

Annex III: Literature review

Author	Link	Citation	Year	Member State	Region	Topics	Relevance	Biome(s)	Aim/Results
Abellán et al.		Abellán, P., Sánchez-Fernández, D. (2015) A gap analysis comparing the effectiveness of Natura 2000 and national protected area networks in representing European amphibians and reptiles. <i>Biodiversity and Conservation</i> 24, 1377-1390.	2015			Effectiveness	1	Terrestrial	Protected area networks represent one of the mainstays of worldwide conservation policies and play a key role in the protection of biodiversity. While numerous studies have evaluated the extent to which reserves fulfil their role of protecting biodiversity in Europe at national and subnational scales, their performance across the whole of Europe has seldom been assessed. Here we assess the effectiveness of nationally designated protected areas and the pan-European Natura 2000 network in representing and maintaining over time European amphibian and reptile biodiversity using a comprehensive and newly available species occurrence dataset. Overall, our results show that often national protected areas and Natura 2000 sites perform poorly in representing amphibians and
Assis et al.		Assis, J., Fragkopoulou, E., Serrão, E.A., Horta e Costa, B., Gandra, M., Abecasis, D. (2021) Weak biodiversity connectivity in the European network of no-take marine protected areas. <i>Science of the Total Environment</i> 773.	2021		Multiple geographic regions	Connectivity	1	Marine	the increasing number of agreements aiming for effective and well-connected networks of Marine Protected Areas . However, the extent to which individual MPAs are connected remains mostly unknown. Here, we use a biophysical model tuned with empirical data on species dispersal ecology to predict connectivity of a vast spectrum of biodiversity in the European network of marine reserves . Our results highlight the correlation between empirical propagule duration data and connectivity potential and show weak network connectivity and strong isolation for major ecological groups, resulting from the lack of direct connectivity corridors between
Cunha et al.		Cunha, N.S., Magalhães, M.R. (2019) Methodology for mapping the national ecological network to mainland Portugal: A planning tool towards a green infrastructure. <i>Ecological Indicators</i> 104, 802-818.	2019	Portugal	Southern Europe	Connectivity, OECMs	1	Terrestrial	This concept moves beyond traditional approaches of «nature protection and preservation», focusing on the ecosystemic approach and the «continuum naturale», emphasising the quality or potentiality of physical components, allowing the articulation with the nature conservation and atrisk areas. In addition, this study shows that the existing protected areas in Portugal, namely Natura 2000 and classified protected areas, are insufficient to ensure landscape ecological balance and avoid fragmentation. The main goal is to develop a methodology to map a National Ecological Network for mainland Portugal, establish the theoretical framework
de Castro-Pardo et al.		de Castro-Pardo, M., Pérez-Rodríguez, F., Martín-Martín, J.M., Azevedo, J.C. (2019) Modelling stakeholders' preferences to pinpoint conflicts in the planning of transboundary protected areas. <i>Land Use Policy</i> 89, 104233.	2019	Spain, Portugal	Southern Europe	Transboundary	1	Terrestrial	In this paper, we propose a sequentially participative model for planning in transboundary protected areas based on the Analytical Hierarchy Process, Goal Programming and Monte Carlo simulation. The model was developed with two scenarios: one determinist and another with simulations that provide a multi-level ranking of the most relevant goals according stakeholders' preferences to establish priorities in the planning of protected areas. Moreover, the proposed methodology is capable of identifying conflicts, providing a comparison between the
de la Fuente et al.		de la Fuente, B., Mateo-Sánchez, M.C., Rodríguez, G., Gastón, A., Pérez de Ayala, R., Colomina-Pérez, D., Melero, M., Saura, S. (2018) Natura 2000 sites, public forests and riparian corridors: The connectivity backbone of forest green infrastructure. <i>Land Use Policy</i> 75, 429-441.	2018	Spain	Southern Europe	Connectivity	1	Terrestrial	The connectivity of protected areas, such as the Natura 2000 network, is crucial for maintaining healthy ecosystems and for the delivery of ecosystem services into the wider landscapes in which they are embedded. We here present a novel combination of methods for connectivity analysis across heterogeneous landscapes, integrating graph-based analyses, least-cost path modelling and the Probability of Connectivity metric, and apply these methods to the network of Natura 2000 woodland sites in mainland Spain. We deliver key insights on the connectors between Natura 2000 sites: their location and width , their prioritization in conservation and restoration scenarios involving different land uses, and the bottlenecks found along them. Based on these results, we characterize the landscapes traversed by the connectors within and outside the protected sites to
Di Franco et al.		Di Franco, A., Hogg, K.E., Calò, A., Bennett, N.J., Sévin-Allouet, M.A., Esparza Alaminos, O., Lang, M., Koutsoubas, D., Prvan, M., Santarossa, L., Niccolini, F., Milazzo, M., Guidetti, P. (2020) Improving marine protected area governance through collaboration and co-production. <i>Journal of Environmental Management</i> 269.	2020	Croatia, France, Greece, Italy, Slovenia, Spain	Multiple geographic regions	Effectiveness	1	Marine	Marine protected areas socio-ecological effectiveness depends on a number of management and governance elements, among which stakeholder engagement and community support play key roles. Collaborative conservation initiatives that engage stakeholders in action research and knowledge co-production processes can enhance management and governance of MPAs. To design effective strategies aimed at reconciling biodiversity conservation and management of sustainable human uses, it is key to assess how local communities respond to such initiatives and identify the set of contextual factors, institutional, local and individual, potentially affecting these responses. This paper presents the approach and results of one such initiative, spanning 6 EU countries and 11 MPAs in the Mediterranean
Fortuna et al.		Fortuna, C.M., Cañadas, A., Holcer, D., Brecciaroli, B., Donovan, G.P., Lazar, B., Mo, G., Tunesi, L., Mackelworth, P.C. (2018) The coherence of the European Union Marine Natura 2000 network for wide-ranging charismatic species: A mediterranean case study. <i>Frontiers in Marine Science</i> 5.	2018	Italy, Albania, Slovenia, Croatia and Montenegro	Southern Europe	Connectivity, Transboundary	1	Marine	Sea, focusing on small-scale fishers as key MPA users. Through a collaborative project, managers and fishers The Natura 2000 (N2k) network is an important site-based protection tool for the protection of biodiversity in Europe. However, for highly mobile and adaptable marine species, such a tool might not be the most effective way to achieve conservation objectives, unless this includes a broader consideration of the direct threats to these species throughout their range. Considering that the N2k network requires that a "significant proportion" of 60% of the population be under protection, this creates a challenge for the conservation of these wide-ranging species. This paper reviews the efficacy of the N2k network as it is presently implemented within the Adriatic Sea for
Friedrichs et al.		Friedrichs, M., Hermoso, V., Bremerich, V., Langhans, S.D. (2018) Evaluation of habitat protection under the European Natura 2000 conservation network – The example for Germany. <i>PLoS One</i> 13.	2018	Germany	Western Europe	Designation, Connectivity, Effectiveness	1	Terrestrial	The world's largest network of protected areas—Natura 2000 (N2000)—has been implemented to protect Europe's biodiversity. N2000 is built upon two cornerstones, the Birds Directive, which lists 691 bird species (plus one additional bird genus with no further classification) and the Habitats Directive, which lists next to a variety of species, 233 habitat types to be protected. There is evidence of the positive impact of the Directives on the EU's biodiversity, although the overall improvement reported for

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Gómez-pazo et al.	Gómez-pazo, A., Pérez-alberti, A., Fraga-santiago, P., Souto-souto, M., Otero, X.L. (2020) Contribution of gis and geochemical proxies to improving habitat identification and delimitation for the natura 2000 network: The case of coastal lagoons in galicia (nw iberian peninsula). Applied Sciences (Switzerland) 10, 1-20.	2020	Spain	Southern Europe	Designation	1	Terrestrial & Marine	<p>The Natura 2000 network is an ambitious European project aimed at nature conservation. Nevertheless, the identification and delimitation of habitats is a complex task and simultaneously essential for correct ecosystem management. In this study we compared the current habitat delimitation and designation and the results produced by Geographic Information Systems and geochemical proxies for the categorization of four coastal lakes in Galicia .</p> <p>The findings reveal important errors in the delimitation/designation. The first error is the designation of all four lakes as Coastal lagoons , when geochemical data indicate that two of these lakes were always freshwater lakes and should consequently be classified as Natural eutrophic lakes . Another error is of conceptual origin, because the lakes comprise a unique functional system composing of diereent environmental units .</p>
Guidetti et al.	Guidetti, P., Addis, P., Atzori, F., Bussotti, S., Calò, A., Cau, A., Culioli, J.M., De Lucia, G., Di Franco, A., Di Lorenzo, M., Follesa, M.C., Gazale, V., Massaro, G., Mura, F., Navone, A., Pala, D., Panzalis, P.A., Pusceddu, A., Ruiu, A. (2019) Assessing the potential of marine Natura 2000 sites to produce ecosystem-wide effects in rocky reefs: A case study from Sardinia Island (Italy). Aquatic Conservation: Marine and Freshwater Ecosystems 29, 537-545.	2019	Italy	Southern Europe	Effectiveness	1	Marine	<p>A number of policy measures have been adopted to cope with ongoing ocean degradation. Marine protected areas are among them. MPAs and their coverage have increased worldwide, including in EU waters. Natura 2000 sites are at the core of the EU biodiversity conservation strategy and have been established to protect habitats and species included in two EU directives. Besides their specific objectives, their potential to contribute to an ecosystem-wide conservation and their complementarity with other national and supranational initiatives have been called into question.</p> <p>Using visual censuses on rocky reefs, the biomass of whole fish assemblages and of a set of ecologically important species have been assessed to evaluate the potential ecosystem-wide effectiveness of Nat2000 marine sites located along the coasts of Sardinia .</p> <p>The assessment was performed in six fully protected MPAs, in 12 Nat2000 sites established or extending at sea, and in 18 adjacent unprotected control sites.</p> <p>Results show that the highest fish biomasses are observed in fully protected MPAs.</p>
Hermoso et al.	Hermoso, V., Morán, O., ntilde, ez, A., Canessa, S., Brotons, L. (2019) Four ideas to boost EU conservation policy as 2020 nears. Environmental Research Letters 14.	2019			EU Biodiversity Strategy 2030	1	Terrestrial	<p>However, all reports show conservation efforts are falling short of their objectives and the status of biodiversity in theEU continues to decline. Here, we propose four key avenues for the next Strategy, currently under discussion, to make EUconservation efforts more effective. First, we suggest the next Biodiversity Strategy should ensure legal coverage for threatened species not listed in the EUHabitats and Birds Directives, which currently cover only 16.4% of all threatened species. Second, halting biodiversity loss requires threatened</p>
Hoffmann et al.	Hoffmann, S., Beierkuhnlein, C., Field, R., Provenzale, A., Chiarucci, A. (2018) Uniqueness of protected areas for conservation strategies in the European Union. Scientific Reports 8, 1-14.	2018	All Member States		Effectiveness	1	Terrestrial	<p>Directives are the most important policies for conservation strategy, legally preserving Europe’s characteristic, rare, endemic and threatened biota. We used occurrence data for species listed in the directives’ Annexes to assess the uniqueness of major PAs in the EU ; this is important for preserving the EU’s focal species. We developed a novel, multifunctional approach to calculate different metrics of conservation value that represent different components of species diversity within the PAs, involving inventory diversity, deviation from the</p>
Jenkins et al.	Jenkins, T.L., Stevens, J.R. (2018) Assessing connectivity between MPAs: Selecting taxa and translating genetic data to inform policy. Marine Policy 94, 165-173.	2018		Multiple geographic regions	Connectivity	1	Marine	<p>Connectivity is frequently cited as a vital component of Marine Protected Area networks and was formally identified as one of five key principles for marine network design in European waters. Yet, without the ability to demonstrate connectivity, it is impossible to be certain that sites designated within a MPA network do in fact constitute a network, when they may –irrespective of the diversity and rarity of the taxa within them– be in reality a set of unlinked habitats and associated species assemblages. However, the process of assessing</p>
Jonsson et al.	Jonsson, P.R., Moksnes, P.-O., Corell, H., Bonsdorff, E., Nilsson Jacobi, M. (2020) Ecological coherence of Marine Protected Areas: New tools applied to the Baltic Sea network. Aquatic Conservation: Marine and Freshwater Ecosystems 30, 743-760.	2020		Multiple geographic regions	Designation, Connectivity	1	Marine	<p>To help maintain and restore marine populations and communities MPAs should form ecologically coherent networks. How to estimate and implement connectivity in MPA design remains a challenge. Here a new theoretical framework is presented based on biophysical modelling of organism dispersal, combined with a suite of tools to assess different aspects of connectivity that can be integrated in MPA design. As a demonstration, these tools are applied to an MPA network in the Baltic Sea . The tools are based on the connectivity matrix, which summarizes dispersal probabilities, averaged over many years, between all considered areas in the geographic target area. The biophysical model used to estimate connectivity included important biological traits</p>
Lai et al.	Lai, S. (2020) Hindrances to effective implementation of the habitats directive in italy: Regional differences in designating special areas of conservation. Sustainability (Switzerland) 12.	2020	Italy	Southern Europe	Designation	1	Terrestrial & Marine	<p>European Union in compliance with two directives (the so-called “Habitats Directive” and the “Birds Directive”) that underpin the Union’s policies on biodiversity conservation. This study is aimed at assessing the implementation of the network by qualitatively analyzing how Special Areas of Conservation are being designated. Such designation process, which is being implemented, although with great delay, in a number of member states, entails the establishment of site-specific conservation measures that may be included within appropriate management plans or other development plans.</p>
Li & Jay	Li, S., Jay, S. (2020) Transboundary marine spatial planning across Europe: Trends and priorities in nearly two decades of project work. Marine Policy 118, 104012.	2020	All Member States	Multiple geographic regions	Connectivity, Transboundary	1	Marine	<p>As an instrument intended, amongst other things, to reduce transboundary conflicts, Transboundary Marine Spatial Planning (TMSP) has gained significant attention by coastal nations and regions recently, especially in Europe. Rather than leading to a joint marine spatial plan, TMSP is more of a continuous process of transboundary cooperation. This paper discusses the understandings of TMSP, tracks current progress of TMSP projects in Europe and examines their underlying priorities, so as to gain lessons and experience for the</p>

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Lillebø et al.	Lillebø, A.I., Teixeira, H., Morgado, M., Martínez-López, J., Marhubi, A., Delacámara, G., Strosser, P., Nogueira, A.J.A. (2019) Ecosystem-based management planning across aquatic realms at the Ria de Aveiro Natura 2000 territory. <i>Science of the Total Environment</i> 650, 1898-1912.	2019	Portugal	Southern Europe	Effectiveness	1	Terrestrial & Marine	network of protected areas, is of paramount importance for the regional and national economy, supporting harbour activities and maritime traffic, agriculture, commercial fisheries, aquaculture, manufacturing, tourism, sports and recreational activities. Current and foreseen changes connected to human activities, namely land and water uses and potential conflicts, in frame of environmental policies, sustainable economic development and human wellbeing require the implementation of ecosystem-based management planning processes considering the connectivity across marine, transitional, freshwater, and terrestrial domains. The main objective is to elaborate on the co-development of the EBM planning process across the threewater domains, all characterized by high biodiversity and by the wide range of services provided by ecosystems and their abiotic components, for
Liu et al.	Liu, J., Yong, D.L., Choi, C.-Y., Gibson, L. (2020) Transboundary frontiers: An emerging priority for biodiversity conservation. <i>Trends in Ecology & Evolution</i> 35, 679-690.	2020	Global (including Europe)	Multiple geographic regions	Connectivity, Transboundary	1	Terrestrial	geopolitical boundaries that define countries. Yet 'transboundary' landscapes often overlap with biodiversity hotspots, contain surprisingly important ecosystems, and provide critical habitats for threatened species. Notwithstanding, biodiversity in these landscapes is increasingly imperiled by infrastructure, including walls and fences along borders and cross-border roads that drive landscape fragmentation
Lomba et al.	Lomba, A., Buchadas, A., Corbelle-Rico, E., Jongman, R., McCracken, D. (2020) Detecting temporal changes in the extent of High Nature Value farmlands: The case-study of the Entre-Douro-e-Minho Region, Portugal. <i>Landscape and Urban Planning</i> 195.	2020	Portugal	Southern Europe	Connectivity	1	Terrestrial	In the European Union, the socio-ecological systems underlying the maintenance of low-intensity farming systems supporting the occurrence of several species and habitats are known as High Nature Value farmlands . Detecting trends of change in the extent and location of HNVf is essential to monitor the impact of policies on biodiversity. However, assessing changes in HNVf extent is challenging, due to the lack of tested approaches and lack of data with adequate spatial and temporal resolutions. We address such challenge by evaluating the usefulness of an existing methodological framework to analyse changes in the extent of HNVf in the agrarian region of Entre-Douro-e-Minho, Northwestern
Maiorano et al.	Maiorano, L., Amori, G., Montemaggiore, A., Rondinini, C., Santini, L., Saura, S. and Boitani, L., 2015. On how much biodiversity is covered in Europe by national protected areas and by the Natura 2000 network: insights from terrestrial vertebrates. <i>Conservation Biology</i> , 29(4), pp.986-995.	2015		All Member States	Connectivity	1	Terrestrial	and with the establishment of the Natura 2000 network of protected areas, one of the largest networks of conservation areas worldwide. We performed a gap analysis of the entire Natura 2000 system plus national protected areas and all terrestrial vertebrates . We also evaluated the level of connectivity of both systems, providing therefore a first estimate of the functionality of the Natura 2000 system as an effective network of protected areas. Together national protected areas and the Natura 2000 network covered more than one-third of the European Union. National protected areas did not offer protection to 13 total gap species or to almost 300 partial gap species . Together the Natura 2000 network and national protected areas left 1 total gap species and 121 partial
Mattsson et al.	Mattsson, B.J., Aarih, A., Heurich, M., Santi, S., Štemberk, J., Vacik, H. (2019) Evaluating a collaborative decision-analytic approach to inform conservation decision-making in transboundary regions. <i>Land Use Policy</i> 83, 282-296.	2019	Italy, Slovenia, Czechia, Germany	Multiple geographic regions	Transboundary	1	Terrestrial	managers working in countries with differing languages, laws, and cultures. Collaborative decision analysis has informed real-world conservation decisions in non-transboundary contexts. Here we evaluate for the first time its application in two transboundary regions in Europe: Julian Alps along the Italian–Slovenian border, and the Bavarian–Bohemian Forest along the German–Czech border. A collaborative-decision analysis led to bilateral agreements about multi-year resource allocations by protected areas in these two transboundary regions of Europe. Steps included problem framing, formulation of objectives, consideration of external factors, alternative
Mazaris et al.	Mazaris, A.D., Alpanidou, V., Giakoumi, S., Katsanevakis, S. (2017) Gaps and challenges of the European network of protected sites in the marine realm. <i>ICES Journal of Marine Science</i> 75, 190-198.	2017	All Member States		Designation, Connectivity, Effectiveness, Transboundary	1	Marine	and is the largest coordinated network of protected areas in the world. Here, we demonstrated that the network fails to adequately cover the marine environment and meet the conservation target of 10% set by the Convention on Biological Diversity. The relative percentage of marine surface cover varies significantly among member states. Interestingly, the relative cover of protected seascape was significantly lower for member states with larger exclusive economic zones. Our analyses demonstrated that the vast majority of the Natura 2000 sites that cover marine waters include both a terrestrial and a marine component. As a result, the majority of the
Mazaris et al.	Mazaris, A.D., Kallimanis, A., Gissi, E., Pipitone, C., Danovaro, R., Claudet, J., Rilov, G., Badalamenti, F., Stelzenmüller, V., Thiault, L., Benedetti-Cecchi, L., Goriup, P., Katsanevakis, S., Fraschetti, S. (2019) Threats to marine biodiversity in European protected areas. <i>Science of the Total Environment</i> 677, 418-426.	2019	All Member States	Multiple geographic regions	Effectiveness	1	Marine	increasing evidence concerning their limited capacity to reduce or eliminate some threats even within their own boundaries. Here, we analysed a Europe-wide dataset comprising 31,579 threats recorded in 1692 sites of the European Union's Natura 2000 conservation network. Focusing specifically on threats related to marine species and habitats, we found that fishing and outdoor activities were the most widespread threats reported within MPA boundaries, although some spatial heterogeneity in the distribution of threats was apparent. Our results clearly demonstrate the need to reconsider current management plans, standardise monitoring approaches and reporting, refine present threat assessments and improve knowledge of their spatial patterns within and outside MPAs in order to improve conservation capacity and outcomes.
Miu et al.	Miu, I.V., Rozyłowicz, L., Popescu, V.D., Anastasiu, P. (2020) Identification of areas of very high biodiversity value to achieve the EU biodiversity strategy for 2030 key commitments. <i>PeerJ</i> 8.	2020	Romania	Eastern Europe	Designation, EU Biodiversity Strategy 2030	1	Terrestrial	which one third should be strictly protected. Designation of the Natura 2000 network, the backbone of nature protection in the EU, was mostly an expert-opinion process with little systematic conservation planning. The designation of the Natura 2000 network in Romania followed the same non-systematic approach, resulting in a suboptimal representation of invertebrates and plants. To help identify areas with very high biodiversity without repeating past planning missteps, we

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Müller et al.	Müller, A., Schneider, U.A., Jantke, K. (2020) Evaluating and expanding the European Union's protected-area network toward potential post-2020 coverage targets. Conservation Biology 34, 654-665.	2020		All Member States	Designation, Connectivity, EU Biodiversity Strategy 2030	1	Terrestrial	Scientists call for more ambitious targets in the next agreement. The nature-needs-half movement, for example, has advocated conserving half of Earth to solve the biodiversity crisis, which has been translated to protecting 50% of each ecoregion. We evaluated current protection levels of ecoregions in the territory of one of the CBD's signatories, the European Union. We also explored the possible enlargement of the Natura 2000 network to implement 30% or 50% ecoregion coverage in the EU member states' protected area network. Based on the most recent land-use data, we examined whether ecoregions have enough natural area left to
Müller et al.	Müller, A., Schneider, U.A., Jantke, K. (2018) Is large good enough? Evaluating and improving representation of ecoregions and habitat types in the European Union's protected area network Natura 2000. Biological Conservation 227, 292-300.	2018	All Member States		Designation, Connectivity	1	Terrestrial	area. Thereby, the network surpasses the goal of the Convention on Biological Diversity's Aichi target 11 to protect 17% of the land area by 2020. However, Aichi target 11 also calls for protected area networks to be ecologically representative. Here, we analyzed the coverage of 43 ecoregions in the terrestrial Natura 2000 estate. To simulate cost-efficient closing of gaps in the current system, we applied a linear programming model that solves the minimum set conservation problem of expanding the Natura 2000 network to achieve 10% ecoregion representation. As Natura 2000 sites are designated for habitat types and species listed on the annexes of the Habitats and Birds directives, we included 226 habitat types as a further biodiversity surrogate in
Nila et al.	Nila, M.U.S., Hossain, M.L. (2019) Predicting the effectiveness of protected areas of Natura 2000 under climate change. Ecological Processes 8.	2019		Multiple geographic regions	Designation, Connectivity	1	Terrestrial	ecosystems to persist. PAs can become climatically unsuitable and unable to sustain their current number of species under climate change. The Natura 2000 is the largest coordinated conservation tool assigned to maintain the long-term survival of Europe's most significant species and habitats. In attempting to understand the effectiveness of PAs in the face of climate change scenarios, we tested two hypotheses: PAs in the Alpine and the
Petsas et al.	Petsas, P., Tsavdaridou, A.I., Mazaris, A.D. (2020) A multispecies approach for assessing landscape connectivity in data-poor regions. Landscape Ecology 35, 561-576.	2020	Greece, the Republic of North Macedonia, Albania and Bulgaria	South-Eastern Europe	Transboundary	1	Terrestrial	Context Identifying animals movement through the landscape and delineating key corridors is critical for effective management and conservation. Still, assessments of space-use patterns and landscape connectivity are subjected to many limitations, especially in large scales. Objectives The main objective of this study was to assess functional connectivity for four focal mammal species with varying dispersal abilities and diets, across protected areas in a transnational region where only scarce
Pogoda et al.	Pogoda, B., Merk, V., Colsoul, B., Hausen, T., Peter, C., Pesch, R., Kramer, M., Jaklin, S., Holler, P., Bartholomä, A., Michaelis, R., Prinz, K. (2020) Site selection for biogenic reef restoration in offshore environments: The Natura 2000 area Borkum Reef Ground as a case study for native oyster restoration. Aquatic Conservation: Marine and Freshwater Ecosystems 30, 2163-2179.	2020	Germany	Western Europe	Effectiveness	1	Marine	1. According to the EU Marine Strategy Framework Directive (2008/56/EC), marine protected areas (MPA) should contribute to a good environmental status of the Europeans seas. Measures maintaining or restoring a favourable conservation status of protected species and habitats are mandatory according to the EU Habitats Directive (92/43/EEC). 2. Identification of suitable sites for ecological restoration measures within MPAs is a crucial step towards successful conservation and sustainable MPA management. In terms of species restoration, it is important to restore the respective species with the best possible environment for growth, survival, fitness, and successful recruitment.
Princé et al.	Princé, K., Rouveyrol, P., Pellissier, V., Touroult, J., Jiguet, F. (2021) Long-term effectiveness of Natura 2000 network to protect biodiversity: A hint of optimism for common birds. Biological Conservation 253.	2021	France	Western Europe	Effectiveness	1	Terrestrial	The Natura 2000 protected area network, implemented under the Birds and Habitats Directives, constitutes a key tool for the conservation of European biodiversity. To date, few studies have looked at its long-term effect on biodiversity and even fewer on common species. Here, using citizen science data, we investigated this effect on the temporal trends of widespread and common bird species in France, over the period 2002–2016. We found results consistent with previous findings demonstrating a significant decline of common bird populations in France.
Rada et al.	Rada, S., Schweiger, O., Harpke, A., Kühn, E., Kuras, T., Settele, J., Musche, M. (2019) Protected areas do not mitigate biodiversity declines: A case study on butterflies. Diversity and Distributions 25, 217-224	2019	Germany	Western Europe	Effectiveness	1	Terrestrial	We first test whether species richness of butterfly assemblages is higher within European Natura 2000 (N2000) sites than in their surroundings. We then assess temporal trends in butterfly richness and test whether these trends differ inside and outside the N2000 network. Location: Germany, Europe. Methods: We utilized generalized linear mixed-effects models (GLMM) to analyse an
Rincón et al.	Rincón, V., Velázquez, J., Gutiérrez, J., Sánchez, B., Hernando, A., García-Abril, A., Santamaría, T., Sánchez-Mata, D. (2019) Evaluating European conservation areas and proposal of new zones of conservation under the habitats directive. application to Spanish territories. Sustainability (Switzerland) 11.	2019	Spain	Southern Europe	Designation, Connectivity	1	Terrestrial	establishes the classification and selection of protected areas at European level. Unfortunately, member countries cannot make the best zoning decisions for biodiversity conservation because there are no clear and uniform parameters to designate Natura 2000 sites. Due to this, it is convenient to evaluate the importance of the criteria for biodiversity conservation through a general assessment, which could establish relevant criteria that can be analysed through geostatistical methods combined in multicriteria analysis. This paper aims to consider biodiversity importance values taking into account land use, so that it is possible to develop a zoning proposal which verifies or corrects the suitability of the designated areas for the Natura 2000 Network in Castilla y León, Andalucía and Madrid. The choice of these regions allows us to compare areas with a high variability of population density, making possible to compare the potential protected areas

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Rozyłowicz et al.	Rozyłowicz, L., Nita, A., Manolache, S., Popescu, V.D., Hartel, T. (2019) Navigating protected areas networks for improving diffusion of conservation practices. <i>Journal of Environmental Management</i> 230, 413-421.	2019	Romania	Eastern Europe	Designation, Connectivity	1	Terrestrial	strategy. These protected areas range across multiple biogeographic regions, and they include a diversity of species assemblages along with a diversity of managing organizations, altogether making difficult to pool relevant sites to facilitate the flow of knowledge significant to their management. Here we introduce an approach to navigating protected area networks that has the potential to foster systematic identification of key sites for facilitating the exchange of knowledge and diffusion of information within the network. To demonstrate our approach, we abstractly represented Romanian Natura 2000 network as a co-occurrence network, with individual sites as nodes and shared species as edges, further combining into our analysis network topology,
Saura et al.	Saura, S., Bertzky, B., Bastin, L., Battistella, L., Mandrici, A., Dubois, G. (2019) Global trends in protected area connectivity from 2010 to 2018. <i>Biological Conservation</i> 238, 108183.	2019		Global (incl. Europe)	Connectivity	1	Terrestrial	ecosystem service delivery. The Convention on Biological Diversity agreed in 2010 to have 17% of land covered by wellconnected PA systems by 2020 (Aichi Target 11). We here globally assess, for all countries, the trends in terrestrial PA connectivity every other year from 2010 to 2018 using the ProtConn indicator, which quantifies how well the PA systems are designed to support connectivity. The percentage of protected connected land (ProtConn) has increased globally from 6.5% in 2010 to 7.7% in 2018. Oceania experienced the largest recent
Silva et al.	Silva, J.P., Correia, R., Alonso, H., Martins, R.C., D'Amico, M., Delgado, A., Sampaio, H., Godinho, C., Moreira, F. (2018) EU protected area network did not prevent a country wide population decline in a threatened grassland bird. <i>PeerJ</i> 6, e4284.	2018	Portugal	Southern Europe	Effectiveness	1	Terrestrial	species. Here, we assess the effectiveness of the Portuguese Natura 2000 in maintaining a species included in the Annex I of the Bird Directive, namely the population of a priority farmland bird, the little bustard <i>Tetrax tetrax</i> . Methods. Protection Areas that were mostly designated for farmland bird conservation and another 30 areas without EU protection. Results. Overall, the national population is estimated to have declined 49% over the last 1014 years. This loss
Virtanen et al.	Virtanen, E.A., Viitasalo, M., Lappalainen, J., Moilanen, A. (2018) Evaluation, Gap Analysis, and Potential Expansion of the Finnish Marine Protected Area Network. <i>Frontiers in Marine Science</i> 5, 402.	2018	Finnland	Western Europe	Designation, Conectivity	1	Marine	Various international and regional agreements require that nations designate sufficient marine areas under protection. Assessing the functionality and coherence of MPA networks is challenging, unless extensive data on species and habitats is available. We evaluated the efficiency of the Finnish MPA network by utilizing a unique dataset of 140,000 samples, recently collected by the Finnish Inventory Programme for the Underwater Marine Environment, VELMU. Using the quantitative conservation planning
Ward et al.	Ward, M., Saura, S., Williams, B., Ramirez-Delgado, J.P., Arafteh-Dalmau, N., Allan, J.R., Venter, O., Dubois, G., Watson, J.E. (2020) Just ten percent of the global terrestrial protected area network is structurally connected via intact land. <i>Nature communications</i> 11, 1-10.	2020		Global (incl. Europe)	Connectivity	1	Terrestrial	Land free of direct anthropogenic disturbance is considered essential for achieving biodiversity conservation outcomes but is rapidly eroding. In response, many nations are increasing their protected area (PA) estates, but little consideration is given to the context of the surrounding landscape. This is despite the fact that structural connectivity between PAs is critical in a changing climate and mandated by international conservation targets. Using a high-resolution assessment of human pressure, we show that while ~40% of the terrestrial planet is intact, only 9.7% of Earth's terrestrial protected network can be considered structurally
Zupan et al.	Zupan, M., Bulleri, F., Evans, J., Frascchetti, S., Guidetti, P., Garcia-Rubies, A., Sostres, M., Asnaghi, V., Caro, A., Deudero, S., Goñi, R., Guarneri, G., Guilhaumon, F., Kersting, D., Kokkali, A., Kruschel, C., Macic, V., Mangialajo, L., Mallol, S., Macpherson, E., Panucci, A., Radolovic, M., Ramdani, M., Schembri, P.J., Terlizzi, A., Villa, E., Claudet, J. (2018) How good is your marine protected area at curbing threats? <i>Biological Conservation</i> 221, 237-245	2018	Mediterranean (unspecified)	Southern Europe	Effectiveness	1	Marine	Marine protected areas are key tools to mitigate human impacts in coastal environments, promoting sustainable activities to conserve biodiversity. The designation of MPAs alone may not result in the lessening of some human threats, which is highly dependent on management goals and the related specific regulations that are adopted. Here, we develop and operationalize a local threat assessment framework. We develop indices to quantify the effectiveness of MPAs in reducing anthropogenic extractive and non-extractive threats operating at local scale, focusing specifically on threats that can be managed through MPAs. We apply this framework in 15 Mediterranean MPAs to assess their threat reduction capacity. We show that fully protected areas effectively eliminate extractive activities, whereas the intensity of artisanal and recreational fishing within partially protected areas, paradoxically, is higher than that found outside MPAs, questioning their ability at reaching conservation targets. In addition, both fully and partially protected areas attract non-extractive activities that are potential threats. Overall, only three of the 15 MPAs had lower intensities for the entire set of eight threats considered, in respect to adjacent control
Alves-Pinto et al.	Alves-Pinto, H., Geldmann, J., Jonas, H., Maioli, V., Balmford, A., Latawicz, A.E., Crouzeilles, R., Strassburg, B. (2021) Opportunities and challenges of other effective area-based conservation measures (OECMs) for biodiversity conservation. <i>Perspectives in Ecology and Conservation</i> .	2021	/		OECMs	2	Terrestrial & Marine	In 2010, the Convention on Biological Diversity adopted the Strategic Plan for Biodiversity 2011–2020. As international attention turns to the development of the post-2020 Global Biodiversity Framework, discussions are focusing on the way in which other effective area-based conservation measures (OECMs) should be reflected in the Framework. To inform this discussion, we gathered in-depth perspectives and expert elicitation on the opportunities and challenges that OECMs offer and present to biodiversity conservation. To do so, we conducted semi-structured interviews with experts involved in OECM-related deliberations. The explicit consideration of OECMs in conservation policy represents a recognition that there are sites outside of formal protected area networks that benefit biodiversity and ecosystems in important ways. However, these benefits and the future
Berzi et al.	Berzi, M., Ariza, E. (2018) A Local Transboundary Approach to the Governance of Mediterranean Coastal Borderlands. <i>Coastal management</i> 46, 471-487.	2018	Spain, France	Southern Europe	Transboundary	2	Terrestrial & Marine	and environmental dynamics in Europe and worldwide. The presence of the international boundary in these areas poses challenges in the process of Integrated Coastal Zone Management (ICZM). The aim of this paper is to explore the existence, characteristics and the role that local cross-border cooperation plays in transboundary coastal

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Biró et al.	Biró, M., Bölöni, J., Molnár, Z. (2018) Use of long-term data to evaluate loss and endangerment status of Natura 2000 habitats and effects of protected areas. <i>Conservation Biology</i> 32, 660-671.	2018	Hungary	Eastern Europe	Effectiveness	2	Terrestrial	Habitat loss is a key driver of biodiversity loss. However, hardly any long-term time series analyses of habitat loss are available above the local scale for finer-level habitat categories. We analysed, from a long-term perspective, the habitat specificity of habitat-area loss, the change in trends in habitat loss since 1989, and the impact of protected areas on habitat loss in Hungary. We studied 20 seminatural habitat types in 5000 randomly selected localities over 7 periods from 1783 to 2013 based on historical maps, archival and recent aerial photos and satellite imagery, botanical descriptions, and field data. We developed a method for estimating habitat types
Brackhane et al.	Brackhane, S., Schoof, N., Reif, A., Schmitt, C.B. (2019) A new wilderness for Central Europe? — The potential for large strictly protected forest reserves in Germany. <i>Biological Conservation</i> 237, 373-382.	2019	Germany	Western Europe	Designation, Connectivity	2	Terrestrial	terrestrial territory by 2020, however wilderness areas in Germany currently only cover 0.6% of the total land area. Operationalizing the wilderness concept in densely populated countries like Germany where few primary habitats remain is challenging. In this study, we developed minimum criteria for forest wilderness areas and assessed their number, spatial distribution and extent for Germany. We tested their ecological representativeness in the main German ecoregions, their compatibility with ecological networks, overlaps with existing protected areas, and forest ownership. Our results revealed a potential for forest wilderness areas to
Brambilla et al.	Brambilla, M., Rizzolli, F., Franzoi, A., Caldonazzi, M., Zanghellini, S., Pedrini, P. (2020) A network of small protected areas favoured generalist but not specialized wetland birds in a 30-year period. <i>Biological Conservation</i> 248.	2020	Italy	Southern Europe	Effectiveness	2	Terrestrial	Protected areas (PAs) have been established to promote the long-term conservation of biodiversity and ecosystems. Wetlands, which represent a key habitat worldwide, have been largely destroyed, particularly in more industrialized countries, and their remnants are now often preserved by PA networks, especially in the European Union. We tested the effectiveness of a PA network of 26 small wetlands in preserving wetland birds over a thirty-year period, by investigating changes in species occurrence and relating them to the species' ecological specialization. Out of 23 species, 10 showed an increase in occurrence, 7 remained stable and 6
Brescancin et al.	Brescancin, F., Dobšínská, Z., De Meo, I., Šálka, J., Paletto, A. (2018) Analysis of stakeholders' involvement in the implementation of the Natura 2000 network in Slovakia. <i>Forest policy and economics</i> 89, 22-30.	2018	Slovakia	Eastern Europe	Designation, Effectiveness	2	Terrestrial	biodiversity. The national governments of European Union member countries have delegated the responsibility to manage the Natura 2000 sites at sub-national/regional level. The responsible for the Natura 2000 sites management must organise stakeholders' involvement in the decision-making process to balance the objectives of nature conservation with the social and economic interests. The aim of this paper is to investigate public participation process in the implementation of Natura 2000 network in Slovakia. After a stakeholder analysis, 16 stakeholders participated in the survey. The data were collected through the administration of face-to-face
Campagnaro et al.	Campagnaro, T., Trentanovi, G., Sitzia, T. (2018) Identifying habitat type conservation priorities under the habitats directive: Application to two Italian biogeographical regions. <i>Sustainability (Switzerland)</i> 10.	2018	Alps	Western Europe	Designation	2	Terrestrial	conservation of critical habitat types. Even though the identification of protected areas is still required in Europe, conservation efforts are now focusing on management requirements for protected areas and habitat types. Establishing effective management approaches is important for the conservation of the natural and semi-natural habitat types that are identified under the Habitats Directive framework. In this study, we propose a methodology for determining priorities in the conservation management of habitat types based on readily available data. This method relies on four simple criteria to rank habitat types, which includes: conservation
Claudet et al.	Claudet, J., Loiseau, C., Pebayle, A. (2021) Critical gaps in the protection of the second largest exclusive economic zone in the world. <i>Marine Policy</i> 124.	2021	France	Western Europe	Effectiveness	2	Marine	A healthy Ocean is critical for achieving sustainable development goals but the Ocean is threatened by multiple stressors. There is a global call to increase the coverage of marine protected areas (MPAs) from 10% to at least 30% by 2030. France, a major actor for marine conservation with the second largest exclusive economic zone in the world, with territories in all Ocean basins but the Arctic, aims at reaching the 30% by 2022, for which one
de la Fuente et al.	de la Fuente, B., Beck, P.S.A. (2018) Invasive species may disrupt protected area networks: Insights from the pine wood nematode spread in Portugal. <i>Forests</i>	2018	Portugal	Southern Europe	Connectivity	2	Terrestrial	potential impacts range from local changes in species composition to wider-scale effects on forest habitat and landscape functioning, although the latter has been relatively little explored in the literature. Here, we assessed the impact of an invasive forest pest, the pine wood nematode, in the Natura 2000 network of protected areas in Portugal, the first European country in which PWN was reported. We considered the impacts of the pest's spread on individual PAs, in terms of the fraction of their coniferous forest infected, and on the corridors
Diz et al.	Diz, D., Johnson, D., Riddell, M., Rees, S., Battle, J., Gjerde, K., Hennige, S., Roberts, J.M. (2018) Mainstreaming marine biodiversity into the SDGs: the role of other effective area-based conservation measures (SDG 14.5). <i>Marine Policy</i> 93, 251-261.	2018			OECMs	2	Marine	This article explores the concept of «other effective area-based conservation measures» in the context of the UN Convention on Biological Diversity Aichi Biodiversity Target 11 on marine protected areas and OECMs and its linkages to the Sustainable Development Goals. It argues that mainstreaming biodiversity through CBD Aichi Biodiversity Targets' implementation into the SDGs can contribute to a more systemic and comprehensive implementation of SDG 14.5 on conservation of at least 10% of marine and coastal areas. It argues that OECMs can complement MPAs and contribute to ecologically representative and effectively managed marine protected areas systems integrated into broader governance systems such as marine spatial planning.
Dudley et al.	Dudley, N., Jonas, H., Nelson, F., Parrish, J., Pyhälä, A., Stolton, S., Watson, J.E. (2018) The essential role of other effective area-based conservation measures in achieving big bold conservation targets. <i>Global Ecology and Conservation</i> 15, e00424.	2018			OECMs	2	Terrestrial & Marine	Selected global and local sectoral conservation measures are therefore highlighted in this analysis as potential Continued biodiversity loss has prompted calls for half of the planet to be set aside for nature including E. O Wilson's "Half-Earth" approach and the Wild Foundation's "Nature Needs Half" initiative. These efforts have provided a necessary wake-up call and drawn welcome global attention for the urgent need for increased action on conserving biodiversity and nature in general. Yet they have also sparked debate within the conservation community, particularly due to the huge practical and political obstacles to establishing or expanding protected areas on this scale. The new designation of «other effective areabased conservation measures» provides the opportunity for formal recognition of and support for areas delivering conservation outcomes outside the

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Elizbarashvili et al.	Elizbarashvili, N., Dvalashvili, G., Sulkanishvili, N. (2019) Selection principles and focuses of landscape planning of protected areas. International Journal of Geoheritage and Parks 7, 33-44.	2019	Georgia, Armenia, Turkey	Eastern Europe	Designation, Transboundary	2	Terrestrial	Armenia, and Turkey. Javakheti's particular transboundary significance is related to its wetlands located at very high altitudes and its highland plateaus that are the crossroads of bird migration routes between Europe, Asia and Africa. According to international environmental regulations, the Javakheti wetlands meet the requirements necessary to be classified as a Ramsar site and may be potentially put Ramsar site list, as Georgia signed the Ramsar Convention in 1996. At present the Javakheti ecosystems need to be protected, sustained, improved and developed,
Gameiro et al.	Gameiro, J., Silva, J.P., Franco, A.M.A., Palmeirim, J.M. (2020) Effectiveness of the European Natura 2000 network at protecting Western Europe's agro-steppes. Biological Conservation 248.	2020	Portugal, Spain	Southern Europe	Effectiveness, Connectivity	2	Terrestrial	Assessing progress towards achieving conservation targets is required for all countries committed to the Convention on Biological Diversity. The Natura 2000 network is the largest protected area network in the world and was created to protect Europe's threatened species and habitats, often requiring active management. This study assesses the effectiveness of areas classified under the EU Birds Directive at protecting Western Europe's agro-steppes, the last remnants of suitable habitat for several endangered bird species. We quantify agro-steppe
Garcia-Lozano et al.	Garcia-Lozano, C., Varga, D., Pintó, J., Roig-Munar, F.X. (2020) Landscape connectivity and suitable habitat analysis for wolves (Canis lupus l.) in the eastern pyrenees. Sustainability (Switzerland) 12, 1-20.	2020	Spain, France	Southern Europe	Connectivity	2	Terrestrial	for species of medium- and large-sized mammals. Some of the occurrences that explain this trend are biodiversity protection, the creation of natural protected areas, and the abandonment of traditional agricultural activities. In recent years, wolves have once again been seen in forests in the eastern sector of the Pyrenees and the Pre-Pyrenees. The success or failure of their permanent settlement will depend on several factors, including conservation measures for the species, habitat availability, and the state of landscape connectivity. The aim of this study is to analyze the state of landscape connectivity for fragments of potential wolf habitat in Catalonia,
Gissi et al.	Gissi, E., McGowan, J., Venier, C., Carlo, D.D., Musco, F., Menegon, S., Mackelworth, P., Agardy, T. and Possingham, H., 2018. Addressing transboundary conservation challenges through marine spatial prioritization. Conservation Biology, 32(5), pp.1107-1117.	2018	Adriatic and Ionian Region	Southern Europe	Connectivity, Transboundary	2	Marine	The Adriatic and Ionian Region is an important area for both strategic maritime development and biodiversity conservation in the European Union . However, given that both EU and non-EU countries border the sea, multiple legal and regulatory frameworks operate at different scales, which can hinder the coordinated long-term sustainable development of the region. Transboundary marine spatial planning can help overcome these challenges by building consensus on planning objectives and making the trade-offs between biodiversity conservation and its influence on economically important sectors more explicit. We address this challenge by developing and testing 4 spatial prioritization strategies with the decision-support tool Marxan, which meets targets for biodiversity conservation while minimizing impacts to users. We evaluated
Gómez-Ballesteros et al.	Gómez-Ballesteros, M., Cervera-Núñez, C., Campillos-Llanos, M., Quintela, A., Sousa, L., Marques, M., Alves, F., Murciano, C., Alloncle, N., Sala, P. (2021) Transboundary cooperation and mechanisms for Maritime Spatial Planning implementation. SIMNORAT project. Marine Policy 127, 104434.	2021	Spain, Portugal, France	Southern Europe	Connectivity, Transboundary	2	Marine	maritime nations exercise greater management over their territorial waters and, in many cases, over exclusive economic zones that span a larger area. The purpose of this planning is to reverse the environmental degradation of the seas and facilitate the sustainable use of marine resources, both for mature uses such as fishing and navigation, and for emergent uses, including renewable energies and mariculture. In Europe, the Directive 2014/ 89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning oblige coastal Member States to develop maritime spatial plans at the latest by 31st March 2021. To help in that process, countries have at their disposal a set of existing supporting guidelines, recommendations and sets of tools and data, as the SIMNORAT project, co-funded by the EC – DG Maritime Affairs and Fisheries (DG MARE). This paper presents best practices developed in this project on technical,
Hermoso et al.	Hermoso, V., Morán-Ordóñez, A., Brotons, L. (2018) Assessing the role of Natura 2000 at maintaining dynamic landscapes in Europe over the last two decades: implications for conservation. Landscape Ecology 33, 1447-1460.	2018		Multiple geographic regions	Effectiveness	2	Terrestrial	The Natura 2000 aims to promote the persistence of biodiversity and traditional uses. European landscapes have, however, undergone large transformations in the past decades, mainly associated with the abandonment of less productive lands concentration of intensive agriculture. These changes could pose management challenges and new opportunities to the achievement of the networks goals. Objective Evaluate changes in land cover within Natura 2000 in the last two decades. Methods: We use different Corine Land Cover datasets to construct transition matrices of land uses for measuring changes for each Natura 2000 site. We also explore the
Hermoso et al.	Hermoso, V., Morán-Ordóñez, A., Lanzas, M., Brotons, L. (2020) Designing a network of green infrastructure for the EU. Landscape and Urban Planning 196, 103732.	2020		Multiple geographic regions	Designation, Connectivity	2	Terrestrial	seminatural areas to support the maintenance of ecosystem services and connect protected areas , promoting in this way multifunctional landscapes. This network of GI aims to address the decline in ESS across the EU and also contribute to achieving the objectives of the Biodiversity Strategy, such as halting biodiversity loss. Here, we demonstrate how a spatial planning tool could be used for designing a network of GI across the EU. We tested two alternative planning scenarios: an EU-based, where the full network is planned at the continental
Jaraiz-Cabanillas et al.	Jaraiz-Cabanillas, F.J., Mora-Aliseda, J., Jeong, J.S., Garrido-Velarde, J. (2018) Methodological proposal to classify and delineate natural protected areas. Study case: Region of Extremadura, Spain. Land Use Policy 79, 310-319.	2018	Spain	Southern Europe	Designation	2	Terrestrial	concurrently potential damages related with NPA characteristics. Particularly, many regions of Spain face strong pressure due to their geographical, demographic and economic handicaps. This study presents a methodological proposal for properly classifying and delineating NPA, highlighted in a case region of Extremadura, being NATURA 2000 site of local heritage and one of less developed regions in European Union . Information System , the case region was firstly analyzed and then presented the real geo-socio-economic impact and environmental protection implementation, which urgently need to adopt a new methodological proposal with the complex and diverse legislations.

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Jones et al.	Jones, N., Malesios, C., Ioannidou, E., Kanakaraki, R., Kazoli, F., Dimitrakopoulos, P.G. (2018) Understanding perceptions of the social impacts of protected areas: Evidence from three NATURA 2000 sites in Greece. Environmental Impact Assessment Review 73, 80-89.	2018	Greece	Southern Europe	Designation	2	Terrestrial	combined with existing evaluation frameworks assessing the economic and environmental impacts of PAs. The present paper focuses on the subjective assessment of social impacts of PAs and how these perceptions are formulated. Results of an empirical study, implemented in three PAs in Greece, are presented. According to the study, individuals' perceived quality of life, trust in institutions, social trust and place attachment are the most important indicators influencing perceptions of social impacts. A main conclusion of the paper is that measuring social impacts is not sufficient for the planning and designation of a PA. Additional research is needed exploring the reasons behind these perceptions in order to plan actions minimizing negative impacts for local communities.
Koemle et al.	Koemle, D., Lakner, S., Yu, X. (2019) The impact of Natura 2000 designation on agricultural land rents in Germany. Land Use Policy 87.	2019	Germany	Western Europe	Designation	2	Terrestrial	resistance from land users due to increased regulations on land use and related value change. This study first develops a theoretical model for rent change due to land regulation, and then empirically investigates whether farmland rents in Germany are affected by Natura 2000 designation. We use a matching procedure based on a zero-inflated beta generalized propensity score on German district level agricultural census data. Our results
Kull et al.	Kull, M., Moodie, J., Thomas, H., Mendez-Roldan, S., Giacometti, A., Morf, A., Isaksson, I. (2019) International good practices for facilitating transboundary collaboration in Marine Spatial Planning. Marine Policy, 103492.	2019	Baltic Sea	Western Europe	Connectivity, Transboundary	2	Marine	the European Commission in 2017, highlights the growing commitment of policy and decision-makers in developing transboundary collaboration relevant to Marine Spatial Planning as a mechanism for promoting sustainable sea use. While collaboration across borders represents positive progress towards global environmental stewardship and international cooperation, transboundary MSP can present challenges and obstacles as it can be a complex process involving different parties and stakeholders across multiple levels of governance. In this article, we examine the different enabling factors and good practices that emerge from two
Lai et al.	Lai, S., Leone, F., Zoppi, C. (2018) Implementing green infrastructures beyond protected areas. Sustainability (Switzerland) 10.	2018	Italy	Southern Europe	OECS, Designation	2	Terrestrial	According to the European Commission, green infrastructure is conceived as a strategically planned network of natural and semi-natural areas. This definition highlights three important issues: environment protection, ecosystems multifunctionality and ecological connectivity. Building upon a methodology that identifies a Sardinian regional GI in relation to four values, this study aims at
Laktic et al.	Laktić, T., Malovrh, Š.P. (2018) Stakeholder participation in Natura 2000 management program: Case study of Slovenia. Forests 9.	2018	Slovenia	Eastern Europe	Designation, Effectiveness	2	Terrestrial	in the European Union's biodiversity conservation policy. To achieve the national enforcement of Natura 2000 and to overcome implementation problems, effective policy measures are needed, and participation among different stakeholders is required. The aim of this paper was to evaluate the process of formulation of the Natura 2000 Management
Lanzas et al.	Lanzas, M., Hermoso, V., de-Miguel, S., Bota, G., Brotons, L. (2019) Designing a network of green infrastructure to enhance the conservation value of protected areas and maintain ecosystem services. Science of the Total Environment 651, 541-550.	2019	Spain	Southern Europe	OECS, Designation	2	Terrestrial	There is a growing demand for holistic landscape planning to enhance sustainable use of ecosystem services and maintenance of the biodiversity that supports them. In this context, the EU is developing policy to regulate the maintenance of ESS and enhance connectivity among protected areas. This is known as the network of Green Infrastructure. However, there is not a working framework defined to plan the spatial design of such network of GI. Here, we use the software Marxan with Zones, to prioritize the spatial distribution of different management zones that accommodate the needs of a network of GI. and a management zone devoted to exploiting provisioning ESS. We performed four planning scenarios that
Loos et al.	Loos, J., Vizauer, T.C., Kastal, A., Davies, M., Hedrich, H., Dolek, M. (2020) A highly endangered species on the edge: distribution, habitat use and outlook for Colias myrmidone in newly established Natura 2000 areas in Romania. Environment, Development and Sustainability 22, 2399-2414.	2020	Romania	Eastern Europe	Designation	2	Terrestrial	Romania is one of the last strongholds of the Danube Clouded Yellow, which is a critically endangered European butterfly species. Knowledge gaps of the ecology and the underlying drivers for its decline hinder the development and implementation of suitable management plans. Here, we investigated habitat characteristics and the social-ecological conditions in two recently established Natura 2000 sites in Romania. We conducted ecological surveys of the species' occurrence and its habitats. We interviewed local farmers about their land-use practices and their perception of the Natura 2000 areas. Moreover, we investigated the information flow on the Natura 2000 implementation process between representatives of local governmental and non-governmental organizations.
Lovric et al.	Lovrić, M., Lovrić, N., Schraml, U., Winkel, G. (2018) Implementing Natura 2000 in Croatian forests: An interplay of science, values and interests. Journal for Nature Conservation 43, 46-66.	2018	Croatia	Eastern Europe	Designation	2	Terrestrial	Directives, for which the national designation of protection areas should be founded on scientific criteria. A review of these processes in different EU member states shows, however, that many factors have affected the designation process, such as power and influence of different interest groups and capacities of the administrations responsible for implementation. In this paper, we assess the activities of an expert working group which has prepared the forestry section of the Ordinance on Natura 2000, the basic legislative act by
Mammola et al.	Mammola, S., Riccardi, N., Prié, V., Correia, R., Cardoso, P., Lopes-Lima, M., Sousa, R. (2020) Towards a taxonomically unbiased European Union biodiversity strategy for 2030: Popularity drives EU conservation. Proceedings of the Royal Society B: Biological Sciences 287.	2020		All Member States	EU Biodiversity Strategy, Effectiveness	2	Terrestrial & Marine	become an experimental arena for biological conservation. With an estimated annual budget of €20 billion, the EU Biodiversity Strategy for 2030 has set an ambitious goal of classifying 30% of its land and sea territory as Protected Areas and ensuring no deterioration in conservation trends and the status of protected species. We analysed LIFE projects focused on animals from 1992 to 2018 and found that investment in vertebrates was six times higher than that for invertebrates (€970 versus €150 million), with birds and mammals alone accounting for 72% of species and 75% of the total budget. In relative terms, investment per species towards vertebrates has been 468 times higher than that for

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Mason et al.	Mason, N., Ward, M., Watson, J.E., Venter, O., Runting, R.K. (2020) Global opportunities and challenges for transboundary conservation. <i>Nature Ecology & Evolution</i> 4, 694-701.	2020	Global (including Europe)	Multiple geographic regions	Connectivity, Transboundary	2	Terrestrial	action among nations remains elusive. As a result, species with ranges that span international borders—which include 53.8% of terrestrial birds, mammals and amphibians—are in increasing peril through uncoordinated management and artificial barriers to human movement, such as border fences. Transboundary conservation initiatives represent a unique opportunity to better protect species through coordinated management across national borders. Using metrics of governance, collaboration and human pressure, we provide an index of
Nilsson et al.	Nilsson, L., Bunnefeld, N., Persson, J., Žydeitis, R., Månsson, J. (2019) Conservation success or increased crop damage risk? The Natura 2000 network for a thriving migratory and protected bird. <i>Biological Conservation</i> 236, 1-7.	2019			Connectivity	2	Terrestrial	small to fulfill the resource requirements of many large and mobile wildlife species, especially when congregating in large numbers. In such cases, wildlife may overflow onto surrounding human-dominated land and cause impacts. The aim of the EU Natura 2000 network is to increase supranational connectivity between protected areas for migratory and protected species such as the common crane (<i>Grus grus</i>). The crane population along the Western European flyway has been increasing rapidly in recent decades, with peaks of 200,000 cranes at specific Natura
Pechanec et al.	Pechanec, V., Machar, I., Pohanka, T., Opršal, Z., Petrovič, F., Švajda, J., Šálek, L., Chobot, K., Filippovová, J., Cudlín, P. and Málková, J., 2018. Effectiveness of Natura 2000 system for habitat types protection: A case study from the Czech Republic. <i>Nature Conservation</i> , 24, p.21.	2018	Czech Republic	Eastern Europe	Effectiveness	2	Terrestrial	biodiversity protection. Worldwide, the area of PAs is continually increasing. But is the effectiveness of biodiversity protection improving with it? Since many PAs only exist as “paper parks”, the answer is uncertain. Moreover, it has long been known that, not only an increase in the extent of PAs, but also the efficiency of their management is fundamentally important for effective nature conservation. Therefore, there is a wide-ranging discussion about the actual effectiveness of PAs and factors that influence it. In the course of the EU pre-accession phase, a comprehensive field mapping of natural habitats took place in the Czech Republic in years 2001–2004.
Pereira et al.	Pereira, J. (2018) Multi-node protection of landscape connectivity: Habitat availability and topological reachability. <i>Community Ecology</i> 19, 176-185.	2018	Spain	Southern Europe	Designation, Connectivity	2	Terrestrial	The selection of reserves for biodiversity conservation involves the evaluation of multiple criteria, ranging from representativeness of ecological features to anthropogenic interests and spatial configuration. Among the principal spatial attributes to be considered, connectivity has received particular emphasis in response to the escalating threat of habitat loss and fragmentation. Connectivity is an intrinsic property of networks.
Petza, et al.	Petza, D., Chalkias, C., Koukouroufli, N., Coll, M., Vassilopoulou, V., Karachle, P.K., Markantonatou, V., Tsikliras, A.C., Katsanevakis, S. (2019) An operational framework to assess the value of fisheries restricted areas for marine conservation. <i>Marine Policy</i> 102, 28-39.	2019	Greece	Southern Europe	OECMs	2	Marine	developed. Such a framework contributes to the wider concept of considering other effective area-based conservation measures, as complementing conservation efforts and substantially contributing to effectively and equitably achieving Aichi biodiversity Target 11. A tailor-made multi-criteria decision analysis was designed and applied, for potential OECMs to be carefully assessed on a case-by-case basis and categorized according to their effectiveness in terms of contributing to marine biodiversity conservation. The official documentation and guidance provided by the IUCN were fully respected and made operational, providing a paradigm to managers and decision makers for assessing the contribution of FRAs to marine conservation under the OECM concept.
Rocchi et al.	Rocchi, L., Cortina, C., Paolotti, L., Boggia, A. (2020) Recreation vs conservation in Natura 2000 sites: a spatial multicriteria approach analysis. <i>Land Use Policy</i> 99.	2020	Italy	Southern Europe	Designation	2	Terrestrial	recreational opportunity, providing benefits in terms of physical and mental health through outdoor experiences. Nature-based tourism is tourism based on the natural attractions of an area: the greater the recreation opportunities, the greater the attractiveness to people. N2K sites are suitable places to favour the development of the NBT, as N2K is not a system of strict nature reserves from which all human activities would be excluded.
Rodríguez-Rodríguez et al.	Rodríguez-Rodríguez, D., López, I. (2020) Socioeconomic effects of protected areas in Spain across spatial scales and protection levels. <i>Ambio</i> 49, 258-270.	2020	Spain	Southern Europe	Designation	2	Terrestrial	and at different spatial scales. In this study, we analysed the organisational perception on the socioeconomic effects of PA designation from all sectors of activity in Spain, accounting for PAs’ legal stringency. A semi-structured questionnaire was administered to 68 organisations at national, regional and local scales through an online survey. Local stakeholders and the primary, secondary and tertiary sectors were most
Rodríguez-Rodríguez et al.	Rodríguez-Rodríguez, D., López, I. (2018) Effects of legal designation and management of a multiple-use protected area on local sustainability. <i>Sustainability (Switzerland)</i> 10.	2018	Spain	Southern Europe	Designation	2	Terrestrial	through access restriction to natural resources. We used a mixed methods research framework that combines time series analysis and stakeholder surveys to elicit objective and subjective effects of legal and managerial designation of Sierra Cabrera-Bedar Natura 2000 site on local sustainability in south-eastern Spain. Firstly, 47 environmental, social, and economic variables for which official time series data were available were assessed using a multiple-paired-Before-After-Control-Impact
Romano et al.	Romano, J., Pérez-Chinarro, E., Coral, B.V. (2020) Network of Landscapes in the Sustainable Management of Transboundary Biosphere Reserves. <i>Land</i> 9, 320.	2020	Spain, Portugal	Southern Europe	Transboundary	2	Terrestrial	conservation proposals and the theoretical convergence of nations towards sustainable development goals with the practices in action. By applying the landscape approach to the case study of the rural system of the Spanish–Portuguese border, declared Meseta Ibérica TBR, it is verified that the spatial zoning of TBRs is a prominent factor in this gap, since they do not correspond to the landscape units and bioregions. This has led to the formulation and implementation of strategic proposals for the reorientation of TBRs towards the stimulation

Annex III: Literature review

Sabatini et al.	Sabatini, F.M., Keeton, W.S., Lindner, M., Svoboda, M., Verkerk, P.J., Bauhus, J., Bruelheide, H., Burrascano, S., Debaive, N., Duarte, I., Garbarino, M., Grigoriadis, N., Lombardi, F., Mikoláš, M., Meyer, P., Motta, R., Mozgeris, G., Nunes, L., Ódor, P., Panayotov, M., Ruete, A., Simovski, B., Stillhard, J., Svensson, J., Szwagrzyk, J., Tikkanen, O.P., Vandekerkhove, K., Volosyanchuk, R., Vrska, T., Zlatanov, T., Kuemmerle, T. (2020) Protection gaps and restoration opportunities for primary forests in Europe. Diversity and Distributions 26, 1646-1662	2020			EU Biodiversity Strategy 2030	2	Terrestrial	Primary forests are critical for forest biodiversity and provide key ecosystem services. In Europe, these forests are particularly scarce and it is unclear whether they are sufficiently protected. Here we aim to: understand whether extant primary forests are representative of the range of naturally occurring forest types, identify forest types which host enough primary forest under strict protection to meet conservation targets and highlight areas where restoration is needed and feasible. Location: Europe. Methods: We combined a unique geodatabase of primary forests with maps of forest cover, potential natural vegetation, biogeographic regions and protected areas to quantify the proportion of extant primary forest across Europe's forest types and to identify gaps in protection. Using spatial predictions of primary forest locations to account for underreporting of primary forests, we then highlighted areas where restoration could complement protection. Results: We found a substantial bias in primary forest distribution across forest types. Of the 54 forest types we assessed, six had no primary forest at all, and in two-thirds of forest types, less than 1% of forest was primary. Even if generally protected, only ten forest types had more than half of their primary
Sahlean et al.	Sahlean, T.C., Papeş, M., Strugariu, A., Gherghel, I. (2020) Ecological corridors for the amphibians and reptiles in the Natura 2000 sites of Romania. Scientific Reports 10.	2020	Romania	Eastern Europe	Connectivity	2	Terrestrial	is increasingly dominated by anthropogenic land use, it is clear that broad-scale systems of nature reserves connected by corridors are needed to enable the dispersal of flora and fauna. The European Union currently supports a continent-wide network of protected areas, the Natura 2000 program, but this program lacks the necessary connectivity component. To examine whether a comprehensive network could be built in order to protect amphibians and reptiles, two taxonomic groups sensitive to environmental changes due to their
Said et al.	Said, A., MacMillan, D., Campbell, B. (2018) Crossroads at sea: Escalating conflict in a marine protected area in Malta. Estuarine, Coastal and Shelf Science 208, 52-60.	2018	Malta	Southern Europe	Effectiveness	2	Marine	This article illustrates how the creation of a Marine Protected Area in Malta is failing to adequately include stakeholders in the configuration of conservation targets and measures, leaving local fishers increasingly disempowered. Through a series of interviews and long-term participatory observation, it has been found that the leaders who represent local fishers are failing to communicate the MPA process to their community. Instead, they are using their position in the MPA negotiations to subjugate and silence the fishing community in general
Schoville et al.	Schoville, S.D., Dalongeville, A., Viennois, G., Gugerli, F., Taberlet, P., Lequette, B., Alvarez, N., Manel, S. (2018) Preserving genetic connectivity in the European Alps protected area network. Biological Conservation 218, 99-109.	2018	Alps	Western Europe	Connectivity, OECMs	2	Terrestrial	to colonize new sites and exchange migrants to sustain viable local populations. Alpine habitats often have a high level of protection, yet extensive environmental heterogeneity and the limited dispersal ability of many endemic species makes it unclear whether PA networks provide sufficient connectivity to protect vulnerable species. We assess landscape connectivity in the European alpine PA network by combining measures of habitat and genetic connectivity using community landscape genetics approaches. Examining 27 plant species, we compare levels of genetic diversity in PA and non-PA sites, and rank non-PA sites for their potential value in facilitating genetic and habitat connectivity, as well as preserving species richness in 893 alpine plants. Non-PA
Steinacker et al.	Steinacker, C., Beierkuhnlein, C., Jaeschke, A. (2019) Assessing the exposure of forest habitat types to projected climate change—Implications for Bavarian protected areas. Ecology and Evolution 9, 14417-14429.	2019	Germany	Western Europe	Designation, Connectivity	2	Terrestrial	Due to their longevity and structure, forest ecosystems are particularly affected by climate change with consequences for their biodiversity, functioning, and services to mankind. In the European Union, natural and seminatural forests are protected by the Habitats Directive and the Natura 2000 network. This study aimed to assess the exposure of three legally defined forest habitat types to climate change, namely Tilio-Acerion forests of slopes, screes, and ravines, bog woodlands, and alluvial forests with Alnus glutinosa and Fraxinus excelsior. We analyzed possible changes in their Bavarian distribution, including their potential future coverage by Natura 2000 sites. We hypothesized that protected areas with larger elevational ranges will remain suitable for the
Svensson et al.	Svensson, J., Neumann, W., Bjärstig, T., Zachrisson, A., Thellbro, C. (2020) Landscape approaches to sustainability-aspects of conflict, integration, and synergy in national public land-use interests. Sustainability (Switzerland) 12.	2020	Sweden	Western Europe	Designation	2	Terrestrial	economic, ecological, and socio-cultural aspects and interests. In the boreal, sub-alpine, and alpine regions in Sweden, encompassing 32 million ha, many and different land-use interests overlap, which causes risks for conflict, but potentially also suggests integration and synergy opportunities. Based on geographic information system analyses of geographically delineated national interests regulated in the Swedish Environmental Code, including, amongst others, Natura 2000, contiguous mountains, recreation, reindeer husbandry, and wind power, and based on forestry as a dominating land use, we found extensive overlap among similar but also between dissimilar types of interest. In some mountain municipalities, our results show that the designated
Terraube et al.	Terraube, J., Helle, P., Cabeza, M. (2020) Assessing the effectiveness of a national protected area network for carnivore conservation. Nature communications 11, 1-9.	2020	Finnland	Western Europe	OECMs, effectiveness	2	Terrestrial	governance and external threats. Although methodological advances have permitted assessments of PA effectiveness in mitigating deforestation, we still lack similar studies for the impact of PAs on wildlife populations. Here we use an innovative combination of matching methods and hurdle-mixed models with a large scale and long-term dataset for Finland's large carnivore species. We show that the national PA network does not support higher densities than
Yakusheva et al.	Yakusheva, N. (2019) Managing protected areas in Central Eastern Europe: Between path-dependence and Europeanisation. Land Use Policy 87.	2019	Poland, Slovakia	Central Eastern Europe	Transboundary, Effectiveness	2	Terrestrial	components established before Socialism, reinforced and solidified during Socialist period, and changes brought about by the democratic transition. For nature conservation, the transition to democracy led to new political and legal frameworks, the re-allocation of resources and land tenure changes, which Central Eastern European countries approached differently. Accession to the European Union became an additional layer in the transition

Annex III: Literature review

Waylen et al.		Waylen, K.A., Blackstock, K.L., Van Hulst, F.J., Damian, C., Horváth, F., Johnson, R.K., Kanka, R., Kúlvik, M., Macleod, C.J., Meissner, K. and Oprina-Pavelescu, M.M., 2019. Policy-driven monitoring and evaluation: Does it support adaptive management of socio-ecological systems?. Science of the Total Environment, 662, pp.373-384.	2019	All Member States	Multiple geographic regions	Effectiveness	1	Terrestrial & Marine	<p>Inadequate Monitoring and Evaluation is often thought to hinder adaptive management of socioecological systems. A key influence on environmental management practices are environmental policies: however, their consequences for M&E practices have not been well-examined.</p> <p>We examine three policy areas - the Water Framework Directive, the Natura 2000 Directives, and the Agri-Environment Schemes of the Common Agricultural Policy - whose statutory requirements influence how the monitored, how monitoring is carried out, and how results are used to update management, based on publicly available documentation across nine regional and national cases.</p> <p>The requirements and guidelines of these policies have provided significant impetus for monitoring: however, we find this policy-driven M&E usually does not match the ideals of what is needed to inform adaptive</p>
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