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Perspective

Transformative Change Needs Direction

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Abstract: Comparing the impacts of future scenarios is essential for developing and guiding the political sustainability agenda. This review-based analysis compares six IPBES scenarios for their impacts on 17 Sustainable Development Goals (SDGs) and 20 biodiversity targets (Aichi targets) for the Europe and Central Asia regions. The comparison is based on a review of 143 modeled scenarios synthesized in a plural cost–benefit approach which provides the distances to multiple policy goals. We confirm and substantiate the claim that transformative change is vital but also point out which directions for political transformation are to be preferred. The hopeful message is that large societal losses might still be avoided, and multiple benefits can be generated over the coming decades and centuries. Yet, policies will need to strongly steer away from scenarios based on regional competition, inequality, and economic optimism.

Keywords: transformation; plural valuation; Sustainable Development Goals; policy scenarios

1. Introduction

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assesses the state and trends of nature and its contributions to people on regional and global scales. Here, we build upon six exploratory scenarios from the regional assessment for Europe and Central Asia. Based on a review of the modeled scenario impacts on plural values of nature, we project the impacts on the UN Sustainable Development 2030 Goals and on the foregone 2020 policy targets of the Convention on Biological Diversity. Our analysis confirms that reaching a sustainable future is still possible but not through business as usual: transformative change is needed. While best-case scenarios have clear benefits, worst-case scenarios—with predicted losses in economic and non-economic values—plunge the region further into undesired futures.

2. Connecting Policy Goals and Scientific Assessments

Humanity faces many challenges in achieving global sustainability. One of the gravest amongst these is the deteriorating state of nature, which jeopardizes the quality of life and pre-conditions of humankind's survival [1]. Addressing this challenge requires concerted and coordinated action, supported by an effective science–policy interface and building on the legacy of sustainable development [2] and the 1992 UN Convention on Biological Diversity [3]. Our analysis combines two complementary milestones from this institutionalized science–policy interface.

The first milestone is the global consensus on a vision for sustainability and its dependence on biodiversity, articulated in two important global commitments: the 2030 Agenda for Sustainable Development (and its Sustainable Development Goals (SDGs)) and the vision of the Convention on Biological Diversity (CDB) that "...by 2050; biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people", operationalized up until 2020 through the Aichi targets (ATs). To date, over 150 states have agreed to pursue the SDGs and the ATs. The 20 Aichi targets should have been accomplished by 2020, while most of the 17 SDGs aim for accomplishment by 2030 (see details in Supplementary Material A1 and A2).

The second milestone consists of IPBES's one global and four regional assessments. These assessments provide the largest and most comprehensive body of knowledge to date regarding the status of the planet's biodiversity and ecosystems and the contributions they provide to people, covering all nations and territorial seas. In particular, the assessment for Europe and Central Asia concludes that nature's contributions to people are critically important to maintain a good quality of life. Yet, these contributions from ecosystems are under threat due to the steady, ongoing decline of biodiversity [4]. Moreover, their benefits are unevenly distributed across the region and across social groups within the region. While sustainability and conservation policies and actions have contributed to reversing some of the negative biodiversity trends, this progress remains insufficient [4].

3. Plausible Futures for Europe and Central Asia

One of the primary sources of information used by the IPBES to improve the understanding of future nature–human interactions is the broad set of the scenario and modeling studies reported in the scientific literature [5–7]. These studies consider different "plausible futures" [8–10], which have been organized by the IPBES into six exploratory scenario archetypes for Europe and Central Asia [4]. Each scenario archetype (*business as usual*, *economic optimism*, *regional competition*, *regional sustainability*, *global sustainable development*, and *inequality*) shares underlying assumptions about the general patterns of future developments and summarizes the broad diversity of information from the scenario research (Box 1) [11].

Box 1. Summary description of the six scenario archetypes used in this study (source: Harrison et al., 2019; see more details in Supplementary Material B).

Business as usual
Continuation of current social, economic, and technological trends results in moderate but uneven population and economic growth, with persisting inequality and societal stratification. International markets and institutions are mostly stable but function imperfectly. Environmental issues are perceived as necessary, but society and industry are reluctant to adopt environmental policies that would lead to substantial improvements. **Economic optimism**
Global developments steered by high economic growth across the majority of European countries result in a strong dominance of international markets with a small degree of regulation and a high level of international cooperation. Technological development is rapid, with a focus on efficiency. Lifestyles are resource intensive, and a reactive attitude toward environmental management prevails.
Regional competition
Social fragmentation, competition, and the failure of market mechanisms result in inequality, declining social cohesion, and decreases in human capital across Europe and Central Asia. Violence and instability challenge international trade and cooperation, leading to a shift toward self-sufficiency.
Inequality
Power becomes concentrated in a relatively small elite across the globe, leading to increasing economic, political, and social inequalities and fragmentation both across and within countries. There are increasing disparities in economic opportunity, leading to substantial proportions of the population of Europe and Central Asia having a low level of development. Political regimes in Central Asia become increasingly authoritarian and repressive, with a growing incidence of social unrest, conflicts, and ethnic clashes. **Global sustainable development**
A high degree of international cooperation and top-down governance results in a globalized world with a high level of proactive regulation in favor of the environment. Technological development is rapid, focusing on green and resource-efficient technologies, biotechnology, and sustainable technologies. High levels of social respect and cohesion lead to substantial increases in human and social capital and low material consumption. **Regional sustainability**
Decision making shifts toward local and regional levels with a focus on welfare, equality, and environmental protection delivered through local solutions. A proactive attitude to environmental management prevails, increasingly influenced by environmentally aware citizens. International collaboration is weak, causing problems with technology transfers and obstructing coordination to solve global issues such as climate change.

4. Projecting Achievement of Policy Goals in Plausible Futures: Methodology

The modeling and a futures analysis provide vital resources for the science–policy interface on biodiversity and sustainable development. They help reveal how different drivers and pressures impact the plural values of nature and how alternative development pathways can facilitate proactive decision making so that it can anticipate change, mitigate undesirable trade-offs, and progress us toward a desired future [11,12].

To assess the key policy challenges and opportunities for implementing the sustainability and biodiversity commitments, we analyzed the six IPBES scenarios against the 37 policy goals and targets (the 17 SDGs and 20 Ats; see Table S3 in Supplementary Material C3). We reviewed 143 scenario studies, 37 of which included the modeled impacts on the plural values of nature (28 value indicators comprising ecological, economic, and socio-cultural dimensions; see Table S2 in Supplementary Material C2). The modeled impacts on the values were synthesized for the six scenario archetypes. Weighted with the policy priority given to these values by the 37 global policy goals and targets, the extent to which the SDGs and ATs are achieved, relative to the current situation, was projected for each scenario. Figure 1 breaks down our method in four steps:

1. The IPBES plural value typology is used as a framework for an integrated analysis and evaluation. The detailed description is found in Table S1 (Supplementary Material C1). This framework is further underpinned by the recent IPBES Methodological Assessment on Diverse Values and Valuation of Nature, which concludes that the use of one single indicator (whether economic, e.g., dollars, or ecologic, e.g., red list species status) provides a too narrow view on the diverse values of nature [13]. Our

analysis therefore departed from the 28 "value targets" (here: indicators) already applied in the ECA and Global assessment.

2. From the IPBES ECA assessment review, we know what the modeled impacts of each plausible future scenario are on each of the 28 value indicators. These impacts are qualified, including their confidence level, based on the number of studies and the consistency of the model outputs.
3. Not all values are equally important for society. The normative benchmark for weighing the indicators in this evaluation are the SDGs and Aichi targets, which reflect a global consensus of how humanity envisions nature (Aichi) and our use of natural resources (SDGs). A quantitative content analysis of which of the 28 value indicators are prioritized by the SDGs and Aichi targets provides us with the overall societal importance of each value indicator (see Supplementary Material C3). For instance, the Aichi targets put more weight on the value indicators in the intrinsic category, while the SDGs emphasize the relational values, and the instrumental values are emphasized in several Aichi targets and SDGs (see Figure 2 and Supplementary Material C3).
4. A given scenario has an impact on a certain value indicator (derived from the review), and this indicator reflects to a certain extent the policy priorities institutionalized through the SDGs and ATs (weight derived from the policy documents). Adding up the weighted value indicators results in a negative "cost" or positive "benefit" contribution to the reaching of the targets. Aggregating the negative and positive contributions of all the targets per scenario results in a total value compared to the current situation.

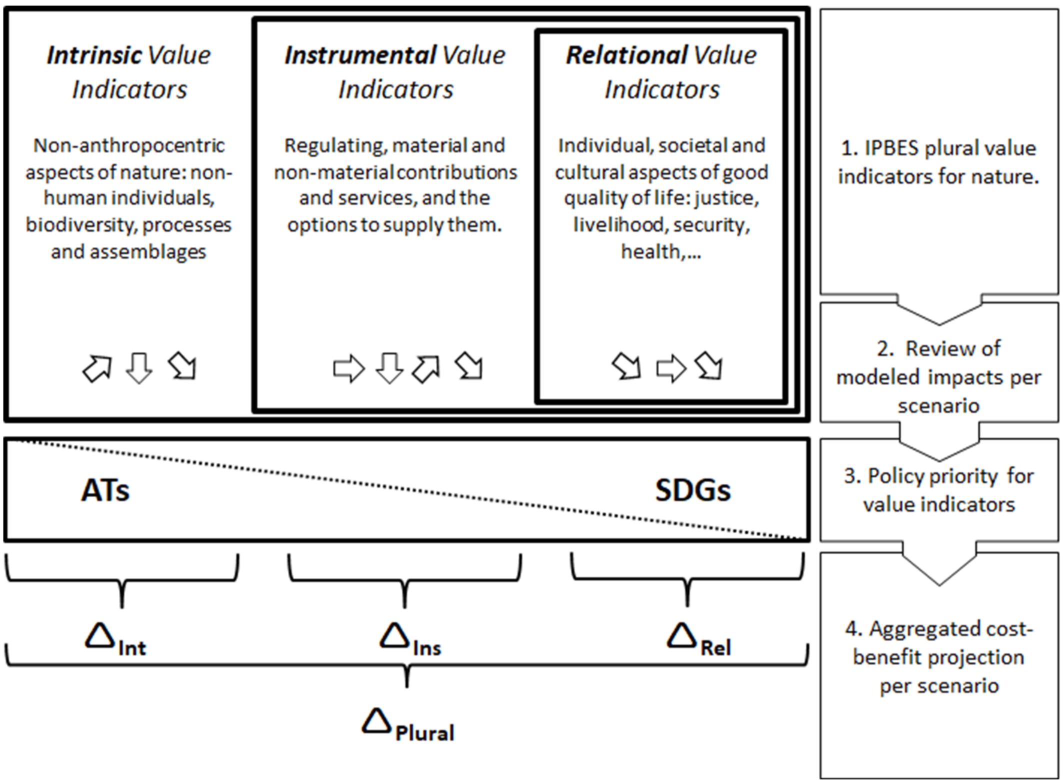

Figure 1. Plural valuation analytical framework (left) and stepwise approach (right): (**1**) selection of multiple indicators for plural values of nature; (**2**) review and synthesis of modeled changes (arrows) from the literature for each indicator per scenario archetype; (**3**) multiplication by the policy priority of each value indicator as derived from their mentioning in individual biodiversity targets (CDB) and policy sustainable goals (SGD); (**4**) evaluation of the plural scenarios analysis across all policy goals per scenario archetype. See Supplementary Material C for further detail.

Prioritisation of values by policy goals

		AICHI 1	AICHI 2	AICHI 3	AICHI 4	AICHI 5	AICHI 6	AICHI 7	AICHI 8	AICHI 9	AICHI 10	AICHI 11	AICHI 12	AICHI 13	AICHI 14	AICHI 15	AICHI 16	AICHI 17	AICHI 18	AICHI 19	AICHI 20	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
Intrinsic	Individual organisms	2	2	1	0	1	3	1	1	2	2	2	4	4	0	0	0	1	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0
	Biophysical assemblages	2	2	1	0	3	1	1	1	2	3	3	3	1	0	2	0	1	1	3	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0
	Biophysical processes	2	2	1	0	1	1	3	4	1	4	3	2	1	3	4	0	2	1	4	1	0	0	0	0	0	3	0	0	0	0	0	0	0	2	4	0	0
	Biodiversity	4	4	4	2	3	4	4	4	3	3	4	4	3	0	2	0	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0
Instrumental (NCP)	18 Maintenance of options	4	1	3	4	1	3	2	2	0	3	1	2	3	2	2	0	0	2	0	0	0	1	0	2	0	2	0	1	1	0	2	2	1	1	3	0	2
	1 Habitat creation and maintenance	0	1	1	0	4	3	2	3	3	3	4	3	0	3	4	0	1	0	0	0	0	1	0	0	0	3	0	0	0	0	2	0	0	4	4	0	0
	2 Pollination and dispersal of seeds and propagules	0	1	0	0	0	0	2	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3 Regulation of air quality	0	1	0	0	0	0	0	3	0	0	1	0	0	1	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	3	0	0	1	0	0
	4 Regulation of climate	0	1	0	0	0	0	0	2	0	4	2	0	0	1	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	4	1	1	0	0
	5 Regulation of ocean acidification	0	1	0	0	0	0	0	2	0	4	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	0	0
	6 Regulation of freshwater quantity, flow and timing	0	1	0	0	0	0	2	0	0	0	1	0	0	2	1	0	0	0	0	0	0	1	0	0	0	4	1	0	0	0	0	0	0	0	1	0	0
	7 Regulation of freshwater and coastal water quality	0	1	0	0	0	0	1	3	0	2	1	0	0	3	1	0	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	3	0	3	1	0	0
	8 Formation, protection and decontamination of soils	0	1	0	0	0	0	2	2	0	0	1	0	0	1	2	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	3	0	0	4	0	0
	9 Regulation of hazards and extreme events	0	1	0	0	0	0	2	0	0	0	1	0	0	3	1	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	3	0	4	0	1	0	0
	10 Regulation of organisms detrimental to humans	0	1	0	0	0	0	1	0	4	0	1	0	0	1	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0
	11 Energy	0	2	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0
	12 Food and feed	0	2	1	1	2	4	4	0	0	3	1	2	4	1	2	0	0	1	0	0	1	4	0	0	0	0	0	0	0	0	0	3	0	3	2	0	0
	13 Materials	0	2	0	1	2	0	3	0	0	0	1	1	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	14 Medicinal, biochemical and genetic resources	1	2	0	0	0	0	0	0	0	0	1	0	4	1	1	4	0	2	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0
	15 Learning and inspiration	3	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	3	3	0	0	1	0	3	0	0	0	0	0	0	1	0	0	0	1	0	0
	16 Physical and psychological experiences	1	1	0	0	0	0	0	0	0	2	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	1	1	0	0
	17 Supporting identities	0	1	0	0	0	0	0	0	0	0	2	0	2	2	1	1	0	3	0	0	0	2	0	0	2	0	0	3	0	0	3	1	0	1	1	0	1
Relational	Living well in harmony with nature	2	1	3	2	1	2	2	2	0	2	1	0	1	3	1	0	1	2	0	0	0	1	0	0	0	0	0	0	0	0	2	3	0	1	2	0	2
	Identity and Autonomy	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	3	0	0	1	0	0	1	0	0	0	2	0	1	1	1	0	0	0	1	0
	Spirituality and Religions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Art and Cultural heritage	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
	Sustainability and Resilience	4	2	3	4	3	4	4	2	0	3	1	3	2	3	3	1	0	4	0	0	0	3	0	2	0	2	1	1	3	0	4	4	2	4	4	1	2
	Diversity and Options	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3	0	1	2	1	2	0	0	2	2
	Governance and Justice	1	3	2	1	3	3	3	0	2	3	3	2	3	3	3	4	3	3	2	2	3	3	2	3	3	3	2	3	2	3	2	3	2	2	3	4	3
	Health and Wellbeing	3	0	0	0	0	0	2	1	0	0	0	0	0	4	0	0	0	2	0	0	2	4	4	1	3	4	0	0	0	0	1	2	0	0	0	0	0
	Education and Knowledge	3	0	0	3	0	2	2	0	2	1	0	0	0	1	0	1	0	2	3	0	1	2	3	4	2	1	0	1	2	1	0	3	3	3	0	1	3
	Good social relations	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1	0	0	0	0	4	1
	Security and Livelihoods	0	0	0	0	0	0	0	0	0	3	0	0	2	3	2	0	0	0	0	1	4	3	3	2	2	2	1	4	2	2	4	0	3	2	2	2	1

4	value explicitly mentioned in the title/main focus
3	value explicitly mentioned in descriptions
2	value mentioned as a synonym or as a group
1	value related
0	value not related

Figure 2. Prioritization of value targets by policy goals. Result of quantitative content analysis (see Supplementary Material C3 for details).

A potential drawback of this plural valuation method is that it does not provide a "tangible" indicator, such as the effect in dollars or habitat surface increases, but a unitless change relative to the current state. However, the aggregation of the monetary (or biophysical) totals, even though perceived as "tangible", is quite meaningless in an economic (resp. biophysical) sense.

Not only does this plural valuation method provide a transparent and legitimate "total value" estimate and comparison between scenarios, but the method also allows to unpack this total value for each tangible policy goal (or, if desired, for the value dimensions). This avoids black box aggregations as well as the arbitrary weighting of the indicators.

Our method thus responds to the dual call for a more plural valuation of nature and the need for tangible metrics to project progress toward individual policy targets and goals. The linkage between the policy goals and diverse values (Figure 2) can be applied as a translation key and further validated in other plural evaluations.

5. Scenarios Differ in their Sustainability and Biodiversity Conservation Impacts

Our results show how two scenarios (*global sustainable development* and *regional sustainability*) advance sustainability in the region: they support 11 (out of 17) SDGs and 19 (out of 20) ATs compared to the current situation described as *business as usual* (Figure 3). Under the three worst-case scenarios (i.e., *economic optimism*, *regional competition*, and *inequality*), the sustainability decreases (positive impacts in only two SDGs and two ATs (Figure 3)).

Notably, the *business-as-usual* scenario is not a sustainable option: it supports only six SDGs and six ATs.

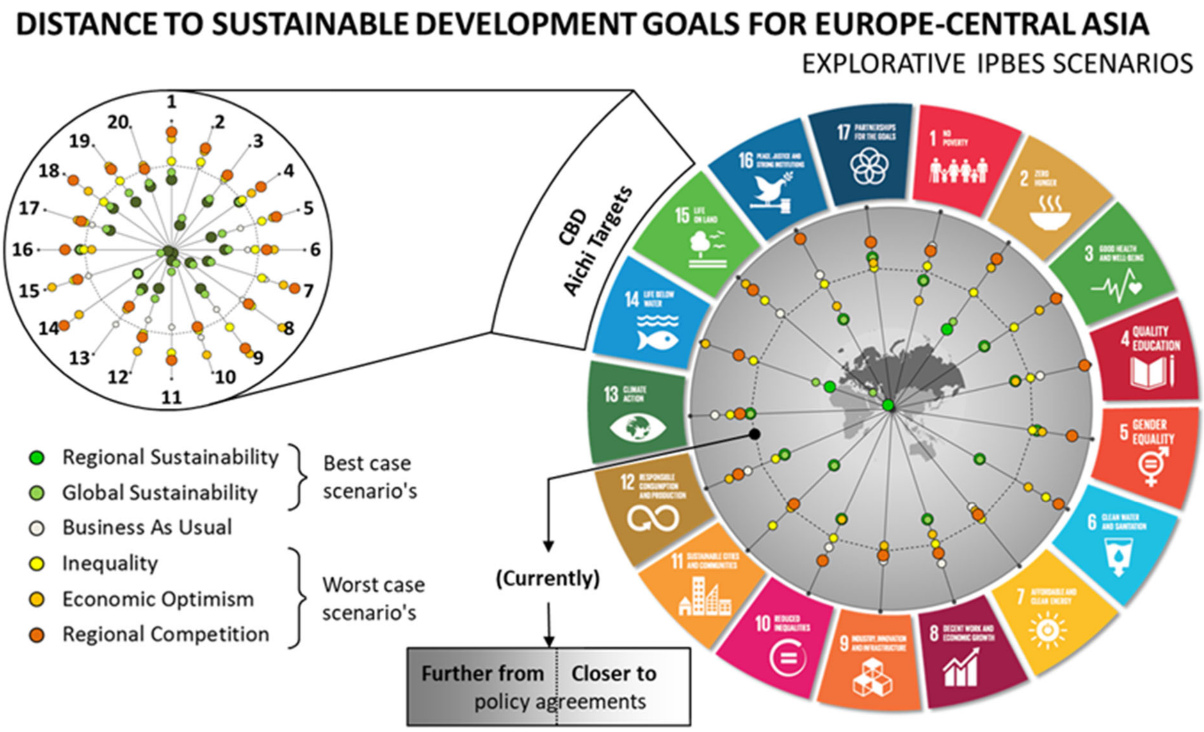

Figure 3. Projected impact on UN Sustainable Development Goals for 6 IPBES explorative scenarios Europe–Central Asia. Relative distance to current situation (dashed line). Upper left detail for SDGs 14 and 15 depicts impact on 2020 AICHI biodiversity targets. Time horizon of literature from 2030 to 2100.

The analysis of the distance to the SGDs (and ATs) shows how future political and societal choices are likely to influence the reaching of sustainability and biodiversity conservation in the region. For example, the best performing scenario, i.e., *global sustainability*, improves sustainability through reducing poverty and hunger and improving health and wellbeing, education, decent work and economy, sustainable cities, justice and strong institutions, responsible production and consumption, and water quality and life on water and land (Figure 3). On the other hand, the worst performing scenario, i.e., *regional competition*, projects only minor sustainability improvements to the SDGs on energy and cities and strong declines in all other goals.

Remarkably, the policy goals connected with the supporting capacity of the biosphere (SGDs 6, 13, 14, and 15) are advanced only in the two sustainability scenarios. In all the other scenario archetypes (including *business as usual*), the supporting capacity of the biosphere is further deteriorated.

6. A Plural Costs–Benefits Projection Points out a Clear Direction

The plural values of nature entail three dimensions: (1) *nature* in itself (intrinsic), (2) nature's *contributions* to people (instrumental); and (3) the *relationships* between nature and people's quality of life (relational) [4].

A total cost/benefit is visualized by the weighted sum of impacts, using higher weights for values prioritized by the policy goals as explained above. The reliability (represented in Figure 4 by the amplitude of the shadow of each line) was estimated based on the number and consistency of the reviewed model results (see Supplementary Material C4).

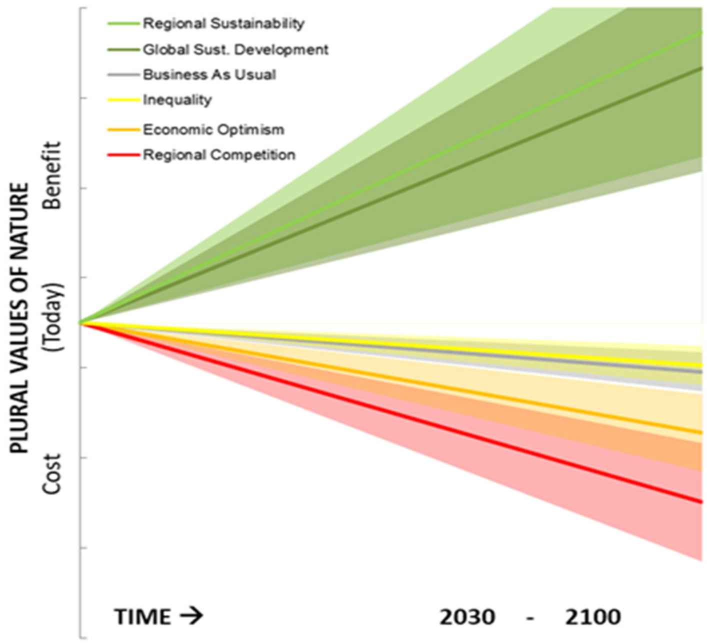

Figure 4. Projected change in the overall value of nature for the six scenario archetypes for Europe and Central Asia. The change in the values of nature for each scenario archetype (each colored line) is represented as the sum of all impacts on value indicators, weighted for policy priorities (dimensionless plural value indicator, see Supplementary Material C4). Reliability is represented by the amplitude of the shadow of each line. Time horizon of the reviewed literature varies from 2030 to 2100.

Despite the trade-offs between the SDGs and in contrast to the earlier projections based on market prices, this "plural cost/benefit estimate" confirms that *global and regional sustainable development* scenarios are the only futures providing overall societal benefits for the region, while the *economic optimism* and *regional competition* scenarios show considerable losses (Figure 4). More specifically, under the two sustainability scenarios, a seven-fold increase in the plural values of nature and the achievement of most of the SDGs is realized. The regional competition scenario causes a five-fold loss in the plural values of nature due to a growing intensification of resource consumption and land use combined with a general lack of societal concern about the environment depicted by these scenarios. Continuing on current development pathways (*business as usual*) suggests that increased food production and forest yield possibly further benefit the region, but the high responding cost of the declining supporting capacity of the biosphere makes this a mere temporary gain and an inherently unsustainable future.

7. Discussion and Conclusions

Our analysis specifies the consequences of different plausible futures and informs the development and direction of new sustainability agendas for Europe and Central Asia, which should set out an ambitious strategic plan of action [14].

While the results strongly suggest that Europe and Central Asia need to consider pathways toward the sustainability scenarios, a more sustainable future for the region will not be reached by simply "choosing the right scenario". The assumptions in the scenarios can, alongside other efforts to delineate key interventions [15] and sustainability pathways [16], inform the actions (steps) that need to be taken on the pathway to sustainability. Yet, these actions need to be assessed in each institutional context and matched with pre-existing policy mechanisms to kick-start the transformation. To design effective pathways (as time-dependent policy actions), the countries in the region should consider actions from multiple scenarios. Importantly, the developments described in the assumptions of the worst-case scenarios should be assessed carefully and avoided or disrupted [17].

Now, to develop pathways toward a sustainable future for Europe and Central Asia, the ambitious and cooperative integration of policy agendas is needed [18]. The effort undertaken to integrate the new EU biodiversity strategy and the agricultural "From Farm to Fork" strategy illustrates such a cooperation. Yet, partnerships for sustainable development should be multi-stakeholder and multi-level [19]. While biodiversity and ecosystem services have slowly entered the political agenda on various levels [20], incumbent actors dominate political discourses, for instance, in the EU policies on industry, trade, agriculture [21], forestry [22], and fisheries [23]. Our results provide a strong argument for sustainability as a common ground for sectoral and global interests.

To realize the integration and make the sustainability transformation happen through the actions included in the scenarios, more robust knowledge on the connection between the scenarios and their impacts is needed, as well as on the interactions between the targets themselves [24]. Most exploratory scenario and modeling studies quantify and assess a rather small selection of the indicators, and do not relate those impacts to specific policy goals and targets, nor are the scenarios tested empirically. We acknowledge the data gaps in this study regarding the model projections for some types of values (i.e., the quality-of-life indicators) and sub-regions (e.g., Central Asia countries), yet our approach advances the scenario comparison by moving away from simplified monetary values [25] toward a more grounded and plural comparison. Because political choices can and will have an impact on future sustainability and biodiversity, the choices should be well-informed to secure a more sustainable future.

Supplementary Materials: The supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su142214844/s1.

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