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The Simplification of Biological Diversity in International and EU Law

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Abstract: Every system that manages or assesses biodiversity rests on a simplification of its complexity. The simplification of biodiversity is debatable and difficult; even, for example, regarding the elements on which the assessment and management should focus. Nevertheless, within law, there are assessment and management schemes that are based on a simplified understanding of the meaning of [the construct of] 'biodiversity'. For example, the Ecosystem Approach, European Union (EU) Habitats Directive, and the EU Water Framework Directive try to assess the status of different biodiversity elements based on their different 'biodiversity' simplifications. As the conservation of biodiversity is a vital global question, it is important to include the right elements within the 'biodiversity' construct to achieve no net loss. Based on international and EU law, I conceptualize a consistent legal simplification of 'biodiversity'.

Keywords: convention on biological diversity; ecosystem approach; EU habitats directive; EU water framework directive; no net loss of biodiversity

1. Introduction

The protection of biodiversity is a vital part of environmental law and the aim of sustainable development, nationally, within the European Union (EU), and internationally. Internationally, the pivotal definition is to be found in the Convention on Biological Diversity (CBD) article two, which defines 'biological diversity', and recognizes genetic, species, and ecosystem elements, and the abiotic and biotic processes from which biological diversity follows. 'Biological diversity' and 'biodiversity' are two comparable constructs, and biodiversity is often used as an abbreviation of 'biological diversity'. I will use foremost the term 'biodiversity'.

The aim of the CBD is to conserve biodiversity and with article two, it has a wide scope as it includes biodiversity in all its complexity. The holistic nature of the definition has the advantage that it can be applied to most circumstances of life on planet Earth. The disadvantage is that it is difficult to apply as a reference for the assessment of biodiversity, since it refers to its full complexity [1]. It is necessary to break down the holistic definition into biodiversity elements that are representative of, for instance, the risk of a species becoming extinct. Still, the simplification of biodiversity has a cost, as the simplified understanding no longer refers to the full complexity of biodiversity—that is, something is lost in the simplification process. The challenge is to find representative biodiversity elements, but the question then is of what should they be representative? Is it species extinction or the effects of conservation measures? Or can the same biodiversity elements be representative of both situations?

The simplification of biodiversity quickly becomes an act of choosing between references for the simplification process, and at the center of these references lies the social aims attached to [the construct of] 'biodiversity'. Both globally and within the EU, the overarching policy aim is to achieve no net loss (NNL) of biodiversity [2,3]. If this is the social aim of simplification, the elements need to allow for establishing equivalence following, for example, compensation measures. However, achieving

equivalence demands the use of certain biodiversity elements, as not all elements are representative of this, owing to their inherent complexity [4].

There are legal attempts to discuss and analyze the NNL aim of biodiversity, with reference to ecological literature, but without going into the question of what [the construct of] 'biodiversity' includes or excludes [5,6]. Within the ecological/biological literature, the question of what constitutes a suitable reference to measure declines or gains of biodiversity is vast. However, law is seldom a reference when arguing for different constructs [1,7,8]. Even when law, such as the CBD, is discussed, ecologically, the research fails to see that the construct of biodiversity is given form and content within the ecosystem approach [1].

The aim of this article is to give legal references for the simplification of 'biodiversity' based on international and EU law, using the NNL aim as reference. To construct this legal reference, the holistic definition of biological diversity in the CBD will be analyzed together with the simplification process found within the Ecosystem Approach (EA) under the CBD, EU Habitats Directive [9] (HD), and EU Water Framework Directive [10] (WFD). I analyze the EA, since this is the main tool for action under the CBD and the directives because of their importance in achieving an NNL within the EU [3]. The directives also complement each other with a focus on endangered species and habitats, under HD, and aquatic ecosystems generally, under WFD. These two directives also have an objective similar to the NNL aim, and their simplification of biodiversity could therefore function as a reference for the establishment of equivalence (which for example the Birds Directive [11] misses). By comparing how these legal acts simplify biodiversity and what types of measures the simplification result in, the aim is to construct a coherent legal reference for the development of the aim of NNL of biodiversity.

2. The Aim of No Net Loss of Biodiversity

The social aim behind a legal act is one of drivers behind the simplification of biodiversity, and this is an essential element when setting up a biodiversity construct [5]. This first section will therefore describe the NNL aim and its developments within international and EU law.

Under the CBD, a Strategic Plan for Biodiversity 2011–2020 has been established for the purpose of promoting the efficient application of the CBD and proceeding toward the vision of humanity "living in harmony with nature" [2]. By achieving this ideal, it is to be hoped that by 2050 biodiversity is appreciated, preserved, rehabilitated, and wisely used, and ecosystem services sustained, resulting in a planet in good condition. Apart from this vision, there is also the undertaking of the Strategic Plan, which aims to bring a halt to the loss of biodiversity and ensure that by 2020, ecosystems are resilient and proceed with providing vital ecosystem services. Even if the aim of NNL is not mentioned explicitly, the sub-aims give a similar approach; for example, that the stresses on biodiversity are decreased, ecosystems are rehabilitated, biological resources are sustainably used, the value of biodiversity is mainstreamed, suitable policies are efficiently realized, and decision-making is based on the precautionary approach. Within the Strategic Plan, biological diversity is said to underpin ecosystem functioning, and the supply of ecosystem services that are indispensable to human well-being.

Regardless of EU efforts under, for example, the WFD and the HD, biodiversity as a whole is still declining within the union. In 2010, the EU established its intent to stop the demise of biodiversity and the deterioration of ecosystem services by 2020, and of restoring 15% of the deteriorated ecosystems anywhere possible. The Biodiversity Strategy sets out six targets and 20 specific actions pointed in the direction of this general objective. The aim of action seven is to safeguard no net loss of biodiversity and ecosystem services. In the strategy, the commission emphasizes the use of compensation measures to secure an NNL of biodiversity, rather than only advocating for prevention and mitigation measures [3]. The reasoning is that to circumvent a net loss of biodiversity and ecosystem services, impairments stemming from human actions need to be balanced by at least equivalent improvements. The European Commission made a commitment back in 2010 to propose an initiative to safeguard there being no net loss (NNL) of ecosystems and their services (for example, through compensation or offsetting

schemes) [12]. The Environment Council of Ministers declared that a mutual approach was required for the implementation in the EU of the "no net loss" concept [13]. It was further clarified that the NNL principle entails "that conservation/biodiversity losses in one geographically or otherwise defined area are balanced by a gain elsewhere, provided that this principle does not entail any impairment of existing biodiversity as protected by EU nature legislation" [14]. However, the commission has so far not provided a common approach or made any developments within this policy area (for additional info on the European Commission's policy toward NNL, see: http://ec.europa.eu/environment/nature/biodiversity/nnl/index_en.htm).

The aim of NNL of biodiversity, as it has been established within the CBD and EU Biodiversity Strategy, emphasizes that the deterioration of biodiversity must stop, and if losses take place, these must be balanced by equivalent gains. *What is missing within the Strategic Plan and Biodiversity Strategy is a simplification of biodiversity*. As any biodiversity assessment scheme depends on the advancement of a simplified understanding of biodiversity, there is a need for a definition that simplifies biodiversity in a way that allows for the establishment of equivalence. The following sections will analyze possible legal references for an NNL biodiversity assessment scheme.

3. The Convention on Biological Diversity

The United Nation's Convention on Biological Diversity of 1992 is a global agreement and most states has signed it; one notable exception being the United States (USA). The objectives of the CBD are the conservation of biological diversity, and the sustainable use of its components. Article two of the CBD defines biological diversity thus: *"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species, and of ecosystems*. The definition highlights "variability" and not species as such; instead, these living organisms are "components of biodiversity" (see e.g., articles one, four, seven, 10).

As a first step to making this overarching definition operational the CBD annex I specify that ecosystems and habitats should be identified that hold, for example, high diversity, large numbers of endemic or threatened species, or involve species exceptional or related with key evolutionary or other biological processes. Regarding species and communities within the CBD annex I emphasize the identification of those under threat. These include, for example: the wild relatives of domesticated or cultivated species, those of medicinal, agricultural, or other economic value, or those of significance for exploration into the conservation and sustainable use of biological diversity, such as indicator species. The identification of these elements of biodiversity is a crucial step in making the CBD operational; however, within the CBD annex I it is not specified, for example, whether threatened species should be managed on community or population bases, nor comments on how to assess whether an ecosystem includes key biological processes. In articles eight and nine, conservation measures are outlined for both habitat and species. For example, in article eight, measures such as the formation of protected areas, promotion of safeguarding of ecosystems, natural habitats, and the preservation of viable populations of species (in natural surroundings) is promoted, together with the rehabilitation and restoration of degraded ecosystems and recovery of threatened species (through the development management plans/strategies). In article eight (k), certain regulations for the protection of threatened species and populations are highlighted as important; however, the level of resolution at which a species is best protected is not defined. The use of 'species' without delimitation opens up for management plans that can focus on the relevant level, and not only the species population or community level. Parties of the CBD treaty can thereby choose at which biological/ecological level of a species they implement conservation measures. Even if parties of the convention, by themselves, can make the CBD biological diversity definition operational through simplifying, e.g., the complexities of a species and choice, a certain level of resolution for, e.g., a management plan, the CBD do not specify which level, or whether all relevant levels must be reflected in the plan. Instead, further simplification is necessary to make the CBD operational for the assessment and management of

biodiversity. Looking at the definition itself, the attainment of NNL using the CBD definition is not possible, so exact replacement is not possible [1].

The definition of biological diversity in the CBD, due to its holistic nature, marks an important turn, as it made the conservation of biodiversity become even more legally important and the focus of protection not only on, for example recreation, but also on biodiversity itself. However, as action is necessary to conserve and compensate for losses of biodiversity, further simplification of the approach that is found in the CBD is necessary. There are two other constructs defined in CBD article two that could have served as a focal point for management developments: 'habitat' and 'ecosystem'. As the CBD has developed, the EA has become the main framework for measures for achieving the aims of the CBD, which uses the 'biological diversity' definition as a reference for its central construct 'ecosystem' [15].

The Ecosystem Approach

The EA is an extensive conception indicating a holistic, cohesive approach to the conservation and sustainable use of biodiversity. The intention is that it should consider all of the components of ecosystems (including humans) and their multifaceted interfaces, as well as the interconnectedness of the ecosystems, and achieve a balance between conservation and development. The focus on interfaces is coherent with the definition of 'ecosystem' in the CBD article two: *Ecosystem means a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit*. The intention is that the EA should promote the achievement of the three objectives (conservation, sustainable use, and fair and equitable sharing of benefits) of the CBD and be the main framework for measures under the CBD [16].

The EA nowadays has its own doctrines and strategies to offer a foundation for comprehending the concept [17]. Even if the EA is intended to take into account all of the components of ecosystems, the priority target is the maintenance of ecosystem structure and functioning to support ecosystem services [15]. To realize this target, EA management objectives should center on environmental circumstances that constrain natural productivity, ecosystem structure, functioning, and diversity [15]. In the guidelines, it is emphasized that supporting ecosystem functioning targeting ecosystem services is the priority for the long-term preservation of biological diversity and conservation/restoration of ecosystem functioning, and the interactions and process included are of greater importance for the long-term preservation of biological diversity than simply the protection of species [17,18].

In accordance with this, it is recognized that management must focus on sustaining or rehabilitating the key structures and ecological processes (for example, hydrological systems, pollination systems, habitats, and food webs) instead of distinct species [17]. If this focus is compatible with Aichi Biodiversity Target 12, that say that by 2020, the loss of identified endangered species has been averted and their conservation status, particularly of those most in decline, has been enhanced and sustained, is questionable. Compared to the aim of the CBD—the conservation of biological diversity—it is a limited problem-oriented focus that the EA incorporates, and the assessment should instead concentrate on the ecosystem problems in need of addressing and not on specific species problems. The assumption behind this rationale is that through the ecosystem approach, the problems of individual species will be addressed.

Based on CBD principles, protected areas must consider the ecosystem approach, since the EA offers a framework within which the correlation of protected areas, regarding the wider landscape and seascape, and the goods and services flowing from these areas can be economically appreciated [19]. In line with this, the CBD Secretariat has stated that it is vital that the biodiversity in ecosystems is preserved, or in some cases restored, to safeguard that those ecosystems are capable of supporting the ecological services on which both biodiversity and people rely on—that is, ensuring both human and ecosystem well-being [18]. There have been suggestions for indicators and targets relating to CBD EA, such as indicators of ecosystem goods and services, ecological integrity or ecosystem health/condition, the sustainable use of ecosystems, and functional ecosystem relationships (such as nutrient flows) [20].

However, these types of indicators need developments such as references for ecosystem functioning and the identification of thresholds when assessment and measures must be implemented, which are necessary for the operationalization of the indicators [20].

It would seem that the EA simplification of biodiversity mainly refers to some of the elements found in the definition of 'biological diversity', foremostly the ecological complexities that make up the functional unit of an ecosystem. Species and habitats are not under focus by the EA; instead, the measures with ecosystem effects are important, which are assumed to also conserve endangered species and habitats. Thereby, the EA assumes that endangered species and habitats, which need special management measures, are included within other management measures (within Europe there is the Bern Convention, which the HD implement within the EU; see Section 3).

The CBD presents a simplification of 'biological diversity' by applying the ecosystem approach. The ecosystem approach offers a starting point for a scheme of simplification, since it focuses on the dynamic complex of plant, animal, and micro-organism communities, and their abiotic environment, interacting as a functional unit, instead of at all of the levels of biological organization indicated by the definition of 'biological diversity' [15]. It is worth repeating that this simplification follows from the definition of 'ecosystem', rather than that of 'biological diversity'. The ecosystem approach should focus on ecosystem problems—not biological diversity problems—that need to be addressed, even where the definitions of 'biological diversity' and 'ecosystem' overlap [15,17,18]. Even if the ecosystem approach requires adaptive management—for example, NNL of biological diversity may be secured only if the management is adaptive with respect to that element of biodiversity that can achieve a status of equivalence. That is, addressing the complex and dynamic nature of ecosystems and the lack of comprehensive knowledge or comprehension of their functions is not enough to secure NNL of biodiversity.

The EA simplification process cannot guarantee that its focus on ecosystem problems results in NNL of biodiversity, even if ecosystem functioning were to be an element where it is possible to achieve equivalence [4]. Still, the EA has been questioned for its concentration on, for instance, ecosystem functioning and services risks that focus on the simplification of the economic indicators of biodiversity [21].

It is questionable whether the EA fully considers the assessment requirements found in CBD Annex I, since it emphasizes both endangered and economic important biodiversity elements. If there is an unclear balance among the CBD aims, the simplification into assessable elements could also become unbalanced and result in a focus on (for example) ecosystem functioning and ecosystem services rather than on threatened species, even if such a focus also can include biodiversity elements on lower levels such as community, species, genes, etc. Still, it is questionable whether a simplification of biodiversity based on ecosystem functioning and ecosystem services fully respects the integrated and holistic approach envisioned by the CBD.

4. The EU Habitats Directive

Related to the previously discussed CBD is the Council of Europe's Bern Convention (opened for signature in 1979 and entered into force in 1982), which together are the multinational environmental agreements that play the biggest role in the protection of European biodiversity. The EU enacted the Habitats Directive to meet obligations under both the Bern Convention and CBD [22]. The HD is enacted in 1992, and the stated goal of the HD reflects the aims of both the CBD and the Bern Convention: "to contribute towards ensuring biodiversity through the conservation of natural habitats and of flora and fauna" within the EU. There is synergies between the CBD and the Bern Convention, and their objectives are pointed in the same direction [23]. Furthermore, the secretariats of the two conventions signed a memorandum of cooperation in 2001 [24] and an enhanced memorandum in 2008 [25] describing the collaboration. As an additional cooperative measure, the Bern Convention is a member of the Friends of Target 12, which is a partnership that is dedicated to supporting the

parties to the CBD in implementing the Aichi target of improving the conservation status of threatened species and preventing extinctions [26].

As prescribed by both the CBD and Bern Convention, the HD obliges for Member States (MS) to implement measures to protect both natural habitats and species. The HD's recital states that its main aim is to promote the maintenance of biodiversity, by ensuring that species and habitats in the EU that need conservation measures achieve a favourable status (article 2(1)(2)). The HD's main biodiversity construct is 'favourable conservation status'. This construct is applied for both species and habitats, but includes different elements, depending on whether it references a species or a habitat. Even so, 'conservation' is jointly defined in the HD as a series of measures required for maintaining or restoring habitats and species to a favourable status (article 1(a)). Similar to the Bern Convention, the Habitats Directive lists species of plants and animals needing strict protection, as well as habitats in need of conservation measures. The convention and directives lists differ from each other, and another difference is that the HD has a different geographical scope (EU member countries) than the Bern Convention (Europe and neighboring areas).

The HD has several similarities to the NNL aim, especially regarding article 6(4), where Member States due to overriding public interest can be allowed to affect negatively the status of a species or habitat, and must also compensate for any losses that the species or habitat may suffer. Furthermore, Member States must consult the commission in an article 6(4) situation and the commission gives opinions of the compensation measures that the Member States intend to implement to achieve NNL regarding 'favourable conservation status'. In these opinions, the commission describes what it perceives to be suitable compensation measures for species and habitats covered by the HD to ensure that there is NNL of the biodiversity elements contained in its main biodiversity construct, 'favourable conservation status'.

4.1. The Simplification of 'Species'

The main definition of 'biological diversity' in the CBD refer to species as a key concept as one of its biodiversity component to assess. In CBD Annex I, threatened species (and communities) are mentioned as being in need of identification and monitoring. In the HD, the conservation status of a species is defined as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations (article 1(i)). The *conservation status* is favourable when a species is able to maintain itself long-term as a viable part of its natural habitats; the natural range of the species neither being reduced nor likely to be reduced in the near future, and where there is, and will continue to be, a sufficiently large habitat to maintain its populations over the long-term. Thus, the sum of the influences acting on the ability of a species to maintain itself and persist within its natural range, which demands a sufficiently large habitat, must not result in a situation where the species concerned cannot maintain itself over the long-term. To achieve this, the HD prescribes the strict protection of these species (see articles 12–16).

For a species to maintain itself and be a viable component of its natural habitat, it is necessary for its evolutionary potential or genetic viability to be maintained or restored, resulting in a more viable population [27–29]. Nevertheless, if necessary, a species may achieve favourable conservation status even if it maintains itself, owing to human intervention [27]. Although human intervention is somewhat subjective and place/species-specific, the other construct, 'be a viable component', may be measured by ecological viability as the interaction between a species and its habitat (or between species) [29]. The scale of the assessment of 'maintain itself' and 'viable component' is based on the species population and/or the biogeographical scale of Member States [27,30]. For example, a population's ability to maintain itself may refer to one or several populations within a Member State, depending on the species; compare the difference in hamster and wolf population dynamics, which result in different biogeographical scales of those populations [27,30].

The various elements that comprise the species' 'favourable conservation status' construct specify what is legally important in the conservation of species. The HD promotes the maintenance of

biodiversity by simplifying the complexity of the biological organization of a species into its population, and the assessment of this population is based on its ability to maintain itself. The main elements that define this biodiversity status are the evolutionary potential or genetic viability of the species' population, whether the species' necessary habitats exist, and whether they are of a quality that enables their populations to maintain themselves (ecological viability).

The EU Commission has given several opinions on article 6(4) situations regarding species [31–33]. It is clear from the opinions that the aim of the notion 'maintain themselves' is important in the evaluation of compensation measures for species, and that such compensation measures are highly species-dependent. For example, when a species is dependent on a certain habitat or environmental conditions, the measures become focused on the habitat conditions that allow the species to maintain itself [34]. Another opinion exemplifies the compensation ratio that can be necessary: the Commission required that the equivalent habitats should be larger or have higher ecological value than the affected area, and to acknowledge this requirement, the German authorities selected an area that was three times larger and had 13 times greater ecological value compared with the lost area [35].

The HD species simplification centers on a basic element of a species in its focus on the ability of species to maintain their populations, which is a fundamental element if the aim is to conserve species diversity as under the CBD.

4.1.1. Typical Species

Related to the 'species' construct is the conceptual element 'typical species', which is one of the indicators on the conservation status of a natural habitat (article 1(e), see also Section 4.2). The term 'typical species' is not defined by the HD, but it is clear that the HD connects the same elements that make up a favourable conservation status of a listed species also as 'typical species' (art. 1(e)). Even if the species listed in the HD annexes could be suitable as 'typical species', they are often rare and only occur in a small number of sites, making them unsuitable; the same may apply to many red-listed species [36]. Therefore, it could be better to use a species that is an indicator of the structures and functions of a natural habitat as 'typical species', even if this species is not threatened or in need of protection [36]. Since typical species directly relate to the conservation status of natural habitats, they are an important element in the assessment of habitats and management plans [37].

4.1.2. Natural Habitat and Habitat of a Species

In the CBD, habitat means the place or type of site where an organism or population naturally occurs and is an important part of the ecological complexes of which species are a part (CBD article two). With regard to the CBD definition, there is an anomaly within HD concerning the simplification of species not addressed above, as there are two habitat definitions for species in HD (article 1(b)(f)):

- natural habitats, which means terrestrial or aquatic areas distinguished by geographic, abiotic, and biotic features, whether entirely natural or semi-natural; and
- habitat of a species, which means an environment defined by specific abiotic and biotic factors, in which the species lives at any stage of its biological cycle.

The HD uses two habitat constructs when it conceptualizes how to assess a 'species' in article 1(i). A species achieves favourable conservation status when there are sufficiently large *habitats* to maintain the species population and when the species is maintaining itself on a long-term basis as a viable component of its *natural habitat*. To further complicate it, article 12(1) require MS to implement strict protection for the animal species listed in Annex IV(a) in their *natural range*. In Case C-383/09, the European Court of Justice (ECJ) uses the construct 'main areas' as a reference for the observation of the population of a species, which included a repopulated area that covers 49% of the main areas [27].

In article 1(i), the construct *habitat* concerns the species population/s. The natural range of species concerns the historical or natural distribution area of a species, and this area must not be reduced within the foreseeable future. Within the natural range of a species, there exists 'natural habitats'

where the species can be a viable component, and where the species occur as a component the area turn into a 'habitat of a species'. If favourable conservation status is not achieved due to a lack of 'natural habitats', or the natural range is decreased, there is an obligation to increase these areas and introduce the species to these areas to turn them into 'habitats of a species'. This does not mean that there is an obligation to achieve a species distribution that coincides with the potential range of the species [29]. However, it seems to be a legal requirement to assess the species potential range to specify the geographical area of the species, and thereby indicate where the strict protection must be adhered to. To establish the potential range, the historical distribution of the species could serve as a reference, which is recommended by the Reporting Guidelines in article 17 [38]. This means that 'habitat' in article 1(i) refers to the habitat of a species, which upholds an environment in which the species can live at any stage of its biological cycle. This area is defined by specific abiotic and biotic factors, such as the physical and biological requirements of the species, e.g., prey, pollinators, etc., and this area covers all of the stages of the species life cycle, and seasonal variation in the species requirements [38]. This includes the biological and physical resources used by a species during its life cycle (i.e., the ecological niche of a species) [38]. This is the area in which a population can exist, and favourable conservation status is assessed.

Left to define is what the 'natural habitat' means when it is connected to the constructs 'maintaining itself', and 'long-term distribution'. Natural habitats refer to areas distinguished by geographic, abiotic, and biotic features, whether these are entirely natural or semi-natural, and it is within this area that the species shall maintain itself on a long-term basis as a viable component. When the HD connects the element 'maintain itself' within the question of natural habitats of a species, it also bring in the question of how long the current habitat can sustain the species. When combining the elements 'maintain itself', the natural habitats of species, and long-term, the future and historical distribution of species and typical species are brought into the assessment, which include considering long-term or short-term changes, such as climate change. This is the correct way to understand 'maintain itself' or 'maintain themselves' as a dynamic state that requires that when compensating for biodiversity losses, it covers the time that is necessary to ensure that the biodiversity of the compensation can maintain themselves over a long-term basis. The assessment requirement on the MS is one that takes into account the future and historical distribution of natural habitats and when implementing compensation measures under article 6(4), the actor is liable to ensure that an NNL is achieved.

This means that the use of 'maintain itself' within the HD requires the MS to consider the cumulative impacts or diffuse emissions in adjacent areas, together with climate changes, within the current area of distribution, when determining that the species and habitats will achieve a favourable conservation status over the long-term. If there is a risk that the distribution area of a typical/listed species will be affected by, e.g., climate change, there is a requirement on the MS to assess the potential areas to secure that the natural habitats of the species can be sustained. The requirement of assessing the natural habitats of species can be compared to a requirement to have a back-up plan if the current state of things no longer serves achieving the objective (favourable conservation status).

4.2. The Simplification of 'Habitats'

The aim of the HD for natural habitats and the habitats of species is their conservation through the establishment of the Natura 2000 network (articles 3–10). The main measures for preserving habitats under the HD is the establishment of Natura 2000 areas. These areas shall be established to preserve the habitats of European importance that are listed in HD Annex I and the habitats that are linked to Annex II species in need of conservation measures (article 3(1)).

In the HD, the conservation status of a habitat (habitats found in Annex I) is 'favourable' when the natural range and areas are stable or improving, where the specific structure and functions that are necessary to its long-term maintenance exist and are likely to continue to exist in the near future, and where the conservation status of the habitat's typical species is favourable (article 1(e)). The aim

is for these habitats to be maintained or restored to a 'favourable conservation status' (article 3(1)). The natural range of these habitats, when identified, must be stable or improving, and the Natura 2000 network is a coherent network, which means that the area that these habitats provides the spatial baseline for what is needed to achieve a 'favourable conservation status' (also see article 6(4)).

The definition of favourable conservation status for a habitat focuses on the habitat's general abiotic and biotic elements, which are referred to as the 'specific structure and functions', together with the range and area of the habitat. It is worth noting that the 'structure' and 'functions' refer not only to abiotic conditions, such as water flow (which is related to habitat functions), but may also refer to biotic conditions such as a certain food chain or a certain species that may be necessary for the long-term maintenance of a habitat (which refer to habitat structure) (article 1(f)). Comparing the HD elements that are important for the assessment of a 'natural habitat' with the CBD 'ecosystem' construct, there are similarities, as the 'specific structure and functions', depending on habitat, can refer to elements such as plants, animals, and micro-organisms and their non-living environment interacting to form the habitat.

The areas of habitats covered by Natura 2000 may not be reduced, just as the natural range of species must not be reduced. Furthermore, the typical species of a habitat must also meet the requirements of favourable conservation status. This means that for a Natura 2000 area with typical species, it is necessary to determine that both the habitat and species elements of favourable conservation status are achieved (see Section 4.1) when compensating for losses in an article 6(4) situation.

The commission opinions on article 6(4) situations demonstrate the type of compensation measures in which this simplification of a habitat results. In the opinions, there are measures that stipulate compensation for habitat loss through successive re-naturalization, in order to allow the specific structure and functions that are necessary for the habitat's long-term maintenance to re-establish. For example, the commission specifies structural improvements for alluvial areas [39]. The aim of the compensation could also be ecological functions, rather than the habitat itself and its ecological structures [40]. Predominantly, the focus is on the abiotic conditions that support the establishment of the protected habitat type, and not biotic elements, which may take much longer to respond to these types of restoration measures [41]. Unrelated to any type of compensation, one essential element is that the compensation area should, if possible, be situated close to the affected area, and that the compensation measures take place before any damage occurs, even if the full biodiversity results of the compensation were to take up to 20–30 years to be established [40].

If the HD protected habitats are understood as being crucial for species survival, they can also be essential elements of the ecological complexities of an area, and if so, a lack of such essential habitats would, most probably, constitute an ecosystem problem within the frame of the EA. Even if the distinctive legal acts focus on different biodiversity constructs, an overlap occurs as species deterioration, habitat destruction, and ecosystem problems can be different frames to apply on the same biodiversity problem and result in similar measures to counter what is seen to be unwanted effects on biodiversity. However, it is also possible for the opposite situation to occur, and that a habitat or ecosystem focus may oversee essential elements of a species.

5. The EU Water Framework Directive

The WFD provides the common principles and the overall framework for the action and development of the general principles and structures for the protection of water and sustainable water use within the EU (Recital 18). Its main ecological purposes are preventing and halting deterioration, and protecting and enhancing aquatic ecosystems, which is elaborated and conceptualized in article four, where the central environmental objectives and exemptions are to be found. Article 4(1)(a) imposes an ambitious requirement on Member States; they are obliged both to 'aim to achieve' good surface water status by the end of 2015, 2021, or 2027, and prevent the deterioration of the status of all of the bodies of water (article 4(4), 4(4)(c)). Whereas non-deterioration is a general objective, and similar

to the NNL aim, good surface water status comprises both 'good chemical status' and 'good ecological status', and for heavily modified and artificial bodies of water, the objective is 'good ecological potential'. Even if the definition of 'ecological status' concerns the establishment of 'good ecological status', the definition is interlinked with the other ecological objectives of the WFD—'non-deterioration' and 'ecological potential'—and are interlinked through the elements of assessment, which are the same [42].

The rest of this section on the WFD describes the assessment system that makes up the 'good ecological status' and non-deterioration objective, and how aquatic ecosystems are simplified into assessable elements to determine when a deterioration—a net loss—takes place, and when measures are effective and able to either secure that no deterioration takes place or a 'good ecological status' will be achieved.

5.1. The Simplification of Aquatic Ecosystems

The WFD defines 'ecological status' as the expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters, systemized in agreement with Annex V (article 2(21)). In the normative definitions of Annex V, aquatic biodiversity is assessed to three groups of quality elements: biological, hydromorphological, and physico-chemical. Generally, the biological quality elements (phytoplankton, macrophytes, phytobenthos, benthic invertebrate fauna, and fish fauna) are considered to be the most important, as they are the main elements that indicate the status of the structures and functioning of a body of water. The assessment of the biological quality elements is intended to indicate the ecosystem 'structure' of a body of water and refers to the biodiversity composition, abundance, biomass, diversity, and sensitivity. In contrast, ecosystem 'functioning' refers to activity such as decomposition or nutrient cycling. Nutrient cycling is a function that allows other natural resources within a water area to be able to take up nutrients that would otherwise remain in the sediment that may be combined with Annex V indicators such as size (for example, body size, or body mass), the procreation or development of specific species, or the age organization of individuals, populations, and communities (Annex V 1.2).

The intention is that the biological quality elements should be able to indicate the stresses and effects of human activities, and thereby make it possible to determine how far a body of water is from 'high ecological status'. The general 'high ecological status' definition refers to a situation where there are no, or only very minor, anthropogenic changes to the physico-chemical and hydromorphological quality elements for the kind of surface water body type that is usually related with that type under undisturbed circumstances. Within such undisturbed circumstances, the values of the biological quality elements for the body of water expose those that are usually related with that type under undisturbed circumstances, and show no, or only a very minor, indication of alterations. All of the biological quality elements have their own high ecological status definition and, e.g., for fish fauna species composition and abundance, resemble entirely or nearly entirely undisturbed circumstances, all of the type-specific disturbance-sensitive species are existent, and the age structures of the fish communities that display any slight sign of anthropogenic disruption. The definitions of 'good' and 'moderate' status are provided with cross-references to the 'high ecological status' for each of the quality elements.

Regarding the other quality elements, hydromorphological quality elements are consistent with the biological quality elements at 'good ecological status', whereas the physico-chemical elements also require that temperature, oxygen balance, pH, acid-neutralizing capacity, and salinity do not extend to the quantities outside the scope that has been determined to safeguard the functioning of type-specific ecosystems. If the physico-chemical elements have 'good' status, and specific non-synthetic and synthetic pollutants are within their limit values [43], it is assumed that the aquatic ecosystems will not be affected to such an extent that the biological quality elements cannot maintain themselves over the long term.

Even if Annex V 1.2 is to be only a point of departure for Member States, and does not stipulate in particular the definite assessment and management of 'ecological status', it is the binding starting point for Member States as a description of the objectives to be realized [42]. It explains what the ecological objectives in article four indicate, and offers a clear flexibility with regard to the diversity and uniqueness of aquatic ecosystems. As highlighted in the WFD preamble, there are different circumstances and needs in the EU that necessitate different answers (recital 13).

In the Weser Case [44], the ECJ clarified that the WFD's assessment and monitoring regimes were important parts of the non-deterioration obligation, where it emphasized that deterioration was not a question of class, but one where each quality element was deemed to be important when determining the 'ecological status' secured by the non-deterioration objective. In a situation such as that of the ECJ Case C-529/15 [45], where a company operated a hydroelectric power station on the River Mürz, in Austria, with an outflow area of 1455 m and whose operation was authorized by a decision of the Landeshauptmann von Steiermark (Governor of Styria) of 20 August 1998, which included prescribed reservoir volumes. The power station started to operate in 2002. As stated by the applicant, the activity of the hydroelectric power station has caused significant environmental damage [46], which has disrupted the natural reproduction of fish and has caused fish to die along stretches of the River Mürz. This was a result of short-term but significant variations in the water level areas that were usually under water, and then began drying up very rapidly, so that small and young fish were confined in the outlet areas disconnected from the river current and thus deprived of the possibility to follow it. The repeated fluctuations affected a long stretch of the river, and were caused first by the absence of a bypass channel at the power station, and second, by the power station's mode of operation. Whether the water area was natural or heavily modified was not clarified in the case material. Most certainly, the body of water around the hydropower station is heavily modified, and the bodies of water below and above are probably natural. Since the body of water classification is not clear from the case, a general discussion, without making a difference between 'natural' or heavily modified bodies of water, regarding what type of measures that the simplification of ecosystems in the WFD result in will follow.

The water areas below the hydropower station appeared not to hold the crucial ecological structures or functions for the biological quality element 'fish'. Since there were:

- an interruption in the continuity of fish migration,
- no mitigating measures that targeted low flow conditions,
- no mitigating measures regarding a high variation of water flow
- rapidly changing flows (hydro peaking)
- disruption of fish flow, both upstream and downstream.

The simplification of the term 'ecosystem' in the WFD stresses that there should only be slight changes in the biological quality elements that are attributable to anthropogenic impacts on bodies of water for good ecological status. For the quality element 'fish', this means that the age structures of the fish communities might display signs of disturbance that are attributable to anthropogenic effects on hydromorphological quality elements, and, in a few occasions, are indicative of a failure in the reproduction or development of a specific species, to the degree that some age classes may be absent. If 'good ecological status' is not achieved, the simplification of biodiversity in the WFD leads to the following measures in order for the crucial ecological functions of fish life cycle demands to be present.

If the fish communities include migrating fish, and these are not present or are of low abundance, there is a need for a bypass channel, or a similar measure, to secure the continuity of fish migration. Furthermore, it may be necessary to ensure that the habitat conditions for rearing and migration are present. If the migrating fish is a long distance migrater, then the necessary measures include suitable flows that are timed to trigger/support upstream and downstream migration; however, this would require the available possibility to migrate upstream or downstream of the hydropower station.

Since low water flows result in fish death, a larger part of the water area must have water cover throughout the year. This can include measures that result in additional flows that are adapted to the habitat characteristics of the area or to river morphology changes (including sediment management) in order to make the best use of available flows. Whether or not the second measure was possible in this section of the River Mürz is not clear from the case. The high variation of water flow can be mitigated through a flow variability where the dynamics are adapted to the fish communities and habitat requirements that they uphold. All of these hydromorphological changes can target the components that make up the definition of 'good' fish fauna status and thereby improve the structures and functioning of the ecosystems. Under the preconditions that are found in the case, the necessary measures concern a re-naturalization to reduce the pressure of the anthropogenic situation caused by the hydropower station on the water area. The MS is required to implement a system where the liable actors permit is reviewed (article 11(3)(e), 11(5)) and measures are implemented that secure that, at the latest, a 'good status' is achieved in the affected bodies of water when the last cycle of WFD programs of measures end (2027).

The implementation of these measures depends on how the river stretch is differentiated into bodies of water, which is the functional unit of the WFD. Aquatic ecosystems are not, as under the EA, differentiated according to the ecosystem or problems attached to the area or ecosystem; instead, they are differentiated into bodies of water based on specific criteria found in WFD Annex II (see Josefsson [47,48]). Comparing the WFD different quality elements with Annex I in the CBD, the quality elements in the 'good' status could provide a reference for what is demanded for the sustainable use of rivers.

6. A Consistent Simplification of Biodiversity

Biodiversity represents an irreducible complexity, so it is therefore a reasonable assumption that it is impossible to fully draw out the elements that can represent this complexity. Still, the global aim of achieving NNL of biodiversity, and other biodiversity targets, depends on the simplification of biodiversity to implement measures to secure, for example, that developments which deteriorate, damage, or obliterate the complexity of biodiversity become sustainable and thereby do not result in net losses of biodiversity. The difficulties of assessing the full complexity of biodiversity of an area, both before and after a loss has taken place, could result in the conclusion that further losses of biodiversity must not take place, as part of the precautionary principle. The ECJ has emphasized the precautionary principle in these types of situations, and has been reluctant to consider ambiguous measures, but instead demands a definite amount of certainty that compensational measures will be successful [49], noting that any positive effect of a future creation of a new habitat is highly difficult to forecast with an absolute degree of certainty [50,51]. It is worth noting that a definite amount of certainty does not mean full certainty, as such demands would be impossible to fulfil due to the complexity of biodiversity. Even if the ECJ emphasizes the precautionary principle, it is bound by the legal acts of the EU, and even the HD allows for deterioration and compensation if the social or political interest is sufficiently important. The question then is: how should biodiversity be simplified to allow for an assessment of losses and gains to secure biodiversity equivalence? Three different simplification approaches have been described above that could serve as a reference when legally discussing how to secure NNL of biodiversity. This section will discuss whether there are any shared themes between these approaches that result in a consistent legal reference when discussing how to achieve NNL of biodiversity.

The CBD is at the center of the legal protection of biodiversity. The CBD simplification of biodiversity, or the lack of it, could be understood to be consistent with its central position, because its holistic nature would be lost if further simplifications were to take place. As it is now, any development of biodiversity conservation legislation could refer to the CBD construct, including the EA, and contribute to the CBD in their particular geographical legal area.

The EA simplification is ecosystem-focused, with the focal point on problems with ecosystem functioning and services. The assumption is that an ecosystem is a functional unit, and that it is possible to differentiate ecosystems into functional units seems to be the main base for the simplification of biodiversity under the EA. The aim for each functional unit appears to be the functioning of the ecosystem that allows for the differentiation of units. Since it is the dynamic complex of plant, animal, and microorganism communities, and their non-living environment that make up the functional unit, it can be assumed that these are important biodiversity elements when formulating EA measures. Since the EA emphasizes adaptive management, it can be assumed that the formulation of measures can target different biodiversity elements, and that if a measure is not successful, then other elements could be targeted by the measures. The EA simplification of biodiversity could, due to its problem-oriented focus, make NNL of biodiversity its ecosystem problem, or, it could focus on ecosystem functioning and assume that NNL will follow if it is achieved, as is assumed regarding the status of species and habitats. Even if the EA is based on a simplification of the CBD holistic construct, it also has a holistic element, since it refrains from giving a more detailed simplification of biodiversity, and instead refers to ecosystems, their functioning and problems, the dynamic complex of plant, animal, and micro-organism communities, and their non-living environment. All of these constructs could result in different assessment elements depending on the aim of the assessment. Therefore, the EA could be understood to be a starting point for more detailed and operative management systems, such as the WFD.

The WFD has a more advanced system than the EA regarding ecosystem functioning through its 'ecological status' construct, which is defined as the expression of the quality of the structure and functioning of aquatic ecosystems. The WFD assesses the 'ecological status' of bodies of water through the biological quality elements, and the assessment of these is intended to show, for example, the status of structures such as biodiversity variety/sensitivity and functioning through reproduction, development, or the age structure of communities. The objective of the WFD is that Member States must achieve a status where the impact of society is reduced or 'ecologically' compensated for to the extent that the quality of the structure of a body of water is such that aquatic ecosystems can function. The simplification of biodiversity in the WFD is intended to secure that when the WFD objectives are achieved, then aquatic ecosystems and their biodiversity can function and maintain themselves without human intervention regarding natural bodies of water (for heavily modified or artificial bodies of water the objective is different; see Josefssson [42]). The simplification of biodiversity in the WFD thereby follows the same line of thinking that underlies the simplification of biodiversity in the HD. However, the outcome is different, and under the HD, this means that species and habitats achieve favourable conservation status (and do not become extinct), while the WFD objectives aim to secure a general ecological status with functioning ecosystems.

Both the WFD and EA focus on ecosystem functioning, as does the HD, even if less so. The HD focus on 'functions' as a 'favourable conservation status' for habitats refers to specific abiotic and biotic structures and functions for the habitats, and their typical species and long-term maintenance. The reference to 'functions' or 'functioning' is found in the WFD, EA, and the HD, the difference being that the WFD and EA refer to ecosystem functioning, and the HD refers to specific functions that are relevant for the the targeted species and habitats (including their typical species). Still, the preconditions that allow for habitats or aquatic ecosystems to function could be similar when the HD habitat is aquatic. For example, typical species for the protected habitat 'Fennoscandian natural rivers' are Brown trout and Salmon; the presence of these fish species is also a biological quality element within the Swedish implementation of the WFD. So, for 'Fennoscandian natural rivers' within Sweden, the same indicators are used under the WFD and HD, and since these species depend on, foremost, natural hydromorphological conditions measures, the targets for the ecosystem/habitat functions should be similar/identical (see the list of measures in Section 5.1). Even if overlaps exist between the WFD and HD, there is a difference, as the HD focuses on the population and the WFD focuses on the

composition and abundance of type-specific communities and disturbance-sensitive taxa. Still, the directives represent similar approaches.

Still, the aims for the HD populations/species and WFD biological quality elements are similar, as they both aim to secure that the pressure/stress is reduced to allow for their indicators being able to maintain themselves. Another difference between the HD and WFD is the WFD's lack of focus on habitats; instead, its focus is on the general structures of the aquatic ecosystems within a body of water; that is, the hydromorphological and physico-chemical status of the aquatic environment, which is termed abiotic features under the HD.

It is notable how both the WFD and HD require a combination of historical and future elements in their assessment process. The historical elements are a way to determine references for the objective and future elements create a way to meet changes in the environment, such as climate change, that can affect the achievement of the objectives. Changes in the environment, whether of human or natural causes, is not a reason that can be used to evade the obligation of achieving the objectives; instead, meeting such changes with measures is an obligation of the MS.

The simplification of biodiversity that is found in the EA, HD, and the WFD has different themes, but two of them stand out: the focus on elements of biodiversity maintaining themselves, and on ecosystem functioning. Using ecosystem functioning or the preconditional functions of an area as biodiversity indicators, this references a diverse set of biodiversity elements that may represent diverse levels and scales of biological organization (including species, communities, and ecosystems) [7]. A 'function' may also signify elements that are linked to a place-specific environment, the distinctive history, and the ecological processes and interactions of the site affected, which are three biodiversity elements that are often emphasized as being important for establishing equivalence [7,52–58]. For example, both river continuity and flow conditions are abiotic ecosystem functions of a river basin, river section, or a river body of water that can result in the biotic responses from fish populations or communities, even if the time scale is extensive and difficult to predict for the biotic elements of ecosystems. Under the HD, the timeframe between the implementation of compensation measures and the full result can vary substantially, and for example be about 20–30 years [40]. By combining the distinctive history of place and ecological processes and interactions, the 'function' becomes a dynamic construct that includes both what has been and the future state of things. Environmental changes need to be considered when the liability of compensation measures is crafted to secure that the elements making up the 'function' will be functioning given such changes.

One criticism of an approach that uses functions to assess an area's biodiversity is that the site's species are given less significance. As mentioned above, apart from the use of functions to assess biodiversity, another legal theme to determine an area's status is through the ability of the indicators to maintain themselves. That is, if the aim of NNL compensation is to achieve species equivalence, a species population that is moved from one site to another should be able to maintain itself with as little human intervention as possible. The impact would then not be irreversible for the species population, even if there were some irreversible losses of unique individuals. Understanding species compensation as being satisfactory when there are no irreversible effects on species population, even where there are anthropogenic effects on individuals, is comparable to the definition of 'favourable conservations status', and also the WFD's 'good ecological status' (e.g., Annex V 1.2.1). Regarding species resolution, the WFD demonstrates that the construct of 'maintain themselves' does not necessarily need to concentrate on species populations, but may also center on species communities or taxa that are sensitive to the deterioration affecting a site. As described under the WFD and HD, the construct(s) 'maintain themselves/itself' is dynamic in the sense that it includes both historical and future distribution/status.

The simplification of biodiversity to achieve NNL could be twofold, when based on the legal simplifications discussed, with a focus on an area's ecosystem functions, and/or its species populations/communities/taxa and their ability to maintain themselves.

7. Conclusions

The purpose of this article is to give a consistent legal simplification of 'biodiversity' based on international and EU law, with reference to the aim of NNL of biodiversity. Attaching this social aim of NNL to the construct of 'biodiversity' requires that the element of assessment can be applied to show when equivalence has been established. This is a challenge, since not all of the elements of biodiversity can achieve equivalence.

To give a consistent legal simplification of 'biodiversity', the simplification of biodiversity in the CBD, EA, HD, and WFD was analyzed. The simplification of biodiversity in these legal acts can be organized into two thematic constructs: 'functioning/functions' and 'maintain themselves/itself'. Considering these legal acts, the simplification of biodiversity could be twofold, with a focus on an area's biodiversity/ecosystem functions/functioning, and/or the ability of the species populations/communities/taxa to maintain themselves/itself. When the focus is on ecosystem functioning, the WFD, EA, and HD offers a road map regarding the assessment of ecosystem functions/functioning, while the construct 'maintain themselves/itself' is developed within the WFD and HD. Both biodiversity/ecosystem functions/functioning and the construct 'maintain themselves/itself' can represent preconditional conditions of biodiversity that can achieve equivalence and seem to be important legal references to consider when the aim of NNL of biodiversity is further developed to achieve a sustainable use/protection of biodiversity.

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