slovakia.

CONCLUSIONS

The entry Slovakia to EU in 2004 was also associated with adoption of regulations related to the Common Agricultural Policy. Seven new categories of SNaNG habitats (A-G) were defined in order to create the support framework for non-project measures of the Rural Development Programme. Subsidies for protection of SNaNG habitats are limited by adhering to specific management conditions. In the programming period 2014-2020, the basic payment for protection of SNaNG

habitats in the categories A, C, F, and G reached 174.00 EUR/ha, which is approximately by 50% more than in the categories B, D, and E. Both basic payments for protection of SNaNG habitats can be combined with the submeasure "Natura 2000 subsidies - permanent grasslands", and the measure "Ecological agriculture - permanent grasslands", with no double funding. The combination with the measure "Ecological agriculture - PG" is the most beneficial one. The payments rate per hectare are applicable since 2015 to the end of 2022, which is the end of the transitional period for the new CAP. In the last part of our paper we assessed the farm profitability in year 2019, with help of the ROE and BEP indicators, as the subsidies shall also serve to compensate the reduced revenues and reflect certain differences in costs. Propensity score matching was applied to create group of unsupported farms with similar character to supported farms (receiving subsidies for protection of SNaNG habitats). Propensity score was generated using Logit model. In model were used four explanatory variables, which should ensure similar character of farms (supported and unsupported). Based on several performed statistical tests we came to the conclusion, that statistically significant difference was between the ratios of ROE of supported and unsupported farms only at the 90% confidence level. By the BEP ratio, we can state, that statistically significant difference was not in year 2019. We can deduct from the comparison of profitability ratios between supported and unsupported farms, that the support in year 2019 was relative sufficient and could compensated differences in income and costs of farms, which complied with the conditions for protection of SNaNG habitats. In general, the profitability of all farms (supported and unsupported) is at a low level. Subsidies for protection of SNaNG habitats should be increased, as the SNaNG habitats contribute to other ecosystem services and are necessary to preserve biodiversity and produce healthy food. For this it will be protentional opportunity in the new CAP programming period 2023-2027.

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