forests

MDPI

Article

Social Acceptability of a Sustainable Forestry Industry in Puerto Rico: Views of Private, Public, and Non-Profit Sectors

Luis E. Santiago [1], Jimena Forero-Montaña [2,*], Elvia J. Melendez-Ackerman [2,3], William A. Gould [4] and Jess K. Zimmerman [2]

[1] School of Public Administration, University of Central Florida, Orlando, FL 32801, USA; luis.santiago2@ucf.edu
[2] Department of Environmental Science, University of Puerto Rico, Río Piedras, PR 00936, USA; elmelend@gmail.com (E.J.M.-A.); jesskz@ites.upr.edu (J.K.Z.)
[3] Center for Applied Tropical Ecology Conservation, University of Puerto Rico, Río Piedras, PR 00936, USA
[4] USDA Forest Service International Institute of Tropical Forestry, Río Piedras, PR 00926, USA; william.a.gould@usda.gov
* Correspondence: forero.jimena@gmail.com

Abstract: Sustainable forestry is key to increase the adaptive capacity and resilience of regions exposed to extreme atmospheric events. Understanding social acceptability of forest management practices through a public dialogue that involves a diversity of stakeholders is important to define management policies and strategies. Here, we inquire about social acceptability of a sustainable forestry industry in Puerto Rico by convening a set of local experts from private, non-profit, and public sectors through focus group discussions. We presented three scenarios characterized by different elements of sustainability. Discussions included organizational and management considerations, potential products and markets, and the impact of extreme weather events. The results show that greater agreement was observed within groups than across groups. Most of the private sector participants valued mainly financial viability, while the public and the non-profit sectors gave more importance to social equity and environmental protection. This suggests that there is no single ideal model; thus, participation from all sectors in subsequent conversations would be worthwhile to seek a model that would work for most of the stakeholders. As a next step, we suggest expanding the stakeholder consultation effort to delineate a clear road map that can inform sustainable forestry planning at the local level.

Keywords: forestry; social acceptability; social perceptions; sustainable forest management

Citation: Santiago, L.E.; Forero-Montaña, J.; Melendez-Ackerman, E.J.; Gould, W.A.; Zimmerman, J.K. Social Acceptability of a Sustainable Forestry Industry in Puerto Rico: Views of Private, Public, and Non-Profit Sectors. *Forests* **2022**, *13*, 576. https://doi.org/10.3390/f13040576

Academic Editor: Luis Diaz-Balteiro

Received: 18 February 2022
Accepted: 2 April 2022
Published: 6 April 2022

1. Introduction

Climate change is expected to increase the frequency and severity of extreme atmospheric events [1–3], challenging countries to increase their adaptive capacity and improve their resilience to such events by implementing best practices in planning, response, and recovery [4–6]. Managing forest resources within the context of future extreme weather events presents challenges in developing practical adaptation measures to maintain social–ecological resilience and reduce social–ecological vulnerability [7]. When it comes to forested lands in tropical areas, salvaging wood of fallen trees after severe storms can present economic opportunities, considering the high economic value that may be derived from tropical woods, but it requires a well-developed forestry industry with the capacity to handle a huge post-storms timber surplus [8].

Development of forestry-driven economic activities requires an understanding of the local stakeholders' acceptance of economic uses of the forests, which factors may drive this acceptance (or lack thereof), and which processes and initiatives can integrate the public and private sectors in the development of sustainable forestry strategies [9–11]. This information and these technical competencies provide useful elements required to define

land policies and strategies [12]. As the world recognizes the multiple ecosystem services provided by forest cover and their importance to human well-being, identifying the social acceptability of certain forestry practices over others has become increasingly important and more so when public participation is deemed as essential for sustainable forestry [13]. Understanding the social acceptability of forestry practices is important not only because of its critical role for decision making [14], but also because ultimately management decisions about natural resources result from selecting intervention alternatives that to some extent are based on value–judgements and motivations from a variety of stakeholders that are not always aligned [15]. Public perceptions and attitudes toward forests may range from biological conservation to considering the forest as a source of goods such as wood, non-wood forest products, and other ecosystem services. Moreover, the success of forestry policies is partially dependent on accountability for public values [10,16]. Private forest managers also share concerns about public acceptance of their practices because forests are often viewed as a larger societal asset, regardless of ownership [17]. Bengston (1994) [18] has highlighted three benefits that managers can derive from an understanding of social values: better inform forest management objectives, predict reactions to particular forest practices, and understand and manage value conflicts [19,20]. In recent decades, a broader segment of society has been exposed to a wider range of sustainable ecosystem services, as opposed to those that center around resource extraction and exploitation [17,21,22]. Managers are increasingly encouraged to ensure that there is alignment between management practices and such public expectations [10,16] with the understanding that forest values and expectations are bounded by their temporal and geographic context [23].

The Puerto Rico Context

The archipelago of Puerto Rico, a United States territory in the Caribbean since 1898, is a characteristic example of forest transition in emergent economies, where industrialization in the mid-20th century led to extensive forest recovery on abandoned agricultural fields [24,25]. Forest cover increased from less than 10% of total land area in the late 1940s to more than 54% in 2014 [26]. For detailed maps and geospatial analyses of Puerto Rico's current land cover, see Gould et al. (2017) [27]. Today, with a population of approximately 3.1 M inhabitants [28], Puerto Rico is experiencing a 15-year plus recession [29], further aggravated by the 2017 hurricanes, Irma and María, that led to reductions in the economic well-being of communities [30]. These hurricanes left thousands of downed trees in urban and rural areas [31,32]. Biomass of these trees created a severe materials management problem to already economically depressed municipalities [33] in part due to an underdeveloped local forestry industry. Past experiences in Puerto Rico with timber harvesting suggest that there may be general public resistance to forestry activities. In 1986, the El Yunque National Forest (EYNF) land and resource management plan [34] was strongly contested by local communities and conservation organizations, who had expressed major concerns with proposed timber harvest and supporting infrastructure, even when supported by ecological and economic scientific data. Thus, timber harvest was mostly excluded from the decision-making process, and reflecting stakeholder's priorities, the EYNF plan at the time emphasized forest protection and cultural activities, limiting opportunities for timber harvesting to a small demonstration plantation plot [35]. Today, however, there is a general scientific consensus that to reorient societies toward a biobased, sustainable or green economy, it is necessary to revive the forestry sector as a key player for providing ecosystem services, raw materials, and products [36].

The previous experience in Puerto Rico is evidence of the evolving paradigms that serve to define forestry in the broader sustainable context. The shift away from a nearly exclusive economic development paradigm to consider environmental and social equity concerns shows an evolution toward a broader definition of sustainability. Within the Planning field, the Planners' Triangle, proposed by Campbell (1996, 2016) [37,38], is used to frame the pursuit of sustainable outcomes considering three elements: economic development, environmental protection, and social equity. A sustainable outcome can be

described as one that seeks a difficult-to-achieve balance among the three elements, given that conflicts arise between each pair of components. We propose that social acceptability of sustainable forestry activities in Puerto Rico must be addressed as a balance among the development of a green economy, the sustainable management of forest resources, and the availability of decent work.

Seeking social acceptability of sustainable forestry in Puerto Rico can be advanced by exploring enabling environments that include effective governance networks and institutions, and more specifically, forest management schemes. Social acceptability of a developing forestry industry can also depend on the perception of whether potential and emerging markets rely on sustainable or unsustainable practices for its production. New products that align with sustainable consumption patterns not only imply a more sustainable way of implementing forest management strategies, but align with broader cultural changes toward sustainability, local production, and carbon neutrality in systems of production and consumption [39].

This study examines the social acceptability of a sustainable forestry industry in Puerto Rico by convening a set of local experts from private, non-profit organizations, and public sectors through a focus group discussion that presented three scenarios, one hypothetical and two real, based on examples of forestry industries in the Central American and Caribbean regions, which are characterized by different positioning in the Planners' Triangle of sustainable development. In addition, the study provides a list of potential and emerging products that may lead to a sustainable forestry industry in Puerto Rico and evaluate factors that would hinder or facilitate the use of locally harvested woods in a commercial context. To address our objectives, the project team contacted key stakeholders who are involved in the forestry sector in Puerto Rico. The study addressed the following research questions:

1. What are stakeholders' preferences when comparing commercial wood harvesting operations with different scales, organizations, and management schemes?
2. What are stakeholder's perceptions of potential markets and wood products?
3. What are stakeholder's perceptions of the impact of extreme weather events on wood harvesting?

We expected a divergence of positions among stakeholders, as well as a difference in the values that they attribute to the forestry sector. For example, the private sector may seek to utilize forest resources on a commercial basis in order to maximize profit from wood and non-wood forest products. Members of non-profit organizations might recognize the worth of forestry practices that will also protect biodiversity and the various functions and services provided by forests, such as agroforestry, organic farming, and reforestation. The public sector may be aligned with Puerto Rico's government forest policy, which until recently was mainly focused on forest protection and recreation rather than on forest production; thus, they might be willing to encourage sustainable economic activities that do not threaten forest survival. However, we recognize that a wide range of opinions and viewpoints may exist within a category of stakeholders and are aware of the limitations in making generalizations about any one group of actors.

2. Materials and Methods

2.1. General Design

A focus group consultation was organized according to three main groups of stakeholders who are directly involved in the forestry sector: the private sector, the public sector, and the non-profit sector (Table 1). We attempted to contact 42 individuals and were able to communicate with 16, 13 of which were successfully recruited. Participants from the private sector belonged to the timber and creative industries, including sawyers (1), artisans (3), and private forest owners (1). The public sector was represented by officials from state (1) and federal (4) government environmental agencies. Non-profit group participants were researchers (2) and community organizers (2) with particular interest in forest management.

Individuals who were identified for participation in each of the three groups were recruited through direct email communication or telephone calls.

Table 1. Role, responsibilities and interest focus of each group of stakeholders in forest policy and governance in Puerto Rico.

Focus Group	Actors and Stakeholders	Roles and Responsibilities	Interest Focus
Private sector	sawyers, artisans, and private forest owners	Seeking opportunities for economic development	Profits derived from forest resources
Public sector	officials from state and federal government agencies	Implementation of the forest law of Puerto Rico (Law 133, 1975)	Long-term protection of forest resources
Non-profit sector	researchers and community organizers	Education, research, and technical assistance	Biodiversity conservation

Although our original intent was to conduct focus groups in person, COVID-19 related restrictions instituted by our local Institutional Review Board led us to adopt an online format. We conducted three online independent meetings, one for each group. The private sector focus group was held with five participants, and the non-profit and public focus groups comprised four participants each. Consent forms were emailed to potential participants to obtain their approval prior to participation. Guiding questions and visual aids presented in PowerPoint format were used to direct the online discussion. Each participant was encouraged to engage and contribute at least once after each question was posed and react to comments made by others.

All three meetings were video recorded and later transcribed. These were conducted in Spanish; thus, original transcripts were translated and analyzed in English. We conducted classical content analysis [40]. See the questionaries used to guide the focus group discussions in the supplementary materials. The analysis included identifying a given code within each participant's speech, both within groups and between groups. Each statement is generally accompanied by the number of participants who endorsed that viewpoint, thus helping to validate any inferences made about the level of consensus or dissent. We also counted the number of interventions made by each participant per question or theme to provide a measure of equitable participation per group.

2.2. Management and Sustainable Production Scenarios

Participants were presented with two examples of commercial wood harvesting operations in locations outside Puerto Rico, and one example of a wood products operation in Puerto Rico. These models specified location, extent and mechanism associated with harvesting, jobs and income created, and products (Table 2).

Table 2. Management and sustainable production scenario characteristics.

Scenario	Type of Project	Location	Extent	Organization	Jobs	Products
1	Real	Honduras	1525 ha	Cooperative	46	resin, timber
2	Hypothetical	The Dominican Republic	NA	Medium Scale	NA	timber, paper
3	Real	Puerto Rico	2111 m^2	Small Scale	2	furniture and crafts

The two real scenarios were selected to show an example of a small-scale sustainable wood products establishment in Puerto Rico and, an example of a cooperatively owned, larger scale sustainable operation in the Central American and Caribbean context. The hypothetical scenario aimed to show to the focus group participants what a traditional

medium scale production with a strong market orientation would look like in a Caribbean Island context. We had to use hypothetical scenarios to explore what participating stakeholders would consider as more socially acceptable means of organizing and managing wood industries that currently do not exist in Puerto Rico because commercial timber harvesting has been excluded from Puerto Rico´s forest policy and practices for more than three decades. Furthermore, due to data confidentiality agreements, it was nearly impossible to obtain an existing financial and production profile of a private wood production firm, which led to the creation of a hypothetical scenario that combines characteristics of existing private forestry operations in other countries.

After providing a detailed description of each scenario, participants were asked to comment on the desirability and applicability of these harvesting practices in the Puerto Rican context and rank each of the three options. Participants were then presented with a definition of sustainability, defined as seeking a balance among three components: environmental protection, economic development, and social equity [37,38]. This concept, in the forestry context, presupposes that sustained timber production is no longer the primary goal of forestry, and emphasizes the importance of different goods and services such as non-wood forest products, biodiversity and nature conservation, soil and water protection, tourism and recreation, carbon storage, and climate change mitigation [41]. Hence, participants were asked to comment on the desirability and suitability of each scenario explicitly considering this definition of sustainability and were given the opportunity to reconsider their previous ranking. Participants were also asked to comment on appropriate management schemes.

The following scenarios were not presented as mutually exclusive, but a scenario ranking exercise was conducted to explore what participating stakeholders would consider as more socially acceptable means of organizing and managing wood products industries in Puerto Rico. The exercise also sought to explore which scenarios would be perceived by stakeholders as more sustainable.

2.2.1. Scenario 1 (Agroforestry Cooperative)

San José de Protección, formed in 1973 in the central highlands of Honduras, was one of the country's first agroforestry cooperatives [42]. The Cooperative of San José de Protección has 46 members, including 11 women. The cooperative has usufruct rights over 1526 hectares of public forest, of which about 90 percent is pine, owned by the local municipality, and commercialization takes place through the cooperative. The cooperative was a founding member of the Honduran Federation of Agroforestry Producers (FEPROAH), which has a critical role in strengthening the voice of community-based producers in policy discussions [42]. Parcel holders would be treated as private owners, receiving a stumpage payment of about USD 4 per m^3. The forest stock is privatized for resin production, but collectively managed with regard to timber. Unlike other agroforestry cooperatives in Honduras, capital assets have been acquired mainly through loans rather than donor grants. Limiting external assistance has been an important cooperative policy, motivated in part by a desire to avoid excessive external interference in its management and decision-making process. All forestry-related activities are undertaken directly by members; professional foresters are only called upon to draw up annual cutting plans and renew the forest management plan every five years. Technical assistance is usually paid for by the cooperative or provided by close partners such as the municipality. Established by resin tappers, resin continues to be the primary income source of its members. Timber production was introduced more recently, initially limited to logs, which are now processed in the cooperative sawmill. The cooperative's entire net income is usually reinvested in capital assets or used to repay loans [42].

2.2.2. Scenario 2 (Private Sector Medium-Sized Enterprise)

Agro-Forestal RD is a medium-sized wood harvesting company located in the Baoruco Province in the Dominican Republic. The firm is a medium-scale commercial operation,

cutting trees for sale as timber or pulp. The company owner was able to enter the wood harvesting industry through logging concessions. A logging concession is an arrangement where the government of a country grants harvesting rights of publicly owned forests for a contract period, which may range from 2 to 20 years. In this case, the contract period is 10 years. Logging machines are used for wood harvesting. As certain sections of the logging area are harvested, available space is slowly converted to commercial agriculture. Capital assets for this company have been acquired mainly through loans rather than donor grants. A large paper company provided Agro-Forestal RD a low interest loan to buy the necessary equipment for operations. Each year Agro-Forestal RD meets with the paper company, its only buyer, to negotiate a price for sawn wood and agree on quantity to be harvested and sold. The owner meets with personnel at the paper company to establish production goals for the following year and negotiate selling prices. The paper company has a sustainability plan for the region, and indicates that it maintains good relationships with its suppliers, generally small and medium wood harvesting clients such as Agro-Forestal RD. Approximately half of the company's net income is used to repay loans required to get the business started. This is the only hypothetical scenario presented to participants, drawing from various characteristics of existing medium sized private paper companies.

2.2.3. Scenario 3 (Small Artisan Furniture Making)

This business, operating for 25 years, is owned by an artisan and cabinetmaker who produces traditional Puerto Rican furniture. The company is located in a 2111 m^2 lot, and the owner has gradually built structures for sawmill, wood processing, and furniture making. The cabinetmaker buys wood harvested from other locations or finds wood through other informal means, and processes its own wood for furniture making. Sawmill equipment was purchased approximately 12 years ago with personal funds, and no loan was obtained to secure this transaction. The business is operated with funds derived from sales of furniture, which are sold through commercial outlets or directly to individuals in Puerto Rican and international markets, including the mainland US, Central America, and the Caribbean. The business is operated by the owner, who works full time in daily operations, and two of the owner's family members, who work in the business on a part-time basis. Some of the species used in furniture making include mahogany (*Swetenia* spp.), Spanish cedar (*Cedrella odorata* L.), white cedar (*Tabebuia heterophylla* (DC.) Britton), and teak (*Tectona grandis* L.), and its main products include wooden tables and chairs. See Forero-Montaña et al. (2018) [43] for more details on the current characteristics of the forestry industry and local wood market in Puerto Rico.

2.3. Potential Markets for Wood Products

Focus group participants were asked to identify potential wood products and markets. A preliminary list that included artisanal products, furniture, household supplies, stationary, wood chips, and compost, among others, was presented. They were also asked to rank the importance of new products.

2.4. Impact of Extreme Weather Events on Wood Harvesting

Given the recent occurrence of hurricanes Irma and María in September 2017, focus group participants were asked to comment on how extreme weather events may affect wood harvesting in Puerto Rico, and were asked to include examples of the impact that hurricanes and earthquakes would have on a local forestry industry.

3. Results

The focus group participant quotes that informed the results are in the supplementary materials.

3.1. Management and Sustainable Production Scenarios

3.1.1. Scenario 1: Agroforestry Cooperative

Private Sector Focus Group: In response to this scenario, the private sector focus group cited examples of unsuccessful artisan cooperatives in Puerto Rico, due in part to stolen ideas and a lack of desire to implement uniform procedures. The majority of participants in this group did not prefer this scenario.

Non-profit Focus Group: Similarly, the majority of participants in this group considered that this scenario would not be feasible due to insufficient acreage or land, but one participant indicated it could work if developed in public lands (an idea also raised by public sector participants) or if landowners associate to work in an integrated manner.

Public Sector Focus Group: In contrast, participants in this group consistently preferred the Agroforestry Cooperative scenario, indicating that it would allow for a distribution of benefits beyond the individual to reach the community. One participant of the public sector indicated that this scenario would be feasible if developed in public lands or if landowners merged to form a cooperative.

3.1.2. Scenario 2: Private Sector Medium-Sized Enterprise

Private Sector Focus Group: This scenario was preferred by the majority of the private sector focus group participants. They attributed value to the reliable source of income at the expense of leaving out possible agreements with other buyers. The idea of a fixed buyer was seen as ideal for the majority in this group. Only one member, however, considered this scenario unsuitable, because he saw its implementation as a privatization exercise. Some of the obstacles for a wood products industry identified by the private sector group included higher operational costs in Puerto Rico, as compared to their neighboring islands, and potential difficulties in selling the products as a result of undeveloped markets.

Non-profit Focus Group: In contrast, the majority of non-profit organization participants, with the exception of one, did not choose the Private Sector Medium-Sized Enterprise scenario. One participant described it as a traditional commercial operation, undesirable in the Puerto Rican context.

Some characteristics of this scenario were identified as feasible, such as the idea of concessions of public land, and others were not, such as land use for agriculture once trees have been harvested. Participants indicated this scenario might be feasible on a smaller scale than described, if market studies would indicate that there are potential buyers for its products, and savings and loans cooperatives would provide the necessary funding.

Public Sector Focus Group: The Private Sector Medium-Sized Enterprise scenario was not acceptable by members of the public sector, although one participant indicated it might be an option for implementation in public lands. The scenario was described as responding to needs different from those of the Puerto Rican market, and its scale was not appropriate. One participant mentioned that she would prefer a combination of the Private Sector Medium-Sized Enterprise and the Agroforestry Cooperative scenarios, with a vision of sustainable management where a balance between environmental and economic benefits would be established.

3.1.3. Scenario 3: Small Artisan Furniture Making Business

Private Sector Focus Group: The majority of the participants in this group described the Small Artisan Making Business as the typical model in the Puerto Rican context, and only one participant selected it as the preferred scenario. They see a need to identify markets for this model to work and highlight the importance of differentiating local wood from imported wood in markets. One of the weaknesses of the model, according to this group, was the reliance on others for wood, and the possibility of having to import wood.

Non-profit Focus Group: Half of the participants in this group preferred this scenario. It was described as being widely adopted in Puerto Rico, and participants focused on how to improve its feasibility. Two of the suggestions included developing a forestry culture and a marketing effort that included digital networks.

Public Sector Focus Group: The Small Artisan Furniture Making scenario was the least preferred by the majority of public sector participants. The scenario was described as the current reality of Puerto Rico, and one that needs free or lower priced raw material. Financing difficulties were also highlighted, particularly that equipment would need to be acquired through private banking loans. However, they mentioned that there is still a need to support those who wish to engage in this practice.

3.1.4. Scenario Ranking

Three out of five participants in the private sector focus group selected the Private Sector Medium-Sized Enterprise scenario as the most preferred and the Small Artisan Furniture Making scenario as the least preferred. The other two participants selected the Agroforestry Cooperative-scenario and the Small Artisan Furniture Making scenario, each, as the most preferred. When asked to consider sustainability explicitly as one of their selection criteria, the three who selected the Private Sector Medium-Sized Enterprise scenario did not change their ordering, while one showed an increased preference for the Agroforestry Cooperative scenario.

The non-profit focus group was quite divided when it came to preferred scenario selection. Out of the four members, two selected the Small Artisan Furniture Making scenario, one the Agroforestry Cooperative, and the other two the Private Sector Medium-Sized Enterprise scenario. Three out of four selected the Private Sector Medium-Sized Enterprise scenario as the least preferred. When asked to consider sustainability as an explicit factor in decision making, none of the participants changed the ordering of their previous selection.

The public sector focus group exhibited more agreement in their preference ordering. All participants in this group selected the Agroforestry Cooperative scenario as the most preferred, and three out of four chose the status quo, the Artisan Furniture Making scenario, as the least preferred. As observed in the non-profit focus group, when asked to consider sustainability as an explicit selection criterion, none of the participants changed their preference ordering.

Considering all participants regardless of their grouping, the most preferred scenario was the Agroforestry Cooperative scenario (six participants), followed by the Private Sector Medium-Sized Enterprise (four participants), and the Small Artisan Furniture Making Business scenario (three participants). When it came to least preferred scenarios, the Small Artisan Furniture Making Business and the Private Sector Medium-Sized Enterprise were selected as equally least preferred, with six responses each, while only one selected the Agroforestry Cooperative as the least preferred. Greater agreement was observed within groups than across groups.

3.2. Potential Markets for Wood and Other Forestry Products

The private sector focus group mentioned potential buyers in the US and Europe. One issue that seemed to be controversial was the price of wood: one private sector member indicated the price of wood from PR was lower compared to US vendors, while others indicated the contrary. He indicated that exotic woods would have a higher market value, including mahoe, lignum-vitae, and Spanish elm.

One member mentioned artisan work, furniture (particularly for supplying tourist facilities such as hotels), construction, wood used for pallets in pharmaceutical settings and agrotourism (including coffee farms). Another member pointed out that tree species for wood cultivation would depend on the development of market niches, considering the time frame to harvesting. A participant focused on the use of exotic wood for musical instruments, which should consider popular instruments such as the guitar, not only the *cuatro* (a traditional string instrument from Puerto Rico).

The non-profit group focused the discussion on products, not markets. The identified potential products and the number of participants who mentioned them (in parentheses) included wood products such as furniture (3), musical instruments (3), toys (1), sculptures

of religious figures (1), and non-wood forest products (NWFP) that can be cultivated in agroforestry systems such as flowers (3), seeds for jewelry (1), leaves (1), seeds (1), resins (1) and mushrooms (1). These products can supplement the families' diet and provide a secondary income. One member highlighted the importance of pursuing a diversified product base, and another mentioned a marketing and branding effort that emphasizes higher quality products.

The public sector participants focused on potential products as well. Some of the products mentioned and participants who mentioned them (in parentheses) included artisan work (1) and NWFP such as seeds (3), germplasm (1), parental trees (1), diversifying native tree quantities (1), meat (1), fruit (1), vegetable (1), coffee (1) and cocoa (1) that can be produced in agroforestry systems. There was an emphasis on the time frame to harvesting and alternatives that would help farmers generate revenue while trees grow for later harvesting. One participant focused on activities of recreation in nature such as birdwatching and cautioned against focusing on native trees as a "magic wand", highlighting the importance of considering scientific evidence in tree species selection and use.

3.3. Impact of Extreme Weather Events on Wood Harvesting

The private sector focus group considered physical infrastructure and tree species. After Hurricane María, participants noted that it became apparent that forestry agencies do not have the necessary physical and organizational infrastructure to recuperate wood.

Accessibility and mobility issues were highlighted. Access to felled trees after an extreme weather event is seen as a challenge, not only because of obstructions, but also because of a lack of gasoline as a result of disruptions to the established supply chains. One participant also mentioned that endemic or native tree species survived hurricane force winds, a fact that should be considered in the long term when tree species are selected.

The non-profit group sector focused on the planning component for extreme weather events. One participant indicated we should focus not only on hurricanes, but also on earthquakes and droughts, which may lead to fires, affecting wood quantity and quality. Avoiding runoff and erosion through tree planting was mentioned by two participants. Selection of tree species resistant to extreme weather event conditions was also highlighted by one participant, although in this case, the native versus exotic species argument was not highlighted, as in the previous focus group. The need for legislation that may foster or hinder wood harvesting efforts after an extreme weather event was also mentioned.

Only one member of the public focus group commented on the impact of extreme weather events, placing emphasis on better planning and management at the Federal and Commonwealth levels. She indicated planning should include urban stakeholders and landowners, not just those associated with public lands.

3.4. Focus Group Participation across Sectors

A brief analysis of total interventions per topic shows that the highest participation across sectors was the discussion of the Private Sector Medium-sized Enterprise scenario (Table 2). Out of the 20 interventions across groups, half occurred in the private sector focus group, who had several participants voice support for this option. The remaining two scenarios did not elicit the same level of participation across groups, with 13 interventions each (Table 2).

Potential markets and products elicited 14 interactions, and half of those occurred in the private sector focus group. The discussion on extreme weather events only prompted five interactions (Table 3). It is possible that its placement in the discussion (last) in a two-hour focus group may have deterred some from participating.

Examining overall participation across topics, the private sector focus group elicited the largest number of interactions, 54% of the total. Although there was an additional fifth member in this group, participation was still proportionately higher for this group. The non-profit group had 16 and the government groups had 14 interactions, or 25 and 23% of the total.

Table 3. Global analysis of focus group participation showing the number of interventions per topic of each stakeholders group.

Group	Scenario 1	Scenario 2	Scenario 3	Markets	Weather	Total
Private	7	10	7	7	4	35
Non-profit	4	365	4	3	0	16
Public	2	5	2	4	1	14
Total	13	20	13	14	5	65

The column "markets" refers to the number of references made by participants on wood products markets during the focus group discussions. The column "weather" refers to the frequency of mentions regarding the impact of extreme weather events on a potential forest industry in Puerto Rico.

4. Discussion

The goal of sustainable forest management is to ensure sustainable ecosystem services and viable forest-based economies while maintaining ecological integrity and social equity [44]. However, achieving sustainability is often considered a substantial problem, as issues of sustainable development are always complex, prone to conflicts and to uncertainties that may themselves be barriers to sustainability [45]. A focus group format was used to evaluate social perceptions of different forest management schemes as a way to uncover potential barriers for the implementation of a sustainable forestry industry associated with timber production. We used the island of Puerto Rico as a case study and the three elements of the Planners' Triangle of sustainable development as our evaluation framework [37]. These research approaches may be particularly useful when the goal is to understand stakeholders' perceptions and expectations of forest management, especially between business and other sectors [16]. They also set the stage for the development of forestry-based economies, which are both more inclusive as well as locally and socially relevant [46].

Our focus group discussions examined elements necessary for the pursuit of a sustainable forestry industry in Puerto Rico. Discussions included organizational and management considerations, potential markets for wood products, and the impact of extreme weather events on the development of sustainable forestry. The results show that stakeholders had diverse perceptions and opinions regarding these issues; however, a general consensus exists on the need of supporting the forestry sector to develop a green economy and climate change mitigation strategy in Puerto Rico.

4.1. Organizational and Management Considerations

Three scenarios describing alternative ways of organizing forestry economic activity were presented: an Agroforestry Cooperative, a Private Sector Medium-Sized Enterprise, and a Small Artisan Furniture Making Business. While there was no consensus in terms of a preferred scenario, focus group participants indicated reasons for their preferred organizational scheme. Greater agreement was observed within groups than across groups, with the Agroforestry Cooperative being the most preferred, followed by the Private Sector Medium-Sized Enterprise, and lastly by the Small Artisan Furniture Making Business. Such differences in scenario organizational scheme preferences showed that diverse stakeholders confer different relative importance to the three elements of the Planners' Triangle of sustainable development. In agreement with our hypotheses, private sector participants valued mainly economic elements such as financial viability and access to markets, while the public and the non-profit sectors gave more importance to elements of social equity such as employment creation, income generation, as well as environmental protection, especially protection of water resources and avoidance of soil erosion. Possible causes for the observed divergence of opinions will be discussed, followed by strategies that may lead to longer term consensus building and a more unified vision of sustainability.

Public sector participants consistently preferred the Agroforestry Cooperative scenario, indicating that it would allow for a distribution of benefits beyond the individual to

reach the community. Compared to the other scenarios (the Private Sector and the Small Artisan Furniture Making), this option would be located closer to the social equity end of the Planners' Triangle. The role of effective cooperatives to achieve the goals of sustainable forest management has been extensively recognized by the United States Department of Agriculture and the Natural Resources Conservation Service [47]. Cooperatives provide a business structure that facilitates the ability of small producers to generate the volume of materials necessary to produce value-added products, increase market access, lower costs to individuals for goods and services, and ultimately contribute to better forestry practices [47,48]. Public sector participants, in this study, identified some of these attributes. They indicated that the agroforestry cooperative scenario would contribute to the local economy through employment creation. In addition, they stated that cooperatives could allow landowners with small plots to increase production, which could improve access to markets. Small forestry businesspersons, however, might be reluctant to associate because they feel that they will lose control or even ownership of their land by joining a cooperative [47]. The private sector focus group cited examples of unsuccessful cooperatives of artisans in Puerto Rico and attributed their failure to intellectual property and production issues. Nonetheless, they focused the discussion on past experiences of artisans' cooperatives and did not mention specific concerns about land tenure. Under the US and state laws, cooperatives are legal entities that formalize the benefits and responsibilities of collaboration with binding contracts, while the land remains privately owned and managed [47]. Forestry cooperatives and landowners' associations in the US Midwest, including the states of Illinois, Indiana, Iowa, Michigan, Minnesota, and Wisconsin, have played a significant role in creating opportunities for the development of local wood industries [48]. In many Latin American countries with experience in the development of small-scale forest enterprises (SSFEs), such as Mexico, Guatemala, Honduras, and Brazil, strong associations or federations of community-based organizations have emerged to represent the interests of local communities or SSFEs [42]. In Puerto Rico, cooperatives in the financial, food, health, agricultural, industrial, transportation, and cultural sectors have generated jobs and self-employment, fostered self-management, created housing, and have provided many other services [49]. However, the government of Puerto Rico has been criticized because of its excessive control over cooperatives, its paternalistic attitude, and its tendency to favor private interests [49]. Thus, a shift in vision to ensure that individuals have sufficient control over production would likely boost the positive outcomes of cooperatives [49]. Therefore, further broad discussion among forest landowners, artisans, and sawyers is important to explore the feasibility of agroforestry cooperatives and other forestry structures in Puerto Rico to promote sustainable forest management.

The majority of private sector participants preferred the Medium-Sized Enterprise scenario, mainly because they valued its financial viability where a single client would provide a loan for equipment and serve as a single reliable purchaser of wood products. This option would be located closer to the economic development end of the Planner's triangle [37], rather than to the environmental protection or social equity ends. These results highlight the need for effective investment in agroforestry and wood processing businesses to support a forestry industry endorsed by sustainable forest management. Innovative strategies for risk reduction and risk management are necessary to engage participation and commitment of the private sector in this field [50]. Some of the obstacles for a wood products industry identified by the private sector focus group included higher operational costs in Puerto Rico, as compared to their neighboring islands, and undeveloped markets. This result indicates that the private sector may be willing to venture into the forestry sector, if investments, increased profit, and market advantages are perceived. The development of SFEs into viable economic businesses requires a much more constructive public–private dialogue to encourage the government to listen more carefully and respond to the needs of the private sector. Transformative policies, purposeful innovative investment, access to finance, as well as new sustainable business models and markets are required to increase business profitability and growth in the forestry sector [50].

Conversely, this scenario was not acceptable by members of the public sector, although one participant indicated it might be an option for public lands. The scenario was described as inappropriate for the scale of Puerto Rico. Likewise, the majority of non-profit organization participants, with the exception of one, did not choose the Private Sector Medium-Sized Enterprise scenario. One participant described it as a traditional commercial operation, undesirable in the Puerto Rican context. The idea of concessions of public lands was identified as feasible, but the use of land for agriculture once trees have been harvested was considered unviable in Puerto Rico. One participant mentioned that she would prefer a combination of this scenario with an agroforestry cooperative, with a vision of sustainable forest management where a balance between environmental and economic benefits would be established. This option could be located along the economic development-social equity side of the Planners' Triangle, its exact location would depend on the weight attributed to each of the two components for a particular project.

There was no clear consensus among non-profit sector participants, with half of the participants selecting the Small Artisan Furniture Making Business scenario and the other half divided between the other scenarios. The small furniture scenario was described as widely adopted in Puerto Rico. When compared to the Medium-Sized Enterprise scenario, it might be located closer to the social equity side due to its focus on small business owners where profits may be more evenly distributed. The role of SSFEs in poverty reduction has been widely recognized, especially when they work together in effective associations [42,51,52]. The production of traditional furniture and handicrafts in Puerto Rico is an important form of self-employment and an essential means to supplement the income of poor families [43]. Artisans in general, however, work in unconnected individual microenterprises, and therefore, they face a number of challenges linked to scale disadvantages, which hinder their competitiveness in globalized markets [43].

Focus group discussions, in the present study, recognized a need to support those who wish to engage in this practice and focused on how to ensure small enterprise feasibility through mechanisms to improve marketing. Non-profit sector participants draw attention to the necessity to develop digital marketing networks. This effort would require a value chain analysis to effectively link government departments, wood product manufactures, wood growers, and industrial specialists. A marketing network would allow cooperation between SSFEs to overcome scale disadvantages [52]. A value chain analysis is also key to develop a support program for SSFEs based on the facilitation of financial services and business development services to create a market development approach to make market work for SSFEs [52]. The private sector focus group pointed out the necessity to find niche markets for tropical exotic woods in the US and Europe. To adapt to new market opportunities, SSFEs in Puerto Rico need to increase production efficiency and improve quality to make products more desirable to consumers [43]. Increasing the competitiveness of micro-, small-, and medium-sized enterprises requires providing better access to quality services, technology, resources, and infrastructure [51,52]. In addition, public sector participants cited financing difficulties as a major barrier for this scenario. Developing financial strategies to support SSFEs in Puerto Rico will require incentives to private funding to provide microcredit or small working capital loans to low-income individuals who are normally excluded from the commercial banking sector [43]. Thus, involving micro-financial institutions with a strong focus on their social missions rather than on their financial viability will be required to develop an effective financial strategy to support SSFEs in Puerto Rico. Other important considerations about the Small Artisan Furniture Making scenario pointed by the focus group discussions were its reliance on free or low-cost raw material, the possibility of having to import wood, and the time frame between cultivation and harvesting. These perceptions suggest that to advance the forestry industry in Puerto Rico, a detailed value chain analysis is required to improve market information systems, reinforce market value chains for wood products, and design forest management strategies that allow for product diversification such as agroforestry systems, which can generate economic opportunities for NWFP that do not require such a long

period of time to perceive economic benefits, an option suggested as part of a discussion on potential markets and forestry products that follows.

4.2. Potential Markets and Products and the Impact of Extreme Weather Events on Forestry

Some of the wood products mentioned by the private sector focus group included solid wood products such as artisan work, furniture (particularly for supplying tourist facilities such as hotels), construction, wood used for pallets in pharmaceutical settings, and economic activities around the forestry sector such as agrotourism in coffee farms. The discussion on potential products was generally framed along the economic development and environmental protection side of the Planners' Triangle, with potential production resulting in tradeoffs among the two components, and having equity implications. Both the non-profit and the public sectors focused on potential agroforestry products that could serve as a source of revenue before trees are ready for harvest. When compared to the private sector product list, these options seem to be located closer to the environmental protection side of the Planners' Triangle, but other production characteristics such as scale and technology need to be considered to determine the products' relative placement in the economic development–environmental protection side of the Planners' Triangle. The non-profit sector group also cautioned against focusing on native trees as a "magic wand", highlighting the importance of considering scientific evidence in tree species selection and use. There is a large body of scientific knowledge about wood quality, wood properties, and silviculture of Puerto Rico´s trees to make wise choices [53–56].

The impact of extreme weather events in the Caribbean is another factor that may influence forestry activity, sustainability, and social acceptability. Private sector focus group participants noted shortcomings in physical and organizational infrastructure to recuperate wood after an extreme weather event. Both non-profit and public sector participants stressed the need for legislation that may foster wood harvesting efforts after an extreme weather event, including better planning and management at the Federal and Commonwealth levels, including private- and public-owned lands. To develop effective forest management policies, the roles, functions, and mandates of different governments, agencies, and organizations must be coordinated [57]. Moreover, to achieve the objective of being socially equitable, forest management policies and processes should recognize, respect, and be inclusive of the perspectives, knowledge systems, values, cultures, and rights of diverse stakeholders [57]. Efforts to understand the social acceptability of forest management activities are therefore essential to co-design and implement socially acceptable options and pathways to improve management initiatives of forests. Further research in this field is needed to provide a comprehensive understanding of diverse stakeholder's perceptions and motivations with regards to forest management.

5. Conclusions

A focus group discussion was used to evaluate stakeholders' preferences of different forest management schemes as a way to uncover potential barriers for the implementation of a sustainable forestry industry associated with timber production in Puerto Rico. There was no agreement on a favorite scenario, but focus group participants indicated reasons for their preferred organizational scheme and helped to identify strategies to overcome those barriers. These perceptions, if well understood by policy makers, will lead to effective and efficient policies to support sustainable forestry industries, which will in turn pave the way for sustainable forest management. The findings state that overall, there is general awareness on the need to support the forestry sector in Puerto Rico to provide more viable ways to mitigate and adapt to climate change in the long run. The contrasting perceptions among stakeholders regarding scenario organizational scheme preferences highlighted the need for inclusive participation and efficient communication of all sectors to codesign and implement a sustainable, efficient, and equitable forestry system that would work for most stakeholders.

The pursuit of social acceptability and sustainability of forestry activities in Puerto Rico requires careful consideration of organizational structure, emerging markets and products, and external factors such as extreme weather events. The recommendations made by participants from the private, public, and non-profit sectors show that there is a wealth of valuable local knowledge to plan and develop projects that consider not only financial viability, but also incorporate key environmental and social equity concerns. As next steps, we suggest, first, to conduct a broader stakeholder consultation effort to delineate a clear road map that can inform sustainable forestry planning efforts at the local level; second, a careful value chain analysis of the wood industry to identify the full range of activities and services required to bring effective technical assistance, market information, and facilitation of low credit to small forestry enterprises (SFEs); third, strengthening cooperation among SFEs by means of associations or alliances to secure resources and cut costs, make strategic alliances, and shape public policy. The diversity in socially acceptable practices among participating stakeholders in our study suggests that evaluating practices for sustainable timber extraction on the island of Puerto Rico would benefit from using co-production approaches.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/f13040576/s1. A. Ques-tionnaires in Spanish used to guide the focus group discussions with the corresponding transla-tion into English in parenthesis. B. Focus group participant quotes that informed the results.

Author Contributions: Conceptualization, L.E.S., J.F.-M. and E.J.M.-A.; methodology, L.E.S.; formal analysis, L.E.S.; investigation, L.E.S., J.F.-M. and E.J.M.-A.; resources, E.J.M.-A. and W.A.G.; data curation, L.E.S.; writing—original draft preparation, L.E.S.; writing—review and editing, all authors; visualization, J.F.-M.; supervision, E.J.M.-A.; project administration, E.J.M.-A.; funding acquisition, E.J.M.-A. and J.K.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Wood Innovation Program of the US Forest Service (grant number 19-DG-11120107-033).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Committee for the Protection of Human Participants in Research (CIPSHI; Spanish Acronym) Office of the Dean for Graduate Studies and Research, University of Puerto Rico Río Piedras (1920-111, 3 March 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Acknowledgments: We thank the participants of the private, non-profit, and public sectors and Sandra Vásquez and Nina Alvandipour for their research assistance. This study was conducted in collaboration between the University of Puerto Rico and the USDA Forest Service International Institute of Tropical Forestry.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Reidmiller, D.R.; Avery, C.W.; Easterling, D.R.; Kunkel, K.E.; Lewis, K.L.M.; Maycock, T.K.; Stewart, B.C. U.S. Caribbean. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*; U.S. Global Change Research Program: Washington, DC, USA, 2018.
2. Bhatia, K.T.; Vecchi, G.A.; Knutson, T.R.; Murakami, H.; Kossin, J.; Dixon, K.W.; Whitlock, C.E. Recent increases in tropical cyclone intensification rates. *Nat. Commun.* **2019**, *10*, 635. [CrossRef] [PubMed]
3. Elsner, J.B.; Kossin, J.P.; Jagger, T.H. The increasing intensity of the strongest tropical cyclones. *Nature* **2008**, *455*, 92–95. [CrossRef] [PubMed]
4. Denton, F.; Wilbanks, T.J.; Abeysinghe, A.C.; Burton, I.; Gao, Q.; Lemos, M.C.; Masui, T.; O'Brien, K.L.; Warner, K. Climate-resilient pathways: Adaptation, mitigation, and sustainable development. *Clim. Change* **2014**, *20*, 1101–1131.

5. Wiener, S.S.; Álvarez-Berríos, N.L.; Lindsey, A.B. Opportunities and challenges for hurricane resilience on agricultural and forest land in the US Southeast and Caribbean. *Sustainability* **2020**, *12*, 1364. [CrossRef]
6. Álvarez-Berríos, N.L.; Wiener, S.L.; McGinley, K.A.; Lindsey, A.B.; Gould, W.A. Hurricane effects, mitigation, and preparedness in the Caribbean: Perspectives on high importance-low prevalence practices from agricultural advisors. *J. Emerg. Manag.* **2021**, *19*, 135–155.
7. Robledo, C.; Kanninen, M.; Pedroni, L. *Tropical Forests and Adaptation to Climate Change: In Search of Synergies*; CIFOR: Bogor Regency, Indonesia, 2005.
8. Van Hensbergen, H.; Cedergren, J. *Forest-Related Disasters–Three Case Studies and Lessons for Management of Extreme Events*; Food & Agriculture Organization: Rome, Italy, 2020; Volume 17.
9. Anderson, C. *Defining Social Acceptability in Ecosystem Management: A Workshop Proceedings*; U.S. Department of Agriculture, Forest Service Pacific Northwest Research Station: Portland, OR, USA, 1996; Volume 1992, pp. 117–123.
10. Shindler, B.A. *Social Acceptability of Forest Conditions and Management Practices: A Problem Analysis*; U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: Portland, OR, USA, 2002; Volume 537.
11. Bjärstig, T.; Sténs, A. Social Values of Forests and Production of New Goods and Services: The Views of Swedish Family Forest Owners. *Small-Scale For.* **2018**, *17*, 125–146. [CrossRef]
12. Trakolis, D. Local people's perceptions of planning and management issues in Prespes Lakes National Park, Greece. *J. Environ. Manag.* **2001**, *61*, 227–241. [CrossRef]
13. Almeida, I.; Rösch, C.; Saha, S. Comparison of Ecosystem Services from Mixed and Monospecific Forests in Southwest Germany: A Survey on Public Perception. *Forests* **2018**, *9*, 627. [CrossRef]
14. Vierikko, K.; Vehkamäki, S.; Niemelä, J.; Pellikka, J.; Lindén, H. Meeting the ecological, social and economic needs of sustainable forest management at a regional scale. *Scand. J. For. Res.* **2008**, *23*, 431–444. [CrossRef]
15. Nelson, M.P.; Vucetich, J.A. Sustainability science: Ethical foundations and emerging challenges. *Nat. Educ. Knowl.* **2012**, *3*, 12.
16. Ford, R.M.; Williams, K.J.H. How can social acceptability research in Australian forests inform social licence to operate? *For. Int. J. For. Res.* **2016**, *89*, 512–524. [CrossRef]
17. De Meo, I.; Cantiani, M.G.; Ferretti, F.; Paletto, A. Qualitative assessment of forest ecosystem services: The stakeholders' point of view in support of landscape planning. *Forests* **2018**, *9*, 465. [CrossRef]
18. Bengston, D.N. Changing forest values and ecosystem management. *Soc. Nat. Resour.* **1994**, *7*, 515–533. [CrossRef]
19. Carnol, M.; Baeten, L.; Branquart, E.; Grégoire, J.C.; Heughebaert, A.; Muys, B.; Ponette, Q.; Verheyen, K. Ecosystem services of mixed species forest stands and monocultures: Comparing practitioners' and scientists' perceptions with formal scientific knowledge. *For. Int. J. For. Res.* **2014**, *87*, 639–653. [CrossRef]
20. Grilli, G.; Jonkisz, J.; Ciolli, M.; Lesinski, J. Mixed forests and ecosystem services: Investigating stakeholders' perceptions in a case study in the Polish Carpathians. *For. Policy Econ.* **2016**, *66*, 11–17. [CrossRef]
21. Gardner, G.T.; Stern, P.C. *Environmental Problems and Human Behavior*; Allyn & Bacon: Boston, MA, USA, 1996.
22. Washington, W.; Taylor, B.; Kopnina, H.N.; Cryer, P.; Piccolo, J.J. Why ecocentrism is the key pathway to sustainability. *Ecol. Citiz.* **2017**, *1*, 35–41.
23. Ribe, R.G.; Ford, R.M.; Williams, K.J. Clearfell controversies and alternative timber harvest designs: How acceptability perceptions vary between Tasmania and the US Pacific Northwest. *J. Environ. Manag.* **2013**, *114*, 46–62. [CrossRef]
24. Grau, H.R.; Aide, T.M.; Zimmerman, J.K.; Thomlinson, J.R.; Helmer, E.; Zou, X. The ecological consequences of socioeconomic and land-use changes in postagriculture Puerto Rico. *BioScience* **2003**, *53*, 1159–1168. [CrossRef]
25. Rudel, T.K.; Coomes, O.T.; Moran, E.; Achard, F.; Angelsen, A.; Xu, J.; Lambin, E. Forest transitions: Towards a global understanding of land use change. *Glob. Environ. Change* **2005**, *15*, 23–31. [CrossRef]
26. Marcano-Vega, H. *Forests of Puerto Rico, 2014*; U.S. Department of Agriculture Forest Service, Southern Research Station: Asheville, NC, USA, 2017; pp. 1–4.
27. Gould, W.A.; Wadsworth, F.H.; Quiñones, M.; Fain, S.J.; Álvarez-Berrios, N. Land Use, Conservation, Forestry, and Agriculture in Puerto Rico. *Forests* **2017**, *8*, 242. [CrossRef]
28. United States Census Bureau. *The Puerto Rico Community Survey and the 2020 Census*. Available online: https://www.census.gov/quickfacts/PR (accessed on 22 September 2021).
29. Fellman, M. Puerto Rico: A U.S. Territory in Crisis. In *Council on Foreign Relations*. Available online: https://www.cfr.org/backgrounder/puerto-rico-us-territory-crisis (accessed on 22 September 2021).
30. Fischbach, J.R.; May, L.W.; Whipkey, K.; Shelton, S.R.; Vaughan, C.A.; Tierney, D.; Leuschner, K.; Meredith, L.S.; Peterson, H.J.; Hsoac Puerto Rico Recovery Team. *After Hurricane Maria: Predisaster Conditions, Hurricane Damage, and Recovery Needs in Puerto Rico Homeland Security Operation Analysis Center operated by the RAND Coorporation*; 2020. Available online: https://www.rand.org/pubs/research_reports/RR2595.html (accessed on 12 October 2021).
31. Uriarte, M.; Thompson, J.; Zimmerman, J.K. Hurricane María tripled stem breaks and doubled tree mortality relative to other major storms. *Nat. Commun.* **2019**, *10*, 1–7.
32. Torres-Martínez, E.; Meléndez-Ackerman, E.J.; Trujillo-Pinto, A. Drivers of hurricane structural effects and mortality for urban trees in a community of San Juan. *Puerto Rico. Acta Cient* **2021**, *32*, 33–43.
33. Lugo, A.E. *Social-Ecological-Technological Effects of Hurricane María on Puerto Rico: Planning for Resilience under Extreme Events*; Springer: Berlin/Heidelberg, Germany, 2018.

34. USDA Forest Service. *Final Land Use and Resource Management Plan*; Caribbean National Forest: Palmer, PR, USA, 1986.
35. McGinley, K.A. Adapting tropical forest policy and practice in the context of the Anthropocene: Opportunities and challenges for the El Yunque National Forest in Puerto Rico. *Forests* **2017**, *8*, 259. [CrossRef]
36. Food and Agriculture Organization of the United Nations (FAO). The Future of Food and Agriculture: Trends and Challenges | Policy Support and Governance | Food and Agriculture Organization of the United Nations. Available online: https://www.fao.org/policy-support/tools-and-publications/resources-details/es/c/472484/ (accessed on 1 April 2021).
37. Campbell, S. Green Cities, Growing Cities, Just Cities?: Urban Planning and the Contradictions of Sustainable Development. *J. Am. Plann. Assoc.* **1996**, *62*, 296–312. [CrossRef]
38. Campbell, S.D. The Planner's Triangle Revisited: Sustainability and the Evolution of a Planning Ideal That Can't Stand Still. *J. Am. Plann. Assoc.* **2016**, *82*, 388–397. [CrossRef]
39. O'Rourke, D.; Lollo, N. Transforming consumption: From decoupling, to behavior change, to system changes for sustainable consumption. *Annu. Rev. Environ. Resour.* **2015**, *40*, 233–259. [CrossRef]
40. Onwuegbuzie, A.J.; Dickinson, W.B.; Leech, N.L.; Zoran, A.G. A Qualitative Framework for Collecting and Analyzing Data in Focus Group Research. *Int. J. Qual. Methods* **2009**, *8*, 1–21. [CrossRef]
41. Wilson, A.M.; Guéneau, S. *Enhancing the Compatibility of Marked-Based Policy Instruments for Sustainable Forest Management. Ressources Naturelles*; Iddri: Paris, France, 2004.
42. Del Gatto, F.; Mbairamadji, J.; Richards, M.; Reeb, D. Small-scale forest enterprises in Latin America: Unlocking their potential for sustainable livelihoods. *For. Work. Pap. FAO* **2018**.
43. Forero-Montaña, J.; Zimmerman, J.K.; Santiago, L.E. Analysis of the potential of small-scale enterprises of artisans and sawyers as instruments for sustainable forest management in Puerto Rico. *J. Sustain. For.* **2018**, *37*, 257–269. [CrossRef]
44. Siry, J.P.; Cubbage, F.W.; Ahmed, M.R. Sustainable forest management: Global trends and opportunities. *For. Policy Econ.* **2005**, *7*, 551–561. [CrossRef]
45. Blok, V.; Gremmen, B.; Wesselink, R. Dealing with the Wicked Problem of Sustainability: The Role of Individual Virtuous Competence. *Bus. Prof. Ethics J.* **2015**, *34*, 297–327. [CrossRef]
46. Ranacher, L.; Wallin, I.; Valsta, L.; Kleinschmit, D. Social dimensions of a forest-based bioeconomy: A summary and synthesis. *Ambio* **2020**, *49*, 1851–1859. [CrossRef] [PubMed]
47. Groot, H.A.R.R.Y.; Bowyer, J.; Bratkovich, S.T.E.V.E.; Fernholz, K.; Frank, M.; Howe, J.; Pepke, E. *The Role of Cooperatives in Forestry*; Dovetail Partners: Minneapolis, MN, USA, 2019.
48. Guillery, P.; Fernholz, K. *Small-Scale Forestry and Landowner Cooperation in the Central United States of America*; World Forestry Congress: Quebec City, QC, Canada, 2003.
49. Salivia, U.J. Cooperatives as a Way of Dealing with the Fiscal Crisis: Opportunities for Puerto Rico—PA TIMES Online | PA TIMES Online. American Society of Public Administration. Available online: https://patimes.org/cooperatives-dealing-fiscal-crisis-opportunities-puerto-rico/ (accessed on 12 October 2021).
50. World Economic Forum. *Investing in Forests: The Business Case*; 2021. Available online: https://www.weforum.org/reports/investing-in-forests-the-business-case (accessed on 12 October 2021).
51. Kozak, R.A. *Small and Medium Forest Enterprises: Instruments of Change in the Developing World*; 2007. Available online: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.494.9436&rep=rep1&type=pdf (accessed on 12 October 2021).
52. Macqueen, D. *Supporting Small Forest Enterprises: A Cross-Sectoral Review of Best Practice*; 2008. Available online: https://pubs.iied.org/sites/default/files/pdfs/migrate/13548IIED.pdf (accessed on 12 October 2021).
53. Longwood, F.R. *Puerto Rican Woods: Their Machining, Seasoning, and related Characteristics*; U.S. Department of Agriculture, Forest Service, 1961. Available online: https://naldc.nal.usda.gov/catalog/CAT10310590 (accessed on 12 October 2021).
54. Little, E.L.; Wadsworth, F.H.; Marrero, J. *Arboles Comunes de Puerto Rico y las Islas Virgenes*; Editorial Universitaria, 1977. Available online: http://edicionesdigitales.info/biblioteca/arbolesprvi1esp.pdf (accessed on 12 October 2021).
55. Little, E.L.; Woodbury, R.O.; Wadsworth, F.H. *Arboles de Puerto Rico y las Islas Vírgenes*; U.S. Department of Agriculture (USDA): El Segundo, CA, USA, 1988.
56. Francis, J.K.; Lowe, C.A.; Trabanino, S. *Bioecología de Árboles Nativos y Exóticos de Puerto Rico y las Indias Occidentales*; U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry: Río Piedras, PR, USA, 2000.
57. Bennett, N.J.; Satterfield, T. Environmental governance: A practical framework to guide design, evaluation, and analysis. *Conserv. Lett.* **2018**, *11*, e12600. [CrossRef]