forests

MDPI

Review

Integrating Social Forestry and Biodiversity Conservation in Indonesia

Hendra Gunawan [1], Irma Yeny [1,*], Endang Karlina [1], Sri Suharti [1], Murniati [1], Subarudi [2], Budi Mulyanto [3], Sulistya Ekawati [4], Raden Garsetiasih [1], Pratiwi [1], Bugi Kabul Sumirat [1], Reny Sawitri [1], Nur M. Heriyanto [1], Mariana Takandjandji [1], Asmanah Widarti [4], Surati [4], Desmiwati [4], Titi Kalima [1], Rachman Effendi [1], Edwin Martin [4], Nur Arifatul Ulya [5], Sylviani [4] and Ari Nurlia [4]

1 Research Center for Ecology and Ethnobiology-National Research and Innovation Agency (BRIN), Jalan Raya Jakarta-Bogor Km.46, Cibinong 16911, Indonesia
2 Research Center for Population, National Research and Innovation Agency (BRIN), JL. Gatot Subroto No. 10, Jakarta 12710, Indonesia
3 Faculty of Agriculture, IPB University, JL. Raya Darmaga Km. 8, Bogor 16680, Indonesia
4 Research Center for Society and Culture, National Research and Innovation Agency (BRIN), Gedung Sasana Widya Sarwono Lantai 06, JL. Jend. Gatot Subroto No.10, Jakarta 12710, Indonesia
5 Research Center for Behavioral and Circular Economics, National Research and Innovation Agency (BRIN), Gedung Widya Graha Lt.4, JL. Jend. Gatot Subroto No.10, Jakarta 12710, Indonesia
* Correspondence: irma015@brin.go.id; Tel.: +62-08124859187

Abstract: Social forestry (SF) has long been implemented in production and protected forests in Indonesia. SF is considered to be a win–win solution for occupied and cultivated forest areas. The aim of this paper was to review the implementation of social forestry in Indonesia and its strengths and challenges. The secondary purpose was to synthesize the lessons learned and recommendations for the government about designing SF that can integrate the objective of forest biodiversity conservation and the social welfare of the surrounding communities. The study used a systematic literature review (SLR) of international and national peer-reviewed articles. The results of the study indicate that SF is intended to achieve benefits in three main areas: social, economic, and ecological. However, the review found that the ecological aspects of biodiversity conservation often receive less attention compared to the social and economic goals. A strong point of SF implementation is increasing community access to forest land use, while a challenge that must be resolved is that including communities in forest management can result in fragmentation and changes to animal habitats; thus, there is the potential for population decline and extinction. This study advises policymakers to pay more attention to ecological functions to ensure forest sustainability in SF development.

Keywords: community; livelihood; conservation; biodiversity; fragmentation; disturbance

Citation: Gunawan, H.; Yeny, I.; Karlina, E.; Suharti, S.; Murniati; Subarudi; Mulyanto, B.; Ekawati, S.; Garsetiasih, R.; Pratiwi; et al. Integrating Social Forestry and Biodiversity Conservation in Indonesia. *Forests* **2022**, *13*, 2152. https://doi.org/10.3390/f13122152

Academic Editor: Jordan M. Marshall

Received: 17 October 2022
Accepted: 3 December 2022
Published: 15 December 2022

1. Introduction

Social forestry (SF) emerged in forest management as a paradigm to address several problems in tropical countries that cannot be solved by forestry science itself, and it requires effective community participation. The concept of SF arises from the perspective that forest management problems can be solved by involving communities that depend on forest resources as an important part of their livelihoods [1]. The principal objective of SF is to meet the basic daily needs of the local community from the forest, such as fuel, fodder, food, timber, income, and environmental services [2]. SF also aims to create flows of production and benefits for the community, on both publicly owned (state) and private land [3]. The government of Indonesia defines social forestry as a sustainable forest management system implemented in state or private/customary forests by local communities or indigenous societies to improve the well-being, environmental balance, and sociocultural dynamics in the form of village forests (VFs), forest communities (FCs), community plantation forests (CPFs), customary forests (CFs), and forestry partnerships (FPs) [4].

The implementation of SF involves multiple stakeholders, and it has been developed in Southeast Asia in conservation areas, timber concession areas, fallow forests, and locally managed agroforestry systems for a long time [5]. In Indonesia, community involvement in forest management has existed since the 1960s, especially in forests managed by Perhutani on Java Island through an intercropping system. Since 1972, various approaches to community involvement have been developed, such as the prosperity approach, forest village community development (1982), social forestry (1984), integrated forest village community development (1994), and collaborative forest management (2001) [6].

The SF program emerged when participative forestry development was launched for the first time by the National Commission on Agriculture in India in 1976. Indonesia adopted community engagement in forest management after the Eighth World Forestry Congress in Jakarta in 1978, which had the theme "forest for people" [7]. This SF policy has evolved since the 1990s through the community forestry (CF) scheme, which was introduced in 1995 (Decree of the Minister of Forestry No. 622/1995). Through Government Regulation No. 6/2007, new schemes of social forestry began to be introduced, such as: CPFs in 2011, FPs in 2013, VFs in 2014, and PFs in 2015 [6].

Since 2016, all arrangements for forest management schemes involving communities have been combined and simplified under the Ministry of Environment and Forestry (MoEF) Regulation No. P.83/2016 concerning social forestry. The regulation stipulates five social forestry schemes: VP, CF, CPF, FP, and CF. SF can be carried out through VF, CF, and FP schemes in protected forests and through VF, CF, CPF, and FP schemes in production forests. In conservation forests, SF can only be carried out through FP schemes, and customary forest schemes are implemented only in customary areas [6]. SF regulation in Indonesia is very dynamic, as shown by the issuance of MoEF Regulation No. 9/2021 concerning social forestry management, which explicitly states that FP schemes in conservation forests are conservation partnerships.

Although policies and regulations continue to be refined, their function in saving biodiversity from extinction is still questionable. First, so far, SF has been applied to production and protected forests, which are mainly not intended to conserve biodiversity. This is due to the forest management system in Indonesia based on law number 41 of 1999, which divides the main functions of forests into three, namely production, protection, and conservation. Although, naturally, forests also have the function of biodiversity conservation, its implementation is not the main objective of management in forest production and protection. Second, the development of SF in conservation forests as a method of conflict resolution with surrounding communities is still new, and there have not been many reports of their success. Protecting and maintaining the sustainability of biodiversity is important for Indonesia as one of the world's megadiverse countries [8].

The Indonesian government had targeted an SF permit covering an area of 12.7 million hectares by 2019 [9,10]. Overall, the accumulation of forest area managed under social forestry schemes as of September 2022 was 5.077 million hectares, involving 1.106 million households and 7678 license units [11]. From these data, it is clear that biodiversity conservation is a challenge when it is applied in combination with SF programs in all forest functions, and even in customary forests. In the past, biodiversity conservation was more related to the management of protected areas and natural forests and lacked opportunities for community involvement in forest management. Paying more attention to the process and implementation of SF could minimize the risks related to biodiversity loss that occur outside protected areas [12].

In line with current facts and trends, we try to examine the implementation of SF in Indonesia by exploring success stories and obstacles in the implementation of traditional and modern SF so that we have a broader perspective. We describe the evidence of SF's success as a solution to preventing deforestation, poverty alleviation, increasing food security, and post-COVID-19 economic recovery in Section 3. In Section 4, we also try to examine potential challenges to biodiversity conservation since decentralization was implemented in 1999 which increased degradation, fragmentation, and the loss of habitat,

as well as illegal hunting and the wildlife trade. The worst impacts occurred in production and protection forests. Meanwhile, the potential for obtaining non-exploitative benefits through such a large number of ecosystem services is still a challenge to be further explored and developed. In Section 5 we try to find the link between SF and biodiversity conservation using the five Ws (why, when, where, who, and what) and one H (how). This link is hard to define, and thus we acknowledge that this is a challenge that must be faced and provide recommendations to overcome this.

2. Conceptual Logical Framework and Methods

The objectives of social forestry are to alleviate poverty in forest communities, to enable communities to have access to legal management and ownership of resources and benefits through empowerment and capacity building, and to improve forest conditions [13]. Social forestry represents an important political commitment to improve access to land for rural people and create opportunities for economic development while protecting the remaining fragile forests [14].

2.1. Conceptual Logical Framework

The conceptual logical framework (Figure 1) indicates that SF is a policy of the Indonesian government to optimize the functions and benefits of sustainable forest resources by balancing the ecological, economic, and social aspects. In this paper, we identify and analyze opportunities and challenges in terms of biodiversity, deforestation, poverty alleviation, food security, economic recovery post-COVID-19, and biodiversity conservation. The result is a formula for improving community welfare, sociocultural sustainability, and environmental balance in the form of recommendations to harmonize SF and biodiversity conservation.

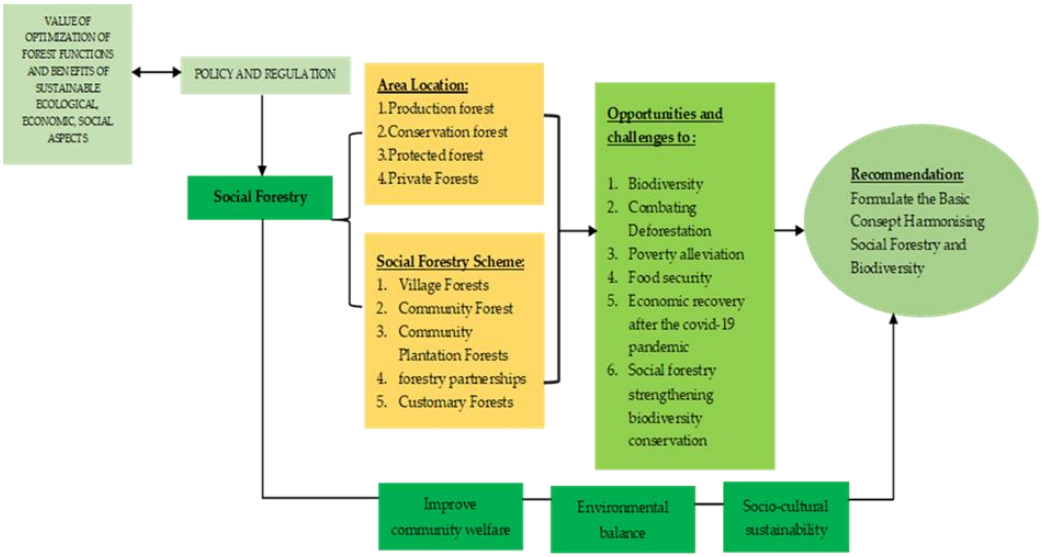

Figure 1. Conceptual logical framework.

Community involvement in SF refers to "initiatives, science, policies, institutions, and processes to enhance the role of local communities in managing forest resources" through various partnership schemes [15–17]. We adopted Wiersum's concept, which distinguishes between SF and community forestry (CF) concepts. SF is a development strategy for professional foresters or development organizations to stimulate local communities to be actively involved in various small-scale forest management activities in order to improve their living conditions [1]. In the Indonesian context, CF applies to customary forests, community forests, and traditional agroforestry practices, and once it gets formal recognition from the state (government), it will become SF.

The conceptual logical framework of this study is summarized. Social forestry in Indonesia is implemented in state forest areas as well as private/customary forests involving

local or customary communities as the main actors to improve welfare, environmental balance, and sociocultural dynamics in the form of VF, CF, CPF, CF, and FP schemes [18]. Social forestry is expected to create a balance between community welfare, economy, and ecology. However, the ecological aspect, especially biodiversity conservation, has received less attention. Therefore, it is necessary to make recommendations on the basic formulation of integrating social forestry and biodiversity conservation.

2.2. Materials and Methods

This review was conducted to assess the optimization of sustainable forest functions and benefits in terms of ecological, economic, and social aspects. We used a systematic literature review with a deep learning approach to find studies in order to review and critically analyze published academic research in the field of social forestry [19,20]. A systematic approach was adopted to focus the search on published academic research directly related to the scope of this paper.

Key steps in a systematic review of research are planning, identifying (searching), screening databases, and determining eligibility [21,22]. Figure 2 shows the steps of the systematic literature review. The research question keywords and selected databases are determined at the planning stage [20,23].

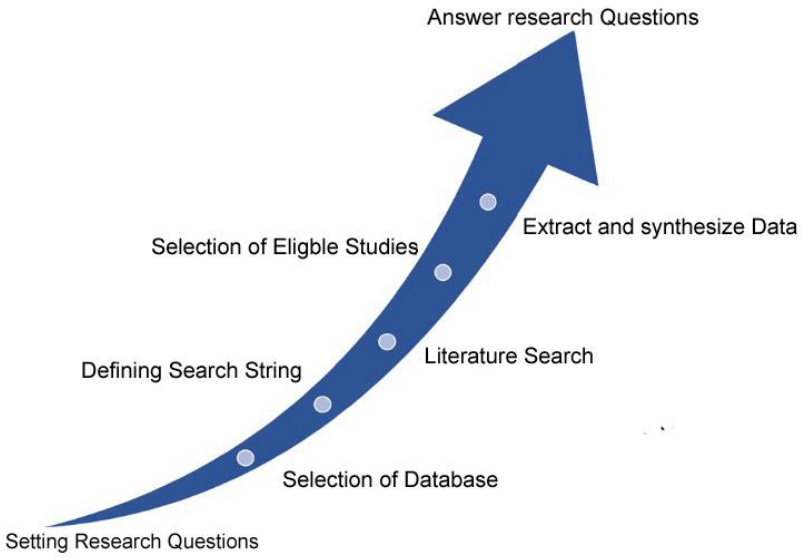

Figure 2. Steps involved in planning a systematic literature review (SLR).

The widest possible range of sources was accessed to capture information. The general sources used were electronic databases (on the Internet), professional networks, and organizations with literature collections or libraries [23]. The databases used in this study included Science Direct, Google Scholar, Scopus, Web of Science, Wiley, and Springer Link. We found 2010 articles, although not all talk directly about the link between biodiversity conservation and social forestry. We focused on international and national scientific publications, books, and laws and regulations relevant to the topic. These papers were selected to extend the review boundaries to ensure good coverage of the target sectors. Relevant studies included community involvement in SF, fragmentation changes to animal habitats, and forest management. Afterward, the selection criteria were defined to select eligible studies. The 252 papers that passed the criteria were collected, and essential data were extracted in response to the research questions, namely (a) social forestry (50%), (b) biodiversity (35%), and (c) correlation between SF and biodiversity (15%).

The stages used in writing this manuscript included reviewing the literature on social forestry practices in Indonesia and the challenges in biodiversity conservation, and analyzing the relationship between social forestry and biodiversity conservation, in an

effort to encourage communities to act more effectively as forest resource managers and promote better conservation practices [24–27].

3. Social Forestry Practices in Indonesia

In contemporary forest governance, decentralized management is one of the most common approaches [28–30]. It provides greater opportunities for managers at the local level to be involved in decision-making, implement policies, and evaluate outcomes related to forest management, and it can induce local communities and related stakeholders to preserve forest areas in order to obtain environmental and economic benefits [31,32] and reduce social conflicts within the community [10,17]. SF in Indonesia is a form of decentralized forest management that has become a state technology through the transfer of certain rights and responsibilities to user groups around forest areas [17,33–35]. The transfer of rights and responsibilities influences the objectives, implementation, and outcomes of modern SF. This is in contrast to conventional forest management, which we call traditional social forestry, and Wiersum, called community forestry (CF). This was widely developed long before the state technology was launched and was based on local and indigenous knowledge. Despite the different development processes, both systems have contributed significantly to forest conservation efforts and community welfare in Indonesia.

3.1. Success Stories of Traditional Social Forestry Practices

The diversity of traditional knowledge systems and practices of forest management reflects environmental conditions and the social, economic, and cultural characteristics of communities in retaining their knowledge [36,37]. The relationship between humans and the environment is always dynamic, and in managing the surrounding environment, we consider the typology of land resources [38–40], which includes plant variation, structure, and composition based on their adaptability to the environment [41]. Some of the features of the traditional system that make it stand out and that differentiate it from modern social forestry practices are as follows [37,42]:

- Keeping the land productive for future generations is the main goal;
- The relationship between humans and the environment is not separated, using knowledge, ideas, and techniques;
- Cultural identity is well maintained;
- Reciprocity becomes the key aspect of a profit-sharing system;
- Although these practices may be involved in market exchange with product flows from the land, the fundamental productivity of the system itself is not seen as capital to be exchanged.

Indonesia has many indigenous forest management practices that provide both economic and ecological benefits. Some indigenous practices are in the form of natural forest conservation, and such forests are referred to as customary forests and agroforests. In Sumatra, customary forests are managed by many ethnic groups. A well-known local term is “rimbo larangan” or prohibited forest. This is a certain natural forest unit that is guarded and maintained as permanent forest for hydrological preservation. Rimbo larangan can be found throughout Sumatra Island [43–49]. Complex agroforests that resemble natural forests are also built and maintained, as a result of previous shifting cultivation activities. This traditional agroforestry system generally consists of various fruit trees, wood-producing trees, and non-timber forest products for household and commercial purposes.

In Sulawesi, a local community conservation area called Pangale functions as a protected area, mostly located on the top of a mountain or at a slope above 40° to prevent erosion and landslides [50]. In Bali, the concepts Tri Hita Karana, Tri Mandala, Terasering, Subak, and Nista Mandala lead to the equitable use of regional space through good supervision to create harmony between utilization and conservation. Bali has become a model for landscape management, where the social and cultural structure acts as an instrument of control [51,52].

In Eastern Indonesia, the Mamar system on Timor Island [53,54] and Kaliwu on Sumba Island [55] are examples of successful indigenous practices. The economic contribution of the Mamar system on Timor Island ranges from 77.74%–78.99% [56], whereas Kaliwu developed with agroforests contributes 46.88% to farmers' income [57].

From the traditional social forestry system in Indonesia, the world can learn how communities consider sustainability and integration in their approach to ecosystem management [58–60]. A good understanding of soil conditions to determine the most suitable planting location, along with good tree maintenance resulting in high growth rates, are considered as parts of sustainable land management practice, particularly in the tropics [61–63].

3.2. Success Stories of Modern Social Forestry Practices

In Indonesia, there are several success stories of social forestry, including its success in preventing deforestation, alleviating poverty around forests, and increasing food security, and as a way to achieve economic recovery after the COVID-19 pandemic. We describe these success stories as follows.

3.2.1. Social Forestry to Prevent Deforestation

Deforestation is one of the main problems of forest management in Indonesia, a tropical country with one of the highest rates of deforestation during 2001–2016 [64] and the highest primary natural forest loss [65]. In fact, the country realized that deforestation has a negative impact on forest resources as well as on human well-being [66]. Such deforestation is alarming for global biodiversity conservation due to the development of agriculture, mining, and infrastructure, and the occurrence of forest fires [64].

During 2001–2016, deforestation occurred due to changes in land use for palm oil plantations (23%), grassland/shrubland (20%), small-scale agriculture (15%), timber plantations (14%), small-scale mixed plantations (7%), and large-scale plantations (7%) [67]. These figures closely correspond to previous estimates of smallholder agriculture in Borneo [64] and Indonesia [68] based on limited land access for local communities surrounding forest areas. Local communities legally manage only 4% of forests that are managed by forest companies [69]. Meanwhile, local communities are strongly dependent on forests to meet their daily needs [70]. The limited land access has led to communities utilizing forest resources without legal permits. This initiated an increase in the use of the social forestry approach to involve local communities in forest management [71].

In order to decrease deforestation, several actions should be taken, including adopting better land-use planning and conservation methods that incorporate information on drivers of deforestation and predictions of future deforestation [67], giving access to communities [71], encouraging partnerships between communities and forestry business entities [18,72], and implementing agriculture certification schemes [73].

There are facts and findings showing that SF programs can prevent forest encroachment, degradation, and deforestation. VF schemes can reduce deforestation in forests allocated for watershed protection and limited timber harvesting [74]. FP schemes can significantly reduce forest encroachment and improve community livelihoods by applying agroforestry techniques and planting multi-purpose tree species in the concession areas [75]. Subsequently, better management in protected areas could potentially prevent deforestation or improve forest regrowth [76]. Importantly, SF programs should never be developed on moratorium peatland or primary forest areas. These policy options have decreased deforestation significantly since 2018, and during 2018–2019 and 2019–2020, the deforestation rate was recorded at 465.5 thousand and 116.9 thousand hectares, respectively. This indicates that Indonesia has a proper forest policy [9].

3.2.2. Social Forestry to Eliminate Poverty of Surrounding Forest Communities

Forest management has the potential to support food security, overcome poverty, and reduce deforestation [77–79]. Research results from various locations in Indonesia show that there are many obstacles to implementing SF [80–83]. However, SF is expected to

contribute to overcoming the poverty of forest communities. The concept of poverty used in this paper refers to a structural definition of poverty where poverty in the communities around forests is caused by low access to resources in general, especially in the terms of surrounding forests, so that people do not have choices and opportunities to fulfill their minimum basic needs for a decent and developed dignified life [84–88]. Although SF implementation has not fully resolved the problems in forest management [89,90], there has been success with regards to the improved welfare of forest communities.

The SF program is a pathway for forest communities to achieve prosperity legally (socio-legally) under the Ministry of Environment and Forestry Regulation No. 9/2021 on social forestry and socio–juridical matters [91,92]. The SF policy made a positive contribution and became an alternative for poverty reduction. Approximately 48.8 million people live around and within state forests, among whom 10.2 million are categorized as poor, and 71.06% depend on forest resources for their livelihood [93].

SF implemented in clusters leads to growth in the center of the domestic economy to create employment opportunities. The commodities produced are based on the respective region's potential, so they could fill national and international markets under the social business system. SF also positively impacts village development index (IDM) scores on social, economic, and environmental indicators and significantly reduces poverty rates [82,93,94].

Agroforestry implementation using a CF scheme in West Lampung significantly increased farmers' income by 66%, putting 93% of them in the prosperous category. In another case, the CF scheme developed in Kulon Progo, Yogyakarta Province, increased farmers' income by 6.4% in production forests and 4.8% in protected forest, for an average land tenure of 2947 m^2. Agroforestry involving the VF community association contributed 41.32% to household income and employment of 2.39 people/hectare. In the Parungpanjang Special Purpose Forest Area of West Java, an SF scheme of forest partnership recognition with an agroforestry pattern contributed 15.8% of the total household income of farmers [95–98]. A CF scheme in Sungai Buluh Nagari Forest, Padang Pariaman, contributed 30.7% to the economy [81].

Subsequently, harvesting under the CPF scheme in Muna Regency had profit sharing of 5% for smallholders plus 28% for cooperative members. Thus, if smallholders were also members of cooperatives, they received 33% in total. There was also a 10% share for social funds from financing. Smallholders who were cooperative members planted teak as the main crop, and for the first three years, they could use the space between teak trees for intercropping [99].

Some studies have shown that SF has not significantly impacted business growth due to several factors, including limited land use, regulatory restrictions, and low entrepreneurial capacity. Some other issues are that SF has not been integrated with village programs, there is a lack of capital, and utilization of forest product processing technology is limited [100]. In addition, there are also concerns that the SF program in Indonesia will not have an impact on poverty alleviation, but instead the subsistence economy will continue [25,101].

From the presentation above, social forestry has a positive impact on rural communities' economic income, although it is not optimally reached. Therefore, more efforts are still required to increase the positive impact of SF, including by diversifying tree crops and providing training on capacity building to optimize land management.

3.2.3. Social Forestry as a Basis for Increasing Food Security

Indonesia's population continues to rise, and thus requires more food in terms of both quality and quantity. However, the limited land resources are an inhibiting factor that threatens food sovereignty [102,103]. The SF program is expected to contribute to the social economy of communities, including by fulfilling their food needs. Food security is the condition of fulfilling the food needs of the country. Food security is defined as food in sufficient quantity that is safe, of good quality, nutritious, and diverse [104–110]. VF schemes have contributed significantly to fulfilling daily community food needs. For

example, in Latuppa Village, Mungkajang Sub District, Luwu Regency, the local community collects NTFPs such as sugar palm, bamboo, honey, nutmeg, and candlenut [111].

CPF schemes have also become a new source of national food production, as food crops can be grown among forest trees. Several studies have shown that CPFs have potential as a new resource for food security [112–117]. In some CPFs, food crops are planted by selecting shade-tolerant varieties, applying several land management principles, utilizing reservoir technology to store rainwater, and integrating crops with livestock by utilizing plant litter for feeding. Hence, CPF significantly contributes not only to economic improvement, but also to forest ecology.

Several studies on customary forests indicated that communities have the capability to manage natural resources for their food security, as well as for environmental services [118]. They can also develop seasonal food crops to meet their daily food needs. According to their understanding, communities can manage their environment as well as maintain their food security. Another SF scheme is FP, which also has positive impact on increasing the income of the community [119,120].

Based on the above, most SF schemes use agroforestry (AF) by intercropping forest trees, fruit crops, and food crops to meet community food needs. Another AF model is silvopasture, which is commonly developed in semi-arid zones, such as East Nusa Tenggara, which has a very long dry season of 8–9 months. Silvopasture comprises a set of practices that combine crops and/or animals and trees within the same area. Farmers have developed silvopasture that fosters a symbiosis between grazed livestock and the forest as a feed provider, while assuring that the forest remains sustainable and livestock increase production [121]. It is expected that through silvopasture systems, meat self-sufficiency as a part of food security can be realized. Data from BPS [122] revealed that the silvopasture model implemented on Timor and Sumba Islands, East Nusa Tenggara Province, produces 13,166.45 tons of meat per year. From an economic perspective, a model of agroforestry with silvopasture (agro-silvopasture) based on dairy farming was shown to have greater profit (B/C ratio of 1.77) than intercropping seasonal crops with vegetables and secondary crops [123].

3.2.4. Social Forestry for Economic Recovery after the COVID-19 Pandemic

The COVID-19 pandemic that hit Indonesia in March 2020 has had a negative impact on the national economy. Six business sectors were significantly affected by the pandemic: accommodation, food, and beverages; trading; transportation and warehouses; construction; processing industries; and other services [124]. A recent study revealed that the pandemic has had a significant effect on farmers' incomes, reducing them by 38.45%, and has caused difficulty in marketing agroforestry products [125]. COVID-19 also lowered the targets for SF. At the national level, until the end of 2020, only 600 thousand hectares had been achieved, or 1 million hectares less than in 2019 (1.6 million hectares) [9]. At the local level, the Forestry Service of West Sumatra Province was forced to shift the budget for the SF program in 2020 from IDR 2.59 billion to IDR 1.14 billion to handle the COVID-19 pandemic [126].

COVID-19 has affected farmers' activities [127]. There are contradicting responses of farmers based on their status (agriculture as primary income or additional revenue) and their access to other sources of income free from COVID-19-prohibited activities. The COVID-19 restrictions have affected men and women differently [128]. In Thailand and Indonesia, women are more affected than men regarding livelihood and food security. In all countries, women have a greater work-load than men due to schooling their children at home and maintaining family health. The cultural aspects are determinant factors. Farmers who live simply and plant food commodities are more resistant than those who plant other types of commodities or have a lower class income [127]. Social forestry has strengthened livelihood communities by optimizing several assets, such as human, social, nature, financial, and physical assets [128]. These assets contributed greatly to community resilience during the early stages of the COVID- 19 pandemic.

In order to recover the national economy in the post-pandemic period, MoEF has applied several important actions, one of which is enhancing the role of communities and their access to agroforestry-based forest resources through SF activities such as CFP and FP. A'dani et al., [127] proposed strategies for farmers to survive in the COVID-19 situation by selling a more significant proportion of their yields because the harvested product prices decreased, looking for other jobs outside the agriculture sector, taking more from their stocks and local granaries and also registering for government assistance funds, such as direct cash and non-cash government aids, and a social safety net.

To improve farmers' incomes, SF should include recommendations for micro, small, and medium enterprises (UMKM) [129], such as finding appropriate technologies, providing good service, and paying attention to the quality of products or goods. In addition, trade should be conducted through e-commerce, digital marketing should be adopted, additional services should be provided to consumers, communication with consumers should be optimized, saleable products should be kept, and existing customers should be maintained. It was also recommended to create new activities for fulfilling daily needs and increasing the productivity of land [126]. Further, SF also offers alternative solutions to problems related to limited capital and market access, and limited human and institutional capacity [130].

4. Biodiversity Conservation Challenges

Forest ecosystems are home to many different species, therefore, the existence of forests is crucial to their sustainability [131]. Forests are among the most valuable ecosystems in the world, containing over 60% of the world's biodiversity [132]. Indonesia has 120 million hectares of forest area, accounting for 64% of the entire land area. Forest areas are managed according to three functions: there are production forests (68.8 million hectares), conservation forests (22.1 million hectares, with an additional 5.3 million hectares of marine conservation areas), and protection forests with watershed functions (29.6 million hectares) [18].

As a megadiverse country with a high number of endemic species, Indonesia is more vulnerable than other Southeast Asian countries due to the high numbers of threatened species and invasive alien species, as well as deforestation and habitat loss exacerbated by poaching and illegal trade, leading to degradation of biodiversity [133]. Deforestation has a significant impact on increasing fragmentation [134,135].

Based on land use, it is estimated that 57% of deforestation in Indonesia is generally caused by oil palm plantations and another 20% by the pulp and paper industries [136,137]. The conversion of forests to grassland/shrubland is the second largest driving factor, contributing 20% (90% CI 16%–24%) of nationwide deforestation [138]. The expansion of small-scale agriculture and small-mixed plantations together accounted for 22% (90% CI 18%–25%) of national deforestation [64].

4.1. Habitat Loss, Fragmentation, and Degradation

Deforestation in Indonesia represents one of the highest rates of primary forest loss in the tropics [65]. Most of the deforestation has been caused by the conversion to agriculture, and as a result lowland forests have disappeared faster than hill/montane forests, and forests on gentle slopes have disappeared faster than forests on steep slopes [139]. The conversion of forests to agriculture has led to habitat loss, creating edge effects and fragmenting the core habitats of large animals such as tigers, rhinos, and elephants [139]. Agricultural expansion has had a tremendous impact on habitats, biodiversity, carbon storage, and soil conditions [133]. Agriculture is mainly expanding in the tropics, where it is estimated that about 80% of new croplands are replacing forests [140]. This expansion is worrisome, given that tropical forests are rich reservoirs of biodiversity and key ecosystem services [141].

The consequences of deforestation include habitat degradation and loss of biodiversity, the impaired regulation of water quality and quantity, air pollution, and emissions of climate change-inducing greenhouse gases (GHGs) [133]. Consequently, forest fragmentation results in the increased isolation of forest patches associated with quantitative measures

of fragmentation and forest compactness [142,143]. These activities have also led to the destruction of forest biota and the loss of suitable habitats for sensitive species [144]. They have also increased competition among common species [145] and the genetic isolation of subpopulations [146]. Fragmentation is also one of the main factors triggering the loss of forest landscape biodiversity [147]. Along this line, fragmentation represents a threat of biodiversity loss [148] for some species; for example, *Macaca ochreata* in Southeast Sulawesi and *Tarsius pelengensis* on Peleng Island in Central Sulawesi have lost the most habitat (14%), followed by *M. hecki* and *M. tonkeana* [149].

Forest degradation and fragmentation are the most influential factors in species extinction and destroy the balance of ecosystems. When an island's habitat area decreases or isolation occurs, the number of species living there also decreases [150]. Habitat loss and fragmentation have long been considered the primary causes of biodiversity loss and ecosystem degradation worldwide [151]. Most tropical deforestation is driven by an increasing demand for land, not an increasing demand for timber. Agricultural expansion, palm oil plantations, and infrastructure development, such as road building and mining, contribute more to deforestation than logging does [152–154].

Maintaining biodiversity in human-affected areas requires a substantially increased understanding of the importance of landscape structures and their dynamics. The response of biodiversity to land use intensity is determined by forest availability and quality; species richness decreases when forest cover falls below 40% and when forest patches contain < 50% undisturbed forest. Identifying relevant landscape characteristics for biodiversity conservation on agricultural land paves the way to defining management policies for the reconstruction of sustainable landscapes, which will help reduce biological erosion by complementing the existing networks of protected forest areas [155].

Biodiversity loss can be reduced by maintaining forest quality in heavily deforested landscapes or large areas of forest cover in areas where forests have been extensively degraded. Anthropogenic landscapes with high-quality forests covering >40% of the surface area may have significant potential to offset biodiversity loss. However, this does not justify the development of agriculture in forest areas that are still intact [155].

The risk of extinction of isolated populations due to fragmentation can be minimized by increasing immigration rates by establishing suitable habitat corridors between habitat patches. Connecting habitat patches with corridors will slow the rate of species extinction and preserve species richness for a longer period of time compared to disconnected patches of habitat [156]. Deforestation significantly impacts large carnivores that depend on large tracts of interconnected forest habitat and are sensitive to human activities [157]. Therefore, it is predicted that predators will be more susceptible to fragmentation due to their greater mobility and smaller population size [156].

One million species on Earth became extinct in the last three years, with the agricultural and fisheries sectors making the biggest contributions to the loss of biodiversity due to excessive use of pesticides, but it turns out that pests are increasingly resistant and species going extinct are other species of wildlife that can damage the food chain [158]. The IUCN and ICBP Red Data Books state that in Indonesia, 126 birds, 63 mammals, 21 reptiles, and 65 other animal species are now threatened with extinction. Other data show that 383 endemic mammal species remain from 720 species, 231 endemic reptile species (32.0%) from 723 species, 656 endemic butterfly species (34.5%) from 1900 species, and 323 endemic birds species (20.1%) from 1605 species [159].

4.2. Conservation in the Era of Decentralization

Protected areas, such as conservation forests, in developing countries face several issues, including a decentralization trend [160,161]. This is because local and regional governments have viewed protected areas within their districts as obstacles to local revenue generation [162]. It is widely reported that decentralization triggers efforts by local governments to exploit the remaining forest resources regardless of their status, with the objective of earning short-term revenues either through timber cutting or by converting

forest areas into agricultural plantations or protected forest into production forest in order to increase regional income from logging permits [162].

A study of deforestation patterns in a protected area in Borneo, Indonesia, found that during 1985–2001, the study area lost 56% of its forest cover, mostly due to timber logging and oil palm plantations. The study attributed the accelerating deforestation rate to the forestry decentralization reform of 2001. This makes sense, because the reform allowed local governments (districts) to issue small logging parcels, which caused uncontrolled harvesting of remaining accessible lowlands [161,163]. In conclusion, decentralization and democratization in forest management have proven to be inadequate for dealing with the direct drivers and underlying causes of deforestation and forest degradation [164].

4.3. Biodiversity Conservation in Production Forests

In Indonesia, 57% of the forest area is production forest, which has an important role as a repository of biodiversity [18]. Thus, it is very important to sustainably manage the abundance of biodiversity in production forests beyond boundary protected areas. In many countries, the large size and diverse habitats of production forests offer opportunities to complement the existing conservation area system [165].

To maintain sustainable production and to protect biodiversity in production and protection forests, the Indonesian government has implemented various policies and techniques for managing forests as forest management units [9]. On the technical side, several silvicultural systems have been implemented, such as Indonesian selective cutting (TPI), which was refined to Indonesian selective cutting and planting (TPTI) and finally improved to Indonesian selective cutting and intensive planting (TPTII) [166]. These systems led to logging in all types of forests, which could eventually have a negative impact on forest biodiversity [165]. The government has also implemented a system to reduce the impact of logging in concession forests outside Java [167,168]. However, such systems cannot be controlled, so they have an impact in terms of significant alteration of forest structure, reduced biomass, loss of carbon storage, and reduced biodiversity [169].

In fact, production forests comprising primary forest provide habitats for many wildlife species [165]. Thus, it is recommended that sensitive areas, steep slopes, riparian corridors, and buffers along waterways and aquatic systems be maintained for conservation. In addition, it is also necessary to leave snags for nesting cavities, leave the main food sources, and provide favorable conditions for the regeneration of harvested tree species [165]. The government of Indonesia has established local protected areas in production forests [170], high-conservation-value forests [171], germplasm conservation areas, wildlife corridors, animal refuge areas, and buffer zones [9].

Indonesia implemented a policy regarding sustainable production forest management certification (PHPL) in 2000 and has made continuous improvements. The current policy regarding natural forest certification is based on the Ministry of Environment and Forestry Regulation No. P.95/Menhut-II/2014 [172]. Among the criteria for sustainable forest management are the maintenance, conservation, and appropriate enhancement of biodiversity in forest ecosystems. For concession forests, the regulation must be implemented at the landscape, ecosystem, species, and genus levels in accordance with the management plan [173]. However, Ministry of Forestry Regulation No. P.33/Menhut-II/2010, concerning the conversion of convertible production forest for other land use activities, was partially stipulated for the benefit of the people's economy and prosperity.

4.4. Biodiversity as a Provider of Ecosystem Services

Recently, human dependence on ecosystem services for earning a livelihood and adapting to global change has become an important concern in environmental policy and ecosystem management [174,175]. Ecosystem services and biodiversity are intrinsically related, as biodiversity contributes to the processes that facilitate the formation of ecosystem services and can be assessed directly by humans [176]. Biodiversity is also considered as a final ecosystem service due to its direct contribution to several goods and values (at the genus

and species levels). Many components of biodiversity have cultural value, including the appreciation of animals and beautiful places, as well as spiritual, educational, religious, and recreational value [177,178]. The value of goods and services produced from ecosystems can support and improve human well-being [179–181]. Subsequently, ecosystem services are economic and ecological products [182]. The management of conservation-based ecosystem services is related to their role in supporting functions such as carbon sequestration, controlling public health, developing geothermal energy, and providing ecotourism and as a controlling factor for hydrological systems. Ecosystem services can be divided into four categories: provider, regulator, cultural, and support services [178,180,181].

In spite of its importance, efforts to protect biodiversity face challenges, especially in the current conditions with people living without national borders [183]. Diversity can decrease due to the intervention of human activities that cause the loss of native habitats, and habitat fragmentation and other domino effects can follow, such as population pressure, overexploitation, the introduction of exotic species, pollution of water, soil, and air; and climate change [184]. To prevent further diversity loss, a strategic approach is needed to manage biodiversity as a provider of ecosystem services that can be carried out through the three following activities: protecting life support systems, preserving the diversity of plant and animal species and their ecosystems, and promoting the sustainable use of natural resources.

Although attempts have been made to increase awareness of the link between biodiversity and environmental services, on a regional to global scale, an understanding of their relationship still needs to be developed systematically with equivalent methods [185].

4.5. Impact of Illegal Hunting and Illegal Trading on Biodiversity

Illegal hunting and trading cause the highest biodiversity loss and extinction, especially for mammals, birds, and some other species groups [186]. Animals are hunted because they are considered as pests in agriculture. Animals are also traded as pets, and their body parts (e.g., meat, bones, teeth, eggs, scales, skulls, horns, tusks, skin, or fur) are sold for products, medicinal remedies, luxury foods, and accessories [187,188]. Mostly, these wildlife trading activities include illegally harvesting threatened species, facilitating transportation, avoiding taxes or other regulatory mechanisms, and other criminal pursuits that are often ignored or unnoticed [189].

The wildlife trade is worth billions of dollars annually [190]. The illegal trade of flora and fauna (other fisheries and timber) in the world was estimated at USD 7–23 billion, including USD 2.5 billion in East Asia and the Pacific, while the value of the illegal trade of wildlife in Indonesia is 1 billion per year [191]. This value was determined from illegal hunting and trade of wildlife such as *Manis javanica*, *Buceros vigil*, *Panthera tigris sumatrae*, *Elephas maximus*, *Rusa unicolor*, *Helarctos malayanus*, *Pongo pygmaeus*, *Elephas maximus*, *Hystrix* sp., and others [192–194].

WWF-Indonesia stated that 85% of the animals being traded came from nature and were victims of illegal hunting [195]. As an example, illegal hunting and the trade of pangolin (*Manis javanica*) during 2002–2015 was 31,564 individuals, but only about 10% of trafficked individuals were confiscated; in total, the population of pangolins that were illegally traded and exported was 315,460 individuals [196]. The demand from China is about 100,000 to 135,000 pangolins per year [197], supplied from Indonesia and Malaysia [198].

Communities surrounding forests are generally in poorer conditions, so they rely on the income from traded animals and body parts for subsistence and to feed their families. This condition has been exacerbated by population growth, increased connectivity to markets, commercialization of luxury goods, and better technology to catch and sell wildlife parts [186]. This anthropogenic pressure affects wildlife, to the point where some species are threatened and on the edge of extinction [199].

5. Linking Social Forestry with Biodiversity Conservation

SF in Indonesia adopts the community-based forest management (CBFM) concept [200], a new paradigm that considers the social aspect [16] and shifts the approach from timber-

based to forest resource-based management and from state-based to community-based [201]. A study proved that community forestry has an important role in biodiversity conservation. Biomass, carbon stock, growing stock, soil organic carbon, forest cover, forest products, and forest resource benefits improved due to community forestry implementation [202]. There is abundant proof of a relationship between community forest management rights and the amelioration of forest circumstances in South Asia, East Africa, and Latin America. It has also been proved that the influence of the tenure variable can be extrapolated across landscapes, countries, and regions since it likely to have similar effects in different socio-cultural and political–economic conditions [203]. This verifies that implementing SF has a strong positive correlation with biodiversity conservation.

5.1. W1H Questions on Social Forestry Must Address Biodiversity Conservation

Linking SF with biodiversity conservation can be explained through the five Ws and one H question (why, when, where, who, what, and how). The answers to these questions provide significant insights into the interrelationship between SF development and biodiversity conservation in Indonesia. Furthermore, some challenges in biodiversity conservation efforts in relation to SF development are discussed.

5.1.1. Why Must Social Forestry Be in Line with Biodiversity Conservation?

Social forestry is a forest management system that places local or traditional indigenous communities as the main actors, aiming to improve community welfare, environmental balance, and sociocultural dynamics [4,9,101]. Improving the environmental balance means conserving and enhancing biodiversity. SF has three key principles: attempt to grant forest management rights to local communities, support livelihoods, and achieve conservation outcomes [17]. The advantages of SF include resolving land tenure gaps and expanding access to empower communities to act as effective forest resource managers in order to improve the condition of the forest [17,25]. Improvements in forest conditions are measured by growth and biodiversity indicators [25]. This confirms that SF must be in line with biodiversity conservation.

Many studies have shown that as an integrated land use system combining tree and crop species, agroforestry directly increases plant diversity, because the cultivated tree and crop species vary based on use, need, and benefits for households [204–206]. Agroforestry systems can regenerate and multiply fauna populations and diversity compared to monoculture systems [207,208]. Many studies have reported on the increased biodiversity induced by agroforestry in temperate and tropical regions [209–211]. In conclusion, to support biodiversity conservation of degraded forests in SF areas, the management of SF should apply an agroforestry pattern.

5.1.2. When Does Social Forestry Meet Biodiversity Conservation?

SF has many advantages in adopting agroforestry systems. First, agroforestry systems can maintain the availability and sustainability of water sources [212]. Second, they serve as a remedy to environmental and livelihood problems. Finally, agroforestry addresses the challenges of food security, poverty alleviation, environmental services, climate change, environmental integrity, and smallholder collective action [213].

Conservation agriculture with trees (CAWT) integrates conservation agriculture and agroforestry into one approach. Factors that significantly affect farmers' adoption of complex conservation practices are training, labor size, land size, and market access [214]. Adopting a "climate-smart village" approach to SF would increase the capability of smallholders to address land degradation and adapt to climate variation. This approach also promotes participatory land management practices, sustainable resource management and institutional organization, community empowerment, and food security [215].

SF implementation should include agriculture certification schemes that not only prevent deforestation, but also improve forest restoration, which is important to prevent biodiversity loss [73]. Agroecology in SF implementation can reduce the ecological impact

on agriculture development. It decreases GHG emissions, biodiversity loss, pollution, soil loss and degradation, pollinator decline, and human health risks [216]. Retention forestry can be applied in SF implementation to improve the performance of CPF and biodiversity conservation [217].

5.1.3. Where Should Social Forestry and Biodiversity Conservation Be Applied Together?

SF and biodiversity conservation should be applied together both inside and outside forest areas. Within forest areas, SF is applied in production, protection, and conservation forests under VF, CF, CPF, and CF schemes. Outside state forest areas, forests on privately owned land are managed by the rights holders as private forests [218] or customary forests [13,219]. Social forestry schemes for various forest functions can be seen in Table 1.

Table 1. Social forestry schemes for various forest functions.

Forest Function/Type of Utilization	Scheme of Social Forestry					
	Village Forest	Community Forest	Community Plantation Forest	Customary Forest	Forestry Partnerships	Private Forest
Production Forest						
• utilization of wood products • utilization of forest area • environmental services • utilization of non-timber forest products (NTFP)	√	√	√	√	√	x
Protection Forest						
• utilization of forest area • environmental services • utilization of NTFP	√	√	x	√	√	x
Conservation Forest						
• collection of NTFP • traditional cultivation • traditional hunting of unprotected species for urgent purposes of custom and daily needs • traditional use of limited water resources for unprotected species • limited nature tourism	x	x	x	√	√	x
Areal for other purposes	x	x	x	√	x	√

Source: Government Regulation No. 23/2021, Ministry of Environment and Forestry Regulation No. P.9/2021, and Director General of Conservation of Natural Resources and Their Ecosystems Regulation No. 6/2018.

Production forests are relatively flexible for SF, because people can take advantage of timber and non-timber forest products and other environmental services. SF programs in protected forests must be related to the forest function so that ecological and economic goals can be achieved. In addition, business activities can be developed such as water flow services, water utilization, nature tourism, and biodiversity protection. However, these activities should be executed carefully because they can influence biodiversity [101].

Since 2018, there has been a reform of the SF policy in Indonesia, which enables SF in conservation forests through conservation partnership schemes. Conservation forests are the last locations chosen for SF, because they have high biodiversity [14,220]. A conservation forest is forest area with certain characteristics, the main function of which is to preserve the diversity of plants and animals and their ecosystems. Conservation partnership involves providing access and encouraging cooperation between permit holders in conservation areas with the local community [221].

Private forests with mixed gardens have high biodiversity value [222]. Private forest farmers using subsistence farming tend to maintain plant diversity by developing agroforestry cropping patterns and selective harvesting systems [223]. The Director General of the IUCN stated that as much as 80% of the remaining biodiversity of forests worldwide is within the territories of indigenous peoples, and biodiversity thrives in the care of in-

digenous communities (IUCN 2019). Therefore, customary and private forests have an important role in maintaining biodiversity.

5.1.4. Who Should Be Involved and Responsible?

The entities involved in and responsible for SF that should pay attention to biodiversity conservation are governments and recipients of legal rights in the form of SF management approval. National and local governments must always take into account biodiversity conservation, especially in relation to the objectives of SF management. The recipients of management permits must always make efforts to conserve biodiversity and be responsible for germplasm preservation. In SF implementation, related stakeholders need to be involved in planning from the beginning, setting the licensing proposal, field implementation, and monitoring [224].

Moreover, biodiversity conservation efforts must consider the community's need for natural resources [165] and the level of education of forest communities [225]. It is expected that communities can earn income for their daily needs, apart from forest management and conservation [226,227]. Knowledge of local communities plays an important role in biodiversity conservation [228,229]. Therefore, in order to increase the success of SF programs, cooperation among all related stakeholders, including government institutions, research institutions, non-government organizations, private sectors, communities, and individuals, is very important.

SF schemes are determined according to the field situations related to the physical–environmental conditions of the forest areas and the control and use of forest land by the community. The relationship between SF schemes, legal subjects for management, and forest area types is presented in Table 2.

Table 2. Legal subjects granted access to manage forest area in various schemes of social forestry.

Social Forestry Scheme	Legal Subjects	Objective/Specification
Village forest (HD)	Village council	Village welfare
Community forest (HKm)	Individuals, forest farmer groups, joint forest farmer groups or local community cooperatives	Community empowerment
Community plantation forest (HTR)	Forest farmer groups, joint forest farmer groups, forest farmer cooperatives, forestry professionals or individuals	Increase potential and quality of production forests by implementing silvicultural system
Customary forest (HA)	Customary law community	Grant forest management rights to customary law communities
Forestry–conservation partnership	Holders of licenses for forest utilization or approval for the use of forest areas with partners/community	Cooperation in forest management between communities and permit holders

5.1.5. What Must Be Harmonized in Social Forestry and Biodiversity Conservation to Achieve Common Goals?

The success of SF programs is not only measured by indicators of improved community welfare and social and cultural dynamics, but also by their ability to integrate the conservation of biodiversity in accordance with the function of the forest where the programs are implemented. Furthermore, the planning of SF activities is developed based on initiatives, knowledge, and policies [15,16], and in general its management is under the supervision of the government. However, SF implementation can have an impact on changes in forest functions and community livelihoods due to increased community mobility and migration [230,231]. The impacts of these changes include the cultivation of commercial crops and an increase in non-agriculture activities [17]. The social changes can alter the communities' perceptions of the role and value of ecosystem services in terms of biodiversity [232].

Minimizing the negative impact and integrating SF activities with biodiversity conservation forms the pillar of sustainability [233–235]. All activities of forest resource utilization must be based on the principle of conservation for the sustainability of the program [184]. Programs and activities should be implemented to achieve the common target of SF and biodiversity conservation:

1. Spatial planning

Space or land use planning is the initial activity before SF implementation. Planning is an important, systematic assessment of land to obtain alternatives and best options for land use in order to meet human needs while preserving biodiversity. Land use patterns must be adapted to the spatial planning based on the potential biophysical conditions of the area.

2. Governance

A good governance system with the support of related stakeholders is needed to monitor and evaluate SF activities in order to equitably and sustainably maintain the existence, function, and distribution of forest benefits.

3. Improved conservation-based programs and activities
    a. Conservation management: This is aimed at managing the risks and pressures of community activities so that the community can utilize the surrounding natural resources optimally without destroying them.
    b. Endangered wildlife conservation: Knowledge should be disseminated to the surrounding community by providing education on the protection and preservation of endangered animals.
    c. Community outreach: This involves programs through which the community is invited to participate directly in conservation efforts by emphasizing the potential of the surrounding nature.
    d. Monitoring and evaluation: This is a control tool that includes security and supervision activities. The goal is to conserve nature and protect it from human influence.

5.1.6. How Can the Benefits Be Obtained by Both the Community and Biodiversity Conservation?

SF provides benefits to both communities and biodiversity conservation in various ways, such as the optimization of land use and activities and environmentally friendly business activities. Land use can be optimized through a trade-off between SF and biodiversity conservation. To improve livelihoods, the community can also plant various trees (agroforestry system) for biodiversity conservation [236]. VF schemes in Sumatra and Kalimantan have shown achievements in avoiding deforestation [79], and CF has a positive impact on increasing forest cover [237].

Forest ecosystem management has a strong relationship with local communities, where forests act as a life-support system. Human activities in forests often become a main driver of deforestation and degradation [238]. Meanwhile, local communities have logged forests excessively due to a lack of knowledge of sustainable forest management (SFM) techniques. Therefore, managing forest ecosystems is not merely about how to achieve SFM [239], but also how to improve people's welfare by providing ecological and socioeconomic benefits [177].

By developing environmentally friendly businesses such as ecotourism, carbon offsetting, and payment for ecosystem services, local communities can generate an income without destroying the forest [240]. These businesses are in line with efforts to maintain and conserve biodiversity, even though they still face social and cultural barriers [101].

5.2. What Are the Challenges Ahead?

The long history of SF implementation in Indonesia has not been as smooth as expected. It will certainly have a significant impact on biodiversity, for example, on the habitat of the Javan leopard (*Panthera pardus melas*), where 50% of the population is scattered in production forests and 19% in protected forests [241]. Positive environmental and social outcomes have not yet been achieved in SF implementation [242]. Indonesia's SF program, which gives local communities access to manage state forests, has not led to a reduction in overall deforestation [243]. Forest loss actually increased in village and community forests. Possible explanations include a lack of capacity and resources for communities to manage their forests, and a lack of financial incentives for them to not clear their forests. Specific investment and guidance are needed to adopt strategies that are in line with local land use

types, livelihoods, and other community characteristics, and a certain amount of training and capacity building needs to be provided [242].

Another finding from SF implementation is that facilitating post-licensing cannot be carried out and cannot be the sole responsibility of the Ministry of Environment and Forestry; it requires synergy with other ministries or institutions and must be in line with regional governments. SF programs are often viewed within the framework of the single interests of each stakeholder. There is no collaborative framework that makes it a common interest involving all parties. Although local governments support SF programs formally and legally, coordination between central and regional governments is still uncertain [220].

SF development in degraded forests using AF technology has faced many challenges, such as low capacity in farming techniques, low awareness and motivation to integrate tree or tree crop species to monoculture farming in forest areas [244], lack of farmers' trust in the government's commitment to SF implementation [245], limited financing availability, limited market availability for AF products, and limited post-harvest processing techniques and capacity [246–248]. Extension workers in the forestry business should be available to guide communities in AF practices. The provision of technology and innovation for post-harvest care and processing of perishable products can increase sales value and help the products reach a wider market [246]. Mainstreaming of AF practices in the development of SF programs needs support from the government and all related stakeholders to overcome structural barriers and limited community capacity [249].

The challenge of SF development is in finding a trade-off between biodiversity conservation and economic development. Integrating biodiversity conservation and SF means that forest lands as sources of community livelihood can be managed by local communities without damaging forest resources. It was reported that CF management is effective at avoiding forest degradation [79] and sustaining forest ecosystem services [250]. These schemes encourage local communities to manage forest areas in a sustainable way and receive economic benefits from forests. It was found that VF management has successfully prevented deforestation overall, but the performance has been increasingly variable over time, influenced by anthropogenic and climatic factors, as well as land use history [79]. An evaluation of the impact of SF in South Sulawesi Province indicated that the sustainability vision had not yet materialized; only 14% of 33 analyzed SF units contributed in terms of land cover by applying an agroforestry system, mainly by planting superior plant species [251].

Both conservation and economic benefits should be maintained and improved by issuing policies and regulations to support the best implementation of SF programs. Such policies could include providing an agriculture certification, assessing the effectiveness of SF programs, and recovering forestry businesses. The policy on agriculture certification schemes aims to halt deforestation and prevent biodiversity loss by adding a criterion for forest restoration [73]. It can be achieved by reducing encroachment by the community [236].

A policy on forest business recovery should be formulated using several actions, such as giving an unconditional cash transfer with the use of updated data, lowering the community activity limitation, revitalizing local culture through online media, and introducing rational choice investment through a comparison ratio between cost, benefit, and risk. These will promote collaboration among units of government institutions to trigger local economies through village-owned business agencies (Badan Usaha Milik Desa, or BUMDes) [252].

Another important challenge is determining how to maintain connectivity between the remaining forest fragments in order to support the life and diversity of fauna in a sustainable manner. The increased intensity of forest fragmentation increases the conflict between humans and large mammals such as big cats, elephants, and orangutans. In the future, many methods will be needed to harmonize biodiversity conservation on anthropogenic lands, such as establishing high-conservation-value areas in the middle of plantations, creating animal corridors, and educating people on how to coexist with animals.

Finally, we conclude that in general, the SF implementation shows a strong positive correlation with biodiversity conservation. However, in Indonesia so far, SF implementation

has not led to a reduction in overall deforestation. In some cases, forest loss actually increased in SF areas, whereas at other sites SF was proved to be effective at preventing forest degradation. Comprehensive efforts should be made to improve SF implementation in order to integrate it with biodiversity conservation.

6. Conclusions

Social forestry and biodiversity conservation have long been implemented in Indonesia, although they are still fragmentary due to their different objectives. Social forestry programs are generally applied in production and protection forests, while biodiversity conservation programs are mainly developed in conservation forests and essential ecosystem areas. Over time, many production, protection, and conservation forests continue to suffer deforestation and degradation, which causes a decrease in forest functions, the degradation of habitat, and the loss of biodiversity. The government has implemented various policies and taken action to control and overcome the problem of deforestation, including imposing moratoriums on new licenses in primary forests and peatlands and developing social forestry programs.

The development of SF, which is a win–win solution between socioeconomic and biodiversity conservation interests, is expected to reduce the pressure on and threat to forest areas from surrounding communities. A decrease in pressure will eventually guarantee a decrease in the speed of deforestation, or even one day can stop it. Further development of SF programs should receive support from related stakeholders, as many studies reveal that both conventional and modern SF patterns applied in Indonesia have proven to have a positive impact on the sustainability of forest ecosystems. With social forestry, forests can still function as producers of products and services while maintaining ecological processes and biodiversity.

We can conclude that it is urgent to address the problems of deforestation and forest degradation caused by many entities, including communities, and to integrate social forestry programs and biodiversity conservation in a harmonious manner. Synchronization and internalization of biodiversity conservation in social forestry implementation should be encouraged and initiated through a multi-stakeholder approach. This is essential to maintaining biodiversity, as forests potentially cover 68.8 million hectares (production forests), 29.6 million hectares (protected forests), and 22.1 million hectares (conservation forests).

Finally, the key to success in meeting the objectives of SF development with biodiversity conservation efforts is to reach a compromise between the two objectives by formulating a harmonious and balanced strategy for both. We recommend that in implementation, SF programs that provide opportunities for communities to be directly involved in forest management should be accompanied by strict warnings and regulations to ensure that forms of cultivation activities do not interfere with ecosystem functions and threaten the existing biodiversity. Therefore, SF development should be more directed at non-extractive activities through the use of ecosystem services and non-timber forest products to minimize forest damage, improve forest quality, encourage the local economy, and at the same time eliminate pressure on forest areas.

Author Contributions: All authors had equal roles as main contributors and discussed the conceptual ideas and outline, provided critical feedback on each section, and helped shape and write the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors would like to express their sincere thanks to the Directorate General of Conservation of Natural Resources and Ecosystems and the Directorate General of Social Forestry and Environmental Partnerships for providing data and information. Thanks to Riset dan Inovasi untuk Indonesia Maju (RIIM) LPDP-BRIN, Pendanaan Ekspedisi dan Eksplorasi BRIN, Rumah Program Hasil Pengungkapan dan Pemanfaatan Biodiversitas Nusantara, ORHL-BRIN; and OR IPSH-BRIN for their support. Special thanks to two anonymous reviewers for their valuable input and comments, which enriched the content of the manuscript so that it can be published.

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

References

1. Wiersum, K.F. *Social Forestry: Changing Perspectives in Forestry Science or Practice?*; Wageningen Agricultural University: Wageningen, The Netherlands, 1999.
2. Tiwari, K.M. *Social Forestry in India*; Natraj Publisher: Deharadun, India, 1983.
3. Westoby, J. *Introduction to World Forestry*; John Wiley and Sons Ltd.: Hoboken, NJ, USA, 1989.
4. Government of Indonesia. Government Regulation of The Republic of Indonesia Number 23 Year 2021 about Forestry Management. 2021. Available online: https://www.fao.org/faolex/results/details/es/c/LEX-FAOC209694/ (accessed on 3 July 2022).
5. Wong, G.Y.; Moeliono, M.; Bong, I.W.; Pham, T.T.; Sahide, M.A.K.; Naito, D.; Brockhaus, M. Social forestry in Southeast Asia: Evolving interests, discourses and the many notions of equity. *Geoforum* **2020**, *117*, 246–258. [CrossRef]
6. Putra, R.A.S.; Muluk, S.; Prayitno, H.; Taufik, A.; Salam, R.; Nugraha, R.; Tarmidzi; Ruru, N.; Sani, K. *Pembiayaan Perhutanan Sosial di Indonesia: Working Paper*; The Asia Foundation: Jakarta, Indonesia, 2019.
7. Nurbaya, S. Kebijakan Perhutanan Sosial Untuk Kesejahteraan Rakyat. Available online: https://sitinurbaya.com/artikelku/997-kebijakan-perhutanan-sosial-untuk-kesejahteraan-rakyat (accessed on 2 August 2021).
8. von Rintelen, K.; Arida, E.; Häuser, C. A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries. *Res. Ideas Outcomes* **2017**, *3*, e20860. [CrossRef]
9. Minister of Environment and Forestry. *Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 8 of 2021 Concerning Forest Governance and the Preparation of Forest Management Plans, as Well as Forest Utilization in Protected Forests and Production Forests*; Minister of Environment and Forestry: Jakarta, Indonesia, 2021.
10. Resosudarmo, I.A.P.; Tacconi, L.; Sloan, S.; Hamdani, F.A.U.; Subarudi; Alviya, I.; Muttaqin, M.Z. Indonesia's land reform: Implications for local livelihoods and climate change. *For. Policy Econ.* **2019**, *108*, 101903. [CrossRef]
11. Ditjen, P.S.K.L. *Capaian Perhutanan Sosial Sampai Dengan Agustus 2022*; Direktorat Jenderal Perhutanan Sosial dan Kemitraan Lingkungan, Kementrian Lingkungan Hidup dan Kehutanan: Jakarta, Indonesia, 2022.
12. Acharya, K.P.; Goutam, K.R.; Acharya, B.K.; Gautam, G. Participatory assessment of biodiversity conservation in community forestry in Nepal. *Banko Janakari* **2007**, *16*, 46–56. [CrossRef]
13. Moeliono, M.; Thuy, P.T.; Waty Bong, I.; Wong, G.Y.; Brockhaus, M. Social Forestry—Why and for Whom? A comparison of policies in Vietnam and Indonesia. *For. Soc.* **2017**, *1*. [CrossRef]
14. Fisher, M.R.; Dhiaulhaq, A.; Sahide, M.A.K. The politics, economies, and ecologies of Indonesia's third generation of social forestry: An introduction to the special section. *For. Soc.* **2019**, *3*, 152–170. [CrossRef]
15. RECOFT. *Current Status of Social Forestry in Climate Change Mitigation and Adaptation in the ASEAN Region: Situational Analysis 2013*; RECOFT: Bangkok, Thailand, 2014.
16. Gilmour, D. *Forty Years of Community-Based Forestry: A Review of Its Extent and Effectiveness*; Food and Agriculture Organization of The Nations: Rome, Italy, 2016.
17. Fisher, M.R.; Moeliono, M.; Mulyana, A.; Yuliani, E.L.; Adriadi, A.; Judda, J.; Sahide, M.A.K. Assessing the new social forestry project in Indonesia: Recognition, livelihood and conservation? *Int. For. Rev.* **2018**, *20*, 346–361. [CrossRef]
18. Ministry of Environment and Forestry. *The State of Indonesia's Forests 2020.*; Ministry of Environment and Forestry: Jakarta, Indonesia, 2020.
19. Tranfield, D.; Denyer, D.; Smart, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *Br. J. Manag.* **2003**, *14*, 207–222. [CrossRef]
20. Mahmud, M.S.; Zahid, A.; Das, A.K.; Muzammil, M.; Khan, M.U. A systematic literature review on deep learning applications for precision cattle farming. *Comput. Electron. Agric.* **2021**, *187*, 106313. [CrossRef]
21. Siddaway, A.P.; Wood, A.M.; Hedges, L.V. How to Do a Systematic Review: A Best Practice Guide for Conducting and Reporting Narrative Reviews, Meta-Analyses, and Meta-Syntheses. *Annu. Rev. Psychol.* **2019**, *70*, 747–770. [CrossRef]
22. Booth, A. Searching for qualitative research for inclusion in systematic reviews: A structured methodological review. *Syst. Rev.* **2016**, *5*, 74. [CrossRef] [PubMed]
23. Pullin, A.S.; Stewart, G.B. Guidelines for Systematic Review in Conservation and Environmental Management. *Conserv. Biol.* **2006**, *20*, 1647–1656. [CrossRef] [PubMed]
24. Shrestha, K.K.; McManus, P. The politics of community participation in natural resource management: Lessons from community forestry in Nepal. *Aust. For.* **2008**, *71*, 135–146. [CrossRef]

25. Maryudi, A.; Devkota, R.R.; Schusser, C.; Yufanyi, C.; Salla, M.; Aurenhammer, H.; Rotchanaphatharawit, R.; Krott, M. Back to basics: Considerations in evaluating the outcomes of community forestry. *For. Policy Econ.* **2012**, *14*, 1–5. [CrossRef]
26. Porter-Bolland, L.; Ellis, E.A.; Guariguata, M.R.; Ruiz-Mallén, I.; Negrete-Yankelevich, S.; Reyes-García, V. Community managed forests and forest protected areas: An assessment of their conservation effectiveness across the tropics. *For. Ecol. Manag.* **2012**, *268*, 6–17. [CrossRef]
27. Larson, A.; Ribot, J. Democratic Decentralisation through a Natural Resource Lens. *Eur. J. Dev. Res.* **2004**, *16*, 1–25. [CrossRef]
28. Kusters, K.; Ruiz Pérez, M.; de Foresta, H.; Dietz, T.; Ros-Tonen, M.; Belcher, B.; Manalu, P.; Nawir, A.; Wollenberg, E. Will Agroforests Vanish? The Case of Damar Agroforests in Indonesia. *Hum. Ecol.* **2008**, *36*, 357–370. [CrossRef]
29. Hajjar, R.F.; Kozak, R.A.; Innes, J.L. Is Decentralization Leading to "Real" Decision-Making Power for Forest-dependent Communities? Case Studies from Mexico and Brazil. *Ecol. Soc.* **2012**, *17*, 1–14. [CrossRef]
30. Parhusip, S.; Suharti, S.; Sukandi, T.; Amano, M.; Matsumura, N. Economic Analysis of Local People's Involvement in Community-based Forest Management (CBFM) in Desa Ciomas, Indonesia. *J. For. Plan.* **2019**, *25*, 1–14. [CrossRef]
31. Wollenberg, E.; Merino, L.; Agrawal, A.; Ostrom, E. Fourteen years of monitoring community-managed forests: Learning from IFRI's experience. *Int. For. Rev.* **2007**, *9*, 670–684. [CrossRef]
32. Persha, L.; Agrawal, A.; Chhatre, A. Social and ecological synergy: Local rulemaking, forest livelihoods, and biodiversity conservation. *Science* **2011**, *331*, 1606–1608. [CrossRef] [PubMed]
33. Suharti, S. The increase of community participation in forest management through development of Social Forestry Program in Indonesia. In Proceedings of the Workshop Proceeding "The Balance between Biodiversity Conservation and Sustainable Use of Tropical Rain Forests", Wageningen, The Netherlands, 1 January 2001; pp. 233–244.
34. Anderson, J.; Mehta, S.; Epelu, E.; Cohen, B. Managing leftovers: Does community forestry increase secure and equitable access to valuable resources for the rural poor? *For. Policy Econ.* **2015**, *58*, 47–55. [CrossRef]
35. Suharti, S. *Kebijakan Pengelolaan Hutan Berbasis Masyarakat: Dari Partisipasi Menuju Inklusi*; Badan Litbang dan Inovasi KLHK: Bogor, Indonesia, 2019.
36. Parrotta, J.A.; Agnoletti, M. Traditional Forest-Related Knowledge; Sustaining Communities, Ecosystems and Biocultural Diversity. *Int. J. Commons.* **2012**, *6*, 388–389. [CrossRef]
37. Tamayo, A.L.; de Chavez, R. *Forest Policies and Indigenous Peoples' Traditional Knowledge and Practices on Sustainable Forest Management: Fiji, Cambodia and Thailand*; Tebtebba Foundation: Benguet, Philippines, 2020.
38. Neyra-Cabatac, N.M.; Pulhin, J.M.; Cabanilla, D.B. Indigenous agroforestry in a changing context: The case of the Erumanen ne Menuvu in Southern Philippines. *For. Policy Econ.* **2012**, *22*, 18–27. [CrossRef]
39. Oluwadare, O.S. Taungya Farming—A Strategy for Sustainable Land Management and Agricultural Development in Nigeria. *Adv. For. Lett.* **2014**, *3*, 16–22.
40. Elbakidze, M.; Surová, D.; Muñoz-Rojas, J.; Persson, J.O.; Dawson, L.; Plieninger, T.; Pinto-Correia, T. Perceived benefits from agroforestry landscapes across North-Eastern Europe: What matters and for whom? *Landsc. Urban Plan.* **2021**, *209*, 104044. [CrossRef]
41. Lelamo, L.L. A review on the indigenous multipurpose agroforestry tree species in Ethiopia: Management, their productive and service roles and constraints. *Heliyon* **2021**, *7*, e07874. [CrossRef]
42. Parrotta, J.; Yeo-Chang, Y.; Camacho, L.D. Traditional knowledge for sustainable forest management and provision of ecosystem services. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2016**, *12*, 1–4. [CrossRef]
43. Asmin, F.; Darusman, D.; Ichwandi, I.; Suharjito, D. Social Capital of Parak and Rimbo Management in West Sumatra. *J. Trop. For. Manag.* **2017**, *23*, 140–149. [CrossRef]
44. Martial, T.; Helmi; Effendi, N.; Martius, E. Land and Tree Tenure Rights on Agroforestry (Parak) System At Communal Land in West Sumatera, Indonesia. *J. Agric. Ext. Rural. Dev.* **2012**, *4*, 486–494. [CrossRef]
45. Ekawati, S.; Nurrochmat, D. Hubungan Modal Sosial Dengan Pemanfaatan Dan Kelestarian Hutan Lindung. *J. Anal. Kebijak. Kehutan.* **2014**, *11*, 40–53. [CrossRef]
46. Hamzah, H.; Suharjito, D.; Istomo, I. Efektifitas Kelembagaan lokal dalam pengelolaan sumber daya hutan pada masyarakat nagari simanau, kabupaten solok. *Risal. Kebijak. Pertan. Lingkung. Rumusan Kaji. Strateg. Bid. Pertan. Lingkung.* **2016**, *2*, 116. [CrossRef]
47. Martin, E.; Suharjito, D.; Darusman, D.; Sunito, S.; Winarno, B. Traditional Institution for Forest Conservation within a Changing Community: Insight from the Case of Upland South Sumatra. *Komunitas Int. J. Indones. Soc. Cult.* **2016**, *8*, 236–249. [CrossRef]
48. Martin, E.; Suharjito, D.; Darusman, D.; Sunito, S.; Winarno, B. Tunggu Tubang Ulu Ayek: Social Mechanism of Sustainable Protected Forest Management. *J. Trop. For. Manag.* **2016**, *22*, 85–93. [CrossRef]
49. Onrizal, O.; Mansor, M. Forest conservation and management practices in Minangkabau Society: Forbidden Forest. *J. Phys. Conf. Ser.* **2020**, *1542*, 012062. [CrossRef]
50. Rapanna, P. *Membumikan Kearifan Lokal Dalam Kemandirian Ekonomi*; Sah Media: Makassar, Indonesia, 2016.
51. Christiawan, P.I. The role of local wisdom in controlling deforestation. *Int. J. Dev. Sustain.* **2017**, *6*, 876–888.
52. Gorda, A.A.N.E.S.; Anggria Wardani, D.K. Refleksi Nilai Kearifan Lokal Masyarakat Hindu Bali Dalam Pengelolaan Lingkungan. *ETTISAL J. Commun.* **2020**, *5*, 91–107. [CrossRef]
53. Ngaji, A.U.K.; Baiquni, M.; Suryatmojo, H.; Haryono, E. Sustaining subsistence culture in Mamar agroforestry management in West Timor, is it possible? *E3S Web Conf.* **2020**, *200*, 02023. [CrossRef]

54. Pujiono, E.; Sri Raharjo, S.A.; Njurumana, G.N.; Prasetyo, B.D.; Rianawati, H. Sustainability status of agroforestry systems in Timor Island, Indonesia. *E3S Web Conf.* **2021**, *305*, 04003. [CrossRef]
55. Njurumana, G.N.; Sadono, R.; Marsono, D.; Irham. Ecosystem Services of Indigenous Kaliwu Agroforestry System in Sumba, Indonesia. *E3S Web Conf.* **2021**, *305*, 04002. [CrossRef]
56. Pujiono, E.; Rahardjo, S.A.S.; Njurumana, G.N.; Prasetyo, B.D.; Rianawati, H. Kajian Aspek Ekologi, Ekonomi dan Sosial Agroforestri di Nusa Tenggara Timur. In Proceedings of the Seminar Nasional Agroforestri dengan thema Agroforestri Untuk Pangan dan Lingkungan Yang Lebih Baik, Malang, Indonesia, 21 May 2013.
57. Njurumana, G.N. Kaliwu, model inisiatif local dalam konservasi daerah perbukitan di pulau Sumba. In Proceedings of the Prosiding Seminar Nasional Biodiversitas, Solo, Indonesia, 4 November 2016.
58. Reed, M.S.; Dougill, A.J.; Taylor, M.J. Integrating local and scientific knowledge for adaptation to land degradation: Kalahari rangeland management options. *Land Degrad. Dev.* **2007**, *18*, 249–268. [CrossRef]
59. Zerihun, M.F. Institutional Analysis of Adoption of Agroforestry Practices in the Eastern Cape Province of South Africa. *South. Afr. J. Environ. Educ.* **2020**, *36*. [CrossRef]
60. Sahoo, G.; Wani, A.; Satpathy, B. Greening Wastelands for Environmental Security through Agroforestry. *Int. J. Adv. Res. Sci. Technol.* **2020**, *7*, 2581–9429.
61. Janra, M.N. Chapter 11—Socioecological Aspects of Mandailing Natal People in Buffer Zone of Batang Gadis National Park, North Sumatra: A Case Study on Community in Batahan Village, Enclave Area in Batang Gadis National Park. In *Redefining Diversity & Dynamics of Natural Resources Management in Asia, Volume 4*; Febriamansyah, R., Yonariza, Ullah, R., Shivakoti, G.P., Eds.; Elsevier: Amsterdam, The Netherlands, 2017; pp. 141–155.
62. Ortolani, G. Agroforestry: An Increasingly Popular Solution for a Hot, Hungry World. Available online: https://news.mongabay.com/2017/10/agroforestry-an-increasingly-popular-solution-for-a-hot-hungry-world/ (accessed on 26 January 2021).
63. Di Sacco, A.; Hardwick, K.A.; Blakesley, D.; Brancalion, P.H.S.; Breman, E.; Cecilio Rebola, L.; Chomba, S.; Dixon, K.; Elliott, S.; Ruyonga, G.; et al. Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits. *Glob. Chang. Biol.* **2021**, *27*, 1328–1348. [CrossRef]
64. Gaveau, D.L.A.; Sheil, D.; Husnayaen; Salim, M.A.; Arjasakusuma, S.; Ancrenaz, M.; Pacheco, P.; Meijaard, E. Rapid conversions and avoided deforestation: Examining four decades of industrial plantation expansion in Borneo. *Sci. Rep.* **2016**, *6*, 32017. [CrossRef] [PubMed]
65. Margono, B.A.; Potapov, P.V.; Turubanova, S.; Stolle, F.; Hansen, M.C. Primary forest cover loss in Indonesia over 2000–2012. *Nat. Clim. Chang.* **2014**, *4*, 730–735. [CrossRef]
66. Sunderlin, W.D.; Resosudarmo, I.A.P. *Rates and Causes of Deforestation in Indonesia: Towards a Resolution of the Ambiguities*; CIFOR: Bogor, Indonesia, 1996.
67. Austin, K.G.; Schwantes, A.; Gu, Y.; Kasibhatla, P.S. What causes deforestation in Indonesia? *Environ. Res. Lett.* **2019**, *14*, 024007. [CrossRef]
68. Agus, F.; Gunarso, P.; Sahardjo, B.; Harris, N.; van Noordwijk, M. *Historical CO_2 Emissions from Land Use and Land Cover Change for the Oil Palm Industry in Indonesia, Malaysia, and Papua New Guinea Reports from the Science Panel of the Second RSPO GHG Working Group*; GHG Working Group: Kuala, Lumpur, 2013.
69. Muttaqin, M.; Subarudi, Z. *Pengelolaan Kawasan Hutan dan Lahan dan Pengaruhnya bagi Pelaksanaan REDD+ di Indonesia: Tenure, Stakeholders dan Livelihoods*; Pusat Penelitian dan Pengembangan Perubahan Iklim dan Kebijakan, Badan Penelitian dan Pengembangan Kehutanan-Kementerian Kehutanan: Bogor, Indonesia, 2013.
70. Hermosilla, A.C.; Fay, C. *Strengthening Forest Management in Indonesia through Land Tenure Reform: Issues and Framework for Action*; World Bank Group: Washington, DC, USA, 2005.
71. Kumar, V. Social forestry in India: Concept and schemes. *Van Sangyan* **2015**, *2*, 18–22. [CrossRef]
72. Dohong, A. Tekan Deforestasi, Indonesia Hentikan Izin Baru di Hutan Primer dan Gambut. Available online: https://www.agrofarm.co.id/2021/11/41271/ (accessed on 20 May 2021).
73. Kubo, H.; Mader, A. *Strengthening Agricultural Certifcation Schemes by Adding Criteria on Forest Restoration*; Policy Brief; Institute for Global Environmental Strategies: Hayama, Japan, 2021.
74. Meijaard, E. Does social forestry always decrease deforestation and poverty? *Mongabay*, 17 September 2017.
75. Subarudi. Community livelihood improvement through social forestry and agraria reform in Indonesia: A critical thought. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *917*, 012015. [CrossRef]
76. Fuller, D.; Miettinen, J.; Meijaard, E. Deforestation, Degradation, and Forest Re-Growth in Indonesia's Protected Areas from 2000–2010. *Indones. J. Conserv.* **2013**, *2*, 1–13.
77. Curtis, K.J.; Bartfeld, J.; Lessem, S. Poverty and Food Security in Forest, Wisconsin. 2014. Available online: https://cdn.apl.wisc.edu/resource-profiles/pfs_profiles/racine_2014.pdf (accessed on 1 October 2022).
78. Apriyanto, D.; Hardjanto; Hero, Y. The Increase of Private Forest' s Role to Support Food Security and Poverty Alleviation. *J. Silvikultur Trop.* **2016**, *7*, 165–173. [CrossRef]
79. Santika, T.; Meijaard, E.; Budiharta, S.; Law, E.A.; Kusworo, A.; Hutabarat, J.A.; Indrawan, T.P.; Struebig, M.; Raharjo, S.; Huda, I.; et al. Community forest management in Indonesia: Avoided deforestation in the context of anthropogenic and climate complexities. *Glob. Environ. Chang.* **2017**, *46*, 60–71. [CrossRef]

80. Aji, G.B.J.; Suryanto, R.; Yulianti, A.; Wirati, A.Y.; Abdurrahim, T.I.M. Poverty Reduction in Villages around the Forest: The Development of Social Forestry Model and Poverty Reduction Policies in Indonesia. *Policy Paper* **2014**.
81. Agustini, S.; Dharmawan, A.H. The Contribution of Community Based Forest Management to Livelihood and Rural Economy: The Case of Hutan Nagari Sungai Buluh in Padang Pariaman. *Sodality J.* **2017**, *5*, 138–147. [CrossRef]
82. Dewi, I.N. Poverty of the Community Around the Forest and the Social Forestry Program. *Info Teknis EBONI* **2018**, *15*, 65–77.
83. Haryono, H.; Siswati, E.; Epriliati, I. *Harmonization and Synchronization of Village Economic Institutional Development Towards The Industrialization of Food and Beverages Based on Yellow Pumps in Social Forestry Area*; Pondok Pesantren Jagad Alimussirry Surabaya: Surabaya, Indonesia, 2019; pp. 1–216.
84. Jarnasy, O. *Pemberdayaan Dan Penanggulangan Kemiskinan*; Blantika: Jakarta, Indonesia, 2004.
85. Chambers, R. *Rural Development: Putting the Last First*; Routledge: New York, NY, USA, 2014.
86. World Bank. *The World Bank Annual Report 2015*; The World Bank: Washington, DC, USA, 2015.
87. Bappenas. *Rencana Strategis Penanggulangan Kemiskinan di Indonesia*; Badan Perencanaan Nasional: Jakarta, Indonesia, 2004.
88. BPS. *Analisis dan Perhitungan Perhitungan Kemiskinan*; Badan Pusat Statistik: Jakarta, Indonesia, 2008.
89. Rumboko, L.; Race, D.; Curtis, A. Optimising Community-Based Forest Management Policy In Indonesia: A Critical Review. *J. Ilmu Sos. Dan Ilmu Polit.* **2013**, *16*, 250–272.
90. Supriyanto, H.; Jayawinangun, R.; Saputro, B. *Community Forest, The Life and Death of Poor Farmers*; IPB Press: Bogor, Indonesia, 2016.
91. Mahardika, A.; Muyani, H.S. Analysis of The Legality of Social Forestry in Improving Community Welfare in Asahan District. *J. Adm. Publik Dan Kebijak.* **2021**, *1*, 1–9.
92. Agusti, T.M.; Nurjana, I.N.; Koeswahyono, I. The Implementation of Social Forestry Regulations that Benefits for Communities Around The Forest. *J. Ilm. Pendidik. Pancasila Dan Kewarganegaraan* **2019**, *4*, 300–309. [CrossRef]
93. Murti, H.A. Social Forestry for Community Justice Access and Poverty Reduction. *J. Anal. Kebijak. Kehutan.* **2018**, *2*, 62–75.
94. Yuliana, B. Impact of Social Forestry Program on Village Development Indicators. *J. Ilm. Indones.* **2022**, *7*, 2799–2812.
95. Puspasari, E.; Wulandari, C.; Darmawan, A.; Banuwa, I.S. Social Economic Aspects Agroforestry System in The Forest Community Work Area (HKm) District West Lampung, Lampung Province. *J. Sylva Lestari* **2017**, *5*, 95–103. [CrossRef]
96. Dewi, I.N.; Awang, S.A.; Andayani, W.; Suryanto, P. Characteristic of Farmer and Contribution of Community Forestry to Farmer's Income in Kulon Progo. *J. Ilmu Kehutan.* **2017**, *12*, 86–98. [CrossRef]
97. Mayrowani, H.; Ashari. Agroforestry Development to Support Food Security and Farmer's Empowerment Nearby the Forests. *Forum Penelit. Agro Ekon.* **2011**, *29*, 83–98. [CrossRef]
98. Desmiwati, D.; Veriasa, T.O.; Aminah, A.; Safitri, A.D.; Wisudayati, T.A.; Hendarto, K.A.; Royani, H.; Dewi, K.H.; Raharjo, S.N.I.; Sari, D.R. Contribution of Agroforestry Systems to Farmer Income in State Forest Areas: A Case Study of Parungpanjang, Indonesia. *For. Soc.* **2021**, *5*, 109–119. [CrossRef]
99. Desmiwati; Zanzibar, M.; Panjaitan, J.H.; Yuniarti, N.; Yulianti; Damayanti, R.U. Technological Innovation of Muna Teak and Its Contribution Toward the Improvement of the Social Economy in Muna District. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *522*, 012014. [CrossRef]
100. Mulyana; Moeis. Impact of Social Forestry Programs on Business Growth and Deforestation: Empirical Evidence from Indonesia. *J. Ekon. Sumebrdaya Lingkung.* **2022**, *11*, 1–20. [CrossRef]
101. Rakatama, A.; Pandit, R. Reviewing social forestry schemes in Indonesia: Opportunities and challenges. *For. Policy Econ.* **2020**, *111*, 102052. [CrossRef]
102. Duffy, C.; Toth, G.G.; Hagan, R.P.O.; McKeown, P.C.; Rahman, S.A.; Widyaningsih, Y.; Sunderland, T.C.H.; Spillane, C. Agroforestry contributions to smallholder farmer food security in Indonesia. *Agrofor. Syst.* **2021**, *95*, 1109–1124. [CrossRef]
103. Yeny, I.; Garsetiasih, R.; Suharti, S.; Gunawan, H.; Sawitri, R.; Karlina, E.; Narendra, B.H.; Surati; Ekawati, S.; Djaenudin, D.; et al. Examining the Socio-Economic and Natural Resource Risks of Food Estate Development on Peatlands: A Strategy for Economic Recovery and Natural Resource Sustainability. *Sustainability* **2022**, *14*, 3961. [CrossRef]
104. Salasa, A.R. Paradigma dan Dimensi Strategi Ketahanan Pangan Indonesia. *Jejaring Adm. Publik* **2021**, *13*, 35–48. [CrossRef]
105. Natalia, V. Implementasi program ketahanan pangan dinas ketahanan pangan kabupaten kotawaringin timur: Implementasi program ketahanan pangan dinas ketahanan pangan kabupaten kotawaringin timur. *J. Ilmu Sos. Polit. Pemerintah.* **2021**, *9*, 23–31. [CrossRef]
106. Nudia, I.; Setyaningsih, A. Kebijakan Food Security: Arah Kebijakan dan Strategi Ketahanan Pangan Pemerintah Indonesia. *J. Gov. Innov.* **2020**, *2*, 77–82. [CrossRef]
107. Saputro, W.A.; Fidayani, Y. Faktor-Faktor Yang Mempengaruhi Ketahanan Pangan Rumah Tangga Petani Di Kabupaten Klaten. *J. Agrica* **2020**, *13*, 115–123. [CrossRef]
108. Asprilla-Perea, J.; Díaz-Puente, J.M. Importance of wild foods to household food security in tropical forest areas. *Food Secur.* **2019**, *11*, 15–22. [CrossRef]
109. Surahman, A.; Soni, P.; Shivakoti, G.P. Reducing CO_2 emissions and supporting food security in Central Kalimantan, Indonesia, with improved peatland management. *Land Use Policy* **2018**, *72*, 325–332. [CrossRef]
110. Asher, K.; Shattuck, A. Forests and Food Security: What's Gender Got to Do with It? *Soc. Sci.* **2017**, *6*, 34. [CrossRef]
111. Irawati; Jusuf, Y.; Muhammad, D. Model Pembangunan Hutan Desa Di Kelurahan Latuppa Kecamatan Mungkajang Kota Palopo. *J. Penelit. Kehutan. BONITA* **2019**, *1*, 16–23. [CrossRef]
112. Abidin, Z. Potential of Food Crops Development in Community Forest Area. *J. Litbang Pertan.* **2015**, *34*, 71–78. [CrossRef]

113. Wahyudiyati, K.T.; Kuniasari, D.R.; Wibowo, L.R.; Race, D. *Fostering the Community Plantation Forest (HTR) Program in Lampung and Gorontalo, Indonesia*; ACIAR: Jakarta, Indonesia, 2019.
114. Wibowo, L.K.; Wahyudiyati, K.T.; Hayati, N.; Bisjoe, A.R.; Kurniasari, D.R.; Herawati, T. *Policy Options for Enhancing Community-Based Commecial Forestry in Indonesia*; ACIAR: Bogor, Indonesia, 2019.
115. Race, D.; Suka, A.P.; Irawanti, S.; Surati; Oktalina, S.N.; Bisjoe, A.; Muin, N.; Purwanti, R.; Sumirat, B. Smallholder forestry: The role of commercial forestry in rural livelihoods in Indonesia. *Int. For. Rev.* **2019**, *21*, 225–237. [CrossRef]
116. Suka, A.P.; Surati; Kurniasari, D.R.; Justianto, A. Sources of income from HTR areas in Boalemo: No single policy for improving welfare of the communities. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *487*, 012012. [CrossRef]
117. Sylviani, S.; Prawesti Suka, A.; Surati, S.; Ratna Kurniasari, D. Social Capital in Managing Community Plantation Forest: A Case Study at Kph Boalemo, Gorontalo Province. *Indones. J. For. Res.* **2020**, *7*, 71–82. [CrossRef]
118. Anna, Z. Praktek Pengelolaan Produksi Dan Konsumsi Yang Berkelanjutan Pada Masyarakat Adat Pesisir Moi Kelim Di Kampung Malaumkarta Kabupaten Sorong Papua Barat. *Bul. Ilm. Mar. Sos. Ekon. Kelaut. Perikan.* **2018**, *4*, 15–21. [CrossRef]
119. Desmiwati; Pribadi, M.A.; Maharani, K.E. The Social Capital of Labour-Farmer in the Middle of Parungpanjang Research Forest Governance. *J. Perbenihan Tanam. Hutan* **2018**, *6*, 61–83. [CrossRef]
120. Sutarno, S. Peran Perguruan Tinggi Dalam Pelestarian Hutan Bersama LMDH Guna Meningkatkan Ketahanan Pangan Masyarakat Desa Hutan Pada New Normal. *Pros. Semin. Nas. Fak. Pertan. UNS* **2020**, *4*, 633–640.
121. Yeni, I.; Dewi, R. *Praktik Silvopastura: Komponen Penyusun & Multi Produk dalam Usaha Pemanfaatan Kawasan Hutan*; IPB Press: Bogor, Indonesia, 2021.
122. BPS. Produksi Sapi Potong di Indonesia Tahun 2020. Available online: https://www.bps.go.id/indicator/24/469/1/populasi-sapi-potong-menurut-provinsi.html (accessed on 23 March 2021).
123. Triwanto, J. Agroforestry Application on Forest Land Under Stands System to Increase Reserved Food and Forest Sustainability at Pujon, Malang District. *Tech. Soc. Sci. J.* **2022**, *30*, 530–537. [CrossRef]
124. Rahman, M.A.; Kusuma, A.Z.D.; Hafiz Arfyanto, H. *Situasi Ketenagakerjaan Di Lapangan Usaha Yang Terdampak Pandemi COVID-19.*; The Semeru Research Institute: Jakarta, Indonesia, 2020.
125. Pieter, L.A.G.; Utomo, M.M.B.; Suhartono, S.; Sudomo, A.; Sanudin, S.; Fauziyah, E.; Widyaningsih, T.S.; Palmolina, M.; Hani, A.; Siagian, C.M. The Nexus of COVID-19 Pandemic and Rural Agroforestry Farmers' Livelihoods in Tasikmalaya Regency, East Priangan, Indonesia. *For. Soc.* **2022**, *6*, 335–354. [CrossRef]
126. Jusmalinda; Asmin, F.D. Dampak Pemberitaan Penyebaran Covid Terhadap Pengelolaan Hutan Sumatera Barat. *J. Pembang. Nagari* **2020**, *5*, 55–68. [CrossRef]
127. A'dani, F.; Sukayat, Y.; Setiawan, I.; Judawinata, M.G. Pandemi COVID-19: Keterpurukan Dan Kebangkitan Pertanian Strategi Mempertahankan Ketersediaan Pangan Pokok Rumah Tangga Petani Padi Pada Masa Pandemi COVID-19 (Studi Kasus: Desa Pelem, Kecamatan Gabus, Kabupaten Grobogan, Jawa Tengah). *Mimba Agribisnis J. Pemikir. Masy. Ilm. Berwawasan Agribisnis* **2021**, *7*, 309–319. [CrossRef]
128. RECOFTC. *Kontribusi Kehutanan Masyarakat dalam Penanggulangan dan Pemulihan COVID-19 di Indonesia*; RECOFTC: Bangkok, Thailand, 2021.
129. Ihza, K.N. Dampak COVID-19 Terhadap Usaha Mikro Kecil Dan Menengah (UMKM) (Studi Kasus UMKM Ikhwa Comp Desa Watesprojo, Kemlagi, Mojokerto). *J. Inov. Penelit.* **2020**, *1*, 1325–1330.
130. Fadila, A.R. Pandemi Corona Hambat Capaian Target Hutan Sosial. Available online: https://katadata.co.id/ekarina/berita/5fa379a47afaa/pandemi-corona-hambat-capaian-target-hutan-sosial/ (accessed on 20 June 2022).
131. Maskun; Assidiq, H.; Mukarramah, N.H.A.; Bachril, S.N. Threats to the sustainability of biodiversity in Indonesia by the utilization of forest areas for national strategic projects: A normative review. *IOP Conf. Ser. Earth Environ. Sci.* **2021**, *886*, 012071. [CrossRef]
132. Oljirra, A. The causes, consequences and remedies of deforestation in Ethiopia. *J. Degrad. Min. Lands Manag.* **2019**, *6*, 1747–1754. [CrossRef]
133. Foley, J.A.; Ramankutty, N.; Brauman, K.A.; Cassidy, E.S.; Gerber, J.S.; Johnston, M.; Mueller, N.D.; O'Connell, C.; Ray, D.K.; West, P.C.; et al. Solutions for a cultivated planet. *Nature* **2011**, *478*, 337–342. [CrossRef] [PubMed]
134. Reddy, C.S.; Sreelekshmi, S.; Jha, C.S.; Dadhwal, V.K. National assessment of forest fragmentation in India: Landscape indices as measures of the effects of fragmentation and forest cover change. *Ecol. Eng.* **2013**, *60*, 453–464. [CrossRef]
135. Newman, M.E.; McLaren, K.P.; Wilson, B.S. Assessing deforestation and fragmentation in a tropical moist forest over 68 years; the impact of roads and legal protection in the Cockpit Country, Jamaica. *For. Ecol. Manag.* **2014**, *315*, 138–152. [CrossRef]
136. Kamim, A.B.H. Perebutan Ruang Kehidupan dan Gangguan terhadap Animal Rights: Studi Atas Konflik Satwa–Manusia sebagai Implikasi dari Ekspansi Perkebunan Sawit di Indonesia. *J. Multidisipliner Mhs. Indones.* **2018**, *1*, 199–218. [CrossRef]
137. Alisjahbana, A. 3 Cara untuk Mengatasi Deforestasi Hutan Tropis Hingga 2020. Available online: https://wri-indonesia.org/id/blog/3-ways-achieve-zero-tropical-deforestation-2020 (accessed on 5 July 2021).
138. Van der Werf, G.R. 2015: Fire Season Updates. Available online: https://globalfiredata.org/pages/2015/11/16/2015-fire-season-indonesia/ (accessed on 24 June 2021).
139. Kinnaird, M.F.; Sanderson, E.W.; O'Brien, T.G.; Wibisono, H.T.; Woolmer, G. Deforestation Trends in a Tropical Landscape and Implications for Endangered Large Mammals. *Conserv. Biol.* **2003**, *17*, 245–257. [CrossRef]

140. Gibbs, H.K.; Ruesch, A.S.; Achard, F.; Clayton, M.K.; Holmgren, P.; Ramankutty, N.; Foley, J.A. Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. *Proc. Natl. Acad. Sci.* **2010**, *107*, 16732–16737. [CrossRef]
141. Foley, J.A.; Asner, G.P.; Costa, M.H.; Coe, M.T.; DeFries, R.; Gibbs, H.K.; Howard, E.A.; Olson, S.; Patz, J.; Ramankutty, N.; et al. Amazonia revealed: Forest degradation and loss of ecosystem goods and services in the Amazon Basin. *Front. Ecol. Environ.* **2007**, *5*, 25–32. [CrossRef]
142. Morton, D.C.; DeFries, R.S.; Shimabukuro, Y.E.; Anderson, L.O.; Arai, E.; del Bon Espirito-Santo, F.; Freitas, R.; Morisette, J. Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon. *Proc. Natl. Acad. Sci. USA* **2006**, *103*, 14637–14641. [CrossRef]
143. Mendoza, E.; Fay, J.; Dirzo, R. A quantitative analysis of forest fragmentation in Las Tuxtlas, southeast Mexico: Patterns and implications for conservation. *Rev. Chil. Hist. Nat.* **2005**, *78*, 451–467. [CrossRef]
144. Nyhus, P.J.; Tilson, R. Characterizing human-tiger conflict in Sumatra, Indonesia: Implications for conservation. *Oryx* **2004**, *38*, 68–74. [CrossRef]
145. Laurance, W.F. Theory meets reality: How habitat fragmentation research has transcended island biogeographic theory. *Biol. Conserv.* **2008**, *141*, 1731–1744. [CrossRef]
146. Goosem, M. Fragmentation impacts caused by roads through rainforests. *Curr. Sci.* **2007**, *93*, 1587–1595.
147. Fahrig, L. Effects of Habitat Fragmentation on Biodiversity. *Annu. Rev. Ecol. Evol. Syst.* **2003**, *34*, 487–515. [CrossRef]
148. Convention on Biological Diversity. *Handbook of the Convention on Biological Diversity Including Its Cartagena Protocol on Biosafety*; Secretariat of the Convention on Biological Diversity: Montreal, QC, Canada, 2005.
149. Supriatna, J.; Shekelle, M.; Fuad, H.A.H.; Winarni, N.L.; Dwiyahreni, A.A.; Farid, M.; Mariati, S.; Margules, C.; Prakoso, B.; Zakaria, Z. Deforestation on the Indonesian island of Sulawesi and the loss of primate habitat. *Glob. Ecol. Conserv.* **2020**, *24*, e01205. [CrossRef]
150. Meffe, G.K.; Carroll, C.R. *Principles of Conservation Biology*; Sinauer Associates, Inc: Sunderland, MA, USA, 1995; pp. 972–974.
151. Wu, J. Key concepts and research topics in landscape ecology revisited: 30 years after the Allerton Park workshop. *Landsc. Ecol.* **2012**, *28*, 1–11. [CrossRef]
152. Kaimowitz, D.; Angelsen, A. *Economic Models of Tropical Deforestation—A Review*; Center for International Forestry Research (CIFOR): Bogor, Indonesia, 1998.
153. Wunder, S. *Oil Wealth and the Fate of the Forest. A Comparative Study of Eight Tropical Countries*; Routledge: London, UK; New York, NY, USA, 2003.
154. Kanninen, M.; Murdiyarso, D.; Seymour, F.; Angelsen, A.; Wunder, S.; German, L. *Do Trees Grow on Money? The Implications of Deforestation Research for Policies to Promote REDD.*; Center for International Forestry Research (CIFOR): Bogor, Indonesia, 2007.
155. Decaens, T.; Martins, M.B.; Feijoo, A.; Oszwald, J.; Doledec, S.; Mathieu, J.; Arnaud de Sartre, X.; Bonilla, D.; Brown, G.G.; Cuellar Criollo, Y.A.; et al. Biodiversity loss along a gradient of deforestation in Amazonian agricultural landscapes. *Conserv. Biol.* **2018**, *32*, 1380–1391. [CrossRef]
156. Gilbert, F.; Gonzalez, A.; Evans-Freke, I. Corridors Maintain Species Richness in the Fragmented Landscapes of a Microecosystem. *Proc. Biol. Sci.* **1998**, *265*, 577–582. [CrossRef]
157. Zemanova, M.A.; Perotto-Baldivieso, H.L.; Dickins, E.L.; Gill, A.B.; Leonard, J.P.; Wester, D.B. Impact of deforestation on habitat connectivity thresholds for large carnivores in tropical forests. *Ecol. Process.* **2017**, *6*, 21. [CrossRef]
158. IPBES. *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*; IPBES: Bonn, Germany, 2019.
159. Widjaja, E.A.; Rahayuningsih, Y.; Rahajoe, J.S.; Ubaidillah, R.; Maryanto, I.; Walujo, E.B.; Semiadi, G. *Kekinian Keanekaragaman Hayati Indonesia*; LIPI Press: Bogor, Indonesia, 2014.
160. Wyckoff-Baird, B.; Kaus, A.; Christen, C.A.; Keck, M. *Shifting the Power: Decentralization and Biodiversity Conservation*; Biodiversity Support Program (BSP): Washington, DC, USA, 2000.
161. Andersson, K.; Gibson, C.C. Decentralization Reforms: Help or Hindrance to Forest Conservation? Available online: https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/895/Andersson_Decentralization_040728.pdf?sequence=1&isAllowed=y (accessed on 1 October 2022).
162. Shivakoti, Y.; Shivakoti, G.P. Decentralization and Co-Management of Protected Areas in Indonesia. *J. Leg. Plur. Unoff. Law* **2008**, *40*, 141–165. [CrossRef]
163. Curran, L.M.; Trigg, S.N.; McDonald, A.K.; Astiani, D.; Hardiono, Y.M.; Siregar, P.; Caniago, I.; Kasischke, E. Lowland forest loss in protected areas of Indonesian Borneo. *Science* **2004**, *303*, 1000–1003. [CrossRef] [PubMed]
164. Resosudarmo, B.P. *The Politics and Economics of Indonesia's Natural Resources*; Institute of Southeast Asian Studies: Singapore, 2005.
165. Center for International Forestry Research; International Union for Forestry Research Organizations. *Biodiversity Conservation in Production Forests*; Center for International Forestry Research/International Union for Forestry Research Organizations: Bogor, Indonesia, 1999.
166. Sihombing, B.H. injauan konsep dan implementasi sistem silvikultur TPTII. *J. Agric. For.* **2015**, *14*, 27–38.
167. Elias, A.G.; Kartawinata, K.; Machfudh, K.A. *Pedoman Reduced Imact Logging Indonesia*; Center for International Forestry Research (CIFOR): Bogor, Indonesia, 2001.
168. Ruslim, Y. Penerapan Reduced Impact Logging Menggunakan Monocable Winch (Pancang Tarik) Implementing Reduced Impact Logging with Monocable Winch. *JMHT* **2011**, *17*, 103–110.
169. Seidler, R. Patterns of Biodiversity Change in Anthropogenically Altered Forests. In *Reference Module in Life Sciences*; Elsevier: Amsterdam, The Netherlands, 2017.

170. President of the Republic of Indonesia. Decree of the President of the Republic of Indonesia Number 32 of 1990 Concerning the Management of Protected Areas. 1990. Available online: https://leap.unep.org/countries/id/national-legislation/presidential-decree-ri-no-32-1990-management-protected-areas (accessed on 6 October 2021).
171. The Indonesian HCV Toolkit Revision Consortium. *Guide to the Identification of High Conservation Value Areas in Indonesia*; Tropenbos International Indonesia Programme: Balikpapan, Indonesia, 2008.
172. Arshanti, L.; Kartodihardjo, H.; Khan, A. Policy and Issues of Sustainable Natural Forest Management Certification: Implementation of Advocacy Coalition Framework. *J. Anal. Kebijak. Kehutan.* **2017**, *14*, 137–148. [CrossRef]
173. Indonesian Forestry Certification Cooperation (IFCC). *Sustainable Forest Management—Requirements*; Perkumpulan Kerjasama Sertifikasi Kehutanan Indonesia (KSK): Bogor, Indonesia, 2021.
174. Daily, G.C.; Polasky, S.; Goldstein, J.; Kareiva, P.M.; Mooney, H.A.; Pejchar, L.; Ricketts, T.H.; Salzman, J.; Shallenberger, R. Ecosystem services in decision making: Time to deliver. *Front. Ecol. Environ.* **2009**, *7*, 21–28. [CrossRef]
175. Perrings, C.; Duraiappah, A.; Larigauderie, A.; Mooney, H. The Biodiversity and Ecosystem Services Science-Policy Interface. *Science* **2011**, *331*, 1139–1140. [CrossRef]
176. Costanza, R.; Kubiszewski, I.; Ervin, D.; Bluffstone, R.; Boyd, J.; Brown, D.; Chang, H.; Dujon, V.; Granek, E.; Polasky, S.; et al. Valuing ecological systems and services. *F1000 Biol. Rep.* **2011**, *3*, 14. [CrossRef]
177. Mace, G.M.; Norris, K.; Fitter, A.H. Biodiversity and ecosystem services: A multilayered relationship. *Trends Ecol. Evol.* **2012**, *27*, 19–26. [CrossRef]
178. The Board of Millennium Ecosystem Assessment. *Living Beyond Our Means: Natural Assets and Human Well-Being*; The Board of Millennium Ecosystem Assessment: Washington, DC, USA, 2005.
179. Baral, H.; Guariguata, M.R.; Keenan, R.J. A proposed framework for assessing ecosystem goods and services from planted forests. *Ecosyst. Serv.* **2016**, *22*, 260–268. [CrossRef]
180. Chan, K.M.A.; Satterfield, T.; Goldstein, J. Rethinking ecosystem services to better address and navigate cultural values. *Ecol. Econ.* **2012**, *74*, 8–18. [CrossRef]
181. RUPES (Rewards for Use of and Shared Investment in Pro-Poor Environmental Service). *Gagas Kebijakan Konsep Jasa Lingkungan dan Pembayaran Jasa Lingkungan di Indonesia*; RUPES World Agroforestry Center ICRAF Southeast Asia Regional Office: Bogor, Indonesia, 2009.
182. Bakri, S.; Setiawan, A.; Nurhaida, I. *Jasa Lingkungan Hutan: Kontribusi Produk Ekonomi-Ekologis bagi Pembangunan Berkelanjutan*; CV. Anugrah Utama Raharja: Bandar Lampung, Indonesia, 2009.
183. Lavorel, S.; Grigulis, K.; Lamarque, P.; Colace, M.-P.; Garden, D.; Girel, J.; Pellet, G.; Douzet, R. Using plant functional traits to understand the landscape distribution of multiple ecosystem services. *J. Ecol.* **2011**, *99*, 135–147. [CrossRef]
184. Alikodra, H.S. *Konservasi Sumberdaya Alam dan Lingkungan*; Gajah Mada University Press: Yogyakarta, Indonesia, 2012.
185. Quijas, S.; Balvanera, P. Biodiversity and Ecosystem Services. In *Encyclopedia of Biodiversity*, 2nd ed.; Levin, S.A., Ed.; Academic Press: Waltham, MA, USA, 2013; pp. 341–356.
186. Ritchie, H.; Roser, M. Biodiversity. *Our World Data*. 2021. Available online: https://ourworldindata.org/biodiversity (accessed on 14 July 2021).
187. Farida, W.R. Kualitas daging dan bagian tubuh lain trenggiling (Manis javanica Desmarest1822). *J. Biol. Indones.* **2012**, *8*, 141–154.
188. Marchal, V.; Hill, C. Primate Crop-raiding: A Study of Local Perceptions in Four Villages in North Sumatra, Indonesia. *Primate Conserv.* **2009**, *24*, 107–116. [CrossRef]
189. International Bank for Reconstruction and Development; The World Bank. *Illegal Logging, Fishing, and Wildlife Trade: The Costs and How to Combat It*; International Bank for Reconstruction and Development/The World Bank: Washington, DC, USA, 2019.
190. Morton, O.; Scheffers, B.R.; Haugaasen, T.; Edwards, D.P. Impacts of wildlife trade on terrestrial biodiversity. *Nat. Ecol. Evol.* **2021**, *5*, 540–548. [CrossRef] [PubMed]
191. UNDP Indonesia. Combating Illegal Wildlife Trade (CIWT). Available online: https://www.undp.org/indonesia/projects/gef-combatting-illegal-wildlife-trade-ciwt (accessed on 16 June 2022).
192. Gomez, L. The illegal hunting and exploitation of porcupines for meat and medicine in Indonesia. *Nat. Conserv.* **2021**, *43*, 109–122. [CrossRef]
193. Nijman, V.; Ardiansyah, A.; Langgeng, A.; Hendrik, R.; Hedger, K.; Foreman, G.; Morcatty, T.Q.; Siriwat, P.; van Balen, S.; Eaton, J.A.; et al. Illegal Wildlife Trade in Traditional Markets, on Instagram and Facebook: Raptors as a Case Study. *Birds* **2022**, *3*, 99–116. [CrossRef]
194. Nijman, V.; Morcatty, T.Q.; Feddema, K.; Campera, M.; Nekaris, K.A.I. Disentangling the Legal and Illegal Wildlife Trade–Insights from Indonesian Wildlife Market Surveys. *Animals* **2022**, *12*, 628. [CrossRef]
195. World Wildlife Fund for Nature. 2020's Most Epic Conservation Wins. Available online: https://www.worldwildlife.org/ (accessed on 17 August 2022).
196. Sawitri, R.; Takandjandji, M. *Konservasi Trenggiling Jawa*; Forda Press: Bogor, Indonesia, 2016.
197. Shi-bao, W. Assessment of threatened status of chinese pangolin (manis pentadactyla). *Chin. J. Appplied Environ. Biol.* **2004**, *10*, 456–461.
198. Semiadi, G.; Darnaedi, D.; Arief, A.J. Sunda Pangolin Manis Javanica Conservation in Indonesia: Status and Problems. In *Trade and Conservation of Pangolins Native to South and Southeast Asia*; Pantel, S., Chin, S.Y., Eds.; TRAFFIC Southeast Asia: Selangor, Malaysia, 2009.

199. Maulany, R.I.; Mutmainnah, A.; Nasri, N.; Achmad, A.; Ngakan, P.O. Tracing Current Wildlife Trade: An Initial Investigation in Makassar City, Indonesia. *For. Soc.* **2021**, *5*, 277–287. [CrossRef]
200. Asmin, F.; Darusman, D.; Ichwandi, I.; Suharjito, D. Mainstreaming community-based forest management in West Sumatra: Social forestry arguments, support, and implementation. *For. Soc.* **2019**, *3*, 77–96. [CrossRef]
201. Nawir, A.A.; Murniati; Rumboko, L. *Forest Rehabilitation in Indonesia: Where to after Three Decades?* Center for International Forestry Research (CIFOR): Bogor, Indonesia, 2007.
202. Anup, K.C. Community Forestry Management and Its Role in Biodiversity Conservation in Nepal. In *Global Exposition of Wildlife Management*; Intechopen: London, UK, 2017.
203. Seymour, F.; Vina, T.L.; Hite, K. *Evidence Linking Community-Level Tenure and Forest Condition: An Annotated Bibliography*; Climate and Land Use Alliance: San Francisco, CA, USA, 2014.
204. Legesse, A.; Negash, M. Species diversity, composition, structure and management in agroforestry systems: The case of Kachabira district, Southern Ethiopia. *Heliyon* **2021**, *7*, e06477. [CrossRef] [PubMed]
205. Afentina, A.; Yanarita, Y.; Indrayanti, L.; Rontinsulu, J.A.; Hidayat, N.; Sianipar, J. The Potential of Agroforestry in Supporting Food Security for Peatland Community—A Case Study in the Kalampangan Village, Central Kalimantan. *J. Ecol. Eng.* **2021**, *22*, 123–130. [CrossRef]
206. Santos, M.; Cajaiba, R.L.; Bastos, R.; Gonzalez, D.; Petrescu Bakış, A.-L.; Ferreira, D.; Leote, P.; Barreto da Silva, W.; Cabral, J.A.; Gonçalves, B.; et al. Why Do Agroforestry Systems Enhance Biodiversity? Evidence From Habitat Amount Hypothesis Predictions. *Front. Ecol. Evol.* **2022**, *9*. [CrossRef]
207. Sari, D.F.; Budiadi; Imron, M.A. The utilization of trees by endangered primate species Javan slow loris (Nycticebus javanicus) in shade-grown coffee agroforestry of Central Java. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *449*, 012044. [CrossRef]
208. Smith, C.; Barton, D.; Johnson, M.; Wendt, C.; Milligan, M. Bird communities in sun and shade coffee farms in Kenya. *Glob. Ecol. Conserv.* **2015**. [CrossRef]
209. Dollinger, J.; Jose, S. Agroforestry for soil health. *Agrofor. Syst.* **2018**, *92*, 213–219. [CrossRef]
210. Torralba, M.; Fagerholm, N.; Burgess, P.; Moreno, G.; Plieninger, T. Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis. *Agric. Ecosyst. Environ.* **2016**, *230*, 150–161. [CrossRef]
211. Bardhan, S.; Jose, S.; Biswas, S.; Kabir, K.; Rogers, W. Homegarden agroforestry systems: An intermediary for biodiversity conservation in Bangladesh. *Agrofor. Syst.* **2012**, *85*, 29–34. [CrossRef]
212. Susanti, P.D.; Ardhana, A. Sistem Agroforestri Di Kawasan Karst Kabupaten Gunungkidul Untuk Pengelolaan Telaga Sebagai Sumber Air Berkelanjutan. In Proceedings of the Prosiding Seminar Nasional Agroforestri: Agroforestri untuk Pangan dan Lingkungan yang Lebih Baik, Malang, Indonesia, 21 May 2013; pp. 374–379.
213. Pradan, U. Foreword from Regional Coordinator, Icraf Southeast Asia Program. In Proceedings of the Prosiding Seminar Nasional Agroforestri: Agroforestri untuk Pangan dan Lingkungan yang Lebih Baik, Malang, Indonesia, 2013.
214. Wafula, L.; Oduol, J.B.A.; Oluoch-Kosura, W.; Muriuki, J.N.; Okello, J.J.; Mowo, J.G. Does strengthening technical capacity of smallholder farmers enhance adoption of conservation practices? The case of conservation agriculture with trees in Kenya. *Agrofor. Syst.* **2015**, *90*, 1045–1059. [CrossRef]
215. Sanogo, D.; Sall, M.; Camara, B.A.; Diop, M.; Badji, M.; Ba, H.S. *The Climate-Smart Village Approach: Putting Communities at the Heart of Restoration*; Tropenbos International: Wageningen, The Netherlands, 2020.
216. DeLonge, M.S.; Miles, A.; Carlisle, L. Investing in the transition to sustainable agriculture. *Environ. Sci. Policy* **2016**, *55*, 266–273. [CrossRef]
217. Storch, I.; Penner, J.; Asbeck, T.; Basile, M.; Bauhus, J.; Braunisch, V.; Dormann, C.F.; Frey, J.; Gärtner, S.; Hanewinkel, M.; et al. Evaluating the effectiveness of retention forestry to enhance biodiversity in production forests of Central Europe using an interdisciplinary, multi-scale approach. *Ecol. Evol.* **2020**, *10*, 1489–1509. [CrossRef] [PubMed]
218. Law no. 41 of 1999 on Forestry. 1999. Available online: http://www.flevin.com/id/lgso/translations/Laws/Law%20No.%2041%20of%201999%20on%20Forestry.pdf (accessed on 5 August 2021).
219. Constitutional Court. *Constitutional Court Decision Number 35/PUU-X/2012 Concerning Customary Forest*; Constitutional Court: Jakarta, Indonesia, 2012.
220. Pambudi, A.S. The Development of Social Forestry in Indonesia: Policy Implementation Review, 2007–2019. *J. Indones. Sustain. Dev. Plan.* **2020**, *1*, 57–66. [CrossRef]
221. Director General of Natural Resources and Ecosystem Conservation. Regulation of the Director General of Natural Resources and Ecosystem Conservation Number: P.6/KSDAE/SET/Kum.1/6/2018 Concerning Technical Guidelines for Conservation Partnerships in Nature Reserves and Nature Conservation Areas. 2018.
222. Siarudin, M.W.A.; Indrajaya, Y.; Badrunasar, A.; Rahayu, S.; Roshetko, J.M. Bogor, Indonesia: Seri Agroforestry dan Kehutanan di Sulawesi: Keanekaragaman Hayati Jenis Pohon pada Hutan Rakyat Agroforestri di DAS Balangtieng, Sulawesi Selatan. *Work. Pap.* **2017**, *253*, 1–14. [CrossRef]
223. Achmad, B.; Diniyati, D. Keragaman jenis tanaman dan pengelolaannya pada hutan rakyat di Kabupaten Ciamis, Jawa Barat. In Proceedings of the Prosiding Seminar Nasional Masyarakat Biodiversity, Yogyakarta, Indonesia, 21 March 2015; pp. 460–465.
224. Darman, R.A. *Analisis Aktor, Relasi Kuasa Dalam Pembangunan Dan Pengelolaan Hutan Desa Labbo*; Hasanuddin University: Makassar, Indonesia, 2017.

225. Kurniadi, R. Social forestry for improving environmental quality and community welfare: A case study of Pantar Island, Alor, East Nusa Tenggara Province. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *487*, 012013. [CrossRef]
226. Lata, L.N.; Rashid, A.Z.M.M. Social Forestry: Principles, Evolution, and Implications for Sustainable Development. In *Life on Land*; Leal Filho, W., Azul, A.M., Brandli, L., Lange Salvia, A., Wall, T., Eds.; Springer International Publishing: Cham, Switzerland, 2020; pp. 1–12.
227. Afroz, S.; Cramb, R.; Grünbühel, C. Ideals and institutions: Systemic reasons for the failure of a social forestry program in south-west Bangladesh. *Geoforum* **2016**, *77*, 161–173. [CrossRef]
228. Berkes, F.; Colding, J.; Folke, C. Rediscovery of Traditional Ecological Knowledge as Adaptive Management. *Ecol. Appl.* **2000**, *10*, 1251–1262. [CrossRef]
229. Rashid, M.A.Z.M.; Craig, D.; Mukul, S.A.; Khan, N.A. A journey towards shared governance: Status and prospects for collaborative management in the protected areas of Bangladesh. *J. For. Res.* **2013**, *24*, 599–605. [CrossRef]
230. Kelley, L.C.; Peluso, N.L.; Carlson, K.M.; Afiff, S. Circular labor migration and land-livelihood dynamics in Southeast Asia's concession landscapes. *J. Rural. Stud.* **2020**, *73*, 21–33. [CrossRef]
231. Peluso, N.; Purwanto, A. The Remittance Forest: Turning Mobile Labor into Agrarian Capital: Nancy Lee Peluso and Agus Budi Purwanto. *Singap. J. Trop. Geogr.* **2017**, *39*. [CrossRef]
232. Pham, T.T.; Bennet, K.; Vu, T.P.; Brunner, J.; Le, N.D.; Nguyen, D.T. Payments for forest environmental services in Vietnam: From policy to practice. *Repos. Agric. Res. Outputs* **2013**.
233. Nahlunnisa, H.; Zuhud, E.A.M.; Santosa, Y. Keanekaragaman spesies tumbuhan di areal nilai konservasi tinggi (NKT) perkebunan kelapa sawit, Provinsi Riau. *Media Konserv.* **2016**, *21*, 91–98.
234. Rahayu, S.; Khususiyah, N.; Galudra, G.; Sofiyuddin, M. *Buku Pedoman Pemantauan dan Evaluasi Pengelolaan Hutan Desa Berbasis Masyarakat*; World Agroforestry Centre (ICRAF): Bogor, Indonesia, 2016.
235. Córdova, R.; Hogarth, N.J.; Kanninen, M. Sustainability of Smallholder Livelihoods in the Ecuadorian Highlands: A Comparison of Agroforestry and Conventional Agriculture Systems in the Indigenous Territory of Kayambi People. *Land* **2018**, *7*, 45. [CrossRef]
236. Surjono, G. Kehutanan Sosial Sebagai Program Pengentasan Kemiskinan Masyarakat Miskin Perdesaan Social Forestry as Poverty Elimination Program on Forestry Poor Community. *Media Inf. Penelit. Kesejaht. Sos.* **2020**, *44*, 211–224.
237. Putraditama, A.; Kim, Y.-S.; Sánchez Meador, A.J. Community forest management and forest cover change in Lampung, Indonesia. *For. Policy Econ.* **2019**, *106*, 101976. [CrossRef]
238. Morris, R.J. Anthropogenic impacts on tropical forest biodiversity: A network structure and ecosystem functioning perspective. *Philos. Trans. R. Soc. B Biol. Sci.* **2010**, *365*, 3709–3718. [CrossRef]
239. Sing, L.; Ray, D.; Watts, K. *Ecosystem Services and Forest Management*; Forestry Commission: Edinburg, UK, 2015.
240. Setiahadi, R. How significant is the existence of forest community contribution in GHG emissions reduction. *J. Eng. Appl. Sci.* **2017**, *12*, 4826–4830.
241. Gunawan, H. *Inovasi Konservasi Habitat Macan Tutul Jawa (Panthera pardus melas) di Lanskap Hutan Terfragmentasi*; Badan Penelitian, Pengembangan dan Inovasi: Bogor, Indonesia, 2019.
242. Meijaard, E.; Santika, T.; Wilson, K.A.; Budiharta, S.; Kusworo, A.; Law, E.A.; Friedman, R.; Hutabarat, J.A.; Indrawan, T.P.; Sherman, J.; et al. Toward improved impact evaluation of community forest management in Indonesia. *Conserv. Sci. Pract.* **2021**, *3*, e189. [CrossRef]
243. Jong, H.N.; Community control of forests hasn't slowed deforestation, Indonesia study finds. Mongabay Ser. *Indones. For.* Available online: https://news.mongabay.com/2022/01/community-control-of-forests-hasnt-slowed-deforestation-indonesia-study-finds/ (accessed on 4 January 2022).
244. Murniati; Yeni, I.; Minarningsih; Sumarhani. Introducing sustainable agroforestry to encourage implementation of social forestry in Gedong Wani Forest Management Unit, Lampung, Indonesia. In Proceedings of the International Workshop and Seminar: Innovation of Environmental-Friendly Agricultural Technology Supporting Sustainable Food Self-Sufficiency, Surakarta, Indonesia, 18–20 September 2018.
245. Yeny, I.; Murniati, M.; Suharti, S. Partisipasi Masyarakat dalam Pengembangan Agroforestri di Kesatuan Pengelolaan Hutan (Kph) Gedong Wani. *J. Penelit. Sos. Dan Ekon. Kehutan.* **2020**, *17*, 49–66. [CrossRef]
246. Octavia, D.; Suharti, S.; Murniati; Dharmawan, I.W.; Nugroho, H.Y.; Supriyanto, B.; Rohadi, D.; Njurumana, G.N.; Yeny, I.; Hani, A.; et al. Mainstreaming Smart Agroforestry for Social Forestry Implementation to Support Sustainable Development Goals in Indonesia: A Review. *Sustainability* **2022**, *14*, 9313. [CrossRef]
247. Winara, A. Prospek Jalawure (*Tacca Leontopetaloides* (L.) Kuntze) sebagai Sumber Pangan Alternatif dari Hutan Pantai. In *Optimalisasi Pemanfaatan Sumber Pangan Dari Hutan*; IPB Press: Bogor, Indonesia, 2019; pp. 89–109.
248. Agustarini, R.; Kartikaningtyas, D. Pangan Lokal Andalan Masyarakat Sumba Timur. In *Optimalisasi Pemanfaatan Sumber Pangan Dari Hutan: Sumbangsih untuk Ketahanan Pangan Nasional*; IPB Press: Bogor, Indonesia, 2019.
249. Rahman, S.A.; Sunderland, T.; Kshatriya, M.; Roshetko, J.M.; Pagella, T.; Healey, J.R. Towards Productive Landscapes: Trade-Offs in Tree-Cover and Income across a Matrix of Smallholder Agricultural Land-Use Systems. *Land Use Policy* **2016**, *58*, 152–164. [CrossRef]
250. Zhang, S.; Paterson, J.S.; Hujala, T. Sustaining Forest Ecosystem Services through Social Enterprises: Motivations and Challenges from a Case Study in Scotland. *Small-Scale For.* **2021**, *20*, 627–647. [CrossRef]
251. Sahide, M.A.K.; Jusuf, Y.; Alam, S.; Supratman; Millang, S.; Mahbub, A.S.; Bachtiar, B.; Sabar, A.; Nasri; Nursaputra, M.; et al. *Kajian Dampak Perhutanan Sosial Provinsi Sulawesi Selatan*; Fakultas Kehutanan, Universitas Hasanuddin: Makassar, Indonesia, 2018.
252. Gani, I. Dampak pandemi COVID-19 terhadap sektor usaha di Kalimantan Timur. *INOVASI* **2021**, *17*, 1–9.