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# Bringing nature into decision-making and policy design. Experiences from overseas Europe

Gianluca Ferraro 🔟 and Pierre Failler 🔟

Centre for Blue Governance, University of Portsmouth, Portsmouth, UK

**ABSTRACT**

Although many legal instruments have been adopted at the international and European Union levels to conserve biodiversity, continued degradation calls for reflections on their national and local implementation. The article examines biodiversity policy implementation in the outermost European region of Canary Islands, a Spanish archipelago rich in biodiversity. In particular it focuses on the policy uptake of new concepts. It deals with the valuation and integration of the services provided by nature into decision-making, and the application of policy measures based on the use of the planet's natural assets. The article also analyses the challenges encountered in such institutional change. The concepts of ecosystem services and nature-based solutions are relatively new in the scientific literature and almost absent in policy literature. This article aims to stress the relevance of these concepts for the development of more innovative policies that bring nature and its services into decision-making and policy practice.

## 1. Introduction

Human development has compromised the health of many natural habitats and their associated flora and fauna in Europe (EEA 2015) as well as in most parts of the planet (IPBES 2019). Biodiversity has decreased at unprecedented rates in human history, mainly in the 20th century with predicted further reduction in the coming decades (Arjjumend, Koutouki, and Alam 2016; Soler Luque and Kostecka 2019). As reported by the European Environment Agency in its latest document on the state of the environment (EEA 2019), about 75% of the terrestrial environment and 40% of the marine environment are now severely altered globally. In the European Union (EU), only 17% of habitats and species and 11% of ecosystems are in a favorable state and about 200 species disappear every day (Arjjumend, Koutouki, and Alam 2016). Several human activities and phenomena are at the root of this alarming biodiversity loss, as direct or

**Table 1.** Pressures on ecosystems.

| Direct causes of biodiversity loss | Indirect causes of biodiversity loss |
|---|---|
| • Changes within aquatic environment and water flows<br>• Climate change<br>• Habitat destruction (degradation, fragmentation, conversion, and loss)<br>• Inappropriate fire regimes<br>• Land-use change for agriculture, fishing, demographic expansion, or deforestation<br>• Introduction by humans and spreading of invasive and exotic species into specific habitats<br>• Overexploitation and unsustainable use of natural resources (e.g. overfishing)<br>• Pollution | • Cultural factors (e.g. limited awareness about biodiversity)<br>• Demographic factors (i.e. population growth)<br>• Institutional drivers<br>• Market demand (that has led to resources overexploitation) |

indirect causes or "pressures" (Table 1); (EU 2011; Maes et al. 2018; Puppim de Oliveira et al. 2011; Soler Luque and Kostecka 2019; Wanjui 2013).

The protection of the environment and the conservation of natural habitats and species is one of the policy priorities of the EU as recently confirmed by the European Commission (EC 2020a) and the Council of the European Union (CEU 2020). The EU has issued a vast amount of environmental legislation by its own initiatives and in compliance with a variety of environmental conventions adopted at the international level. This has led to a rich array of legally binding directives and regulations, as well as policies, programs, action plans, strategies, and other political documents (Annex A). The core of EU environmental legislation is built on three major pillars that consist of the following directives: The Birds Directive (BD) and Habitats Directive (HB), also known together as Nature Directives; the Water Framework Directive (WFD); and the Marine Strategy Framework Directive (MSFD) (Maes et al. 2018). They constitute the "four main environmental directives" of the EU (Table 2) (Rouillard et al. 2016). The most important strategic document for the purpose of this article is the EU Biodiversity Strategy adopted and regularly updated by the EU since 1998 as a Contracting Party to the Convention on Biological Diversity[1] (CBD) signed by the EU in 1992. The accomplishment of the objectives of the EU Biodiversity Strategy strongly relies on the success of the abovementioned four Directives (Rouillard et al. 2016).

Despite the international and EU efforts in promoting biodiversity protection and restoration, current national policies and policy practices still neglect the importance of our natural assets. Policy makers are rarely trained and aware of the value of nature that can be used to shape better policies. In particular subnational governments can play a crucial role in the implementation – and therefore, the success – of national policies and strategies for the conservation of biodiversity (Walter 2017). Local and, more extensively, sub-national implementation in the EU is extremely challenging in those remote areas of the Union that are characterized by geographical, constitutional, and institutional peculiarities, such as its overseas entities.

The article investigates the implementation of biodiversity policy in on one of these overseas entities, i.e. the Canary Islands. The Canary Islands is chosen because it constitutes a relevant case. It is part of Macaronesia, an important geographical area for biodiversity; it is also an autonomous region of Spain, a country characterized by the highest degree of biological diversity in the European continent (OSE 2012). More

**Table 2.** EU main environmental directives.

|  | Birds directive[a] (BD) | Habitats directive[b] (HD) | Water framework directive[c] (WFD) | Marine strategy framework directive[d] (MSFD) |
|---|---|---|---|---|
| Adopted | 2009 | 1992 | 2000 | 2008 |
| Entered into force | 2010 | 1994 | 2000 | 2008 |
| Object | Wild birds | Natural habitats | Sustainable water management – inland surface waters, transitional waters, groundwater and coastal waters until one nautical mile | Marine environment – coastal waters beyond the limit of one nautical mile, seabed and subsoil |
| Reporting | Every three years (BD, art. 12) | Every six years (HB, art. 17) | Every six years | Every six years |
|  | The sites under Annex I of the BD, and Annex I and II of the HD form a network of nature areas, i.e. European Natura 2000 Network. The Natura 2000 Network is at the core of the EU's nature and biodiversity policy. It consists of a network of protected sites established under the Habitats Directive (OSE 2012). | | | |

[a]Full name: Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds (replacing Council Directive 79/409/EEC of 2 April 1979).
[b]Full name: Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
[c]Full name: Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.
[d]Full name: Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy. It has EEA relevance (Maes et al. 2018).

precisely, the article analyses the uptake of nature and its assets in national and local policies, strategies, and actions, and highlights the major challenges faced by such change in policy formulation and design. After clarifying some concepts (Section 2) and motivating the geographical focus (Section 3), the article analyses the incorporation of the values of nature in biodiversity policy in the Canary Islands as an outermost region of Spain (Section 4). Finally, it discusses the complexity of such change and develops possible ways to overcome major obstacles. Section 5 concludes the article.

## 2. Conceptual clarifications

Biological diversity, or "biodiversity", refers to the variety of life present on Earth (OSE 2012; Soler Luque and Kostecka 2019). It includes animals, plants and micro-organisms and is the building block of our ecosystems (Puppim de Oliveira et al. 2011; Wanjui 2013). An ecosystem is "a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit" (UN 1992). Examples of ecosystems are forests, coral reefs, deserts, estuaries, and rivers (OECD 2018).

Ecosystems have important functions for our economic and social well-being that fall under the name of "ecosystem services" (ESs) as defined during the millennium ecosystem evaluation in the early 2000s (OECD 2018). Examples of ESs are the

**Table 3.** Ecosystems and their services.

| Category of ecosystem services | Examples of services |
| --- | --- |
| Provisioning services | Provision of food, potable water, raw materials (e.g., timber) and energy; Production of biomass. |
| Regulating services | Regulation of climate, air pollution, floods, fire; water purification; Waste assimilation; noise reduction; rainwater drainage; sewage treatment; oxygen production; protection of the seacoast against currents and waves; feeding of many species; carbon dioxide sequestration; pests control; pollination support. |
| Cultural services | Cultural developments; spiritual meanings; leisure and recreational use (e.g., in nature reserves); aesthetic interactions; ecological knowledge; physical and mental health. |

provision of food, fresh water, clean air, and materials (e.g. timber). Other important, though less obvious, ESs are the protection from natural disasters (e.g. through the moderation of floods), regulation of climate, purification of water, pollination of crops, decomposition of waste, and regulation of pests and diseases. Ecosystems also provide important cultural services (Table 3) (McFarland and Gerdes 2016; Wanjui 2013). In particular, marine ecosystems – e.g. seagrass beds and mangroves – are well-known carbon sinks with a key role in climate change (CC) adaptation and mitigation (MACOBIOS 2019). Through ESs, the planet's natural assets (i.e. Earth's environmental resources) provide us with important inputs for our economies and societies (UNSD 1997). The degradation of natural ecosystems alters their provision of ESs with negative consequences for human well-being (McFarland and Gerdes 2016). Therefore, the concept of ESs can have an important impact on policy-making for biodiversity conservation at all levels of governance.

The value of nature for addressing environmental, social, and economic challenges has been largely acknowledge by science, practitioners, civil society, and the business sector (Maes and Jacobs 2017). However, the uptake of ESs in decision-making is advancing slowly and remains predominantly in international debates rather than in national practices where their valuation is still confined to punctual exercises. In 2011, the EU included ES valuation in its "Biodiversity Strategy to 2020" (EU 2011) under Action 5. The review conducted by Maes, Teller, and Erhard (2014) on the achievements reached under this action reveals, though, a lack of integration of the concept of ESs in European environmental policies. In the "Biodiversity Strategy to 2030" that was recently released (June 2020), the EU has no longer defined a specific action on the use of ESs but it has recognized it as prejudicial to the implementation of sound policies.

The valuation of ESs has its skeptics about both its ability to supply accurate data and the use of such data. On a large scale, values are often astronomically high as shown by studies around the world. For instance, the estimated annual value of ESs within marine protected areas in some non-EU islands reaches USD 9 billion in the Bahamas (Arkema, Fisher, and Wyatt 2017) and USD 48 billion in Seychelles (Laine 2020). Consequently, ESs are hard to compare to economic reality or to integrate in a national accounting system. Practitioners debate methodological questions, notably issues surrounding benefit transfer and the aggregation and use of the results. Even the core principle of valuation is questioned, since studies tend to show that the more humans exploit an ecosystem, the more its economic value increases, boosted by direct

use values (Failler et al. 2010; Trégarot, Failler, and Maréchal 2017). Such results run counter to marine biodiversity management policies that tend to limit ecosystem services uses.

In this intricate context, a new term has merged in environmental research and management, i.e. Nature-Based Solutions (NBSs; Cohen-Shacham et al. 2016). The term appeared in the early 2000s in the policy practice and international reports (e.g. World Bank 2008). It has been used in the scientific literature only in the last few years (among the first works, see Eggermont et al. 2015; Kabisch et al. 2016; Maes and Jacobs 2017). However, the concept is still not well developed in journals falling under policy science despite its relevance for the development of new policy measures and their inclusion in more innovative policy design that relies on ESs and natural assets. According to Walter (2017), reliance of policy design on NBSs gives a new value to nature by bringing it in the decision-making.

While the term has gained momentum in different stakeholder communities (Faivre et al. 2017), it is still quite "vague or unknown" to the larger public (Nesshöver et al. 2017). Several definitions have been suggested for NBSs; in simple words, they are solutions that use nature and rely on ESs to tackle societal challenges such as climate change, food security, water provision, natural disasters, human health, and our socio-economic development (EC 2020b). NBSs – also called green (and blue) infrastructure or ecosystem-based approaches – are all those actions that protect, restore and manage ecosystems in a sustainable way, and lead simultaneously to human well-being and biodiversity benefits (Cohen-Shacham et al. 2016). NBSs include a plethora of possible interventions; see Table 4 for a categorization developed by the International Union for Conservation of Nature (IUCN). We are particularly interested in "ecosystem restoration" and "ecosystem protection" for the case analyzed in this article. Ecosystem *protection* is the practice of protecting the natural environment and its resources without further direct action to improve its status. Ecosystem *restoration* consists of any attempt to repair, enhance, or assist the recovery of an ecosystem that is degraded, damaged, or destroyed (Cohen-Shacham et al. 2016).

## 3. Case selection: why look so far?

The EU has included 34 overseas entities until Brexit. They either belong or are linked to six of its current or ex- Member States (MSs): Denmark, France, the Netherlands, Portugal, Spain, and the United Kingdom (UK). Nine outermost regions (ORs) are part of these countries; hence they fully comply with the *acquis communautaire* (i.e. the body of EU laws); the remaining 25 overseas countries and territories (OCTs) are not part of these states and have no obligation to comply with EU laws, but benefit from association with the EU (Benzaken and Renard 2011).

All overseas entities – both ORs and OCTs – share peculiar geographical characteristics, i.e. remoteness, insularity, small size, difficult topography, and exposure to climate threats (Azevedo 2017). Remoteness and the insularity (of most of them) have allowed the growth of rich biodiversity on land and, even more so, at sea (Menini et al. 2018). The EU's overseas entities are spread across all oceans and host a diversity of ecosystems that make up more than 70% of the EU's biodiversity. They

**Table 4.** Categories and examples of NBSs.

| Category of NBSs | Examples |
|---|---|
| *Ecosystem restoration approaches* | • Ecological restoration |
| | • Ecological engineering |
| | • Forest landscape restoration |
| *Issue-specific ecosystem-related approaches* | • Ecosystem-based adaptation |
| | • Ecosystem-based mitigation |
| | • Climate adaptation services |
| | • Ecosystem-based disaster risk reduction |
| *Infrastructure-related approaches* | • Natural infrastructure |
| | • Green infrastructure |
| *Ecosystem-based management approaches* | • Integrated coastal zone management |
| | • Integrated water resources management |
| *Ecosystem protection approaches* | • Area-based conservation approaches (including protected area management) |

Source: Cohen-Shacham et al. (2016, 10)

also are home to more than 30% of the globally threatened species, which makes them important for biodiversity at the global scale (Benzaken and Renard 2011; Kettunen and Bezerra 2008; Petit and Prudent 2008). However, the same traits (remoteness, insularity, small size, and difficult topography) make implementation of national policies rather challenging. For instance, coordination with central authorities demands major efforts; monitoring and enforcement by the central government and agencies is difficult; access to technical expertise is limited (McFarland and Gerdes 2016). It is thus important to assess whether and how national policies and strategies are implemented here, and define not only which factors hinder implementation but also which local actions can support national legal frameworks for biodiversity (Benzaken and Renard 2011).

EU overseas entities can be grouped into separate biogeographic regions: polar and subpolar regions; Amazonia; the Caribbean; South Atlantic; Pacific;the Indian Ocean; and Macaronesia. Macaronesia is an important biodiversity hotspot[2] (EU BEST 2016). With its deserts, mountains, forests, rivers, and islands, the region has a unique biogeography made of flora and fauna that reached the archipelagos from adjacent continental areas via long-distance dispersal (Whittaker and Fernández-Palacios 2007). This region is situated in the North East Atlantic Ocean and shared by three countries: Spain and Portugal (within the EU) and the Republic of Cape Verde (Figure 1). The region encompasses a total of 28 main islands, seven uninhabited ones and more than 100 islets (Menini et al. 2018). Looking at EU land only, Macaronesia is composed of three archipelagos: Azores and Madeira (Portuguese ORs) and the Canary Islands (an OR of Spain) (Tuya and Haroun 2009).

In particular, the Canary Islands represents one of the richest biodiversity hotspots in Europe (Benzaken and Renard 2011). It is also the biggest archipelago of Macaronesia (Menini et al. 2018); with more than 2 million inhabitants, it is the most populated of all European overseas entities (EU BEST 2016). It includes seven major islands divided into two administrative provinces. Lanzarote, Fuerteventura, and Gran Canaria (together with some minor islands) form the Province of Las Palmas. Tenerife, La Gomera, La Palma, and El Hierro form the Province of Santa Cruz de Tenerife (EU BEST 2016; Madruga, Wallenstein, and Azevedo 2016). The Canary Islands is a region of Spain and one of its autonomous communities (ACs).

**Figure 1.** The Macaronesia region.

## 4. Changes in policy design and practice in the Canary Islands

This section analyses the changes in policy design and practice that have occurred in the last two decades in Spain under the pressure of international environmental obligations, increasing political attention to ESs and local experimentation with NBSs.

### 4.1. A national strategy and its subnational implementation

For a long time, Spain did not have a consolidated national environmental law, but several legislative texts supported by multiple strategies and programmes. Under the CDB[3]'s legal obligations, the country issued its first national strategy for biodiversity in 1998 (*Estrategia Española para la Conservación y el Uso Sostenible de la Diversidad Biológica*). The National Biodiversity Strategies and Action Plans (NBSAPs) serve as

the primary instrument for the implementation of the CBD's objectives (Hagerman and Pelai 2016; IUCN 2018). The adoption of a strategic document for biodiversity represented a milestone in Spain's biodiversity policy. The Strategy called for a new law that was enacted in 2007.

Law 42/2007 on natural heritage and biodiversity constitutes the core legal document for the conservation, restoration, and enhancement of biodiversity in Spain. The new law incorporated Spain's commitments to several international agreements, including the CBD, and transposed the Habitats Directive of the EU. It consolidated several previous national biodiversity laws and established the Strategic Plan on Natural Heritage and Biodiversity (*Plan Estratégico del Patrimonio Natural y la Biodiversidad*) as pivotal for Spain's strategic planning in the domain of nature conservation (OECD 2015; Ministry of the Environment, and Rural and Marine Affairs 2011). The strategic plan supports the implementation of Law 42/2007, is in line with the EU Biodiversity Strategy 2020 and works as the NBSAP requested by the CBD (OECD 2015).

The development and adoption of the NBSAPs is a complex process that requires the involvement of government, the private sector and society at large; their implementation needs to engage stakeholders at both national and local levels. Spain's current[4] strategic plan was developed with the active engagement of political, economic, and social actors (Ministry of the Environment, and Rural and Marine Affairs 2011) and was issued in 2011 for the period 2011–2017. It acknowledges that the actions that the document foresees are responsibilities of the central administration but that the achievement of its objectives relies on the strict collaboration between the central administration and the ACs of the country (Ministry of the Environment, and Rural and Marine Affairs 2011).

Both Law 42/2007 and the strategic plan recognize the importance of ESs and stress the need to integrate them into public decisions. The strategic plan also promotes "protection and restoration" measures against biodiversity loss. Among the protection measures, protected areas gained momentum as an important policy instrument for biodiversity under Law 42/2007. While this is true mainly for the terrestrial environment, marine protected areas (MPAs) have not developed remarkably and their establishment still needs more attention (OECD 2015; Ministry of the Environment, and Rural and Marine Affairs 2011).

The national strategic plan applies to the Canary Islands. In addition, this autonomous region can also approve its own strategy. Indeed, this AC has its own government, parliament, and exclusive competence in several fields: physical planning, land management, hunting, fisheries in inner waters, aquaculture, water management, scientific research (in coordination with the Spanish State), natural protected areas, and coastal zone management. Funds for nature conservation come from the regional authorities. The Canary Islands has a tradition of good collaboration with central authorities. For instance, it reports periodically to the national government about the actions implemented at the regional and local level for the preparation of national reports under the CBD. In general, the region shows good institutional interaction among all actors involved in biodiversity, i.e. its biodiversity policy community: government departments, research laboratories, universities, NGOs, and municipalities (Benzaken and Renard 2011).

The presence of a harmonious policy community has certainly played in favor of implementation. According to Benzaken and Renard (2011), most objectives of the CBD have been achieved in the Canary Islands. The region has approved legislation by establishing and regulating a wide set of protected areas (both on land and in the ocean) and issued catalogues of protected species (EU BEST 2016). It has also implemented several actions for biodiversity protection and restoration. The result is that about 40% of the territory of the Canary Islands is under some form of protection (Benzaken and Renard 2011). The region has also experimented with the use of NBSs for ecosystem restoration.

## 4.2. Restoration projects at the local level

The uptake of innovative NBSs in policy-making and their integration into public polices can be promoted by the action of the subnational level (Walter 2017). A good example is provided by the local attempts to restore seagrass meadows in the sea waters of the Canary Islands. We focus on seagrasses because they constitute one of the most valuable ecosystems in the world; yet they have been in decline all over the planet since the 1930s. According to the UN (UNEP 2020), an estimate of 7% of seagrasses are lost worldwide every year, which equates to the loss of a football field (of seagrass) every 30 min.

Seagrasses are plants of the marine environment; they create meadows on the seabed and can be considered as "underwater forests". Like forests on land, they are essential habitats for a variety of species; they also contribute to human wellbeing through a variety of ESs. They are an important source of oxygen and natural sinks of carbon dioxide in the fight against climate change; they clean the surrounding water; they capture sand and stabilize the sediment, thus protecting the coastline against erosion and floods. Therefore, the loss of seagrass meadows will affect humans both directly and indirectly since it will lead to decline in marine biodiversity, levels of oxygen, quality of water, beach sand and substrate's stability, and fishing resources (OCEANA 2010; UNEP 2020). Severe losses of seagrass are occurring in Spanish waters, including those of the Canary Islands (OSE 2012).

Although natural causes (e.g. wave action and winter storms) can damage seagrass beds, the major threats to these marine plants come from human activities: irresponsible fishing with destructive practices (e.g. by bottom trawling); mass tourism (e.g. anchoring on seagrass); poor coastal management (e.g. construction of ports); water contamination (e.g. due to discharges from agriculture); and many more human activities (e.g. aquaculture and sand extraction) (OCEANA 2010). The conservation of seagrass meadows can be pursued by combining measures that protect the existing beds – e.g. marine protected areas, regulations to prevent pollution or destructive fishing practices, and sanctions – and instruments that help the degraded areas to recover such as replanting.

Regarding the protection of seagrass at the global level, the UN points out that "[o]f the known distribution of seagrasses, only one quarter (26%) occurs within MPAs" (UNEP 2020, 63); this indicates a general neglect for seagrasses protection in biodiversity policies. By contrast, a relatively large number of local initiatives have tried to

restore seagrass meadows, by either collecting and transplanting adult plants, or obtaining and planting seeds (OCEANA 2010). The debate about these techniques and their risks falls out of the focus of our article; suffice to stress, here, that more scientific knowledge is needed as we argue later in this article (Section 5.1).

Several local projects to restore seagrass were conducted in Spain, too. These initiatives have been driven by NGOs, private actors, or scientific institutions and – more often – by a combination of actors. An example of collaboration between an NGO and a private actor is the seagrass restoration project conducted by OCEANA[5] and Banco Santander Foundation along the coastline of Almeria with the endorsement of the Regional Government of Andalusia (OCEANA 2010). Another project took place in the early 2000s in the Canary Islands and was carried out by the *Instituto Canario de Ciencias Marinas* (ICCM; Canary Institute of Marine Sciences). The ICCM depends upon the Regional Government of the Canary Islands; it is an institute devoted to research, technological development, and innovation. The ICCM conducted a series of experimental transplants (and relocation) of a species of seagrass, *Cymodocea nodosa*, across the waters of the archipelago. *Cymodocea nodosa* is a protected species under the legislation of the Canary Islands (Decree 151/2001). The success of some of these small-scale pilot projects (e.g. in Gran Canaria and Lanzarote) contributed to the restoration of seagrass beds. In addition, a regional Conservation Plan was drafted for this species.

## 5. Putting change into practice

In this section, we present considerations on two major implementation challenges that we draw from our empirical study on the Canary Islands: the uncertainty existing in science and the involvement of stakeholders and local actors. We acknowledge that nature-based policy development using ESs and NBSs must recognize the institutional history of a specific context and its social heritage. As stated by Barton, Ring, and Rusch (2014, 6), "[a]chieving biodiversity conservation and ecosystem services provision includes attuning policy mixes to societal challenges which are local and place-specific". Although we will not aim at complete generalization of our considerations, we try to set the direction for future action beyond the case study presented in this article.

### 5.1. Reducing scientific uncertainty through research and local knowledge

Political science literature has traditionally explained public policy developments by appealing to three key factors: actors' interests and ideas, as well as institutions. Interests refer to the preferences of various stakeholders (elected officials, civil servants, societal groups, etc.) that are willing to achieve their own ends with maximum benefit at minimum costs. Ideas refer to factual knowledge such as scientific evidence, technical expertise, or experiential knowledge of societal groups about public problems and possible solutions[6]. Institutions are the rules (both formal and informal) that structure political behavior, for instance laws, organizational practices, and policy legacies (Gauvin 2014).

In the context of this paper, we want to focus on ideas understood as knowledge and, more precisely, on the uncertainty and complexity that affect scientific knowledge. Scientific evidence is rarely complete and often dynamic and contestable (SAPEA 2019). Based on their very nature, the success of NBSs – that employ ESs – largely depends on the scientific knowledge we possess on ecosystems and their dynamics (Cohen-Shacham et al. 2016). Not all projects of seagrass beds' transplants and relocation have worked as hoped because scientific knowledge is often lacking. Knowledge gaps exist, for instance, about the conditions of the donor bed, threats and opportunities of the future location, dynamics of seagrass' recovery, and interactions with the surrounding environment (OCEANA 2010).

Gaps in the knowledge of these aspects and, more broadly, on habitats and ecosystems exist beyond the specific case study investigated here. Lack of adequate data seems to affect many other overseas entities of the EU, both ORs (e.g. Reunion and Azores), and OCTs (e.g. Nouvelle-Calédonie and Sint Maarten) as we have experienced during our research[7]. Weaknesses in the available data on ecosystems – and consequently their services – also affect policy-making in European countries as reported by a policy expert from an environmental international NGO (Interview file MO.01.XI.20; UK, 27 November 2020). Similarly for NBSs, "[t]he gaps in knowledge are often still of a fundamental character and need to be addressed in order to inform future NBS projects" (Nesshöver et al. 2017, 1223).

The lack of evidence can hamper the adoption and implementation of adequate management measures where the political commitment to biodiversity is not strong enough. More generally, weak knowledge of ecosystems, ecosystem dynamics and services may enhance the political neglect for including ESs in policy decisions and NBSs in policy design (McFarland and Gerdes 2016). As clearly stated by Farrell and Finnemore (2016), it is difficult to advance new ideas in the absence of good data.

Knowledge gaps are usually substantial in marine ecosystems due to the complexity of these ecosystems and limited access to the marine environment. In particular, the EU's overseas entities (both ORs and OCTs) still lag behind in the mapping and assessment of their ecosystems and related services. Although funding has found some financial sources in EU projects, EU's overseas entities often lack technical skills and need to rely on research centers located in mainland Europe. Furthermore, understanding ESs supposes that we have good knowledge of the ecosystems present in a territory and their condition. With a focus on our case study, comprehensive knowledge about the condition of habitats and species in Spain is still far from complete (Real Decreto 1274/2011).

There are not only serious data limitations associated with the valuation of ESs but also a complex scientific debate about methodological aspects. First, the growing number of valuation methods risks to shift attention away from the initial objective of providing a valuation of the ESs (monetary or not) toward discussions about techniques and their limits. Second, there is no clear direction on how to integrate ESs into policy- and decision-making (BSR 2013). Although many efforts have been made to improve the science-policy interface (Bagstad et al. 2013; Grêt-Regamey et al. 2017), any doubt regarding the reliability of the valuation and any difficulty to operationalize ESs represents an additional constraint to convince policy-makers of the validity of the approach.

While knowledge needs to be reinforced, scientific research is not the only possible route to follow. A good amount of information, expertise and ideas can be brought into policy-making by the public. Indeed, knowledge is not limited to the scientific community. Quite the opposite, experts working in isolation from local populations may overlook important aspects that are well known to the latter. Therefore, better policy design can be achieved not only with more scientific research but also through public involvement. Experts and lay knowledge are complementary; in particular, public involvement will expose policy-makers to a wider range of perspectives, priorities, and values (Thomas 2012), which is strongly needed for the application of ESs and NBSs as we argue in the following section.

## 5.2. Increasing public engagement

The importance of public engagement in policy decisions is undeniable in the modern systems of governance. The multiple reasons why public involvement is pivotal for better decision-making can be simplified into three major benefits. On the substantive (or cognitive) level, public involvement improves the "quality" of public decisions by bringing a broader spectrum of ideas and knowledge into policy-making. On a political (or instrumental) level, public involvement enhances the "legitimacy" of the way public decisions are adopted; in turn, legitimacy increases "trust" in the government and eases the implementation of policy initiatives. On an ethical (or normative) level, public involvement strengthens the "democracy" of a political system and its public support (Thomas 2012). These advantages of public involvement (i.e. quality, legitimacy, and public support) also apply to the topic investigated in this article. The involvement of people can be useful for three important reasons: improving knowledge on NBSs and ESs, easing the adoption of innovative policy measures and gaining public support for NBSs.

First, the utilization of NBSs relies on the concept of ESs. For the full understanding of what services are provided by ecosystems (such as seagrass) and their inclusion in policy decisions, the mapping and assessment of ecosystem services (MAES) is required. MAES exercises have started in many parts of the EU's overseas entities, for instance in Macaronesia and particularly in the Canary Islands (MOVE 2020). However, the policy uptake of the ESs concept is, in general, still weak. In particular, the inclusion of ESs in decision-making in many ORs and OCTs is still affected by their insularity, the fragmentation of efforts across many overseas entities, insufficient financial resources, limited availability of data for many areas and lack of knowledge. Furthermore, any meaningful MAES endeavor needs to be participatory and involve stakeholders. This is crucial for the understanding of how the loss of specific ecosystems will affect different actors. Therefore, local knowledge and stakeholders' perceptions needs to be included if the goal is to inform decision-making with more complete knowledge and expertise. Such approaches that integrate a socio-ecological analysis with biophysical insights is still lacking for many ORs and OCTs (Geneletti et al. 2020).

Second, informing and including the public in MAES will not only lead to more knowledge that will strengthen the gaps highlighted above. It can also ease the adoption and implementation of ESs and NBSs and raise awareness among people about nature

and its services. Public engagement tends to generate legitimacy and trust (Thomas 2012), which has a positive impact on policy implementation. Indeed, decisions recognized as legitimate by the affected groups are likely to face less opposition. Public involvement produces higher rates of implementation through the legitimation and acceptance of decisions, and the reduction of (exiting or potential) conflicts among competing interests (Ferraro 2019). This is important for our case. Maintaining ecosystem and ecological functions often implies tradeoffs with other uses of the land. These tradeoffs need to be fully acknowledged while adopting NBSs, in order to consider the possible disturbance that reliance on ESs and NBSs may cause to vested interests. In many cases, public decisions on NBS design, costs, location, scale, and management will involve a variety of stakeholders who may have quite different opinions on the best ways of managing their problems. NBS will have to be accepted as alternatives to other solutions (Nesshöver et al. 2017). The case of Canary Islands is an example of good public engagement at the subnational level and institutional collaboration with the central authorities for the adoption and implementation of a national strategy for biodiversity in compliance with international and EU obligations for biodiversity protection and restoration (Section 4.1).

Third, if the uptake of ESs and NBSs is done inclusively, this can even generate public support to advance policy reform for biodiversity conservation or oppose myopic policy decisions. In other words, aware, informed and engaged publics can exert pressures on politicians at the local level to uptake ESs and apply NBSs. Public engagement is important to steer more NBSs in the policy practice. Several seagrass restoration projects in Spain have been promoted by a combination of actors: NGOs, the private sector, and scientific institutions (Section 4.2). Indeed, NBSs (such as ecosystems restoration measures) can be: "government-driven initiatives," when the government plays an active role in the restoration and management of specific habitats; "NGOs-driven initiatives," when (local and international) NGOs direct restoration activities and also engage local stakeholders; "community-driven initiatives," when local communities embark on restoration activities without external assistance once they face the ecological impact of biodiversity degradation; and based on a "mixed approach," when government agencies, NGOs and local communities work together in the restoration and management of degraded habitats (UNEP-Nairobi Convention/USAID/WIOMSA 2020). In almost all approaches the importance of public engagement is undeniable.

## 6. Conclusion

Spain has clearly experienced a change in its policy design for biodiversity. This has happened under the pressure of international rules at the global and EU level. Spain is one of the EU's MSs with the richest biodiversity because of many factors, including the geographical position and extension that embraces remote areas such as the Canary Islands. Biodiversity loss in the country is accelerating under several pressures such as changes in land use, overexploitation of natural resources, pollution on land and at sea, the spread of invasive alien species, and climate change (OSE 2012). Biodiversity loss is more acute in some areas of the country, such as the Macaronesian islands (Ministry of the Environment, and Rural and Marine Affairs 2011). Pressures on biodiversity are

not likely to decrease in the coming years; in particular, climate change will be increasingly worrying for mainland Spain and its archipelagos (OSE 2012).

Similar dynamics will affect other EU's overseas entities and biodiversity hotspots (IPBES 2019; MOVE 2020). The current national policies of many countries have not halted biodiversity loss despite the several international obligations that commit states to the conservation of ecosystems (IUCN 2018). Now, more than ever, it is pivotal that national governments implement those commitments and develop new domestic biodiversity policies that fully acknowledge and incorporate nature both in the process of decision-making and in policy design (Trégarot, Failler, and Maréchal 2017). Unfortunately, policy reforms are not easily achieved, especially when change concerns not only the instruments available but also the objectives of public intervention (Hall 1993). However, starting from the Spanish case and Macaronesia, the article has shown some possible pathways to attain such change.

First, the socio-economic gain coming from biodiversity protection and restoration needs to be made clearer to policymakers and the general public. Despite the recognition of the relevance of ESs at the international level, the value of biological diversity is not yet sufficiently applied in *national* public decisions (OSE 2012). Unfortunately, we argued, the calculation of this value brings along some level of scientific complexity that might weaken its adoption. Experts from several disciplines (economists, ecologists, and social scientists) have worked in the last decades to improve the valuation of ESs in monetary, social, and political terms so that it can be more easily incorporated into the decision-making process (Archer et al. 2018; Failler et al. 2015; OSE 2012). However, some knowledge gaps still exist, which leads us to our next point.

Second, more scientific research on ecosystems dynamics is needed, particularly in EU's overseas entities where capacity is often lacking despite their crucial role for biodiversity. Stronger scientific evidence can also benefit the uptake of new policy measures in policy design. Scientists from different disciplines need to fill existing knowledge gaps and provide guidance to policymakers and all other relevant stakeholders on more innovative and effective measures. In the effort to fill these gaps, scientific research can be complemented by local knowledge; yet this will require more inclusive practices of decision-making that are not common across all EU's overseas entities.

Third, public participation needs to be enhanced in biodiversity policy as well as in all environmental matters as requested by the Aarhus Convention[8] more than two decades ago. Inclusive decision-making, harmonious center-local relations and local entrepreneurship have certainly played a positive role in the case analyzed in this article, both for the adoption and implementation of a new national strategy acknowledging ESs and the local uptake of new policy measures like the NBSs.

## Notes

1. In 1992, the United Nations Conference on Environment and Development (or the Rio "Earth Summit") led to the adoption of three important conventions: The Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations Convention to Combat Desertification (UNCCD). In particular, the CBD – that came into force in 1993 – represents the main

global instrument and most comprehensive international agreement for biodiversity conservation (Arjjumend, Koutouki, and Alam201662; Benzaken and Renard 2011).

2. Biodiversity hotspots are places on Earth that are both biologically rich and deeply threatened. For more information, see https://www.conservation.org/priorities/biodiversity-hotspots (last accessed: August 13 2020).
3. Spain ratified the CBD in 1993.
4. Although Law 42/2007 foresees that the strategic plan will be revised every six years, the last valid version is still the one adopted in 2011.
5. OCEANA groups several foundations (i.e. The Pew Charitable Trusts, Oak Foundation, Marisla Foundation, Sandler Foundation, and the Rockefeller Brothers Fund). It is an international non-profit organisation focusing on oceans and conducting science-based policy campaigns. More information is available at www.oceana.org (last access: October 10, 2020).
6. Ideas can also refer to personal beliefs and cultural values (Gauvin 2014).
7. We conducted several interviews on the uptake of ESs in various EU's ORs and OCTs in the framework of a research project funded by the EU. For more information on the MOVE project see https://moveproject.eu/ last access: Janurary 1 2021).
8. For more information on the Aarhus Convention, please visit https://www.unece.org/env/pp/treatytext.html (last access: September 9 2020).
9. Full name: Directive 2009/147/EC of the European Parliament and of the Council of November 30 2009 on the Conservation of Wild Birds (replacing Council Directive 79/409/EEC of April 2 1979).
10. Full name: Council Directive 92/43/EEC of May 21 1992 on the conservation of natural habitats and of wild fauna and flora.
11. Full name: Directive 2000/60/EC of the European Parliament and of the Council of October 23 2000 establishing a framework for Community action in the field of water policy.
12. Full name: Directive 2008/56/EC of the European Parliament and of the Council of June 17 2008 establishing a framework for community action in the field of marine environmental policy. It has EEA relevance (Maes et al. 2018).
13. The Natura 2000 Network is at the core of the EU's nature and biodiversity policy. It consists of a network of protected sites established under the Habitats Directive (OSE 2012).

## Disclosure statement

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## ORCID

Gianluca Ferraro http://orcid.org/0000-0002-9457-6136
Pierre Failler http://orcid.org/0000-0002-9225-9399

## References

Archer, E., L. E. Dziba, K. J. Mulongoy, M. A. Maoela, M. Walters, R. Biggs, M.-C. Cormier-Salem, et al. 2018. *Summary for Policymakers of the Regional Assessment Report on Biodiversity and Ecosystem Services for Africa of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* Bonn, Germany: IPBES secretariat.

Arkema, K., D. Fisher, and K. Wyatt. 2017. "Economic Valuation of Ecosystem Services in Bahamian Marine Protected Areas." Paper prepared for BREEF by The Natural Capital Project, Stanford University, 22 November.

Arjjumend, H., K. Koutouki, and S. Alam. 2016. "Evolution of International Governance of Biodiversity." *Journal of Global Resources* 3: 1–15. https://www.researchgate.net/publication/311841506_Evolution_of_International_Governance_of_Biodiversity

Azevedo, F. 2017. "Outermost Regions." *Factsheets of the European Union*, 1–3. https://www.europarl.europa.eu/RegData/etudes/fiches_techniques/2013/050107/04A_FT(2013)050107_EN.pdf

Bagstad, K. J., D. J. Semmens, S. Waage, and R. Winthrop. 2013. "A Comparative Assessment of Decision-Support Tools for Ecosystem Services Quantification and Valuation." *Ecosystem Services* 5: 27–39. doi:10.1016/j.ecoser.2013.07.004.

Barton, D. N., I. Ring, and G. Rusch. 2014. "Policyscapes – Nature-Based Policy Mixes for Biodiversity Conservation and Ecosystem Services Provision." *Policymix Project*, Policy Brief No. 2.

Benzaken, D., and Y. Renard. 2011. *Future Directions for Biodiversity Action in Europe Overseas: Outcomes of the Review of the Implementation of the Convention on Biological Diversity.* Gland, Switzerland: IUCN.

BSR (Business for Social Responsibility). 2013. "Private Sector Uptake of Ecosystem Services Concepts and Frameworks – The Current State of Play." https://www.bsr.org/reports/BSR_Private_Sector_Uptake_Ecosystem_Services.pdf.

CEU (Council of the European Union). 2020. *Conclusions on Biodiversity – the Need for Urgent Action.* Brussels, (accessed October 16 2020). https://data.consilium.europa.eu/doc/document/ST-11829-2020-INIT/en/pdf

Cohen-Shacham, E., G. Walters, C. Janzen, and S. Maginnis, eds. 2016. *Nature-Based Solutions to Address Global Societal Challenges.* Gland, Switzerland: IUCN.

EC (European Commission). 2020a. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – EU Biodiversity Strategy For 2030. Bringing nature back into our lives." EC, Brussels. Accessed June 20 2020). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0380

EC (European Commission). 2020b. *Biodiversity and Nature-based Solutions – Analysis of EU-funded projects.* EC, Brussels. https://op.europa.eu/en/publication-detail/-/publication/d7e8f4d4-c577-11ea-b3a4-01aa75ed71a1.

EEA (European Environment Agency). 2015. *EU 2010 Biodiversity Baseline – Adapted to the MAES Typology* Copenhagen: EEA.

EEA (European Environment Agency). 2019. *The European Environment – State and Outlook* 2020. Copenhagen: European Environment Agency.

Eggermont, H., E. Balian, J. Manuel, N. Azevedo, V. Beumer, T. Brodin, J. Claudet, et al. 2015. "Nature-Based Solutions: New Influence for Environmental Management and Research in Europe." *GAIA - Ecological Perspectives for Science and Society* 24 (4): 243–248. doi:10.14512/gaia.24.4.9.

EU (European Union) 2011. *Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions – Our Life Insurance, Our Natural Capital: An EU Biodiversity Strategy to 2020*. Brussels: European Commission.

EU BEST. 2016. *Regional ecosystem profile – Macaronesian Region*. Brussels: European Commission.

Failler, P., E. Petre, F. Charrier, and J.-P. Marechal. 2010. *Détermination de la valeur socio-économique des récifs coralliens et écosystèmes associés (mangroves, herbiers de phanérogames, zones littorales envasées) de Martinique* [Determination of the socio-economic value of coral reefs and associated ecosystems (mangroves, phanerogam meadows, silted coastal areas) of Martinique]. Plan d'actions national IFRECOR 2006–2010. Fort-de-France, Martinique: Ministry of Ecology. Spanish.

Failler, P., J.-P. Maréchal, E. Petre, and T. Binet. 2015. "Valuation of Marine and Coastal Ecosystem Services as a Tool for Conservation: The Case of Martinique in the Caribbean." *Journal of Ecosystem Services* 11: 67–75. doi:10.1016/j.ecoser.2014.10.011..

Faivre, N., M. Fritz, T. Freitas, B. de Boissezon, and S. Vandewoestijne. 2017. "Nature-Based Solutions in the EU: Innovating with Nature to Address Social, Economic and Environmental Challenges." *Environmental Research* 159: 509–518. doi:10.1016/j.envres.2017.08.032..

Farrell, H., and M. Finnemore. 2016. "Global Institutions without a Global State." In *The Oxford Handbook of Historical Institutionalism*, edited by O. Fioretos, T.G. Falleti, and A. Sheingate, Oxford: Oxford University Press, pp. 572-589.

Ferraro, G. 2019. *The Public and the Politics of Radioactive Waste Management: Public Involvement and Policy-Making in the European Union*. London: Routledge.

Gauvin, F.-P. 2014. *Understanding Policy Developments and Choices through the "3-i" Framework: Interests, Ideas and Institutions*. Montréal, Québec: National Collaborating Centre for Healthy Public Policy.

Geneletti, D., B. Adem Esmail, C. Cortinovis, I. Arany, M. Balzan, P. van Beukering, S. Bicking, et al. 2020. "Ecosystem Services Mapping and Assessment for Policy- and Decision-Making: Lessons Learned from a Comparative Analysis of European Case Studies." *One Ecosystem* 5: e53111. doi:10.3897/oneeco.5.e53111.

Grêt-Regamey, A., E. Sirén, S. H. Brunner, and B. Weibel. 2017. "Review of Decision Support Tools to Operationalize the Ecosystem Services Concept." *Ecosystem Services* 26: 306–315. doi: 0.1016/j.ecoser.2016.10.012. doi:10.1016/j.ecoser.2016.10.012.

Hagerman, S. M., and R. Pelai. 2016. "As Far as Possible and as Appropriate: Implementing the Aichi Biodiversity Targets." *Conservation Letters* 9 (6): 469–478. doi:10.1111/conl.12290.

Hall, P. 1993. "Policy Paradigms, Social Learning, and the State – the Case of Economic Policymaking in Britain." *Comparative Politics* 25 (3): 275–296. doi:10.2307/422246.

IPBES. 2019. *Global Assessment Report on Biodiversity and Ecosystem Services*, Bonn, Germany: IPBES.

IUCN 2018. *Strengthening Global Biodiversity Governance Post-2020: lessons from the Climate Regime?, Information Paper, International Union for Conservation of Nature*. Gland: IUCN.

Kabisch, N., N. Frantzeskaki, S. Pauleit, S. Naumann, M. Davis, M. Artmann, D. Haase, et al. 2016. "Nature-Based Solutions to Climate Change Mitigation and Adaptation in Urban Areas: perspectives on Indicators, Knowledge Gaps, Barriers, and Opportunities for Action." *Ecology and Society* 21(2): 39. doi:10.5751/ES-08373-210239.

Kettunen, M., and N. P. Bezerra. 2008. *Brussels in Brief: Conserving Biodiversity in the EU Overseas Entities*. Institute for European Environmental Policy, Brussels.

Laine, S. 2020. *Valuation of the Blue Economy in Seychelles*. UNECA project of Blue Economy Valuation Toolkit.

Madruga, L., F. Wallenstein, and J. M. N. Azevedo. 2016. *Regional Ecosystem Profile – Macaronesian Region. EU Outermost Regions and Overseas Countries and Territories*. European Commission.

Maes, J., A. Teller, and M. Erhard. 2014. *Mapping and Assessment of Ecosystems and their Services. Indicators for Ecosystem Assessments Under Action 5 of the EU Biodiversity Strategy to 2020*, European Union, Luxembourg.

Maes, J., and S. Jacobs. 2017. "Nature-Based Solutions for Europe's Sustainable Development." *Conservation Letters* 10 (1): 121–124. doi:10.1111/conl.12216.

Maes, J., A. Teller, M. Erhard, B. Grizzetti, J. I. Barredo, M. L. Paracchini, S. Condé, et al. 2018. Mapping and Assessment of Ecosystems and Their Services: An Analytical Framework for Ecosystem Condition. European Union, Luxembourg.

McFarland, K., and H. Gerdes. 2016. *Uptake of Ecosystem Valuations in Policymaking in Europe's Overseas Entities: Application, Barriers to Use, and Opportunities for Improved Uptake.* NetBiome-CSA, Grant Agreement n° 603710.

Menini, E., F. Halim, D. Gabriel, J. L. Suarez de Vivero, H. Calado, F. Moniz, and M. Caña Varona. 2018. Geopolitical Framework of the Macaronesia Region. GPS Azores Project, Ponta Delgada.

MACOBIOS. 2019. *Marine Coastal Ecosystems Biodiversity and Services in a Changing World*, MACOVIOS Project.

MOVE. 2020. *Scientific research on mapping and assessment of ecosystems and their services in the EU Overseas*. MOVE Project, Grant Agreement n° 07.027735/2018/776517/SUB/ENV.D2.

Nesshöver, C., T. Assmuth, K. N. Irvine, G. M. Rusch, K. A. Waylen, B. Delbaere, D. Haase, et al. 2017. "The Science, Policy and Practice of Nature-Based Solutions: An Interdisciplinary Perspective." *The Science of the Total Environment* 579: 1215–1227. doi:10.1016/j.scitotenv.2016.11.106.

OCEANA. 2010. *Sustainable Development Manuals Restoration of Seagrass Meadows*. Madrid: OCEANA.

OECD. 2015. *OECD Environmental Performance Review-Spain 2015*. Paris: OECD.

OECD. 2018. *Cost-Benefit Analysis and the Environment: Further Developments and Policy Use.* Paris: OECD Publishing.

OSE. 2012. *Biodiversity in Spain. The Basis for Sustainability in the Face of Global Change*, Madrid: Observatorio de la Sostenibilidad en España.

Petit, J., and G. Prudent. 2008. *Climate Change and Biodiversity in the European Union Overseas Entities*. Brussels: IUCN.

Puppim de Oliveira, J. A., O. Balaban, C. N. H. Doll, R. Moreno-Peñaranda, A. Gasparatos, D. Iossifova, and A. Suwa. 2011. "Cities and Biodiversity: Perspectives and Governance Challenges for Implementing the Convention on Biological Diversity (CBD) at the City Level." *Biological Conservation* 144 (5): 1302–1313. doi:10.1016/j.biocon.2010.12.007.

Ministry of the Environment, and Rural and Marine Affairs. (2011). *Real Decreto 1274/2011, de 16 de septiembre, por el que se aprueba el Plan estratégico del patrimonio natural y de la biodiversidad 2011-2017, en aplicación de la Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad* [Royal Decree 1274/2011, of September 16, approving the Strategic Plan for Natural Heritage and Biodiversity 2011-2017, in application of Law 42/2007, of December 13, on Natural Heritage and the Biodiversity]. Spanish. https://www.boe.es/eli/es/rd/2011/09/16/1274

Rouillard, J., M. Lago, K. Abhold, L. Roeschel, T. Kafyeke, H. Klimmek, and V. Mattheiß. 2016. *Synergies and Differences between Biodiversity, Nature, Water and Marine Environment EU Policies*, Aquacross project, Deliverable 2.1. https://aquacross.eu/sites/default/files/D2.1_Synergies%20and%20Differences%20between%20EU%20Policies%20with%20Annexes%2003112016.pdf

SAPEA. 2019. *Making Sense of Science for Policy Under Conditions of Complexity and Uncertainty. Science Advice for Policy by European Academies (SAPEA)*. SAPEA, Berlin.

Soler Luque, Z., and J. Kostecka.2019. "Biodiversity Loss, the Causes, the State and Basic Form of Nature Protection in Spain and Poland." *Polish Journal for Sustainable Development* 22 (2): 75–84. doi:10.15584/pjsd.2018.22.2.9.

Thomas, J. C. 2012. *Citizen, Customer, Partner: Engaging the Public in Public Management*. Routledge: Oxon and New York.

Trégarot, E., P. Failler, and J.-P. Maréchal. 2017. "Evaluation of Coastal and Marine Ecosystem Services of Mayotte: Indirect Use Values of Coral Reefs and Associated Ecosystems." *International Journal of Biodiversity Science, Ecosystem Services & Management* 13 (3): 19–34. doi:10.1080/21513732.2017.1407361.

Tuya, F., and R. J. Haroun. 2009. "Phytogeography of Lusitanian Macaronesia: biogeographic Affinities in Species Richness and Assemblage Composition." *European Journal of Phycology* 44 (3): 405–413. doi:10.1080/09670260902836246.

UN. 1992. *Convention on Biological Diversity*. Rio de Janeiro: United Nations.

UNEP. 2020. *Out of the Blue: The Value of Seagrasses to the Environment and to People*. Nairobi: United Nations Environment Programme.

UNEP-Nairobi Convention/USAID/WIOMSA. 2020. *Guidelines on Mangrove Ecosystem Restoration for the Western Indian Ocean Region*. Nairobi: UNEP.

UNSD. 1997. *Glossary of Environment Statistics. Studies in Methods, Series F, No. 67*. New York: United Nations.

Walter, S. G. 2017. "*Nature-based Solutions: Pandora box or reconciling concept?*" IUCN Webinar. October 4 2017. https://www.youtube.com/watch?v=dzBsIy9P5Bc&feature=youtu.be

Wanjui, J. 2013. "Biodiversity Conservation Needs and Method to Conserve the Biological Diversity." *Journal of Biodiversity and Endangered Species* 1: 1–2. doi:10.4172/2332-2543.1000113.

Whittaker, R. J., and J. M. Fernández-Palacios. 2007. *Island Biogeography. Ecology, Evolution and Conservation*. London: Oxford University Press.

World Bank. 2008. *Biodiversity, Climate Change and Adaptation: Nature-Based Solutions from the World Bank Portfolio*. Washington DC: World Bank.

## Annex A

## Overview of the most relevant EU documents for the protection of the environment

| Directives and regulations | Policies, programs, and action plans | Strategies and other documents |
| --- | --- | --- |
| • Birds Directive<br>• Directive on Environmental Quality Standards<br>• Floods Directive<br>• Habitat Directive<br>• Invasive Alien Species Regulation<br>• Marine Strategy Framework Directive<br>• Marine Spatial Planning Directive<br>• Water Framework Directive | • Action Plan for Nature, People, and the Economy<br>• Common Fisheries Policy<br>• Integrated Maritime Policy<br>• Seventh Environment Action Programme<br>• Water Security and Drought Policy | • Biodiversity Strategy<br>• Bioeconomy Strategy<br>• Blue Growth Strategy<br>• Green Infrastructure Strategy<br>• Ocean Governance Communication<br>• Strategy on Adaptation to Climate Change<br>• 2030 Climate and Energy Framework |