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Investigating the contribution of the potential "umbrella effect" of Nationally Designated Areas (CDDA sites) for European plant biodiversity

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Investigating the contribution of the potential "umbrella effect" of Nationally Designated Areas (CDDA sites) for European plant biodiversity.

Summary

This report sets out the results of a short study to investigate the potential contribution ("umbrella effect") of the European-wide network of Nationally Designated Areas (CDDA sites) in relation to plant hotspots. The methodology is based on that used in the report *How much Biodiversity is in Natura 2000? The "Umbrella Effect" of the European Natura 2000 protected area network* (Sluis, *et al*. 2016). As was the case for the Natura 2000 study, it concludes that there is a noticeable positive impact on plant biodiversity provided by CDDA sites and that a 'buffer' effect can be seen around the sites that is (at least partly) related to the quality of the surrounding landscape. There is a brief discussion of the results, including some potential policy implications.

1 Introduction

In May 2015 the European Commission published the report The State of Nature in the European Union - which sets out the status of and trends for habitat types and species covered by the Birds and Habitats Directives (EEA, 2015a). However, the report does not show the wider contribution of either Natura 2000 or the European-wide network of Nationally Designated Areas (CDDA sites) to the conservation of species that are not listed in the annexes to the Directives[1]. The need to understand this contribution was driven by a general inquiry into the effectiveness of the Nature Directives and the EU strategic target within the Biodiversity Strategy to 2020.

The Commission therefore initiated a research project to assess the significance of the presumed "umbrella effect" of Natura 2000, related to its potential contribution in terms of halting and reversing the loss of species other than those for which the Natura 2000 sites have been set-up. The specific question that the European Commission asked a WENR-led team of researchers from Italy, the Netherlands and the United Kingdom was therefore "How much biodiversity is found in the nature areas of the European Natura 2000 network?"

A subsequent analysis of the data inside and outside the Natura 2000 network showed that all flora and fauna investigated benefit from the network. The rarer species of flora benefit the most. And it was found that both the more common and rarer species of fauna occur more frequently in the Natura 2000 areas than in other areas. Butterflies in particular, and most bird species, were found to benefit from the Natura 2000 network. Approximately 35% to 40% of the populations of threatened species investigated were found to occur within the Natura 2000 areas. The fact that only 18% of the surface area of the European Union is designated as Natura 2000 area highlights that this is a relatively high amount.

In conclusion, the Natura 2000 network proved to be of crucial importance for the protection of biodiversity and for all groups of species investigated, especially for birds, butterflies and plants. Not only for the species covered in the Birds and Habitats Directives for which the areas were designated, but also for many other threatened and non-threatened European species of flora and fauna.

[1] Note that in 2015 the EEA also published their report *State of nature in the EU: Results from reporting under the nature directives 2007–2012*. This is much more detailed than the Commission document of the same name and contains facts and figures derived from studies on (for example) birds and butterflies that extend beyond the Nature Directive Annex species. The full reference for the EEA publication is provided at the end of this report and the document can be downloaded as a PDF. A concise review of recent literature relating to this subject area can be found in Sluis, *et al*. 2016.

The results of the study on *How much Biodiversity is in Natura 2000? The "Umbrella Effect" of the European Natura 2000 protected area network* (Sluis, *et al*. 2016[2]) proved to be relatively impacting, including by (positively) influencing the 'fitness check' review of the Nature Directives that took place in 2015-16. Following a short presentation of the results and related discussion at the ETC/BD Management Committee meeting in October 2016 a suggestion was made, and subsequently included in the 2017 Implementation Plan, for the development of a feasibility report on the extension of the approach to CDDA sites (Jones-Walters, 2017). As a result of this report it was agreed that the study should in the first instance focus on plants and it is restricted to the 28 EU Member States. This restriction was applied for a number of reasons. Firstly we have reliable data for the 28 Member States and not for the other countries, secondly and most important we wished to be able to make a direct comparison with the Natura 2000 analysis as determining the added value of CDDA with respect to Natura with respect to Natura 2000 was a key element of the study.

2 The Common Database on Designated Areas (CDDA)

The Common Database on Designated Areas (CDDA) holds the data for the numbers, area and location of Nationally Designated Areas in Europe. It is the official source of protected area information from European countries to the World Database of Protected Areas (WDPA). The inventory began in 1995 under the CORINE programme of the European Commission. It is now one of the agreed EIONET core data flows[3] maintained by EEA with support from the European Topic Centre on Biological Diversity. The CDDA data can be queried online in the European Nature Information System (EUNIS) and the European Environment Agency maintains a webpage with access to data and related information (EEA, 2017).

Our own analysis of the mapped information[4] for CDDA within the territory of the European Union, combined with data available for Natura 2000 shows that in 2016:

- CDDA sites covered a terrestrial area of 857,310 km^2;
- Natura 2000 covered a terrestrial area of 792,223 km^2 ;
- Their combined terrestrial area was 1,121,971 km^2;
- An area of 592,649 km^2, 69% of the total area of CDDA overlapped with Natura 2000;
- CDDA added an additional 329,748 km^2 to the coverage provided by Natura 2000;
- The additional 329,748 km^2 represents a 29.4% increase to the area that was then covered by Natura 2000;
- CDDA covered a further 7.5% of the total European Union terrestrial area[5], in addition to the 18.1% covered by Natura 2000;
- The two classifications of protected area (CDDA and Natura 2000) therefore together covered a total of 25.6% of the European Union terrestrial area.

Given the fact that the hot spot distribution in and out for CDDA is comparable with N2k (see section 4), the addition 283.508 km2 is an important bonus for European biodiversity.

[2] The summary and technical reports resulting from the project may be found on the EC website here (and can be downloaded as PDF): http://ec.europa.eu/environment/nature/knowledge/how_much_biodiversity_in_natura2000_en.htm

3 See http://www.eionet.europa.eu/dataflows

[4] Using CDDA version 14, and Natura 2000 version of 2016

[5] EU terrestrial area: 4,385,998 km^2 (https://www.synbiosys.alterra.nl/turboveg3/maps/European_countries.zip)

In terms of the significance of CDDA sites within the EU, the above figures clearly indicate their importance. They cover 7.5% of the terrestrial area of the European Union that is not covered by Natura 2000 (providing a 29.4% increase to the area presently covered by Natura 2000). The combined terrestrial area of CDDA and Natura 2000 is 1,121,971 km^2 or a quarter (25.6%) of the European Union terrestrial area.

Beyond the EU territory, according to the information currently available in SEBI 007 indicator: Nationally designated protected areas (EEA 2015b) on the EEA website[6] "...the total area of nationally-designated protected areas in Europe has increased over time and amounted to over 1,1 million square kilometres in 39 European countries in 2014"...." The total area of nationally designated protected areas currently covers about 21% of terrestrial territory and inland waters, although further expansion of the marine network is required to meet targets". Moreover, the degree of overlap between Natura 2000 and national designations "illustrates the extent to which countries have made use of their nationally designated areas to underpin Natura 2000 and to what extent Natura 2000 sites extend beyond national systems".

In relation to the 66% overlap between CDDA and Natura 2000, Figure 5.1 (in the discussion section below, and taken from the EEA webpage) illustrates that there are different patterns amongst countries, as in some cases Natura 2000 sites nearly always overlap with national designations and in others, there is little or no overlap. According to analysis by the EEA: "Natura 2000 sites mostly overlap with nationally designated sites under IUCN categories I to IV, which aim to protect ecological processes and biodiversity. However, they also overlap with IUCN categories V and VI, particularly in mountainous regions, supporting the idea that Natura 2000 is not restricted to nature reserves but also serves the broader principle of conservation and sustainable use".

3 Methods

To assess what the importance is of the CDDA network for plant biodiversity in Europe, and its relationship to the Natura 2000 network, the vegetation data stored in European Vegetation Archive EVA (version of 20-10-2017) was used. Although the assessment of the contribution of the Natura 2000 network to plant biodiversity has already been reported in a previous study (Sluis *et al*, 2016) we ran the analysis on the Natura 2000 network for plants once more, together with the analysis of the CDDA network, because during intervening period the European Vegetation Archive (Chytrý *et al*, 2016) has significantly expanded from 1.1 million vegetation plots to 1.6.

The EVA database therefore contains 1,636,657 vegetation plots, comprising 35,938,820 species recordings. In total, more than 54,000 taxa are represented in the database. The assessment was restricted to vascular plants as they are better represented in the database than cryptogams. Altogether 1,142,819 vegetation plots are georeferenced in the European Vegetation Archive and are located in EU-28 countries, representing 631,841 unique locations. These unique locations in EU-28 countries have been assigned to 151,704 unique 2x2 km grid[7] cells, of which 76,538 grid cells are located within Natura 2000 sites and 75,165 grid cells outside Natura 2000 sites. For the CDDA network the distribution is 68,271grid cells inside and 83,432 grid cells outside CDDA sites. In table 3.1 the number of unique grid cells is listed for all 28 Member States and then for three MS countries for which digital Red Lists for vascular plants are available and for which we have sufficient data.

6 https://www.eea.europa.eu/data-and-maps/indicators/nationally-designated-protected-areas/nationally-designated-protected-areas-assessment-3

7 The grid size of 2x2km has been chosen because of the uncertainty of the location precision of the plots. With a grid size of 1x1 km too many plots would have been excluded.

Within this procedure, a grid cell has been assigned to the Natura 2000 and CDDA network whenever it intersects (at least partly overlaps) with a site.

Table 3.1 Number of unique 2x2 km grid cells represented in the European Vegetation Database for the whole territory of EU-28 countries, and for countries for which a digital Red List for vascular plants and sufficient vegetation plots is available

EU/Country	Unique 2x2 km grid cells inside CDDA sites	Unique 2x2 km grid cells outside CDDA sites	Unique 2x2 km grid cells inside Natura 2000 sites	Unique 2x2 km grid cells outside Natura 2000 sites
EU-28 countries	68,271	83,432	76,538	75,165
Czech Republic	5,356	6,049	5,098	6,307
Slovak Republic	2,912	2,121	3,134	1,899
The Netherlands	3,115	4,670	2,883	4,902

Not all (of the approximately 25,000) European vascular plants can be assessed for the present study. We have therefore restricted the analyses to plant species that are listed in the European Red List of vascular plants of the IUCN, (Bilz *et al*, 2011) and a number of national Red Lists. The reasons for this are set out in further detail in Sluis *et al.* (2016) but can be summarised as: 1) common and generalist species are found with a similar distribution between samples analysed from both protected areas and the wider countryside and therefore do not tell us anything about the specific contribution of protected areas to protecting 'special' nature; 2) species with what might be termed 'ecological significance', that is which have a narrow niche, tell a particular story relevant to the topic of this study; 3) this is often a reason that they are under threat and therefore on the red list(s) used here; and 4) the time required for analysing the selected species is extremely lengthy and the inclusion of generalist species, whilst unnecessary for the outcomes, would also extend the analysis times to the extent that they become unmanageable.

Criteria for selecting national Red List species were the availability of national Red Lists of vascular plants in digital form, as well as the availability of sufficient well located plot data in the vegetation database at national levels. Species indicated as 'Least Concern' (LC) were excluded from the analysis, as well as species from the Annex II list. The former were excluded because it was expected that it would change the result too much and moreover would reduce the time required for an already lengthy analysis). The latter group has been excluded because these concern plant species that have contributed to the designation of Natura 2000 sites. In general the Red Lists contain few Annex II species, with the exception of the IUCN European Red List of vascular plants. A complete overview of all the plant species included in the analysis is provided as a separate Excel file.

We further compiled a list of European orchid species on the basis of the European Vegetation Archive. Orchid species are selected because they capture the interest of the public, but also because these species often occur in vulnerable habitats. It should be noted that by selecting species in this way, there is a risk that results for the plants would be skewed towards range restricted and habitat specialist species. However, to test whether this selectivity will give a result more positive than would be the case if all plant species had been (could be) considered, we analysed the relationship between number of Red List species and the total number of species recorded in grid cells for the countries for which red lists and sufficient data were available. The results showed, at least for those countries for which sufficient data is available (the Czech Republic, the Slovak Republic and The Netherlands), that there is a clear relationship between the number of Red List plant species and the total number of species in grid cells (see figure 3.1 for the Slovak Republic below), It therefore seems justified to use counts of Red List plant species as a proxy for biodiversity.

For each species group the total number of random selected grid cells was counted with 5 or more[8] Red List plant/Orchid species (and as such defined as a 'hotspot'), inside and outside Natura 2000 sites and inside and outside CDDA sites. For the first two groups (Red List of European vascular plants and orchid species), the number of random selected grid cells was set to 2,500 inside and 2,500 outside Natura 2000/ CDDA sites. For the analyses at national level the number of random selected grid cells was set to 250 (250 grid cells inside and 250 grid cells outside), since the selections were only performed on the country specific grid cells. Within each area, a grid cell was selected only once. The procedure of random selection was repeated 50 times in order to obtain more statistically reliable results, delivering a mean value for the number of hotspots and a standard deviation.

We also analysed the presence of Red List plant/Orchid species in a 500 m buffer zone surrounding the CDDA sites[9]. To this end, each grid cell was assigned as CDDA, buffer zone, and other cells. A grid cell assigned to the buffer zone always intersects (overlaps) with the buffer zone, and at the same time does *not* intersect with the CDDA area. The 'buffer grids' are therefore always located outside CDDA sites. As such the actual buffer size is actually not 500 m, but has a max span of 2000 + 500 = 2500 m. Nevertheless, the plots assigned to the buffer area are all located in the vicinity of CDDA sites and in our opinion well represent the vegetation (species) in the buffer zone.

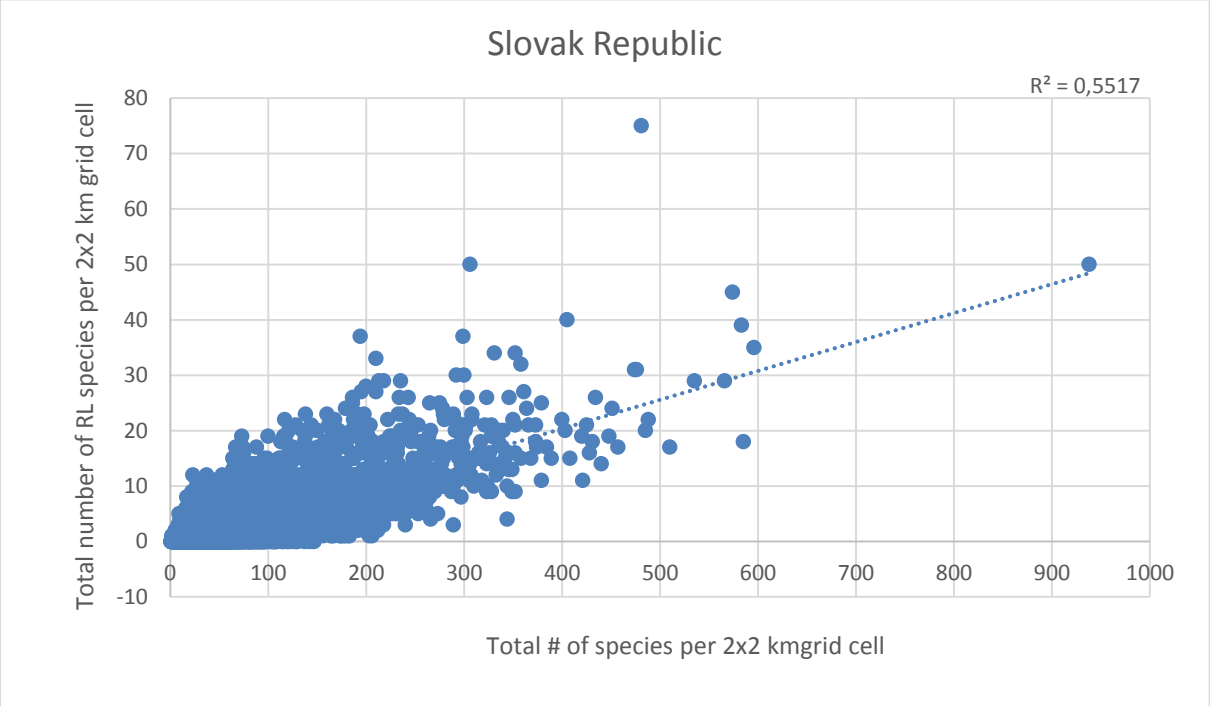


Figure 3.1 Relationship between the number of Red List species and total number of species in grid cells

Furthermore, whilst in the previous study we excluded the designated bird areas from the plant analysis (indicated as 'sitetype' 'A' in the map of the Natura 2000 network), in the current study we did not exclude bird sites to be able to make a better comparison with the CDDA network. For the assessment of CDDA network we used CDDA version 14.

[8] The threshold of 5 species was chosen because it delivers sufficient difference in numbers of Red list species between grids cells located inside and outside the networks

[9] We did not analyse the buffer zone of Natura 2000 sites because this had already been carried out in the previous study by Sluis *et al*. (2016) and due to time constraints.

Note that we did not examine the distribution of the 300 most commonly occurring species in the database in relation to their occurrence inside and outside CDDA sites. When this was carried out for Natura 2000 sites study (Sluis *et al*, 2016) the graph to the right clearly shows that even though there are slightly more grids that meet the criterion outside rather than inside Natura 2000 sites, common species are more or less equally distributed inside and outside Natura 2000 sites. It was assumed that this is also likely to be the pattern with CDDA sites.

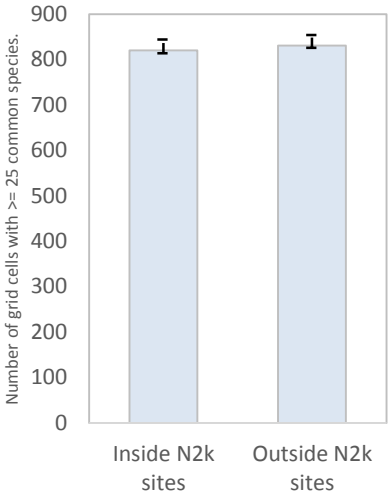


Figure 3.2 Common plants present inside and outside Natura2000. Based on 250x250 random sampled grids

4 Results

The graphs below (Figure 4.1), representing the different species groups mentioned in Table 4.1. Based on the analyses of plant species distribution it is clear that the Red list species and some orchid species occur significantly more often inside than outside CDDA sites. Indeed, none of the plant species considered in this study showed a strong preference for areas outside CDDA sites.

Table 4.1 Surface of study areas

EU/Country	Terrestrial area km^2 CDDA network	Terrestrial area km^2 Natura 2000 network
EU-28 countries	834,271	792,223
Czech Republic	13,172	11,148
Slovak Republic	11,558	14437
The Netherlands	10,153	11,439

In addition, in terms of the reanalysis of the extended Natura 2000 data set (including the bird areas, sitetype A), Figure 4.1 clearly show that hot spots for Red List and orchid species are (still) more likely to be found inside rather than outside Natura 2000 sites and that, in spite of the enlargement of the EVA database, the figures are very similar to the previous analysis of Sluis et al (2016). The pattern of Red List plant species hotspot concentration inside CDDA is even more distinct for CDDA than was seen for Natura 2000; this is possibly because of the inclusion of Special Protection areas in the Natura 2000 dataset whose primary reason for designation is birds and not plant diversity or habitats.

As referred to above, the EEA has identified that nationally designated sites (CDDA) fall within IUCN categories I to IV, which aim to protect ecological processes and biodiversity. However, they also overlap with IUCN categories V and VI, particularly in mountainous regions. These categories cover protected areas where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value; or where protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. For categories I to IV it is probable that their constituent habitats are generally rich in plant species, and are likely to include rare species and this may be a further criterion for their selection. Categories V and VI require that nature conservation is seen as one of the main aims of the area and, by their definition, they will contain biological interest.

Habitat based criteria therefore clearly play an important part in the selection of CDDA sites, their constituent habitats are generally rich in plant species, and are likely to include rare species as this may be a further criterion for their selection. This is confirmed by the hotspot analysis. CDDA sites are protecting the majority of what is left of the most diverse and species-rich habitats. Outside CDDA there are fewer species of nature conservation interest. Nevertheless, many Red list species and some other rare species do, to some extent, also occur outside CDDA sites; one of the reasons for this could be that the network of CDDA and other protected sites may not be fully developed at national level.

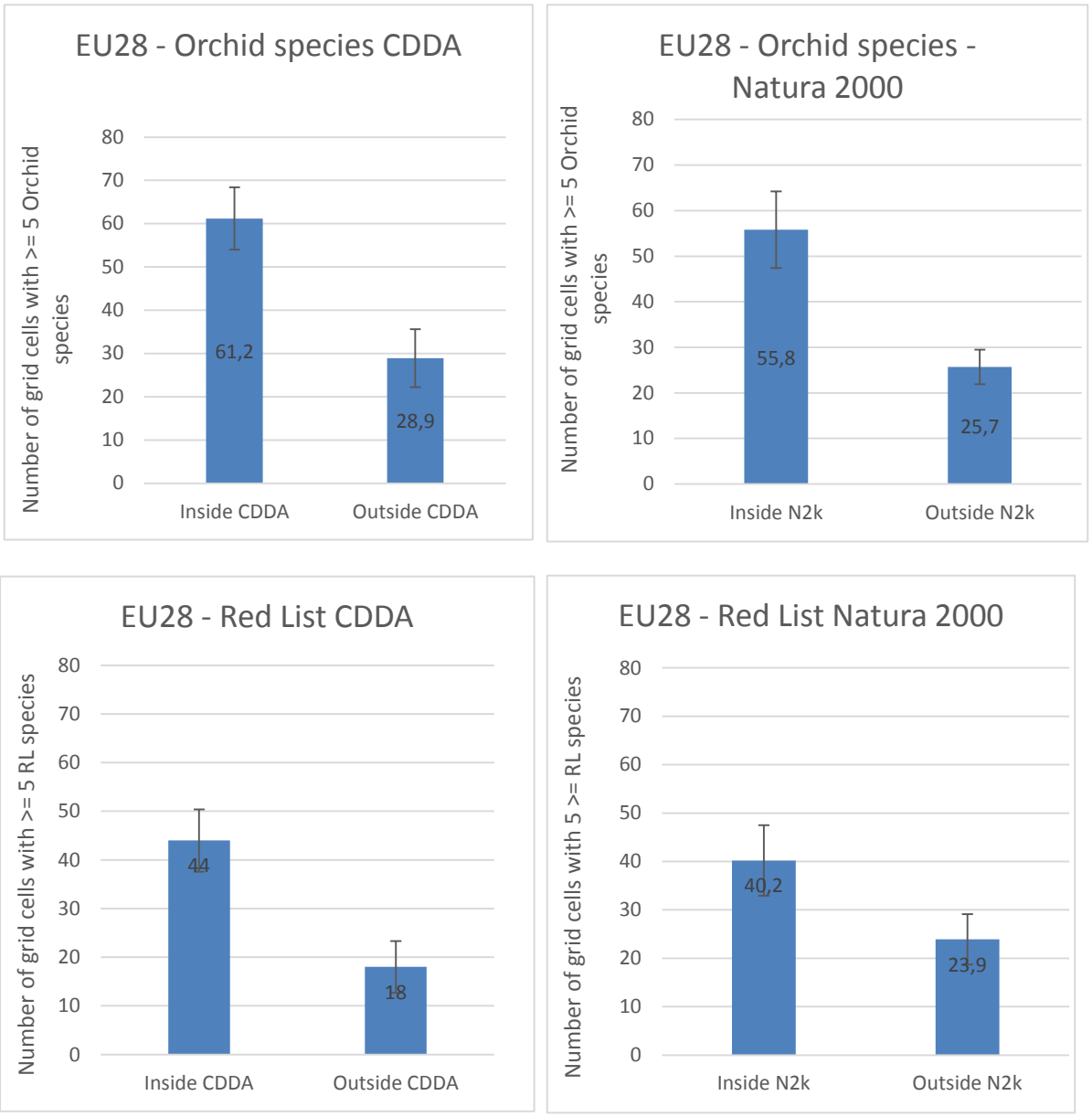


Figure 4.1 a-d

In the previous study Natura 2000 sites were shown to exert a strong 'buffer zone' effect. We therefore carried out an extended analysis beyond the boundaries of CDDA sites to a 500 meter 'buffer zone'. In figures 4.2, 4.3 and 4.4 for the Czech Republic, the Slovak Republic and the Netherlands respectively, we show a) the number of grid cells with more than 5 Red List plant species inside and outside Natura 2000, b) the number of grid cells with more than 5 Red List plant species inside and outside CDDA, and c) the number of grid cells with more than 5 Red List plant

species inside CDDA sites, inside a 500 meter 'buffer zone', and outside CDDA sites and the buffer zone[10].

It can be seen from the graphs that, at least for the countries covered by this analysis, biodiversity in the buffer zones (measured in terms of number of hotspots) is intermediate between the CDDA sites and the area outside the buffer zone. The CDDA sites therefore show a similar phenomenon to Natura 2000 sites. The figures for 'inside the buffer' and 'outside the buffer' show a reduction in hotspots for each of the countries. However the Dutch figures show that there are proportionately more species in the CDDA sites and proportionately less in the buffer than for the other two countries.

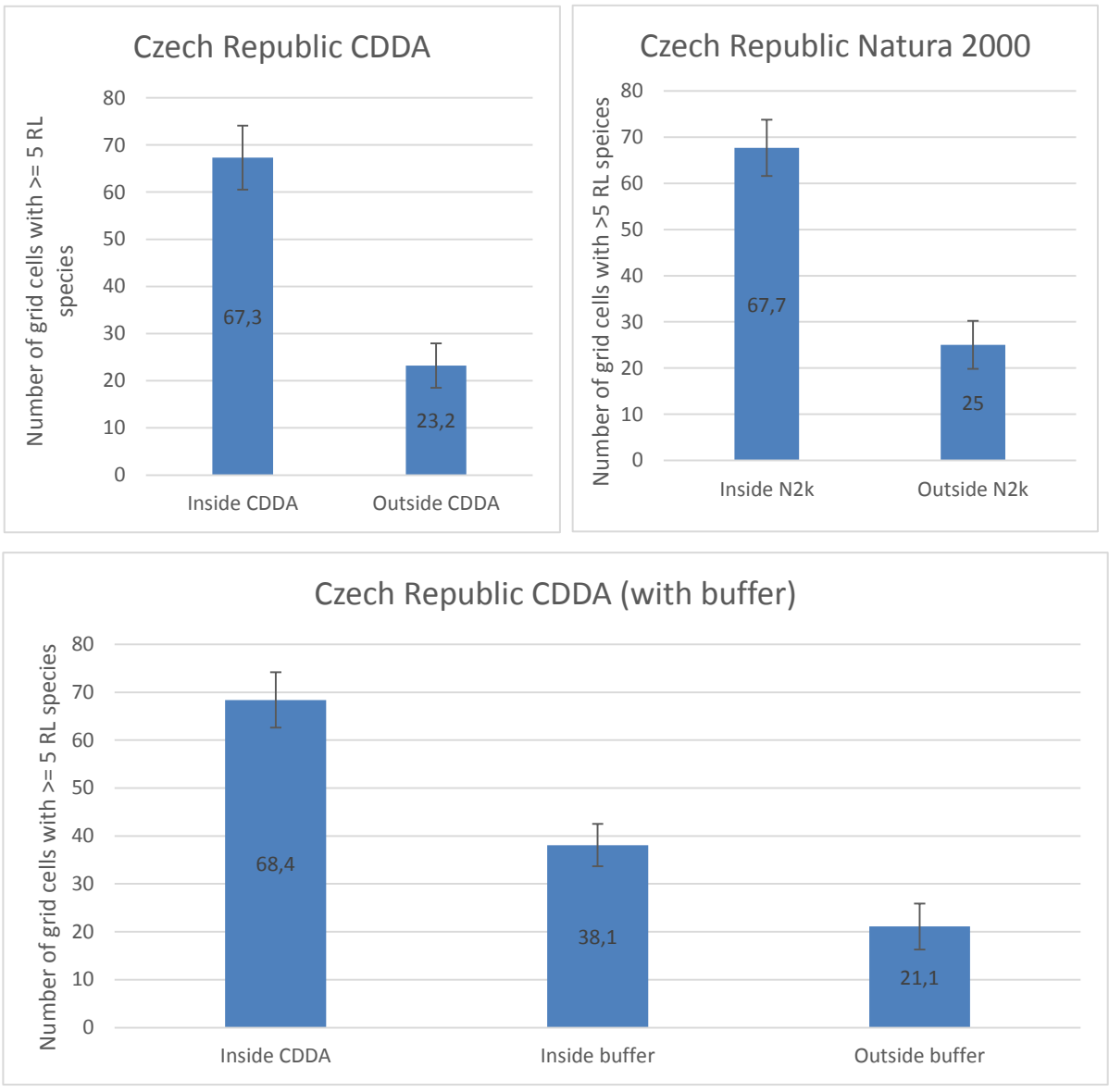
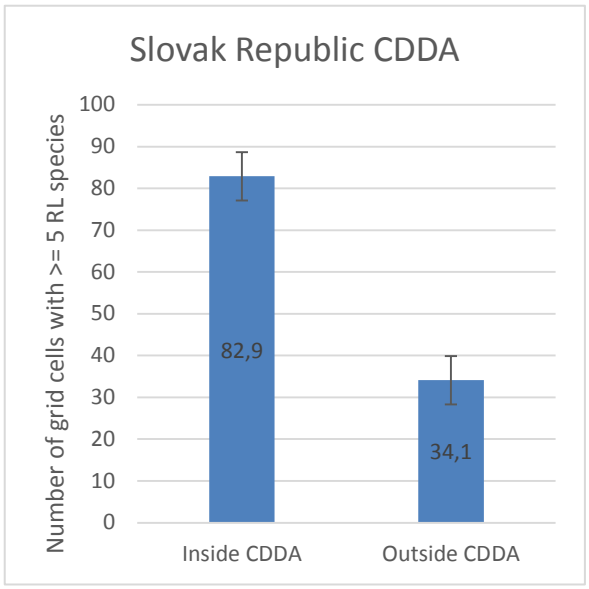
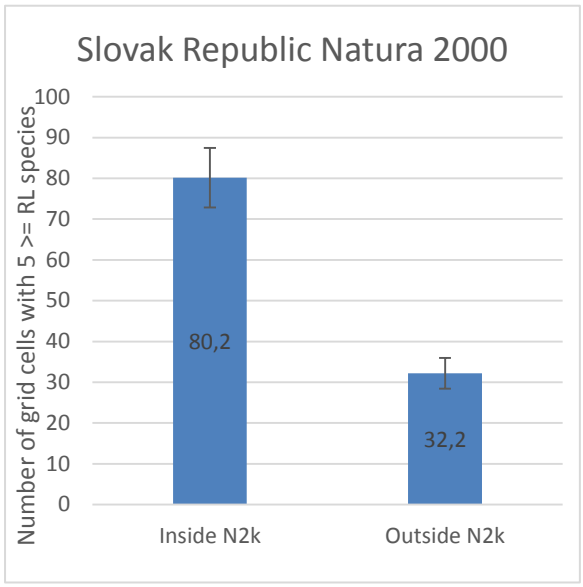


Figure 4.2 ***a-c***

[10] Note that in each of the figures 4.2, 4.3 and 4.4, "Inside CDDA" in fig b not the same as "Inside CDDA" in fig c. This is because each time the graphs are generated, a new random selection to determine the hot spots has been taken. Therefore the figures may differ.





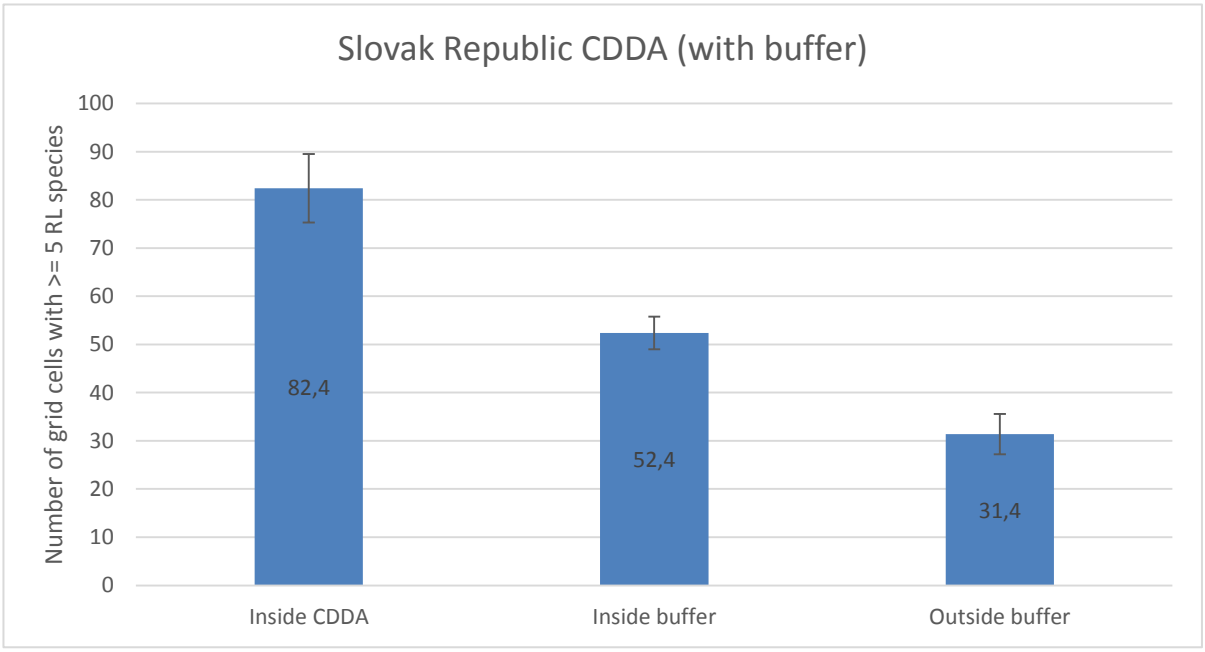


Figure 4.3 **a-c (Note that "Inside CDDA" in fig b not the same as "Inside CDDA" in fig c because each time the analysis is made, new random selections are taken. The figures may therefore differ slightly).**

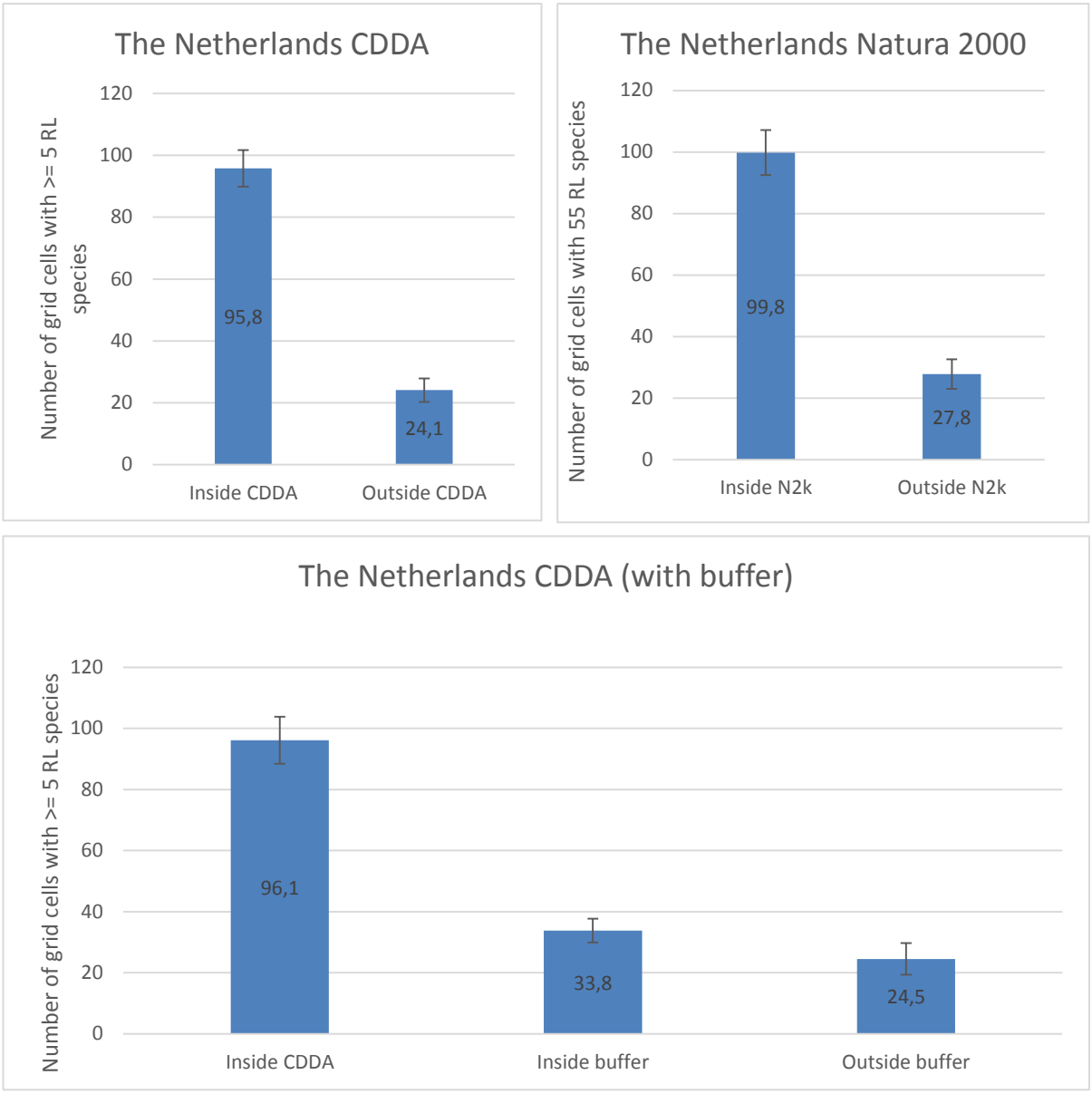


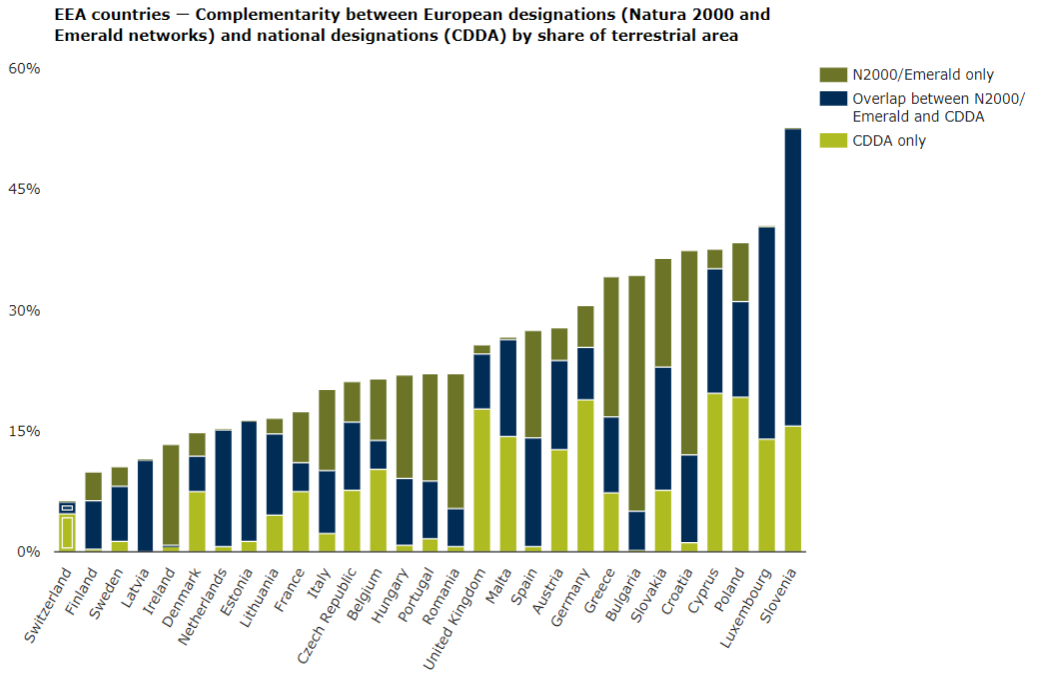
Figure 4.4 **a-c (Note that "Inside CDDA" in fig b not the same as "Inside CDDA" in fig c because each time the analysis is made, new random selections are taken. The figures may therefore differ slightly).**

5 Discussion

It is clear that CDDA sites play an important role in plant biodiversity conservation within the EU territory and are therefore also likely to do so in wider Europe. More hotspots are found within them than outside which reflects that the presence of Red List species may be a reason for their designation; it also shows that they have and may continue to provide suitable conditions for plant species that tend to have a narrower niche and therefore have a restricted distribution (which is the case for many Red List plant species). Furthermore, the figures set out in Section 2 which show that the CDDA sites provide a 29.4 % increase to the area presently covered by Natura 2000.

In order to provide further context for the discussion we have created maps of the Czech Republic, the Slovak Republic and The Netherlands in which the Natura 2000 and CDDA (hatched) networks

are overlaid (Appendices A-C). In addition, Figure 5.1 (SEBI 007, EEA, 2015b) shows the complementarity between European designations (Natura 2000 and Emerald networks) and national



Note: The overlap for Switzerland refers to Emerald Network sites rather than Natura 2000.

designations (CDDA) by share of terrestrial area.

Figure 5.1 Complementarity between European designations (Natura 2000 and Emerald networks) and national designations by share of terrestrial area (Source: EEA - SEBI 007 indicator[11])

It can be seen from the maps in the Annexes and from the figures in section 2 that Natura 2000 sites also often occur in close proximity to CDDA and that there is significant overlap between them (66% across the EU Member States). Historically the CDDA designation almost always precedes that for the Natura 2000 sites. It seems that Natura 2000 boundaries are often drawn around the 'best' part of a CDDA site; the areas that are left around them have already been designated and remain as CDDA sites. This situation is reversed (for example) in the northern part of the Slovak Republic where large areas of 'new' Natura 2000 have been designated (and where close inspection shows that they now completely surround smaller CDDA sites). Figure 5.1 shows how the Slovak and Czech Republics have similar and relatively high number of areas of Natura 2000 that do not overlap with CDDA sites, whereas the Netherlands has relatively little, with a 90% overlap.

CDDA sites can be viewed as a vital part of the protected area 'network' particularly as they deliver gains for biodiversity beyond the boundaries of Natura 2000 sites. As well as providing habitat for less and non-mobile species, they form buffer zones around Natura 2000 and they can be seen to offer 'stepping stones' and corridors for the movement of mobile species and have buffer zones of their own. This effect can be seen clearly in all three maps and the analysis of plant hotspots confirms that they do not only provide physical 'connectivity' but, based on the likely nature conservation value of their habitats, that they also provide suitable habitats and species for many mobile animal species.

[11] https://www.eea.europa.eu/data-and-maps/indicators/nationally-designated-protected-areas/nationally-designated-protected-areas-assessment-3 and https://www.eea.europa.eu/data-and-maps/daviz/complementarity-between-european-designations-1

The results for 'inside the buffer' and 'outside the buffer' for the three countries are interesting. The Dutch figures show that there are proportionately more species in the CDDA sites and proportionately less in the CDDA buffer than for the other two countries (figures 4.1, 4.2 and 4.3). This may relate to the greater intensification of the Dutch agricultural landscape than in the others, resulting in a steeper decline in hotspots in the wider countryside outside protected areas. A simple visual examination of the maps bears this out, the Netherlands has 'less' solid or cross hatched area overall and the map is more 'empty' outside the larger designated areas. This is also confirmed by Figure 5.1, where not only does the Netherlands have a lower percentage area cover of protected areas than the other two countries, but the proportion of overlapping CDDA and Natura 2000 sites is also high. This is confirmed by the Thematic Report of the Netherlands on Protected Areas to the Convention on Biological Diversity (Dutch Ministry of Agriculture, Nature Management and Fisheries, 2003) which states that, at that time, "the majority of the area of State Nature Reserves or Protected Nature Reserves already coincides with Natura 2000 Sites".

6 Future Research

In terms of future studies, it would be interesting to look at the factors underlying the patterns visible in Figure 5.1. Whilst the bar charts show the overlap based on area, a further GIS driven study could look at the 'percentage of boundaries shared between Natura 2000 and CDDA as a proportion of the total Natura 2000 boundary'. This would give a clear picture of the 'edge effect' of CDDA sites country by country and as a combined EU figure. For example, the United Kingdom and Germany both have a relatively very high proportion of CDDA sites; without them, both countries have a relatively low coverage of Natura 2000. In several other countries (Netherlands, Estonia, Portugal, Hungary, Romania, Spain, Croatia) the overlap of Natura 2000 with CDDA is almost complete. To what extent are the boundaries shared between their Natura 2000 and CDDA (the edge effect), and are they acting as ecological corridors and stepping stones? How does this differ from other countries, can this be linked to reporting by Member States on Favourable Conservation Status of sites and species? What are the historical, cultural and policy-governance issues (if any) that underlie these differences? A review of the legislation or financial arrangements for CDDA sites with recommendations in relation to agri-environment policy and delivery would be particularly useful.

Green infrastructure has Natura 2000 and CDDA areas at its heart and the approach and analysis that have been used here could be further applied to the development of new indicators for fragmentation-connectivity, and to answer questions about policy. This could potentially be facilitated by the investigation and use of additional information on habitats and networks derived from Copernicus as well as other remote sensing data.

Furthermore the approaches used in this study could be applied to other drivers of biodiversity patterns such as climate change, for example modelling the impacts of temperature increase. Another policy issue of relevance, linked to the importance of high quality habitats for a range of species and which could be modelled, is that of land abandonment.

A further obvious step is to extend the present analysis to the animal groups considered in the Natura 2000 study: birds, butterflies, amphibians, reptiles and mammals.

7 Conclusion

In conclusion the results confirm that nationally designated protected areas (CDDA sites) provide important additional value for plant biodiversity in the European Union Member States, in conjunction with the Natura 2000 network. Their value may be even greater in a wider European

context where international designation schemes, such as the Emerald network, are still in the process of design and implementation. This has already been reflected in policy at EU and national level although, as can be seen from the above, the situation can vary between countries. This study emphasises the key role that the nationally designated areas have to play in protecting Europe's plant biodiversity and suggests that an overall strengthening in the legislation or financial arrangements for area protection at the national level would be beneficial.

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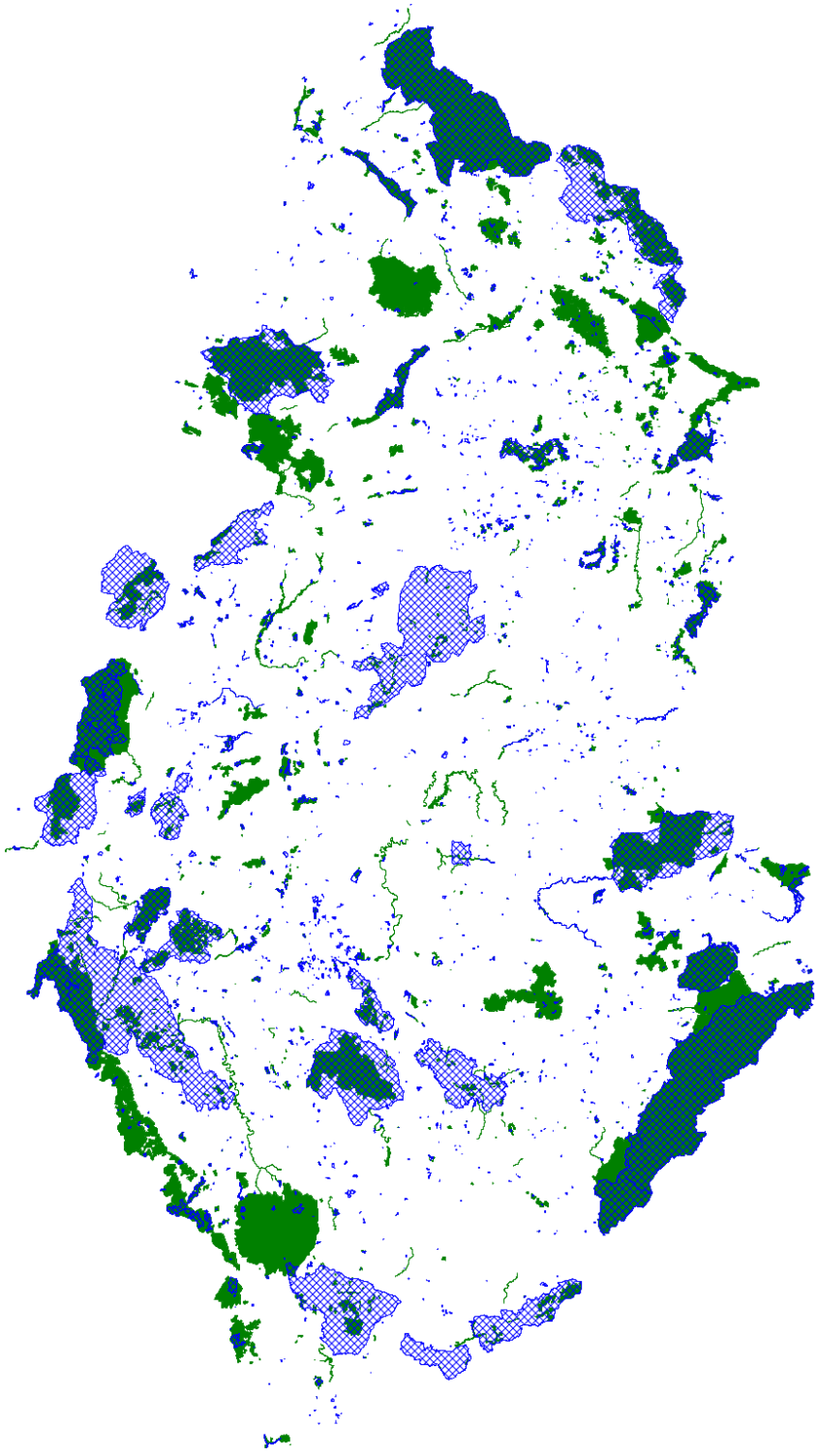
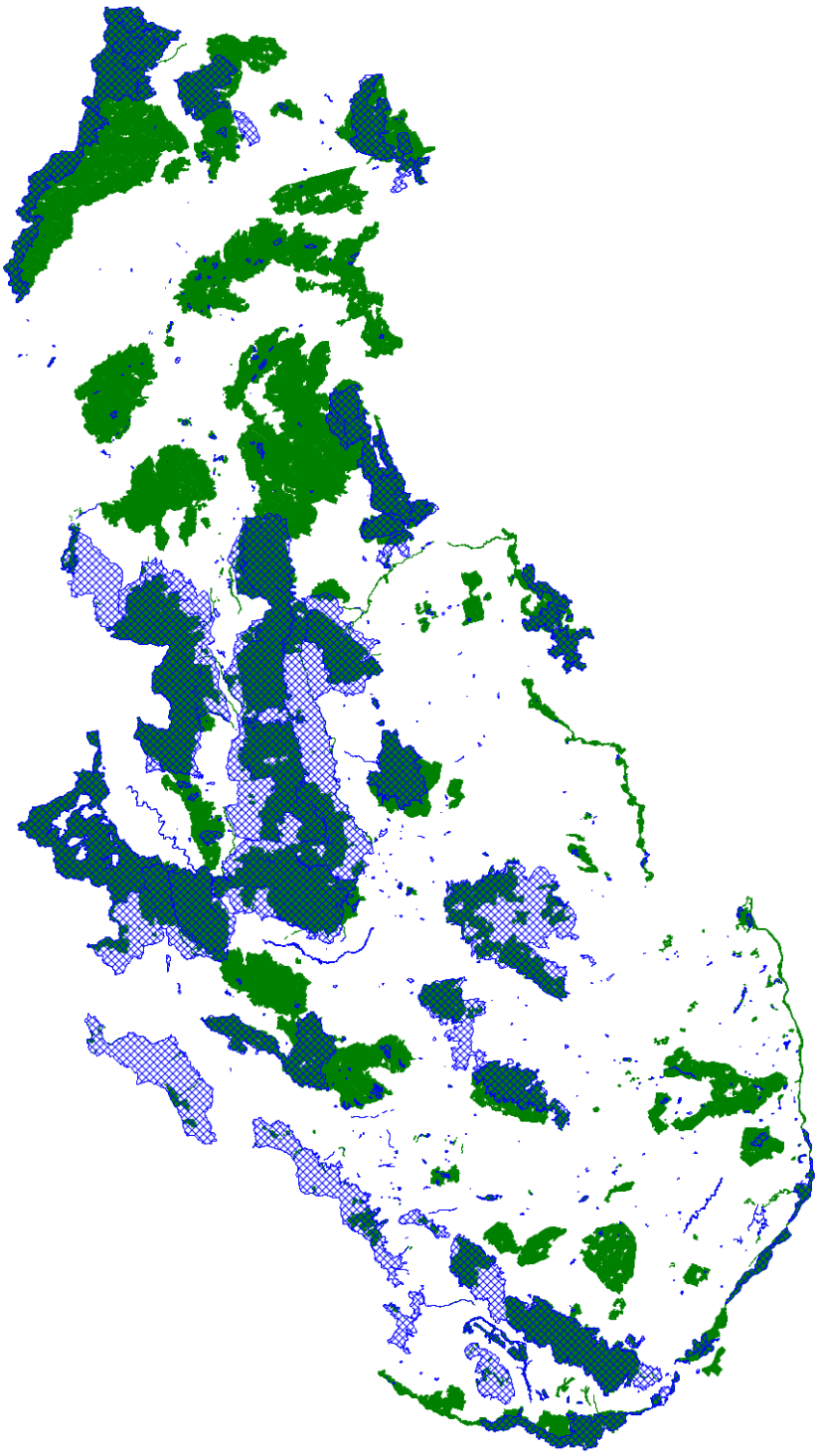
Appendix A – Natura 2000 and CDDA (hatched) network in the Czech Republic



Appendix B – Natura 2000 and CDDA (hatched) network in the Slovak Republic



Appendix C – Natura 2000 and CDDA (hatched) network in The Netherlands