ACTA ZOOLOGICA BULGARICA
Acta zool. bulg., 64 (4), 2012: 367-374

Special Protected Areas for Conservation of Romania' Forest Birds: Status Assessment and Possible Expansion using Predictive Tools

***Attila D. Sándor*[1, 2], *Cristian Domşa*[2, 3*]**

[1] Babeş-Bolyai University, Depart. Ecology and Systematics, str. Clinicilor 5-7., Cluj, RO-400007, Romania; E-mail: adsandor@gmail.com
[2] University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Depart. Parasitology and Parasitic Diseases, Calea Mănăştur 3-5, Cluj, RO-400372, Romania; E-mail: cristidomsa@yahoo.com
[3] Romanian Ornithological Society, Bd. Hristo Botev, nr.3/6, Bucharest, RO-030231, Romania

Abstract: The Birds Directive provides the most important legal framework for protection of wild birds' habitats within the European Union. Based on Article 4 of the Directive, Member States have to identify, delimitate and designate as protected areas Special Protected Areas (SPA). These sites designated by all Member States will result in a European network of protected sites (also known as NATURA 2000 sites). Here we evaluate whether the Romanian SPA network is enough to preserve forest specialist species, on the basis of a thorough analysis of habitat preferences and the presence of suitable forested habitats inside the SPA network. A GAP analysis is performed in order to provide a revision of current SPA. Our results suggest that the current network is insufficient to protect these species. We propose the enlargement of SPA network, based on the distribution of potential suitable habitat for these species, taken into account the needs and possibilities. A total number of 19 areas, covering 515 000 ha were selected for the species considered. The new proposals lay either on already established protected areas (declared according to Habitat Directive) or cover valuable areas already identified as important bird habitats inside Important Bird Areas.

Key words: SPA, Bird Directive, conservation tools, GAP analysis, GIS, habitat suitability, predictive models, forest birds, Romania

Introduction

The recent biodiversity crisis started a process of responses from international organisations and national governments, the most important outcome being the creation of networks of conservation areas (Boitani *et al.* 2007). These are often designed by using different flagship species like birds (endemic bird areas, important bird areas), habitats (centres of plant diversity) or general biodiversity approaches, like biodiversity hotspots (Sarakinos *et al.* 2001) or tropical wilderness areas (Vimal *et al.* 2011). The designation process and implementation of conservative management of these areas is often problematic, as most of the selected surfaces (to contain globally important biodiversity values) are too large to be protected entirely (Cogălniceanu, Cogălniceanu 2010, McDonald, Boucher 2011). Especially in the case of birds there are only a few networks which have proved long-term reliability, such as the important bird areas network of BirdLife (Gaston *et al.* 2008) or NATURA 2000 developed by the European Union (BirdLife International 2004b, Hernando *et al.* 2010). The goal of NATURA 2000 is to protect biodiversity through the delineation of areas (Special Protection Areas, SPA, according to the EU Birds

*Corresponding author

Directive (79/409/EEC) and Sites of Community Importance, SCIs according to the EU Habitat Directive (92/43/EEC)) for a set of endangered habitats and species. The combined network of all these SPA and SCIs constitutes the trans-boundary NATURA 2000 system (Gaston *et al.* 2008).

The European Commission also created a legal framework for the conservation of wild birds based on these networks. The BD Directive requires Member States to classify Special Protection Areas for those species listed in Annex I as well as for migratory bird species. The Habitat Directive, which was issued later, recognized the need for a proper management, thus states that throughout implementation all enlisted habitat and species should attain 'favourable conservation status' all over Europe. Therefore each member state is responsible for developing such a network, taking into account its specific natural, social and economic situation (BirdLife International 2004b).

As a new EU Member State, Romania had to designate SPA's under the Birds Directive (BD) and also to present a list of proposed Sites of Community Importance (pSCI's) under the Habitats Directive (HD) by 1 Jan 2007. The work on site selection started with identifying habitat types and species of Community Importance that occur in Romania. It was found that Annex I of the BD included 130 bird taxa recorded in the country. Because some of the identified species are already extinct or have a scarce and/or irregular occurrence in Romania sites were selected only for 103 species listed in annex I of the BD. In addition, 95 other species (migratory species) were taken into account in site selection. The criteria for this selection were developed on the basis of BirdLife International recommendations (Papp, Sándor 2007).

The selection of sites was a difficult process in Romania for several reasons: because of the lack of an overall national inventory of bird distribution and population data, coupled with the uneven knowledge of the distribution of most species, except for certain well known or localized bird species, like pelicans (*Pelecanus* sp.) and some rare or otherwise charismatic species. Moreover, there were problems associated with the lack of qualitative data on the local occurrence of most species and a chronic difficulty of access to recent information (new data often are unpublished and remain in the 'drawers' of specialists). The governmental implication was weak, with lack of governmental financial support for the process (Papp, Sándor 2007, Iojă *et al.* 2010, Knorn *et al.* 2012).

Although the selection process was officially closed in October 2006, the official designation only took place in November 2007 (through the Government Order 1284/2007), considerably late than required. There are 108 SPA in Romania (including one Marine Protected Area), according to the order, covering 2 988 713 ha (Iojă *et al.* 2010). The Romanian proposal has been assessed by the European Commission and referred as 'insufficient' to comply with the obligations of Romania according to the Bird Directive (in the letter C(2008)4631 from 18 Sept 2008, according to the case 2007/2266). To avoid a legal procedure opened by the European Union, accusing of lacking an adequate network of SPA to preserve the Annex I species in the region, Romania was required to propose a new (enlarged) network to comply with its obligations. Moreover, Romania has one of the highest number of globally threatened birds breeding on its territory (Sándor A. unpublished), still largely covered by semi-natural habitats (Tryjanowski *et al.* 2011) and has a special situation in terms of conservation dependent species/habitats, harbouring 5 bioregions, too (Iojă *et al.* 2010), thus conservation state of its birds is of wider significance (Sándor, DOMŞA Unpubished).

As the situation of data gathering, data access and financial support has not been significantly improved in Romania (Cogălniceanu, Cogălniceanu 2010), there is an acute need to find alternative ways to bring forward the designation process (Iojă *et al.* 2010). In this paper we evaluate whether the current SPA network is enough to preserve Annex I species which depend on forest ecosystems and try to propose ways of the SPAs network enlargement in a way so to reduce as much as possible economic and social conflicts (Grodzinska-Jurczak, Cent 2011). We selected forested habitats because these are considered most representative for Romania, while still possessing an ecologically significant area of high nature value (Veen *et al.* 2010). Furthermore there are georeferenced digital datasets available for different forest types (Domşa, Turcu 2009, Veen *et al.* 2010, Ikauniece *et al.* 2012). Moreover, forested areas are among the first listed for long term land-use changes due to urban sprawl (Gerard *et al.* 2010), climate change (Crossman *et al.* 2011, Ruiz-Labourdette *et al.* 2011, Strange *et al.* 2011) and habitat fragmentation (Fuller *et al.* 2007, Gregory *et al.* 2007, Araújo *et al.* 2011, Shurulinkov *et al.* 2012).

A GAP analysis was performed to conduct a revision of current SPA, using areas already identified inside SCIs and IBAs. On the basis of a thorough analysis of habitat needs and availability we quantify what amount of potential habitat surface remains unprotected by current SPA and by using the existing knowledge of IBAs and Biologically Important Forests, we propose new areas to be included into the planned revision of Romania's NATURA2000 network.

Methods

Target species

All Annex I species for which SPA were selected were assessed. We assumed that any species for which less than 10% of national breeding population was present inside the SPA network is not sufficiently conserved by the NATURA2000 network. From the list of 'insufficiently protected species', a number of 6 forest specialist species were selected for further analysis. They were assigned into habitat categories using Tucker, Evans (1997), but also habitat attributes mentioned in Hagemijer, Blair (1997) were taken into account. We used only those species which complete their full reproductive cycle in forested habitats and do no require other habitats neither for foraging nor for resting. Species with large habitat tolerance or rare occurrence were omitted. These species were assigned to one of two categories according to the forest types they primarily use (Table 1).

We assessed the importance of the populations of these species inside SPA and IBAs against their national population. The figures provided by Standard Data Forms were used for SPA, Papp, Sándor (2007) for IBAs and BirdLife International (2004a) was the source for the national population figures (Table 2). Two different forest categories were assigned and analysed for these species. All potential habitat cover, both inside and outside Special Protection Areas, was mapped for each species group (Table 2).

GAP Analysis

Several different vectorial databases were used for the analysis. The forest habitat database covering all major forest categories in Romania was provided by LIFE05 NAT/RO/000176 project. For NATURA 2000 network (both Special Protected Areas and Special Areas of Conservation) we used the official boundary dataset provided by the Romanian Ministry of Environment (www.mmediu.ro). For IBAs proposed by BirdLife International we used digital shapefiles available from SOR/BirdLife Romania (available as digital shapefile at http://iba.sor.ro). Additionally, for ranking the habitats outside SPA, Biologically Important Forest dataset was used (Domşa, Turcu 2009). Biologically Important Forest (BIF) is a concept developed by BirdLife International through its Forest Task Force (Laurance 2007). There is a set of criteria against which all the forests within a country were evaluated. These criteria refer to important aspects of ecological values and include: forests with low level of human disturbance, old and close to natural structure forests, forests with rare tree species and rare forest habitat types. For this paper we used the results from a recent survey in Romania (Domşa, Turcu 2009).

The analysis was based on 25 ha grid (500x500 m cell) covering the entire forested surface of Romania. This grid was used to intersect habitat, NATURA 2000 areas, IBA and BIF layers. If a grid cell containing target species' habitat(s) was outside the current SPA network, the respective grid cell was considered for the analysis (see Fig. 1. for the algorithm followed). For GIS analyses we used ArCGIS 9 software (ESRI 2004, Zlatanova *et al.* 2008).

When evaluating the new proposals for SPA, three different criteria were used: if a forested patch is inside a Special Conservation Area, if the forested patch is inside an Important Bird Area (but not includ-

Table 1. Bird species and forest types assessed.

Group	Species	Habitat type	SPA coverage from total available habitat in Romania (%)
1	*Dendrocopos leucotos*, *Ficedula albicollis*, *Ficedula parva*	1. Beech forests in mountain areas	15.3
2	*Aegolius funereus*, *Bonasia bonasia*, *Strix uralensis*	1. Mixed beech and conifer forests and 2. Beech forests in mountain areas	14.8

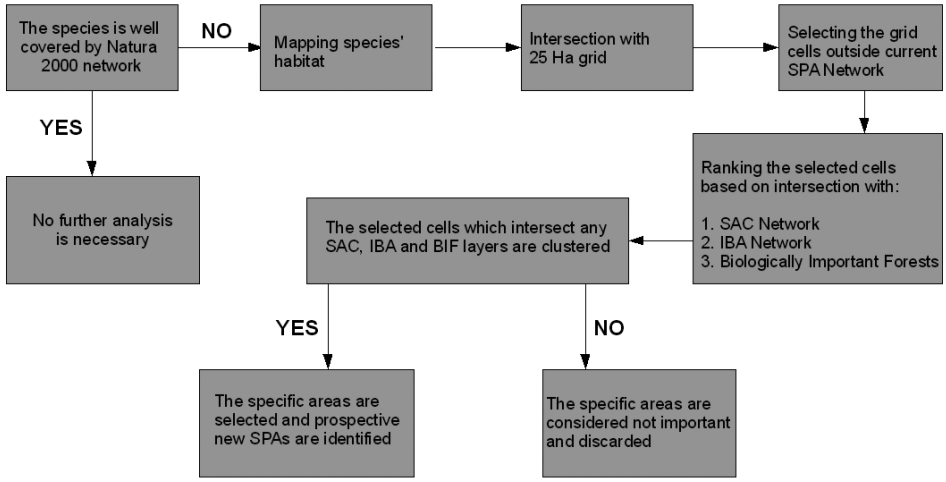

Fig. 1. Algorithm used for the GAP analysis and habitat selection for completing the Romanian SPA network.

Table 2. Selected species and their populations inside the Romanian SPA and IBA network.

Species	National population breed min-max*	SPA breed min-max	% SPA/ Nat breed min-max	IBA breed min-max**	% IBA/Nat breed min-max	Group
Aegolius funereus	6000-10000	894-1178	14,9-11,8	1379-1661	23,0-16,6	2
Bonasa bonasia	10000-13000	2772-3425	27,7-26,3	3460-4230	34,6-32,5	2
Dendrocopos leucotos	16000-24000	3325-4007	20,8-16,7	3706-4490	23,2-18,7	1
Ficedula albicollis	460000-712000	144252-193790	31,4-27,2	178292-238390	38,8-33,5	1
Ficedula parva	360000-512000	22337-29730	6,2-5,8	24017-31495	6,7-6,2	1
Strix uralensis	12000-20000	895-1159	7,5-5,8	1169-1443	9,7-7,2	2

* According to Papp and Sándor 2007.
** According to BirdLife International 2004.

ed in current SPA network) and if the forested patch is Biologically Important Forest. Based on the criteria number fulfilled, the selected grid cells with potential habitats to be included in SPA Network were ranked from **low** (only one criteria fulfilled), **medium** to **high** (all three criteria fulfilled) importance. The delimitation of new proposal boundaries was performed using spatial aggregation of high and medium importance category grid cells. The resulted polygons with large numbers of high and medium importance grid cells falling inside the existing NATURA 2000 sites (SCIs) were considered of high priority in selecting the new proposals. For each species' group, the first 10 most important (largest) distinct areas were selected to be proposed as prospective new SPA-s.

Results

A total of 26 forest specialist bird species were assessed. Between 6.2 and 31.4 % of the national populations of these species of community importance are breeding inside the current SPA network. The GAP analysis indicates that the current network of SPA only protects less than 10% of breeding population for a number of six forest dependent bird species (grouped acording to their habitat needs, see Table 1). As for a suitable habitat for these species, 15.3% of habitat for Group 1 species and 14.8% for Group 2 are inside the current SPA network (Fig. 2).

By completing the assessment of these habitat categories nationally, a number of further areas outside the current SPA network emerged. Forests belonging to Group 1 accounted for 18.77% of the IBASs, while for Group 2 some 18.60% of the suitable areas are included in the IBAs (Fig. 3, Table 3). Similarly, this cover acounted for 7, 846 ha inside already designated SCIs for Group 1 and 13 748 ha for Group 2. (Fig. 4, Table 3). There were a total of 5922 polygons of *high* and 13, 994 polygons of *me-*

Table 3. Characteristics of the two habitat categories used in the analysis.

	Group 1	Group 2
Overall number of grids cells covered by the habitat type	57025	126881
Number of grids inside or intersected by the current SPA network	8750	18789
Percentage covered by the current SPA network	15.34	14.81
Percentage covered by the current SPA network	18.77	18.60
Percentage of the overall habitat surface covered by the new proposals (to be added to the current SPA network)	15.48	12.33
Percentage of the new proposals covered by the SCI network	88.91	87.85
Percentage of the new proposals covered by the IBA network	14.22	21.87
Percentage of the new proposals covered only by the BIF network	3.03	3.30
Number of grids with Medium or High importance cells	5922	13994
Final coverage of the habitat type inside the proposed new SPA network	30.82	27.14

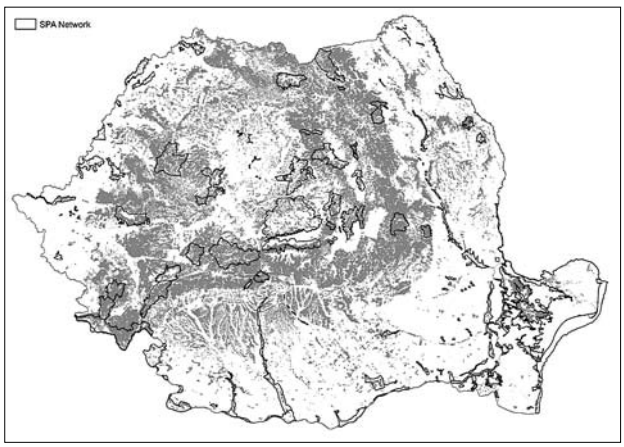

Fig. 2. The distribution of forested habitats in relation to the current SPA-s network in Romania.

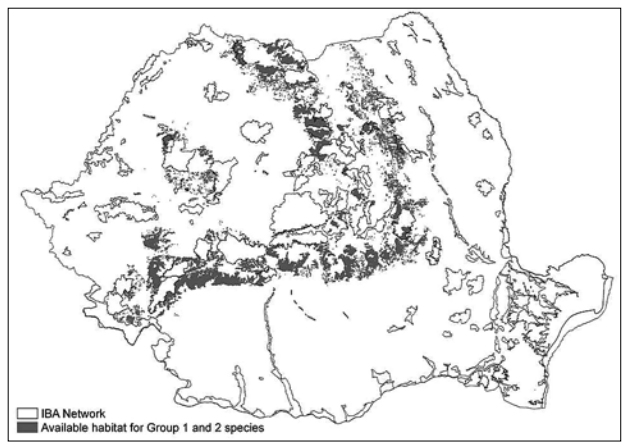

Fig. 3. The distribution of Group 1 and Group 2 habitats and the IBA network in Romania.

dium rank, used for delimiting the new proposals.

To reach a minimum of 20% cover of potential habitat inside the proposed new SPA cover, polygons were selected using areas identified formerly inside IBAs and/or SCIs. As it is not financially viable to expand the current SPA network with all the grids identified as containing High or Medium importance habitat patches, we selected manually those regions were compact areas could be delimited, and using clusters we delineated the prospective new SPA proposals. All new polygons were delimited along the existing boundaries of SCIs or IBAs. A total number of 19 areas, covering 515 000 ha were selected for the three groups considered. In this way the potential habitat included in the network of IBAs extends with 18.3 % of the entire potential habitat, whereas the current network of SPAs includes only 15.3 % of the entire potential habitat (Fig. 3; Table 3).

The proposed new network of SPA includes 30.82 % of the entire potential habitat of Group 1 species, while 27.14% for Group 2 of Annex 1 bird species at a national level (Table 3). The new proposals lay either on already established protected areas (SCIs declared according the HD, 88.91 % vs. 87.85 % of the proposals) or cover valuable areas already identified as important bird habitats inside IBAs (14.22 % for Group 1 and 21.8 7% for Group 2, some areas fulfill both conditions, are IBAs inside the SCI network). However, there is a small percentage of the proposed territory which is not part of the two above networks, but is covered by Biologically Important Forests (3.03% vs 3.30% of the total area, see also Fig. 5, Table 3).

Discussion

Systematic conservation planning requires firstly the identification of what species are priorities for conservation (Hernando *et al.* 2010), and subsequently the identification of what places are the most rep-

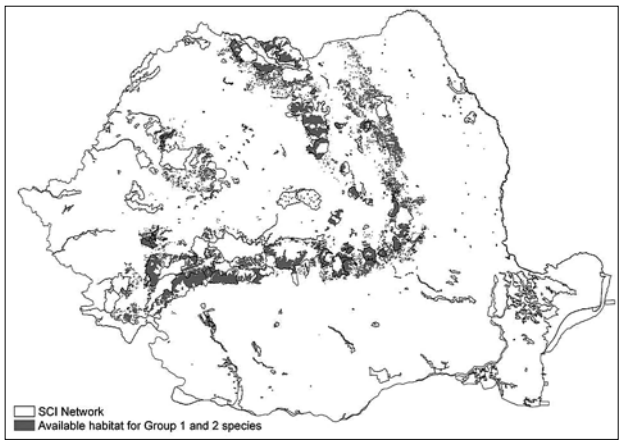

Fig. 4. The distribution of Group 1 and Group 2 habitats and the current SCI network in Romania.

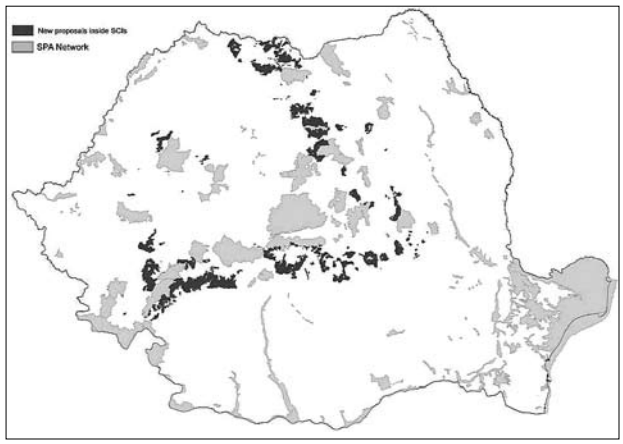

Fig. 5. The distribution of Group 1 and Group 2 habitats in relation to the current SPA network.

resentative to protect them (Chen 2007, Branquart *et al.* 2008, Hernando *et al.* 2010). Therefore, it is necessary to evaluate the degree to which the focus species is represented in the existing protected areas. This task is usually referred as GAP analysis and it attempts to detect voids by the identification of species/areas that need further protection (Scott *et al.* 1993, for a detailed review see Vimal *et al.* 2011). GAP analysis was already used for prioritizing conservation measures at different scales, from states (Oldfield *et al.* 2004) to continents (Catullo *et al.* 2008), for species to habitat groups (de Pous *et al.* 2011) or even ecosystems (Kujala *et al.* 2011). Moreover, this method was deployed for assessing completeness and coverage of national protected area network for tropical habitats (Powell *et al.* 2000) as well as arctic regions (Kujala *et al.* 2011). Recently Jantke *et al.* (2011) proposed its use to establish priorities in the expansion of NATURA 2000 network in wetland areas.

Using this method we managed to localize potential areas covered by habitats of 6 forest dependent Bird Directive Annex I species which may form the basis for a revised SPA network in Romania. By applying the GAP analysis we managed to increase the national SPA coverage to contain more than 20% of potential habitat for the treated species, by localizing potential habitat in the framework of the already existing NATURA 2000 network (ca. 88% of the new proposals) or in areas with proven value for a number of other species (Coldea *et al.* 2009). Moreover, areas selected/proposed as new SPA outside of the current SCI network may be well know regions (IBAs possess well known and ready to use datasets of Annex I bird Populations, see Papp, Sándor 2007) or may be linked to the conservation of other biodiversity forms (Coldea *et al.* 2009, Domşa, Turcu 2009, Veen *et al.* 2010).

By applying the algorithm of our methods one may provide a scientifically sound tool for a desktop selection of prospective new protected areas for the benefit of the mentioned species (for a detailed analysis of a similar method, with its positive aspects and drawbacks, see López-López *et al.* (2007). We are, however, aware that a pure speculative approach may not work for all and any species (Sarakinos *et al.* 2001), but may be a good tool to reduce the amount of data to be collected on the field and/or to be a good coarse filter to canalize efforts of conservation designation (see also Pasquini *et al.* 2010, but Ikauniece *et al.* 2012).

With this approach, we intended to avoid unrealistic results like protecting large-scale habitat continuums or extensive areas, trying to optimize the financial budget required for such a work (Barberán *et al.* 2005, McDonald, Boucher 2011). Given the trade-off between financial investment/social conflict and the conservation of biodiversity, our intention was to maximize the surface of potential habitat included in the natural protected network while minimizing the surface of the study area that would be necessary to cover, thus avoiding unnecessary expenses (Barberán *et al.* 2005) or long lasting conflicts with local interests (Niemela *et al.* 2005, Grodzinska-Jurczak, Cent 2011). Conflict is easily generated by the delineation of a new protected area all over the world (Fuentes 2011). As protection per se is usually conceived by local people as restric-

tions in everyday life, designation of new protected areas is problematic for local governments (Mouro, Castro 2010). A way to reduce this conflict is to propose new conservation measures for areas already accepted as protected areas (eg. increasing the area available for bird conservation inside already existing NATURA 2000 sites - SCIs, Fig. 5).

We consider this is a proper solution that relies on objective methods based on biological criteria. Evidently, we are fully aware that a good network of protected areas should not be based on the requirements of a few species however charismatic and well-known they are (López-López *et al.* 2007, Rozylowicz *et al.* 2011). Notwithstanding, in a social framework where resources accessible for nature conservation are limited, and considering the urgent need to improve SPA network in Romania, our proposal could be taken into account and may be further developed to suit most Annex I species' needs. While ecological relations among birds and habitat-types are mostly well known (Tucker, Evans 1997), even habitat selection of bird species breeding in forested areas at regional scales (Shurulinkov *et al.* 2012), there is a considerably knowledge gathered and ready available on forest structure based on remote sensing, there is still a lack of easy-to-use analitycal methods for linking these two in the help of nature conservation. We consider that our methods are enough robust and easy to be deployed to screen large forest patches for selecting areas for further conservation effort, withouth the use of sophisticated resources and excessive manpower.

Acknowledgements. This research was supported from grant POSDRU/88/1.5/S/60185 (to SDA) and POSDRU 6/1.5/S/3 (to CD).

References

Araújo M.B., D. Alagador, M. Cabeza, D. Nogués-Bravo and W. Thuiller 2011. Climate change threatens European conservation areas. – *Ecology Letters*, **14**: 484-492.

Barberán R., P. Egea, L. Pérez y Pérez 2005. The cost of Natura 2000 in Spain. – *European Environment*, **15**: 161-174.

BirdLife International 2004a. Birds in Europe: Population estimates, trends and conservation status. Cambridge, UK: BirdLife International.

BirdLife International 2004b. Birds in the European Union: a status assessment. Wageningen, The Netherlands: BirdLife International.

Boitani L., A. Falcucci, L. Maiorano and C. Rondinini 2007. Ecological networks as conceptual frameworks or operational tools in conservation. – *Conservation Biology*, **21**: 1414-1422.

Branquart E., K. Verheyen, J. Latham 2008. Selection criteria of protected forest areas in Europe: The theory and the real world. – *Biological Conservation*, **141**: 2795-2806.

Catullo G., M. Masi, A. Falcucci, L. Maiorano, C. Rondinini and L. Boitani 2008. A gap analysis of Southeast Asian mammals based on habitat suitability models. – *Biological Conservation*, **141**: 2730-2744.

Chen Y. H. 2007. Prioritizing avian conservation areas in China by hotspot scoring, heuristics and optimisation. – *Acta Ornithologica*, **42**: 119-128.

Cogălniceanu D., C. G. Cogălniceanu 2010. An enlarged European Union challenges priority settings in conservation. – *Biodiversity and Conservation*, **19**: 1471-1483.

Coldea G., I. Stoica, M. Puşcaş, T. Ursu, A. Oprea and The IntraBioDiv Consortium 2009. Alpine-subalpine species richness of the Romanian Carpathians and the current conservation status of rare species. – *Biodiversity and Conservation*, **18**: 1441-1458.

Crossman N. D., B. A. Bryan and D. M. Summers 2011. Identifying priority areas for reducing species vulnerability to climate change. – *Diversity and Distributions*, **18**: 60-72.

de Pous P., W. Beukema, M. Weterings, I. Dümmer and P. Geniez 2011. Area prioritization and performance evaluation of the conservation area network for the Moroccan herpetofauna: a preliminary assessment. – *Biodiversity and Conservation*, **20**: 89-118.

Domşa C., D. Turcu 2009. Proiectul Bulgaro-Român de cartare a pădurilor cu importanţă biologică ridicată (Bioligically Important Forests/BIF. – Bulgarian-Romanian Forest Mapping – Project Report 2009, SOR, Bucureşti.

ESRI 2004. ArcGIS 9.1. Environmental Systems Research Institute Inc. New York.

Fuentes M. 2011. Economic growth and biodiversity. – *Biodiversity and Conservation*, **20**: 3453-3458.

Fuller R. J., K. W. Smith, P. V. Grice, F. A. Currie and C. P. Quine 2007. Habitat change and woodland birds in Britain: implications for management and future research. – *Ibis suppl.*, **2**: 261-268.

Gaston K. J., S. F. Jackson, A. Nagy, L. Cantú-Salazar and M. Johnson 2008. Protected areas in Europe. Principle and practice. – *Annals of the New York Academy of Science*, **1134**: 97-119.

Gerard F., *et al.* 2010. Land cover change in Europe between 1950 and 2000 determined employing aerial photography. – *Progress in Physical Geography*, **34**: 183-205.

Gregory R. D., P. Vorisek, A. Van Strien, A. W. Gmelig Meyling, F. Jiguet, L. Fornasari, J. Reif, P. Chylarecki and I. J. Burfield 2007. Population trends of widespread woodland birds in Europe. – *Ibis*, **149**: 78-97.

Grodzinska-Jurczak M., J. Cent 2011. Expansion of nature conservation areas: problems with Natura 2000 implementation in Poland. *Environmental Management*, **47**: 11-27.

Hagemijer E. J. M., M. J. Blair (Eds.) 1997. The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance. T&A Poyser, London.

Hernando A., R. Tejera, J. Velázquez and M. V. Núñez 2010. Quantitatively defining the conservation status of Natura 2000 forest habitats and improving management options for enhancing biodiversity. – *Biodiversity and Conservation*, **19**: 2221-2233.

Ikauniece S., G. Brūmelis and J. Zariņe 2012. Linking woodland key habitat inventory and forest inventory data to prioritize districts needing conservation efforts. – *Ecological Indicators*, **14**: 18-26.

Iojă C. I., M. Pătroescu, M. Rozylowicz, V. D. Popescu, M. Verghelet, M. I. Zotta and M. Felciuc 2010. The efficacy of Romania's protected areas network in conserving biodiversity. – *Biological Conservation*, **143**: 2468-2476.

Jantke K., C. Schleupner and U. Schneider 2011. Gap analysis of European wetland species: priority regions for expanding the Natura 2000 network. – *Biodiversity and Conservation*, **20**: 581-605.

Knorn J., T. Kuemmerle, V. C. Radeloff, A. Szabo, M. Mindrescu, W. S. Keeton, I. Abrudan, P. Griffiths, V. Gancz and P. Hostert 2012. Forest restitution and protected area effectiveness in post-socialist Romania. – *Biological Conservation*, **146**: 204-212.

Kujala H., M. B. Araújo, W. Thuiller and M. Cabeza 2011. Misleading results from conventional gap analysis - Messages from the warming north. – *Biological Conservation*, **144**: 2450-2458.

Laurance W. F. 2007. A new initiative to use carbon trading for tropical forest conservation. – *Biotropica*, **39**: 20-24.

LIFENAT05/RO/000176 – Habitate prioritare alpine, subalpine si forestiere din România, 2006.

López-López P., C. García-Ripollés, Á. Soutullo, L. Cadahía and V. Urios 2007. Are important bird areas and special protected areas enough for conservation? The case of Bonelli's eagle in a Mediterranean area. – *Biodiversity and Conservation*, **16**: 3755-3780.

McDonald R. I., T. M. Boucher 2011. Global development and the future of the protected area strategy. – *Biological Conservation*, **144**: 383-392.

Mouro C., Castro P. 2010. Local communities responding to ecological challenges – A psycho-social approach to the Natura 2000 network. – *Journal of Community Applied Social Psychology*, **20**: 139-155.

Niemela J., J. Young, D. Alard, M. Askasibar, K. Henle, R. Johnson, M. Kurttila, T. B. Larsson, S. Matouch, P. Nowicki, R. Paiva, L. Portoghesi, R. Smulders, A. Stevenson, U. Tartes and A. Watt 2005. Identifying, managing and monitoring conflicts between forest biodiversity conservation and other human interests in Europe. – *Forest Policy and Economics*, **7**: 877-890.

Oldfield T. E. E., R. J. Smith, S. R. Harrop and N. Leader-Williams 2004. A gap analysis of terrestrial protected areas in England and its implications for conservation policy. – *Biological Conservation*, **120**: 303-309.

Papp T., A. D. Sándor (Eds.) 2007. Important Bird Areas in Romania / Important Bird Areas in Romania. Ed. Societatea Ornitologică Română & Asociaţia pentru Protecţia Păsărilor şi a Naturii Grupul Milvus, Târgu Mureş. (In Romanian).

Pasquini L., C. Twyman and J. Wainwright 2010. Toward a conceptual framework for blending social and biophysical attributes in conservation planning: a case-study of privately-conserved lands. – *Environmental Management*, **46**: 659-670.

Powell G. V. N., J. Barborak and M. S. Rodriguez 2000. Assessing representativeness of protected natural areas in Costa Rica for conserving biodiversity: a preliminary gap analysis. – *Biological Conservation*, **93**: 35-41.

Rozylowicz L., V. D. Popescu, M. Pătroescu and G. Chisamera 2011. The potential of large carnivores as conservation surrogates in the Romanian Carpathians. – *Biodiversity and Conservation*, **20**: 561-579.

Ruiz-Labourdette D., D. Nogués-Bravo, H. S. Ollero, M. F. Schmitz and F. D. Pineda 2012. Forest composition in Mediterranean mountains is projected to shift along the entire elevational gradient under climate change. – *Journal of Biogeography*, **39**: 162-176.

Sándor A. D., C. Domşa (unpublished data). Forecasting areas for future conservation effort: assessing future distribution of dry semi-natural grasslands for Lesser-grey Shrike (*Lanius minor*) conservation under different climate change scenarios.

Sarakinos H., A. O. Nicholls, A. Tubert, A. Aggarwal, C. R. Margules and S. Sarkar 2001. Area prioritization for biodiversity conservation in Québec on the basis of species distributions: a preliminary analysis. – *Biodiversity and Conservation*, **10**: 1419-1472.

Scott J. M, F. Davis, B. Csuti, R. Noss, B. Butterfield, C. Groves, H. Anderson, S. Caicco, F. D'Erchia, T. C. Edwards Jr., J. Ulliman and G. Wright 1993. Gap Analysis: A geographic approach to protection of biodiversity. – *Wildlife Monographs*, **123**: 1-41.

Shurulinkov, P., G. Stoyanov, E. Komitov, G. Daskalova and A. Ralev 2012. Contribution to the knowledge on distribution, number and habitat preferences of rare and endangered birds in Western Rhodopes Mts, Southern Bulgaria. Strigiformes and Piciformes. – *Acta zoologica bulgarica*, **64**: 43-56.

Strange N. B., J. Thorsen, J. Bladt, K. A. Wilson and C. Rahbek 2011. Conservation policies and planning under climate change. – *Biological Conservation*, **144**: 2968-2977.

Tucker G. M., M. I. Evans 1997. Habitats for birds in Europe: a conservation strategy for the wider environment. Cambridge, UK: BirdLife International.

Tryjanowski P., T. Hartel, A. Báldi, P. Szymański, M. Tobolka, I. Herzon, A. Goławski, M. Konvička, M. Hromada, L. Jerzak, K. Kujawa, M. Lenda, G. Orłowski, M. Panek, P. Skórka, T. H. Sparks, S. Tworek, A. Wuczyński and M. Żmihorski 2011. Conservation of farmland birds faces different challenges in Western and Central-Eastern Europe. – *Acta Ornithologica*, **46**: 1-12.

Veen P., J. Fanta, I. Raev, I. A. Biriş, J. de Smidt and B. Maes 2010. Virgin forests in Romania and Bulgaria: results of two national inventory projects and their implications for protection. – *Biodiversity and Conservation*, **19**: 1805-1819.

Vimal R., A. S. L. Rodrigues, R. Mathevet and J. D. Thompson 2011. The sensitivity of gap analysis to conservation targets. – *Biodiversity and Conservation*, **20**: 531-543.

Zlatanova, D., V. Racheva and G. Gavrilov 2008. Application of gis model for assessment of the habitat quality and prediction of the potential distribution of carnivore species in local scale - Lynx (*Lynx lynx* L.) in the Strandzha Mountain as an example. – *Acta zoologica bulgarica,* Supplementum, **2**: 133-140.

Received: 03.07.2012
Accepted: 26.09.2012