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Review

Framework Proposal to Quantify the Contribution of Non-Wood Forest Products to the European Union Forest-Based Bioeconomy

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Abstract: Forest ecosystems provide numerous services that contribute to the wellbeing of societies. However, the lack of knowledge about the benefits of non-wood forest ecosystem services, such as non-wood forest products (NWFPs), hinders efficient forest policy decision-making processes. This study proposes a new extension of the Social Accounting Matrices (SAMs) to capture both the private and the social component of NWFPs. By means of a literature review, we show how extended SAMs can be a suitable approach to explain the causal relationship between the supply of forest ecosystem services, forest-based value chains, and the European bioeconomy. The literature analysis shows that the number of research studies calibrating or using SAMs has been increasing over the last decades. Recent extensions of the SAMs made it possible to evaluate the relationship between human wellbeing and the environment. Moreover, we found applications to the forest sector (limited to timber) and to the supply of some non-wood ecosystem services. We believe the extended SAMs will support decision-makers to design forest strategies that properly account for the benefits NWFPs provide to both the economy and the society.

Keywords: social accounting matrix; environmental accounting; supply chains; forest sector; non-wood forest products

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1. Introduction

European forests are multifunctional, providing a range of ecosystem services [1], including food, water, shelter, raw material and energy, medicine, clean air, and water. The European Green Deal makes a point of this concept, linking the resilience of forests to the promotion of the circular bioeconomy [2]. Likewise, the new EU bioeconomy strategy [3] places an emphasis on innovation, calling for new business models based on the valuation of forest ecosystem services (ESs).

Among different forest ESs, Non-Wood Forest Products (NWFPs) are gaining attention in relation to the European bioeconomy: they provide food, material, and services to the socioeconomic system. FAO defines NWFPs as being "goods of biological origin other than wood derived from forests, other wooded land and trees outside forests" [4]. Lovrić et al. [5] estimate that the value of harvested NWFPs in Europe amounted to 23.3 billion euros in 2016, which corresponds to about 71% of the value of annual round wood production. Despite the wide-ranging contributions made by NWFPs, their value is regarded as significantly underestimated [1,6]. Nevertheless, NWFPs and related services provide opportunities for the forest domain to connect with other sectors and disciplines. In Europe, some of these interactions are already taking place in a more or less organized way, opening opportunities for joint value chain development [7]. The production of NWFPs, as a market product such as cork oak, chestnut, or truffle, is the specific objective of several forest management and agro-forestry activities. These products are then transformed in

food and material industries. The health, personal care, and medical sectors also rely on numerous non-wood forest products. These economic activities generate added value and provide employment [7].

Besides their market (or private) component, NWFPs are also strongly connected to services such as recreation, local culture, wellbeing, and biodiversity conservation. This social (or public) component of NWFPs is less known because it is difficult to attach a value to it. Hence, the NWFPs contribution to wealth and societies is only partially known.

The real value of NWFPs is difficult to determine also due to sparse and incoherent data. One reason is that many of these products are sold on informal markets or are even not subject to transactions. Moreover, several economic activities use and transform NWFPs (e.g., in the cork oak value chain). Finally, the frequentation of rural areas by NWFP pickers benefit indirectly other activities such as local shops and restaurants. These effects are rarely quantified. This represents a major gap towards understanding the total economic value of NWFPs. Thus, in this study, based on a bibliographic analysis, we propose a framework to estimate the contribution of NWFPs to the economy and the society, as well as to evaluate how NWFPs can support a further development of the bioeconomy.

Our aim is not only to present a way to estimate the value of the NWFPs—both as commercial products and as socio-cultural services connected to tourism and recreation—but also to show the link between NWFP supply to the whole economy. This includes the impact of a change in NWFP supply on value chains making use of NWFPs (direct effect), products and services supplied to the NWFP value chains (indirect effect), and the consumption of households involved in the NWFP value chains and related sectors (induced effect). Finally, to liaise the supply of NWFPs to the economy, we propose two techniques among those already present in the field of ecosystem service evaluation [8], for both the market and the social component of NWFPs.

To represent the link between the economy and the environment, the System of Environmental-Economic Accounting (SEEA) [9] has been developed as a first step to extend the System of National Accounts (SNA). As part of the SEEA, the Experimental Ecosystem Accounting (SEEA EEA) [10] focuses on accounts considering the role of ecosystems and their services. In the SEEA EEA, ecosystem services accounts present the physical and monetary supply and use of ESs in a way that complies with other SNA-derived economic indicators [11]. This framework has been implemented by the European Commission through the Knowledge and Innovation Project on an Integrated system of Natural Capital and ecosystem services Accounting (KIP-INCA) in the EU. Although this framework makes it possible to identify the flows of services from the ecosystem to the economy, it is still not able to provide information on NWFPs value chains and on upstream and downstream socioeconomic impacts. This particular link between ecosystems and human society is one of the current concerns, as highlighted in the latest Global Assessment Report on Biodiversity and Ecosystem Services [12] released by the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES). This report emphasizes the need to understand the contribution of multiple values of ecosystem functions and of nature to people's wellbeing.

Social Accounting Matrices (SAM)—"a matrix presentation that elaborates the linkages between supply and use tables and the sector accounts" [13]—would be a possible tool to link flows of ecosystem services to the functioning of the economy. However, usual SAMs do not include information about flows of ecosystem services. Therefore, we propose an Ecosystem-extended SAM (EcosySAM) that represents the impact of ES flows, where the flows correspond to those estimated in ES supply and use tables.

The EcosySAM represents a novelty in the field of ecosystem service accounting. To validate the hypothesis that this approach is suitable, this study relies on a literature review. It focuses on environmental studies that use the SAM methodology to understand whether the EcosySAM would make it possible to analyze the effects of NWFPs on the European bioeconomy.

This paper is organized into five sections. After the first introductory section, the second section explains how the EcosySAM works, based on standard SAM, and how to calculate the monetary value of both the market and the social component of NWFPs and introduces the theoretical framework of ecosystem-extended SAM, as well as the methodological approach we used to perform the literature review; the third and the fourth sections present and discuss the results of the review, respectively; finally, the fifth section draws conclusions and highlights research gaps, their implications for policy-making, and future research needs.

2. Materials and Methods

2.1. Extending SAMs to Embed Ecosystem Services

An SAM presents "a series of accounts in each of which incomings and outgoings (or income and expenditure, in many cases) must balance" [14]. Thus, it contains information about the economic and social structure of a country in a particular year, representing in a detailed manner the interaction and inter-dependences between sectors, activities, and products of an economy [15,16]. It is a square matrix, in which each account is represented by a row and a column. Each cell shows the payment by column account to the account in the row. There are six basic groups of agents (i.e., activities and/or commodities; production factors; private institutions—households and corporations/enterprises; public institutions—government; saving–investments; the rest of the world) that can be disaggregated depending on which level of analysis is required. Data sources for developing an SAM can come from national accounts, input–output framework (with supply and use tables), and data on consumption patterns, among others. Micro-data use is also strongly recommended (primary data from survey interviews) [16].

An SAM represents an invaluable database for two main reasons: (1) it shows a complete but intuitive snapshot of the economy and (2) it provides data for economic modelling, particularly multi-sectorial linear modelling and/or Computable General Equilibrium models. Multipliers and CGE models can be used for the analysis of key socioeconomic issues, such as employment, value added, and growth and income distribution. Similarly to input–output tables, SAMs capture not only the direct effects (occurring in the economic activity that is analyzed) and the indirect effects (occurring in backward-linked activities that supply the activity analyzed), but also the "induced effects" that arise as employees of the analyzed activity and the backward-linked activities spend their income [17]. Studying the total economic impact of an ecosystem service considering these three types of effects can provide robust information to decision-makers about the contribution of this service to the national economy.

The standard structure of the SAM, however, is not sufficient to explain the relationship occurring between environment and economy. For this reason, in the last 20 years the literature has developed different types of extended SAMs to study the effects of the socioeconomic system on the environment and vice versa [18–20]. These extended SAMs became tools that can connect national account data to data from satellite accounts such as the environmental accounts. These satellite accounts enable the linkage of physical data and analysis to the monetary accounting system, a key issue for environmental and ecological economics studies [16].

We hypothesized that an EcosySAM could highlight how society benefits from NWFPs, either with a direct flow from the supply of the ecosystem to the households, or through a value chain from the ecosystem to economic activities (industries and services) before arriving to the household. Both data concerning the market and the public component of NWFPs can be used as satellite accounts to extend the standard structure of an SAM and to analyze the effects of this forest service on different economic activities and actors.

In practice, in the EcosySAM, forest ecosystems appear as agents of the economy, supplying goods and services in interaction with economic agents. The calibration of an EcosySAM allows to understand the actual flow (i.e., the flow of ES used by the socioeconomic system) [9,21] of NWFPs from the forest to the socioeconomic system and

to calculate indicators such as value added and employment related to this service both upstream and downstream.

2.2. Proposed Assessment of the NWFP Value Following an Ecosystem Service Evaluation Approach

Following the SEEA EEA approach, physical and monetary data in the form of supply and use tables can allow detecting the actual flow of services from forests to the economy. The first way we propose to quantify the actual flow of ESs is to follow a fast-track approach [21] based on officially published statistics. This is particularly the case for ESs that contribute to the supply of products already reported in the SNAs, such as timber. Similarly, this methodology can be applied to the market component of NWFPs (e.g., cork), considering its use along the entire value chain (i.e., direct effect from the ecosystem to final users) and investigating the data on quantity and volume and how this adds value into each step of the forest-based bioeconomy.

Alternatively, different valuation techniques shall be used when data are not already available and when it is not possible to estimate a market price [8] like in the case of the social component of NWFPs. A widely used approach to estimate the value of such ESs is the choice experiment [22–25] that can be employed to explore individuals' preferences towards NWFPs and services associated with them. Discrete Choice Models are used to derive individual marginal Willingness To Pay (WTP) values that provide an economic assessment of the ES under evaluation [8,24,26,27]. The choice experiment questionnaire can include auxiliary questions to make it possible to also investigate some indirect effects. For example, beneficiaries of forest ecosystem services are likely to spend money in the area where forests are located (e.g., in local restaurants and shops) and therefore to influence non-forest sectors of the economy. Evaluating the social component of NWFPs under this perspective allows understanding people's behavior in terms of consumption, how much they are willing to pay for this environmental service, as well as which economic activities are stimulated by this service.

2.3. Ecosystem-Extended SAM (EcosySAM) Theoretical Framework

By combining extended SAMs and ES valuation techniques, we developed a theoretical framework to account for the socioeconomic impact of ecosystem services in value chains, as shown in Figure 1. This framework makes it possible to represent flows subject to transactions (i.e., market flows—private component) and flows without transactions (i.e., going directly to households—social component).

In the framework, the forest ecosystem represents the supply of ES, while the socioeconomic system represents the demand. The match between supply and demand represents the met demand and thus the actual flow from the forest ecosystem to the socioeconomic system [28]. The actual flow can be analyzed by means of ecosystem service evaluation techniques, such as those we presented in the previous paragraph (market price and choice experiment). Up to this stage, the framework is aligned with the KIP-INCA, where the value of ES is recognized but is not distributed among the different stakeholders and the different steps of the value chain. Moving ahead, the ecosystem-extended SAM can be utilized for unlocking the upstream and downstream impacts in value chains and estimate the benefits.

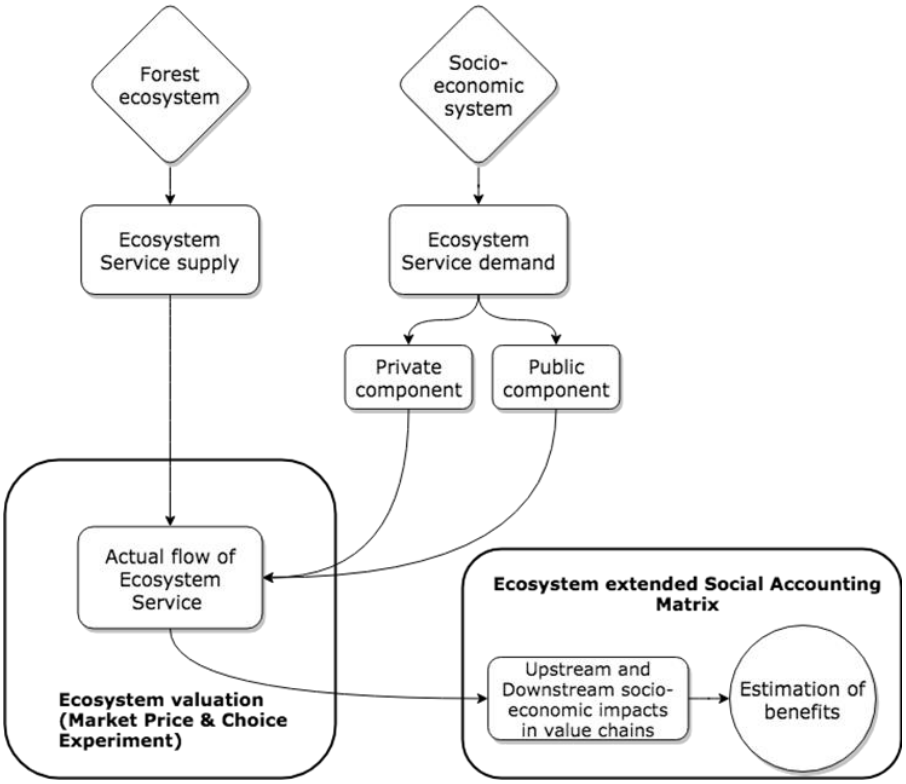

Figure 1. Theoretical framework to account for the socioeconomic impact of ecosystem services in value chains. Source: adapted from Vallecillo et al. [28].

2.4. Literature Search: Suitable Keywords, Inclusion, and Exclusion Criteria

To demonstrate whether the SAM methodology would make it possible to analyze the effects of NWFPs on the socioeconomic system, we performed a literature review completed in January 2022, analyzing the different applications of SAM methodology. The first step of the analysis was performed with the R package "*Bibliometrix*" [29] and was based on studies published in journals included in the databases Scopus and Web of Science, using the string "social accounting matrix". Then, we narrowed the search focusing on records belonging to environmental studies as well as agricultural and biological studies. As a final step, we performed a systematic literature review based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology [30–32] for the screening and selection of relevant papers. The systematic review focused on empirical studies that uses the SAM methodology applied to environmental issues, with a focus on forest sector, ecosystem services, and bioeconomy. Here, we used the string: "('social accounting matrix' AND 'bioeconomy' OR 'environment*' OR 'forest*' OR 'ecosystem service')". By using this string, the database returned documents in which the term "social accounting matrix" was always present in the tile, abstract, and/or keywords, and at least one of the other words was included.

Figure 2 shows the approach to the screening and selection of relevant papers. The first set of excluded records did not meet the following criteria: (1) journal article, (2) papers published in English, (3) full text available, (4) from 1992 to 2022. Then, due to the many different applications of the SAM methodology, there was a second set of excluded records based on applications not in line with our research topic.

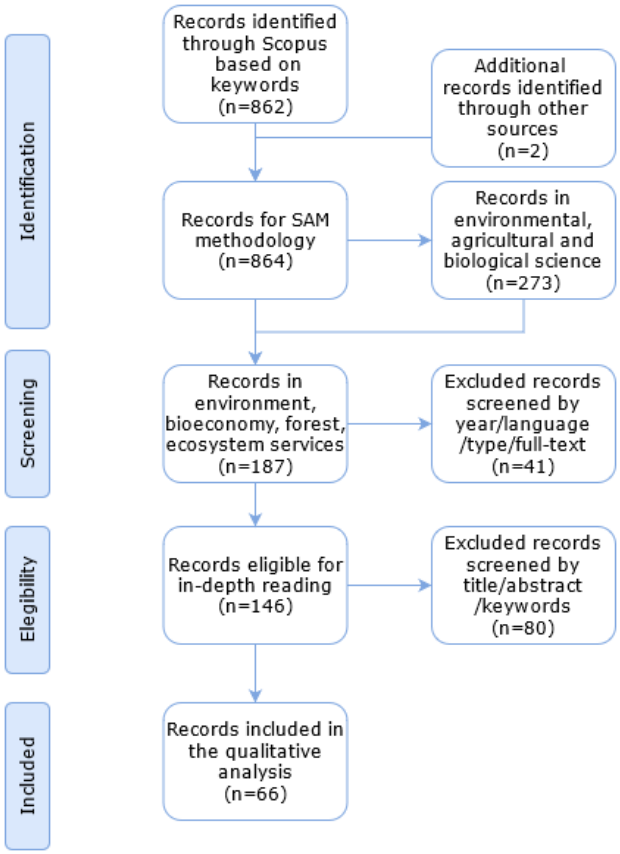

Figure 2. Flowchart showing the steps of the literature review. Source: adapted from Liberati et al. [31].

3. Results

3.1. Descriptive Analysis

The initial number of records was 864. Regarding the temporal evolution of the studies, their number generally showed an increasing trend over time starting from the 1960s–1970s, with more than 50% of the studies published within the last 7 years. More in details, the maximum number of documents was published in 2017 (65) and 2021 (64), with an annual growth rate of 10% until 2021 (included). One reason could lie in data accessibility and availability, since the SAM requires a substantial amount of data; in addition, technology development has sped up data processing and the calibration of the matrix.

Similarly, the number of studies on bioeconomy, environment, forest, or ecosystem services has recently increased, as shown in Figure 3. The concepts of 'bioeconomy' and 'ecosystem services' are relatively new, so studies using the SAM on these topics started from the 2000s, while studies with a focus on the environment came earlier.

Analyzing the documents by subject area, we can notice how the major fields were economics, econometrics, and finance (437 documents—29.7%), followed by social science (327 documents—22.2%), environmental studies (215 documents—14.6%), and agricultural and biological science (86 documents—5.8%). Taking into consideration the most 20 relevant sources (based on the number of publications), more than a half (11) of the studies somewhat belonged to the field of environmental studies, and 3 of them appeared to be among those with the highest h-index (e.g., Ecological Economics, Environmental and Resource Economics, Journal of Cleaner Production).

Narrowing the field to bioeconomy, environment, forest, and ecosystem services, Table 1 shows a descriptive analysis of the results. Regarding the geographical distribution of case studies, only 21% of the total records applied this methodology to countries belonging to the European Union. In particular, Spain was the most studied country (22 records), followed by the European Union (8 records, both for the EU as an aggregate and for each

of its 28 Member States), while the remaining countries showed a frequency of 2 records or less.

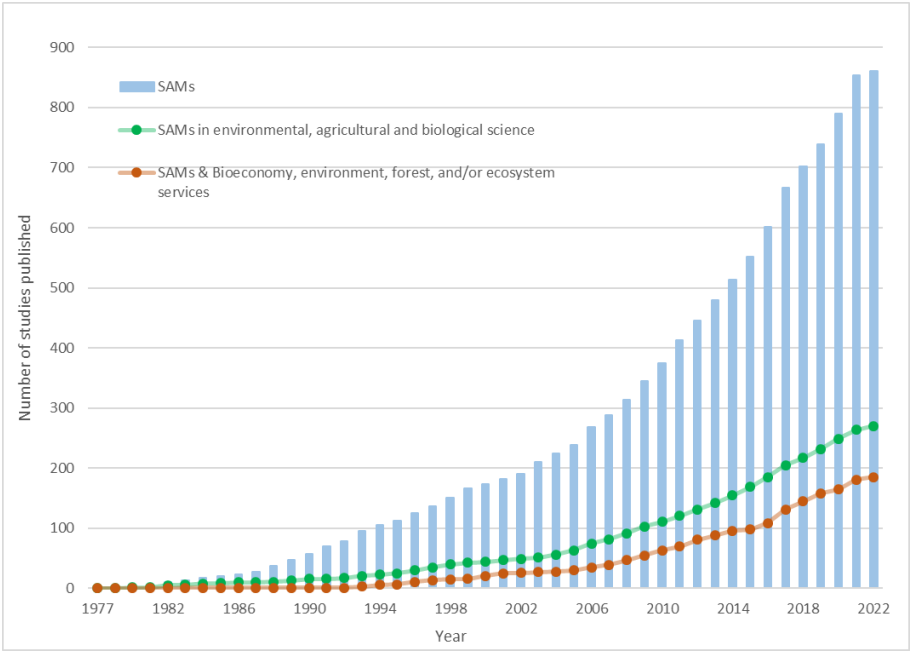

Figure 3. Cumulated number of publications on SAMs and subfields. Source: authors' own elaboration.

Table 1. Summary of the results of the studies related to bioeconomy, environment, forest, and ecosystem services (N = 146). Source: own elaboration, based on Scopus, last update: 6 February 2022.

Criteria	Category	Results (N)
Publication year	Before 2003	24
	2003–2012	38
	2013–2022	84
Number of studies per different quartile	1st quartile	51
	2nd quartile	49
	3rd quartile	22
	4th quartile	17
	Not listed	7
Country	EU	35
	Non-EU	109
	Global	2
Level of analysis	National	85
	Regional	45
	Local	16
Focus/categories of the main indicators studied	Economy	38
	Environment	33
	Households	26
	GHG emissions	20
	Energy sector	11
	Economic Growth	11
	Employment	11
	Water	7
	Value added	7

Moreover, the flexibility in SAMs geographical structure was also confirmed by the descriptive analysis. The SAM methodology was applied at the national level in most

studies. However, this approach was implemented at a regional or even local level in quite many cases.

Finally, we wanted to explore which aspects of the socioeconomic system were analyzed. Due to its accounting accuracy, comprehensiveness in recording data, and flexibility, the SAM method (fixed-price linear models) has been used widely in the last three decades to evaluate (among others) the link between economy and environment in general; the impact on households (including income, consumption decisions, living costs and wellbeing); GHG emissions (the majority of studies focused specifically on CO_2 emissions); the energy sector (including biofuels, energy prices, and use); economic growth; employment; water (including water quality, water pollution, and water resources); value added.

3.2. In-Depth Reading

After screening for title, keywords, and abstract, 66 records were considered for in-depth reading. In this section, we present those dealing with the more specific topics of bioeconomy, ecosystem and ecosystem services, and forestry sector.

A first group of studies worth mentioning focused on the European bioeconomy, based on the work of Müller et al. [33] who constructed a series of AgroSAMs for each of the EU Member State with detailed accounts for 30 agricultural activities and 11 food activities, benchmarked to the year 2000. These AgroSAMs were then updated to the year 2007 by Philippidis et al. [34] who also generated EU regional clusters with comparable agricultural sector structures. Continuing this research line, a new set of SAMs specifically designed for the study of bioeconomy and natural resources, referred to as the BioSAMs [35], further extended the accounts of the bio-based industry to include new sources of biomass and contemporary applications of biomass in the liquid fuel, energy, and chemical sectors [36,37]. The resulting BioSAMs, recently updated to the year 2015 [38], were utilized to calculate output and employment multipliers [39] as well as both backward-linkage (BL) and forward-linkage (FL) multipliers [40].

These studies have all contributed to break down the EU bio-based sector, beyond the limited details of bioeconomy available from existing national accounts data [34]. Despite their substantial contributions, the authors of these studies agreed on the lack of data being one of the main constrains to the use of a comprehensive SAM for evaluating the activities of a bioeconomy. More precisely, bioeconomic activities are usually defined in the context of the standard national accounts as large sectoral aggregates (i.e., agriculture, food processing, forestry, fisheries, wood, and pulp) or even in their parent sectors (e.g., chemical industries, clothing, energy) [39] which include both bio-based and non-bio-based activities.

We found few studies using SAMs to analyze the forest sector. These studies presented a limited level of details on the forest sector, splitting it into forestry, wood sector (including lumber and wood products, paper, and allied products), and wood furniture [41,42]. The effects have been studied, among others, on enlarged economic impacts of changes both in the forest industry and in other sectors of the economy [43], distributional consequences for households [41,44,45], output, value added, and employment by forestry export value chains [46,47], as well as carbon tax and subsidies on the forest sector [48]. Going more into detail, interesting results concern the impact of productive linkages that the forest sector may have on other sectors of the economy. Indeed, especially in developing countries, the forest sector represents a key sector of the economy, meaning that it has the capacity to lever up other sectors of the economy through its backward or forward linkages. For example, according to Gallardo and Mardones [18], the forest sector in Chile is a key sector and one with the greatest backward linkages. This means that the outputs from the forest sector are highly utilized by other sectors. This is confirmed by another study in Indonesia founding the forest sector to be the only one resulting in a higher multiplier effect on another sector, in this case the manufacturing sector, rather than on its own sector [43]. Again, a recent study analyzing the forest sector of 58 countries, confirms how the contribution of the forest sector to national economy goes beyond the sector itself and extends to many other

sectors of the economy through indirect and induced effects [17], contributing to sustainable development, especially in rural areas, regardless of the development stage and region.

However, one must keep in mind that this big share of the economy is often paid for with a high rate of deforestation. Indeed, one limitation of studies analyzing the forest sector through SAMs is that they take into account market benefits and costs and not the non-market benefits and costs associated with environmental improvements or degradation linked to the state of forest resources [43]. In the same way, the cultural services coming from forest ecosystems have not been yet analyzed with the SAM methodology. Nonetheless, it is worth mentioning the study by Campoy-Muñoz et al. [49], who assessed the economic impact of a cultural heritage site on the economy of the city of Cordoba. The authors performed the analysis via linear models based on regionalized SAMs to determine the heritage site's contribution to the host economy in terms of production and employment. In the same way, it could be possible to assess the cultural services coming from forest ecosystems (as well as other type of ecosystems), especially the recreational ones.

Moving to SAM and ecosystem services, few studies considered the value that ESs bring into the economy, using SAMs to trace the flow of services across the supply chains. Those studies focused mainly on provisioning services, providing a view of the links between the biophysical environment and the economic activities. For example, Arto et al. [50] developed a dynamic Computable General Equilibrium (CGE) model to capture the impacts of climatic changes (e.g., reduction in crop productivity) on some critical variables affecting specific economic processes. Another service under study is water provision. For example, Zhou et al. [51] constructed a water resource embedded SAM to analyze the relationship between water resource utilization and socio-economic development; multiplier analysis was then applied to explore the economic structure, feedback mechanisms, and water flows among different sectors.

Finally, we found one study focusing on NWFPs. Specifically, Campoy-Muñoz et al. [52] estimated the economic impacts of small-scale pine nut cooperatives in Southern Spain. Authors employed a SAM linear model and primary data to show the positive contribution to province's production, GDP, and employment levels.

4. Discussion

Based on the descriptive analysis and in-depth reading, we can outline some considerations. The chronological survey of publications, together with the geographical distribution of case studies, showed that the SAM approach has been widely used across the globe and that is has gained attention due to its capability to explain the relationship between the environment and human wellbeing. Moreover, the descriptive analysis of indicators showed the versatility of this methodology. Indeed, it can be applied to estimate the impact of exogenous shocks (e.g., effect of policies or climate change) on a wide range of socioeconomic characteristics.

The literature showed a visible growing trend linking economic accounts with environmental accounts. Several studies demonstrated how standard SAM can be extended to include the environmental dimension and how this effectively works. By using this methodology, is it possible to analyze a specific forest ES and its role within the socioeconomic system. As highlighted in the study by Mainar-Causapé et al. [37], there is a need to fill gaps in the BioSAMs regarding, in particular, a comprehensive representation of the forest sector, as well as additional transactions accounts to capture non-market ESs within the SAM structure. In this perspective, the incorporation of both social and market components of NWFPs into the forest sector represents a novelty addressing both aspects.

Notwithstanding, the SAM methodology has its drawbacks. First, it does not allow substitution between factors of production; second, factor demands do not depend on relative changes in factor prices; third, the model assumes that the supply of factor inputs is unlimited in the economy [41]; finally, the SAM methodology provides only a snapshot of a certain economy during a specific period of time (usually one year), meaning that it could not represent adequately periods of disruption of the economy, such as the one we are

experiencing now because of COVID-19. For example, during 2020 the transportation and storage sector shrank, while at the same time the information and communication sector grew. Even though it is possible to perform a sensitivity analysis of the matrix and make a hypothesis on how this will impact an entire economy, it is not possible to use previous data to balance the matrix without weakening of the information.

5. Conclusions

Forests can contribute to the European bioeconomy in many ways other than wood-related products. They supply key ESs such as cultural services (recreation, tourism, and health); regulating services (water, soil, air quality, and noise reduction); provisioning services (clean drinking water, non-wood forest products like mushrooms and berries). The knowledge of ES values and ES impacts on the economy must improve to support better economic and policy decision making [6,53]. In fact, despite a rapid improvement over the last decades, data on the supply of several ecosystem services and their value are still scarce [1]. Moreover, in order to estimate how economic activities depend on forest ecosystems and to estimate the contribution of forest ESs to the gross domestic product (GDP), one must look beyond the direct contribution to the forest sector, trying to estimate the economic impact on other sectors and the indirect and induced effects on the economy. In a natural resource-based bioeconomy, there is a need to understand more thoroughly the full spectrum of available resources, define opportunities and niches of those resources, explain rights of use as well as trade-offs and synergies between forests and other types of land use [7]. In this study, we proposed a new theoretical framework that links ES supply to the whole economy and society. Based on a literature review, we showed that the SAM methodology is suitable to investigate the value that NWFPs brings to the bioeconomy in both their private and social components. Extending the SAM framework would represent a novelty in the field of forest ES. It will allow estimating the contribution of market and non-market forest ecosystem services to the economy and the society. We found that the literature on SAMs has developed at a rapid pace over the last decades worldwide. SAMs are gaining attention because of their capacity to explain the relationship between the economy, the environment, and human wellbeing, as well as the increased availability of accounting data. The studies applying the SAM approach to the forest sector were able to quantify the value that the forest sector brings into the economy through its direct, indirect, and induced effects. Nevertheless, the non-market ecosystem services have not been represented so far. The structure of a SAM being flexible, we proposed an extension to account for forest ESs other than wood (EcosySAM), making it possible to estimate the total economic value that forests bring into the socioeconomic system in terms of value added, employment, and other socioeconomic indicators. The calibration of EcosySAMs will provide estimates of the link between the ES flows and the economy and can become a tool to support IPBES reporting.

The main limitation of this study is that it considered only one possible approach. There might be alternative approaches to the SAM methodology for estimating the value forest ESs bring into the economy. Moreover, a literature analysis is not sufficient to prove the goodness of the methodology. There is a need for a case study to demonstrate its practicability.

Providing information on the relation between forest ecosystem services and the economy will support policy-makers in their decisions to invest and act to maintain ecosystem services. For this reason, we expect a development of research on EcosySAMs in connection with the ecosystem valuation literature. Non-Wood Forest Products can be taken as a pilot to calculate Social Accounting Matrices extended to forest ecosystem services, including both a market and a social component.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/f13030362/s1, Table S1: list of records included in the literature review.

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