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Opinion

Beyond the IPCC for Food: An Overarching Framework for Food Systems Sustainability Assessment

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Abstract: Food systems are responsible for a large share of anthropogenic impacts. In recent debates, the need to strengthen the link between science and policy has emerged with the proposal to establish a new global science–policy interface for a sustainable food system. While the clash between those who consider necessary and those who do not consider necessary the creation of this panel increases, this paper takes inspiration from this debate to highlight how strengthening the interactions between science and policy should be supported by increasing the informativeness of current sustainability assessments, regardless of the need for such a panel. In particular, we delve into this emerging topic by focusing on some critical aspects of the current sustainability assessments of food systems, which include the need for more comprehensive assessments, based on the joint use of multiple indicators. While sustainability assessments of food systems have been historically focusing on just one–two externalities at a time, the introduction of new multi-faceted indicators make it now possible to look at multiple externalities concurrently and at the trade-offs among them. Dietary contextualization becomes essential too, to avoid the provision of misleading information. An operative framework to improve sustainability assessments of food systems is presented here and discussed with the aim of promoting more informative approaches, which are crucial for transforming scientific knowledge into mitigation policies.

Keywords: sustainable food systems; science–policy interface; sustainable diets; intergovernmental governance; indicator informativeness

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Citation: Caro, D.; Sporchia, F.; Antonelli, M.; Galli, A. Beyond the IPCC for Food: An Overarching Framework for Food Systems Sustainability Assessment. *Sustainability* **2023**, *15*, 14107. https://doi.org/10.3390/su151914107

Academic Editor: Michael S. Carolan

Received: 26 July 2023
Revised: 6 September 2023
Accepted: 15 September 2023
Published: 23 September 2023

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1. The Need to Strengthen the Science–Policy Interface

Over the past decades, global food systems have addressed the needs of a growing population undergoing demographic and nutritional transitions, contributing to the overshoot of the planet's capacity to regenerate its biological resources [1]. These premises render food systems subject to significant political attention across the globe, and growing relationships between scientists and policymakers—which often still operate on two distinct levels—highly desirable. In this context, the United Nations held in September 2021 the Food Systems Summit, the first ever event bringing together experts and representatives from farmers, youth and indigenous people, scientists, and individuals, to design governance and transformation, acting on the global food systems [2].

Debates spurring from the summit have been arguing that—due to the global extent and interconnections characterizing food systems—food-related issues should be carefully addressed through a new intergovernmental panel that provides a global science-policy interface for a sustainable food system. This new panel, also called "IPCC for food" in reference to the widely known Intergovernmental Panel on Climate Change (IPCC), would represent for food systems what the IPCC represents for climate change-related issues. The creation of a new science–policy panel however, has been promptly and extensively criticized because of its potential capacity to undermine the ability of existing UN bodies to guide food system reforms [3,4]. Moreover, it has been criticized due to the potential exclusion of key voices from the governance process, like those of indigenous people and farmers (https://drive.google.com/file/d/1axLNs6Ck1FA_T8WjQbmxKAQavT_5l9fI/view) (accessed on 27 February 2023). Indeed, a science–policy interface already exists, and it continuously operates to encompass relations between scientists and other actors in the debate around food policies. It is the High Level Panel of Experts (HLPE) on Food Security and Nutrition of the Committee on World Food Security (CFS), the United Nations' body responsible for assessing the science related to world food security and nutrition issues.

However, it has been argued that the HLPE consists of a broad range of mechanisms mainly characterized by considerable fragmentation. From this point of view, a multi-stakeholder panel involving a broad range of stakeholders from across the world and from all the sectors might constitute a solid framework for the science–policy interface. This would allow a voice to be given to small-scale farmers and fishers and large numbers of indigenous people as well—whose knowledge and needs have been historically neglected [5]. Moreover, it has been highlighted how a panel of this sort would also represent a robust reference point for the Sustainable Development Goals (SDGs), which are strongly connected with food systems and currently have no food-focused dedicated representative political body [6]. Indeed, currently there is only the UN Department of Economic and Social Affairs as overarching management body.

However, [3] warned that the members of the Scientific Group of the UN Food Systems Summit lacked the necessary expertise in interactions of science, technology and society, transition studies, legal studies, or human rights, which would be greatly needed to support interdisciplinary goals such as SDGs. Moreover, the activities of the Scientific Group were seen as a reinforcement of an agenda of technological innovations mainly addressed to large-scale producers while neglecting small-scale producers and enterprises. On the other hand, [5] highlighted a potential point in favor of the hypothesized IPCC for food: the IPCC existence itself. Indeed, the development of a new science-to-policy panel would have the opportunity to follow the leading example of the existing IPCC, in particular the way the IPCC is structured and governed and how it operates around multi-dimensional, complex and transdisciplinary topics, as well as the way in which it interacts with diverse stakeholders' groups, such as policymakers, industries, and non-governmental organizations. Thus, the existence of the IPCC would in itself accelerate the creation of such a new "IPCC for food". However, [7] argued that this new panel would follow a different trajectory in which efforts to govern global food systems in the public interest would be subverted to maintain colonial and corporate forms of control. Finally, they concluded that the time and money spent on the UN Food Systems Summit would have been better spent on shoring up the current UN Committee on World Food Security.

To recap, while on one side the creation of a new panel could be seen as an opportunity to strengthen, rather than undermine, the existing science–policy interfaces on food systems, the current existence of researchers advising various organs such as the Food and Agriculture Organization and the Committee on World Food Security risks make it superfluous or even counter-productive.

We do not necessarily feel the need to take sides in this debate, as this surely goes beyond our role. Rather, we argue for the need to find a point of agreement between these positions. To do this, we propose going back to the origin of the debate. In particular, we want to emphasize how both sides acknowledge that a reinforcement of the interactions between science and policy is needed now more than ever. In particular, a major investment is needed in better and more relevant knowledge systems and in more efficient science–policy interfaces [8]. This is especially true in the context of the COVID-19 pandemic, which has shown the dysfunctionalities and structural vulnerabilities of the neoliberal model of food systems. Indeed, during the pandemic such distortions were exacerbated, hitting low-income populations the hardest and hindering the post-pandemic recovery. Therefore, rather than focusing on technocratic issues and different visions of what constitutes legitimate science and relevant knowledge for food systems, we want to highlight the critical importance of a reinforcement of the science–policy interface for food systems through a transversal perspective. This is regardless of whether a new IPCC for food is needed or not.

In particular, we focus here on some critical aspects of the current sustainability assessments of food systems, which are conducted for supporting decision making and policy. As key tools for transferring information from science to policy, indicators are key tools for measuring the impact of food systems and support policies aimed at managing such impacts. This paper builds on current gaps in systemic assessments of food system sustainability to then discuss potential improvements in the provision of scientific information and associated policy implications. An operative framework for improving the sustainability assessment of food systems is here presented and discussed with the aim of reducing the gap between science and policy.

2. A More Informative Approach Drives More Effective Mitigation Policies

2.1. The Multidimensionality Nature of Environmental and Health Impacts

We strongly believe that capturing the multi-dimensional characteristics of food systems represents a crucial and necessary precondition for strengthening the global science–policy interface. As food systems are characterized by multiple dimensions and can have multifaceted implications [9,10], identifying a proper way to measure the multi-faceted impact of our current food systems becomes a priority to properly inform decision makers, thus reducing the gap between science and policy.

Food systems are a significant contributor to environmental pressures, climate change from deforestation and resultant biodiversity loss, water resources, air pollution, and soil degradation.

The environmental footprint is an umbrella concept referring to environmental indicators used to quantify environmental pressures and impacts of human activities such as production or consumption [11]. Footprint indicators are a suite of tools that are now able to capture a large variety of environmental issues, also focusing on food systems. These include the Ecological [12], Carbon [13], Water [14], and Nitrogen Footprints [15]. Accordingly, a large body of research has highlighted the contribution of food consumption to a wide range of global environmental impacts [16,17]. For instance, food systems alone account for about one-third of the global anthropogenic greenhouse gas (GHG) emission [18]. GHGs are gaseous constituents of the atmosphere, both natural and anthropogenic, with specific physical properties that allow them to absorb and trap the solar radiation causing the greenhouse effect [19]. Agricultural water abstraction covers about 70% of total water withdrawals [20], representing over 90% of humanity's water footprint [21]. Again, the world's net cultivated area has grown by 12 percent over the last 50 years, mostly at the expense of forest, wetland and grassland habitats, while global irrigated areas have doubled [20]. Although the distribution of these land and water assets is unequal among countries, the scope for further expansion of cultivated land is basically limited to those parts of South America and sub-Saharan Africa that are already facing an unprecedented expansion in cultivated lands [22].

Nitrogen is also involved in the supply chain of food systems, mainly due to the utilization of fertilizers participating in the worsening of its already unbalanced cycle and contributing to climate change, biodiversity loss, air and water pollution [23,24]. Food systems are also responsible for multiple health effects [9,10]. The Lancet Commission on the Double Burden of Malnutrition describes the current state of food systems as a "triple crisis" in which obesity, undernutrition, and climate change are simultaneously jeopardizing human and planetary health [25]. Globally, eight million deaths are attributable to dietary risk factors [26]; up to 828 million people faced food insecurity in 2021 [20,27], while more than 3 billion people cannot afford a healthy diet, as it costs 60% more than nutrient-adequate diets [28].

Based on this broad picture, recent studies agreed that analyses focusing on single impacts in isolation from the others (e.g., looking at GHG emissions while ignoring water abstraction), are limited in terms of interpretation of findings and associated recommendations for effective mitigation policies [9,29,30], thus increasing the science–policy gap. Multiple health and environmental assessments of food items have been therefore developed with the aim of providing more comprehensive and informative impact analyses [29,31]. Indeed, when different impacts are analyzed and interpreted simultaneously, decision makers can better manage the tensions arising from their management. This integrated view has become relevant, showing the potential trade-offs and synergies among impacts. For instance, [9] found that foods mostly recommended for adult consumption (such as whole grains, fruits, vegetables, and legumes) also often have low environmental impacts. This indicates that the same dietary transitions that would lower incidences of noncommunicable diseases would also help meet environmental sustainability targets. Such a relevant scientific finding would not have been achieved (and communicated to the policy interface) with an analysis focusing on single impacts of food systems. The development of multiple environmental impact assessments of food systems as an approach for measuring their sustainability thus represents the most promising way to provide the necessary holistic approach to inform policy making.

2.2. Production, Consumption, and Post-Consumption

In our era, food systems are also structured in different steps from production to consumption. The supply chain of food systems consists of determined stages that may occur at different times and spaces. Among food system stages, food production has been identified as the main driver of impacts [32–35]. Consequently, most sustainability assessments have historically focused on food production, providing decision makers with important advice in terms of domestic intensity of production [36,37]. However, such focus on production has contributed to neglecting the remaining stages of the supply chain of food systems and their associated impacts, often leading to incomplete and misleading information. Ref. [38] for instance, have found that as much as nearly 25 percent of the biocapacity needed to support the diets of EU-27 residents originates from non-EU countries; focusing solely on increased sustainable practices within the EU agricultural sector is likely insufficient to meet the region's decarbonization targets, and rather shifts environmental impacts abroad. Moreover, food systems are also part of the problem when they become waste: according to [39], one-third of global food production is lost or wasted, with social, economic and environmental implications.

From a desirable circular economy perspective, all the stages of the supply chain of food systems are strictly connected because food should be produced in ways to reduce the amount of waste generated. Indeed, all stages of the food systems are calling for synergic transition towards more sustainable practices. Therefore, the limitations of analyses focusing on a single step of the food supply chain—whether production, consumption or trade—are becoming increasingly evident, as they limit the information on the total burden associated with food systems, thus weakening the effectiveness of the science–policy interface. We thus argue that a systemic approach concurrently investigating each and every step of the supply chain—which could be provided, for instance, by the joint use of multiple footprint-types of indicators [11]—is necessary when assessing food systems to avoid partial or misleading recommendations being transferred to the political fora, and to guide governments in the development of holistic, evidence-based food policies. For instance, when considering the whole supply chain, transport emission accounts for about 19% of the total supply chain emission—including production and land use change [40]—and focusing on the sole production phase would overlook such a remarkable part of the overall impact.

2.3. From Single Food Items to Diets

Nowadays, sustainability assessments focusing on single food items are widespread [41,42]. In particular, the analyses concerning predominant food systems such as staple foods (rice, sugar) or crucial food items in terms of impact such as livestock products are considered highly relevant. However, these kind of assessments may not be so instructive, and may lead to misleading information for policymakers as individual foods should be contextualized within a national diet. For instance, looking at one single food item limits the possibility of understanding its relevance in relative terms. Furthermore, the identification of a single food item as a potential nutritional replacement, within a proper contextualization with respect to relevant dietary patterns, is hindered. From a policy perspective, receiving a more systemic and complete assessment involving the collection of information on food and beverages consumed over a specified time and space represents a significant upgrade in terms of knowledge and consequent capacity of decision. Furthermore, it does not prevent policymakers from focusing on specific or predominant foods of high relevance. Not coincidentally, analyses estimating the impacts of national diets are increasingly emerging [11,38,43–46], showing their relevance in terms of communication and policy recommendations. In this context, we believe that strengthening the science–policy interface of food systems requires an urgent change of paradigm, shifting the attention from sustainable foods to sustainable diets.

2.4. From Mass Value to Nutritional Values

Dietary patterns are based on nutritional values of food and not on mass of food. A key to strengthening the science–policy interface is to take this distinction, and its implications, into consideration [47]. It means that assessments based on mass of food may provide limited information and lead to wrong conclusions on how individual food items contribute to sustainable diets. For instance, the environmental impact of 1 kg of olive oil [48] does not consider that 1 kg of olive oil provides about 9000 calories [49], almost 7000 calories more than one kg of beef. Therefore, it does not capture the fact that more kilograms of beef are needed to obtain the same calories as 1 kg of olive oil. Moreover, considerations should be made whenever comparing food with different features, intake, and nutritional properties [47]. It means that assessments based on the mass of food cannot provide information about how the food affects the level of intake sufficient to meet nutrient requirements, and are thus unable to properly capture the trade-offs between nutritional provision and environmental impacts associated with food consumption. Such limited information may also lead to ineffective counteractions.

3. An Operative Framework to Improve Sustainability Assessment of Food Systems

As discussed above, effective policies targeting food system sustainability cannot prescind from simultaneously accounting for multiple environmental externalities by considering all steps of the food supply chains while embracing a wider dietary approach. Figure 1 presents a schematic representation of some of the features that characterize food systems and the data required to build information upon which meaningful and effective food policies could be designed.

Starting from Figure 1, this paper proposes an assessment framework for use by scientists and policymakers aiming to address the sustainability of food systems. As the primary function of food is to feed humanity, the assessment starts from an evaluation of the nutritional adequacy of the diets existing in the territory under study, as shown in Figure 2. The framework caters to both scientists—guiding their research to provide comprehensive information—and policymakers—called to implement sustainable food system strategies based on such information.

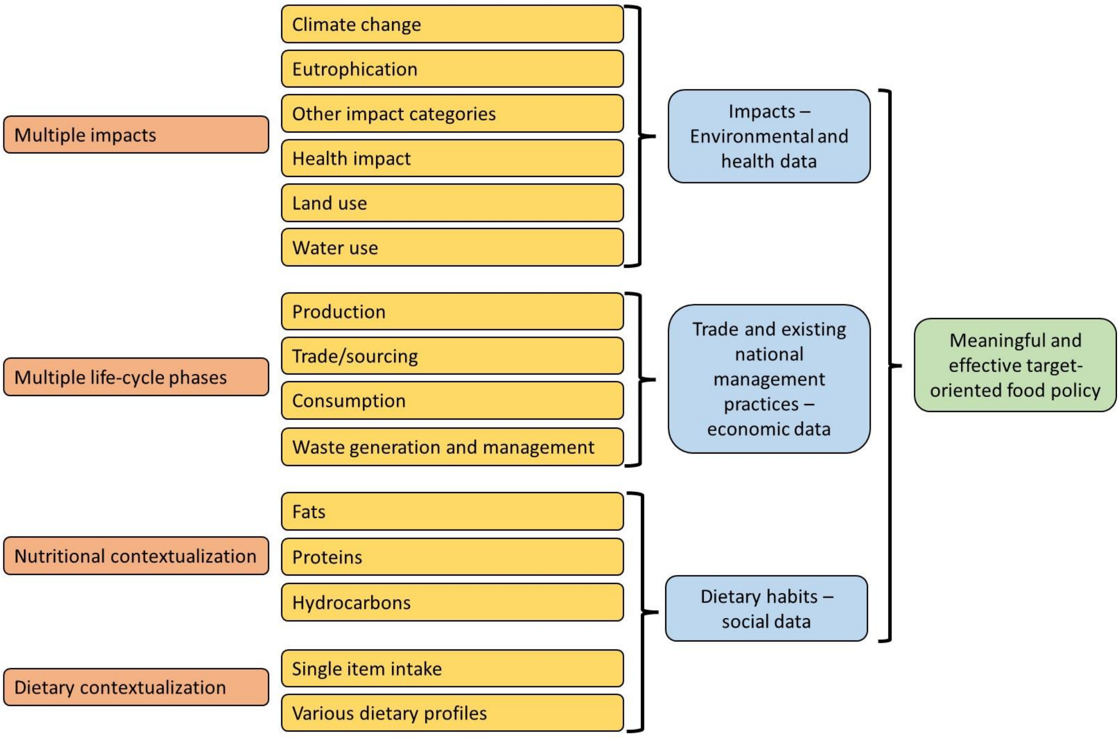

Figure 1. Schematic exemplary representation of some features to be considered when assessing the sustainability of food systems and the related required data.

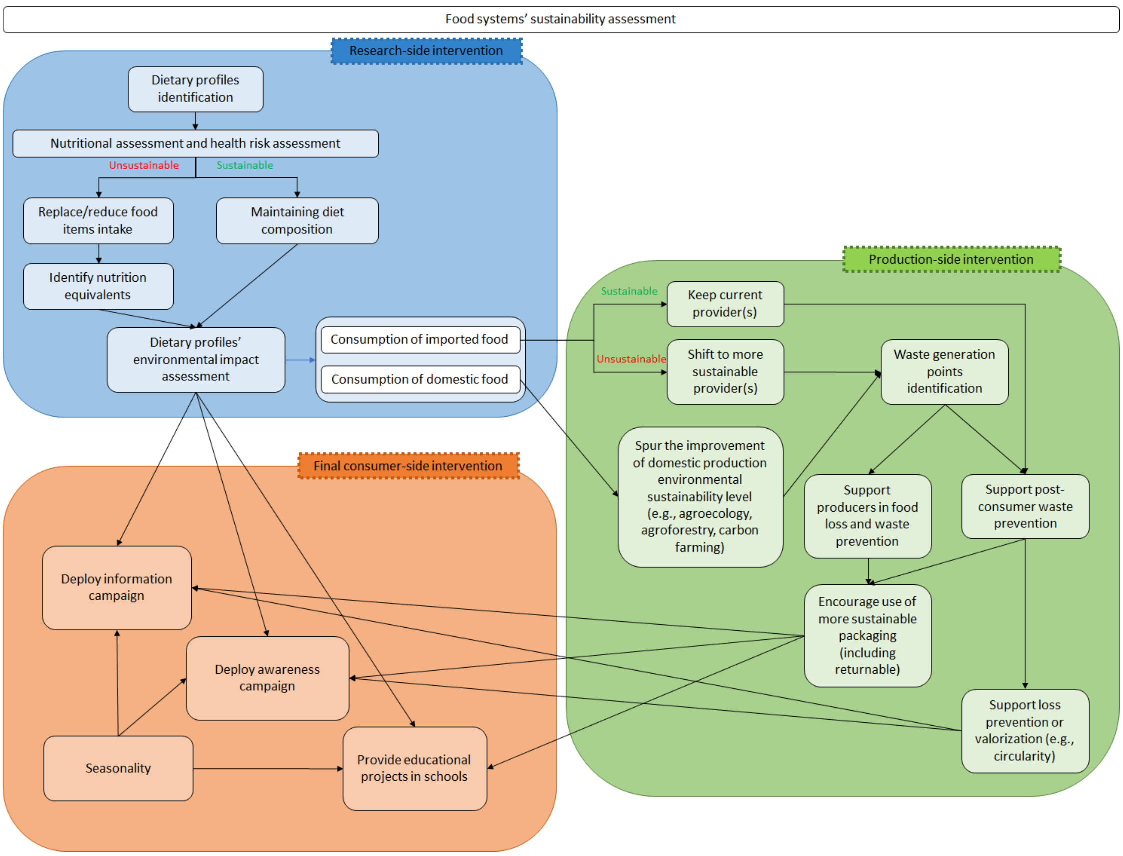

Figure 2. Proposal for an overarching methodological framework for the sustainability assessment of food systems and the design of target-oriented mitigation policies.

Multiple dietary profiles can co-exist and each must be identified and ideally studied separately, through a dedicated initial social investigation. If any of the identified dietary profiles presents unsustainable nutritional traits (e.g., deficiencies in terms of vitamins, or excess of trans fatty acids), various adjustment should be identified to reach a nutritionally sustainable diet—e.g., reduction or replacement of nutritionally poor or unbalanced food items. The alternative or original dietary profiles then undergo an environmental sustainability evaluation which considers both domestic and international supply chains for all food items involved. As is carried out for the nutritional side, the dietary profiles are scrutinized to identify hotspots in terms of environmental impacts for both imported and domestically produced foods. The former, when not replaceable with locally sourced products, could be sourced from a different provider if found to have a low sustainability level. The latter could be subject to local sustainability improvement actions that are proven to be effective for increasing the sustainability level of agricultural systems, such as agroecology, agroforestry, and carbon farming. On top of this, another effective strategy could focus, for instance, on the prevention of food loss during the pre-consumption phase, or on waste prevention during the post-consumption phase. Examples of these kinds of actions could be the introduction of returnable packaging to replace disposable ones (whether recyclable or not), when such measure is identified as beneficial from the environmental viewpoint. Finally, the nutritional, health, and environmental sustainability assessment results could then act as the basis to develop and conduct awareness and information campaigns directly targeting the population. In this sense, educational institutions [50] could play a key role and become the hub for a bottom-up shift to more sustainable food systems. The fundamental link between agricultural seasonality, seasonal nutritional demand, and sustainability should be stressed via interventions in the context of the final consumer-side to ensure that this often neglected aspect is given renewed attention.

The described framework should be interpreted from an iterative and interactive point of view, where all stakeholders (i.e., policymakers, researchers, industry, and consumers) are involved in a transformative process that can gradually achieve the targeted sustainability level. It represents an initial proposal to stimulate further discussion and to reach a more developed and comprehensive form, with the ultimate aim of being considered an effective tool to help address the issues that currently affect the science–policy interface at a national and international level.

4. Mind the Gap between Science and Policy

The UN appointed a scientific group to channel research inputs into the Food Systems Summit, where many researchers asserted their difficulty in reaching decision makers and policy actors. They complained about a lack of connection between science and policy and highlighted the timely relevance of addressing such a disconnection. Concerning the global science–policy mechanisms, for any mechanism as such to be effective, a clear communication within the science–policy interface is required. In light of this, we believe that the operative framework for food sustainability assessments presented here could represent a useful starting point to fill the gap between science and policy; we also highlight how it goes beyond the eventual establishment of a new IPCC for food. Moreover, such an establishment would require a transformation on different scales (local, national, and global) that would occur in line with the creation of other scientific panels (the IPCC itself) and would take many years to become operational. Although the authors of this paper do not have any bias towards this option, they want to remark how time-consuming it may be. Hence, it should be considered in the light of the remaining seven years for achieving the SDGs.

This paper emphasizes that transformative and post-normal science is urgently needed to support policy and offer innovative solutions for food system transformation. Current environmental impact assessments of food systems do not always provide direct target-based information to policymakers or highlight how this may limit the knowledge transfer process, resulting in less-effective policy actions. This is particularly relevant for food systems, due to their intrinsic complexity and multi-dimensionality. Indeed, enabling the transformation of food systems has the potential to catalyze progress in many SDGs as food is directly or indirectly related to all of them. Future scientific advancements and institutional initiatives should therefore promote new forms of transdisciplinary approaches. Making progress on these challenges will require a huge effort in different scientific and political fields. While we are aware that the argumentations here discussed constitute a small part of the issue, they represent, in our opinion, the first concrete step towards a systemic and more informative approach aimed at supporting and helping policymakers in designing more effective mitigation strategies. As such, they can strengthen the science–policy interface, constituting a pillar upon which the relations between scientists and policymakers can be grounded. Citing Joseph Stiglitz "What we measure affects what we do. If we have the wrong metrics, we will strive for the wrong things" [51].

Author Contributions: Conceptualization, D.C., F.S., M.A. and A.G.; investigation, D.C., F.S., M.A. and A.G.; writing—original draft preparation, D.C. and F.S.; writing—review and editing, D.C., F.S., M.A. and A.G.; supervision, D.C. and A.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data sharing not applicable.

Acknowledgments: This paper and the related research have been conducted during and with the support of the Italian national inter-university PhD course in Sustainable Development and Climate change.

Conflicts of Interest: The authors declare no conflict of interest.

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