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Importance of Natura 2000 Network for the Birds of Romania

Abstract of the Ph D Dissertation

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Chapter I. Introduction. European directives and the Natura 2000 network in Romania

Accession to the European Union concluded a long preparation process in Romania. One of the direct and visible benefits of the accession is the increase of social and economic welfare, the initiation of a production-consumption model of the consumer society. This social and economic development is at the ground of and offers the main source to resources and needs for a series of changes regarding the people's way of living, of industrial production and of the agricultural development (Howarth 1997, Meffe and Caroll 1997). However these changes have an impact on the environment as well, especially on nature. In Romania as well, a similar process will start like in other member states (or perhaps it has already started), namely the decline of the biological biodiversity (Cogălniceanu and Cogălniceanu 2010). When elaborating its environmental policy, the European Community takes into account the available scientific and technical information, the environmental conditions from different regions of the Community, and the economic and social development of the Community as a whole, the balanced development of its regions, but also the potential benefits and costs of its actions or of the lack of such actions (Goteborg European Council 2001). On Community level the framework of measures for the preservation of biodiversity is given by two directives, the Birds Directive (Council Directive 79/409/EEC 1979) and the Habitats Directive (Council Directive 92/43/EEC 1992). The Birds Directive adopted on April 4th 1979 was the first regulation of the European Union which expressly referred to biodiversity conservation. This directive specifies provisions regarding the protection of certain bird species and of their natural habitats. On May 21st 1992 the Habitats Directive was adopted, which ensures a framework for the protection of several plant and animal species (with the exception of birds), of their natural habitats, but also of certain habitats characteristic for the biogeographic regions of Europe (Apostolopoulou and Pantis 2009). These EU directives aim at the protection of the European Continent's biodiversity through the establishment of a network of protected areas on EU level, where habitats and species characteristic of Europe's biogeographic regions would be conserved. This network is called Natura 2000 (European Commission 2000).

The Habitats Directive declares that in order to protect habitats and species of Community interest "[a] coherent European ecological network of special areas of conservation shall be set up under the title Natura 2000." This ecological network, consisting of sites hosting natural habitat types of Community interest and of the habitats of species considered to be of Community interest "shall enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range" (Article 3, Council Directive 92/43/EEC, 1992). Natura 2000 network includes Special Conservation Areas, designated according to the Habitats Directive, and Special Protection Areas, classified according to the Birds Directive. "Each Member State shall contribute to the creation of Natura 2000 in proportion to the representation within its territory of the natural habitat types and the habitats of species of Community interest." (Article 3 of Council Directive 92/43/EEC, 1992). Articles 4 and 5 of the Habitats Directive specify the constitution process of the Natura 2000 network, assigning the responsibilities of the EU member states. The establishment of the Natura 2000 network and the adequate management of the sites included in this network are important landmarks within Community policies of biodiversity conservation. The implementation of the Natura 2000 network represents an important way of fulfilling the commitments of the European Community ensuing from the convention regarding biodiversity (Rio de Janeiro Convention 1992) and from the convention regarding the conservation of Europe's wildlife and natural habitats (the Bern Convention, 1979; Apostolopoulou and Pantis 2009). According to the procedures specified by the Habitats Directive, the establishment of the protected natural areas network Natura 2000 involves the accomplishment of three main phases: 1) compilation of national lists of Special Protected Areas (SPAs) and of national lists of potential Sites of Community Interest (SCIs); 2) selection of SCIs through negotiation within the framework of biogeographic seminars; 3) designation by the member states of Special Conservation Areas, thus the SCIs become SPAs. The criteria at the base of the selection of sites constituting the Natura 2000 network shall be scientific criteria, and shall be subjected to the objectives of protecting species and habitats (Gaston et al. 2008). The aim of the establishment of the Natura 2000 network is the protection and/or restoration of habitats and species of Community interest, therefore the management of these sites has to ensure the fulfilment of this objective (Duhme et al. 1997). Thus the Natura 2000 sites are not areas strictly protected under the terms of IUCN ranking (IUCN 1980), any kind of economic or social activity can be carried out on their territory, which activities don't prejudice the habitats and/or species for the protection of which the site was designated (Getzner and Jungmeier 2002).

Birds in Romania and the importance of the populations of our country

Due to its position and geographic features, Romania is the only European country which has five biogeographic regions (Continental, Alpine, Pannonian, Steppic and Black Sea). The great diversity of habitats ranging from the shores of the Black Sea to the bare peaks of the Carpathians, from the arid steppe of Dobruja to the centuries old forests, from the karstic formations to the Danube Delta, it creates proper conditions for a unique avifauna. In Romania a total of 385 bird species were recorded, of which 66% nested at least once in our country (Torok 2005, Papp and Sándor 2007). There are 109 breeding species, 36 wintering species, 134 summer visitors, 36 migrating species passing through Romania, and 70 species are considered to occur rarely, accidentally. Furthermore, the breeding populations of some species in Romania are of European significance. There are 7 bird species in the case of which more than 50% of the European population nests in our country, and 13 species in the case of which 10-15% of the European population can be found in Romania (BirdLife International 2004a). Proposals for SPAs for the entire territory of the country were elaborated, in total 137 areas were submitted (Papp and Sándor 2007).

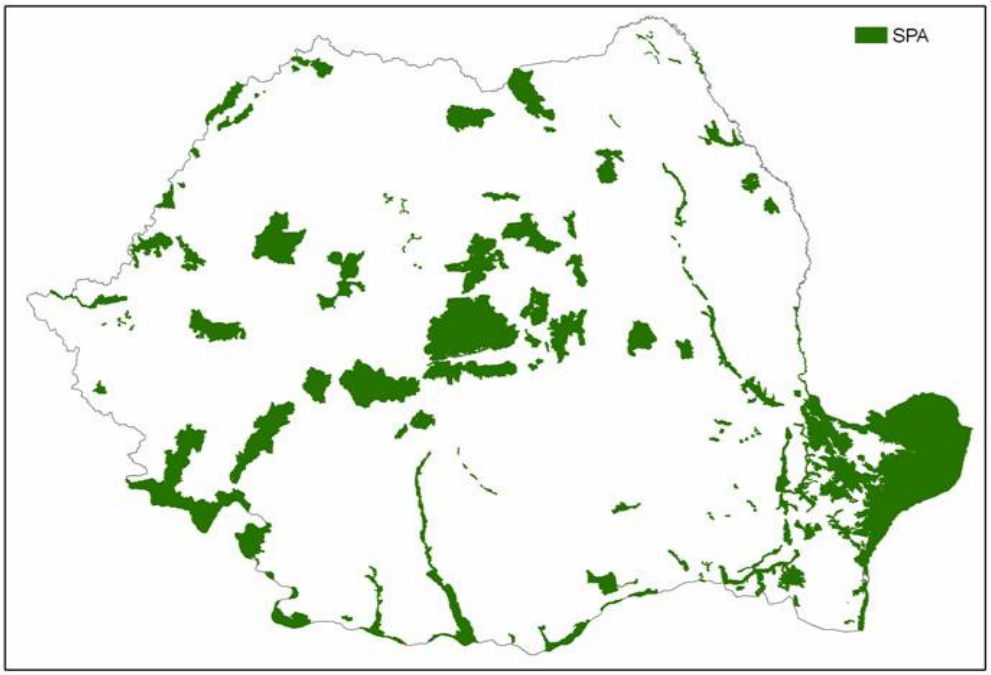

Figure 1.1 Romanian SPAs distribution map

Taking into account the aforesaid, and Romania's obligations undertaken under the terms of the accession treaty and of various ratified international conventions, an imminent and profound need for improving the national network of SPAs was highlighted. For this reason the process was revised starting from 2009 and finalized in 2012, with a new proposal for SPAs, announced in October 2011 (Government Decree No 429 of 2011, HG 429/2011). Through this regulation 138 areas were designated, with a total of 3,694,394 ha.

The aim of this study is to carry out a critical evaluation of these proposals, by identifying the gaps and deficiencies at national level, through the application of statistical methods, using the geographic information system (GIS) and case studies carried out inside several protected areas. I also attempt to evaluate the significance of the Natura 2000 national network as the largest protected area network by comparing the features of these areas with the national and international obligations of Romania as a state (Chapter II). Through the researches we tried to suggest improvement strategies of this network through environmental policies to be followed in order to increase the efficiency of the network in the conservation of bird species (Chapter III). Subsequently we carried out field studies in order to verify the capacity of certain areas to maintain on long term the bird species which are important on national and international level (Chapter IV). Finally we assessed the resilience capacity of the network against climatic changes, which would serve as main tools in the conservation of certain bird species characteristic to open areas (Chapter V).

Chapter II. Romania's role in the maintenance of significant populations for species of Community interest

The designation of the Natura 2000 sites in 2007 was one of the most important achievements with respect to biodiversity protection in Romania. The selection for protection of 18% of the total surface of the country is the most important step in the conservation of biodiversity in recent years. In the case of the Birds Directive these species are birds which were assigned the endangered status on European level, and the conservation status of which should become a favourable conservation status through the implementation of the Directive. The sites were designated on the basis of the "best available knowledge", using the guidelines of BirdLife International (Heath and Evans 2000), but the sites weren't assessed with regard to the success, taking into account the level of Romanian populations.

In order to assess the actual impact of SPA proposals for the conservation and/or improvement of the conservation status of the populations belonging to species of Community interest, we carried out a GAP analysis, comparing the populations within the national SPA network with populations on national level. Through this process our aim was to see to what extent the rule of 20-60% can be applied to Romania, which are the species or groups of species and/or habitats in the case of which insufficiencies can be detected on national level, and where intervention is needed.

By designating these areas, Romania pursued not only to fulfil its obligations as an EU member state, but also to complete its protected areas network. By designating the SPAs, it tried to achieve not only its own national conservation objectives, but also those resulted from Romania's accession to a series of international conventions. For this reason the annexes to the law adopting the Birds Directive and the Habitats Directive, Government Decree No 57 of 2007 (HG 57/2007, later Law No 49/2011) include 124 other species, which are not included in the annexes to the Directives. Taking into account this demand, we carried out an analysis of the national SPA network, using the same GAP analysis method in order to compare the condition of these species and habitats (those which are not listed on the Annex I to the Birds Directive), and in order to evaluate the potential of the Natura 2000 network from the perspective of national and international conservation objectives.

Several methods were used in the evaluation of the potential of the Natura 2000 network. As a first step we evaluated the populations of bird species of Community interest which are inside the selected areas (SPAs), as compared with the populations of these species on national, respectively European level. For this purpose we used the figures from the application forms of SPAs according to the designation rule (HG 971/2011). In case of national and European populations data given by BirdLife International (2004a and 2004b) were used. If less than 20% of the national population breeds within the protected areas, the species is considered a species with low coverage (McLeod et al. 2005). The species the populations of which occur in SPAs between 20 and 60% of the national population, were named species with medium coverage, as for the rest of the species we used the designation species with high coverage. In our analysis we carried out comparisons using a scale from 1 to 3 (1 – low coverage, 2 – medium coverage, 3 – high coverage). The analysis of the coverage and distribution of Natura 2000 sites was carried out in GIS, using the data base of the Romanian Ministry of Environment and Forests (www.mmediu.ro). Following the analysis on species' level, the species with insufficiencies were grouped on the basis of the major type of land use where the species accomplishes its most important phases of biological cycle (Batáry et al. 2007, Boitani et al. 2007). The analysis of the populations was repeated on species group level, using the above mentioned classification, and conferring a cumulative score to each group according to the afore mentioned scale. As an indicator of national conservation objectives we used the Red Book of Vertebrates (Butchart et al. 2004, Botnariuc and Tatole 2006), in the case of international objectives we used as indicators the international conventions signed by Romania (Possingham et al. 2002).

SPA network coverage for species of Community interest

A number of 102 species were used in the designation of the SPAs representative on EU level. From the avifauna of Romania, other 162 migratory species are listed in the Annex II to the Bern Convention (1979), 132 are listed in the Annex II to the Bonn Convention (CMS 2007) and 53 are included in CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). The Romanian Red Book of Vertebrates specifies 77 bird species, which are considered highly endangered species in Romania, and/or the objects of national conservation under the regulations in force (Law No 49 of 2011). In the course of the GAP analysis we confined to these species. For coverage analysis we focused only on nesting species. From the 79 such species, a number of 21 species (26.9%) have less than 20% of their nesting populations inside SPAs, 19 species (24.3%) showing medium coverage and 38 species (48.8%) high coverage – see Table 2.2. The aforementioned 19 species show insufficiencies regarding the capacity of the populations to maintain their favourable conservation status only within the protected areas designated for their protection. Most species of Community interest breeding in Romania are wetland birds (32 species, 41%), followed by

forest birds (26 species, 33.3%) and grassland birds (20 species, 25.7%). Among these three groups most of the species with low coverage are forest birds (10 species, 38% of the total of forest birds and 48% of the species with low coverage), followed by grassland birds (7 species, 35% of the total of grassland birds and 33% of species with low coverage), and the fewest are from the group of wetland birds (4 birds, 12.5% of wetland birds and 19% of species with low coverage – for a sum-up see Table 2.2).

Table 2.2 – Situation of species of the three groups regarding insufficiency score.

Habitat type	No of total species	No of species with low coverage	% of the group	No of species with medium coverage	% of the group	No of species with high coverage	% of the grou p	Score
Forest birds	26	10	38.46	8	30.77	8	30.77	1.76
Wetland birds	32	4	12.50	7	21.88	21	65.63	2.1
Grassland birds	20	7	35.00	4	20.00	9	45.00	2.34
Total	78	21	26.92	19	24.36	38	48.72	

Table 2.3 – The situation of species of Community interest listed in the Romanian Red Book of Vertebrate and their relationship with insufficiency scores.

Categorie IUCN	**Nr specii total**	**Nr specii cu insuficiențe**	**% din grup**	**Nr specii intermediar reprezentate**	**% din grup**	**Nr specii bine reprezentate**	**% din grup**
Periclitat critic	18	3	16.67	6	33.33	9	50
Periclitat	24	5	20.83	5	20.83	14	58.33
Vulnerabil	30	9	30	3	10	18	60
Total	**72**	**17**	**23.61**	**14**	**19.44**	**41**	**56.94**

SPA network coverage for species listed by international conventions

Protected areas were designated for a number of 51 (31.9%) species listed in the Annex II to the Bern Convention, 60 (44.7%) species listed in the Annex II to the Bonn Convention and 50 (92.6%) species listed in the CITES annexes. Moreover, 104 (64.2%) species listed in the Annex II to the Bern Convention, 64 (54%) species in the Annex II to the Bonn Convention and 5 (10%) species listed in the CITES annexes are mentioned by application forms of different SPAs as Other Migratory Species according to Annex II to the Birds Directive. The coverage of these species by designated areas differs greatly. Thus species from the SPEC 1 category have a high coverage in Romania, followed by species belonging to SPEC 3 and SPEC 2. If we analyse these categories with respect to species with low coverage in the designation of Natura 2000 sites, we can see that most of the species with low coverage are in group SPEC 3 and NonSPEC, namely species with a more favourable status in Europe.

Analysis shows that the Romanian Government designated a total of 136 sites in two phases, on a surface of around 21% of the country's surface. These sites are supposed to fulfil Romania's obligations under Article 3 and 4 of the Birds Directive. From the analysis carried out in order to assess the bird populations inside the protected areas of Community interest, we concluded that certain species have a low coverage regarding the SPA populations (species with low coverage, see Table 2.2). In most cases these species have a large distribution, without being concentrated in certain locations. The majority of these species are species distributed in forested habitats and grassland habitats (extensively or moderately used agricultural habitats). Due to these discrepancies, we think that in order to preserve the species with Community interest using forests and grasslands on long term new conservation measures will be needed. These measures can be quantitative, like the extension of the present sites, or qualitative, e.g. the implementation of certain management methods suitable to species with low coverage outside the protected areas (Gaston et al. 2007, Branquart et al. 2008, Sándor and Domşa under preparation).

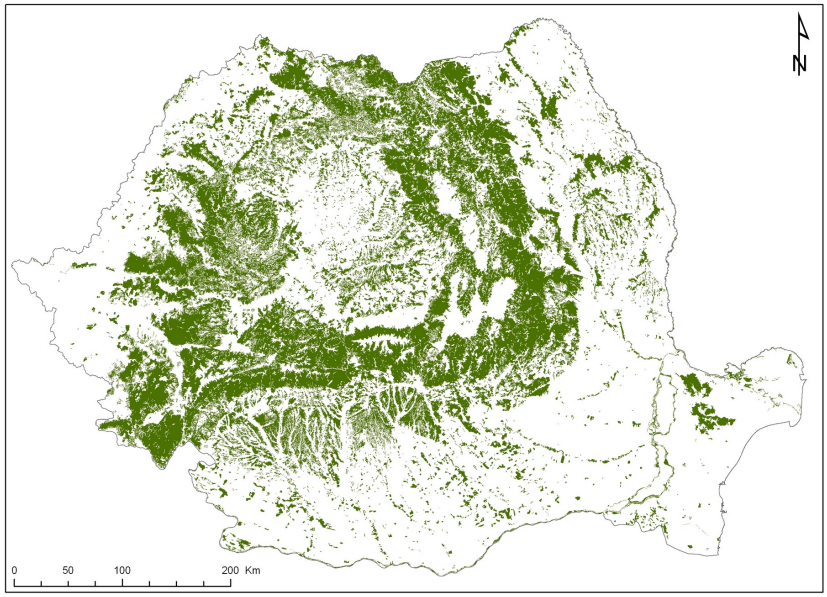

Figure 2.2. The distribution of forested habitats in Romania (on the basis of CORINE LandCover)

It seems that the group of aquatic species benefited the most from the designation of Natura 2000 sites, as most of the habitats and populations of wetland species are inside the network. There are 11 species in the case of which the entire or almost the entire national population breeds inside protected areas. Only those species have a low coverage, which have a large distribution, and use linear habitats (e.g. the course of rivers, Alcedo atthis), or which have a hiding lifestyle, thus the populations can't be assessed in each area (e.g. Porzana parva). The main cause may consist in the homogeneity of wetland habitats, but also in their range grouped within a geographic perimeter, allowing the easy delimitation of the sites. Moreover, aquatic bird species are much easier to observe and monitor (Platteeuw et al. 2004), and the entire group was much more observed. A bibliographic study on publications about birds in Romania listing 1071 publications shows that more than half of the publications are about aquatic species (59%), followed by grassland species (23.5%) and forest species (17.5%) (Sándor in prep). In the same context, wetland species are much more accepted as objects of conservation on national level, both by scientific approach (Botnariuc and Tatole 2006, Papp and Sándor 2007) and general perception (Munteanu 2006).

The designation of the national SPA network contributes to the protection of more than half of the bird species listed in the Romanian Red Book. Thus the declaration of these sites as protected areas meant a great step also regarding the species which represent national priorities in nature protection. Furthermore, by extending the protected areas on national level and ensuring a protection level of the natural habitats inside these sites, specific habitats were ensured significant areas also for the rest of species from the red list in the course of the designation of the Natura 2000 network. Most of the species listed by international conventions are included in the standard data sheets of Romanian SPAs, with a good correspondence regarding the status of the species on European level and the coverage of the populations of that species inside protected areas. As a conclusion we mention that with respect to its international obligations, Romania has taken a major step in the protection of species to be conserved – it had undertaken this role by adhering to various international conventions.

Chapter III. Analysis of special protected areas (SPA) for the conservation of Romania' forest birds: status assessment and possible expansion using predictive tools

From the two groups with low coverage (Chapter II), 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 SPAs, using areas already identified inside SCI-s 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 SPAs. 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. All Annex I species for which SPA-s 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 coverage were omitted. These species were assigned to one of two categories according to the forest types they primarily use (Tab. 3. 1.).

Table 3.1. Species and habitat types used.

Group	Species	Habitat Type	SPA cover from total on national level (%)
1	*Dendrocopos leucotos, Ficedula albicollis, Ficedula parva*	1. Beech forests in mountain areas/Păduri de fag în zone montane	15.3
2	*Aegolius funereus, Bonasia bonasia, Strix uralensis*	1. Mixed beech and conifer forests/Păduri de amestec 2. Beech forests in mountain areas/Păduri de fag în zone montane	14.8

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 3.2.). For GIS analyses we used ArCGIS 9 software (ESRI 2004). When evaluating the new proposals for Special Protection Areas (SPAs), 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 included 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. The GAP analysis indicates that the current network of SPAs only protects less than 10% of breeding population for a number of six forest dependent bird species. 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 (Table 3.3).

Table 3.3. Characterisitcs of the two habitat types used in our 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

Forests belonging to the Group 1 accounted for 18.77% of the IBAS-s, while for Group 2 some 18.60% of the suitable areas are included in the IBAs (Fig. 3.6, Tab. 3.3). Similarly, this cover accounted for 7, 846 ha inside already designated SCI-s for Group 1 and 13, 748 ha for Group 2 (Fig. 3.7, Tab. 3.3). There were a

total of 5, 922 polygons of high and 13, 994 polygons of medium 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 IBA-s and/or SCI-s.
All new polygons were delimited along the existing boundaries of SCI-s or IBA-s. A total number of 19 areas, covering 515, 000 hectares 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. 3.6.; Tab. 3.4.). The proposed new network of SPAs includes 30.82 % of the entire potential habitat of the Group 1 species, while 27.14% for Group 2 of the Annex 1 bird species at a national level (Tab. 3.4). The new proposals lay either on already established protected areas (SCI-s declared according the HD, 88.91 % vs. 87.85 % of the proposals) or cover valuable areas already identified as important bird habitats inside IBA-s (14.22 % for Group 1 and 21.8 7% for Group 2, some areas fulfil both conditions, are IBA-s 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 Table 3.3).

Table 3.4 Habitat surfaces included in recent proposals.

	Group 1	Group 2
Current habitat coverage in SPA (%)	15.34	14.81
Habitat surface that can be added according to criteria 1, 2, and 3 (%)	15.48	12.33
Habitat coverage in case of SPA network extension SPA (%)	30.82	27.14

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. We consider that our methods are enough easy to apply, are robust and easy to be deployed to filter even large forest patches (on regional or national level) in order to select areas for further conservation effort, without the use of sophisticated resources and excessive manpower.

Chapter IV. Changes in the conservation status of grassland bird species. Case study – the Lesser-grey Shrike (*Lanius minor*) in Romania

The changes in land usage have a major impact on the biodiversity of areas where traditional agriculture is being carried out, and the modifications in the distribution and composition of the species is an accelerated process. There are already a great number of studies which reflect the impact of these changes on the flora and fauna, especially on invertebrate (groups which reflect faster modifications), studies treating the impacts on vertebrate species lacking (Cremene et al. 2005, Baur et al. 2006, Coldea et al. 2009). The aim of this chapter is to assess the impact of changes occurred in land usage (especially changes of land usage in agricultural areas, respectively the infrastructural developments in these areas) on the distribution of a bird species, the Lesser-grey Shrike (Lanius minor). This species is habitat specialist, attached to agricultural areas with grasslands. This species was chosen not only because it is a habitat specialist, but also because it is quite a common species in Romania (Munteanu et al. 1994, BirdLife International 2004). Although the Government of Romania assigned 138 Special Protected Areas for the long-term preservation of the species, these areas cover only a fraction of the national population's distribution, therefore we are convinced that not all premises are given for the conservation of the species (see Chapter II).

The repeated assessment of a Lanius minor population during a period of 10 years aimed at finding out the impacts of changes occurred in agriculture and rural infrastructural development on this species, and at evaluating its conservation status in Romania. The species is protected throughout the entire Europe, but it

is a common hunted species in some countries of the basin of the Mediterranean Sea and Africa (del Hoyo et al. 2008). The species is in decline in Romania as well (Sándor and Domşa in prep.).

In order to acquire data on the distribution and evolution of Lesser-grey Shrike populations, three different methods were used: 1. the assessment of coverage on the basis of punctual observation, 2. the assessment of the population based on transects, and 3. the evaluation of the occurrence and bird-habitat relationship in selected perimeters.

A punctual assessment of breeding populations was carried out on test patches distributed randomly in the entire country. When acquiring data, the Fix Points method was used, in 15 points of 25 selected at random. Taking into account that for many monitoring points information is available about the Lesser-grey Shrike collected two times a year, for many consecutive years maximal figures between the two annual assessments, and the average of different years were used. Thus the used data represent the average figures of annual maximums. In total the present study used information provided by 3126 observation points, distributed quite evenly on national level (Figure 4.4).

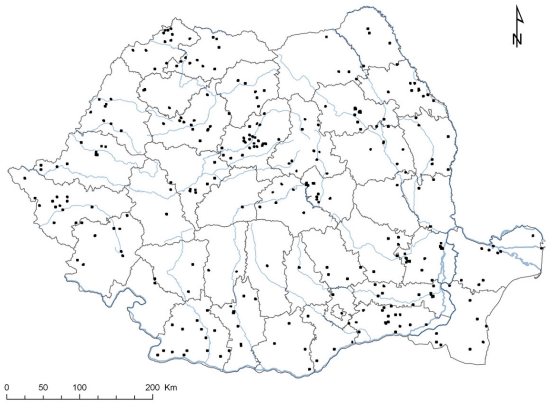

Figure 4.6. The distribution of observation squares for the monitoring the breeding species

2. Assessment of populations through transects

This method was chosen in order to define the distribution of the species on larger areas and to collect data on populations from the main distribution area, the Romanian Plain and Dobruja. Data collection was carried out by travelling over by car a long distance, in the nesting period, and by observing all the birds which use the vegetation strip along public roads. Two field trips were effectuated in years 2002 and 2011. The covered route was 1190 km (2002) and 1270 km (2011) long.

3. Assessment of breeding populations in selected perimeters

In order to acquire more data on the evolution of breeding populations of Lesser-grey Shrike simultaneously with changes in land usage and protection status, three research areas were selected, where the species was abundant. The individual research of each pair was accomplished between 2004 and 2011. During the research each year the number of trees (nest support) and land usage in the nest's surrounding was observed, along with calculations regarding flight distance for food (0 km if the tree is inside or on the edge of a usable habitat, e.g. seminatural grassland).

Statistical analyses

For every statistical analysis we used softwares Statistica 7 and R. All of these were considered as significant at value $p< 0.05$.

When creating the distribution map of the Lesser-grey Shrike in Romania we used data from 2001-2004 and 2006-2010, using a total of 197 observations of Lanius minor (see details in Sándor and Domşa in prep.). The result of the evaluation on transects shows a significant difference between data collected in 2002 and those collected in 2011, in the case of each variable, with a major decline of the number of birds observed, of trees, and the increase of arable strips to the detriment of abandoned lands and grasslands. The rate of decline regarding the number of observed birds is different between the routes outside the protected areas (more significant), than the rate inside the protected areas; however, the average number of birds on km of route is the same (0.23 bird/km) in both categories. We think that in 2002 habitat was not a limiting factor along the transects, due to many uncultivated (abandoned) parcels and the width of uncultivated stripes along the route.

Tabel 4.4 Decline rate of Lesser-grey Shrike population in the south and south-east part of Romania

Estimated decline					Status
Method	SPA	Unprotected	Average	Projection on 10 years	IUCN
Transects	78.00%	88.00%	82.50%	> 90%	A2 Critically Endangered
Territory mapping	77.00%	95.00%	80.40%	> 90%	

In case of the research perimeter of breeding a continuous decrease was observed, which led to the local disappearance of a population. This decline wasn't a linear one (see Table 4.4), it accelerated after 2007. There aren't major differences in yearly breeding, therefore we think that the population decline was caused by the lack or alteration of the habitat and nesting place. The decline is connected with the disappearance of nest supports (in two cases), but also with the increase of the distance between the nest and the closest specific habitat patch. The decline related to the number resulted from nesting from these perimeters is similar to the decline observed through transects, highlighting the fact that the impact of changes in land usage strike with the same intensity populations with high density.

By collecting these data we tried to elucidate issues regarding the impact of changes in the habitat and of changes in the availability of the nest support on the evolution of Lesser-grey Shrike populations in Romania. The analysis was carried out using several variables in different locations, and all the data was reported to two categories of land: those inside and those outside the protected areas designated for the conservation of the species (SPA). A strong decline of the Lesser-grey Shrike populations was observed both inside and outside the protected areas. The decline was broader outside SPA, but the decline pointed out is approximately equal to a decrease rate of 82.8% in case of populations monitored through transects, and 80.5% in case of populations breeding within the selected perimeters (see also Table 4.4). The decline is a severe one, and if we adopt IUCN criteria on regional level (that is, only to the south and south-east of Romania), the species can be classified as a Critically Endangered Species, using criterion A2. Criterion A2 means a sustained decline of 80% or more during a period of 10 years, where the probable causes of the decline persist and/or will persist in the future (IUCN 2001, 2011). Taking into account the aforesaid, we can conclude that the Lesser-grey Shrike populations of Romania are dependent of the conservation effort, the broad decline will not stop in the near future, due to the persistence of the disturbing factors (the intensification of agriculture is foreseeable in the plain areas in future years, while infrastructure development is a continuous process, Gorton et al. 2009, Otiman et al. 2010). The decline among the populations inside the protected areas isn't as intense as in the case of populations outside the SPAs, thus the protection ensured through designation supports the species. However, taking into account the rate of the decline, we think that urgent interventions are needed on the level of the proactive management of the species' habitats in order to slow down or stop the decline, especially inside SPAs, but not only. As only 5% of the national population breeds inside SPAs, and the maintenance capacity of the protected areas is not known, we can conclude that the maintenance of the species can't be ensured on long term solely through the protected areas designated for this species.

Chapter V. Assessment of the adaptability of Lesser-grey Shrike (Lanius minor) to climate change scenarios with respect to the SPA network in Romania

Climate change, along with habitat alterations at landscape level are considered by most as major driving forces of the current and future biodiversity loss all over the world (Thomas et al. 2004, Harrison et al. 2006, Pearce-Higgins et al. 2011). Climate change thus may accelerate the risk of extinction by pushing species limits out of the available range or decreasing densities below the recovery levels (Thomas et al., 2004; Araujo and Rahbek, 2006). It has been stressed that future conservation scenarios should build climate aspects into the planning process in a proactive way (Caroll et al 2010, Strange et al. 2011).

The use of bioclimatic models is generally accepted for the assessment of potential climate-induced range shifts (Araujo et al., 2006; Gritti et al., 2006), to estimate extinction rates (Thomas et al., 2004), to examine the efficacy of existing reserve systems (Bittner et al. 2011, Araujo et al., 2011), or to identify priority areas for conservation (Crossman et al. 2011). Our goal is to estimate the probable future distribution of the species in Romania at two different time-scales (short term – 2020, long term – 2050) and to assess the usefulness of the site-based conservation approach to maintain the species' populations in Romania. Using data collected on field we created a distribution model of the Lanius minor species in Romania, then we

tested the evolution in space of the habitat modelled for different climate change scenarios, using as single conservation feature the protected areas of Community interest designated for this species. The climatic limits of the species' global distribution were identified using an upper thermal limit at 14.5 or 13.5 annual isotherm, with the lower tolerance limit being set at 17°C July isotherm, according to the current range limits of the species.

Several ecological data sets were used to model the birds' distribution at national level. These include the spatial location (national projection system, Stereografic 1970), altitude (WorldClim), habitats (general distribution of habitats based on Corine LandCover 2000) and climatic variables (temperature, precipitations and evapotranspiration, available from WorldClim data base (Hijmans et al. 2005)). Climatic data used is available from WorldClim data base, obtained for the 1960-2000 period (Hijmans et al. 2005). The data were used in statistical modelling in two ways: as annual means and as April-June (monitoring period) means. For different future climatic scenarios we used the available data from CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Different data sets were used in order to assess the predicted climatic changes that will occur in Romania and how will they influence the Lesser Grey Shrike distribution. All the data sets used belong to HadCM3 general atmosphere circulation model (Ramirez and Jarvis 2008). Two different climate scenarios were used A1 and B2, for both time frame used in our analysis, 2020 and 2050 (Araujo et al. 2011, Seavy et al. 2008).

For statistical and spatial modelling, two general statistical methods were used: Generalized Linear Model (GLM) and Multivariate Adaptive Regression Splines (MARS) (Hastie & Pregibon 1992, Leathwick et al 2005, Leathwick et al. 2006). Among the large number of statistical models tested, these two had the best performance for the data sets used. Combined with ecological predictors, 6 different models were built and used for the analysis (Table 5.1).

Tabelul 5.1. Applied statistical models (*monthly climatic data = monthly mean for the months April-June)

Name	Statistical model	Predictors (ecological variables)
GLM1	GLM	Coordinates, altitude, habitats
GLM2	GLM	Coordinates, altitude, habitats, annual climatic data
GLM3	GLM	Coordinates, altitude, habitats, monthly climatic data*
MARS1	MARS	Coordinates, altitude, habitats
MARS2	MARS	Coordinates, altitude, habitats, annual climatic data
MARS3	MARS	Coordinates, altitude, habitats, monthly climatic data*

* - Monthly climatic data – averages of months April-June

The statistical modelling was implemented in the R software environment (http://www.r-project.org/), using the available modules on the software's website. We used TrimMaps software (still in development at SOVON Netherlands), for it possesses the capacity of combining the statistic and spatial modules available for R. The model having the lowest RMSE was selected (Hengl 2009). The final selected model was considered the best available image (based on best available data) of the Lesser Grey Shrike's distribution in Romania, and hence used in evaluating how future predicted climate change will shape the species range.

According to the distribution model, there are two areas with high concentration at national level: south-east and north-west of the country. From the total 148 SPAs, a number of 105 sites were designated also for the lesser-grey shrike protection (see Figure 5.3: Distribution of SPAs designated for the protection of Lesser Grey Shrike in Romania). These represent 71.4% from the total number and 59.9% in term of total SPAs area. So, in our analysis, we referred to the species' future status at national level, current SPA network and SPA sites where the lesser-grey shrike is a key conservation species (key SPAs).

The results show no significant change for the first climatic model (A1) and for short range (2020), while for the second scenario (B2) a s mall decrease is projected, with 21% decrease of available habitat for the lower thermal limit at 13.5 °C. In the case of the longer time frame (2050), the results project a sharp decline in available habitat for both climate scenarios in case of both thermal limits considered, with maximum loss in case of A1 climatic scenario. The maximum loss results also when considering habitats inside the current SPA network, with 60% habitat loss in case of upper tolerance temperature limit at 14.5 °C and 84% habitat loss in case of lower tolerance limit. The synthetic results are presented in Table 5.2. The minimum values of suitable habitat loss refers to 14.5 °C temperature limit and maximum values of suitable habitat loss refers to 13.5 °C temperature limit.

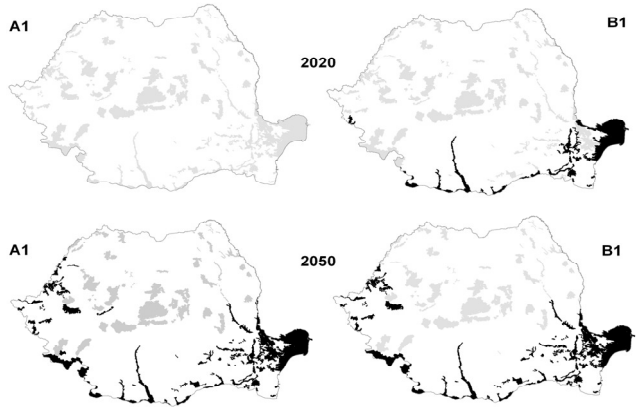

Figura 5.5. Habitat losses in case of the model according to scenario A1 in year 2050.

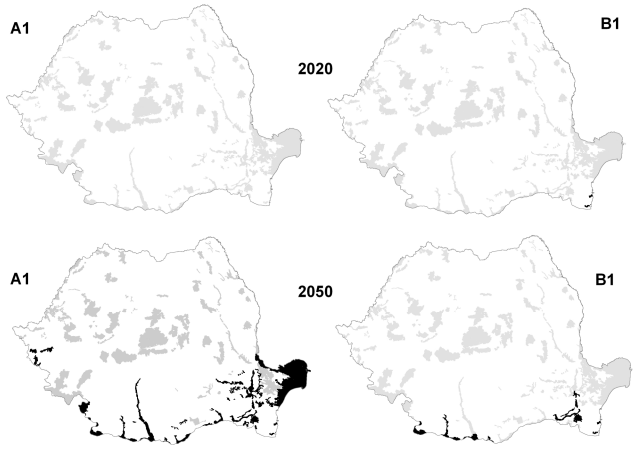

Figura 5.6. Habitat losses in case of the model according to scenario B2 in year 2050.

Significant habitat loss is projected using both climatic scenarios in geographical distribution, too. Habitat decrease shows an uneven distribution, with larger decline noted in the south-eastern and north-western part of the country (see Fig 5.4 and 5.5). When comparing habitat loss with the current spatial distribution (Fig 5.3 and 5.4), it can be observed an overlap of areas most affected by habitat loss with areas with high concentration of the species.

Figure 5.7. SPA distribution with relation to Lesser Grey Shrike, according to different scenarios, in case of thermal tolerance limit of 13.5o C (black means non-existing habitat).

Figure 5.8. SPA distribution with relation to Lesser Grey Shrike, according to different scenarios, in case of thermal tolerance limit of 14.5o C (black means non-existing habitat).

The results of our modelling are consistent with the general pattern observed in the case of a number of bird species. Recent studies show that species' distributions are already responding to the changing climate (Jonzen et al. 2007, Mac Nally et al. 2009, Hamer 2010) and that the rate at which they do so may increase in the future (Huntley et al. 2008, Anderson et al. 2009). The forecasted habitat-decrease and range contraction is consistent with the used climate scenario and will be most intensive in case of scenario A1 for the year 2050. Obviously, we cannot have a real prediction of the density distribution in case of future time-series, as there are so many unknowns in the evolution of the factors modelling lesser-grey shrike density distribution (such as habitat alteration, population changes independent of climate effects, changes in agricultural policies, etc). This decrease will be general, showing low resilience potential against climate-change for the current protected area system in Romania. This is consistent with the conclusions drawn by Araujo et al. (2011), who found that while protected areas in mountains may offer reliable climate refugia, those designed primarily on flat-lands will incur proportionally larger range losses. There are small to negligible changes forecasted for short term (both A1 and B2), however the level of forecasted habitat-decrease ranges between 8-41% (higher temperature range limit) and 62-75% (lower temperature limit) at

country level. Although the magnitude of this range-decrease is small in case of higher temperature limit, even in this case the decrease may be important inside the protected areas designed for the conservation of the species (SPA-s). The projected 60-84% decrease (A1 scenario for 2050) may jeopardise most conservation efforts targeting the species. Currently lesser-grey shrikes conservation is based purely on the existence of specially designated protected areas, namely the Natura 2000 network, with no alternative conservation measure in force in Romania (Iojă et al. 2010). Coupled with the fact that there is a large scale decline of the species due to recent changes in land use practices (Chapter IV), there is an urgent need to assess the efficiency of these sites in terms of climate resilience.

Although the current policy of reduction of greenhouse gas emissions may help mitigating climate impacts on biodiversity, maintaining healthy populations of certain bird species may require further efforts (Harrison et al. 2006, Araújo et al. 2011, Fischer et al. 2011, Strange et al. 2011). This is especially true for Romania, where biodiversity conservation relies only on reserve delimitations, in most cases without any management policy (Iojă et al. 2010). We argue that for the conservation of lesser-grey shrikes there is a need for the implementation of mechanisms for integrated management of agricultural areas (especially grasslands), primarily to facilitate the movement of the species between conservation areas and to increase the potential of climate resilience of the protected area network through the designation of new areas acting as corridors or temporary buffers where the species may survive (Caroll et al. 2010, Strange et al. 2011). This will require a major shift in current conservation policies regionally or locally and such modelling exercises may provide a very basic guidance for starting this process.

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Publication list

Sándor, A.D., C. Domşa (submitted) Large-scale decline of lesser-grey shrikes (*Lanius minor*) in Romania

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