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1 Contents

2 Policy summary

The main objective of this Deliverable is an assessment of gaps in existing information, which is important for an application of systematic and efficient reserve site selection approaches. In addition, we briefly summarize current approaches for the selection of Natura2000 sites and national networks of conservation areas. Using the Pannonian region as an example, we illustrate differences among countries in approaches to site selection that lead to qualitatively different networks; none of which is based on recent advances in the methodology for effective reserve site selection. We assess exemplarily gaps in existing conservation networks (Natura2000, national or regional networks) in terms of species and habitat representation. This gap analysis had to be restricted to data prior to 2005 and thus to the EU15 since only the publicly available EEA database could be used for the gap analyses because some Member States reject to the use of the full database. As of 2004, in the EU15, not all habitats and species of Annex I and II, respectively, were represented in the Natura2000 network. Coverage was best for mammals and worst for plants (87% of the Annex species occurred in ≤ 10 Natura2000 sites). In total, 16.4% of the 712 Annex II species were not represented at all in Natura2000 sites. Though the situation probably has well improved, this major deficiency strongly argues for making available the most current full data set to assess to which extend the current Natura2000 covers Annex II species. Gaps in representation were further identified for Annex II species, for which Hungary or Germany has high national responsibility as well as in the coverage of the national monitoring schemes of Lithuania. We expect similar gaps for other countries both regarding the coverage of species in the Natura2000 network and in monitoring programs. We make recommendations how research, monitoring, and data management programs could contribute to filling identified information gaps. A first important information gap is the lack of an explicit quantitative criterion regarding the representation of the target species and habitats. For the management and improvement of the Natura2000 network, (1) setting quantitative representation targets, (2) information about the selected targets within the existing network and outside, and ideally (3) information about viability of species and connectivity requirements should be available.

3 General background and objectives

The protection of the full spectrum of regional biodiversity is one of the most important challenges for nature conservation in practice (Frankel & Soulé 1981, Vane-Wright 1994, Margules & Pressey 2000, Groves et al. 2002, Specht et al. 2003). The establishment of conservation area networks, such as Natura2000 and similar national networks of protected sites, are one of the main practical approaches for protecting the full range of regional biodiversity and for achieving the 2010 target. Traditionally, reserve site selection is opportunistic and does not use methods that aim at maximizing efficiency. Even when based on expert opinion, opportunistic reserve site selection does not guarantee an adequate representation of species and habitats or may require unnecessary and difficult to achieve numbers of sites to represent the full spectrum of biodiversity (Pressey 1990).

In the face of socio-political and economic constraints building a reserve network that will conserve biodiversity effectively is not a process of accumulating as much land as possible, but instead biodiversity protection efforts have to be carried out as efficiently as possible. This means that a set of priority sites has to be identified, which suites best for conserving as wide an array of species and habitats as possible, at the same time minimizes the total area required to protect all components of biodiversity, and reduces conflicts with competing land-uses (Pressey et al. 1993, Saetersdal & Birks 1993, Margules & Pressey 2000, Polasky et al. 2000, Faith et al. 2001a, Pressey & Cowling 2001, Sarkar et al. 2002, Anderson et al. 1999, Gaston et al. 2002, Garson et al. 2002, Margules et al. 2002, Williams et al. 2002, Groves 2003). As a consequence of these increasing demands methods for the selection of conservation priority sites have become more sophisticated and systematic within the last two decades.

In D11, we summarized the methods available for a systematic site selection for reserve networks. The application of these methods requires the availability of information about species, habitats, or other biodiversity surrogates.

3.1 Current approaches for Natura2000 site selection

The Natura2000 network aims at representing the species and habitats listed in Annex II of the Habitats Directive in a sufficient number of sites: "Member States have to produce an exhaustive list of sites eligible as sites of Community importance and ensure the coherence of the Natura2000 network by designating a sufficient number of sites hosting habitats of animal species listed in Annex II. A coherent and complete network, which is established in accordance with the procedure and criteria set out in Annex III of the Directive, shall enable or contribute to the maintenance or the restoration at favourable conservation status of those species, in their natural range."

In terms of systematic reserve site selection methodology, « sufficient » requires that a concrete target is set for each species or habitat, e.g. that each species is represented in the network at least 1,5,10, etc times. Current ecological knowledge does not allow as yet providing firm guidelines, how many sites are the minimal requirement to ensure long-term survival of species. Metapopulation modeling indicates that systems are frequently instable when they comprise less than 7 sites (Ovaskainen et al. 2002, Drechsler 2005, Drechsler et al. 2003). Thus, for a European-wide network one may argue that each species should be represented in 10 different sites within the Natura2000 network, at the very least, which is difficult with very local and endemic species, which are *per se* rare. Therefore, in practice, a pragmatic approach was taken to the establishment of the network in the so-called biogeographic process (see below) and, depending on the threat status, ecology and distribution of a species a more or less complete coverage of habitat was agreed to be included in the network. **The specification of concrete targets is a first gap that needs to be filled for a more systematic Natura2000 site selection.** The following example from the Pannonian region makes this evident.

Site selection and designation is a national task that was based primarily on expert knowledge. Different countries followed different approaches. For example, in the Czech Republic areas of small extension (< 100 ha) pre-dominate, in Slovakia the majority of areas belongs to the smaller (< 100 ha) and medium size category (100-1000 ha), whereas in Hungary the medium-sized or large areas (1000-10000 ha) pre-dominate (Fig. 1a).

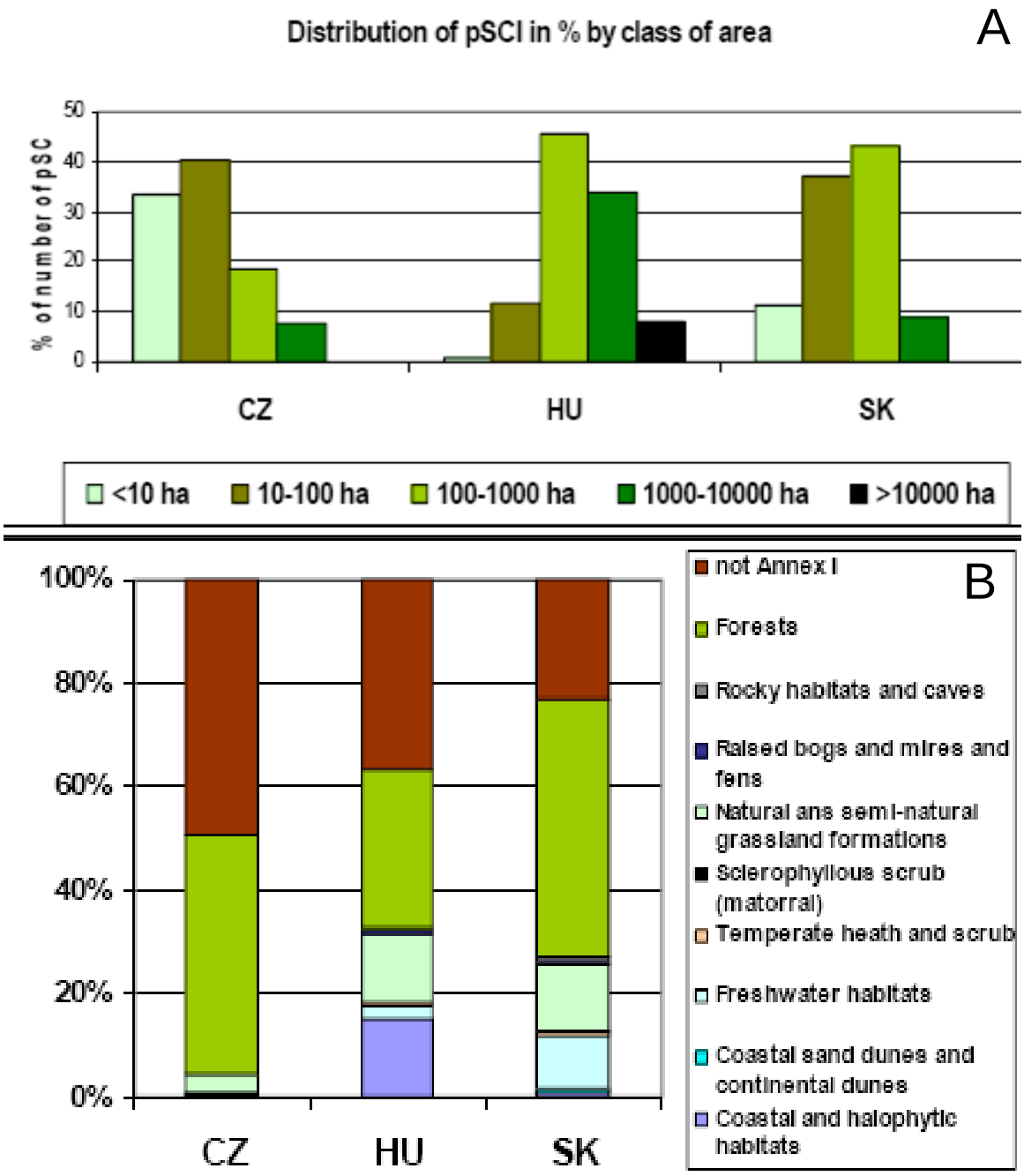

Figure 1: (A) Proportions of the smaller vs. larger pSCI areas in the 3 new EU-Member States Czech Republic (CZ), Slovakia (SK), and Hungary (HU). (B) Representation of major habitat types in the pSCI sites of 3 new Member States

Likewise, there are essential differences regarding the coverage of habitat types among countries (Fig. 1b): in the Czech Republic, the „not-ANNEX I" habitats comprise approximately half of the whole area, whereas the other half consists mostly of forests. In Slovakia, the forest types clearly pre-dominate, whereas the grasslands and freshwater habitats are nearly equally represented. In Hungary

the "non-Annex I" habitats comprise 1/3, the forests also cover nearly 1/3, and the remaining area is nearly equally subdivided between grasslands and halophytic habitats (See section 5.2 for further analyses of coverage).

To address potential biases in coverage and to assess whether the Natura2000 sites sufficiently represent species and habitats of the Annexes, biogeographic seminars were set up. Specifically, the main purposes of the biogeographical seminars, organized by the Habitats Committee, are as follows:

- To assess, whether the suite of proposed SCIs are sufficient for each Annex I habitat type and for each Annex II species;
- To assess the national lists of pSCI at biogeographical region level,
- To assess habitat by habitat (Annex I) and species by species (Annex II), but not to discuss individual sites and boundaries of sites.

Sufficiency is evaluated in terms of the number and extension of sites as well as connectivity. Sufficiency was qualified according to Table 1.

Table 1. Action required depending on the sufficiency of sites selected for Natura2000

Abbreviation	Meaning	Action required
CD	Correction of data	Data needs to be corrected / completed
SUF	Sufficient	No further sites needed
IN MIN	Insufficient – minor	More sites required but habitat is present on sites already proposed for other habitats/species
IN MOD	Insufficient – moderate	One or a few additional sites (or maybe extension to sites) required
IN MAJOR	Insufficient – major	No sites proposed at present and a significant effort required
SCI RES	Scientific Reserve	Further study required

The extension of sites was differently assessed by different member states, e.g. the proportion proposed for Slovakia is based on 'expert judgment' of the total habitat area sent to ETC-BD prior to the Alpine Seminar and is for the Pannonian region only, whereas the proportion proposed for the Czech Republic and Hungary are estimated from evaluations of 'relative surface'. For the Czech Republic they are the proportion of the habitat throughout the country, i.e. in both Pannonian and Continental regions.

For certain species, the expert group for the Natura2000 network examined the connectivity between sites (e.g. Iberian Lynx, *Felis lynx*, and brown bear, *Ursus arctos,* in Spain). Attention was also paid to the needs of migratory fish where the expert group demanded additional sites acting as 'stepping stones' in some cases. Here, the varying distance of migration of a particular fish species has been taken into account. The following migration types were distinguished:

- spawning migrations
- larval and juvenile migrations
- feeding migrations
- wintering migrations
- drift-correction migrations

Some species show short-range migrations, while others undertake long range migrations. Here, exact data is missing and a systematic literature research on the migratory behaviour of Annex species has not been undertaken. In addition, also site selection is necessary for all essential parts of the life cycle including all areas where specimens remain for longer periods of time. Different types of sites are taken into account. E.g., resting sites need a minimum extent of 2-3 km downstream for drift correction. Distances between resting sites should not exceed 10-20 km (depending on the needs of the different species). Sites to be considered for selection are:

- spawning sites
- egg sites (if not identical with spawning sites; example: Alosa fallax)
- larval sites
- juvenile sites
- feeding sites
- wintering sites

- resting sites (for long-distance adult upstream or juvenile downstream migrations)

Site selection must reflect the biology and the individual needs of each species.

Despite the efforts, sufficient life history data is not available for many species and can hardly be taken into account. For Central European birds, a database is currently being prepared (Reinhard Klenke, Gesellschaft für Naturschutz und Landschaftsökologie, Kratzeburg, Germany) for these purposes. Further, clear definitions of connectivity are missing and connectivity decisions are thus made on a species or species group level. Here, clear definitions would help and facilitate the assessment of the connectivity between Natura2000 sites and allow for easy future adjustments.

An additional problem is that member states have different monitoring schemes and that only a fraction (3.7% of species schemes, considering precision, data analysis, and data collection) of the European monitoring schemes collected by EuMon has good potential for integration. The EU-directive is given as reason for launching in 11.9% of species schemes, whereas 24% followed from national law. Hence, 35.7% have been set up explicitly to meet legal requirements. For example, in Hungary a National Biodiversity Monitoring System is working since 8 years loosely interconnected with several programs not focused to the Natura2000 areas. However, between 2001 and 2003 a detailed baseline assessment of the designated sites was carried out, with estimation of the extension of the habitat types, with the presence and proportion of populations of the Annex II species in each pSCI site.

In summary, the Natura2000 selection mainly followed traditional approaches of reserve site selection, neglecting the systematic reserve site selection methods based on complementarity principles that consider simultaneously the contribution of all selected and candidate sites to the biodiversity targets in the planning region (Margules & Pressey 2000). Such approaches risk biases and insufficiencies in the resulting network, i.e. that biodiversity is rather imperfectly represented, because some species, communities, or ecosystems are left without protection, whereas other features are frequently represented (Pressey & Tully 1994, Sarkar et al. 2002). Therefore, we assess exemplarily gaps in the current network as a first step towards an improved and more systematic Natura2000 network.

3.2 Gaps in the Natura2000 network

In this section we analyze exemplarily gaps in the representation of species in the Natura2000 network and in monitoring programs. The first example assesses the representation of all Annex II species in the Natura2000 network. In the second example, we analyze whether selected Annex species, for which a country has high national responsibility, are represented nationally or European wide in the Natura2000 network. In the third example, we evaluate the coverage of monitoring in Lithuania regarding the extent that Annex species are monitored within and outside Natura2000 sites.

3.2.1 European wide gaps of species coverage in Natura2000 sited

Without doubt, the Natura2000 network is globally the most successful network in terms of the number of protected sites included in a system of conservation areas. It currently comprises 25479 sites (SCIs: 20862; SPAs: 4617). According to the Natura2000 Newsletter (2007) SCIs cover 12.2 % and SPAs 9.9 % of the EUs' terrestrial territories (due to overlaps and inclusions of SPAs within SCIs and vice versa it is difficult to give an overall estimate of the total surface coverage of the Natura2000 network). During the Fourth World Congress on National Parks (1992, Caracass) it was recommended that "protected areas cover at least 10 % of each biome by the year 2000". With respect to this percentage target, Natura2000 has proven successful. Thus, the Habitats Directive has been one of the most effective legal instruments in biodiversity conservation.

Notwithstanding, not all species of Annex II and habitats of Annex I are covered in the current system, some are underrepresented, whereas others are over represented. Some gaps and biases have already been mentioned in the previous section. In this section, we describe results of an exemplary gap analyses done in the EuMon project. These gaps provide first insights towards needs and priorities for expanding the existing Natura2000 network.

For the analysis we extracted data from the EEA Natura 2000 Database, which is publicly available through the EEA website (http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=774). As

complete data of all EU 27 member states were not available, we focused on the time frame where an almost complete data set could be obtained which was the case for the EU15 countries until 2005. Data gaps were partially caused by sensitive data, meaning sites which were reported to the European Commission, but not listed in the database due to conservation concerns. We considered only species, which were listed in Annex II of the Habitats Directive before 2004.

Table 2 shows the gap in representation per species group for species with zero, less than five and less than 10 listings in Natura 2000 sites. Plants were the least well represented group (87 % (421 species of Annex II plants occured in ≤ 10 Natura2000 sites and 102 species were not covered by the network) followed by amphibians and invertebrates. Mammals were the best represented group although nearly 22 % (9 species) were represented ≤ 10 times. This supports the assumption that site selection lacked a systematic approach and that sites with popular and well studies species, like mammals were favored.

Table 2: Gaps in species coverage by species group (EU15, 2004). Columns one, three and five show the number of species per group which occur in equal to or less than 10, 5 or 0 Natura2000 sites respectively. In column seven are listed the numbers of Annex II species of the Habitats Directive per species group. Column two, three and five display the percentage of species with insufficient representativity compared to the number of species listed in Annex II within the respective group. Data Source: EEA Nat2000 Database, all entries for EU 15 MSs until 2004; Habitats Directive Annex II Species List before 2004. Nx = No. of species listed in less than x Natura2000 sites; Px = proportion of species of Annex II occurring in less than x sites; N Annex = No. of Annex II species; R_{spec}, Annex II = Ratio of species (per species group) to the total number of HD Annex II species (%).

Group	N10	P10	N5	P5	N0	P0	N Annex II	R_{spec}, Annex II
Mammals	9	21.95	5	12.20	2	4.88	41	5.75
Reptiles	8	38.10	4	19.05	2	9.52	21	2.94
Amphibians	12	52.17	10	43.48	5	21.74	23	3.22
Fish	21	32.31	14	21.54	5	7.69	65	9.08
Invertebrates	40	50.63	34	43.04	1	1.27	79	11.02
Plants	421	87.16	379	78.47	102	21.12	483	67.41
Total	511	71.77	446	62.64	117	16.43	712	

This analysis offers a first estimate of representativity and can be used to identify species, which should receive special attention in future Natura2000 planning and management. However it needs to be considered that only the number of sites was taken into account, whereas site size as well as abundance of species and populations within sites were neglected. Natura2000 sites exist in various sizes from only a few square meters (e.g. attics for bat conservation) to hundreds of square kilometers. Hence treating all sites as of equal size introduces some bias into the representativity analysis. A more reliable approximation for representativity would be the number of protected populations or metapopulations as a measure of overall representativity of the Natura2000 network. Another way would be to relate area size to species area requirements. But such detailed data are not available for most species.

Table 3, Five examples of species listed in the Habitats Directive for which respective countries have high to very high national responsibilities as determined with the EuMon-method. "No. of sites" refers to the number of Natura 2000 sites in the country or the EU as listed in EUNIS database (http://eunis.eea.europa.eu/).

Species	Group	NR	Country	No. of Sites	No. of Sites (EU)
Coenagrion hylas	invertebrate	very high	DE	1	2
Triturus dobrogicus	amphibian	high	HU	14	30
Isophya stysi	invertebrate	very high	HU	2	3
Pholidoptera transsylvanica	invertebrate	very high	HU	1	3
Odontopodisma rubripes	invertebrate	very high	HU	0	2

Table 3 shows five species with high to very high national responsibilities (EuMon method) in Hungary and Germany and the number of Natura2000 sites in which they occur. The results indicate a low representativity (< 10 sites) not only within the country that has a high national responsibility, but EU-wide, for four out of the five presented species. Such combined information on national responsibility status and total number of Natura 2000 sites in which a species is listed may aid in identifying species which are in need of stronger conservation measures.

3.2.2 Gaps in habitat coverage

In 2006, the Natura2000 network covered ca. 12% of the country territory of Lithuania, which comprise 125000 ha of habitats of Community interest, of which 57 exist in Lithuania. They may be grouped into three main habitat groups: woodlands, grasslands (incl. coastal habitats and rocks) and wetlands (incl. inland water habitats). The Natura2000 network territory might be roughly equally divided among these three habitat types. Thus, we may expect each of the three types to be represented by ca. 42000 ha in the SACs of the national Natura2000 network. However, among the assessed Natura2000 habitats, there are ca. 80500 ha of wetlands, ca. 39000 ha of woodlands, and only 5000 ha of grasslands. The recent National Grassland Inventory (2002-2005) has assessed

and mapped 42504 ha of grasslands, most of which belongs to the habitats of Community interest (Table 4). If we accept the proportional share of habitat types as a criterion of their representation in the SACs, the disproportionally low share of grassland habitats in the Lithuanian network might be used as a justification for its extension by adding new territories with grassland habitats.

Table 4. Habitats of the Annex I of the Habitat Directive, found in Lithuania, number of the Natura 2000 territories, where they are listed as values, the area of these habitats in the Natura 2000 network and the area of grassland habitats assessed during the national grassland inventory 2002-2005. In blue habitat types not distinguished from other Annex habitat types in Lithuania..

Habitat type	**N of territories**	**area in N2k (ha)**	**assessed area in Lithuania***
Wetlands, inland & coastal waters	total:	81039	
1110 Sandbanks which are slightly covered by sea water all the time	1	12435	
1130 Estuaries	1	2080	
1150 Coastal lagoons	3	38942	
1170 Reefs	1	1073	
3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea	4	327	
3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp	20	3654	
3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition- type vegetation	13	162	
3160 Natural dystrophic lakes and ponds	26	900	
3190 Lakes of gypsum karst	2	91	
3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	17	737	
3270 Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation	1	50	
7110 Active raised bogs	38	10972	
7120 Degraded raised bogs still capable of natural regeneration	18	3545	
7140 Transition mires and quaking bogs	53	4183	
7150 Depressions on peat substrates of the Rhynchosporion	1	8	
7160 Fennoscandian mineral-rich springs and springfens	20	229	
7210 Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae	12	252	
7220 Petrifying springs with tufa formation (Cratoneurion)	4	28	
7230 Alkaline fens	33	1371	
Grasslands & coastal habitats	total:	5053	41848
2110 Embryonic shifting dunes	2	139	
2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	2	385	
2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)	2	789	
2140 Decalcified fixed dunes with *Empetrum nigrum*	1	78	
2170 Dunes with *Salix repens* ssp. *argentea* (Salicion arenariae)	2	61	
2180 Wooded dunes of the Atlantic, Continental and Boreal region	3	515	
2190 Humid dune slacks	1	16	
2310 Dry sand heaths with *Calluna* and *Genista* (not separated from 4030 in Lithuania)	0	0	
2320 Dry sand heaths with *Calluna* and *Empetrum nigrum*	3	148	
2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands	5	233	235
4030 European dry heaths	3	70	

5130 *Juniperus communis* formations on heaths or calcareous grasslands (scarce in Lithuania)	7	51	
6120 Xeric sand calcareous grasslands	10	92	611
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (important orchid sites)	28	379	1867
6230 Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	13	164	266
6270 Fennoscandian lowland species-rich dry to mesic grasslands (not separated from 6510 in Lithuania)	0	0	5140
6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	23	222	741
6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	20	365	6152
6450 Northern boreal alluvial meadows	16	354	1748
6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	24	878	5026
[mosaic of 2330, 6120, 6210, 6230, 6270, 6410, 6430, 6450 and 6510 in Nemunas and Minija lower reaches meadows, only partly covered by Natura 2000 network]			20062
6530 Fennoscandian wooded meadows (very scarce in Lithuania)	3	22	
8210 Calcareous rocky slopes with chasmophytic vegetation (very scarce in Lithuania)	0	0	
8220 Siliceous rocky slopes with chasmophytic vegetation (scarce in Lithuania)	11	91	
8310 Caves not open to the public (very scarce in Lithuania)	1	1	
Woodland habitats	total:	39263	
9010 Western taiga	42	7597	
9020 Fennoscandian hemiboreal natural old broad-leaved deciduous forests (*Quercus*, *Tilia*, *Acer*, *Fraxinus*, or *Ulmus*) rich in epiphytes	25	2167	
9050 Fennoscandian herb-rich forests with *Picea abies*	27	1293	
9060 Coniferous forests on, or connected to, glaciofluvial eskers (not separated from 9010 in Lithuania)	0	0	
9070 Fennoscandian wooded pastures (very scarce in Lithuania)	10	127	
9080 Fennoscandian deciduous swamp woods	49	3624	
9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	24	4266	
9170 Galio-Carpinetum oak-hornbeam forests (not separated from 9160 in Lithuania)	0	0	
9180 Tilio-Acerion forests of slopes, screes, and ravines	14	804	
9190 Old acidophilous oak woods with *Quercus robur* on sandy plains	2	187	
91D0 Bog woodland	73	17018	
91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)	20	1575	
91F0 Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (Ulmenion minoris)	2	105	
91T0 Central European lichen Scots pine forests	2	500	

*Report No 9: Grasslands of Lithuania, 2006, Lithuanian Fund for Nature, Lithuania.

Another visible bias is a higher representation of habitats of lesser value for agriculture/forestry/recreation. For instance, among the Lithuanian inland wetlands of the Natura2000 network, the raised bogs (habitats 7110 and 7120) take much higher share than e.g. mire or lake habitats. The bog woodland (9100) is much better represented in the network than commercially more

valuable types of forest (e.g. 9010, 9020, 9050, etc., see Table 4) though it is not the most typical or widespread forest habitat of Lithuania. Generally, the raised bogs and the bog woodland are under lower commercial and recreational pressure and remain in a better and more natural state outside the Natura2000 network, as well. Therefore, during the further extension of Natura2000 network, the habitats that are under higher commercial and recreational pressure should be included with priority.

3.2.3 Gaps in monitoring Annex species

To improve the efficiency of reserve site selection, data are needed on the presence of all Annex II and Annex I species of the Habitats and the Birds Directives, respectively, in the Natura2000 sites and the potential candidate sites. This is rarely achieved in monitoring programs. A less ambitious goal would be to include all Annex II species that are underrepresented in Natura2000 sites and all species, for which the country has high national responsibility. To illustrate, we use the state monitoring program in Lithuania because of our familiarity with the program. Three state monitoring programs were established in Lithuania after it became independent: 1993-1998, 1999-2004, and 2005-2100. In general terms, the second program was the continuation of the first program, but the last Lithuanian state monitoring program for 2005-2100 is supposedly completely different from the two previous programs. Most monitoring schemes were stopped in 2004 (e.g. small mammals, breeding water birds, wintering water birds), except for some economic important species like fishes or some game mammals. In the latter case, however, monitoring methods have changed.

Since 2005, all attention is dedicated to the animal species included in the Annex I of the Birds Directive and Annex II of the Habitats Directive. Species of Annex IV and V of the Habitats Directive not included in Annex II, are not covered in this monitoring program. In Lithuania, 67 bird species included into Annex I of Birds Directive are regularly registered (Raudonikis 2004), but only 16 species of them were monitored in 2005 (according to state monitoring plan for 2005). Monitoring of these bird species is carried out mostly within Natura2000 network with few additional sites outside this network and in different frequency. The

Lithuanian state monitoring program for 2005-2100 monitors globally threatened bird species (except corncrake) within the Natura2000 network at 11 sites every year, and outside the Natura2000 network only at 3 sites every third year. The corncrake (*Crex crex*) is monitored at 20 sites every other year within and at 5 sites every third year outside the Natura2000 network. Special monitoring efforts are put on rare breeding birds. They are monitored at 70 sites every other year within the Natura2000 network, but only at 16 sites every third year outside the Natura2000 network. Monitoring of habitats and other species of Community interest (except birds) has not been started yet; it is planned to start in 2008. In most cases, only higher taxa (e.g. rare amphibians & reptiles, rare fishes, rare invertebrates, rare plants etc.), but no particular species are indicated in the state monitoring plan. Hence, the current Lithuanian state monitoring program for 2005-2010 is in the initial phase and has too many gaps to be used for an application of systematic reserve site selection.

The data on distribution of most Annex II species in Lithuania, particularly information on invertebrates is scarce. Therefore, currently the designation of most SACs is based mainly on the information (1) from the territories that have been protected earlier (strict nature reserves, zoological-botanical preserves and national parks, which traditionally have been studied much more than other sites) (2) on habitats and on rather common and widespread species of Lithuania (otter – *Lutra lutra*, *Ophiogomphus cecilia*, *Leucorrhinia pectoralis*, *Lycaena dispar*, etc.), and (3) charismatic species (e.g. orchids). At the same time few rare and little known species of the Annex II have been listed among values of SACs (see Table 6).

4 Information requirements for effective conservation networks

To be able to use the efficient methodological framework for systematic conservation planning outlined in D11, one requires (1) setting quantitative representation targets, (2) information about the selected targets within the existing network and outside. In addition, ideally (3) information about viability of species and connectivity requirements should be available.

(1) Setting quantitative representation targets

Quantitative representation targets means that it needs to be defined which species and how often each species should be represented in the conservation network. Similarly, it needs to be defined which habitats should be represented. Furthermore, explicit targets need to be set regarding either the number of sites that maintain the habitat or the amount (percentage) of habitat that should be represented. Targets may be differentiated among different species or habitats (e.g according to global risk status of a species: see Hilton-Taylor 2000).

(2) Information about the selected targets within the existing network and outside

Once the quantitative targets for the reserve network are set, we need information about the state of the targeted habitats and species for all sites within the existing network and for all candidate sites that could be added to the existing reserve network. Sites can be any manageable-sized parts of the landscape and they can differ with respect to size and form. Irregular polygons, such as habitat fragments, watersheds, or distinct habitats (Ryti & Gilpin 1987, Margules et al. 1988, Pressey & Nicholls 1989a, Bedward et al. 1992, Saetersdal & Birks 1993, Margules et al. 1994, Kershaw et al. 1995, Ranta et al. 1999), may serve as planning units as well as regular grid cells defined e.g. by latitude and longitude (Kirkpatrick 1983, Rebelo & Siegfried 1990, Rebelo & Siegfried 1992, Nicholls & Margules 1993, Freitag et al. 1996, Freitag et al. 1998, Araújo 1999).

The decision about planning units (grid cells vs. irregular polygons as "real" sites) has to be carried out carefully. Whereas grids as planning units are generally applied on a coarse spatial scale (as Europe and larger Member States) and used for a delineation of search areas ("hotspots") for future conservation actions, real sites predominately play a decisive role on a fine spatial scale and for the identification of sites, which are appropriate for the inclusion into a concrete network (such as Natura2000).

Ideally, the information about species and habitats should be similar for all sites since only then biases due to different sampling intensities can be avoided. Only monitoring schemes that fully cover all sites or stratified monitoring schemes that fully cover all sites in relevant strata provide unbiased data. Since this is

almost impossible for large planning regions, such as Europe, the systematic reserve site selection literature generally uses coarse grain grid cells and distribution information for the identification of target regions for potential reserve sites.

In conclusion, to assess information gaps that complicate a systematic reserve site selection approach, one needs to assess what distributional data is available for the target species and habitats and at which scale of resolution. This would allow evaluating the extent of additional information that is needed for identifying priority search areas within which one could search for suitable sites. For the concrete selection of additional sites, one needs to assess what information is available for the sites already in the Natura2000 network and what information is available for potential candidate sites, such as the sites in the shadow lists. For this latter step, representative monitoring schemes can already allow a major step forwards towards a fully efficient reserve site selection approach even without a full spatial or species/habitat coverage.

(3) Information about viability of species and connectivity requirements

To achieve long-term protection, each of the target species should be represented with viable (meta-)populations in the reserve network. Thus, we need to have information on the area requirement for viable (meta-)populations of the target species, on their distribution potential, and the permeability of the matrix between existing sites. In addition, we need monitoring data for the existing sites to allow the addition of sites once targets fall below agreed levels (e.g. a species is presented less frequently than agreed).

5 Information gaps

5.1 Quantitative targets for conservation networks

Taking the 2010 target strictly would require that all European biodiversity should be covered in the Natura2000 network and similarly all of the national biodiversity should be covered in corresponding national networks. However, the Natura2000 network has less ambitious targets. It should cover sufficiently all species of Annex II and all habitats of Annex I of the Habitats Directive and Birds Directive. According to Article 4 of the Birds Directive (see box 1), Special Protection Areas should cover rare or vulnerable bird species listed in Annex I as well as all regularly occurring migratory species not listed in Annex I, paying particular attention to the protection of wetlands of international importance.

Box1: Article 4 of the Birds Directive

1. The species mentioned in Annex I shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this connection, account shall be taken of:
   a. species in danger of extinction;
   b. species vulnerable to specific changes in their habitat;
   c. species considered rare because of small populations or restricted local distribution;
   d. other species requiring particular attention for reasons of the specific nature of their habitat.
2. Trends and variations in population levels shall be taken into account as a background for evaluations.
   Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this Directive applies.
   Member States shall take similar measures for regularly occurring migratory species not listed in Annex I, bearing in mind their need for protection in the geographical sea and land area where this Directive applies, as regards their breeding, moulting and wintering areas and staging posts along their migration routes. To this end, Member States shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance.)

Thus, a first important information gaps is the lack of an explicit quantitative criterion regarding the representation of the target species and habitats. We recommend that each species is represented at the very least in 10 different sites of the network (see section 3).

We further suggest that for national networks, the targets should be broadened and the national conservation networks should encompass also all species and habitats, for which the country has elevated national responsibility, with quantitative targets for each species and habitats set equivalent to that at the European level. Table 4 summarizes, which countries have identified national responsibilities for which taxonomic groups. No country has done an assessment for habitats.

Table 4. Existing assessments of National Responsibilities in European countries

Country	Taxonomic groups assessed	References
Germany	Amphibia	Steinicke et al. 2004, EuMon
	Reptilia	Steinicke et al. 2004, EuMon
	Aves	EuMon
	Mammalia	Schütz et al. 2004

	Grasshoppers	EuMon, Gruttke et al. 2004
	Orchids	EuMon
	Cyprinids	EuMon
	Dragonflies	EuMon
	Carabids	EuMon, Gruttke et al. 2004
	Ranunculaceae	EuMon
	Butterflies	Gruttke et al. 2004
	Coleoptera	Gruttke et al. 2004
	Bryophytes	Gruttke et al. 2004
Hungary	Amphibia	EuMon
	Reptilia	EuMon
	Aves	EuMon
	Mammalia	EuMon
	Grasshoppers	EuMon
	Orchids	EuMon
	Cyprinids	EuMon
	Dragonflies	EuMon
	Carabids	EuMon
	Ranunculaceae	EuMon
Slovenia	Amphibia	EuMon
	Reptilia	EuMon
	Aves	EuMon
	Mammalia	EuMon
	Grasshoppers	EuMon
	Orchids	EuMon
	Cyprinids	EuMon
	Dragonflies	EuMon
	Carabids	EuMon
	Ranunculaceae	EuMon
Lithuania and Baltics	Amphibia	EuMon
	Reptilia	EuMon
	Aves	EuMon
	Mammalia	EuMon
	Grasshoppers	EuMon
	Orchids	EuMon
	Cyprinids	EuMon
	Dragonflies	EuMon
	Carabids	EuMon
	Ranunculaceae	EuMon
Italy	Amphibia/Reptilia	Sindaco 2005
Switzerland	Birds	Keller and Bollmann 2001
UK	Birds	Burfield et al. 2004

5.2 Biodiversity data for existing Natura2000 sites and candidate sites

To systematically and efficiently fill representation gaps in existing networks, we need data for underrepresented target habitats and target species for as large a range of potential add-on sites as possible. This requires that species and habitats are monitored outside the existing reserve network, ideally such that comparable data are obtained for all potential add-on sites. Therefore, we assessed the availability of distribution data in the EUNIS database and other web sources (Annex 1).

Some indication that monitoring takes place inside and outside of protected areas is given by the EuMon database. However, it does not become clear from our database, to what extent the collected data will be provided to Natura2000

authorities. Few of the schemes inputted in the database are totally inside or outside of protected areas, most schemes seem to monitor within and in vicinity to protected areas (Fig. 2).

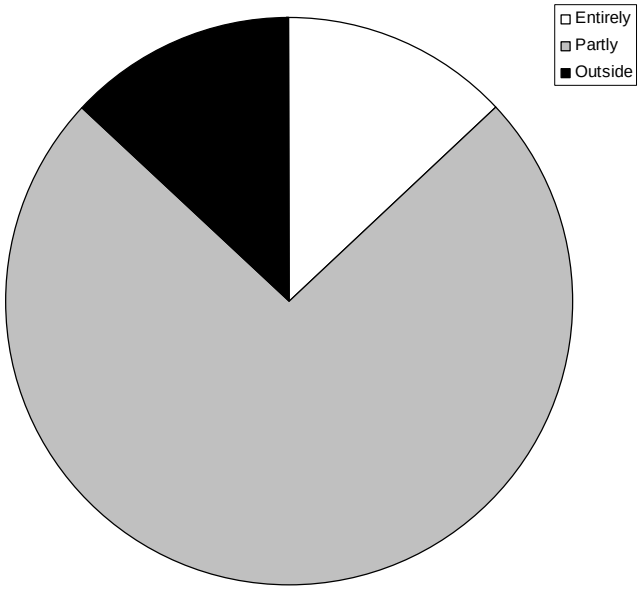

Figure 2: Proportion of monitoring schemes in the EuMon database, monitoring an area inside (white), partly inside (grey), and outside of a protected area.

Imbalances in the coverage of monitoring different species groups are also rather obvious from the EuMon database. Especially bird schemes are very frequent, whereas e.g. fungi are hardly covered (Fig. 3).

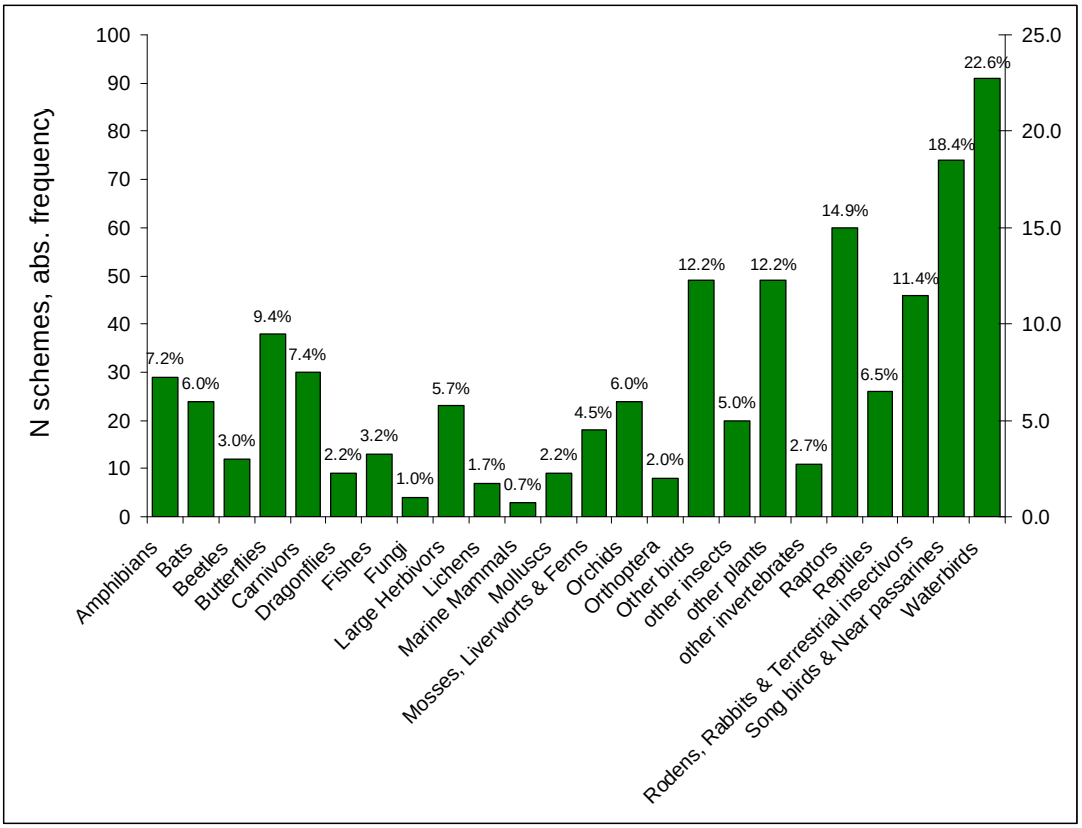

Figure 3: Schemes (absolute and relative frequency) by species group currently available in DaEuMon.

5.3 Species and habitat distribution data

A large range of information about the distribution of species or habitats exists but most information is widely dispersed and only for few species the information is systematically compiled on the European level. Some countries put distribution maps on their internet pages. Annex 1 lists those that we found by using search engines or by personal contacts. Whereas information about the spatial distribution of species is being collected by many international organizations (e.g. Birdlife International), there are no explicit maps about the spatial distribution of habitats in Europe.

Compiling habitat maps on a European scale poses several problems. Firstly, there are various forms of possible habitat and vegetation categories, which may differ even within countries. Also, difficulties may be encountered, when trying to classify vegetation categories according to the definitions of the Annex I habitats. Secondly, information on the distribution of habitats is scattered as most

information is available on national or regional scales [Cahiers d'habitats, France (Bensettiti 2001-2005), Poland (Herbich 2004), handbooks of Austria (Ellmauer & Taxler 2000), Slovakia (Viceníková and Polák 2003)].

Two of the major initiatives for compilation of data beyond single taxonomic groups are the EUNIS database and the Pan-European Ecological Network (PEEN) project. The EUNIS database encompasses 274.405 different species. Geographical distribution maps (present or absent within country) are available for 163.279 species and grid distribution maps for 374 species. (http://eunis.eea.europa.eu/species-statistics-module.jsp). Distribution of species is documented by references to publications. Species entries may also include links to sites of occurrence (e.g. Natura2000 sites, Corine sites). Grid-based distribution maps within the EUNIS database are rather rare. They are available for European amphibians and reptiles (Gasc et al. 1999), for plants (Flora Europaea database), mammals (Mitchell-Jones et al. 1999) and birds. Despite being available only for a small fraction of all European species, grid-based distributional data in EUNIS are available for the majority of Annex II species (about 76 %, the fraction of mammals, amphibians, reptiles and plants in Annex II). For the remaining species, an information gap exists that should be filled with high priority. In addition, one needs to keep in mind that grid-based data entries have different coverages among countries, which may introduce biases. Notwithstanding, they are the best we currently have.

We have not found a possibility to search the EUNIS database directly for species with grid distribution data and a routine that allows the extraction of such data for specific taxa. We suggest that the development of such routines should be a priority in the further development of the database.

The EUNIS database contains also geographical data on a number of Annex I habitat types. For example for Annex I habitats, fact sheets can be found under "habitat types search"/" Annex I habitat types hierarchical view". These fact sheets give information on geographical distribution (country-wise information on presence supported by literature or other references), as well as on relationships with other classification systems, on Natura2000 sites where the habitat is present and on habitat specific characteristic species.

To produce European-wide habitat distribution maps the PEENHab project was initiated. Its aim was to support the Pan European Ecological Network (PEEN)

project, which states as one of its main goals "to develop an indicative map of the pan-European ecological network" (Mücher et al. 2005). The objective of PEENHab was to develop a method to derive European habitat maps, based on the classification system of the HD Annex I habitat types, by combining different information sources, such as the CORINE land cover data, soil maps, topographic maps, the Map of Potential Natural Vegetation (Bohn et al. 2003) as well as distribution data of indicator species. However, distribution maps have been derived only for some habitats and contain a relevant amount of uncertainty due to missing information or uncertainties in data (Mücher et al. 2005).

Another approach, similar to PEENHab in that it integrates satellite imagery with relevant data, is the European Forest Map of the European Forest Institute (EFI) (Schuck et al. 2002). Like PEENHab, its accuracy suffers from misclassifications and uncertainties in underlying datasets.

Table 6. Species of Annex II of the Habitat Directive, found in Lithuania, and the number of Natura2000 territories, where they are listed as values.

Species	N of territories	Total area of the territories
Unio crassus	7	55777
Vertigo angustior	3	21164
Vertigo geyeri	0*	
Vertigo moulinsiana	1	17024
Ophiogomphus cecilia	12	
Leucorrhinia pectoralis	14	63735
Graphoderes bilineatus	7	66513
Dytiscus latissimus	4	53564
Oxyporus mannerheimii	0*	
Cucujus cinnaberinus	4	2035
Boros schneideri	4	127376
Mesosa myops	0*	
Osmoderma eremita	11	12578
Euphydryas aurinia	9	56518
Euphydryas maturna	11	87138
Maculinea teleius	9	81871
Lycaena dispar	16	144723
Lycaena helle	2	768
Petromyzon marinus	1	26733
Lampetra fluviatilis	5	4536
Lampetra planeri	9	113043
Alosa fallax	1	31642
Salmo salar	7	9351
Pelecus cultratus	0**	
Aspius aspius	6	66900
Rhodeus sericeus	8	63911
Phoxinus perenurus	0*	
Cobitis taenia	6	8836
Sabanejewia aurata	1	1030
Misgurnus fossilis	4	85490
Cottus gobio	7	10049
Triturus cristatus	7	11017
Bombina bombina	8	36986

Emys orbicularis	4	17698
Barbastella barbastellus	6	112
Myotis dasycneme	10	104546
Lutra lutra	25	213566
Lynx lynx	7	180357
Halichoerus grypus	0*	
Phocaena phocaena	0*	
Bison bonasus	0***	
Hamatocaulis vernicosus	12	30216
Botrychium simplex	1	17933
Thesium ebracteatum	3	29980
Pulsatilla patens	6	43070
Saxifraga hirculus	10	117680
Dianthus arenarius	1	243
Agrimonia pilosa	1	68
Linaria loeselii	1	24996
Aldrovanda vesiculosa	1	205
Najas flexilis	1	117
Liparis loeselii	24	176256
Cypripedium calceolus	13	128436

*Rare in Lithuania and little studied species, not listed among the values of the current Natura 2000 site network
**The species is protected in some Natura 2000 sites, although not listed in their values
***It is planned to remove the species (ca. 50-60 animals, ca. 3 wild herds in Lithuania) from the wild due to several reasons, including "too high damage to agriculture",; therefore no Natura 2000 site is assigned for it.

The analysis shows that for ca. three quarters (by area) of all SACs of Lithuania (68 sites, 440 822 ha) the listed values include both habitats and species. However, ca. a quarter of SACs are based on habitats (154 sites, 66 115 ha) or species only (72 sites, 152 329 ha). In many cases, the list of known values is short due to the lack of information on species or on habitats in these territories. At the current stage of the Natura2000 development in Lithuania, particularly concerning SACs, an investment into more detailed research of the assigned territories is needed before any conclusion about the sufficiency of the current network for conservation of particular habitat or species may be drawn.

In conclusion, though information gaps regarding the distribution of habitats and species exist and there is unequal data coverage, the existing information should allow a systematic and efficient search for promising areas that could harbor sites suitable to fill gaps in the existing network.

5.4 Protected Areas distribution

Information about the distribution of protected areas in Europe is readily available for most countries. A number of EU countries offer online information and maps of Natura 2000 sites on their territories via the websites of the

relevant national authorities (for links to national Natura 2000 websites see: http://ec.europa.eu/environment/nature/natura2000/db_gis/index_en.htm). On a European level this is facilitated through the EEA EUNIS website (http://eunis.eea.europa.eu/sites.jsp), which is connected to the EEA Common Database on nationally and internationally Designated Areas (CDDA National and International respectively) and the EEA Natura 2000 database, which contains information on SCAs and SPAs in Europe. Distribution data on nationally designated sites (CDDA National) within the EU can be downloaded from the EEA site as GIS shape files with the exception of some EU member states. European Maps of Natura 2000 shall be made available through the EU Commission soon (http://ec.europa.eu/environment/nature/natura2000/db_gis/index_en.htm).

5.5 Viability of species, connectivity, and monitoring

Ideally, species should not only be adequately represented within existing reserve networks, the represented populations should be viable. Determination of the long-term viability of a population is a demanding task (Burgman et al. 1993; Beissinger & Wetsphal 1998) that is beyond the capacity of most reserve site administrations. Therefore, assessments of the viability of target species for reserve sites are an exception and will remain far ahead of standard for a long time. Two types of information may help to partly circumvent this gaps: a) published information on habitat requirements for viable populations of European species and rules of thumb, b) regular monitoring of the status of the target species within the reserve networks with methods that are sensitive to detect negative trends.

a) With the insight that stochasticity plays a vital role for understanding the future survival prospects of species, population viability analyses (PVA) have become a popular tool in conservation biology, with various attempts to identify minimum viable population size and habitat requirements for viable populations of a range of species (Soulé 1987; Burgman et al. 1993). Meanwhile, it is clear that the determination of minimum viable population sizes or/and the habitats that such populations require is hampered due to uncertainties in data, processes, and the degree of natural fluctuations (Grimm et al. 2005).

Nevertheless, existing PVAs that assess the relationships between population viability and habitat size may give a very crude orientation whether a particular site has the size, where viability may be achievable. A database summarizing PVA studies is available on the internet (http://www.ufz.de/pva/). It covers 56 European species of which 8 are listed in an Annex of the Habitats or Bird Directives. The database does not provide direct figures for minimum viable populations or for minimum habitat requirements but it allows to extract studies that analyzed the relationship between viability and habitat area and provide bibliographic references to the study.

The next problem one faces is the determination of connectivity, which is important for determining viability of metapopulations. Although GIS information is available for major infrastructure networks, such as major roads, across Europe that allows assessing the degree of fragmentation of the landscape (e.g. Jaeger 1999), this is only the first step. We need to be able to classify species into sensitivity classes regarding their ability to cross such barriers. There are many studies available that examine the strength of roads and other infrastructures as barrier for particular taxa but to our knowledge, there are no comprehensive reviews or databases available that would allow an application of this information for standard planning purposes. The development of such databases should be a future research priority.

Additionally, species have different dispersal power. Some are able to disperse long distances, whereas others have very restricted dispersal power. Therefore, sites are likely to be connected for some species but not for others. Determining dispersal is methodologically difficult and results of studies are extremely widely dispersed within the literature and therefore very tedious to extract. Only very restricted reviews are available (e.g. dispersal potential of German species of reptiles and butterflies: Settele et al. 1996). The PVA database mentioned above allows extraction of this dispersal information for the species covered, if such information was given in the original source. Again, the compilation of the existing information in databases has a high priority, if we want to determine realistically the degree of connectivity among reserve sites or any other population of species of Community interest and thus should be another research priority.

Finally, the type of matrix (e.g. meadows versus agricultural fields versus forests) influence the permeability of the landscape for dispersing individuals and this influence also needs to be determined to assess connectivity realistically. Again, many studies address this topic but the gained knowledge has never been summarized and thus is a further research deficit that needs to be filled before connectivity can be determined realistically for existing Natura2000 sites. Until we have these essential information requirements improved considerably, we are left with their limitations and the use of rules of thumb (e.g. Henle et al. 1999, Henle & Frank 2001), which provide some guidance.

Once such information is available, programs exist that can explicitly incorporate connectivity criteria in an optimal reserve site selection.

(b) A complementary approach to secure representation of species in the Natura2000 network despite natural fluctuations, barriers separating individual sites, and uncertainties about the requirements for viable populations is the monitoring of the species in the existing network. If monitoring indicates that species representation drops below agreed targets (say presence in at least 10 different sites), sites must be added to the existing Natura2000 network preferentially by using systematic reserve site methodology as outlined in D11. Since designation takes time, it is advisable, to either increase representation targets or to consider only populations that have a minimum size. Such a minimum size may be specified in classes for different species groups based on the degree of their national fluctuation.

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Annex

Annex 1: List of web pages with distribution maps or further information on other sources.

Country	Group	Grid distribution	Point distribution	Plotted distribution	Regional distribution	Name	Address
Armenia	Dragonflies		Yes			Dragonflies Odonata of Armenia	http://users.pandora.be/tailly/armenodon/armeniandragonflies.htm
Belgium	Amphibians & Reptiles	Yes				System d'informations sur la Biodiversité en Wallonie	http://www.gomphus.be/
Belgium	Carabus	?				System d'informations sur la Biodiversité en Wallonie	http://www.gomphus.be/
Belgium	Plants (protected)	yes				System d'informations sur la Biodiversité en Wallonie	http://www.gomphus.be/
Belgum	Plants	yes				System d'informations sur la Biodiversité en Wallonie	http://www.gomphus.be/
Belgium	Birds	?				System d'informations sur la Biodiversite en Wallonie	http://www.gomphus.be/
Belgium	Butterflies	Yes				System d'informations sur la Biodiversite en Wallonie	http://environnement.wallonie.be/sibw/especes/ecologie/papillons/ISB_SURWAL/home.html
Belgium	Dragonflies	Yes				System d'informations sur la Biodiversité en Wallonie	http://environnement.wallonie.be/sibw/especes/ecologie/papillons/ISB_SURWAL/home.html
Czech Republic	Orchids	Yes				Orchids of Czech Republik	http://orchideje.net/Gustbook.html
Estonia	Orchids	Yes				Estonian orchids	http://www.orhidee.ee/esileht.jsp?keel=english&lang=gb
Europe	Amphibians & Reptiles	Yes				Atlas of amphibians and reptiles in Europe	http://www.gli.cas.cz/SEH/atlas/atlas.htm
Europe	Animals	No				Fauna Europaea	http://www.faunaeur.org/index.php
Europe	Plants	Yes				Atlas Florae Europaeae database	http://www.fmnh.helsinki.fi/english/botany/afe/publishing/database.htm
Europe	Plants					Links to vegetation maps in Europe	http://www.lib.berkeley.edu/EART/vegmaps2.html#europe

Country	Group	Grid distribution	Point distribution	Plotted distribution	Regional distribution	Name	Address
Europe	Birds	Yes				EBCC European breeding birds	http://www.sovon.nl/ebcc/eoa/
Europe	Mammals	Yes				Atlas of European mammals	http://www.european-mammals.org/php/mapmaker.php
Finland	Amphibians & Reptiles	Yes				Suomen sammakkoeläimet ja matelijat 2006	http://www.hatikka.fi/public_query2.php?queryid=0.413
Finland	Invertebrates	Yes				Hyönteiskartoitus 81 - havainnot vuodelta 2006	http://www.hatikka.fi/public_query2.php?queryid=0.389
France	Dragonflies	Yes				Société française d'Odonatologie	http://www.libellules.org/fra/fra_index.php
Germany	Plants	Yes				Flora Web	http://www.floraweb.de/datenservice/datenservice.html?datenservice/datenservicetext.html
Germany	Spiders	Yes				Spiderling	http://www.spiderling.de/arages/index2.htm
Germany	Orchids	Yes				Orchideen in Deutschland	http://www.orchideen-kartierung.de/GERMANY/Arten2.html
Latvia	Orchids	Yes					http://www.latvijasdaba.lv/2/view_1_descr.asp?id=127
Norway	Spiders		Yes			Araneae norvegiae	http://www.ntnu.no/vmuseet/nathist/norspider/sjekklisteportal.htm
Poland	Orchids	?	?	?		Skorowidz naukowych (łacińskich) nazw roślin	http://www.atlas-roslin.pl/skorowidz.htm
Portugal	Spiders		Yes			Portugal spider catalogue	http://www.ennor.org/catalogue.php
Skandinavia	Plants		Yes			Den virtuelle floran	http://linnaeus.nrm.se/flora/
Slovenia	all ?	Yes				bioportal	http://www.bioportal.si/
Slovenia	Invertebrates		Yes			TNP-Fauna Avertebrata	http://www.sigov.si/tnp/s/bio/nevr/nevret.htm#Arthr_arachn
Spain	Orchids			Yes		Orquideas ibericas	http://www.orquideasibericas.info/
Sweden	Orchids		Yes			Sveriges bofasta orkideer	http://www.elgebrant.se/svorkid.html
Switzerland	Habitats	Yes				Habitat maps	http://www.wsl.ch/land/products/biomod/habmaps.html

Country	Group	Grid distribution	Point distribution	Plotted distribution	Regional distribution	Name	Address
Switzerland	Animals	Yes				Centre Suisse de Cartographie de la Faune	http://lepus.unine.ch/carto/
Switzerland	Mosses		Yes			Online-Atlas der Schweizer Moose	http://www.nism.unizh.ch/map/map.htm
Switzerland	Plants		Yes			Swiss Web Flora	http://www.wsl.ch/land/products/webflora/floramodul1-en.html
Switzerland	Orchids	Yes				Die Orchideen der Schweiz	http://www.ageo.ch/index_10.htm
UK	All	Yes				NBN gateway	http://www.searchnbn.net/
Bulgaria	Butterflies	Yes				Prime butterfly areas in Bulgaria	http://www.netempire.biz/butterfly_areas_bg/species/index.htm
France	Butterflies		Yes			Enquete sur les papillons diurnes du département de la drome	http://perso.orange.fr/ramieres/papillons/papillonsdrome.html
Europe	Birds	Yes				Euring	http://www.euring.org/edb/species-maps/index.htm
France	Birds	Yes				STOC, Suivi Temporel des Oiseaux Communs : Présentation générale	http://www.mnhn.fr/vigie-nature/1-STOC_index.htm ; http://www.mnhn.fr/mnhn/crbpo/
France	All				Yes	Inventaire national du patrimoine naturel	http://inpn.mnhn.fr/inpn/fr/biodiv/species/search.htm