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Forestry Bioeconomy Contribution on Socioeconomic Development: Evidence from Greece

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Abstract: Forests are of utmost importance for sustainability because of their ongoing contributions to biodiversity protection, fertility management in agricultural areas, and the well-being of people. However, few studies have focused on the extent to which the bioeconomy of forests impacts a country's social and economic development. This study aimed to examine the bioeconomy contribution of forestry to social and economic development using Greece as a case study. Data was collected from 312 professionals in the forestry and finance sectors of Greece using a survey questionnaire. Forests are associated with direct and indirect contributions that impact human livelihood and contribute toward a country's economic development. However, the role of forestry in development is affected by policy-related and human-made challenges. The difficulties are primarily caused by shifts in how economic activity is distributed from the agricultural to the industrial to the service sectors, different government policies intended to increase forest cover, and in other instances, as a result of the role of global capital and trade. The forestry contributions to global commerce, national economies, employment, and family incomes remain consistent throughout all these patterns of loss, stabilization, and recovery. It was established that the bioeconomy can increase the benefits of forests by further exploiting forest wealth (biomass, resins) with the direct and indirect benefits for forest-related societies and local economies. In addition, the management and exploitation of forests by adopting bioeconomy practices, allows the attainment of important skills, knowledge, and new fields of entrepreneurship.

Keywords: forestry; bioeconomy; direct and indirect incomes from forests; social and economic development

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1. Introduction

1.1. The Forestry Contribution and Value

Forests and multiple-use forest management are often essential to regional development [1]. In addition to producing wood, forests are valuable natural resources that also provide a variety of non-wood items, such as medicinal and aromatic plants, fruits, edible leaves, and game animals, that help boost people's incomes [2]. Forests offer different services relating to recreation, protection against soil erosion, biodiversity protection, preservation of water resources, and protection against climate change through carbon sequestration and the reduction of global warming [3]. The importance of forests in the modern era, especially their influence on climate change, has continued to attract significant attention. The economics of the forest industry is significantly impacted by climate change; hence, it is crucial to adjust forestry methods to combat it [4].

According to Fantechi and Fratesi (2022), forests help to provide job opportunities, add value to the GDP, and raise living standards; forests are essential drivers of regional

development [5]. Additionally, the socioeconomic process of community development based on the forest sector has several facets. Reforestation and newly wooded regions are contributing to a larger regional development initiative, raising the value of forests to local economies [6]. Because the local populations choose to remain in the place and take advantage of the new jobs generated by forestry activities, forest products and services significantly impact less-favored areas [7]. Furthermore, the income from the forest's natural resources is crucial to the poor. Reduced income disparities and the potential to lessen socioeconomic disparities among households dependent on forests but with varying economic status are two of the most crucial functions of forests in regional development [3]. Recently, Cheng et al. (2019) created a systematic map protocol for forests' role in reducing poverty [2]. Afforestation programs are also used to enhance forest acreage, which helps to reduce inequality and spur economic development in rural regions [8].

Ballas et al. (2017) claimed the global forest sector is in a phase of creative destruction, which can be attributed to the decline in the protection and proper management of traditional forest products and the emergence of new production opportunities, such as wood products, thus impacting the economy [9]. Resources from the national forests are regarded as a source of commodities and services. One of the primary goals of national forest policy across the globe has always been the sustainable utilization of these resources. The forest industry also can boost national economies. Harvested wood products from forests and other forested areas are a significant part of the productive function. The amount of wood taken shows how valuable forest resources are to local economies and societies [10].

Eurostat (2020) indicates that although forests are a valuable natural resource, the European Union's forestry sector lacks a Common Policy [10]. To offer a compelling framework for the national forest policies of the member states, the European Union Commission produced the EU Forest Strategy in 2013. Kupec et al. (2022) indicated that some of the barriers to implementing a standard EU-based forest policy is that it is cross-sectorial and consequently interferes with other policies at the European level, including those related to agriculture, rural development, the environment, energy, and the climate change, among others, and lacks efficient coordination mechanisms [11]. In addition, establishing a comprehensive framework for the EU's forest policy must consider the forest value chain's extensive coverage of intersecting sectoral interests and policy tools [12].

As a Mediterranean country, Greece has favorable agro-climatic conditions for producing and collecting medicinal and aromatic plants. The growing demand for these raw materials, which traditional recipes can explain and the shift observed towards a healthy diet, increased the cultivation of these plants, which was non-existent and the needs were covered by over-exploitation and the irreversible damage to wild populations within forests [13,14]. Furthermore, Greece has a large number of plants (>7000) with 22% of them being endemic and contributing to forest biodiversity [15–17].

Forests help in sustainability because of their influence on biodiversity, agricultural areas, and the standards of living of people who rely on them. However, very few studies have examined how much the forestry development based on a bioeconomy affects a country's social and economic growth. It is therefore important to investigate this contribution of forestry to social and economic development.

1.2. Purpose of the Study

The study's main purpose was to investigate the bioeconomy contribution of forests' social and economic development, using evidence from Greece. This objective was analyzed based on two specific objectives:

1. To establish the relationship between dimensions of forest bioeconomy and economic benefits for forest-related societies and local economies.
2. To investigate the relationship between management and exploitation of forests and to explore the development of new skills, knowledge, and new fields of entrepreneurship by the local population related to forestry exploitation.

1.3. Research Questions

- What is the relationship between dimensions of forest bioeconomy and economic benefits for forest-related societies and local economies?
- What is the relationship between management and exploitation of forests and developing new skills, knowledge, and new fields of entrepreneurship?

1.4. Research Hypotheses

Hypothesis 1 (H1.) *The bioeconomy could increase the benefits provided by forests as it could further exploit forest wealth (biomass, resins) with economic benefits for forest-related societies and local economies.*

Hypothesis 2 (H2.) *Those involved in the management and exploitation of forests, by adopting bioeconomy practices, will develop new skills, knowledge, and new fields of entrepreneurship.*

1.5. Significance of the Study

The study findings will provide key insights into the contribution of forest bioeconomy towards social and economic development. In this case, new knowledge will be generated about the relationship between dimensions of forest bioeconomy and economic benefits for forest-related societies and local economies and the effect of management and exploitation of forests using bioeconomy practices on the development of new skills, knowledge, and new fields of entrepreneurship. The study has a significant academic contribution as future researchers can utilize this study to make more informed conclusions in the same or related area of study.

2. Literature Review

2.1. Economic Contribution of Forestry

The forestry sector employs a significant portion of the world's population and provides a primary, secondary, or alternative source of income [18], especially the SMEs dealing in forest products contribute significantly to the economy in terms of employment and income [4]. According to Masiero et al. (2016), the forestry sector creates employment opportunities for many people, and the production and trading of wood fuel employ tens of thousands of workers, many of whom work informally [7,19].

SMEs' contribution to employment is stable or expanding, notably in the US domestic wood furniture sub-sector, in contrast to worldwide declining employment in wood processing. In the US, SMEs dealing in forest products account for 37.4% of all solid wood products processing industry employment [4].

Li et al. (2019) state that in 2011, the global forestry sector directly employed more than 18.21 million people and created more than 45.15 million jobs through direct, indirect and induced effects. The direct contribution of the global forestry sector amounted to more than USD 539 billion, and the total contribution of more than USD 1298 billion to the global GDP, always through direct, indirect and induced effects [20].

In Table 1, the forestry sector output was higher in Sweden, Germany, and France, three European economies that have historically relied on the forestry industry. On the other hand, Greece comes almost last (excluding Cyprus, Luxembourg, and Malta). Greece is one of the European nations with the lowest productivity in primary round wood production [10,21].

Greece, together with the Netherlands, is ranked 25th among the 29 countries of the European Continent that provide sufficient data on the contribution of the forestry sector to their Gross Domestic Product (0.04%) (Table 1) with data for the year 2019. Two Baltic countries, Latvia and Estonia, have the largest contribution of the forestry sector to their Gross Domestic Product (4.56% and 3.85%, respectively). In total, eleven (11) countries have more than 1% contribution of forests to GDP [21]. The research of Tsiaras et al. (2021) reaches similar conclusions with data for the year 2016 [22].

Table 1. Output of forestry and GDP in the year 2019 for selected European countries.

Country	Forestry Output 2019 (Million €)	GDP-Based Market Prices (Million €)	%
Belgium	407.1	478,645.0	0.09
Bulgaria	697.51	61,558.5	1.13
Czechia	2720.8	225,613.5	1.21
Denmark	562.27	309,526.4	0.18
Germany (until 1990, former territory of the FRG)	6947.38	3,473,260.0	0.20
Estonia	1069.1	27,764.7	3.85
Ireland	173.9	356,704.6	0.05
Greece	76.7	183,351.2	0.04
Spain	1941.05	1,245,513.0	0.16
France	6485.81	2,437,635.0	0.27
Croatia	328.31	55,644.4	0.59
Italy	2457.1	1,796,648.5	0.14
Cyprus	4.46	23,176.2	0.02
Latvia	1398.6	30,678.6	4.56
Lithuania	561.8	48,908.2	1.15
Luxembourg	19.99	62,373.6	0.03
Hungary	584.6	146,526.1	0.40
Malta	0	14,047.9	0.00
Netherlands	350	813,055.0	0.04
Austria	1966.91	397,169.5	0.50
Poland	5332.44	532,504.7	1.00
Portugal	1306.31	214,374.6	0.61
Romania	2507.91	224,178.6	1.12
Slovenia	547.63	48,533.1	1.13
Slovakia	1127.4	94,437.5	1.19
Finland	5,745	239,858.0	2.40
Sweden	9571.73	476,869.5	2.01
Norway	1405.77	361,734.6	0.39
Switzerland	864.17	644,443.2	0.13

Source: Authors' own work, based on Eurostat [(https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Forests,_forestry_and_logging#Forests_in_the_EU (accessed on 10 November 2022))].

In Greece, forest production is concentrated in the Regional Unit of Drama located in the northeast of the country and in the Region of Eastern Macedonia and Thrace, where we find the large forest and transitional forest areas, as well as pastures. The second-most valuable regions of Greece in terms of forest production are the Regional Units of Grevena and Florina in the northwest of the country, in the Region of Western Macedonia in Northern Greece. Furthermore, the geomorphological relief and the weather conditions favor the production of energy from the exploitation of wind and solar radiation, with wind generation mainly located above the upper forest line [23–25].

The global economic crisis significantly impacted the forestry sector in Greece, whereby forest consumption levels per person were greatly reduced, and employment and the total output of the forestry sector were drastically reduced between 2008 and 2017 [26]. Greece's

predominant trait is that most of its forestland is found in regions with steep mountains and slopes, which usually makes harvesting very difficult. For various management and ecological reasons, wood production and quality are often constrained. Karametou and Apostolopoulos (2010) also listed Greece as one of the EU countries with the lowest productivity [27]. The economic growth of rural regions and the well-being of the Mediterranean region's urban inhabitants depends on the forest ecosystems' variety of forest products and services [19].

FAOSTAT (2022) indicates that several factors, such as organizational problems, limited funding for forest management, issues with following forest law, and ambiguous ownership of forest land, as well as governance and bureaucracy issues, all affect the removal of wood. Consequently, Greece's national forest industry has had a trade imbalance in forest products. To meet local demand, Greece imports more forest products than it exports [28]. Figure 1 depicts the trade balance for forest products in Greece over the last 18 years and shows that the imbalance is still one of the industry's most pressing problems.

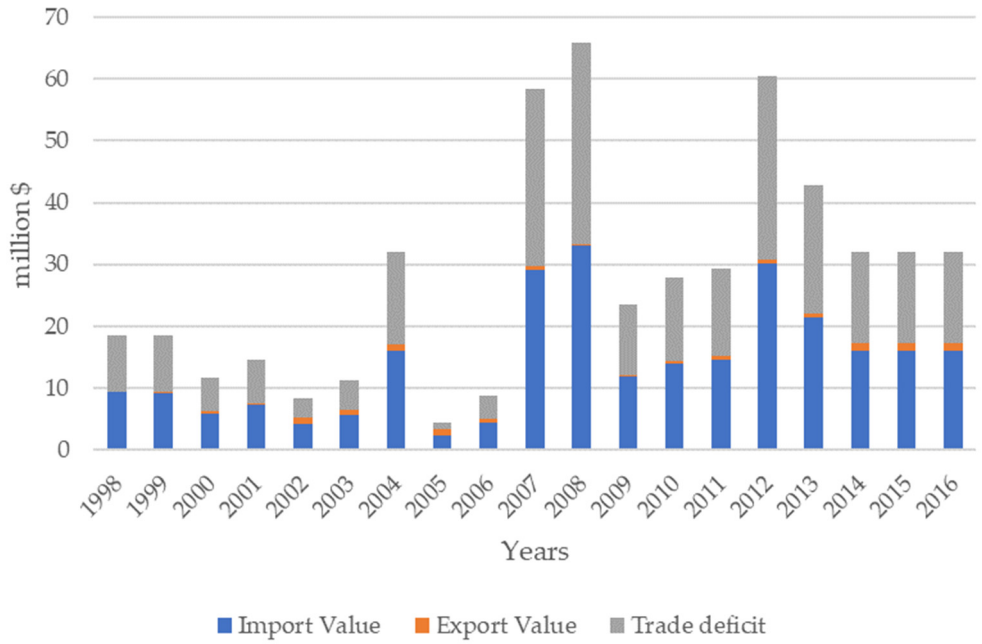

Figure 1. The trade balance and deficit for the Greek forest sector. Source: Authors' own work, based on FAO data [https://www.fao.org/faostat/en/#home (accessed on 24 September 2022)].

According to FAOSTAT (2022) data, Figure 2 was created to demonstrate the employment in forestry and logging between 1992 to 2020 in Greece. The course of the employment curve in these two decades seems to have reduced significantly in the Greek forestry and logging sector, and the whole activity as a result of the employee reduction [28].

Greece's National Forest Strategy made an effort to incorporate the forestry strategy of the EU and its key priorities while taking into account the various qualities of Greek forests, such as their protective role, multiple functions, significant contribution to the ecosystem, and efforts to produce innovative forestry and products with added value. Additionally, the National Forest Strategy of Greece seeks to address two significant environmental problems in Greece: the restoration of forest ecosystems and the absence of effective forest management, which are two of the biggest inefficiencies for Greek forests [26,29].

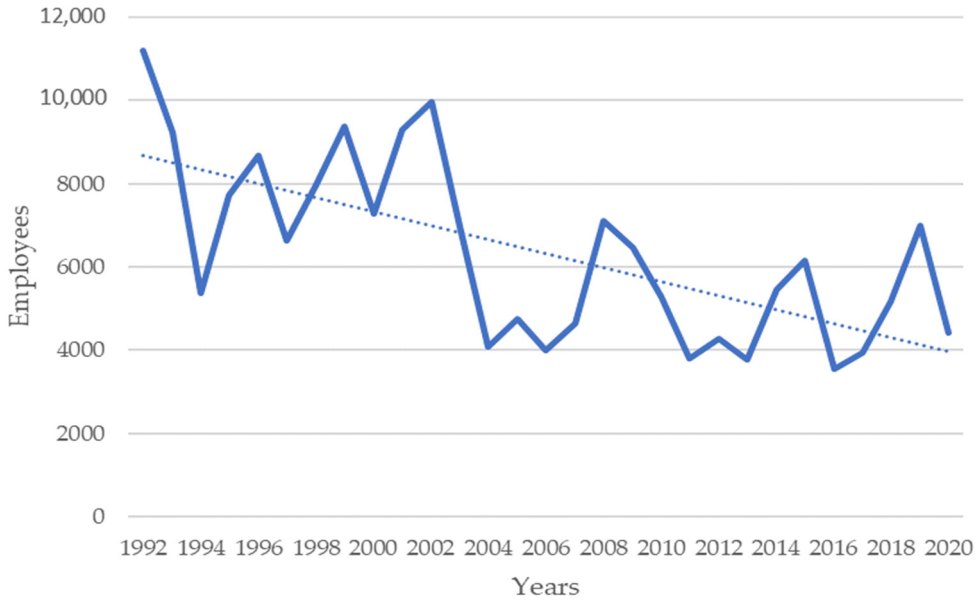

Figure 2. Employment in forestry and logging for Greece. Source: Authors' own work, based on FAO data [https://www.fao.org/faostat/en/#home (accessed on 24 September 2022)].

2.2. Forestry's Direct and Indirect Income Contribution

The high levels of economic advantages that forests continue to provide to individuals, businesses, and governments served as the first motivation for protective laws and regulations. According to Masiero et al. (2016), the forest sector contributed more than USD 450 billion to national earnings in 2008, accounting for close to 1% of the global GDP and formal employment 0.4% of the total working force worldwide [7]. Additionally, forests provide chances for informal jobs, alternative sources of income, and economic value reservoirs that lessen family income shocks, especially in rural regions of developing nations. However, there are no valid statistical data on a global or national scale to allow for aggregate estimations of the non-industrial economic benefits of forests [9]. Globally and locally, the forest sector has contributed significantly to formal direct employment and continues to do so. In addition, since 1990, economic diversification and liberalization of the economy have increased, proving positive for the trade of forest products but sometimes negative for long-term employment. How the forest sector influences economic development, as well as the changing ways in which it continues to impact global political, economic, and social development, are all highlighted by these changing dynamics [30].

Aggestam and Pülzl (2018) indicate that even when there is an absence of sales income of any forest products, different indirect economic benefits can be enjoyed from forests by stakeholders. Second, indirect economic benefits nearly always contribute more to total family income than direct [12]. The connection between forests' direct and indirect income contributions to the total family income varies. The most significant direct and indirect income sources were firewood, construction supplies, and forest foods. However, other commodities like fiber and herbal remedies also rank highly in terms of relative value to the family [1]. Spanos et al. (2021) revealed that firewood accounts for over 36% of the direct income category's forest revenue, housebuilding materials account for about 36%, and forest foods and herbal remedies account for 25%. The significance of timber is insignificant. Even when the revenue proportions differ somewhat, the indirect income category's order of importance remains the same [26].

2.3. Role of Forests in Eradication of Poverty and Social Contribution

Forests have a far more nuanced function in lowering long-term poverty and assisting people in escaping it than was once believed. Initially, it was thought that poverty would be decreased by identifying forest goods and increasing their production. However, only

selling wood would do that, and even if governments were willing to let the world's poorest people become loggers, timber production requires too much cash [2].

In many circumstances, trees are valued for their welfare benefits rather than for the income they may provide. Studies demonstrate how much woods support local lives. They are good days for both men and women, for wealthy and poorer people, and not simply under challenging times. The livelihood benefits associated with forests are very important in uplifting the household incomes of different people, which further helps to boost the national GDP [1].

Aggestam and Pülzl (2018) showed how rare it is for people living in remote locations to escape poverty quickly. Before poverty can be reduced, it is often necessary to alter the relationship between agriculture and reliance on the forest [31]. The forest also plays a part in helping some families get by during hard times at home as the primary breadwinners establish a foothold as labor migrants to cities for employment opportunities or to get more money to put into the farm [12]. Moreover, the authors revealed that community forestry organizations are still respected since they provide beneficial advantages [12]. Women and their female offspring increasingly manage the local forests and generate the local economy [1,26,32].

Cheng et al. (2019) revealed that people often discover that a dual strategy is the greatest approach to harnessing the synergy between agriculture and the forest. Investing in cattle and utilizing the forest as feed in tropical dry forests is often the simplest way to escape poverty [2]. Multistory forest gardens attest to the pattern that has prevailed across Southeast Asia, and this tactic is now being used in Papua. Some people are concerned by the changes in the tree species that make up forests, but forest function is preserved in each instance. In addition, chances for poverty reduction exist while maintaining or even improving the forest cover. In the case of post-conflict rebuilding, the forest has been able to temporarily pick up the slack while families return to their previous lifestyles and start to search for methods to save money for the future. In all these ways, woodlands assist locals in finding detours away from poverty. These ideas about "direct revenue from trees," prevalent ten to fifteen years ago, are pretty different [8,32].

The stabilization and control of soil erosion are significant benefits of forests. Studies have shown that forest growth stabilizes soils and prevents sedimentation and erosion. The estimated values for soil stabilization mainly account for the expenses of sedimentation. The prices vary from $1.94 per ton in Tennessee to $5.5 million yearly in Oregon's Willamette Valley. In Tucson, Arizona, 500,000 mesquite plants are anticipated to lessen runoff, which would otherwise need the $90,000 building of detention ponds. Forests also help to enhance air quality. Because trees capture airborne dust, the environment and people's health are improved. Only one study on the importance of trees' contributions to air quality is discussed in this essay. According to the findings of that research, Tucson, Arizona, plans to plant 500,000 mesquite trees, which, when fully grown, would remove 6500 tonnes of particulate matter yearly. An alternate dust management method in Tucson costs $1.5 million. Therefore, each tree is worth $4.16 in terms of air quality [33].

Forests are crucial for carbon sequestration and climate regulation. By retaining moisture and cooling the earth's surface, trees contribute to climate control. According to Fantechi and Fratesi (2022), benefits from climate control provided by U.S. woods amount to $18.5 billion annually [5]. According to studies conducted in metropolitan areas, 100,000 correctly positioned, mature trees in American cities might save $2 billion in heating and cooling expenses [7]. Additionally, trees absorb atmospheric carbon dioxide, which slows global warming. According to the U.S. Forest Service, these carbon sequestration services result in benefits of $65 per ton, or $3.4 billion per year, for all U.S. forests [19].

Pilli & Grassi (2021) indicate that forests are crucial in preserving biodiversity [34]. Numerous factors contribute to the importance of biological variety, including its capacity to produce valuable pharmaceuticals, its function as a genetic resource bank that can be used to selectively breed plants and animals, and its involvement in natural pest and disease management. Although there have been few studies on the worth of biological

variety in forest ecosystems, it is predicted that utilizing chemical pesticides to replace the natural pest control services provided by all-natural ecosystems would cost Greece's agriculture USD 54 billion yearly [7].

Tourism and recreation forests are well-liked sites for outdoor leisure because of their scenic beauty and recreational features. According to Krieger (2001), recreational activities in national forests alone boost our country's GDP by USD 110 billion annually. Regionally, the proximity of population centers and the distinctive qualities of a region's forest resources influence the economic impact of forest-based recreation. The estimated yearly economic effect of entertainment impacted by forests ranges from USD 6 billion in the Southern Appalachians to USD 736 million in Montana [35]. Numerous studies have calculated the benefit of outdoor recreation using wilderness-related areas that are untamed and unloaded.

In addition, trees have a significant impact on regional microclimates and perhaps worldwide climate. The environment around trees is impacted by temperature, humidity, moisture availability, and lighting changes. The ability of the trees to raise relative humidity and regulate soil and air temperatures, two variables crucial for better crop development, plays a role in the success of many agroforestry systems [19].

Recent studies also imply that trees may affect rainfall patterns, surface reflectance, and other meteorological factors, which may impact climate [9,11,36]. One aspect is how clearing trees alters how sunlight is reflected from the earth's surface. The leaves, branches, and tree trunks in a living forest absorb sunlight. When a forest is cleared, reflectivity rises, and heat absorption decreases on the land. Additionally, less solar energy is utilized in deforested regions to evaporate moisture from plant and tree leaves. This causes more climatic variations, raising daytime temperatures and reducing nighttime ones. Furthermore, forests play a significant role in the carbon cycle [26,37]. When forests are cleared and burnt, their carbon is released into the atmosphere, increasing the level of atmospheric carbon dioxide, one of the leading causes of the greenhouse effect-induced global warming [33]. Living trees provide the opposite function by absorbing carbon dioxide from the atmosphere. Reforestation on a large scale has been advocated as a critical strategy for reducing anticipated global warming. However, if afforestation were to reduce the levels of carbon dioxide in the atmosphere significantly, it would need to be done on a continental scale [12].

2.4. The Role of Ecosystems Services and the Landsenses Ecology

If sustainable land management is sought over time, regional policy must include economic and environmental aspects, which reflect the conditions prevailing in the specific geographical area [38–41]. The study of ecosystem services over the last two to three decades has changed how the concept of nature conservation is generally viewed, changed the rationale for ecosystem management and the wider policy for natural ecosystems (e.g., forests, lakes, etc.). A few years ago, protecting the environment was the priority of governance at all levels (regional, national, European and global), but today the preservation of natural ecosystems and the restoration of disturbed ones are at the tip of the spear [38,42–45].

The ecosystem services of natural forests, without excluding urban and peri-urban forests, play an essential role in adjacent populations' economic and social cohesion [46,47]. The assessment of ecosystem services, introduced more recently, is constantly developing since many ecosystem services (e.g., protection from landslides, floods, strong winds, etc.) cannot be easily measured [48–51]. Therefore, assessing ecosystem services requires the contribution of many scientific disciplines (economics, ecology, statistics, geography, mathematics, computers, etc.) [52–55].

For the quantification of ecosystem services, international standards have been created that de facto use geometric methods and Geographic Information Systems (GIS) [56–58]. The quantification results are considered in decisions related to spatial planning on land and sea [59,60], but also with land use in agriculture and forestry [61–64].

Scientists who deal with ecosystem services study existing management practices, but also synergies that develop between man and nature and to evaluate the policies applied at all levels, having sustainability as the background of the study [65–67].

A relatively more recent approach is "Landsenses ecology" and "Landsenseology", which is defined as the scientific discipline that investigates the planning, construction, and management of land use for sustainable development [68–72]. "Landenses" is based on ecological principles but also the analysis of physical factors, senses, perceptions, and socio-economic conditions [68,69,73]. A new approach could not lack technology, the Internet of Things (IoT), GIS, intelligent systems, and artificial intelligence as part of earth sensing [69,70,72,74,75].

2.5. Bioeconomy in Europe

The EU Bioeconomy Strategy encouraged many member states to adopt such projects [76]. Bioeconomy focuses on producing renewable biological resources and converting these resources and their waste into value-added products such as food, feed, bio-based products, or bio-energy [77,78]. The circular economy, which appeared in the European Union's revised bioeconomy strategy, is a model of production and consumption that focuses on preserving the value of products, materials and resources for as long as possible, minimizing waste production [79]. Therefore, the integration of both, i.e., the circular bioeconomy, is intended to represent a sustainable economic and social model [80,81], bringing together many existing economic sectors, including the primary sector (agriculture, forestry, fisheries and aquaculture), the bio-based industrial sector (food, textiles, textiles, paper, chemicals, pharmaceuticals) and the service sector (consulting, logistics, trade, transport) [79]. As the core concepts of the bioeconomy and circular economy overlap in their attempt to reconcile economic, environmental, and social goals through the development of a sustainable economy, this search included documents published after 2018, as well as green economy and green growth strategies [82,83].

Further objectives of the bioeconomy strategies are to promote energy security, to green the energy industry, and to contribute to rural development. To strengthen the agricultural and forestry sectors, since they are the prominent bio-mass resources, through the development and application of biotechnology, biotechnology strategies aim to promote economic growth, healthcare, and environmental security [84,85]. They relate technology advancements to social progress while promoting socioeconomic well-being, the green economy or green growth plans and adopt a comprehensive approach to supporting low-carbon, resource-efficient, and resilient development approaches [86,87].

The Greece bioeconomy strategy focuses on technology and economics and places a lot less emphasis on the social aspects of a bioeconomy transition, placing a lot more emphasis on job development [88]. The fact that this approach primarily omits the utilization of forest resources and only sometimes discusses the significance of rural areas when highlighting employment creation in the biofuel and agricultural industries is of special relevance [82].

Hodge et al. (2017) revealed that the most comprehensive socioeconomic perspective is provided by green economy policies, which recognize the value of the forestry and agroforestry industries in achieving their objectives [89]. This is not surprising given that green economy strategies are more extensive than bioeconomy strategies and include a wider range of social and disciplinary viewpoints. It is interesting to note that different stakeholder categories were engaged in the strategies' design [90].

Recent initiatives, such as the European Green Deal [91], confirm the expected role of the circular bioeconomy in the European Union of the future and in each region. In particular, it can be seen how regions and Member States are starting to implement circular bioeconomy planning (strategies, action plans) to promote the development of this sector, largely as a result of the political impetus given at a higher level. Many corresponding policy documents address primarily the agricultural and forest sectors while highlighting the significance of research and innovation programs as the pillars of a knowledge-based transition towards a sustainable bioeconomy [92].

3. Methodology

3.1. Research Design, Study Area, Target Population and Data Collection

3.1.1. Research Design

The study utilized a quantitative research methodology based on the cross-sectional survey design. The cross-sectional research design depends on an in-depth investigation of a group or event to explore the causes of different underlying principles associated with the research problem or topic of study. The cross-sectional research design made it easy to focus on specific aspects of forestry in Greece, the dimensions of forest bioeconomy such as direct and indirect income contributions of forests, management and exploitation of forests and their effect on social and economic development.

3.1.2. Research Population and Sample Size

The research targeted professionals in the forestry and finance sector of Greece. The research population included workers in primary forest production (loggers, transporters, 4000 resin collectors, but also 4600 public employees in the country's public forestry service) [28,93]. In addition, workers in the private sector who related to forest production (e.g., sawmills and sale of firewood) as well as design-construction companies mainly in the tertiary sector, but also board members from forest management companies were included in the research population, which were estimated at 5200 employees. The total research population was estimated to comprise 13,800 employees and professionals related to direct and indirect forestry in Greece. From this research population, we estimated a total sample of 312 professionals. The purposive sampling technique helped in the selection of the survey sample.

3.1.3. Data Collection

A well-structured online questionnaire was used in the collection of data. Data were only collected after obtaining informed consent from the participants, conforming to their willingness to participate in the study. The data gathered helped establish relationships between this study's variables to answer the research questions. The questionnaire contained questions about forestry and social and economic results from the specific activity. A sample of 312 study participants, mainly from the forestry areas of Greece, was employed in the investigation. The study was carried out between 5–25 September 2022.

The sample size was determined after assessing survey reliability (P = 99.7%) and precision (km 26.76). S^2 = 16,254.46 and s = 127.53 were estimated for each respondent using a preliminary (or pilot) sample of 50 people. The value of z is determined by the desired degree of confidence (P). A value of z = 3 is often used when calculating the samples. This corresponds to a confidence interval of P = 99.7%. We use the values N = 13,800, s = 127.53, z = 3, and d = 24.00 (the desired precision d was chosen arbitrarily to represent half the confidence interval, giving the confidence interval 11.5% "air") [47,94–96]. Equation (1) calculates that the minimum sample size should be 311.86 or 312 people.

$$n = \frac{N(zs)^2}{Nd^2 + (zs)^2} \quad (1)$$

Calculation of the minimum sample of respondents.

$$n = \frac{13,800\ (3 * 127.53)^2}{13,800 * 24.00^2 + (3 * 127.53)^2} \Leftrightarrow n = 311.86$$

The following are some of the important questions from the survey questionnaire. At the start, there were questions to identify the respondents' profiles, such as gender, degree of education, and time in the forestry sector.

This was followed by questions examining the impact of forest cash revenue on social and economic development. "Timber sales are a great source of income for many people in

the forestry sector; farm trees grown as cash crops can provide people with brushwood for both cooking and selling in the market; hunting and trading game are extremely profitable forest-based enterprises in forest-endowed countries; and forest products contribute greatly to the economic transformation of households," the questions stated. For the issue, the response scale was 4: SD—severely disagree, D—disagree, U—undecided, A—agree, and SA—strongly agree.

This was followed by questions designed to elicit information on the results of indirect revenue from forests. Forests provide soil nutrients and forage for crops and livestock, which greatly contributes to agriculture; People can earn a living through employment, processing, and trade of forest products and energy; Forests provide several opportunities for recreation and spiritual renewal in most communities; The majority of forest income is non-cash and includes food, fuel, fodder, and construction materials, as well as herbal medicine. The response scale for the question was 4: SD stands ofr for severely disagree, D for disagree, U for uncertain, A for agree, and SA for strongly agree.

This was followed by questions aimed to elicit locals' perspectives on critical aspects of forest bioeconomy:

- Income, both direct and indirect;
- Products derived from bioenergy;
- Goods for the consumer;
- Industrial goods.

This was followed by questions meant to elicit communities' perspectives on critical areas of forest management and exploitation:

- Preventing forest overexploitation;
- Chemical management in the forest;
- Forest zone management based on policy;
- Forest fire prevention and control;
- Correct timber harvesting;
- Reforestation of forest land.

This was followed by questions designed to elicit information on the effects of forests on social and economic development. Forests could regulate the climate through carbon storage, which contributes to a high quality of life; trees are typically produced as an insurance policy against bad times and as an investment for the future; trees may be cut down to provide cash for emergencies or to pay for equipment or real estate; many nations have historically benefited from increased food security because the money made from tree cultivation is used to purchase food; trees may be cut down to provide cash for emergencies or to pay for equipment or real estate; trees may be cut down to provide cash for emergencies. The response scale for the question was 4: SD is for severely disagree, D stands for disagree, U stands for uncertain, A stands for agree, and SA stands for strongly agree.

3.2. Data Analysis

The quantitative data was coded and then analyzed using the Statistical Package for Social Sciences (SPSS) software. Tables were utilized to display the study findings, and frequencies and percentages were relied on in interpreting the results. The total predictive power of the various independent factors on the study's dependent variable was determined using regression analysis. In this instance, calculating various predictive values requires the use of a multiple regression model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \ldots\ldots\ldots\ldots$$

where;

Y = Social and economic development;

β_0 = Constant (coefficient of intercept);

X_1 = Aspects of forestry bioeconomy;

X_2 = Management and exploitation of forests;
ε = Represents the error term in the multiple regression model.

The study's hypotheses are assessed based on the 5% (0.05) level of significance. Table 2 describes and measures variables and their a priori expectations.

Table 2. Description and measurement of variables and their a priori expectations.

Variable	Description	Measurement	A Priori Expectation
	Dependent variable		
Social and economic development	Economic benefits for forest-related societies and local economies New skills, knowledge, and new fields of entrepreneurship	1 = yes, 0 = otherwise	+/−
	Independent variables		
Dimensions of forest bioeconomy	Cash income from forests, non-cash income from forests	1 = yes, 0 = otherwise	+
Management and exploitation of forests	Bioeconomy practices of management	1 = yes, 0 = otherwise	+

Source: Authors' own work (2022).

3.3. Ethical Considerations

Informed consent was obtained to confirm the willingness of the sample to participate in the study. This was in addition to protecting the respondents' data with a high level of secrecy and privacy. Respondents were also allowed to interpret the various opinion questions to respond to inquiries. This made it easier to get general responses to certain inquiries.

4. Results

Results obtained after analysis using SPSS are presented in this section.

4.1. Univariate Analysis

This section focuses on the presentation and general interpretation of the results.

Most survey participants (59.9%) were male, and 40.1% were female. Most participants (42.3%) had a bachelor's degree, followed by 31.1% with postgraduate studies degrees. Most participants (49%) had spent over 10 years in forestry, and only 8.7% had spent below five years in this sector (Table 3).

Table 3. Demographic data of study participants.

Characteristics	Frequency	Percentage (%)
	Gender	
Male	186	59.6
Female	126	40.4
	Education level	
Diploma	62	19.9
Bachelor's	142	45.5
Master's	97	31.1
Ph.D.	11	3.5
	Duration in the forestry sector	
Below 5 years	27	8.7
5–10 years	132	42.3
Above 10 years	153	49.0
Total	312	100

Source: Authors' work (2022).

4.2. Descriptive Statistics

The study also sought to explore the effect of cash income from forests on social and economic development, and the findings are presented in Table 4.

Table 4. Results on direct income from forests.

	SD	D	U	A	SA
	%	%	%	%	%
Timber sales are a great source of income to many people in the forestry sector	7.6	11.3	2.6	53.7	25.4
Farm trees that are grown as cash crops can provide people with brushwood for both cooking and for selling in the market	3.0	2.7	5.8	62.8	25.6
Hunting and trading game are extremely lucrative forest-based enterprises in forest-endowed countries	11.8	20.2	4.4	50.9	4.6
Forestry products contribute greatly to the economic transformation of households	10.3	4.7	11.5	28.2	45.3

Key: SD—strongly disagree, D—disagree, U—undecided, A—agree, SA—strongly agree. Source: Primary Data (2022).

The results in Table 4 indicate that 53.1% of respondents agreed that Timber sales are a great source of income for people in the forestry sector. A percentage of 62.8% of respondents also agreed that Farm trees that are grown as direct income crops can provide indirectly through brushwood for both cooking and for selling in the market. A total of 50.9% agreed that Hunting and trading games are extremely lucrative forest-based enterprises in forest-endowed countries. In addition, 45.3% of the respondents strongly agreed that Forestry products contribute greatly to the economic transformation of households.

The study also sought to explore the effect of indirect income from forests on social and economic development; the findings are presented in Table 5.

Table 5. Results of indirect income from forests.

	SD	D	U	A	SA
	%	%	%	%	%
Forests provide soil nutrients and forage for crops and livestock, which contributes greatly to agriculture	4.6	18.4	3.7	49.2	24.1
People are able to earn a living through employment, processing, and trade of forest products and energy	8.6	12.6	9.4	11.9	57.5
Forests provide several opportunities for recreation and spiritual renewal in most communities	5.9	7.7	10.2	43.2	33.1
Most of the income from forests is non-cash and cuts across food, fuel, fodder, and construction materials, as well as herbal medicine	3.8	4.3	20.2	47.9	23.9
Forests are a great source of shelter, livelihoods, water, food, and fuel security for both humans and animals	5.7	8.9	13.2	60.2	12.1

Key: SD—strongly disagree, D—disagree, U—undecided, A—agree, SA—strongly agree. Source: Primary Data (2022).

The results in Table 5 show that 49.2% of participants agreed that forests provide soil nutrients and forage for crops and livestock, significantly contributing to agriculture. A percentage of 57.5% of respondents strongly agreed that people can earn a living through employment, processing, and trade of forest products and energy. A percentage of 43.2% of the study participants agreed that forests provide several opportunities for recreation and spiritual renewal in most communities. Furthermore, 47.9% agreed that most of the income from forests is indirect and cuts across food, fuel, fodder, construction materials, and herbal medicine. Furthermore, 60.2% of the study participants agreed with the fact that forests are a great source of shelter, livelihoods, water, food, and fuel security for both humans and animals.

The study established the key dimensions of forest bioeconomy, and the results are presented in Figure 3.

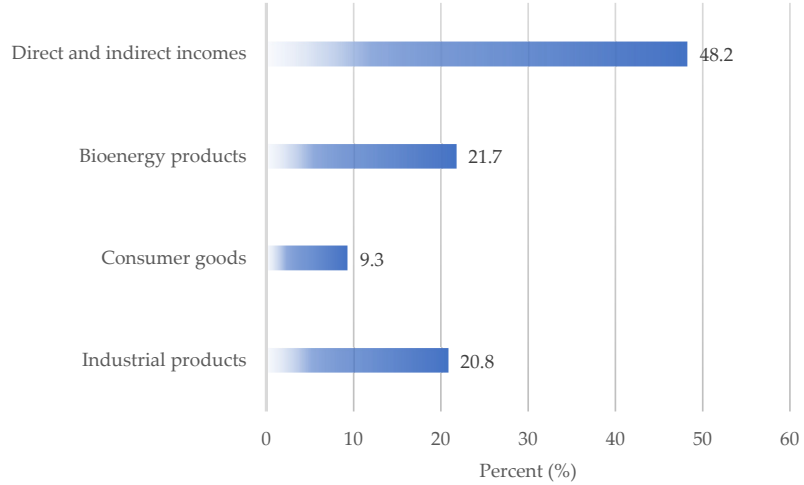

Figure 3. The dimensions of forest bioeconomy. Source: Authors' own work (2022).

Most of the participants (48.2%) mentioned direct and indirect income contributions as the major dimension of the forest bioeconomy, followed by bioenergy products (21.7%), then industrial products (20.8%), and the least number of respondents (9.3%) mentioned consumer goods from forests, such as herbal medicine.

This study established the key aspects in managing and exploiting forests, and the results are presented in Figure 4.

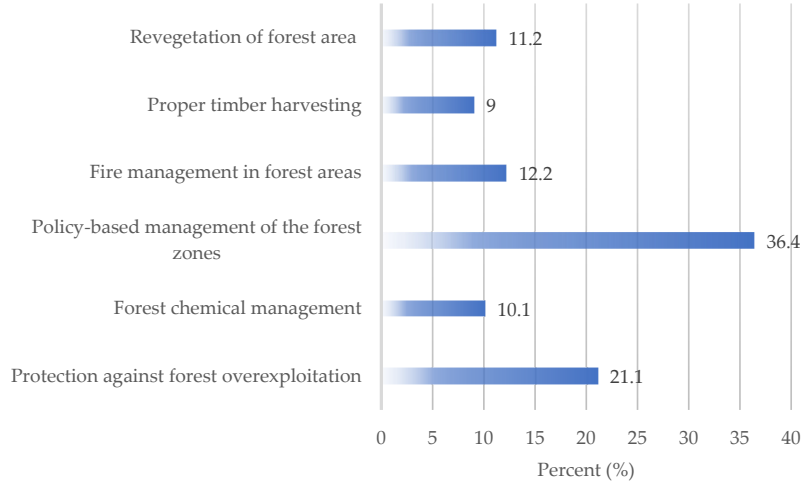

Figure 4. Key aspects in the management and exploitation of forests. Source: Authors' own work (2022).

From Figure 4, policy-based management of forest zones was selected by the largest percentage of participants (36.4%) as a key aspect of the management and exploitation of forests, followed by protection against forest overexploitation (21.1%), fire management in forest areas (12.2%), revegetation of forest areas (11.2%), and the least number of participants (9.0%) cited proper timber harvesting as a key aspect of management and exploitation of forests.

Table 6 presents the findings concerning the perspective of social and economic development in relation to forestry.

Table 6. Results on social and economic development related to forests.

	SD	D	U	A	SA
	%	%	%	%	%
Forests could regulate the climate through carbon storage, which contributes to a high quality of life	5.2	3.5	6.6	38.4	46.3
Trees are typically produced as an insurance policy against bad times and as an investment for the future	2.6	6.8	17.1	47.0	26.5
Trees may be cut down to provide cash for emergencies or to pay for equipment or real estate.	4.0	6.0	7.7	51.5	30.8
Many nations have historically benefited from increased food security because the money made from tree cultivation is used to purchase food, additional agricultural land, machinery, and inputs.	1.9	4.7	6.3	55.6	31.6

Key: SD—strongly disagree, D—disagree, U—undecided, A—agree, SA—strongly agree. Source: Primary Data (2022).

According to Table 6, the largest number of participants (46.3%) strongly agreed that forests could regulate the climate through carbon storage, contributing to the high quality of life. A percentage of 47.0% of respondents agreed that trees are typically produced as an insurance policy against bad times and as an investment for the future. The respondents (51.5%) agreed that trees may be cut down to provide income for emergencies or to pay for equipment or real estate. A percentage of 55.6% of the respondents agreed that many nations have historically benefited from increased food security because the money made from tree cultivation is used to purchase food, additional agricultural land, machinery, and inputs.

4.3. Regression Analysis

The relationship between forest bioeconomy and social and economic development was established using regression analysis as presented in the subsequent tables (Tables 7–9).

Table 7. Model Summary.

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
	0.798 a	0.786	0.684	0.10214

a—Predictors: (Constant), aspects of forestry bioeconomy, management, and exploitation of forests.

Table 8. ANOVA.

	Sum of Squares	Df.	Mean Square	F	Sig.
Regression	76.204	2	28.031	73.261	0.014
Residual	71.051	310	0.413		
Total	147.255	312			

Dependent variable: social and economic development. Predictors: (Constant), dimensions of forest bioeconomy, management, and exploitation of forests.

Table 9. Coefficients.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.588	0.126		1.941	0.210
Dimensions of forest bioeconomy	0.168	0.054	0.371	1.124	0.024
Management and exploitation of forests	0.042	0.072	0.062	0.817	0.011

Dependent Variable: Social and economic development.

The dependent variable is social and economic development. The independent variable is regressed against the dependent variable obtaining a R^2 value of 0.673. This indicates that the independent variables jointly explain 78.6% of the variation in the dependent variable (social and economic development). The regression results also confirm that the study's independent variables do not influence 21.4% of the changes.

The F-statistic of 73.261 at prob. (Sig) = 0.014 at 5% significance level means that there is a statistically significant linear relationship between the independent variables (dimensions of forest bioeconomy, management, and exploitation of forests) and the dependent variable (social and economic development) as a whole.

The results in Table 9 confirm a relationship between forestry measured in terms of forest bioeconomy, management and exploitation of forests, and social and economic development since $p < 0.05$.

Hypotheses Testing

Since the significance level of 0.024 is less than 0.05%, we confirm that dimensions of forest bioeconomy, such as direct and indirect income from forests, have a positive effect on social and economic development. Therefore, we accept hypothesis H1 and conclude that the bioeconomy could increase the benefits of forests as it could further exploit forest wealth (biomass, resins) with economic benefits for forest-related societies and local economies.

In addition, there is a relationship between the management and exploitation of forests and social and economic development since the significance level of 0.011 is less than 0.05%. This indicates that the management and exploitation of forests help develop new skills, knowledge, and new fields of entrepreneurship. Therefore, we accept H2 and conclude that those involved in the management and exploitation of forests, by adopting bioeconomy practices, will develop new skills, knowledge, and fields of entrepreneurship.

5. Discussion

This study investigated the bioeconomy contribution of forestry on social and economic development. The study confirmed a positive relationship between dimensions of forest bioeconomy and social and economic development. It is clear that the bioeconomy can increase the benefits of forests as it could further exploit forest wealth (biomass, resins) with direct and indirect benefits for forest-related societies and local economies. In addition, the management and exploitation of forests by adopting bioeconomy practices allows the attainment of important skills, knowledge, and new fields of entrepreneurship. Globally and throughout many locations, the forest sector has contributed significantly to formal and direct employment and continues to do so. It is important to note that as economic diversification and liberalization have increased, these consequences have decreased proportionally. Trade in forest products has also grown in importance. These dynamic natures show how the forest sector has aided the economy in the previous era and how it plays a key role in global economic, political, and social development. They also show the importance of keeping and developing "real-time" data sets to map these changes [3,33].

The study showed that forests could regulate the climate through carbon storage, contributing to a high quality of life. Managi et al. (2019) also noted that by helping to preserve the natural conditions required for agricultural production, forests and trees play

a crucial role in ensuring global food security. They balance soil temperatures, stop erosion, improve the ability of the land to hold water and stabilize the soil. With the removal of tree cover and the resultant loss of millions of hectares of fertile land, the significance of these consequences has often been overlooked in the past [1]. Additionally, the resource foundation for agriculture continues to be weakened by soil erosion and land degradation as forests are cut down, exposing the land to direct wind and rain assault. Industrialized and developing nations employ trees as windbreaks to cover crops, stop erosion, and save the soil. Trees help to protect crops, water supplies, soils, and towns and increase agricultural output by reducing wind speeds [2,19,26].

The study showed that forests provide soil nutrients and forage for crops and livestock, contributing greatly to agriculture. This agrees with Karametou and Apostolopoulos (2010), who argued that trees stabilize dunes and prevent the spread of deserts in arid and semi-arid regions of the globe so that crops may be cultivated there. In many arid and semi-arid environments, shelter belts provide fuelwood, food, and fodder, shielding crops from the wind's wrath and protecting them from grazing animals [27]. Additionally, the belts lessen the pace at which crops lose water via evapotranspiration. Thus, the crops use less water. As salt barriers along coastlines, trees may enable cropping closer to the water [4,22,31]. In addition to protecting against wave damage during storms, these salt barriers also lessen the likelihood of floods and bodily harm from tidal surges to inland regions. Greece scores poorly in this area in terms of raw numbers. Furthermore, Greece is ranked third from the bottom among EU nations in terms of how much its forest sector contributes to the GDP, with a meager 0.05 percent. This is because the EU countries are ranked according to how much their forest sectors contribute to their respective country's GDPs. Only Cyprus and the Netherlands do worse than Greece in terms of economic performance [8,22,27]. Likewise, Greece performs poorly regarding the economic activities related to forestry's gross value added.

The national forest sector in Greece has a significant trade imbalance in forest products over time, which has a negative impact on the industry's ability to contribute to the national economy. On the other hand, the sector has viable and attractive new growth potential, including non-wood forest products and forest services.

Another barrier for the forest industry is the general inclination of Greek administrations to cut spending throughout the years of the economic crisis. Growth in the forest sector's GDP contribution has been further hampered by the Green Fund, one of the largest investors in Greece's forest industry, cutting its financing by around half between 2011 and 2015 [26]. The nation's poor performance in the EU's most recent Regional Competitiveness Index worsens the issue. Despite the obstacles above, there are still many possibilities for development in Greece's forest industry. The National Forest Strategy's most current law in Greece gives Greece's forest industry a fantastic chance to increase its share of the country's GDP [8,27]. The recently enacted National Forest Strategy of Greece adopts the Mediterranean forestry model, ideally adapted to the local circumstances, and enhances the numerous functions of forests [22]. Its promotion of collaboration with rural communities, which results in regional development and employment possibilities and, in turn, may improve the general contribution of the forest industry to the nation's GDP, is one of its essential features. However, addressing the Greek forest industry's structural issues will take time. On the contrary, they need extensive policy adjustments, reprogramming of forest money, encouragement of fresh investments, and limitations on realizing the NFP's new, expansive goal [26].

6. Conclusions

This study confirmed that forestry has a significant influence on the social and economic transformation of a country. Both direct and indirect benefits generated by people and the government from forests greatly influence the social well-being of people and the economic transformation of a country. Governments must modify current forest policies and regulations to accomplish these new goals. Production and environmental and

developmental objectives are covered in national forest policies, which provide a basic overview of a government's strategy in relation to forest management. These policies often seek to increase profits and foreign currency from wood and timber while ensuring the availability of raw materials for significant forest-based businesses. Many nations have implemented laws granting exclusive use of forest land and wood reserves to governments and commercial companies to accomplish these goals.

To unlock the potential of the forest bioeconomy and move towards sustainable development, governments must adopt a strong sustainability approach on the base of bioeconomy practices and also integrate innovations in forest activities that result in the valorization of biomass and the production of value-added goods and services. In other words, a transition to sustainability and a transition to "new" forest bioeconomy techniques activities are required. Failure to transition to an innovative bioeconomy and to challenge traditional forest activities will result in missed opportunities for socioeconomic development and inefficient resource use.

6.1. Recommendations

In national forests, local agroforestry programs should be created to generate a variety of goods such as bushmeat, fuelwood, and traditional medicines, among other forest foods. These programs should also be implemented. This may be accomplished by setting aside forest areas to serve as animals' homes or to cultivate regionally valuable crops. Alternatively, this goal can be accomplished by planting rows of these crops in government plantations.

Numerous people cut down trees and produce forest products to generate income for themselves. These activities can become more profitable and sustainable if favorable forest policies and government regulations exist. This would improve the means of subsistence and the food security of the impacted communities. Those individuals who depend on these activities the most, often those without land or otherwise disadvantaged, benefit the most from this change.

6.2. Limitations and Future Research

Even today, the COVID-19 pandemic introduced many limitations to this research; it was very difficult for the survey to be conducted face-to-face with the selected sample. In this type of research, where the researchers would gain more than the direct transfer of the participants' experience, the interview's limitations due to the pandemic were significant. Another limitation was the impossibility of collecting quantitative and economic data (due to reliability from a distance) from the forestry stakeholders for methodological support of the research and technical, economic analysis. In future research, the team intends to collect primary quantitative data related to the forestry activities to conduct techno-economic analyses.

The current study focused on the influences of forestry and especially the forestry bioeconomy on socioeconomic development and, for this purpose, used evidence from Greece. Future research should emphasize the role of government and EU policies in promoting the forestry bioeconomy and how contributes to the GDP of a region or a country. Moreover, the EU can set the rules for forest exploitation in a sustainable way and with the circular bioeconomy as a vehicle. For this reason, in our future research, we will examine those conditions that will govern planning at the European and national levels through international experts and the Delphi approach. The ultimate goal is to formulate forest environmental and circular economy programs that will ensure sustainability, promote circular bioeconomy forestry products and the economic result for local communities connected to the forest.

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References

1. Managi, S.; Wang, J.; Zhang, L. Research progress on monitoring and assessment of forestry area for improving forest management in China. *For. Econ. Rev.* **2019**, *1*, 57–70. [CrossRef]
2. Cheng, S.H.; MacLeod, K.; Ahlroth, S.; Onder, S.; Perge, E.; Shyamsundar, P.; Rana, P.; Garside, R.; Kristjanson, P.; McKinnon, M.C.; et al. A systematic map of evidence on the contribution of forests to poverty alleviation. *Environ. Evid.* **2019**, *8*, 3. [CrossRef]
3. Kupěák, V.; Šmída, Z. Forestry and wood sector and profitability development in the wood-processing industry of the Czech Republic. *J. For. Sci.* **2015**, *61*, 244–249. [CrossRef]
4. Antonarakis, A.S.; Pacca, L.; Antoniades, A. The effect of financial crises on deforestation: A global and regional panel data analysis. *Sustain. Sci.* **2022**, *17*, 1037–1057. [CrossRef] [PubMed]
5. Fantechi, F.; Fratesi, U. Measuring competitiveness differentials inside the same region: A propensity-score matching approach. *Soc. Indic. Res.* **2022**. [CrossRef]
6. United Nations. *Special Edition: Progress towards the Sustainable Development Goals*; United Nations: New York, NY, USA, 2019.
7. Masiero, M.; Pettenella, D.M.; Secco, L. From failure to value: Economic valuation for a selected set of products and services from Mediterranean forests. *For. Syst.* **2016**, *25*, 1–16. [CrossRef]
8. Maheras, G. *Forests Fires in Greece. The Analysis of the Phenomenon Affecting Both Natural And Human Environment. The Role of Sustainable Development in Controlling Fire Effects*; Lund University: Lund, Sweden, 2002.
9. Ballas, D.; Dorling, D.; Hennig, B. Analysing the regional geography of poverty, austerity and inequality in Europe: A human cartographic perspective. *Reg. Stud.* **2017**, *51*, 174–185. [CrossRef]
10. Eurostat Urban and Rural Living in the EU. Available online: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20200207-1 (accessed on 22 September 2022).
11. Kupec, P.; Marková, J.; Pelikán, P.; Brychtová, M.; Autratová, S.; Fialová, J. Urban Parks Hydrological Regime in the Context of Climate Change— A Case Study of Štěpánka Forest Park (Mladá Boleslav, Czech Republic). *Land* **2022**, *11*, 412. [CrossRef]
12. Aggestam, F.; Pülzl, H. Coordinating the Uncoordinated: The EU Forest Strategy. *Forests* **2018**, *9*, 125. [CrossRef]
13. Taghouti, I.; Cristobal, R.; Brenko, A.; Stara, K.; Markos, N.; Chapelet, B.; Hamrouni, L.; Buršić, D.; Bonet, J.-A. The Market Evolution of Medicinal and Aromatic Plants: A Global Supply Chain Analysis and an Application of the Delphi Method in the Mediterranean Area. *Forests* **2022**, *13*, 808. [CrossRef]
14. Martinez de Arano, I.; Maltoni, S.; Picardo, A.; Mutke, S. *Non-Wood Forest Products for People, Nature and the Green Economy. Recommendations for Policy Priorities in Europe. A White Paper Based on Lessons Learned from around the Mediterranean*; Giessen, L., Adams, S., Martinez de Arano, I., Eds.; The European Forest Institute and the Food and Agriculture Organization of the United Nations: Joensuu, Finland, 2021; ISBN 9789251347270.
15. Solomou, A.; Martinos, K.; Skoufogianni, E.; Danalatos, N.G. Medicinal and Aromatic Plants Diversity in Greece and Their Future Prospects: A Review. *Agric. Sci.* **2016**, *4*, 9–20. [CrossRef]
16. Cheminal, A.; Kokkoris, I.P.; Strid, A.; Dimopoulos, P. Medicinal and Aromatic Lamiaceae Plants in Greece: Linking Diversity and Distribution Patterns with Ecosystem Services. *Forests* **2020**, *11*, 661. [CrossRef]
17. Kougioumoutzis, K.; Kokkoris, I.P.; Panitsa, M.; Kallimanis, A.; Strid, A.; Dimopoulos, P. Plant Endemism Centres and Biodiversity Hotspots in Greece. *Biology* **2021**, *10*, 72. [CrossRef] [PubMed]
18. Fitzgerald, J.; Lindner, M. (Eds.) *Adapting to Climate Change in European Forests—Results of the MOTIVE Project*; Pensoft Publishers: Sofia, Bulgaria, 2013.
19. Schulz, T.; Lieberherr, E.; Zabel, A. How national bioeconomy strategies address governance challenges arising from forest-related trade-offs. *J. Environ. Policy Plan.* **2022**, *24*, 123–136. [CrossRef]
20. Li, Y.; Mei, B.; Linhares-Juvenal, T. The economic contribution of the world's forest sector. *For. Policy Econ.* **2019**, *100*, 236–253. [CrossRef]
21. Eurostat Forests, Forestry and Logging. Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Forests,_forestry_and_logging#Forests_in_the_EU (accessed on 10 November 2022).

22. Tsiaras, S.; Koulelis, P.; Tsiroukis, A.; Spanos, I. The contribution of forests in regional development: The role of National Forest Strategy in Greece. *Mibes Trans.* **2021**, *14*, 110–122.
23. Ioannou, K.; Tsantopoulos, G.; Arabatzis, G.; Andreopoulou, Z.; Zafeiriou, E. A Spatial Decision Support System Framework for the Evaluation of Biomass Energy Production Locations: Case Study in the Regional Unit of Drama, Greece. *Sustainability* **2018**, *10*, 531. [CrossRef]
24. Arabatzis, G.; Kyriakopoulos, G.; Tsialis, P. Typology of regional units based on RES plants: The case of Greece. *Renew. Sustain. Energy Rev.* **2017**, *78*, 1424–1434. [CrossRef]
25. Koundouri, P.; Kountouris, Y.; Remoundou, K. Valuing a wind farm construction: A contingent valuation study in Greece. *Energy Policy* **2009**, *37*, 1939–1944. [CrossRef]
26. Spanos, K.A.; Skouteri, A.; Gaitanis, D.; Petrakis, P.V.; Meliadis, I.; Michopoulos, P.; Solomou, A.; Koulelis, P.; Avramidou, E.V. Forests of Greece, Their Multiple Functions and Uses, Sustainable Management and Biodiversity Conservation in the Face of Climate Change. *Open J. Ecol.* **2021**, *11*, 374–406. [CrossRef]
27. Karametou, P.; Apostolopoulos, C. The causal nexus between social capital and local development in mountain rural Greece. *Int. J. Soc. Inq.* **2010**, *3*, 29–66.
28. FAOSTAT FAOSTAT. Available online: https://www.fao.org/faostat/en/#home (accessed on 24 September 2022).
29. Hoover, K.; Riddle, A.A. *National Forest System Management: Overview, Appropriations, and Issues for Congress*, 13th ed.; Congressional Research Service, U.S. Congress, House Committee: Washington, DC, USA, 2019.
30. Agrawal, A.; Cashore, B.; Hardin, R.; Shepherd, G.; Benson, C.; Miller, D. Economic contributions of forests. *Backgr. Pap.* **2013**, *1*, 1–127.
31. Annoni, P.; Dijkstra, L. *EU Regional Competitiveness Index 2019*; Dijkstra, L., Ed.; Publications Office of the European Union: Luxembourg, 2019.
32. OECD. *The Economic Significance of Natural Resources: Key Points for Reformers in Eastern Europe, Caucasus and Central Asia*; OECD: Paris, France, 2011; pp. 1–42. Available online: http://www.oecd.org/env/outreach/2011_AB_Economic%20significance%20of%20NR%20in%20EECCA_ENG.pdf (accessed on 29 September 2022).
33. Lele, U.; Karsenty, A.; Benson, C.; Fétiveau, J.; Agarwal, M.; Goswani, S. Changing roles of forests and their cross-sectorial linkages in the course of economic development. In Proceedings of the United Nations Forum for Forests, Istanbul, Turkey, 8–19 April 2013; United Nations Forum for Forests, Ed.; United Nations: Istanbul, Turkey, 2013; p. 172.
34. Pilli, R.; Grassi, G. *Provision of Technical and Scientific Support to DG ESTAT in Relation to EU Land Footprint Estimates and Gap-Filling Techniques for European Forest Accounts (LAFO)*; Publications Office of the European Union: Luxembourg, 2021; pp. 1–46. [CrossRef]
35. Krieger, D.J. *Economic Value of Forest Ecosystem Services: A Review*; Kloepfer, D., Ed.; The Wilderness Society: Washington, DC, USA, 2001.
36. Huber, N.; Bugmann, H.; Cailleret, M.; Bircher, N.; Lafond, V. Stand-scale climate change impacts on forests over large areas: Transient responses and projection uncertainties. *Ecol. Appl.* **2021**, *31*, e02313. [CrossRef] [PubMed]
37. Campos Arce, J.J. Forests, inclusive and sustainable economic growth and employment. In Proceedings of the Fourteenth Session of the United Nations Forum on Forests, New York, NY, USA, 6–10 May 2019; United Nations Forum on Forests: New York, NY, USA, 2019; pp. 1–58.
38. Liu, S.; Costanza, R.; Farber, S.; Troy, A. Valuing ecosystem services. Theory, practice, and the need for a transdisciplinary synthesis. *Ann. N. Y. Acad. Sci.* **2010**, *1185*, 54–78. [CrossRef] [PubMed]
39. Odgaard, M.V.; Turner, K.G.; Bøcher, P.K.; Svenning, J.-C.; Dalgaard, T. A multi-criteria, ecosystem-service value method used to assess catchment suitability for potential wetland reconstruction in Denmark. *Ecol. Indic.* **2017**, *77*, 151–165. [CrossRef]
40. Kalfas, D.G.; Zagkas, D.T.; Raptis, D.I.; Zagkas, T.D. The multifunctionality of the natural environment through the basic ecosystem services in the Florina region, Greece. *Int. J. Sustain. Dev. World Ecol.* **2019**, *26*, 57–68. [CrossRef]
41. Liu, Y.; Hou, X.; Li, X.; Song, B.; Wang, C. Assessing and predicting changes in ecosystem service values based on land use/cover change in the Bohai Rim coastal zone. *Ecol. Indic.* **2020**, *111*, 106004. [CrossRef]
42. Song, X.; Yang, G.; Yan, C.; Duan, H.; Liu, G.; Zhu, Y. Driving forces behind land use and cover change in the Qinghai-Tibetan Plateau: A case study of the source region of the Yellow River, Qinghai Province, China. *Environ. Earth Sci.* **2009**, *59*, 793. [CrossRef]
43. Reid, W.V.; Mooney, H.A.; Cropper, A.; Capistrano, D.; Carpenter, S.R.; Chopra, K.; Dasgupta, P.; Dietz, T.; Du-raiappah, A.K.; Hassan, R.; et al. Monika. Millennium Ecosystem Assessment. In *Ecosystems and Human Well-Being: Synthesis*; Island Press: Washington, DC, USA, 2005; Volume 5, ISBN 1597260401.
44. Carpenter, S.R.; Mooney, H.A.; Agard, J.; Capistrano, D.; Defries, R.S.; Diaz, S.; Dietz, T.; Duraiappah, A.K.; Oteng-Yeboah, A.; Pereira, H.M.; et al. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proc. Natl. Acad. Sci. USA* **2009**, *106*, 1305–1312. [CrossRef]
45. Palmer, M.A.; Filoso, S.; Fanelli, R.M. From ecosystems to ecosystem services: Stream restoration as ecological engineering. *Ecol. Eng.* **2014**, *65*, 62–70. [CrossRef]
46. Gottero, E.; Cassatella, C.; Larcher, F. Planning Peri-Urban Open Spaces: Methods and Tools for Interpretation and Classification. *Land* **2021**, *10*, 802. [CrossRef]
47. Kalfas, D.; Zagkas, D.; Dragozi, E.; Zagkas, T. Estimating value of the ecosystem services in the urban and peri-urban green of a town Florina-Greece, using the CVM. *Int. J. Sustain. Dev. World Ecol.* **2020**, *27*, 310–321. [CrossRef]

48. Crossman, N.D.; Burkhard, B.; Nedkov, S.; Willemen, L.; Petz, K.; Palomo, I.; Drakou, E.G.; Martín-Lopez, B.; McPhearson, T.; Boyanova, K.; et al. A blueprint for mapping and modelling ecosystem services. *Ecosyst. Serv.* **2013**, *4*, 4–14. [CrossRef]
49. Turner, K.G.; Odgaard, M.V.; Bøcher, P.K.; Dalgaard, T.; Svenning, J.-C.C. Bundling ecosystem services in Denmark: Trade-offs and synergies in a cultural landscape. *Landsc. Urban Plan.* **2014**, *125*, 89–104. [CrossRef]
50. Andrew, M.E.; Wulder, M.A.; Nelson, T.A.; Coops, N.C. Spatial data, analysis approaches, and information needs for spatial ecosystem service assessments: A review. *GIScience Remote Sens.* **2015**, *52*, 344–373. [CrossRef]
51. Kay, S.; Crous-Duran, J.; Ferreiro-Domínguez, N.; García de Jalón, S.; Graves, A.; Moreno, G.; Mosquera-Losada, M.R.; Palma, J.H.N.; Roces-Díaz, J.V.; Santiago-Freijanes, J.J.; et al. Spatial similarities between European agroforestry systems and ecosystem services at the landscape scale. *Agrofor. Syst.* **2017**, *92*, 1075–1089. [CrossRef]
52. Costanza, R.; Kubiszewski, I. The authorship structure of "ecosystem services" as a transdisciplinary field of scholarship. *Ecosyst. Serv.* **2012**, *1*, 16–25. [CrossRef]
53. de Groot, R.S.; Alkemade, R.; Braat, L.; Hein, L.; Willemen, L. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecol. Complex.* **2010**, *7*, 260–272. [CrossRef]
54. Fisher, B.; Turner, R.K.; Morling, P. Defining and classifying ecosystem services for decision making. *Ecol. Econ.* **2009**, *68*, 643–653. [CrossRef]
55. Farber, S.; Costanza, R.; Childers, D.L.; Erickson, J.; Gross, K.; Grove, M.; Hopkinson, C.S.; Kahn, J.; Pinceti, S.; Troy, A.; et al. Linking Ecology and Economics for Ecosystem Management. *Bioscience* **2006**, *56*, 121–134. [CrossRef]
56. Martinez-Harms, M.J.; Bryan, B.A.; Balvanera, P.; Law, E.A.; Rhodes, J.R.; Possingham, H.P.; Wilson, K.A. Making decisions for managing ecosystem services. *Biol. Conserv.* **2015**, *184*, 229–238. [CrossRef]
57. Maes, J.; Egoh, B.; Willemen, L.; Liquete, C.; Vihervaara, P.; Schägner, J.P.; Grizzetti, B.; Drakou, E.G.; La Notte, A.; Zulian, G.; et al. Mapping ecosystem services for policy support and decision making in the European Union. *Ecosyst. Serv.* **2012**, *1*, 31–39. [CrossRef]
58. Mancinelli, R.; Di Felice, V.; Karkalis, K.; Bari, S.; Radicetti, E.; Campiglia, E. Assessment of the state of agroecosystem sustainability using landscape indicators: A comparative study of three rural areas in Greece. *Int. J. Sustain. Dev. World Ecol.* **2018**, *25*, 35–46. [CrossRef]
59. Outeiro, L.; Häussermann, V.; Viddi, F.; Hucke-Gaete, R.; Försterra, G.; Oyarzo, H.; Kosiel, K.; Villasante, S. Using ecosystem services mapping for marine spatial planning in southern Chile under scenario assessment. *Ecosyst. Serv.* **2015**, *16*, 341–353. [CrossRef]
60. Von Haaren, C.; Albert, C. Integrating ecosystem services and environmental planning: Limitations and synergies. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2011**, *7*, 150–167. [CrossRef]
61. Doré, T.; Makowski, D.; Malézieux, E.; Munier-Jolain, N.; Tchamitchian, M.; Tittonell, P. Facing up to the paradigm of ecological intensification in agronomy: Revisiting methods, concepts and knowledge. *Eur. J. Agron.* **2011**, *34*, 197–210. [CrossRef]
62. Grêt-Regamey, A.; Weibel, B.; Kienast, F.; Rabe, S.-E.; Zulian, G. A tiered approach for mapping ecosystem services. *Ecosyst. Serv.* **2015**, *13*, 16–27. [CrossRef]
63. Soussana, J.-F.; Fereres, E.; Long, S.P.; Mohren, F.G.; Pandya-Lorch, R.; Peltonen-Sainio, P.; Porter, J.R.; Rosswall, T.; von Braun, J. A European science plan to sustainably increase food security under climate change. *Glob. Chang. Biol.* **2012**, *18*, 3269–3271. [CrossRef]
64. Lavorel, S.; Bayer, A.; Bondeau, A.; Lautenbach, S.; Ruiz-frau, A.; Schulp, N.; Seppelt, R.; Verburg, P.; Van Teeffelen, A.; Vannier, C.; et al. Pathways to bridge the biophysical realism gap in ecosystem services mapping approaches. *Ecol. Indic.* **2017**, *74*, 241–260. [CrossRef]
65. 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]
66. Costanza, R.; de Groot, R.; Braat, L.; Kubiszewski, I.; Fioramonti, L.; Sutton, P.; Farber, S.; Grasso, M. Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosyst. Serv.* **2017**, *28*, 1–16. [CrossRef]
67. Pártl, A.; Vačkář, D.; Loučková, B.; Lorencová, E.K. A spatial analysis of integrated risk: Vulnerability of ecosystem services provisioning to different hazards in the Czech Republic. *Nat. Hazards* **2017**, *89*, 1185–1204. [CrossRef]
68. Zhao, J.; Liu, X.; Dong, R.; Shao, G. Landsenses ecology and ecological planning toward sustainable development. *Int. J. Sustain. Dev. World Ecol.* **2016**, *23*, 293–297. [CrossRef]
69. Zhao, J.; Yan, Y.; Deng, H.; Liu, G.; Dai, L.; Tang, L.; Shi, L.; Shao, G. Remarks about landsenses ecology and ecosystem services. *Int. J. Sustain. Dev. World Ecol.* **2020**, *27*, 196–201. [CrossRef]
70. Zheng, S.; Cui, K.; Sun, S.; Wu, J.; Qiu, Q.; Tian, Y. Planning and design based on landsenses ecology: The case study of Chongming Island Landsenses Ecol-industrial Park. *Int. J. Sustain. Dev. World Ecol.* **2020**, *27*, 435–442. [CrossRef]
71. Tian, Y.; Guo, Z.; Zhong, W.; Qiao, Y.; Qin, J. A design of ecological restoration and eco-revetment construction for the riparian zone of Xianghe Segment of China's Grand Canal. *Int. J. Sustain. Dev. World Ecol.* **2016**, *23*, 333–342. [CrossRef]
72. Kalfas, D.G.; Zagkas, D.T.; Dragozi, E.I.; Melfou, K.K. An approach of landsenses ecology and landsenseology in Greece. *Int. J. Sustain. Dev. World Ecol.* **2021**, *28*, 677–692. [CrossRef]
73. Linwei, H.; Longyu, S.; Fengmei, Y.; Xue-qin, X.; Lijie, G. Method for the evaluation of residents' perceptions of their community based on landsenses ecology. *J. Clean. Prod.* **2021**, *281*, 124048. [CrossRef]

74. Dong, R.; Yu, T.; Ma, H.; Ren, Y. Soundscape planning for the Xianghe Segment of China's Grand Canal based on landsenses ecology. *Int. J. Sustain. Dev. World Ecol.* **2016**, *23*, 343–350. [CrossRef]
75. Zhang, L.; Huang, G.; Li, Y.; Bao, S. Advancement trajectory of emerging landsenses ecology for sustainability research and implementation. *Int. J. Sustain. Dev. World Ecol.* **2022**, *29*, 641–652. [CrossRef]
76. Stephenson, P.J.; Damerell, A. Bioeconomy and Circular Economy Approaches Need to Enhance the Focus on Biodiversity to Achieve Sustainability. *Sustainability* **2022**, *14*, 10643. [CrossRef]
77. European Commission, Directorate-General for Research and Innovation. *Innovating for Sustainable Growth. A Bioeconomy for Europe*; Publications Office of the European Union: Brussels, Belgium, 2012.
78. Papadopoulou, C.-I.; Loizou, E.; Melfou, K.; Chatzitheodoridis, F. The Knowledge Based Agricultural Bioeconomy: A Bibliometric Network Analysis. *Energies* **2021**, *14*, 6823. [CrossRef]
79. European Commission. *A Sustainable Bioeconomy for Europe: Strengthening the Connection between Economy, Society and the Environment*; European Commission: Brussels, Belgium, 2018.
80. Carus, M.; Dammer, L. The Circular Bioeconomy—Concepts, Opportunities, and Limitations. *Ind. Biotechnol.* **2018**, *14*, 83–91. [CrossRef]
81. Kardung, M.; Cingiz, K.; Costenoble, O.; Delahaye, R.; Heijman, W.; Lovrić, M.; van Leeuwen, M.; M'Barek, R.; van Meijl, H.; Piotrowski, S.; et al. Development of the Circular Bioeconomy: Drivers and Indicators. *Sustainability* **2021**, *13*, 413. [CrossRef]
82. Lovrić, M.; Lovrić, N.; Mavsar, R. Mapping forest-based bioeconomy research in Europe. *For. Policy Econ.* **2020**, *110*, 101874. [CrossRef]
83. Papadopoulou, C.-I.; Loizou, E.; Chatzitheodoridis, F. Priorities in Bioeconomy Strategies: A Systematic Literature Review. *Energies* **2022**, *15*, 7258. [CrossRef]
84. Spies, M.; Zuberi, M.; Mählis, M.; Zakirova, A.; Alff, H.; Raab, C. Towards a participatory systems approach to managing complex bioeconomy interventions in the agrarian sector. *Sustain. Prod. Consum.* **2022**, *31*, 557–568. [CrossRef]
85. Mihova, T.B.; Alexieva, V.N. Business communities—A factor of industry and bioeconomy development. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *878*, 012070. [CrossRef]
86. Ranacher, L.; Wallin, I.; Valsta, L.; Kleinschmit, D. Social dimensions of a forest-based bioeconomy: A summary and synthesis. *Ambio* **2020**, *49*, 1851–1859. [CrossRef]
87. Lillemets, J.; Fertő, I.; Viira, A.-H. The socioeconomic impacts of the CAP: Systematic literature review. *Land Use Policy* **2022**, *114*, 105968. [CrossRef]
88. Papadopoulou, E.; Vaitsas, K.; Fallas, I.; Tsipas, G.; Chrissafis, K.; Bikiaris, D.; Kottaridi, C.; Vorgias, K.E. Bio-economy in Greece: Current trends and the road ahead. *EuroBiotech J.* **2018**, *2*, 137–145. [CrossRef]
89. Hodge, D.; Brukas, V.; Giurca, A. Forests in a bioeconomy: Bridge, boundary or divide? *Scand. J. For. Res.* **2017**, *32*, 582–587. [CrossRef]
90. Jurga, P.; Loizou, E.; Rozakis, S. Comparing Bioeconomy Potential at National vs. Regional Level Employing Input-Output Modeling. *Energies* **2021**, *14*, 1714. [CrossRef]
91. European Commission—Green Deal European Commission—Green Deal. Available online: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en (accessed on 31 August 2022).
92. Backhouse, M.; Lehmann, R.; Lorenzen, K.; Puder, J.; Rodríguez, F.; Tittor, A. (Eds.) *Contextualizing the Bioeconomy in an Unequal World: Biomass Sourcing and Global Socio-Ecological Inequalities BT—Bioeconomy and Global Inequalities: Socio-Ecological Perspectives on Biomass Sourcing and Production*; Springer International Publishing: Cham, Switzerland, 2021; pp. 3–22, ISBN 978-3-030-68944-5.
93. MEE-YPEN Ministry of Environment and Energy. Available online: https://ypen.gov.gr/ (accessed on 23 October 2022).
94. Kalfas, D.; Chatzitheodoridis, F.; Loizou, E.; Melfou, K. Willingness to Pay for Urban and Suburban Green. *Sustainability* **2022**, *14*, 2332. [CrossRef]
95. Kalogiannidis, S.; Toska, E.; Chatzitheodoridis, F.; Kalfas, D. Using School Systems as a Hub for Risk and Disaster Management: A Case Study of Greece. *Risks* **2022**, *10*, 89. [CrossRef]
96. Kalogiannidis, S.; Kalfas, D.; Chatzitheodoridis, F.; Papaevangelou, O. Role of Crop-Protection Technologies in Sustainable Agricultural Productivity and Management. *Land* **2022**, *11*, 1680. [CrossRef]