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Towards Innovative Governance of Nature Areas

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Abstract: How can the governance of nature areas foster the sustainability of ecosystems? This is discussed with regard to larger threats on ecosystems despite larger global nature areas that reach 19 million km^2 of land along with larger costs per area unit. Moreover, monetization of nature with payments for ecosystem services is sometimes demanded for justification of the nature areas; however, this does not resolve the threats but faces scientific and ethical scrutiny. An alternative is the governance that incubates sustainable innovations in the nature areas for broad dissemination which generates interests in the sustainability of ecosystems. Opportunities are due to demands for ethical products, ecotourism and images of nature which generate USD 1100 billion in global markets. Sustainable innovations of using reed for insulation walls, furniture panels and upholstery in the EU can generate a few hundred million dollars in addition to present roof thatching, fodder and fuels if good functional qualities of the reed products are developed. Their functionalities can be supported by the inclusive economics, CO_2 storage, treatment of water pollution, richer biodiversity, and other ethical qualities. The governance of nature areas can prevent the present deadlock but needs the development of technical and entrepreneurial capabilities.

Keywords: nature protection; sustainable innovations; ecosystem services; delta; reed

Highlights

- Governance of nature evolves toward a deadlock because it insufficiently reduces threats and is costly.
- An alternative is incubating sustainable innovations for USD 1100 billion in demands for ethical products.
- Sustainable innovations in reed generate income with CO_2 capture, cleaner water and richer biodiversity.

1. Introduction

Global man-made bioresources have increased by mass throughout centuries [1], but all global biomass and the biodiversity measured by species have decreased from the pre-human period onward. This is because more crops and cattle do not compensate for the degradation of pristine ecosystems caused by capture of land, monocultures, excessive extractions, pollution, climate change, and other human interventions [2]. Although the total biomass production on the global scale is several times larger than all human consumption, as the global demands for food, cloth, paper and other biobased products increase, the availability of particular bioresources is threatened. Maintaining availability

of diverse biological networks for all processes in nature, including economic activities, is risked as the biodiversity of ecosystems deteriorates [3]. Presently, the sustainability of ecosystems is governed mainly through the dedication of vulnerable and biodiverse areas for the protection of species. In the descending order of protective regulations, the nature areas are divided by the International Union on Conservation of Nature (IUCN) into strict nature reserve (I a), wilderness area (I b), national parks (II), national monument or feature (III), habitat or species management area (IV), landscape or seascape areas (V), sustainable use of natural resources (VI), and unspecified categories of nature protection. Globally, altogether more than twenty thousand of such nature areas on 25.4 million km^2 of land are shown in the IUCN database; their scale varies from a few hectares to nearly fifty thousand square kilometers [4]. The databases of Word Bank [5] and OECD [6] show data on these nature areas per country, which cover about 19 million km^2 globally as of 2019. However, these areas are insufficient for the protection of species. Although the nature areas have increased for decades to more than 13% of all global land, they are larger than the territory of the Russian Federation, and the biodiversity of ecosystems declined because more species are threatened [7].

Present governance aims to locate the nature areas far from economic centers on the assumption that their spatial isolation prevents degradation of ecosystems, thereby fostering biodiversity. If this assumption cannot hold because the environmental impacts undermine biodiversity in nature areas, then the question is how to foster the sustainability of ecosystems. The issue discussed in this paper is whether the governance of nature areas should pursue larger areas or focus on the incubation of sustainable innovations that can disseminate in economies. Herewith, it is assessed if larger nature areas generate sufficient results and how that innovation strategy can be pursued. The aim of this paper is to underpin possibilities for the incubation of sustainable innovations in the nature areas which will enable the generation of interests for ecosystems along with improvements of environmental qualities and income for communities in the nature areas when these innovations disseminate in economies. When innovations are developed due to ecosystems in the nature areas, the ecosystem qualities become both valuable economic and ecological assets. Assuming that this development is pursued within the ecological criteria of nature areas, sustainability of these assets (e.g., a particular species, biodiversity, landscape and other qualities) is therefore warranted. Such an option for the governance of nature areas is assessed by statistical data and a case study but need further examination in practices.

Concept Design

A few definitions are presented to avoid confusion, followed by the research concept. Governance is defined as interactions between the interest groups for decision-making about resolving common problems or collective uses of resources. Innovations are described by the pioneer of innovation theory as "doing things differently" [8] with reference to novel technologies, designs, images, models or other objects aiming at a profit; it means higher incomes or cost-savings rather than all costs and risks. What qualifies sustainable innovations is high environmental performance in practices such as renewable energy, agroforestry, circular constructions and suchlike technologies. Innovative opportunities, then, refer to chances for innovations regarding demands.

The idea about innovation strategy in the governance of nature areas is derived from the seminal works of Ostrom on the polycentric governance of ecosystems when knowledge about local ecosystems is used for the income-generating activities by the local communities that have interests in maintaining availability of the ecosystem qualities [9]. This paper is focused on innovations rather than governance because essential for answering the question above. It is assumed that sustainability goes along with valuable production if wasteful discharges are prevented due to know-how about cleaner technologies and that this know-how is developed when far-reaching improvements of environmental performance are demanded [10]. With this, governance of nature areas provides opportunities for incubating sustainable innovations because it generates knowledge about the local ecosystem, and that incubation must comply with strict ecological criteria. For the dissemination of sustainable innovations, trustful information is necessary. An innovation is attained when subsequent suppliers in the value chain

compound qualities assumed to be attractive for their customers and the customers perceived these qualities highly valuable. This perception is possible when those qualities are considered reliable. However, information about qualities is often biased because the suppliers are interested in showing the attractive qualities but hiding deficiencies not assessable by the customers but known to them before purchases [11]. Herewith, trustful information about sustainability is important because many consumers care about health, nature and other ethical qualities in addition to demands for heat, strength, power and other functional qualities whilst synergies between the attributes of those qualities are rewarded with mark-up for products, goodwill for investments, and other prizes [12]. Hence, when the governance of nature areas incubates sustainable innovation, it can as well provide trustful information about the ethical qualities, which enhances the dissemination of well-prized novelties. These assumptions are assessed but tests of incubating innovations in practices are required because the governance of nature areas needs to accrue high technological and entrepreneurial capabilities for successful sustainable innovations.

2. Method

That research concept is used to assess the present governance of nature areas and opportunities for the sustainable innovations. Present governance of nature areas is assessed with the statistical data on several largest countries by population and area with the OECD database that covers 47 high-income countries, excluding high-income Arab countries, but many non-OECD countries. The data show threatened species and scale of the areas in ten years intervals [13]. In addition, the Eurostat data on the European Union (EU) of 28 member countries cover bird species, investments and operational costs in the category of 'biodiversity and landscape' [14]. Euros are converted into the current US dollars (USD) based on annual closing exchange rates which show fluctuations between 1.2 and 1.4 USD per euro during the last decades [15]; conversion into the constant dollars is not relevant in this study and the inflation rates are low. The assessment is original and all statistical data are processed by the authors of this paper. It should be noted that the statistical data are imperfect, several data are interpolated, and these statistics do not specify the vulnerability and biodiversity of ecosystems but only the categories mentioned above. Hence, the results of this statistical assessment are indicative. This assessment is followed by a discussion about the monetization of nature with Payments for Ecosystem Services (PES) based on literature data. Results of the present situation are presented in Section 3.

The innovation strategy in the governance of nature is assessed with regard to demands for the ethical consumption, which generate opportunities for sustainable innovations. This assessment is based on literature and indicative data because statistics are deficient. Although the opportunities are presumably larger within more flexible governance, all categories of nature areas are assumed to provide some innovative opportunities. The opportunities in practices are assessed based on the Common Reed in the Danube Delta national park. This case of a fast-growing plant is based on local data about reed and market data about possible applications in Europe are used. This innovating strategy is covered in Section 4. The paper ends with a discussion and conclusions in Section 5.

3. Governance of the Nature Areas

The governance of nature areas pursues biodiverse ecosystems. However, this aim is not always successfully measured by threatened species and societal costs, referred to as effectivity and efficiency. Herewith, effectivity is comprehended as impacts of the area and expenditures on threatened species, while efficiency is the costs of nature protection compared to other market demands and policy aims. These two issues are assessed for the nature areas in the IUCN categories. This assessment is followed by a discussion about whether the monetization of nature with PES would improve the effectivity and efficiency.

3.1. Effectivity

The OECD data shows that global nature areas have increased from about 3.8 million km^2 in 1970 to 15.3 million km^2 in 2019, but the growth rates of that enlargement have decreased in time. These rates were 7% annual average from 1970 to 1980, 3% from 1980 to 1990 during the economic recession, declined to 1.5% during high economic growth from 1990 to 2000 and about 1% thereafter. It does not mean that the global interests in nature have decreased but the acquisitions of larger areas are slowed down in a few large countries. The fast growth of the areas during the 1970s and 1980s was partly driven by the exchange of debts of several low-income countries for nature areas on their territories, called 'debt swap'. This was possible when the governments of several high-income countries became guarantors for losses of their lender banks; in particular, the government of the United States of America (USA) was a large guarantor for high indebtment of several Latin American countries such as Brazil and Costa Rica. Figure 1 shows the nature areas between 1970 and 2020 in the EU as a whole, the USA, Brazil, China, India, Indonesia and Russia. By far, the largest nature area is in Brazil, located mainly in the basin of the Amazon River. It increased from 1.6 million km^2 in 1970 to 10.3 million km^2 in 2020, which covered 43% and 68% of all global nature areas but nearly 50% of that area is the unspecified category. Nearly 1 million km^2 of nature areas were established in the USA in 1970 but they hardly increased, contrary to ten times smaller areas in the EU in 1970 which increased fast to more than 1.1 million km^2 in 2019. The areas in other countries are small, whereas the total area in the OECD is smaller than that in low-income countries mainly due to the large area in Brazil. Hence, complaints of organizations in high-income countries about the degradation of ecosystems in low-income countries are disputed as insufficiently underpinned and unfair.

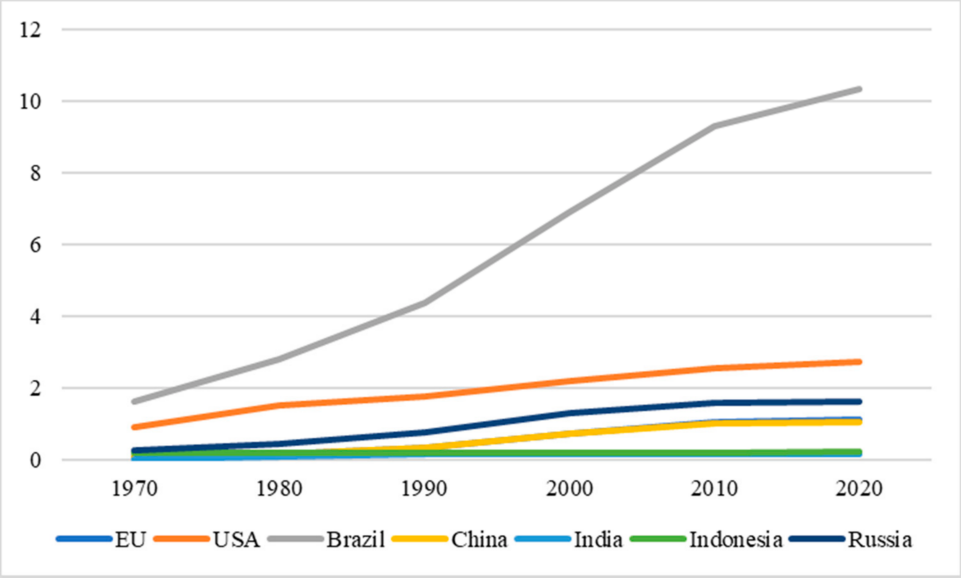

Figure 1. Areas of nature in million square km in the selected countries.

The commitments of the countries to the protection of ecosystems are indicated by the share of nature areas on their territories. The global share increased from 2.6% in 1970 to 13.2% in 2019 but differs across countries, and changes in time are also observed. Figure 2 shows the percentages of nature areas in the territories of countries. Indonesia topped those countries in 1970 with 11% of nature areas on its territory, but that share increased only to 12.2% in 2019; whilst Brazil increased its share more than 120 times and the EU 13 times to 29.8% and 25.8% of their territories, respectively. Although the share in China was only 1.7% in 2019, it increased 57 times after 1970 when its share was close to nil, which indicates that fast income growth and larger nature areas can go hand in hand. The shares in India and Indonesia are much higher than that of China but their share increased slower, whilst the share in Russia increased until the economic crisis in the late 1990s and stagnated thereafter.

Those changes on the countries' levels indicate that nature areas can go along with denser populations, e.g., Indonesia and India, and with fast income growth, e.g., China and Brazil, whereas economic crisis has a negative impact, e.g., Russia.

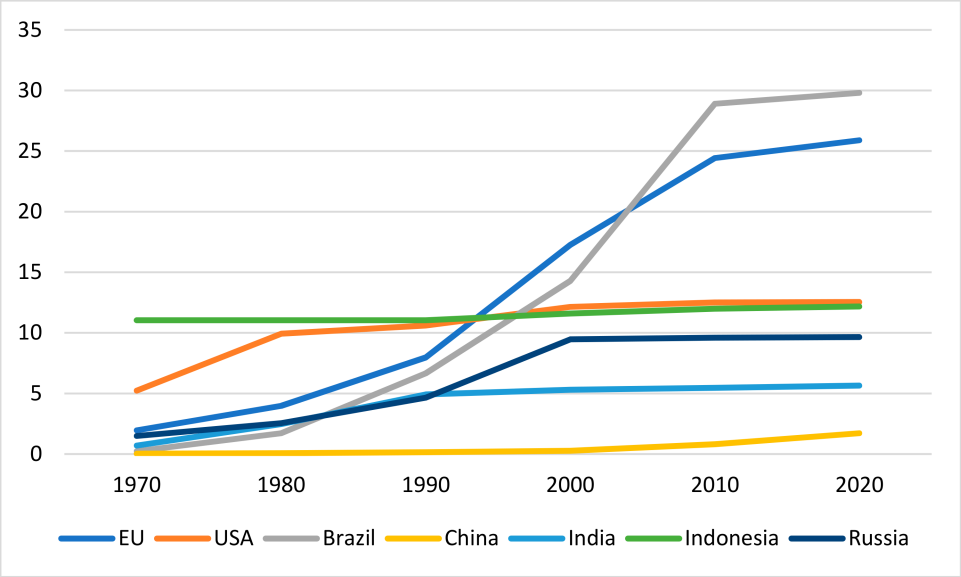

Figure 2. Share of nature areas in % of territories in the selected countries.

The growing nature areas indicate larger commitments to protect ecosystems but not necessarily for better protection. Impacts of the nature areas on threatened species are assessed for all OECD countries excluding the USA because of unavailable data. Non-OECD countries are excluded because their data on threatened species strongly deviate from the data on OECD countries, presumably because different methodologies are used to assess the threats. Per country, the nature areas divided into seven IUCN categories of protection and the category of unspecified protection (8 variables) are combined with the number of threatened species divided into Mammals, Birds, Reptiles, Amphibian, Fish, Marine Fish, Fresh Water fish, Vascular plants, Moss, Lichens, Invertebrates and All species (12 variables). Pearson regressions are calculated, which is a conventional statistical method of assessing correlations between two data inventories (it is formally $R^2(x,y) = \frac{\sum(x-\overline{x})\cdot(y-\overline{y})}{\sqrt{\sum(x-\overline{x})^2\cdot\sum(y-\overline{y})^2}}$ for x area of nature area and y number of threatened species); high negative correlations ($R^2 < -0.7$) between the nature areas and threatened species are hypothesized. All possible combinations are estimated, meaning each protection category with each category of threatened species. Table 1 shows the results. Weak correlations are found because only one is below −0.4, which indicates that larger areas and stricter protection rarely reduce the threats to species. Lifting of the ecosystem protection presumably degrades the biodiversity, but larger protection areas and stricter protection are insufficient to reduce the threats.

Low protective performance of the nature area could be explained by too small area and low budget. These possibilities are assessed with statistical data for the EU as a whole. The assumptions are that the EU expenditures on biodiversity and landscape indicate its expenditures on the nature areas, which is plausible regarding fast area growth mentioned above, that the nature areas indicate protection of the ecosystem, and that the bird index, which integrates population and diversity of species, indicates the biodiversity. These data have limitations because they cover only bird species, some years are lacking and the expenditures for biodiversity are mixed with ones on the landscape but differences between those two categories are not exactly clear. Given these imperfections, the trends are relevant rather than particular years. Figure 3 shows the indexes for the EU expenditure, areas and birds from 1995 to 2017 (1995 = 100); the area data for 5 years intervals 1995–2000, 2000–2005 and 2005–2010 are interpolated because the annual data are available only from 2010 to 2017. The findings

indicate that despite larger areas and higher expenditures, the index of birds steadily decreased. Whilst the growth of area and expenditures stopped after the financial crisis in 2008, the decline of birds also slowed down. These results indicate that the growth of nature areas has hardly any positive impacts on the biodiversity of birds in the EU. These assessments point out in a similar direction that the scale of nature areas has limited positive impacts on biodiversity, presumably because the environmental pressures of surrounding economies create more threats.

Table 1. Correlations between IUCN categories for protected areas in columns and threatened species in rows across 34 OECD countries based on the OECD statistical data.

	Ia	Ib	II	III	IV	V	VI	Unspecified Protection
Mammals	0.21	0.12	0.15	0.22	0.20	0.19	0.24	0.04
Birds	−0.15	−0.17	−0.28	−0.13	−0.31	0.05	−0.12	−0.28
Reptiles	−0.30	0.16	0.02	−0.25	0.08	−0.06	−0.29	−0.27
Amphibians	−0.22	−0.01	−0.07	−0.15	0.12	−0.10	−0.21	−0.24
Fish	−0.30	−0.19	−0.30	−0.25	−0.35	−0.03	−0.28	−0.09
Marine	−0.24	−0.07	−0.22	−0.24	−0.17	0.17	−0.23	−0.09
Freshwater	−0.24	−0.07	−0.17	−0.21	0.06	−0.07	−0.18	−0.15
Vascular plants	−0.19	0.09	−0.05	−0.13	0.02	0.07	−0.19	−0.19
Mosses	−0.43	−0.01	−0.28	−0.38	−0.30	0.03	−0.39	−0.02
Lichens	−0.38	−0.03	−0.11	−0.08	−0.23	0.23	−0.23	0.13
Invertebrates	−0.19	−0.09	−0.19	−0.23	−0.22	0.22	−0.18	0.04

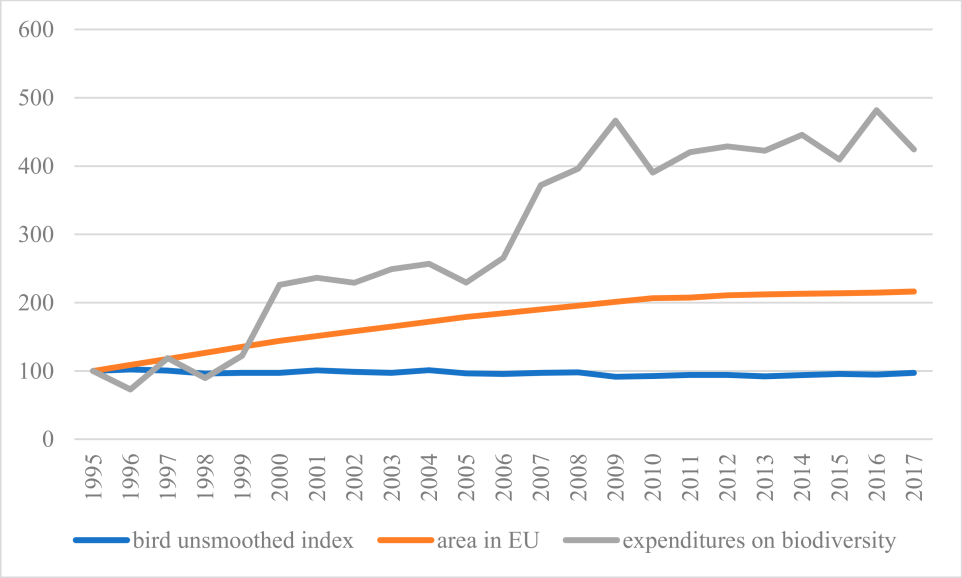

Figure 3. Index population of birds, protected areas and expenditures on biodiversity in the EU.

3.2. *Efficiency*

Assessments of the global expenditures on nature areas are disputable. The global expenditures are mentioned several times [16,17] but they refer to an inventory that shows USD 11.2 billion investments from 1990 to 1996 [18]. This is equivalent to USD 1.9 billion annual average during those 6 years; however, the author of that inventory mentions USD 6.5 billion annual expenditures mid-1990s, of which about 90% comes from high-income countries [19]. A more recent estimate found in literature

mentions USD 8.5 billion global expenditures mid-2000s mainly from public sources [20], but the statistical observations of the EU expenditures on biodiversity and landscape alone exceeded USD 8.5 billion mid-2000s. This latest global estimate implies 0.055 dollar-cent per m^2 given 15.3 million km^2 nature areas, which is about one hundred times cheaper than low-priced agricultural land in the USA of USD 0.6 per m^2 [21] and two hundred times cheaper than low-priced agricultural land in the EU of USD 1.2 per m^2 based on the agricultural land prices in the European statistics (Eurostat). At that price of nature areas, many people in high-income countries would buy a spot in nature but such purchases are rare.

In practice in the EU, the price of land per m^2 increases fast when more is accrued for the nature areas because the land area is limited. Figure 4 shows indexes (1995 = 100) of the additional area, total investments in nature areas and the investments per m^2 additional nature area in the EU during the period 1995–2015 in 5 years intervals. Whilst acquisition of nature areas declined from 2.2 million km^2 during five years from 1995 to 2000 to only 0.1 million km^2 from 2010 to 2015, the investments increased from USD 4.8 billion to USD 22 billion. This means that the cost of land increased nearly 80 times from USD 0.02 per m^2 to USD 1.64 per m^2 during that time. The exponentially growing land prices when market demands grow impede the growth of nature areas. More nature areas could be considered acceptable in the economic policies if larger private investments are attracted, but the share of private investments declined because the share of public investments increased from 54% in 1995 to 84% in 2011 and fluctuated between 71% and 85% thereafter.

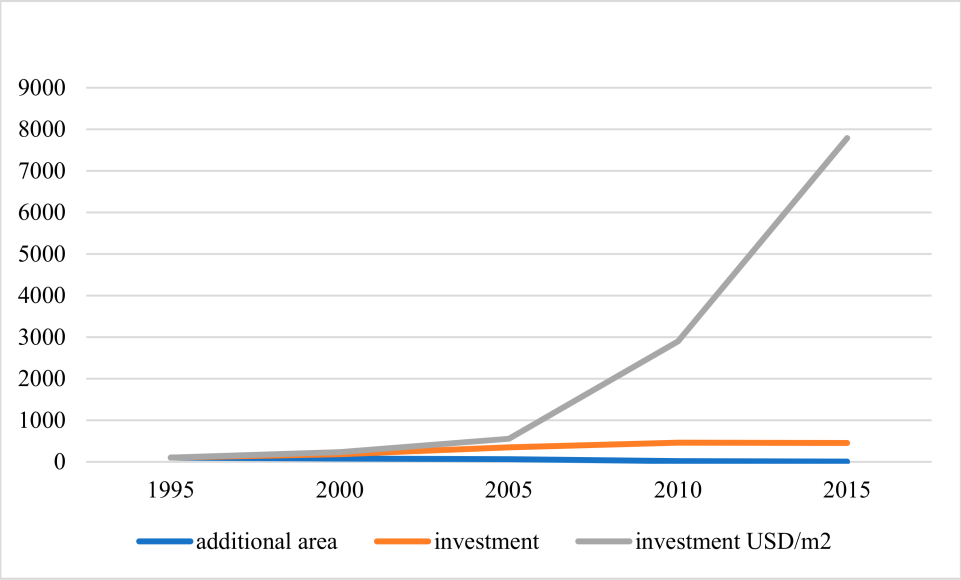

Figure 4. Indexed land acquisition, investments and investment costs per square meter in the EU.

The total expenditures in biodiversity and landscape cover capital costs based on depreciation of the investments from the past and current, operational costs for prevention of fires, intrusion, poaching and maintenance, as well as information, education and other services to the public. These expenditures in the EU increased from USD 2.6 billion in 1996 to USD 12.5 billion in 2016 but declined to USD 8.6 billion in 2018. Between 1995 and 2019, those expenditures grew 11% annual average which is higher than the growth of expenditures on all environmental issues. Hence, the expenditures on biodiversity and landscape in all expenditures on environmental protection increased from 1.9% in 1995 to 4.5% in 2013 whilst that share of investments increased twice faster from 2.5% to 10.2% during that time. Higher expenditures in nature areas became costly from the perspective of environmental policies as well.

The present governance of nature evolves to a deadlock. Even if more private capital is attracted through informal investors and corporate responsibilities of financiers, the growing land prices limit

expansion except in the thinly populated countries with small nature areas on territories; for example, Russia, Canada, or Kazakhstan. Changes in the governance of nature areas are urgently needed. In recent decades, the monetization of nature has gained popularity in policymaking on the assumption that a better allocation of funds for nature could improve the effectivity and efficiency of nature areas. This option is discussed below.

3.3. Monetization of Nature

The governance of nature is about the economics of 'moral good', meaning that many common goods are perceived as priceless because they are attractive to all people: for instance, love, care, health and suchlike virtues [22]. As the founding father of modern economics, Adam Smith wrote in the late 1700s: "The beauty of the country, the pleasure of a country life, the tranquility of mind which it promises, and wherever the injustice of human laws does not disturb it, the independency which it really affords, have charms that more or less attract everybody; and as to cultivate the ground was the original destination of man, so in every stage of his existence he seems to retain a predilection for this primitive employment" [23]. During the subsequent two centuries, the protection of nature attracted millions of participants from various backgrounds. Meanwhile, the civil organizations for the protection of nature involve about 16 million people in the EU and 14 million in the USA, nearly as many in scouting, and an unknown number in other countries. This participation also generates assessments of biodiversity, education on nature and environment, arts and media about nature, and vesting of institutional interests aiming at the sustainability of ecosystems. During the late decades of the 1900s, the idea about nature as the moral good was challenged by the assumption that adding up the individual interests in bioresources was a good approximation of that common good. Hence, justifications of the nature areas with respect to forestry, mining, transport, and other private, economic interests were demanded. In the early 1980s, those demands were formalized by the administration of Ronald Reagan in the USA when the cost-benefit assessments were prescribed for all large public projects and regulations [24]; the trigger for this regulation supposed to be civil resistance to extraction of forest that hosted the Northern spotted owl (*Strix occidentalis caurina*) [25]. This USA policy aimed at the selection of the ecosystems for exploitation based on their costs and benefits. The USA policy was followed by the United Kingdom (UK) but the EU and most of other OECD countries kept the ecological justification of their nature policies. Indeed, the growth of nature protection dropped dramatically in the 1980s and 1990s in the USA and the UK whilst it grew in the EU. This suggests that the policy on the monetization of nature could limit the expansion of nature areas.

The policy on the monetization of nature also triggered many economic studies on the monetary valuations of nature because until the 1980s only a small group of economists considered the uses of ecosystems as private goods whose properties are mainly based on prices set by the market transaction. During the last forty years, this utilitarian perspective on nature evolved into mainstream economics on environmental qualities and natural resources. Debates about the scientific foundations and practical consequences of that intellectual shift to the monetization during the late 1990s and early 2000s go on. Herewith, these debates are only briefly touched because the valuation methods can be found in manuals on cost-benefit assessments, e.g., [26–28], and the economic argumentations about pros and cons are reviewed in other scholarly publications, among the ones inclined to support the idea of monetization [29] and to oppose it [30].

In monetization, the usefulness of nature is labelled as ecosystem services. The ecosystem services enable the provision of goods (e.g., food and water), regulation of the environment (e.g., climate and waste), support of resources (e.g., oxygen and nutrients), and cultural services (e.g., leisure and education). Regarding these services in the cost-benefit assessments, the monetary benefits of particular ecosystems or species are compared to the costs of nature areas including the foregone benefits of alternative uses of these areas; for instance, for agriculture, forestry and other productive activities. The benefits of nature areas that cover the current consumptive expenditures in tourism, education and suchlike, are called the user values, while the consumer preferences for such consumption in

the future estimated with inquiries into the willingness of citizens to pay for nature are called the option values. For example, the beneficial value of all global ecosystem services using literature review on the willingness to pay is estimated at USD 16–54 trillion by the end of the 1990s [31]. Its minimum is about 14% of 117 trillion of global wealth in the year 2000 shown by the Suisse Credit [32], presumably based on the estimate of the global assets minus liabilities [33]. That benefit is lower than the global value of nature areas if they are measured by the low prices of agricultural land in the EU, which is about one euro per square meter, and which implies that larger nature areas cause net societal costs. Such monetary valuations are refined when it is aimed at including the ethical values of nature [34], considered as the rights for amenities of nature [35] and popularized as the quality of life [36]. This refinement that is labelled Total Economic Value encompasses the direct user values measured by the market transactions and the indirect ones based on public interventions, as well as the non-user values divided into the option values of present generation indicated by the willingness to pay, the options values of future generations, called the bequest values, and the ecological considerations, called the existence values [37,38]. Both latter, however, are rarely monetized but usually considered as residuals in the cost-benefit assessments. Meanwhile, the monetization of nature is focused on the incomes that can be generated through fees, compensations, taxes and other payments referred to as payments for ecosystem services [39].

The monetization of nature invoked many critiques. Herewith, only a few critical points are summarized. Various methodological deficiencies are pinpointed; for example, the heterogeneous qualities of ecosystems cannot be reduced to the single dimension measured by money [40], the monetization reflects the fetishism of consumerism rather than the societal interests in nature [41], traditional capabilities to maintain biodiverse ecosystems are neglected [42]. A compromise across the economic viewpoints is searched but without success, so far [43]. Indeed, a compromise is laborious to reach because the monetization methods reflect conventions of social groups rather than the scientific findings [44] and the monetization of 'moral goods' is perceived by many economists as unethical [45].

The anthropocentric utility of nature can be harmful in decision-making about the nature areas when focused on the provisional and cultural services. These services can be monetized whereas other services are largely neglected because they reflect less assessable attributes of nature. Hence, the monetization of sustainability in nature areas does not resolve the degradation of ecosystems. It can limit expansion of the nature areas and can reduce some costs in the nature area if generating income due to payments for ecosystem services by the private interests is attained but, this is not yet revealed despite numerous attempts; the private expenditures declined in the EU including the UK that embraced the monetization. However, this approach adds to debates in science and policies. Rather than the contentious monetization of nature, innovative opportunities can be explored to support the emanation of the governance of nature areas in economies outside the areas.

4. Innovation Strategies in Nature Areas

If the governance of nature areas can consider local ecosystems as a resource for biodiversity and a valuable economic asset, it can facilitate innovations that foster local biodiversity, environmental qualities as well as income generation. Herewith, it is underpinned that the demands for attributes of nature are sufficient to create innovative opportunities in the nature areas, which implies that the sustainable innovations can be incubated systematically in the nature areas for dissemination outside in economies. This can generate the economic interests in the sustainability of ecosystems and improves environmental performances of economies. That hypothesizing is underpinned. However, the innovative capabilities in the governance of nature areas are not touched because need other assessments about entrepreneurship, innovation process, business clusters and networks.

4.1. Innovative Opportunities

An observation is that the demanded attributes of nature increase as the income grows, leisure time elongates and economies shift from agriculture and industries to the knowledge-based activities

because they need tranquility, spaciousness and other qualities found in nature areas, and reproduced in city parks. These demands refer to policies on the effective uses of natural resources and pollution prevention in agriculture and industries, as well as consumer preferences for the attributes of nature in products, services and images called 'natural blends' because all these attributes are cultural expressions of nature. Those natural blends grow fast when consumers sense responsibilities for the common goods expressed as demands for the ethical qualities in products; for example, natural qualities, fair qualities and so on [46]. A few innovative opportunities due to the consumer demands are indicated beneath, whereas the policy demands on nature are assumed to be indicated by the expenditures on the nature areas.

Many products refer to ecological values. For example, retail sales of organic foods in the EU exceeded USD 36 billion in 2017 which grew at two-digit rates, whilst the production on farms grew a few percent slower [47]; the global retail sales of organic foods are estimated to be nearly USD 90 billion that year [48]. Estimates of all expenditures on ethical consumption in the UK per year vary from USD 54 billion [49] to USD 106 billion [50] depending on definition; they grow a few percent faster than all retail sales despite higher retail prices. Scaling up the minimum UK data on the global scale based on the consumer expenditures would deliver an unrealistically large market of ethical consumption. A reasonable assumption is 1% global expenditures on ethical consumption, similar to 3% retail sales in 2018 [51], which is plausible regarding a higher share in the EU. Based on this assumption, this global demand provides nearly USD 700 billion opportunities for innovations in ethical products. They grow by 5–6% a year. Note that the ethical products for foods, personal care, energy, paper, cloths, housing, and others can be developed in the nature areas. Ecotourism is a growing service. Inquiries into the destination goals of tourists suggest that nearly USD 600 billion is spent globally on ecotourism, which grows faster than 4% annual growth of total international tourism [52]; even more is spent if the domestic tourism related to health, wellness and nature is included [53]. A nuance is that not all stated preferences are revealed in the tourism practices. Nevertheless, some nature parks generate a larger income from ecotourism than from government funding as shown in Table 2 based on a few examples in the EU in the mid-2000s [54]. This income is generated mainly due to the visit to nature parks and hospitality in their surroundings. Opportunities also emerge due to demands for nature in media, education and other cultural activities based on the local arts and crafts, but their total value is smaller. A conservative estimate is that globally about USD 1100 billion consumer expenditures are related to the attributes of nature, which provide innovative opportunities.

Table 2. Characteristics, visits and income of select nature areas.

	I	II	III	IV	V	VI	VII	VIII
Area 1000 km^2	0.04	0.1	3.4	0.08	0.02	1.87	3.2	4.41
Community × 1000		3.5	10.2	10.0	2.0	3.5	90	36.0
Million Visits Year	0.1	1.0	0.05		0.75	2.2	0.62	21.0
State Support in € Mill	0.3		3.8		0.8	13.0	0.08	
Tourist Income in € Mill	102	32			0.08	99	0.6	
Costs in € Mill	0.22	2.6	0.9	0.6				

I. Alde Feanen (Netherlands), II. Weerribben-Wieden (Netherlands), III. Hardangervidda (Norway), IV. Lille Vildmose (Denmark), V Söderåsen (Sweden), VI. Loch Lomond (Scotland/United Kingdom), VII. British Waterways (United Kingdom), VIII. Region Uthlande (Germany).

For sustainable innovations in the nature areas, the demanded attributes of nature must be linked to specific nature areas because their particular qualities deliver bioresources for activities. Assessing the innovative opportunities in a nature park is a process that can be based on ideas of local stakeholders and external experts followed by a selection of the most promising ones from the market perspectives and sustainability of the ecosystem, and reaching agreements between the

local stakeholders about implementation. This process is area-specific. For illustration, several innovative opportunities are mentioned by the local stakeholders and experts in the ongoing project on economic development in nature areas of river deltas in the EU with support of the Interreg Europe, an EU program on the regional cooperation. This project, called Delta Lady after the song of Joe Cocker about nature, aims at generating economic opportunities in deltas of the European rivers: Danube (Romania), Po (Italy), Rhone (France), Albufera (Spain), Rhine (Netherlands) and Blackwater (Ireland). https://www.interregeurope.eu/deltalady/); the deltas are considered estuary areas of rivers. The non-exhaustive list of opportunities for the income-creating activities covers:

- Salt production with specific qualities, e.g., sweet salt for chocolate.
- Rice production with specific qualities, e.g., paella rice, organic rice through intercropping.
- Picking and cultivation of mushrooms and truffles.
- Fishing of eels, shrimps, and muscles, as well as cultivation of clam and salmon.
- Tourism in peri-urban areas with electric boats, bird watching and fishing tours.
- Uses of local fibers, such as reed for panels, fences, mats, insulation.
- Developing gastronomy with local labels and branding of slow foods.
- Development of sports, e.g., cycling and water-related sports.
- Local designs with algae, fibers, handicrafts and arts.
- Re-imagining wetlands in films, music and arts based on biodiversity.
- Development of local heritage and histories about land use.
- Tourism infrastructure with wooden walk paths, routes for cycling, walking, arts.
- Maintaining of the coastline, meandering and balancing of waterways.
- Maintaining ecosystems of lagoons and local species.
- Pollution prevention of rice cultivation, husbandry and treatment of closed waterways.
- Policies on local brands, bidding for land use, cross-regional allocation of costs and benefits.

Selection of the most promising opportunities for their realization depends on local capabilities for innovations. This, however, is hindered by the declining technological and entrepreneurial capabilities in the economic peripheries where most nature areas are situated. This is because young people move out to cities entailing poor educational and technical facilities for the development of technologies and businesses. Dense knowledge networks in cities foster innovations even though the rural areas can provide lower prices and high-level quality of life. Development of those capabilities in the nature areas is needed.

4.2. Reed Bioresources

Possibilities of sustainable innovations in the nature areas are assessed in case of the common reed (*Phragmites australis*). Its wide global coverage and high biomass productivity in nature justify assessment of innovations. The assessment is focused on the Danube Delta, the largest nature area in the EU deltas, because proper exploitation of this plant enables valuable products along with richer biodiversity in this area. Reed is a perennial plant widely spread across various climatic zones. It grows typically in the wetlands. Its buds under mud multiplies vegetatively to form dense reedbeds, whereas the stems usually grow more than two meters high with inflorescences blooming in the summer, which replenish genetically. Reed grows fast without the use of pesticides and fertilizers because it has good natural resistance to pests and the ambient water usually contains sufficient nutrients for growth [55].

Globally, reed covers more than 10 million hectares of wetlands, that is 100,000 km^2; of that, about 10% is found in Europe. The largest contiguous area in Europe on more than 218,000 hectares is located in the Danube Delta divided into 87% in Romania and 13% in Ukraine [56]. Monodominant harvestable reed covers 117,000 hectares. Reed in the Danube Delta generates a maximum of 20 tons of fresh biomass a year [57]; in a good season about 10 tons after drying on land, which is several

times higher than in most parts of Europe due to the nutrient-rich water and sunny climate in this delta. [58] Reed can be harvested if it is first or second generation and the amount of harvestable reed is influenced by the management of reedbeds, but without intervention, the productivity of reedbeds declines to 90% of the maximum. In order to protect biodiversity, 25% of the surface must not be harvested [59]. In general, this percentage is represented by surfaces that are difficult to access or areas of lower productivity. For calculation of the harvestable reed, losses should also be considered: 10% to 20% losses are made during manual and mechanical harvesting, respectively, and 10% losses are usually made after the harvest on fields. As a result, the harvestable reed is about 45% of the maximum production in an area. The preferable harvest period is winter when soft organic soils are frozen into solids. After burning of the post-harvest residuals, animals are put for grazing young sprouts in the spring when the soil conditions and weather are suitable. In the summer, benches of lakes and waterways are grazed; summer cuttings are also used for hay. These practices increase the diversity of plants and prevent the degeneration of the reedbeds by other invasive plants. Rotational cutting and removal of the reed is an effective way of conserving the Phragmites community. Thinning of the reedbeds is recommendable for its biodiversity [60] because fast growth of plants causes the high density of reedbeds, which suffocates other plants and impedes wildlife [61]. Theoretically, the Danube Delta can generate nearly 500,000 tons of dry reed yearly based on optimistic productivity of 10 tons of dry biomass per hectare. In practice, the maximum harvest in the Danube Delta was 220,000 tons after the losses mentioned above. A reliable annual average production is about 130,000 tons based on 7 tons of dry plants per hectare due to various factors that influence the harvesting. These factors are snow and ice damages, limited access to machinery for harvesting during high water levels, and mild winter when soils are not frozen. About 64,000 hectares of reedbeds on soft organic soil are difficult to harvest and 11,875 hectares are strictly protected areas [62].

In addition to the production of bioresources, reed improves water quality because it absorbs nutrients and minerals dissolved in water for the plant growth through its submerged buds. Periodic harvests of the stems enhance this absorption [63], thereby ambient water quality; hence, reed is widely used for cheap wastewater treatment [64]. It also captures carbon dioxide as it stores nearly 5 tons of carbon per hectare in the Danube Delta, the equivalent of nearly 16 tons of CO_2 per hectare, based on the assumption that the capture of CO_2 throughout the life cycle outweighs the CO_2 emissions after combustion of plants by 85% [65]. If thinned reedbeds are used for durable products, CO_2 remains stored. This thinning prevents rotting; thereby, the methane emissions and smells are avoided. In addition, the versatile structure of reedbeds is a habitat for many bird species, which attracts tourism; it is rich in fish for fisheries, whereas dragonflies, butterflies and other insects are subjects of education, research and arts. Reed fields also provide the aesthetical values which attract crafts [66]. Hence, the exploitation of reed in balance with ecosystems generates productive bioresources for income, as well as biodiversity and better environmental qualities.

Reed is much used but mainly for low-value products [67]. The main use of stems, seeds, leaves and flowers from the summer harvest is fodder for cattle because it is richer in nutrients and softer than the winter harvest. The winter harvests in brackish waters of high salinity are used for the constructive material in dwellings and roofs, as well as in the handicrafts because their stems are strong. Buds, stems, flowers are applied in traditional medicine, particularly in the Chinese traditional medicine [68]. Ornamenting, weaving, stuffing of mattresses, pillows and other upholstery are traditional applications in households [69]. However, the traditional uses decay because the imported fodder and constructive materials from minerals and plastics are usually cheaper than these bioresources. Present sales are mainly for biofuels and roof thatching. Dry reed is cheap fuel for open fires, but it is of low quality and its combustion is not effective. It can be compressed into briquettes for fuel in stoves and grills at about USD 100 per ton which is cheaper than wood and coal but worse fuel. Reed in the roof thatching has roughly five times higher price than in briquettes. Roof thatching costs about USD 100–120 per m^2 based on 40–50 kg of reed per m^2 which means about USD 500 per ton purchased reed bundles, based on literature and the Dutch thatching style but only half of the harvest is of sufficient quality

for the reed bundles used on roofs, whereas the other half remains on-field or it is dried for fuels and fodder [70]. The market demand is also limited. The total sales for the roof thatching are low as the EU markets absorb a maximum of 11 million reed bundles, the equivalent of 55,000 tons a year, and the sales grow slowly because the thatched roofs are more expensive than other roof coverages [71]. A few present and possible uses are summarized in Table 3 based on a market assessment; a market assessment done for the Business Development in Bioresources course at the Technical University of Graz.

Table 3. A few prices of reed products and their rivals.

Prices USD/kg Material	**Winter Harvest**			**Summer Harvest**	
	Energy Briquettes	**Reed Panels**	**Roof Thatching**	**Fodder**	**Flowers**
Reed price	0.08	3.5 [72]	2.0–2.5	0.05	Nil
Rival price	0.09	0.8–3.0 (*)	2.2 (**)	0.07	85
Market	Local	Large	Niches	Local	Niches

(*) prices of foam and board, (**) prices of tiles.

4.3. Possibilities for Innovations

A few innovative possibilities are assessed, inspired by the designs of reed stems for the insulation walls and furniture panels, and reed flowers for filling materials in upholstery [73]. These are sufficiently large markets to absorb all reed harvests but good designs and engineering of production are needed to compete with the vested materials and products.

Insulation in the EU uses about 235 million m^3 materials whose total value exceeds USD 14 billion a year [74]. These uses presumably grow due to the EU policies on energy-efficient buildings [75] but the market is dominated by the polyurethanes, polystyrenes, mineral wool and other chemicals, whilst the biobased materials are rarely used because they are perceived as costly and less performing. Nevertheless, the exterior insulation of the building with the reed straw has a similar insulating performance to rock wool and polystyrene [76] and can be improved by the hollow stem reed made durable and fire-proof. Designs for the hollow-stem insulation walls show high insulation performance [77] and avoid hazards of chemicals in production and uses; for example, the smoke of heated chemicals is the main cause of death and injuries during fire disasters. The furniture panels in the EU constitute nearly USD 28 billion of market [78]. Most furniture panels are particleboards based on glued wood residues. Reed panels are esthetical and lighter and can be made nearly as durable if well-designed and engineered because the lignin content in reed is similar to wood; lignin gives strength to fibers. Reed flowers can be used for stuffing of mattresses, cushions, seats and other upholstery, which constitutes additional nearly USD 2 billion of market in Europe related to the furniture; presently, mainly chemicals are used [79].

These opportunities are worth the efforts because they generate income and meet demands for the functional and ethical qualities in consumption if well-designed and produced. Nearly USD 500 million income a year can be generated from such reed products if only 1% of the markets in Europe are reached, a part of it generated in the economic peripheries of Europe. Much income can be gained by women involved in handicrafts which contribute to the inclusive economies. The sustainable harvest also stores about 0.6 million tons of carbon a year, the equivalent of more than 2 million tons of CO_2 captured from the air, as well as reduces nitrification and enriches biodiversity in the wetlands.

A business model of the insulation walls is assessed with the Canvas methodology [80], assuming initial, sustainable harvest on 1000 hectare with sales of 2000 tons of dried plants for the insulation walls and fuels. It shows that the annual income covers all costs if the functional qualities of the insulation walls are sufficient for competitive sales prices. The sales can be fostered through combinations of various business elements because generate unique customer proposition [81]. Therefore, synergies in the functional qualities are relevant; for instance, insulation of energy, noise and fire protection

with the fire-proof hollow reed insulation walls. The governance of nature areas is supportive when it warranties delivery of ethical qualities related to biodiversity and environmental qualities. The CO_2 storage generates income if compensations are allowed; for example, if a ton of CO_2 is priced at USD 70 as recommended by the International Monetary Fund, an additional USD 1100 per hectare is generated for the durable reed-based products. Biodegradation enables fishing, hunting and suchlike activities which can be rewarded by policies on wastewater treatment. Similarly, biodiversity fosters tourism, leisure and education which can generate rewards from policies and consumers. Sales of the durable reed-based products can be combined with awards for purchasers, such as visits to the deltas, crafts workshops and festivals. These ethical quality values can be linked to the biophilic architecture and the circular economy because the reed insulation walls, furniture and upholstery foster well-being and are recyclable.

Sustainable innovations in reed foster ecosystems of deltas and generate income based on products that reduce pollution, which illustrates that the Danube Delta National Park can be a valuable economic asset if know-how on pursuing innovations within the ecological criteria is generated. Regarding the list of ideas about income-generating opportunities in deltas, more sustainable innovation within the criteria of the nature areas can be developed.

5. Conclusions

Present governance of nature is focused on the protection of ecosystems in isolated areas. The issue discussed is whether this strategy is sufficient for the sustainability of ecosystems or it should be enriched with incubation of the sustainable innovations for dissemination in economies. It is underpinned that the innovation strategy is urgently needed because present protection cannot maintain the availability of biodiverse ecosystems.

Although the nature areas are large because nearly 14% of global land is under protection, largely in low-income countries, and the protected areas reach a quarter of territories in the EU and other countries, the number of threatened species hardly decreases. Moreover, based on the EU data, it is observed that the governance of nature areas faces exponentially growing land prices but low private investments, and the annual costs increase faster than all costs of environmental protection. Regarding the debatable effects versus expanding costs, present governance of nature areas evolves toward a deadlock because it cannot enlarge the areas whilst environmental impacts from outside continue. In addition, there is pressure for more monetary justification based on the assumption that nature can be treated as a private utility rather than a common good, though this viewpoint meets scientific scrutiny and can be perceived as unethical.

Another perspective is the incubation of sustainable innovations based on specific qualities of the ecosystem within the nature areas for dissemination of such innovations in economies outside the areas. If successful, such sustainable innovations foster interests in the sustainability of ecosystems and generate income in the nature areas along with better environmental qualities in the surroundings. This is a promising strategy concerning the growing demands for attributes of nature in consumption. These demands encompass ecologically justified products, ecotourism services and images of nature in media which generate global innovative opportunities of about USD 1100 billion a year. Several possibilities for income-generating activities in the nature parks of the river deltas are envisioned. An example of sustainable innovation based on the ecosystems in the river deltas refers to applications of the Common Reed. In addition to modest uses of reed for fuels, fodder and roof thatching, good functional designs for the insulation walls, furniture panels and filling of upholstery can generate a few hundred million dollars a year on the EU markets. The ethical qualities for responsible consumption can be supported by the governance of nature areas because such reed-based products contribute to the mitigation of climate change due to carbon storage, improvement of ambient water qualities due to reduced nitrification and the enrichment of biodiversity in the wetland ecosystems. If such ethical qualities are converted into awarding instruments, additional incomes are generated, but the technological and entrepreneurial capabilities in the nature areas need to be developed. It is to

be seen if incubating sustainable innovations within ecological criteria of the nature areas is realistic in practices but such innovating governance of nature areas is a promising strategy for the emanation of interest in nature across the economic activities.

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References

1. Li, P.; Peng, C.; Wang, M.; Li, W.; Zhao, P.; Wang, K.; Yang, Y.; Zhu, Q. Quantification of the response of global terrestrial net primary production to multifactor global change. *Ecol. Indic.* **2017**, *76*, 245–255. [CrossRef]
2. Bar-On, Y.; Philips, R.; Milo, R. The Biomass Distribution on Earth. *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 6506–6511. [CrossRef] [PubMed]
3. Brooks, T.M.; Akçakaya, H.R.; Burgess, N.D.; Butchart, S.H.M.; Hilton-Taylor, C.; Hoffmann, M.; Juffe-Bignoli, D.; Kingston, N.; MacSharry, B.; Parr, M.; et al. Analysing biodiversity and conservation knowledge products to support regional environmental assessments. *Nat. Sci. Data* **2016**, *3*, 160007. [CrossRef]
4. IUCN Database. Available online: https://www.protectedplanet.net/ (accessed on 21 August 2020).
5. World Bank Database. Available online: https://data.worldbank.org/indicator (accessed on 21 August 2020).
6. OECD Database. Available online: https://stats.oecd.org/ (accessed on 21 August 2020).
7. Brondizio, S.; Settele, J.; Díaz, S.; Ngo, H.T. *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*; IPBES Secretariat: Bonn, Germany, 2019.
8. Schumpeter, J.A. *Business Cycles XE "Cycles"*, 4th ed.; Porcupine Press: Philadelphia, PA, USA, 1989; p. 59.
9. Ostrom, E.; Burger, J.; Field, C.B.; Norgaard, R.B.; Policansky, D. Revisiting the Commons: Local Lessons, Global Challenges. *Science* **1999**, *284*, 278–282. [CrossRef] [PubMed]
10. Krozer, Y. *Innovations and the Environment*; Springer: London, UK, 2008.
11. Akerlof, G.A. The market XE "market" for "lemons": Quality Uncertainty and Market Mechanism. *Q. J. Econ.* **1970**, *84*, 488–500. [CrossRef]
12. Kotler, P.; Zaltman, G. Social Marketing: An Approach to Planned Social Change. *Marketing* **1971**, *35*, 3–12. [CrossRef]
13. The OECD has 37 member countries in Europe (26) Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom; in Americas (5)—Canada, Chile, Colombia, Mexico, and the United States; in far East Asia (2)—Japan and Korea; in Pacific (2)—Australia and New Zealand and in Middle East Asia (2)—Israel and Turkey. Available online: https://www.oecd.org/about/document/list-oecd-member-countries.htm (accessed on 2 September 2020).
14. European Statistical Database. Available online: https://ec.europa.eu/eurostat (accessed on 15 December 2020).
15. Financial Rates in Ox-Com. Available online: https://www.ofx.com/en-au/forex-news/historical-exchange-rates/yearly-average-rates/ (accessed on 29 August 2020).
16. Molnar, A.; Scherr, S.J.; Khare, A. *Who Conserves the World's Forests? Community-Driven Strategies to Protect Forests and Respect Rights*; Forest Trends: Washington, DC, USA, 2004.
17. Green, M.J.B.; Paine, J. State of the World's Protected Areas at the End of Twentieth Century. In Proceedings of the Paper IUCN World Commission on Protected Areas Symposium on Protected Areas in the 21st Century: From Islands to Networks, Albany, Australia, 24–29 November 1997.

18. Green, J.A.N.; Paine, J. *Financial Indicators and Targets for Protected Areas*; Background paper for GBF6: Dialogue on Biodiversity Indicators and Targets; UN Headquarters: New York, NY, USA, 1997.
19. James, A.; Gaston, K.J.; Balmford, A. Can We Afford to Conserve Biodiversity? *BioScience* **2001**, *51*, 43–52. [CrossRef]
20. Pearce, D. Do we really care about Biodiversity. *Environ. Resour. Econ.* **2007**, *37*, 313–333. [CrossRef]
21. US Database on Agriculture. Available online: https://www.nass.usda.gov/Publications/Todays_Reports/reports/land0819.pdf (accessed on 25 November 2020).
22. Sedláček, T. *Economics of Good and Evil; The Quest for Economic Meaning from Gilgamesh to Wall Street*; Oxford University Press: New York, NY, USA, 2011; pp. 341–365.
23. Smith, A. On the natural progress of opulence. In *The Wealth of Nations*, 19th ed.; Book III, Chapter I; Penguin Classics: London, UK, 1986; p. 481.
24. The Environmental Law Reporter. 1981. Available online: https://elr.info/sites/default/files/articles/11.10044.htm (accessed on 9 September 2020).
25. Andre, C.; Velasquez, M. The Spotted Owl Controversy, Ethics and the Environment, 2015, original *Issues in Ethics V. 4, N. 1 Spring 1991*. 2015. Available online: https://www.scu.edu/environmental-ethics/resources/ethics-and-the-environment-the-spotted-owl/ (accessed on 9 September 2020).
26. Boardman, A.; Greenberg, D.H.; Vining, A.R.; Weimer, D.L. *Cost-Benefit Analysis*, 4th ed.; Prentice Hall: New York, NY, USA, 2011.
27. Brent, R.J. *Applied Cost-Benefit Analysis*; Edward Elgar: Cheltenham, UK, 2006.
28. Zerbe, R.O., Jr.; Bellas, A.S. *A Primer for Benefit–Cost Analysis*; Edward Elgar: Cheltenham, UK, 2006.
29. Gómez-Baggethun, E.; de Groot, R.; Lomas, P.R.; Montes, C. The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecol. Econ.* **2010**, *69*, 1209–1218. [CrossRef]
30. Wegner, G.; Pascal, U. *Cost-Benefit Analysis in the Context of Ecosystem Services for Human Well-Being: A Multidisciplinary Critique*; The United Nations Environment Programme: Nairobi, Kenya, 2011; p. 13.
31. Costanza, R.; d'Arge, R.; de Groot, R.; Farber, S.; Grasso, M.; Hannon, B.; Limburg, K.; Naeem, S.; O'Neill, R.V.; Paruelo, J.; et al. The value of the world's ecosystem services and natural capital. *Nature* **1997**, *387*, 253–260. [CrossRef]
32. Hechler-Fayd'herbe, N. *Global Wealth Data Book 2019*; Credit Suisse AG: Zurich, Switzerland, 2020.
33. Davies, J.D.; Lluberas, R. Estimating the level and distribution of global wealth 2000–2014. *Rev. Income Wealth Ser.* **2017**, *63*, 731–759. [CrossRef]
34. Krutilla, J.V. Conservation Reconsidered. *Am. Econ. Rev.* **1967**, *57*, 777–786.
35. Mishan, E.J. *The Cost of Economic Growth*, 3rd ed.; Weidenfeld and Nicholson: London, UK, 1993; pp. 30–46.
36. Ehrenfeld, J. *Sustainability by Design*, 1st ed.; Yale University Press: New Haven, CT, USA, 2008.
37. McNeely, J. *Economics and Biological Diversity*, 1st ed.; International Union for Conservation of Nature (IUCN): Gland, Switzerland, 1988.
38. Hanley, N. Are there Environmental Limits to Cost Benefit Analysis? *Environ. Resour. Econ.* **1992**, *2*, 33–59. [CrossRef]
39. Rode, J.; Wittmer, H.; Emerton, L.; Schröter-Schlaack, C. Ecosystem service opportunities: A practice-oriented framework for identifying economic instruments to enhance biodiversity and human livelihoods. *J. Nat. Conserv.* **2016**, *33*, 35–47. [CrossRef] [PubMed]
40. Gowdy, J.; Erickson, J.D. The approach of ecological economics. *Camb. J. Econ.* **2005**, *29*, 207–222. [CrossRef]
41. Kosoy, N.; Corbera, E. Payments for ecosystem services as commodity fetishism. *Ecol. Econ.* **2010**, *69*, 1228–1236. [CrossRef]
42. Singh, N.M. Payments for ecosystem services and the gift paradigm: Sharing the burden and joy of environmental care. *Ecol. Econ.* **2015**, *117*, 53–61. [CrossRef]
43. Brouwer, R.; Brander, L.; Kuik, O.; Papyrakis, E.; Bateman, I. *A Synthesis of Approaches to Assess and Value Ecosystem Services in the EU in the Context of TEEB*; Vrije Universiteit: Amsterdam, The Netherlands, 2013.
44. Kahneman, D.; Knetsch, J.L. Valuing Goods, The purchase of Moral Satisfaction. *J. Environ. Econ. Manag.* **1992**, *22*, 57–70. [CrossRef]
45. Tirole, J. *The Common Good*, 1st ed.; Princeton University Press: Princeton, NJ, USA, 2017; pp. 36–40.
46. Krozer, Y. *Theories and Practices in Innovating for Sustainable Development*; Springer: Dordrecht, The Netherlands, 2015; pp. 35–47.

47. Willer, H.; Schaak, D.; Lernoud, J. Organic Farming and Market Development in Europe and the European Union. In *The World of Organic Agriculture. Statistics and Emerging Trends*; Willer, H., Lernoud, J., Eds.; FiBL & IFOAM–Organics International: Frick and Bonn, Germany, 2017.
48. Statista. Available online: https://www.statista.com/statistics/273090/worldwide-sales-of-organic-foods-since-1999/#:~{}:text=The%20global%20sales%20of%20organic,18%20billion%20dollars%20in%202000 (accessed on 11 September 2020).
49. Coop. *Twenty Years of Ethical Consumerism*. 2018. Available online: https://www.ethicalconsumer.org/research-hub/uk-ethical-consumer-markets-report (accessed on 11 September 2020).
50. Triodos Bank. *Ethical Consumer Markets Report*. 2017. Available online: https://www.ethicalconsumer.org/sites/default/files/inline-files/ec%20markets%20report%202017.pdf (accessed on 11 September 2020).
51. Statista. Available online: https://www.statista.com/statistics/443522/global-retail-sales/ (accessed on 12 September 2020).
52. Balmford, A.; Green, J.M.H.; Anderson, M.; Beresford, J.; Huang, C.; Naidoo, R. Walk on the Wild Side: Estimating the Global Magnitude of Visits to Protected Areas. *PLoS Biol.* **2015**, *13*. [CrossRef]
53. Krozer, Y.; Lordkipanidze, M. Bioresources for Cultural Services. In *Economics of Bioresources*; Krozer, Y., Narodoslawsky, M., Eds.; Springer: Dordrecht, The Netherlands, 2018; pp. 195–206.
54. Krozer, Y.; Christensen-Redzepovic, E. Sustainable Innovations at Tourist Destinations. *Tour. Rev. Int.* **2006**, *10*, 113–124. [CrossRef]
55. Rudescu, L.; Niculescu, C.; Chivu, I.P. *Monografiastufului din Delta Dunării/Monography of the Reeds in the Danube Delta.*; Editura Academiei Republicii Socialiste România: Bucharest, Romania, 1965.
56. Hanganu, J.; Dubyna, D.; Zhmud, M.E.; Grigoras, I.; Menke, U.; Drost, H.; Ştefan, N.; Sârbu, I. *Vegetation of the Biosphere Reserve "Danube Delta" with Transboundary Vegetation Map on a 1:150,000 Scale*; Danube Delta National Institute, Romania, M.G., Eds.; Kholodny—Institute of Botany & Danube Delta Biosphere Reserve, Ukraine and RIZA; RIZA: Lelystad, The Netherlands, 2002; ISBN 903695479.
57. Ştefan, N.; Gridin, M.; Constantinescu, A.; Grigoraş, I.; Hanganu, J. *Reed Biomass Analyze from DDBR Using GIS*; Scientific Annals of the Danube Delta Institute: Tulcea, Romania, 1996.
58. Hanganu, J.; Sârbu, I.; Ştefan, N.; Vegetaţia in: Gâştescu, P.; Ştiucă, R. *Delta Dunării Rezervaţie a Biosferei*; Editura CD Press: Bucureşti, Romania, 2018; pp. 144–149.
59. Ditlhogo MK, M.; James, R.; Laurence, B.R.; Sutherland, W.J. The effects of conservation management of reedbeds I. The invertebrates. *J. App. Ecol.* **1992**, *29*, 265–276. [CrossRef]
60. Stoica, A. *Comparative Biological Studies of the Common Reed in the Characteristic areas of the Danube Delta and Opportunities to Maintain the Current Potential of Reed*; Study 2/197; Archives of DDNI Tulcea: Tulcea, Romania, 1972.
61. Hanganu, J. Managementul resurselor naturale (stuf, păduri, plante medicinale, ciupercişi pajişti) în Delta Dunării. In *Delta Dunării Rezervaţie a Biosferei*; Gâştescu, P., Ştiucă, R., Eds.; Editura CD Press: Bucharest, Romania, 2008.
62. Munteanu, I. *Soils of the Romanian Danube Delta Biosphere Reserve*; RIZA: Lelystad, Netherlands, 1997; ISBN 90-369-5037-6.
63. Oosterberg, W.; Hanganu, J.; Menting, G.; Gridin, M.; Tudor, M. *Filtering Capacity of the Mustaca Reedbed*; Danube delta Romania; RIZA: Werkdocument: Lelystad, The Netherlands, 1998.
64. N-HABITAT. *Constructed Wetlands Manual*; UN-HABITAT Water for Asian Cities Programme: Kathmandu, Nepal, 2008.
65. Adler, P.R.; del Grosso, S.J.; Patton, W.J. Life Cycle Assessment of Net Greenhouse-Gas Flux for Bioenergy Cropping Systems. *Ecol. Appl.* **2007**, *17*, 675–691. [CrossRef] [PubMed]
66. Kask, U.; Kask, L. Reed Supply Chains, Mowing Equipment and Technologies, Logistics, Environmental Impact from Reed Supply Chain, Supply Risks. In *Guidebook for Reed Businesses, A Report of the CORFEEN Project*; Kask, U., Ed.; Central Baltic Interreg IV A Program: 2007–2013; Tallinn University of Technology: Tallinn, Estonia, 2014.
67. Köbbing, J.F.; Thevs, N.; Zerbe, S. The utilisation of reed (*Phragmites australis*): A review. *Mires Peat* **2014**, *13*, 1–14. Available online: http://www.mires-and-peat.net/ (accessed on 29 September 2020).
68. Available online: http://www.chineseherbsheali/ng.com/phragmites-communis (accessed on 28 September 2020).
69. Hakkinen, J. Traditional use of reed. In *Read Up on Reed! A Report of the Reed Strategy Project*; Ikonen, I., Hagelberg, E., Eds.; Interreg IIIA programme: 2007–2013; Tallin University: Tallinn, Estonia, 2013.

70. Laizans, A. Business Models and Social-economic Effects of Reed Business. In *Guidebook for Reed Businesses, A Report of the CORFEEN Project*; Kask, U., Ed.; Central Baltic Interreg IV A programme: 2007–2013; Turku University: Turku, Finland, 2013.
71. Wichmann, S.; Kõbbing, J.F. Common reed for thatching—A first review of the European market. *Ind. Crop. Prod.* **2015**, *77*, 1063–1073. [CrossRef]
72. Reed HISS Catalogue; Insulation Foam. Available online: https://www.hiss-reet-shop.de/naturbaustoffe/reet-platte/; http://iaddicshelters.net/structural-insulated-panels-cost/ (accessed on 15 December 2020).
73. Myllyniemi, J.; Virtanen, M. Common Reed. In *Guidebook for Reed Businesses, a Report of the CORFEEN Project*; Kask, U., Ed.; EU, Central Baltic Interreg IV A Programme: 2007–2013; Tallin University: Tallinn, Estonia, 2013.
74. Pavel, C.C.; Blagoeva, C.D.T. *Competitive Landscape of the EU's Insulation Materials Industry for Energy-Efficient Buildings*; European Commission, Joint Research Centre: Petten, The Netherlands, 2018.
75. DG Environment-G2. *Green Public Procurement, Thermal Insulation*; Technical Background Report; Brussels, Belgium, 2010.
76. Georgescu, S.-V.; Coşereanu, C.; Fotin, A.; Brenci, L.-M.; Costiuc, L. Experimental thermal characterization of timber frame exterior wall using reed straws as heat insulation materials. *J. Therm. Anal. Calorim.* **2019**, *138*, 2505–2513. [CrossRef]
77. Karja, K.; Miljan, J.; Miljan, M.-J.; Akermann, K. Experimental study-Thermal conductivity of timber framed walls insulated with reed. *Mires Peat* **2013**, *13*, 1–12.
78. Europanels. Available online: https://europanels.org/ (accessed on 2 October 2020).
79. Centre for European Policy. *The EU Furniture Market Situation and Possible Furniture Products Initiatives*; Centre for European Policy: Brussels, Belgium, 2014.
80. Osterwalder, A.; Pigneur, Y. *Business Model Generation*; John Wiley & Co.: New York, NY, USA, 2010.
81. Keeley, L. *Ten Types of Innovation*; John Wiley & Sons: Hoboken, NJ, USA, 2013.