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THE EVALUATION OF FOREST SMALL-SCALE SPECIALLY PROTECTED AREAS AND THEIR BUFFER ZONES IN EXAMPLES OF THE REGION TIŠNOV, CZECH REPUBLIC

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Abstract

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This study evaluates the eight forest small-scale specially protected areas (nature reserves: Babí lom, Břenčák, Krnovec, Slunná, Sokolí skála, and Nature monuments: Březina, Květnice, Zlobice) of the total area of 382 ha of the region Tišnov. The evaluation used two methodologies and results of were compared. From the outcomes obtained show that almost all the territories are in good (50%) or moderate (37.5%) status and quality of care is good in most cases (75%). The highest degree of care achieves is in a nature reserve Břenčák, which is generally excellent. The lowest recorded level of care, average, is in a natural monument Slunná. The poor condition or unsatisfactory of care were not found. Of the total area of protected areas and their areas of buffer zones is an average 24% affected by negative events. The most common reason for this effect is a landscape managed by intensive agriculture. Among the most invasive species belongs to *Impatiens parviflora* DC.; *Impatiens glandulifera* Royle. These are forming a continuous herb stand. In the trees stand is the most occurrences from invasive species *Robinia pseudoacacia* L. After comparing the summary results of the two methodologies can be concluded that the findings of both evaluate are very similar. The best current state is in natural reserve Břenčák and the worst state is in natural monument Květnice. Methodologies are different from each other. The methods for evaluate of forest small-scale protected areas were tested as suitable. One method, but should be somewhat modified.

buffer zone, protected areas, evaluation method, Tišnov region, *Impatiens parviflora* DC., *Impatiens glandulifera* Royle, *Robinia pseudoacacia* L.

The objective evaluation of the buffer zone of small-scale specially protected area, subject to the protection of forest communities, it is objectively capture buffer zone that actually fulfils its function, provides a protected area before the disturbance from the surrounding environment and mitigating the negative effects of external influences on the object of protection. It should be kept in mind that the protection zones usually do not have higher natural scientific or aesthetic value, and do not contain important ecosystems for a given geographic area or other particularly valuable parts of nature to such an extent as its own specially protected area. Evaluation of buffer zone reflects the hierarchical principle and compares it with the current state of optimum condition. The priority of buffer zone has to be the protection of a protected area, the second function of buffer zone is friendly use of renewable resources by local community (Martino, 2001; Rustagi, 2005). What is the optimal state of the buffer zone of specially protected areas can generally be expressed as follows:

The priority of the protection zone should be protection (protection – the transition zone between ecosystems) of the protected area. But it can function as ecotone and also corridors.

Secondary function of the protection zone is a friendly use of renewable resources.

The establishing and maintaining a protection zone is considered one of the appropriate strategies to address existing or potential conflicts in nature conservation.

These three functions of buffer zones are basically the same in small-and large protected areas. The only difference is the mechanisms of their functioning within the scale. While small-SPA is mostly the level of communities. The large protected areas work almost always a segment of the country and all its elements, links and flows. The basic input documents for the evaluation are valid plans for specially protected areas. The all documentation relating to the locality; maps (preferably in digital form), or inventory surveys, forest management plans (forest management scheme).

The aim of this study is to evaluate the current status of forest small-scale specially protected areas and theirs buffer zones (including state and care about them) in the region of Tišnov.

These areas were chosen: nature reserves: "Babí lom", "Břenčák", "Krnovec", "Slunná", "Sokolí skála", and Nature monuments: "Březina", "Květnice", "Zlobice".

For evaluation were used these methodologies:

Methodology of assessments of state and care about in small-scale specially protected areas (Svátek, Buček, 2005) and Design of methodology for evaluation of forest small-scale specially protected areas and theirs buffer zones (Rebrošová, Schneider, 2009) – Special Report project IGA Faculty of Forestry and Wood Technology, Mendel University in Brno No. 18/2009 – "Design of method of evaluation of buffer zones of forest small-scale specially protected areas".

Using these methods in selected areas such methodologies to compare, to analyse and compare the results obtained. Another objective of this study is to verify the practical applicability of these methodologies for selected forest small-scale specially protected areas. The results may also serve as a suitable basis to correct the deficiencies in the management of these areas, which may be accompanied by assessment (reflected).

This learning framework aims to develop a methodology that could be applicable to:

Objective evaluation of the status of the protected area and in particular the functionality and the need to safeguard forest small-scale specially protected areas and theirs buffer zones, where the prevailing or sole purpose of protecting the forest communities, or a combination of subject matter: the protection of forest communities and species (plants, animals, fungi), forest communities and the pieces of inanimate nature etc.

Collect of documents such as the basic source of information on the achievement of effectiveness of care for forest small-scale specially protected area, with all the conditions of protection, including buffer zone.

Data processing for forest management plans for forest small-scale specially protected areas in Czech Republic.

The methodology should be applicable for protection of areas where forest communities are. The proposed methodology should be based on the regulations of nature conservation and landscape of Czech Republic.

MATERIALS AND METHODS

To address this study were used two methodological approaches:

Methodology of assessments of state and care about in small-scale specially protected areas (Svátek, Buček, 2005).

Design of methodology for evaluation of forest small-scale specially protected areas and theirs buffer zones (Rebrošová, Schneider, 2009) – Special Report project IGA Faculty of Forestry and Wood Technology, Mendel University in Brno No. 18/2009 – "Design of method of evaluation of buffer zones of forest small-scale specially protected areas".

In year 2009 was run the collection of data and information on the areas, field investigation and processing.

The Tišnov region has been studied eight forest small scale specially protected areas (under the Act of nature and landscape protection No. 114/1992 Coll., Czech Republic). These area were chosen to cover a wide range of environmental conditions, among them forest communities, natural forests, coppice forest and pine relict habitats in the extreme. When choosing to take into account diversity (biodiversity) in buffer zones and the related external influences. For this reason, was chosen as the complex of forests, the area surrounded by agricultural land or in contact with the water flow. Select the application and therefore allows comparison of the results of methodologies for different types of forest ecosystems.

Study areas

According to Mackovčin (2007) is basic geomorphological structure of Tišnov region – the territory divided into two areas: the Brno Highlands (with units: Boskovic Wake, Bobrav Highlands, Highlands and Drahan-Brno Basin, and the Bohemian-Moravian Highlands (with units: Křižanov Highlands and Hornosvratec Highlands). The relief of studing area is varied, in the northwest reaches of upland Sykorsk fragmentation of the territory to levels with difference in altitude 400 m.km^{-2}, while the southeast is reduced to the level of the hilly Brno basin. There are contacted several geological units: Moldanubicum, Svratka Crystalline, Moravicum, Brno Massif and Boskovic furrow. Soil cover of

Tišnov region takes the typical Cambisol acidic and neutral intrusive gneisses and granulites. The Tišnov region, which is part of the river basin Svratka, belongs to the drainage area of the Black Sea. The main watercourse is the left-hand tributary of the River Thaya Svratka (Vlček, 1984). According to Quitt (1975) it is in moderately warm climate, characterized by average air temperature in July 16 to 18 ° C in January from –2 to –5 ° C. Biogeographic description is possible to read in monograph Culek *et al.* (1995).

Table I shows the characteristics of the objects of nature conservation for individual protected areas and there are the sizes of chosen areas.

The main and only source of information on the areas reviewed were used care plans and in some cases, inventory surveys. These documents were obtained by contacting and visiting the Department of Environment Regional Office Southern Moravian Region. From these materials it was possible to obtain identifying data, location information, ecotopes, biota, and of course the objective of safeguarding the protected area, a survey carried out by the care and proposed interventions and actions. It was used a digital register too of the Central List of Nature Protection from Agency of Nature Conservation and Landscape protection of the Czech Republic. Assessment was based on a quick field survey focused on obtaining recent information about the realities and outcomes of care. All fieldwork took place in August and the fall of 2009. The exact location was determined using the GPS. First, we found where is situated the boundary of protected area; we controlled too the control bar marking the border, the state board with a small sign and evaluation of the buffer zone. After them it followed directly in the survey focused on the evaluation of other criteria of protected area. During the fieldwork notes were made on individual squares on the map according to the current position (Methodology

I: *Characteristics of the objects and the size of the areas*

Name of protected area	Size of protected area (ha)	Object of protection	Origin
NR "Babí lom"	20.94	Rock ridge formed by Devonian conglomerates occupied by forest communities with an adequate range of organic herbal undergrowth.	Management Plan for the period 2005 –2014
NR "Břenčák"	28.075	Nature close to nature forest communities of scrub oak with a rich representation of general and dogwood species-rich herb layer.	Management –Plan for the period 1998–2011
NM "Březina"	32.1169	The mission of this protected area is to protect biogeocenosis indigenous forests and rare flora, including all other natural phenomena located in that area.	Management Plan for the period 2007–2011
NR "Krnovec"	7.69	The object of protection SPA site is of great significance and biogeographic phytocenologic geobiocenoses with segments of the natural character of the protected and endangered species of flora and fauna.	Management Plan for the period 2008–2012
NM "Květnice"	127.3743	The main object of protection in reserve "Kvetnice" is an exceptional variety of animate and inanimate nature.	Management Plan for the period 2003–2013
NR "Slunná"	5.6427	Protection of the natural (original autochthonous) forest primeval character is a object of protection.	Management Plan for the period 2008–2011
NR "Sokolí skála"	128.4585	Protecting forest complexes of mixed forest and steep gneiss rocks that were once nesting peregrine falcons. Currently, the eagle owl nesting sites. Mosaic of well-preserved biota of extreme habitats (scree, rocks) with the occurrence of rare, endangered and legally protected species *Lilium martagon* L., *Vicia pissiformis* L., *Aurinia saxatilis* Fritsch subsp. *Arduini*, *Melica transsilvanica* Schur., and the wider area of unique specimens *Taxus baccata* (age 200 years).	Management Plan for the period 2006–2012
NM "Zlobice"	62.3397	Protected natural monument "Zlobice" is an important botanical thermophilous flora and vegetation in the northwest near Brno. Cultural and scientific value lies primarily in the areas of near-natural plant communities, especially communities subxerofilních oak and peripheral parts xerothermal herbaceous communities in which there are a number of endangered and protected plant taxa.	Honzova 2010

Explanatory notes:
NM – Natural Monument
NR – Natural Reserve
SPA – Special Protected Area

according to Rebrošová, Schneider, 2009). During the investigation it was also taken photographs. Time-consuming field evaluations will depend on the size and complexity of the area, its accessibility and other factors. The selected area does not exceed the length of the assessment for one day, as the authors stated in methodologies so. The other time is needed for both methods for completing the trial data and processing of complex outputs.

RESULTS AND DISCUSSION

The evaluation results obtained by methodology according to Svátek, Buček (2005)

The current state of most investigational selected protected areas of Tišnov region was rated as good in 50% of the all assessed areas. On the 37.5% of the assessed areas was state evaluated as average. Only one area is in excellent condition, it is a natural reserve Břenčák. The positive fact is that in any area there is not a bad or very bad condition. On most of evaluated areas are maintained subject of protection, which has been published, including the optimal structure of biota. The studying areas are not significantly affected by the presence of black garbage dumps and litter. The lowest level was the most frequently evaluated criteria "expansive and invasive species". Among the most unwanted species that were identified during field surveys include *Impatiens parviflora* DC; forming a continuous growth in the herb *Impatiens glandulifera* Royle; *Robinia pseudoacacia* L. and others. The invasive species are mainly *Fraxinus excelsior* L.

On the evaluated areas are mostly contain this kind of type forest: relict pine forest, forest communities, forest management resulting of stool shoot; forests with natural species composition. Highest degree of preservation of the subject matter has been found in "Břenčák", "Babí lom" and "Sokolí skala". The lowest proportion of the area with optimal conditions for preservation of the subject matter is in areas "Březina", "Slunná" and "Květnice". The structure of biota in selected areas is mainly influenced by the way of agriculture, which was previously applied. The optimal structure of the approximating to nature or natural condition has been detected in nature reserves "Babí lom" and "Břenčák". The least satisfactory structure of vegetation and natural heritage are in areas "Březina" and "Květnice". There is a significant problem non-native species composition of certain parts of the stands. Sozology protected and important species was assessed in three areas, which have used information from surveys, inventories and management plans. The highest ratings of this criteria obtained natural reserve "Břenčák". Often,

II: *Criteria and reasons for declining values of point*

Criterion	Reason	Reduction of X degrees
A	occurrence of invasive species under 100 m^2 surface coverage	–1
B	occurrence of invasive species over 100 m^2 surface coverage	–2
C	non-native species composition of mixed	–1
D	non-native species composition – monoculture	–2
E	buildings, railways, houses, broadcasters, el. management, gardening colony	–1
F	industrial buildings (companies, warehouses, factories)	–2
G	landfill and waste, debris and landfill – the type and scale –and major character	–2
H	landfill and waste, debris and landfill - the type and scale – a minor nature - only in places	–1
CH	occurrence of paths - the width of 4 m (hiking trails, forest roads)	–1
I	occurrence of paths - more or equal to 4 meters asphalt road, traffic	–2
J	highways and motorways	–3
K	tourism impact – a significant movement of people on bikes or other means – limited peace, space, growth, development, etc.	–2
L	evident by the increased movement of people outside the protected paths	–1
M	recreational facilities	–1
N	game management buildings – such as racks, pulpits, seats, other equipment	–1
O	damage of nature by wild beasts in gradation on area to 100 m^2	–1
P	damage of nature by wild beasts in gradation on area over 100 m^2	–2
Q	removal of the wall and stands forest – the emergence of sun scorch, support forest weed, destructive penetration wind	–2
R	clear large-scale silviculture cutting	–2
S	clear small-scale silviculture cutting	–1
V	intensive farming	–1

this type of evaluation was not significant, because it would require a longer time-tracking site, or would not be up to date inventory surveys. On the majority of selected areas was sufficient reproduction of the species. Conditions allowing adequate reproduction of populations to ensure their continued existence, are the most negatively affected by shading, dense undergrowth and herb spread of aggressive alien species, which prevents the natural development of new species. Quality of care for selected forest small-scale specially protected areas is generally rated as good (75% of the studying areas). The highest degree of care achieves a natural reserve "Břenčák", which is generally excellent. The lowest recorded level of care, the average, is in a natural monument "Slunná". The criterion with the highest rating ever is the "documentation" is all selected areas reached the maximum number of points denoting excellent condition. Documentation was complete in most areas, not just in some processed inventory survey. On the contrary, the worst rating criterion was "buffer zone", which is usually not respected and often does not fulfil its protective function. The evaluation of quality of care about protected area is a criterion "buffer zone" the lowest rated criterion. Common side effects and activities in buffer zones is the presence of cabana's areas and allotment gardener areas, landfill waste, the population of invasive species and intensive agricultural activities causing damage ecotone parts, hunting equipment and not least the presence of clear cutting.

Significant shortcomings in achieving conservation objectives have been discovered in the care about the natural reserve "Slunná", the most valuable part (the primeval beech stand) is in the process of decay, without ensuring their adequate regeneration. This criterion was common rated grade 4, less than 5.

The final evaluation of the current situation (state) in forest small-scale specially protected areas evaluated using by the methodology according to Svátek, Buček (2005) shows in Table III.

The evaluation results obtained by methodology according to Rebrošová, Schneider (2009)

The most of the reviewed by methodology Rebrošová, Schneider (2009) has not the ideal shape considering to its subject of protection, it is elongated rectangle or lines (50% of the studying areas). Triangular and rectangular shape, which is always preferable, has only one territory. The most ideal shape close to a square or a circle is represented by only one evaluated area. A size category in most cases (62.5%) exceeds the minimum size for the type of vegetation by Vacek (2003). These minimum surfaces of areas are not reaching three territories, namely: "Babí lom", "Slunná" and "Krnovec" (for the reservation, it is likely the extension).

The situation in the landscape of forest small-scale specially protected areas is affected by the associated ecotones of different widths and species diversity is usually a combination of several options (often the surrounding agricultural land adjacent to forests with him, in some cases near the settlement), only two areas ("Babí lom" and "Slunná") are situated in a complex of forest. After the assessment of interest areas was found that on average 76% of the excavated areas are not affected. Least affected areas are in the forest complex (88% surface of area "Babí lom", 84% surface of "Slunná"). Conversely, the biggest proportion of the areas of influence of one factor,

III: *The final evaluation of the current status and treatment in selected Tišnov region specially protected areas (according to the methodology Svátek, Buček, 2005)*

Evaluation of current state and management in protected areas and its buffer zone			final assessment of the state		final assessment of the management	
code	**cat.**	**name of area**	**Σ (%)**	**state**	**Σ (%)**	**management**
1130	NR	"Břenčák"	91	EX	96	EX
403	NR	"Sokolí skála"	89	G	90	G
189	NR	"Babí lom"	83	G	82	G
1129	NR	"Krnovec"	77	G	81	G
883	NM	"Zlobice"	75	G	81	G
1015	NR	"Slunná"	68	A	77	G
1438	NM	"Březina"	66	A	71	G
204	NM	"Květnice"	63	A	66	A
Arithmetic average			76,5	G	80	G

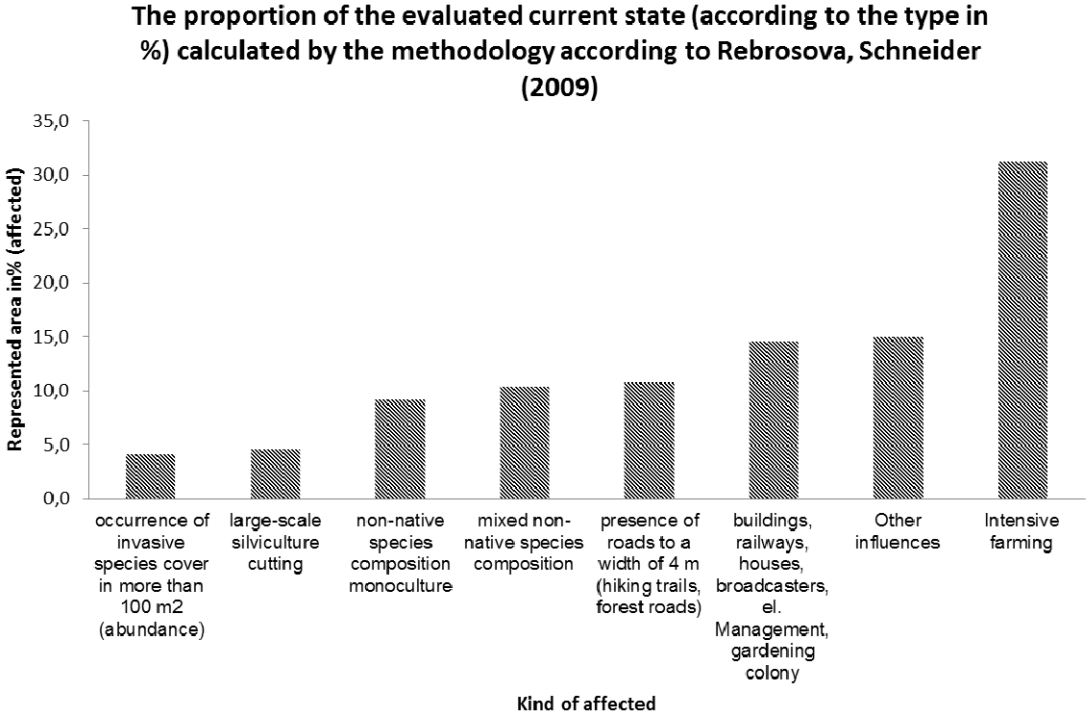
Explanatory notes:
EX – Excellent
G – Good
A – Average
Cat. – Categories of protection
NR – Natural Reserve
NM – Natural Monument
Code – Code of protected areas by the award Czech Republic

the area surrounded by intensively farmed land near settlements or in contact with gardening colonies ("Březina" 64%, "Květnice" 68% and "Zlobice" 68%). Interestingly, this group includes all the categories of natural monument.

The most commonly occurring adverse phenomenon operating in the buffer zones is an intensive agriculture. Intensive farming can cause plowing valuable stand borders, changes in soil nutrients due to fertilization, etc. The second most common phenomenon is the presence of buildings, railways buildings, electric line transmitters and other leadership. It is important to precise definition and demarcation of borders and prevents the dumping of property owners within the buffer zone, or directly into the area. Relatively often has been reported with non-native vegetation species composition, mixed or monoculture. Monocultures should be transferred to appropriate silvicultural interventions on this area, which corresponds to the natural conditions. Places affected by the occurrence of invasive species reduce the protective function of buffer zone and influenced to object of protection. Another negative effect is large-scale silviculture cutting found mainly in protected areas. The fact that even a small percentage of the protection zone with a significant negative influence can have on the status of protected areas and critical impact, the protected area "Slunná" shows, whose status was disrupted because silviculture cutting in the northern part of the buffer zone and the subsequent effect destructive winds. The role of the protection zone is the territory also depends on the size and shape of small-scale special protected areas. An example might be a protected area "Sokolí skála", the buffer zone and territories in its vicinity is influenced by a number of different phenomena (rail track, asphalt roads, invasive species, recreational facilities …), but the overall condition of the area is positive. It was found that 76% of the total area evaluate selected specially protected areas of Tišnov region are not affected. The remaining 24% of the area affected is registered, which is defined in Table II. Tabularly the most common reason of interference of assessed protected areas and their buffer zones expresses the Figure 1.

Comparing the results of both methods

"Methods" according to Rebrošová, Schneider (2009) is not designed to create a universal comprehensive evaluation. It is therefore quite difficult to clearly determine which evaluated areas are in the best and in worst of the state. After considering the nature, intensity and type of influence can be described as the best state in the "Babí lom" and "Břenčák" fracture. This result corresponds to the output of the methodology developed under Svátek, Buček (2005), where the highest ranking has protected area "Břenčák". According to the methodology under Svátek, Buček (2005) Current status of at least not corresponds to the optimum condition for protected area "Květnice". Also according to the method established Rebrošová, Schneider (2009) are in the worst condition protected areas: "Květnice", "Březina" and "Krnovec". Based on the above



1: *The proportion of the evaluated current state (according to the type in %) calculated by the methodology according to Rebrošová, Schneider (2009)*

comparison we can say that although their approach differs both methods, the resulting assessment of the state interest is broadly similar.

CONCLUSIONS

The results of this study should enable the identified gaps and determine optimal management guidelines. Draw attention to the issue of management of the buffer zones, it si necessary to be further addressed. Comparison of the both methodologies can be used to their potential improving. The main purpose of this study was to apply and try on the set of areas to set the method according to Rebrošová, Schneider (2009) – Special Report project IGA Faculty of Forestry and Wood Technology, Mendel University in Brno No. 18/2009 – "Design of method of evaluation of buffer zones of forest small-scale specially protected areas".

A further aim was to identify shortcomings of this proposal and find other possible solutions for improvement.

SUMMARY

In summer, in autumn 2009 and spring 2010 assessment have been conducted eight forest small-scale specially protected areas in the Tišnov region. Once collected and examined the necessary information and material (effective management plans, inventory surveys) was conducted field research. Based on these surveys has been reviewed the current status and quality of care for each territory according to methodologies: a. according to Svátek, Buček (2005) and b. according to Rebrošová, Schneider (2009). The results obtained revealed that 50% of the assessed protected areas and theirs buffer zones are in good condition and 37.5% are in average condition. Some of the protected areas are characterized by the presence of part of the alien woody species composition and presence of invasive species. Frequent negative effect the damage caused by browsing of cloven browsing animals and the presence of garbage dumps and increased tourist traffic. The quality of care for selected protected areas of Tišnov region can generally be characterized as good (75% of evaluated areas). The excellent care was observed only in protected area "Břenčák". Highly evaluated is the documentation of the areas (in all cases, the highest level). The worst was assessed criterion "buffer zone", which is often not respected or fails to fulfill its purpose. In terms of the evaluation of care were not identified serious deficiencies in respect of nature conservation. There are as average 24% of the evaluation of total protected areas and their buffer zone. The most common reason for this effect is intensive agriculture. After comparing the summary results of the two methodologies can be concluded that the findings of both reviews are similar. The best current state is in a natural reserve "Brencak" and vice versa for the worst is in "Květnice". The results of this work should enable the identified gaps and determine optimal management in protected areas. Moreover, it highlighted the issue of management of the buffer zones to be further addressed. Comparison of the two methodologies can be used for improvement, particularly the right emerging methodology for assessing the status and the methods of management in buffer zones of forest small-scale specially protected areas.

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