

POLICY PERSPECTIVE

The Contributions of the EU Nature Directives to the CBD and Other Multilateral Environmental Agreements

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Abstract

Through a review of published studies and new analyses of publicly available data, we assess how the European Union (EU) Nature Directives complements the CBD strategic goals for 2020 as set out in the 20 Aichi Targets, thereby addressing a question posed by the European Commission about the coherence of the Directives with other international biodiversity commitments. We find evidence that the Directives complement several Aichi Targets and other Multilateral Environmental Agreements (MEAs). For example, 92% of the EU's Important Bird and Biodiversity Areas (IBAs), many of them otherwise unprotected, are partly or wholly covered by the Natura 2000 network of protected areas (contributing to Aichi Target 11). Species listed on Annex I of the Birds Directive have fared better than other species (Aichi Target 12). As 65% of EU citizens live within 5 km of a Natura 2000 site, and 98% within 20 km, these sites have the potential to raise awareness of biodiversity (Aichi Target 1) and to deliver ecosystem services to a high proportion of the EU's population (Aichi Target 14). The Nature Directives provide a regulatory framework that, with fuller implementation, will help EU Member States to meet their obligations under the CBD and other MEAs.

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Introduction

The 28 Member States of the European Union (EU) are legally bound by the 1979 (amended in 2009) Birds Directive and the 1992 Habitats Directive, jointly referred to as the Nature Directives, which form the cornerstone of EU conservation law. These Directives oblige all Member States to safeguard and restore threatened species and habitats. Countries joining the EU are required to bring their national legislation into line with these Directives, so that the aims of the Directives are codified in national laws relating to wildlife conservation and other policy areas that impact on target sites and species.

The Directives have two main pillars, a strict system of species protection and the Natura 2000 network of protected sites. Natura 2000 comprises over 27,300 protected sites (around 3,000 of them having a significant marine component) covering 18% of the land area of the EU (<http://ec.europa.eu/environment/nature/natura2000/barometer/index'en.htm>). It forms the world's largest

network of conservation sites under a single regulatory framework (Evans 2012). Natura 2000 sites are highly heterogeneous and most contain human populations, agricultural land, and forestry (Tsiafouli *et al.* 2013). The Directives also contain Annexes of species for which Member States must implement special conservation measures. This may take the form of legal protection from persecution and disturbance, habitat protection and restoration, and monitoring and research. The EU LIFE funding instrument provides targeted, albeit modest, financial support to conservation, and additional resources are available through the Common Agricultural Policy in the form of agri-environment measures (Matthews 2013), which in many countries are targeted toward Natura 2000 sites, and through EU Structural Funds and the new EU Natural Capital Financing Facility (Kettunen *et al.* 2014).

There is empirical evidence that both the Birds Directive (Donald *et al.* 2007; Deinet *et al.* 2013; Sanderson *et al.* 2015) and the Habitats Directive (Pellissier *et al.*

2013, 2014; Brodier *et al.* 2014; Kallimanis *et al.* 2015, but see Santana *et al.* 2013) have had a positive impact on the EU's biodiversity. However, there remain considerable challenges to achieving full implementation of the Directives (Křenová & Kindlmann 2015), which could be improved with more effective planning and enforcement, more effective, consistent and policy-relevant monitoring (Davis *et al.* 2014) and, perhaps most important, increased funding (Kettunen *et al.* 2011; Hochkirch *et al.* 2013; Louette *et al.* 2015).

In 2014, the EC commissioned a "Fitness Check" of the EU Nature Directives under the Regulatory Fitness and Performance Programme (REFIT), which explicitly poses the question: "How coherent are the Directives with international and global commitments on nature and biodiversity?" (<http://ec.europa.eu/environment/nature/legislation/fitness%20check/docs/Mandate%20for%20Nature%20Legislation.pdf>).

We assess the extent to which the Directives complement or directly contribute to a wider multilateral environmental agreement, the Convention on Biological Diversity (CBD). All EU Member States, and the EU in its own right, have ratified the CBD. The CBD Strategic Plan for 2011–2020 contains five strategic goals under which are organized the 20 Aichi Biodiversity Targets. The Nature Directives and the CBD both emphasize the conservation of threatened species, the protection of important habitats and the integration of societal considerations in conservation management. These commonalities are recognized in the EU Biodiversity Strategy (<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011SC05406&from=EN>), which links the full implementation of the Nature Directives with progress toward Aichi Targets 11 (site protection) and 12 (species protection).

Rationale

Despite these commonalities, and much recent attention on measuring progress toward the Aichi Targets (Tittensor *et al.* 2014; Butchart *et al.* 2015), there has been no quantitative assessment of the extent to which the Directives contribute to the full set of Aichi Targets, either directly or by complementarity (i.e., creating an environment within which the Aichi Targets are more likely to be met). Here, we map the objectives and successes of the Nature Directives onto the 20 Aichi Targets to assess their complementarity. We identify six Aichi Targets whose complementarity with the EU Nature Directives can be assessed empirically (Table 1).

Counterfactual assessments of what the EU conservation landscape would look like in the absence of the Di-

rectives are difficult because the Directives are codified in national law in ways unique to each Member State (European Environment Agency 2012). However, there is ample evidence that the Directives have yielded additional benefits. For example, over 50% of Natura 2000 sites are not covered by any other form of protected area designation (see below). Countries acceding to the EU show substantial increases in their coverage by protected areas around the time of accession (European Environment Agency 2012), and increases in the populations of target species thereafter (Sanderson *et al.* 2015). Even in the United Kingdom, which has a longer history of conservation legislation than most countries, the "Directives have added a layer of protection for nature ... above and beyond that provided in previous national legislation" (Institute for European Environmental Policy 2013). However, some of these conservation gains may have accrued in the absence of EU legislation, and the unique contribution of the Directives cannot be quantified.

Species protection is explicitly addressed in just one Aichi target (Target 12), and the contribution of the Directives to species protection have already been quantified (e.g., Donald *et al.* 2007; Sanderson *et al.* 2015). The complementarity of Natura 2000 is less well understood, yet the Aichi targets are divided in such a way that site protection, and the wider benefits thereof, are spread across several targets. We therefore undertake new analyses to assess the role of Natura 2000 in meeting Aichi targets.

Full details of the analyses are presented in Appendix S1. Data sources for each analysis are referenced in Table 1, which also summarizes some of the limitations of the data used.

Complimentarily and contribution of the EU Nature Directives to the CBD Aichi Targets

Aichi Target 1—awareness of biodiversity

As an assessment of the extent to which the Natura 2000 network might complement the target that "people are aware of the value of biodiversity," we quantified the extent to which people in the EU live in proximity to Natura 2000 sites, since proximity to wildlife has been shown to promote environmental awareness (e.g., Miller 2005) and there is a correlation between the time spent in nature as a child and the level of support to environmental protection as an adult (Wells & Lekies 2006). We used two measures of human population distribution, one based on commune-level census data, and the other based on satellite-detected night

Table 1 Summary of assessment of the contribution of Natura 2000 to the CBD Aichi Targets

Aichi Target	Test metrics	Test of contribution or complementarity, and limitations of metric	Sources of data
1: "By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably"	The proportion of the EU's population living within accessible distance of a Natura 2000 site	Complementarity Remoteness/disconnection from wild nature hinders an awareness of biodiversity, but proximity to wild nature does not on its own necessarily increase it.	Human population: Population density disaggregated with Corine land cover 2000, European Environment Agency ^{a,b} http://www.eea.europa.eu/data-and-maps/data/population-density-disaggregated-with-corine-land-cover-2000-2 Night lights: Version 4 DMSP-OLS Night-time Lights Time Series, NOAA Earth Observation Group ^{a,b} http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html#AVSLCFC Accessibility: Natural England (2015)
5: "By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced"	Rates of forest loss between 2000 and 2012 within Natura 2000 sites compared with rates of forest loss outside Natura 2000 sites	Contribution The forest loss statistics used do not differentiate between natural forest and plantations, nor between different types of natural forest	Forest loss and tree cover: Hansen <i>et al.</i> (2013) Human population: see Target 1 Altitude: SRTM Digital Elevation Model, USGS http://glcf.umd.edu/data/srtm/ Distance to roads: Vector map Level 0, ^{a,b} www.mapability.com/index1.html?http&&www.mapability.com/info/vmap0_intro.html
11: "By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes"	The increase in the number of ecoregions having less than 17% coverage by protected areas when areas protected only by Natura 2000 are excluded The proportion of all Important Bird and Biodiversity Areas (IBAs) inside Natura 2000 sites in each country and across the EU as a whole	Contribution Natura 2000 sites do not necessarily cover the most representative or pristine elements of each ecoregion Contribution	Terrestrial ecoregions: WWF terrestrial ecoregions of the world (Olson <i>et al.</i> 2001) IBAs: http://www.birdlife.org/datazone/site Distribution of protected areas: http://www.protectedplanet.net/ Distribution of UNESCO World Heritage Sites: http://whc.unesco.org/en/list/
12: "By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained"	The proportion of all Important Bird and Biodiversity Areas (IBAs) listed for globally threatened species or species threatened at a European level that are contained within Natura 2000 sites across the EU	Complementarity Substantial proportions of some threatened species' ranges may fall outside IBAs	As for Aichi Target 11, plus: Global conservation status: IUCN Red List (http://www.iucnredlist.org/) European conservation status: BirdLife International (2004)

Continued

Table 1 Continued

Aichi Target	Test metrics	Test of contribution or complementarity, and limitations of metric	Sources of data
14: "By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable"	The proportion of the EU population living close to Natura 2000 sites	Complementarity Proximity to Natura 2000 sites does not necessarily guarantee access to/benefits of the ecosystem services they provide	As for Aichi Target 1
15: "By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification"	Carbon stocks within the Natura 2000 sites as a proportion of total EU carbon stocks	Complementarity The metric used relates only to estimates of current carbon stocks, not to their enhancement or restoration	Carbon stocks: Kapos <i>et al.</i> (2008) ^{a,b}

Note: Under "Sources of data", ^aindicates data of uncertain accuracy and ^bindicates data with coarse spatial resolution.

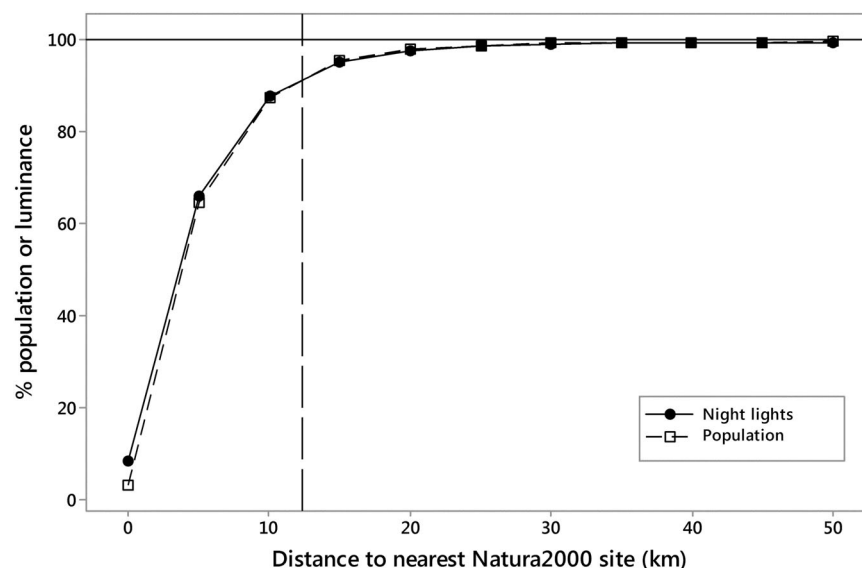


Figure 1 Percentages of the total EU population (estimated directly and from luminance from night lights) living within different distances of Natura 2000 sites. The vertical line at 12.35 km represents the mean distance traveled by participants in the MENE survey (Natural England 2015) to visit a number of wildlife habitats for recreational purposes.

lights (Appendix S1). We estimate that 65% of EU citizens live within 5 km of a Natura 2000 site, and 98% live within 20 km (Figures 1 and S1). This accessibility is reflected in visitor numbers; Natura 2000 sites are estimated to receive between 1.2 and 2.2 billion visitor days each year (ten Brink *et al.* 2011). The Directives also offer the opportunity for the general public and national and international NGOs to be involved in the designation, monitoring and management of Natura 2000, with the potential for greater engagement by the public and stakeholder groups (landowners, hunters, farmers etc.) in nature conservation and the growth of volunteer networks of site support groups and citizen scientists (Unnerstall 2008).

Aichi Target 5—loss of natural habitats

We are unaware of any attempt to quantify the extent to which Natura 2000 designation slows habitat change across multiple countries. Using a global assessment of tree cover loss (Hansen *et al.* 2013), we estimate that the probability of significant forest loss between 2000 and 2012 was lower in forested or partly forested 1 km² within Natura 2000 than outside (Figure 2; Appendix S1). Some forest loss within Natura 2000 is likely to result from management for nature conservation, making our assessment conservative. Data on the loss of other natural habitats within and outside Natura 2000 are not available at a resolution appropriate for analysis.

Aichi Target 11—protected area coverage

Target 11 aims to protect 17% of terrestrial areas in “ecologically representative” and “well-connected” systems and to include “areas of particular importance for biodiversity.” We quantified the spatial overlap between Natura 2000 and (1) the EU’s terrestrial ecoregions and (2) all the EU’s Important Bird and Biodiversity Areas (IBAs), both at a country level and across the EU as a whole. The European Court of Justice has indicated that the coverage of IBAs by the Natura 2000 network should be used in assessing whether Member States have met their obligations regarding the designation of key sites (http://ec.europa.eu/environment/nature/info/pubs/docs/others/ecj_rulings-en.pdf). We also intersected the Natura 2000 and IBA networks with all other protected (Appendix S1).

Of the EU’s 42 ecoregions, 37 (88%) had at least 17% coverage by area by all classes of protected area designation, falling to 23 (55%) when areas protected only by Natura 2000 were excluded (Figure 3a). At the national level, 84 of the 107 country/ecoregion combinations (79%) had at least 17% coverage by all classes of protected area, falling to 56 (52%) when areas pro-

tected only by Natura 2000 were excluded (Figure 3b). Across the EU, 94% of all IBAs are wholly or partly covered by Natura 2000 (Figure S2), with 72% coverage by area (Figures 4 and S3). Of the area of IBAs within Natura 2000, 47% is otherwise unprotected (Figure 4). The designation of marine Natura 2000 sites lags behind that of terrestrial designations, and is unlikely to meet the 10% coverage of key marine areas required by Aichi Target 11. Around half the area covered by Natura 2000 is otherwise unprotected (Figure 4). This is likely to underestimate the contribution of the Directives, since Natura 2000 designation often triggers further protective designation (European Environment Agency 2012).

The connectivity of the Natura 2000 network was assessed with a nearest-neighbor analysis, which indicated that nearly half (>11,000; 44.5%) of all sites were contiguous with one or more other sites, and that sites not contiguous with other sites were a mean of just 2.7 km from the closest site, suggesting that the network is well-connected and thus spatially aligned to provide a useful role in mitigating climate-change induced range shifts (Kettunen *et al.* 2007).

Aichi Target 12—species extinction

The performance of the EU Directives in preventing the “extinction of known threatened species,” and ensuring that their “conservation status... has been improved,” has previously been assessed by Donald *et al.* (2007) and Sanderson *et al.* (2015), who showed that species listed on Annex I of the Birds Directive showed greater improvements in their population trajectories than did non-Annex I species after, but not before, the introduction of the Directive, and within, but not outside, the EU. Natura 2000 effectively captures the ranges of a high proportion of threatened species (Gruber *et al.* 2012; Trochet & Schmeller 2013). Over 90% of IBAs designated for their importance to threatened species are included in Natura 2000 (Figure 4). The species protection measures of the Directives have also been important in the recovery of many species (Deinet *et al.* 2013, European Commission 2015).

Aichi Target 14—ecosystem services

Safeguarding sites important for biodiversity conservation provides substantial benefits to human well-being (e.g., European Environment Agency 2012; Larsen *et al.* 2012). It has been estimated that the value of the ecosystem services delivered by Natura 2000 is approximately €200–300 billion per year (2–3% of the EU’s GDP), without taking account of benefits to human health (ten Brink *et al.* 2011). The growing public recognition of these

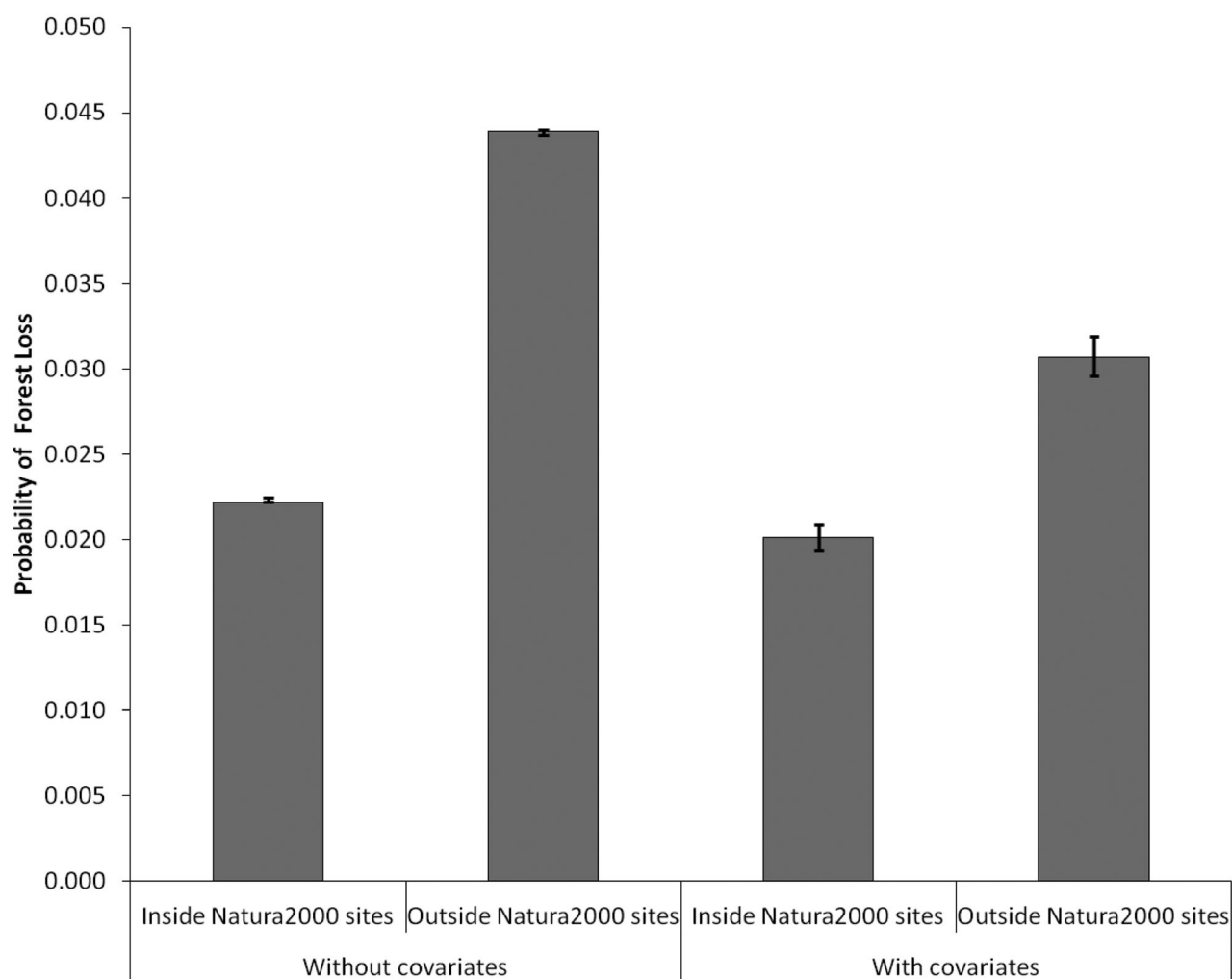


Figure 2 Probability (± 1 SE) of significant forest loss between 2000 and 2012 in forested or partially forested 1 km² within and outside the Natura 2000 network, modeled with and without covariates (altitude, distance to nearest major or primary road, and human population density). See Appendix S1 for full methods.

benefits is evidenced by increased property values close to such sites (Mourato *et al.* 2010). Most EU citizens live close to Natura 2000 sites (Figure 1), which receive 1.2–2.2 billion visitor days per year yielding annual recreational benefits worth €5–9 billion (ten Brink *et al.* 2011), suggesting that they can “contribute to health, livelihoods and well-being.” In one region of Spain, increases in human well-being between 1989 and 2009 were significantly higher within Natura 2000 sites than outside (Bonet-García *et al.* 2015).

Aichi Target 15—carbon and climate change

Estimated below and above ground carbon stocks per unit area in Natura 2000 sites are 43% higher than the

average across the rest of the EU (Figure 5), “thereby contributing to climate change mitigation.” This importance has been recognized by the EU in its assessment of the economic benefits of Natura 2000 (ten Brink *et al.* 2011). Requirements in the Directives to restore habitats are likely to increase the amount of carbon they store. As some of this carbon is stored in trees, there is a clear synergy with Aichi Target 5. Many areas of high-carbon peatland are captured by the Natura 2000 network (e.g., in Caithness, UK), and are benefiting from EU funding aimed specifically at bogs and mires, and hence carbon storage. No data are available on changes in carbon stocks over time, so it is not possible to assess whether Natura 2000 contributes to the Aichi target to “enhance” carbon stocks.

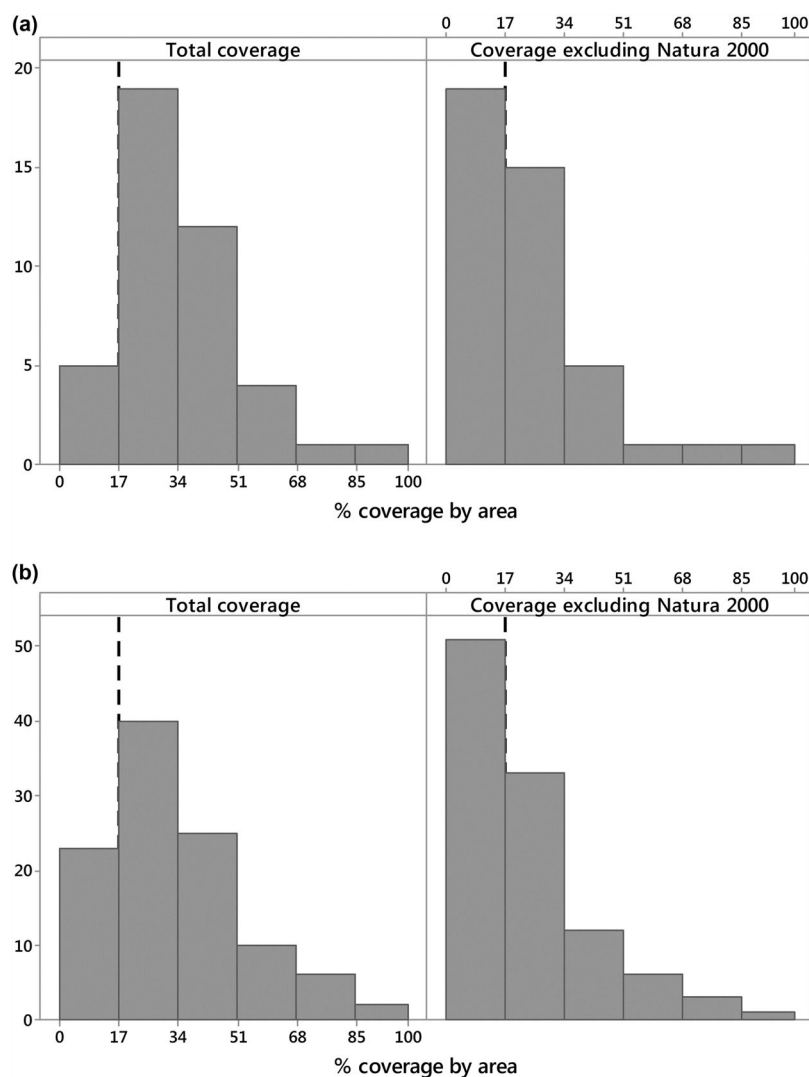


Figure 3 Histograms of percentage coverage (by area) of different ecoregions (Olson *et al.* 2001) by all classes of protected area (left) and by all classes of protected area excluding Natura 2000 (right), (a) across the entire EU and (b) by country/ecoregion combinations. The reference line indicates the 17% protected area coverage target of Aichi Target 11.

Other Aichi Targets

The Nature Directives require EU Member States to account for biodiversity in development and planning processes, and the reporting requirements of the Directives mean that status, threats, and trends in biodiversity are included within national reporting systems (Aichi Target 2). Most Natura 2000 sites contain agriculture and forestry (Tsiafouli *et al.* 2013) which designation requires be sensitively managed, thus contributing to Aichi Targets 7 and 8. The Directives encourage the preparation of management plans for selected sites and species, thus contributing to the preparation of national action plans (Aichi Target 17). Both Directives require Member States to collect scientific information on the status and trends of target species and habitats and changes in them (Aichi Target 19). The EU LIFE funding instrument, established

in part to support the implementation of the Nature Directives, has since 1992 provided around €3.4 billion to support over 4,000 biodiversity conservation projects, and Article 8 of the Habitats Directive requires Member States to establish prioritized action frameworks to support the financing of nature conservation (Aichi Target 20).

Other multilateral environmental agreements

The EU and its Member States are bound by a number of other agreements, including the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention; 1979), the Convention on Migratory Species (CMS, or Bonn Convention; 1979) and the

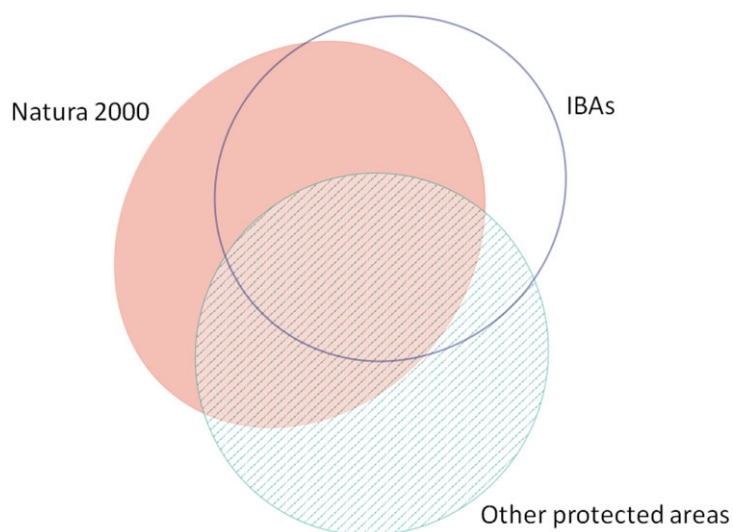


Figure 4 Proportional-area Venn diagram of the relative coverage by area of Natura 2000, Important Bird and Biodiversity Areas (IBAs) and other protected areas (all IUCN categories, not necessarily designated for nature conservation), and their respective intersections. Plotted using “eulerAPE” (Micallef & Rodgers 2014), which uses ellipses to enable the exact proportions, by area, of each segment to be represented.

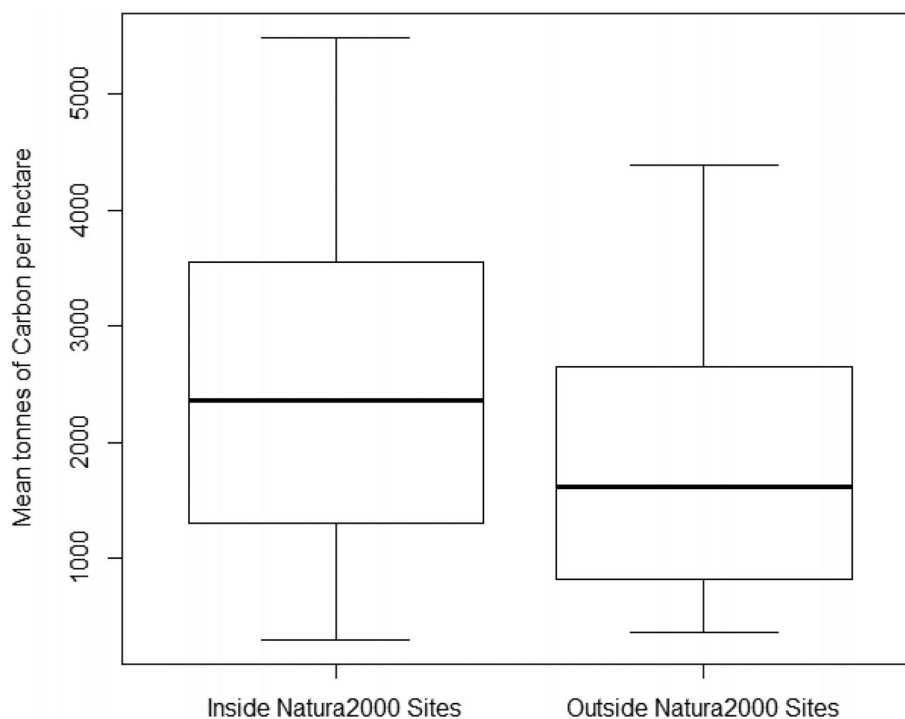


Figure 5 Box-and-whisker plot of total above and below ground carbon per hectare inside and outside Natura 2000. The horizontal bar indicates the median, the box contains the interquartile range and the whiskers the 95 percentile limits.

Convention on Wetlands (Ramsar Convention; 1971). The Directives are the means by which the EU meets its obligations under the Bern Convention, and Natura 2000 is the contribution from EU Member States to the Bern Convention’s Emerald Network. The Birds Directive makes special mention of the importance of migratory species and Article 4 requires Member States to

protect areas of importance for migratory species, thus contributing directly to the CMS and its agreements, such as the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA). Article 4 also requires “Member States to pay particular attention to the protection of wetlands of international importance,” as defined under the Ramsar Convention; indeed, 83.3% of

the area of the 659 Ramsar sites in the EU for which digital boundaries are available falls inside Natura 2000. The 106 natural and mixed UNESCO World Heritage Sites in the EU whose digital boundaries were available for analysis have 91.7% of their total area captured by the Natura 2000 network.

Policy implications

The Directives set out principles and targets that are enshrined in national law, thereby creating the legal framework necessary for meeting the requirements of other international obligations. We suggest that fuller implementation of the EU Nature Directives will help the EU and its Member States to meet their commitments under a number of agreements. This will require the wider designation and better management of new sites, particularly IBAs, a significant improvement in the management of existing sites, particularly in more recently acceded states (Křenová & Kindlmann 2015), significantly better representation in the Appendices of the Directives of currently underrepresented taxa (e.g., Gruber *et al.* 2012; Rubio-Salcedo *et al.* 2013) and better capture of threatened species (Maiorano *et al.* 2015), and substantially increased funding. Furthermore, the extent to which the Nature Directives achieve their aims and contribute to other international agreements will continue to depend largely on the degree to which they are undermined by other policy frameworks, such as those relating to agriculture (European Environment Agency 2015).

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Figure S1. Percentages of the each EU Member State's population living within different distances of Natura 2000 sites.

Figure S2. Number of IBAs qualifying under different criteria that are wholly (>98%), partially (2–98%) or not (<2%) covered by Natura 2000 sites across the EU.

Figure S3. Percentage coverage by area of all IBAs by Natura 2000 sites in each EU country.

Appendix S1.

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