

CHALLENGES FOR THE CONSERVATION OF SEMI-NATURAL GRASSLANDS IN MOUNTAINOUS NATIONAL PARKS – CASE STUDIES FROM THE POLISH CARPATHIANS

Natalia TOKARCZYK

*Institute of Geography and Spatial Management, Jagiellonian University, Gronostajowa 7, 30-387 Kraków, Poland,
E-mail: n.tokarczyk@doctoral.uj.edu.pl*

Abstract: Semi-natural grasslands are characteristic elements of mountain landscapes across the world. However, a significant decrease in their area has been observed in many places in Europe. This phenomenon leads to many negative consequences, which is why meadows and pastures are managed for conservation purposes in most European countries, especially in protected areas. The aim of this study is to identify the challenges for the management of semi-natural grasslands in the national parks of the Polish Carpathians with a special focus on the implementation of conservation measures. The study highlights also attitudes of local communities towards the conservation of semi-natural grasslands as well as motivations guiding the residents to support conservation activities. According to interviews conducted with parks' employees six key categories of challenges have been distinguished. They are associated with the land ownership structure, financing and implementation of conservation measures, planning and evaluation of applied treatments, and natural and social determinants. Only some of the challenges result exclusively from the mountainous conditions or refer directly to the effectiveness of the conservation measures. Most of the challenges are typical of those found in national parks throughout the world and are connected with legislative and financial issues. The results of interviews showed that implementation of conservation measures in difficult, mountainous conditions, and their labour consumption pose the biggest challenge. A significant problem is also the removal of mown biomass. The possibility of efficient conservation of semi-natural grasslands is in many cases limited by advanced processes of secondary forest succession, complicated ownership relations and difficult procedures of obtaining funds for the active conservation. The attitudes of local communities towards the conservation of semi-natural grasslands are different in individual national parks. The residents supporting the conservation activities are guided by aesthetic and scenic, historical and cultural as well as financial motivations.

Keywords: meadows, pastures, mowing, grazing, management, protected areas, the Carpathians

1. INTRODUCTION

Meadows and pastures are characteristic elements of mountain landscapes across the world. Some of them have a natural character (above the treeline, on floodplains), while others have emerged as a result of human activity. These semi-natural communities were for hundreds of years maintained by regular mowing or grazing (Valkó et al., 2012; Tälle et al., 2015). However, they are formed mainly of native species, which have spread significantly as a result of agricultural activity (Zarzycki &

Korzeniak, 2013). Currently, they are included among the richest ecosystems in Europe (Dahlström et al., 2013). It results from the large diversity of habitat conditions and agricultural practices in mountain areas (Pärtel et al., 2005). Semi-natural grasslands are important habitats for many species of birds (Sirami et al., 2007) and invertebrates (Baur et al., 2006). They also provide the necessary ecosystem services such as: (1) provisioning services – source of food and forage, genetic resources, medicinal value, bioenergy production, (2) regulating services – soil erosion protection,

water flow regulation, carbon sequestration, pest control, pollination, (3) habitat services – maintenance habitat for migratory species, gene pool protection, and (4) cultural services – recreational and aesthetic values, inspiration for art and design (Hönigová et al., 2012).

Currently, due to the changes in traditional land use, semi-natural grasslands are among the most endangered biocultural diversity "hotspots" in Europe (Babai et al., 2015). Their area is decreasing at an alarming rate. Two opposing but related trends can be observed – one towards the intensification of agriculture and another one towards land abandonment (Emanuelsson, 2008; Halada et al., 2011). In most Western European countries, semi-natural grasslands have lost their ecological function due to the introduction of cultivated fodder and artificial fertilizers (Dahlström et al., 2013). The intensification of agriculture leads to the homogenization of the landscape and fragmentation of natural and semi-natural habitats (Halada et al., 2011). Overutilization can produce a lessening in ecosystems' capacity of support to biodiversity (Ioja et al., 2011). The threat to semi-natural grasslands is also conversion into arable land as well as increasingly widespread bio-energy crops and biomass plantations. In many places, the area of grasslands decreases with the progressing urbanization of rural areas.

On the other hand, the process of land abandonment and the associated increase in forest area is observed on less favoured and peripheral areas in many developed countries (MacDonald et al., 2000; Lasanta et al., 2017). It is estimated that as a result of governmental and non-governmental afforestation programmes, secondary forest succession, and the abandonment of farming activity, the forest area in Europe has been increasing since 1990 by about 0.4% per year (European Commission, 2013). In many areas, the process of abandoning traditional farming began as early as in the mid-19th century as a result of the Industrial Revolution (Gellrich & Zimmermann, 2007). In Central and Eastern Europe, the process of land abandonment was associated directly with the collapse of the Soviet Union and the opening of the EU market to the former socialist countries (Emanuelsson, 2008).

The disappearance of mountain meadows and pastures leads to many negative consequences, causing changes in the structure and functioning of the landscape (Lasanta et al., 2015). However, some authors perceive this process as an opportunity for rewilding (Navarro & Pereira, 2012). In modern nature conservation, the maintaining of biodiversity

and main ecosystem services is as important as preservation the natural ecological processes, or the restoration of degraded habitats. It also stresses the need to protect cultural landscapes, which are semi-natural grasslands.

For a long time, semi-natural grasslands have had low priority in European nature conservation. The first programmes of their protection were introduced in the early 1980s by Sweden, the United Kingdom and the Netherlands (Emanuelsson, 2008). Currently, semi-natural grasslands are managed for conservation purposes in most European countries and maintenance of them is a key issue of the EU agri-environmental policy (Valkó et al., 2012). It is for this reason that year by year considerable financial resources are allocated for the conservation of these communities. Agri-environmental subsidies give the possibility for many farmers to stay in agriculture, contribute to the preservation of a large area of biodiversity-rich grasslands, or even renewed management of grasslands abandoned for many years. However, some authors call into question the effectiveness of such subsidies (Kleijn et al., 2006; Whittingham, 2007). The support is mostly focused on large-scale farming, what may raise some concerns because of the homogenization of the landscape, as well as the omission of small areas of high biodiversity (Bezák & Halada, 2010). Furthermore, the effect of subsidies is not strong enough to completely prevent the abandonment of agricultural land (Šebo & Kopecká, 2014) and the funds are not sufficient to protect all of the grasslands of high conservation value. Thus, mowing and extensive grazing are often the forms of conservation measures implemented only in national parks and other protected areas (Bezák & Halada, 2010). This is the case in the Polish Carpathians, where semi-natural grasslands are actively managed in six national parks.

The aim of this study is to identify the challenges for the management of semi-natural grasslands in the national parks of the Polish Carpathians with a special focus on the implementation of conservation measures. The study highlights also attitudes of local communities towards the conservation of semi-natural grasslands as well as motivations guiding the residents to support conservation activities. The analysis of these case studies leads to better understanding of complex socio-ecological factors influencing effective conservation of semi-natural communities in the mountainous conditions. Therefore, it may contribute to the improvement of grassland management practices in different protected areas across the world.

2. STUDY AREA

Most meadows and pastures in the foothill and montane zones in the Polish Carpathians are semi-natural communities. Their maintenance, therefore, requires the use of conservation measures as close as possible to the forms of management under which they formed. In the past few decades, the area of semi-natural grasslands in the Polish Carpathians has decreased significantly (Zarzycki & Korzeniak, 2013). Since the mid-1950s, the area of montane glades has decreased by 45% in the Tatra Mts. (Bukowski, 2009) and by 32% in the Gorce Mts. (Tokarczyk, 2012). In the Bieszczady Mts. as much as 73% of montane glades have overgrown

since the late 19th century (Kucharzyk & Augustyn, 2010).

The observed phenomenon is related primarily to the gradual abandonment of extensive farming as a result of socio-economic changes. A separate case are the grassland located in the eastern part of the Polish Carpathians, where the intensity of secondary forest succession had a direct relationship with the resettlement of national minorities after World War II from these areas (Wolski, 2007). The situation was different in the case of grasslands in the Tatra Mts. Following the establishment of national park, they were taken under strict protection, which was associated with the cessation of grazing and mowing (Ciurzycki, 2004).



Figure 1. The study area – national parks in the Polish Carpathians

Table 1. The characteristic features of the studied national parks – based on data from the Central Statistic Office (2016) and unpublished reports on the implementation of conservation measures

National park	Year of establishment	IUCN category	Area [km ²]	Max elevation [m a.s.l.]	Vegetation zones	Mown and grazed area in 2014 [ha]
Bieszczady BdNP	1973	II	292.02	1346	lower montane, subalpine (polonynas)	985.5
Babia Góra BgNP	1954	II	33.95	1725	lower montane, upper montane, subalpine, alpine	14.0
Gorce GNP	1981	II	70.29	1288	lower montane, upper montane	98.2
Magura MNP	1995	–	194.38	846	foothills, lower montane	456.2
Pieniny PNP	(1932) ^a 1954	II	23.72	982	lower montane	136.6
Tatra TNP	(1947) ^b 1954	II	211.97	2499	lower montane, upper montane, subalpine, alpine, subnival	187.0

^a The National Forests Unit "Park Narodowy w Pieninach"

^b The National Forests Unit "Park Tatrzański"

Despite the great value of Carpathian meadows and pastures, it is currently not possible to maintain them all (Czurzycki, 2004). They are managed for conservation purposes mainly in six national parks in the Polish Carpathians – in Babia Góra National Park (BgNP), Gorce National Park (GNP), Pieniny National Park (PNP), Tatra National Park (TNP), Magura National Park (MNP), and Bieszczady National Park (BdNP) (Fig. 1, Table 1).

Initially, semi-natural grasslands in the Carpathian national parks were not given so much attention as other natural ecosystems. They were often protected in a wrong way (strict protection) or in some cases they were intentionally afforested. The first conservation measures on grasslands in Poland were carried out in 1989 in PNP. In the following years, their active conservation was also initiated in other national parks.

Conservation tasks are aimed at restoring the appropriate state of communities through such treatments as: mechanical mowing and traditional scything, grazing, organic fertilization, removal of trees and shrubs, and the formation of ecotones, enriching the species composition of impoverished communities, removal of invasive alien species and synanthropes, as well as the amelioration and maintenance of proper soil moisture. Following the formation of a target community, treatments maintaining this condition are implemented. The selection of a particular method depends on many factors such as the area of meadow or pasture, its location, accessibility, type of plant community, advancement of secondary forest succession, and ownership structure.

3. MATERIAL AND METHODS

The research procedure consisted of three stages. The initial stage took the form of in-depth, semi-structured interviews conducted with experts managing the conservation of semi-natural grasslands in national parks of the Polish Carpathians. Such an approach allows to obtain many detailed and valuable information – not available through other data collection methods. One respondent from each national park was interviewed, because in the studied national parks only one employee is usually responsible for management of non-forest ecosystems. All respondents are biologists or foresters directly involved in the implementation of conservation measures and monitoring the achieved effects, thus they have the best knowledge of the analysed issues.

Six face-to-face interviews were conducted in parks' offices in December 2015. Each interview lasted an average of one hour. The questions focused

on three main issues: (1) problems hindered the effective conservation of semi-natural grasslands, (2) attitudes of local communities towards the conservation of semi-natural grasslands, (3) motivations guiding the residents to support the conservation of semi-natural grasslands.

Next, the data gathered from in-depth interviews were analysed by open coding. All interviews were coded by the same person. Similar or repeating answers were distinguished as distinct challenges, attitudes and motivations, and then grouped into several key categories. The data from the interviews were validated on the basis of comparison with the information collected during the detailed analysis of unpublished materials, such as conservation plans and reports on the implementation of conservation measures.

At the final stage, the same respondents evaluated in a 3-point scale the importance of the previously distinguished and categorized challenges for the national parks they represent. The data derived from scoring method were supposed to show similarities and differences between studied national parks.

4. RESULTS

4.1. Challenges for the conservation of semi-natural grasslands in the national parks of the Polish Carpathians

The study highlighted 20 main challenges associated with the conservation of semi-natural grasslands. They were arranged in six key categories, including issues related to the land ownership structure, the financing of conservation measures, implementation of conservation measures, planning and evaluation of applied treatments, natural and social determinants (Table 2). It results from the conducted interviews that part of the challenges are common to all the parks, while others are related to the specificity of individual areas, and still others occur only occasionally.

According to the employees of all the parks, implementation of conservation measures in difficult, mountainous conditions, and their labour consumption pose the biggest challenge. Currently, all the parks poorly cope with the removal of mown biomass. The possibility of efficient conservation of semi-natural grasslands is in many cases significantly limited by advanced processes of secondary forest succession. Most of the parks' employees also indicated difficult procedures and excessive formalism as factors hindering the obtaining of funds for the implementation of conservation measures.

Complicated ownership relations are also an important problem prolonging the procedure for the purchase of private land. It does not apply, however, to the parks in which public ownership dominates, such as BdNP, MNP or TNP.

In the national parks in which the area of readily available meadows and pastures is smaller, or

there is no large-scale organized grazing, as in BgNP, GNP or PNP, the little interest of private landowners in agri-environmental schemes is also a considerable difficulty. The rest of the challenges were indicated by the parks' employees more rarely, or only in individual cases, which suggests their smaller role.

Table 2. Challenges for the conservation of semi-natural grasslands in the national parks of the Polish Carpathians

Category	Challenge	BdNP	BgNP	GNP	MNP	PNP	TNP
land ownership structure	small funds for the purchase of private land						
	complicated ownership relations hindering the purchase of private land						
	uncertainty of conservation measures on leased lands						
financing of conservation measures	small funds to implement conservation measures						
	complicated procedures of obtaining funds for the active conservation						
	little interest of private landowners in agri-environmental schemes						
implementation of conservation measures	implementation of conservation measures in mountainous conditions						
	labour consumption of conservation measures						
	outsourcing the conservation treatments to specialist companies						
	removal of mown biomass						
	low effectiveness of applied conservation measures						
planning and evaluation of applied treatments	lack of approved conservation plans						
	understaffing						
	poor cooperation with academic circles						
	scarce exchange of experience with other national parks						
	insufficient scale of monitoring the achieved effects						
natural determinants	small area of semi-natural grasslands across the whole park						
	advanced processes of secondary forest succession						
social determinants	marginalization of semi-natural communities by the park staff						
	poor cooperation with local residents						

white – does not occur or occurs to a small extent, grey – occurs to a moderate extent, black – very important

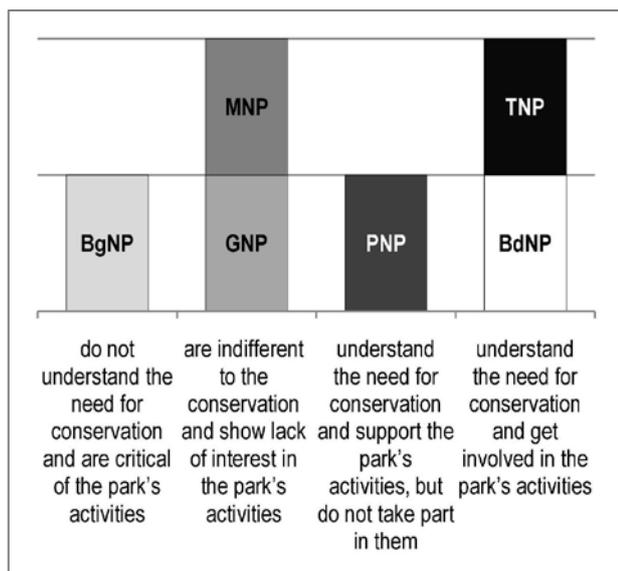


Figure 2. Attitudes of the majority of residents towards the conservation of semi-natural grasslands – in the opinion of parks' employees

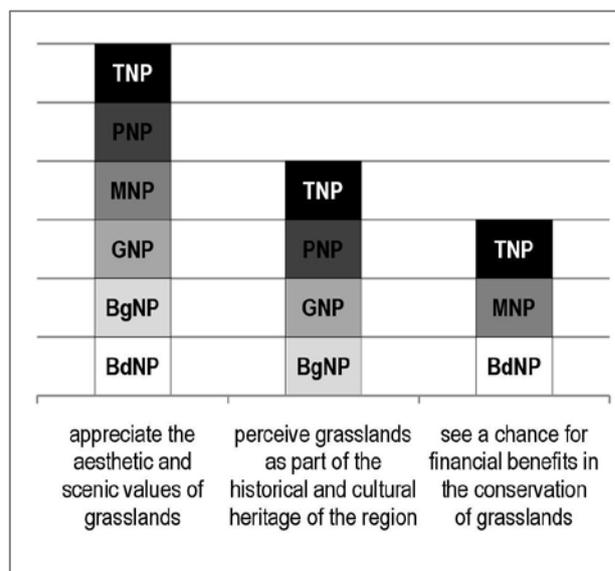


Figure 3. Motivations of the residents supporting the conservation of semi-natural grasslands – in the opinion of parks' employees

4.2. Attitudes of local residents towards the conservation of semi-natural grasslands and motivations to support measures undertaken by the national parks

The attitudes of local residents towards the conservation of semi-natural grasslands as well as motivations to support conservation measures vary between national parks (Fig. 2, Fig. 3). Most of the people living near BdNP, PNP and TNP understand the need for the conservation of grasslands, and support the measures undertaken by the parks, however, only in the case of BdNP and TNP the residents take an active part in these activities. Most of the residents of villages neighbouring GNP and MNP adopt an indifferent attitude towards overgrowing of grasslands and show lack of interest in the measures implemented by the parks. Only in the case of BgNP the attitude of the majority of the residents was described as negative. However, even in these three national parks a certain number of residents concerned about the condition of semi-natural grasslands can be found. For these people aesthetic and scenic considerations are the most common motivation, mentioned by employees of all the parks. The local communities living close to the national parks in the western part of the Carpathians, where pastoral traditions were deeply rooted, perceive meadows and pastures as elements of the historical and cultural heritage of the region. The situation is different in BdNP and MNP where, due to the post-war displacements, local identity is not as strong. In the case of BdNP, MNP and TNP, a large role is played by financial motivations. This evaluation is, however, of subjective nature, and a survey conducted among the local communities could provide more reliable results.

5. DISCUSSION

5.1. Challenges associated with the land ownership structure

5.1.1. Small funds for the purchase of private land

The private ownership of land within protected areas is a phenomenon that exists throughout Europe. However, it is usually characteristic of less strictly protected sites that allow for a degree of sustainable land use (European Environment Agency, 2012). In the national parks of the Polish Carpathians a vast area of semi-natural grasslands is private property, reaching in the case of PNP and GNP as much as 60%. The problem of private land ownership does not apply to BdNP and MNP since, in connection with

the post-war displacements, almost 100% of non-forest areas within them constitutes public property. The situation is similar in TNP, where purchase and expropriation for conservation purposes took place at the turn of the 1960s and 1970s. In the case of the private land located in national parks, all conservation measures must be agreed with the owners or managers of the land, who may not grant their consent to the implementation of conservation measures. It is for this reason that managers of national parks seek to purchase the most valuable land plots as far as their funds allow. Since its establishment in 1981, GNP has bought out more than 140 hectares of meadows and pastures. Since 1999, PNP has been buying out on average about 3-3.5 hectares of non-forest ecosystems a year. However, the purchase is not always possible due to the limited financial possibilities of parks. The problem is not so much the lack of funds, since purchase can be financed from various sources (e.g. national, EU, parks' own budget), but the high prices that the owners would be willing to sell their land for.

5.1.2. Complicated ownership relations hindering the purchase of private land

Unregulated, complicated ownership relations may also be an obstacle to purchase private land. One meadow or pasture often consists of a large number of small plots belonging to different landowners. The situation is similar in many other places in Europe, where the challenges of managing cultural landscapes are often rooted in cadastral realities (Vejre et al., 2015). The mosaic of ownership makes the buyout process last for many years. Community lands, in which each of their owners has a corresponding share, tend to be more problematic for purchase. In this case, it is necessary to obtain simultaneously the consent of all co-owners, who may have conflicting interests. The most difficult situation concerns lands where unregulated property rights make it virtually impossible to buy them out. The absence of inheritance acquisition, mistakes in land and mortgage registers, lack of contact with landowners who are not always aware of their ownership rights, are some of the challenges that are faced by managers of protected areas, not only in Poland (Prazan et al., 2005).

5.1.3. Uncertainty of conservation measures on leased lands

Long-term leases can be used to prevent secondary forest succession until funds for the purchase of a land plots are obtained, or their legal status is resolved, if the landowners are interested in selling. In the past, GNP and PNP used to sign agreements with the owners of private meadows and

pastures on which conservation measures were then implemented. Today this is a rare practice, because landowners may terminate the contract at any time, thus thwarting the further conservation of valuable communities.

5.2. Challenges associated with the financing of conservation measures

5.2.1. Small funds to implement conservation measures

Many protected areas around the world are poorly funded, and the financial resources are often inadequate to meet the conservation goals (Iojă et al., 2010; Andrea et al., 2013). Also in the case of Polish national parks, the funds from the state budget are spent in the vast majority on the staff salaries. The implementation of the conservation measures is therefore largely dependent on obtaining additional funds (Supreme Audit Office, 2013). The costs of mowing in mountainous areas are high and in many regions it is difficult to ensure a sufficient number of livestock for conservation grazing (Tälle et al., 2015). Part of the treatments are financed from the national parks' own income (sale of wood, entrance fees, leases), especially in TNP, which draws large revenues from tourism. In recent years, local initiatives related to the revitalization of the traditional farming and pastoral culture are also beginning to play an increasingly important role.

5.2.2. Complicated procedures of obtaining funds for the active conservation

Funds for the implementation of conservation measures can now be obtained from various sources. Many activities, also outside protected areas, are taken on the basis of the LIFE + Programme (Iojă et al., 2010). Unfortunately, difficult procedures and excessive formalism associated with the obtaining of funds from some sources hinder the work of parks' staff. Profitable solution for national parks may be funding of conservation measures by NGOs under their projects.

5.2.3. Little interest of private landowners in agri-environmental schemes

The chance to maintain semi-natural grasslands is increased by EU agricultural subsidies (direct, LFA and agri-environmental payments). EU subsidies are used by managers of national parks (except TNP and BgNP) and also by private landowners or leaseholders. The situation is most favourable in BdNP and MNP where, due to the presence of large areas of low-lying meadows, many farmers benefit from subsidies and parks receive

additional income from their lease. EU subsidies (including subsidies for native breeds of livestock) enjoy considerable popularity among the shepherds grazing their flocks of sheep in TNP. Only in BgNP the owners of private land are not interested in subsidies at all. Factors discouraging farmers from participating in agri-environmental schemes include: complicated procedures for obtaining funds, inadequacy of the subsidy to the specificity of farming in difficult mountain areas, and guidelines concerning the use of meadows (date and method of mowing) (Loch & Staszyńska, 2011). National parks offer farmers assistance in obtaining a subsidy. Nonetheless, the majority of private landowners use exclusively direct and LFA payments, which are less restrictive than agri-environmental schemes. In addition, the large fragmentation of farms is not conducive to the use of EU subsidies. In the case of small farms, the ratio of financial outlays to the benefits obtained is too low to be profitable (Prazan et al., 2005).

5.3. Challenges associated with the implementation of conservation measures

5.3.1. Implementation of conservation measures in mountainous conditions

At the stage of implementation of conservation measures, the necessity to work in mountainous conditions poses the most challenges. Unfavourable location often prevents the mechanization, due to the difficult access, slope steepness, ground rockiness and land fragmentation.

5.3.2. Labour consumption of conservation measures

Maintaining semi-natural grasslands imposes considerable workload, since their effective conservation requires regularly repeated treatments such as mowing or grazing (Valkó et al., 2012). Moreover, mowing has to be carried out manually in some cases. Despite the reduction to an acceptable minimum (e.g. mowing every 2 or 3 years), the labour consumption of treatments is still a significant challenge.

5.3.3. Outsourcing the conservation treatments to specialist companies

Basically, each of the parks has its own equipment facilities but, due to safety regulations, most of them commission the implementation of conservation measures from specialist companies, which often use the equipment purchased by the parks. PNP, where most of the works are performed by its employees, is an exception. Outsourcing the

conservation treatments may increase their costs. Sometimes it also requires open tender procedure.

5.3.4. Removal of mown biomass

A problem which occurs in all national parks in the Polish Carpathians is the removal of the mown biomass. In most cases it comes from the late mowing, so it has low feed value, which combined with the low demand for hay makes it difficult to sell (Doležal et al., 2011). In spite of this, PNP, MNP and TNP manage to generate revenue from the sale of biomass. Parks try to cope with unutilized biomass in different ways. Most often, it is stored in heaps at the edge of the meadows, and the resulting compost can be used for the fertilization of impoverished habitats. Part of the biomass is left on the swathes. Its controlled burning is also allowed. A practical solution was used in MNP where the heating system in the park office was modernized so as to allow the burning of the pellets from the mown biomass.

5.3.5. Low effectiveness of applied conservation measures

The results of the inventory of plant communities, carried out in recent years in all of the studied national parks in order to prepare conservation plans, indicate that the conservation of semi-natural grasslands was in most cases adequate, which is also confirmed by parks' employees. The conservation measures implemented since the 1990s have produced many positive results. For example, treatments used in PNP have contributed to the preservation of the species-rich thermophilous meadow community (*Anthyllidi-Trifolietum montani*) (Wróbel, 2006). However, the implementation of appropriate treatments, referring to traditional management practices, is not always possible. At present, the conservation of communities related to grazing, especially mountain *Nardus stricta* grasslands, presents a considerable difficulty in the national parks of the Polish Carpathians. This problem has two causes. Firstly, it is not easy to find farmers willing to graze livestock and the studied parks do not have their own livestock, except for BdNP where some pastures are grazed by Hucul horses from its own stud. Secondly, *Nardus* grasslands often occur in the form of small patches mixed with mesophilic meadows. In such an area, sheep avoid poor *Nardus* grasslands, as a result of which grazing proves to be little effective (Korzeniak, 2009). The problem of invasive species in pastures, mainly the creeping thistle (*Cirsium arvense*), also requires a more effective solution.

5.4. Challenges associated with the planning and evaluation of applied treatments

5.4.1. Lack of approved conservation plans

The activities in the field of conservation of semi-natural grasslands are governed by the provisions contained in conservation plans. Due to changes in the law on nature conservation in Poland, formally only one of the studied parks (PNP) has an approved conservation plan. In other national parks, the treatments are carried out based on annual conservation tasks. It may present some difficulty, especially since a plan of such tasks has to be prepared every year, and then must be approved by the Minister of the Environment. However, conservation tasks are based mostly on draft conservation plans or on previous plans, so it cannot be unequivocally said that there is no long-term concept of conservation of semi-natural grasslands. Fortunately, all the parks are finishing or have already finalized the preparation of conservation plans, so in the near future this problem should be outdated.

5.4.2. Understaffing

Many protected areas around the world are understaffed (Ioja et al., 2010; Andrea et al., 2013). In 2012, 23 national parks in Poland employed a total of 1,539 people (Supreme Audit Office, 2013). Only a part of them dealt with specific tasks related to the nature conservation. Consequently, there is a problem of "multitasking" of the staff, i.e. scientific workers often have to deal with formal and organizational matters, so that is why their work is sometimes less effective. The staff generally have appropriate qualifications, however, from the point of view of conservation of grasslands, the overwhelming majority of foresters among the employed personnel may raise concern (Ginalski, 2008).

5.4.3. Poor cooperation with academic circles

Cooperation with academic circles is an essential element of grassland conservation. It contributes in delivering effective management practices. According to parks' employees, cooperation with scientists is rather at a sufficient level. In recent years, numerous studies and projects are carried out by students and researchers in the parks.

5.4.4. Scarce exchange of experience with other national parks

The exchange of experience with employees of the other national parks allows the application of

best practices and contributes in developing joint solutions. Employees of national parks in the western part of the Carpathians maintain that despite the absence of regular meetings, such as symposia or conferences, they remain in contact with each other. In MNP and BdNP cooperation with other parks is less intensive, but their specificity is also slightly different due to the large area of leased grasslands.

5.4.5. Insufficient scale of monitoring the achieved effects

In order to maintain the value of protected areas, the continuous monitoring of the condition of plant communities as well as the evaluation of the effectiveness of the implemented measures is required. This allows to identify the main problems and to concentrate on solving them (Ganatsas et al., 2013). In the studied national parks, monitoring is carried out at different spatial scales using various methods such as the analysis of satellite imagery or aerial photographs as well as field surveys (including repeated *phytosociological relevés* on permanent research plots). According to the employees of the studied parks, the scale of monitoring the achieved effects should be larger. All these activities require, however, significant investment of staff resources and funds. Fortunately, in accordance with the new conservation plans, the scope of the monitoring is to be increased in the following years.

5.5. Challenges associated with natural determinants

5.5.1. Small area of semi-natural grasslands across the whole park

The implementation of conservation measures may be hindered by the small area of semi-natural grasslands, as in BgNP. In this case, their maintenance is not included in the mainstream conservation policy of the park. Moreover, treatments taken on a larger scale are more profitable due to the possibility of their mechanization, and thus to the reduction of their costs.

5.5.2. Advanced processes of secondary forest succession

In the studied national parks, a vast area of semi-natural grasslands has now overgrown, or is in an advanced stage of succession. The restoration of strongly transformed communities is difficult and labour-consuming, which is associated with an increase in financial outlays. In most cases, due to ecological and economic reasons (lack of target species, necessity to cut many mature trees), such

areas are left to continue secondary forest succession. An attempt to restore a former montane glade, almost entirely overgrown with a forty-year spruce forest, was made in 2013 in BgNP. This treatment raised a lot of controversy, especially that after a very long period of abandonment, meadow species occurred there in small quantities. As a solution to this problem, a diaspora transfer with biomass mown on species-rich meadows lying below was proposed. This method had been previously used for different types of meadows, more or less successfully (Donath et al., 2007).

5.6. Challenges associated with social determinants

5.6.1. Marginalization of semi-natural communities by the park staff

The social aspect of conservation of semi-natural grasslands is linked to the perception of these measures by parks' employees. The problem of marginalization of semi-natural communities by the staff in most of the parks does not play a significant role, although much more attention is usually paid to forest ecosystems. However, it does not change the fact that some employees of national parks still claim that meadows and pastures, as a product of human activity, should be left to secondary forest succession.

5.6.2. Poor cooperation with local residents

Difficulties in the implementation of conservation measures can be also augmented by poor cooperation with local communities, since residents' approval is conducive to the proper implementation of conservation goals (Zawilińska, 2016). The attitudes towards conservation activities are often a reflection of the general perception of national parks and negative opinions result from the poor communication (Andrea et al., 2013). Most residents living near the studied national parks have positive or indifferent attitudes towards conservation of semi-natural grasslands and the lack of their direct involvement in the implementation of conservation measures is mostly related to economic reasons.

The attitudes towards the conservation of semi-natural grasslands depends on the values attributed to them by local communities, i.e. the ecological, economic, cultural, aesthetic, ethical and spiritual ones (Lindemann-Matthies et al., 2010). Landscapes seen as visually pleasant are more likely to be protected, even if their ecological value is lower (Gobster et al., 2007; Lindemann-Matthies et al., 2010). Many residents realize that the loss of open spaces adversely affects the landscape, and

tourists would like to see livestock on pastures (Bieling, 2013). Moreover, well-managed areas evoke positive aesthetic feelings in many residents, hence they support the treatments performed on meadows and pastures (Ruskule et al., 2013). The perception of grasslands as elements of historical and cultural heritage of the region also plays an important role. A sense of duty to farm on the inherited land may be manifested in the positive attitudes towards the park's activity or, on the other hand, in the reluctance to sell land. This emotional attachment to land is a common phenomenon, especially for older people in mountainous regions (Bieling, 2013).

Local residents can see in the maintenance of semi-natural land a source of income, because many of them are leased and subsidized by EU. In situations where a tender is not required, employees of national parks outsource the performance of treatments to local people. Such approach is also related to financial benefits for residents, while improving the image of the park. The income related to sheep grazing and the sales of "oscypki" (traditional smoked sheep milk cheese) also impact positively on the perception of parks' activity. It is worth noting that none of the respondents mentioned that the residents want to conserve meadows and pastures because they are aware of their ecological significance as communities with high biodiversity. The residents' knowledge of the role of semi-natural communities seems to be still quite low, hence the undoubted need for broader educational actions.

6. CONCLUSIONS

In the national parks of the Polish Carpathians semi-natural grasslands are protected on a large scale, even though the implementation of conservation measures faces many challenges. Only some of the identified challenges result exclusively from the mountainous conditions – i.e. an increased labour consumption related to hindered mechanization, land fragmentation, complicated ownership relations or little interest of private landowners in agri-environmental schemes. However, national parks gradually raise funds for the purchase of private lands, increase the scale of implemented measures, and invest in the equipment that reduces the labour consumption of conservation treatments. They also support the extensive farming on private and leased land by providing assistance in obtaining EU subsidies.

Most of the mentioned challenges are very typical of those found in national parks throughout the world – not only in the mountains. These are the

legislative and financial issues, affecting the management of protected areas, and thus the conservation of semi-natural grasslands. Finally, some of the challenges refer directly to the effectiveness of the conservation measures in the case of individual plant communities. Currently a number of experimental research leading to achieve the most efficient methods of conservation are conducted in different environmental conditions, thus some of the problems are likely to be resolved any time soon.

Despite numerous challenges, the existence of national parks guarantees the maintenance of semi-natural grasslands, and the important species related to them. The situation looks definitely worse outside protected areas, both in the Polish Carpathians and in other European mountains. EU subsidies are only a half-measure. The extensive farming cannot be, in the long run and on a large scale, replaced by conservation measures that do not stimulate agricultural production (Babai & Molnár, 2014). The mowing of meadows only for conservation purposes generates, among others, the problem of removing mown biomass in conditions of a low demand for hay, and the future of meadows and pastures depends on external financing. Therefore, the maintaining of these semi-natural communities in the landscape of the Carpathians requires economic justification for their use (Prazan et al., 2005; Doležal et al., 2011; Zarzycki & Korzeniak, 2013), which involves an effective, long-term policy to support economically acceptable and nature friendly agriculture in the mountains.

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