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Unveiling the Centrality of Knowledge in Stakeholder Involvement Strategies Regarding Public Forest Management

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Abstract: Stakeholder involvement can foster more socially and environmentally sustainable management of natural resources, including forests. However, few studies have approached the effect of knowledge on stakeholders' involvement in forest management. This study intends to contribute to filling this gap by exploring the relationship between access to knowledge, involvement, stakeholders' profiles, and levels of influence and interest regarding public forest management strategies. To this end, this article examines the data collected through a questionnaire directed to all the stakeholders potentially interested in the management of the Matas do Litoral. Matas do Litoral are part of the 3% of publicly managed forests in Portugal. The results reveal a discrepancy between the high levels of interest regarding Matas do Litoral management, and low levels of influence on those processes. Most of the stakeholders surveyed know forest management strategies, and their involvement in those strategies is limited. The proximity and role of *governmental* organizations are key factors underlying knowledge levels among the various stakeholders. Furthermore, knowledge acts as a critical factor in encouraging the stakeholders' influence and involvement in management strategies and policies. This study gives insights regarding the need for knowledge management as a tool for empowering local stakeholders and promoting their involvement in bottom-up forest management strategies.

Keywords: bottom-up management strategies; forest management; knowledge; stakeholder's involvement

Citation: Ferreira, C.; Fernandes, M.E.; Figueiredo, E. Unveiling the Centrality of Knowledge in Stakeholder Involvement Strategies Regarding Public Forest Management. *Forests* **2024**, *15*, 1471. https://doi.org/10.3390/f15081471

Academic Editor: David Ellison

Received: 24 June 2024
Revised: 14 August 2024
Accepted: 15 August 2024
Published: 21 August 2024

1. Introduction

Life on earth is balanced by the interactions between the environment and society. Knowledge about those interactions is crucial considering the importance of environmental management towards a more egalitarian and environmentally sustainable society [1–3]. Knowledge is a complex construct, combined with experience and expertise, that predicts decision-making and involves several dimensions, means, organizations, and social actors [4]. Environmental management is undeniably often based on interactions between different stakeholders, using diverse means, with different types of knowledge supporting the decision context [5]. This is true regarding the management of natural resources in general and forest resources management, in particular. Therefore, understanding the key role of knowledge of the social actors in the development of such interactions seems to be critical to enhancing forest management and governance strategies and outcomes [6–8]. To foster forest stakeholders' involvement and pursue co-management models, their needs, perceptions, preferences, and behaviors must be considered.

Several theoretical frameworks have been applied to assess strategies for stakeholders' involvement in natural resource management, as is the case of the forest sector [7,9–11]. Previous studies [12,13] discuss the role of stakeholders in social and natural phenomena, demonstrating the influence of individuals, organizations, and group decisions and actions.

Since different stakeholders with different interests and positionings are engaged in attaining the objectives of forest protection and production, the understanding of multiple stakes is essential [7]. Accordingly, several authors have suggested and applied different theoretical frameworks and methodological approaches while assessing the stakeholders in forest management processes [12,13]. Although there are several differences between those studies, the interests, influence, and positioning of the concerned parties in the design of forest policies are usually common topics regarding stakeholder analysis. Few studies, however, have considered the influence of stakeholders' knowledge on this analysis. Some exceptions are the studies by [8,14]. The first investigates how knowledge management, through the use of information technologies, can be applied in forest management to improve decision-making. The second addresses the relationship between stakeholder pressure for environmental practices, corporate social responsibility, green innovation, and knowledge management processes. Regarding the effect of knowledge on forest management processes particularly, research on how knowledge can balance stakeholders' interactions on the development of policies for forest management is still an emerging topic. Although stakeholder engagement and knowledge exchange in the management of natural and environmental resources is a topic already addressed in the literature [15], as well as its importance for better policy or practice decision-making [16], the role of knowledge as a driver for stakeholders' involvement in the management policies of these resources is still overlooked. This article aims to help fill this gap by analyzing the case of Matas do Litoral—coastal public forest areas located in the Central Region of Portugal—that were particularly affected by the wildfires of October 2017.

Forests are complex natural resources that provide various services—ecological, social, cultural, economic, and political [9]—requiring new governance models to deal with major threats both to forests and rural communities, like wildfires [17]. The catastrophic wildfires which occurred in 2017 in Portugal and destroyed around 70% of the Matas do Litoral area, are a good example of the urgent need for reforestation and territory reorganization policies. Following those wildfires, the envisioned governance model for forest management proposes a greater involvement of stakeholders alongside larger public participation as ways of promoting sustainability, preventing future wildfires, and transforming the relationship of agents and citizens with forests [18]. Contrary to other European countries, where public and private ownership of forests is roughly balanced [18], only 3% of Portuguese forests are publicly owned, which makes its sustainable management even more fundamental. Based on a survey directed to Matas do Litoral-related stakeholders (N = 174), this article aims to examine the role that knowledge plays in stakeholders' involvement in (sustainable) forest management strategies and policies, simultaneously addressing the relationship between the stakeholders' influence and interest in those processes. As such, the findings of this paper are particularly relevant to inform policymakers aiming to design bottom-up strategies using participatory methodologies. By grouping stakeholders in different categories and studying their different patterns of engagement and level of knowledge about management strategies and policies of the area under study, different patterns might be identified and considered. The findings contribute to our understanding of how knowledge is applied in environmental management, as stated by [16]. Further, we contribute additional arguments about the overlooked relationship between agents' knowledge about and their involvement in public forest management policies.

Besides this introductory section, this article is structured in five parts: In the following section, the conceptual grounding for understanding the relationship between stakeholders' knowledge and involvement in the development of forest management policies is presented. Section 3 describes the methodological procedures for the collection and analysis of data. The results are presented in Section 4, which is followed by a detailed discussion in Section 5. Section 6 presents the main conclusions and provides some strategic implications for forest policymakers.

2. Literature Review

2.1. Knowledge: Definitions and Perspectives

Commonly, knowledge is understood as a predictor of an individual's behavior, contributing to creating, acquiring, and disseminating values and beliefs that underline intentions and objectives [2]. Notwithstanding this broader definition, knowledge and its role have been diversely addressed by different authors. For [19], knowledge is a relation, a highly valued state in which an individual is in contact with reality. For [1], on the other hand, knowledge is considered as the interpretation of the information in a context, a result of reason, perception, and learning, whereas for [20], it may be defined as a multifaceted concept with multi-layered meanings. Knowledge has been discussed considering mainly two dimensions: explicit and tacit [20–24]. Explicit knowledge refers to knowledge that is easily articulated, written, and accessible [1]. Tacit knowledge refers to individuals' own experiences, reflections, interiorizations, or talents, which may be difficult to express [25]. The theory of knowledge creation proposed by [26] argues that knowledge evolves ontologically in groups, individuals, and organizations from the tacit to the explicit mode and vice versa. Knowledge is also considered an intangible and inimitable benefit that can be viewed as a source of competitive advantage by organizations [14]. In a business context, knowledge refers to the accumulation of experiences, skills, capabilities, and insights [3]. Therefore, academics and practitioners are becoming increasingly interested in knowledge management as a discipline within the business literature [1,3,27,28]. Knowledge management is a process that ensures that people within an organization have the right information at the right time in the right format [29]. Consequently, the effective management of knowledge may improve an organization's capability to innovate [30]. The importance of leveraging implicit knowledge in the context of knowledge management within an organization through processes rather than content has been highlighted [31], as well as the need to set broad priorities and integrate the goals of managing intellectual capital and the corresponding effective knowledge processes [32]. Furthermore, knowledge management has a real impact on the decision-making process, which makes knowledge sharing essential within an organization [33]. More recently, [3] highlighted the role of the different stakeholders in communication, coordination, decision-making, and knowledge sharing for successful management. Despite the difficulties of dealing with a complex concept like knowledge, especially in the context of business management, which has long been emphasized [34], the importance of successful implementation of knowledge management within organizations, to apply their collective learning and knowledge to different problems and contexts, has been equally highlighted [35].

While the relevance of knowledge in business management is well recognized in the literature [3,30], the creation, mobilization, and utilization of knowledge also emerged as key factors for environmental management [2]. Understanding knowledge as a predictor of individuals' and organizations' behaviors can help foster the relationship between societies and nature [8]. Environmental governance may involve informing decision-making on environmental change, bringing together a variety of scientific and lay knowledge, and dealing with knowledge disputes that may exist between various groups of stakeholders [36,37]. In this sense, environmental governance is usually a process in which knowledge influences the decision-making of different actors with different backgrounds, interests, and ideas. Such knowledgeable actors may include citizens, scientists, non-governmental organizations (NGOs), companies, and policymakers [38].

The relationship between knowledge and well-informed environmental governance requires coordination and knowledge exchange among experts, stakeholders, and policymakers [2]. For this, it is necessary to involve boundary organizations that can play an intermediary role between knowledge and decision-making, promoting the achievement of cooperation in relation to a common aim [2,39]. This cooperation is perceived as a type of interactive or participatory process in which several groups of actors collaboratively share knowledge [36], which is extremely important, for instance, for risk governance and management [40]. In the same way, forest management requires multiple perspectives

regarding stakeholders' interests and needs [41]. In this vein, with the active involvement of stakeholders, new insights and information may be brought into public forest management and decision-making processes [42]. However, as with the management of any other public, natural, and environmental resources, different forms of public forest governance will integrate public knowledge and participation differently [43]. As scientific and public environmental knowledge has been at the root of social movements, like environmental activism, highlighting the importance of knowledge for participation [43], public forest stakeholders' knowledge may encourage their involvement in forest management.

2.2. Stakeholders' Involvement in Forest Management

Forests play a critical role in addressing current global socio-ecological challenges, including climate change, biodiversity loss, and natural resource-based livelihoods [10]. Forests are multidimensional resources, since they have ecological, social, cultural, economic, and political dimensions [44]. On the one hand, this justifies the increasing interest and concerns regarding the uses and management of forest resources. On the other hand, this underlines the emergence of several studies highlighting the need for collaborative forest management strategies to achieve sustainability [6,7,12,45,46]. Collaborative forest management focuses on the co-management of forest resources between government forestry agencies and other stakeholders, especially local communities [7]. As with the management of any other resource, non-participation is a significant issue that can result from a lack of resources, potential delays in decision-making, or deliberate exclusion [47,48]. Especially when a large number of stakeholders are involved, the benefits of collaborative processes are questioned considering the balance between efforts necessary to involve all and the utility perceived from that participation [48]. The lack of participation channels is also an institutional barrier that may lead to the non-participation of stakeholders [49].

As forest co-management should involve different groups, the correct identification of who these stakeholders are is the first challenge that should be overcome [12]. Stakeholders have been diversely defined within the academic literature [50,51]. Studies tend to emphasize the distinction between stakeholders who affect and those who are affected by decisions or actions [50]. As stakeholders can be individuals, communities, social groups, or organizations, stakeholder analysis emerges as an adequate tool to obtain information about "relevant actors", understanding their agendas, needs, interests, behaviors, and levels of influence on decision-making processes [52]. Approaches to stakeholder analysis have progressively been adapted from business management to natural resource management [17]. In the natural resource management literature, stakeholder analysis is commonly used to understand power dynamics and enhance the transparency and equity of decision-making [12,14]. However, each stakeholder may have different and/or opposite interests competing with one another [11], as well as affecting or being affected by a certain policy or program [12]. To design policy options that are win–win solutions, all stakeholders' interests must be prioritized, and to do so, it is necessary to know the stakeholders, their roles, and their power [10]. In this study, stakeholder theory has been adopted in general. Furthermore, the theoretical framework of stakeholder analysis in deliberations regarding forest policies is adopted paying special attention to public forest management [7].

3. Materials and Methods

The current study uses a mixed-method approach to explore the effect of stakeholders' knowledge on their involvement in the management of a Portuguese public forest area—Matas do Litoral. This is an approach previously used by studies on forest management, given the complexity of the use of natural resources and associated economic activities [10,14,42].

3.1. Case Study—Matas Do Litoral

The focus on the Matas do Litoral—coastal forest areas in the Central Region of Portugal, part of the 3% of the country's public forests managed by a State body (the

ICNF-Institute for Nature and Forests Conservation)—is mainly related to the fact that these areas were particularly affected by the October 2017 wildfires. The soil in this forest is made up of sand from wind-blown dunes and beaches, and the specific characteristics related to the type of terrain that Matas do Litoral occupy perform functions like dune stabilization and the protection of agricultural crops and urban areas while ensuring the production of high-quality wood. Having an important role in nature conservation, guaranteeing forest systems' functions, preserving high-value ecosystems, and promoting management-related services, Matas do Litoral also have a high historical, symbolic, and social value. Given the public character of these forests, the vast consequences of the wildfires, and the importance of forestry in Portugal (circa 36% of the country's area), the events of October 2017 generated wide social and political debates regarding fire and forest management strategies, emphasizing the need to promote the social valorization of forests and citizens' participation in management decision-making processes [53–55]. The magnitude of the October 2017 wildfires, at a scale never seen in Portugal and in Europe [56], together with their consequences, make the worst environmental disaster in Portugal's recent history [53,55]. Furthermore, the October 2017 wildfires strongly affected one of the oldest Matas do Litoral—the Mata Nacional de Leiria—a seven-hundred-year-old pine forest, considered one of Portugal's greatest monuments. Around 80% of this forest area (around eleven thousand hectares) was destroyed by these wildfires. Managed by a State body, the need to define a new management model, emphasizing citizens' and stakeholders' participation, was definitely recognized in the *Recovery Program for the* Matas do Litoral issued by the Portuguese Government, following the 2017 wildfires [18].

The Matas do Litoral considered in this study are the most affected areas by the October 2017 wildfires (Figure 1): the National Forests (Matas Nacionais—MN) of Leiria, Pedrógão, Urso, Dunes of Vagos, and Dunes of Quiaios and the Forest Perimeters (Perímetros Florestais—PF) of Dunes of Cantanhede and Dunes and Pinewoods of Mira.

To explore the factors underlying stakeholders' involvement in public forest management policies, namely their knowledge about those policies and their impact, this study was carried out in two main stages. The first corresponded to the identification of all the stakeholders that act and/or benefit from the areas under analysis, following the recommendations of [12]. Next, a survey was directed to those stakeholders, and the data were analyzed using a quantitative approach.

3.2. Stakeholder Identification

The initial step of this study was to identify the stakeholders acting and/or benefiting from the Matas do Litoral areas, following the guidelines of stakeholder analysis proposed by [10,12]. To identify those stakeholders, four combined criteria were used: (1) the identification of all governmental organizations and bodies related to public forest management; (2) an online search of private companies and NGOs located or operating in the municipalities where the Matas do Litoral are located; (3) identification of the additional stakeholders by those surveyed (snowball method); and (4) identification based on the previous knowledge and experience of the research team members [18]. Following these procedures, a total of 284 stakeholders were first identified and grouped into four categories: governmental organizations (GOs); non-governmental organizations (NGOs); private companies; and public companies. The stakeholders identified operate at the national, regional, and local levels in different fields, such as forests and biodiversity, wildfires, emergency and civil protection, planning socioeconomic development, and research and education. This diversity reflects the multidimensional and multifunctional character of the Matas do Litoral, with a diversity of actors that use it and have various interests, as highlighted in the literature [7,13,41]. Following the initial identification, all the contacts of the stakeholders were verified and validated, leading to the exclusion of 47 agents (because they have since closed down, for example). Finally, a total of 237 stakeholders were considered and first contacted to be surveyed. The focus of the current study was thus the whole population and not a sample of stakeholders of the Matas do Litoral.

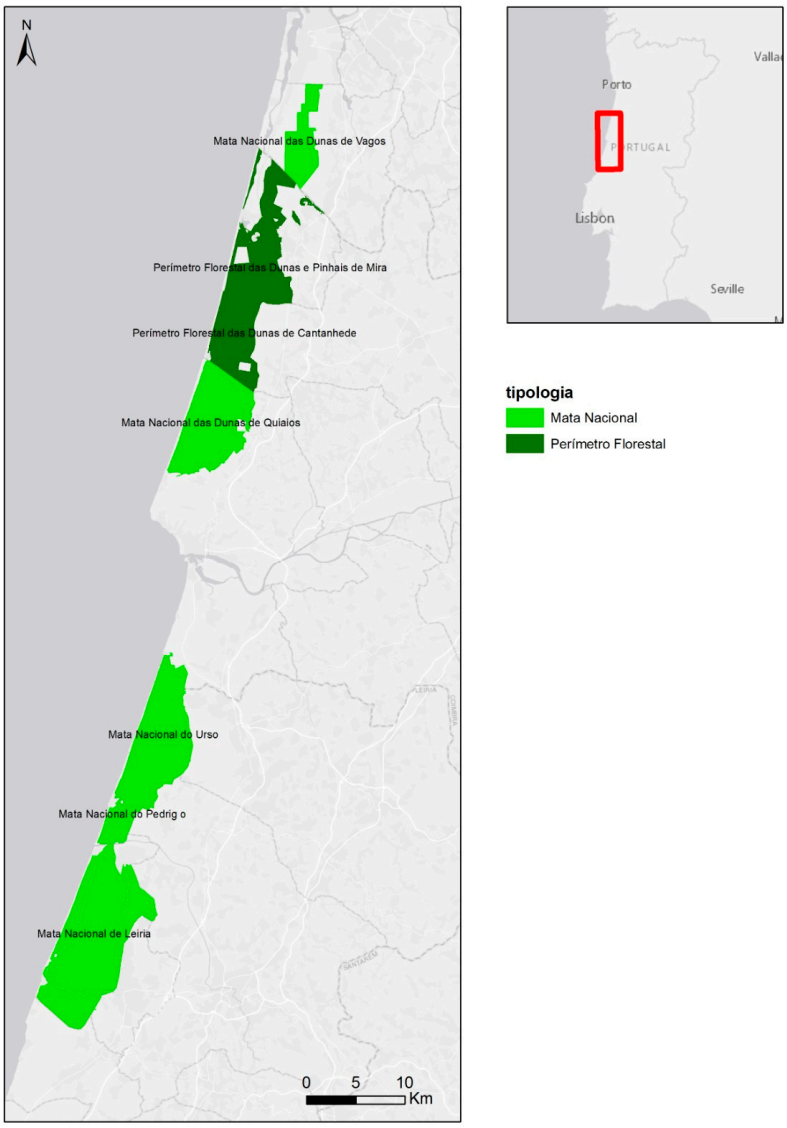

Figure 1. Location of the Matas do Litoral analyzed. The light green areas on the map correspond to the Matas Nacionais (National Woods) and the dark green areas to the Perímetros Florestais (Forest Perimeters). (Source: own elaboration, based on REFLOA-https://geocatalogo.icnf.pt/geovisualizador/refloa/, accessed on 3 January 2024).

3.3. Data Collection and Analysis

An online survey questionnaire was used, and the link was made available to all the identified 237 stakeholders by email, explaining the main aim of the survey and the research. This procedure was preceded by a telephone or email contact. The questionnaire was elaborated based on the scientific literature on stakeholder analysis, knowledge, and involvement in forest-related management and decision-making processes. Previous results highlight the importance of understanding stakeholders' interests [54], referring to their level of concern, attention, or investment in forest management strategies. Thus, the questionnaire included questions to evaluate how much stakeholders care about or are affected by the outcomes of Matas do Litoral management decisions [13,57] that were then treated to define their level of interest. Stakeholders' influence considered the power or capacity of stakeholders to affect the decision-making process and outcomes of Matas do Litoral management strategies, following [12,58]. Finally, stakeholders' knowledge refers to their self-assessed, perceived knowledge of forest management issues, strategies, and their implications, measuring how well-informed stakeholders believe they are about Matas

do Litoral management strategies, considering their accumulation of experiences, skills, capabilities, and insights [3].

To ensure the validity of the questionnaire, a pilot test was conducted with a group of six stakeholders. After analysis of their comments, small changes in the questionnaire were made. The final version of the questionnaire was applied between November 2021 and February 2022. A total of 174 valid answers were obtained, representing 73.5% of the stakeholders initially identified and contacted.

The questionnaire was organized in five parts. The first included questions regarding the respondents' characterization. The second was devoted to collecting information about the organization or company the respondent was representing, namely the type, dimension, scope, and domains of action. Part three included questions regarding the relevance and interest of the Matas do Litoral, namely agreement level with the current management of those areas, cooperation with the State body responsible for the management, and—using a 5-point Likert scale—the levels of interest and influence in the Matas do Litoral management processes. The fourth section of the questionnaire encompassed questions regarding the identification and types of cooperation with other stakeholders within the Matas do Litoral. The last section of the questionnaire included questions on stakeholders' experience in public participation, and their knowledge and engagement in decision-making processes concerning the Matas do Litoral.

Given the focus of the present article, two groups of questions will be analyzed in more detail. One group considers stakeholders' answers about their perceived level of knowledge about the Matas do Litoral management policies, and their level of agreement with those policies, when they know them. A dichotomous variable (yes or no) was used to evaluate their perceived knowledge of the Matas do Litoral management policies. Those familiar with the policies were asked to express their level of agreement using a five-point Likert scale. The second group of questions analyzed concerned stakeholders' engagement in Matas do Litoral management policies. To this end, they were asked about their involvement in different types of initiatives, which were further categorized as in [57]: (1) practices for biodiversity; (2) sociopolitical actions; (3) research and conservation; and (4) others. In cases where respondents reported their involvement, they were further questioned about the type of engagement, either promotion or collaboration, in the initiatives identified.

Data management and analysis were performed using the Software Statistical Package for Social Sciences (IBM SPSS Statistics, version 26). Univariate statistical analysis was carried out for initial data examination. Non-parametric tests, like the Pearson's chi-square (X^2) and the Kruskal–Wallis tests, were used to compare the differences between stakeholder groups regarding the variables of knowledge and involvement. A p-value < 0.05 was considered significant.

Regarding the perceived levels of interest and influence in the management strategies of the Matas do Litoral territories, a median split for each variable was determined: stakeholders with scores above the median on each measure were classified as having "high" levels, and stakeholders with scores equal to the median were classified as having "moderate" levels, while the other stakeholders were classified as having "low" levels of both interest and influence [10,12].

4. Results

4.1. Stakeholders' Profiles

A total of 174 valid answers were obtained from the survey. As shown in Table 1, the respondents are mainly men (77.7%), between 35 and 54 years old (57.7%), with higher education levels (61.7%) and occupying executive positions (59.4%) within the organizations they represent. As also shown in Table 1, the entities surveyed are mainly micro or small companies/entities (71.9%). In total, 42.0% were NGOs, 31.0% private firms, and 27.0% GOs. Concerning the scope of action, 42.9% act at the national level, and, in terms of their domains of action, most activities are related to biodiversity management (58.3%).

These activities comprise the development and implementation of conservation guidelines and/or policies of biomass management, for example.

Table 1. Stakeholders' characterization.

		Relative Frequency
Respondents' profile (N = 174)	Gender	
	Women	22.3%
	Men	77.7%
	Age	
	≥4 years old	13.1%
	35 to 54 years old	57.7%
	≤55 years old	29.2%
	Education level	
	Up to 9 years	17.7%
	10–12 years	20.6%
	Higher education	61.7%
	Job positions	
	Executive positions	59.4%
	Administrative positions	28.0%
	Operational position	6.3%
	Others	6.3%
Stakeholders' profiles [2]	Business size [1] (N = 152)	
	Micro business	43.1%
	Small business	28.8%
	Medium-sized business	15.7%
	Large business	12.4%
	Stakeholder type (N = 174)	
	Governmental organizations (GOs)	27.0%
	Non-governmental organizations (NGOs)	42.0%
	Private firms	31.0%
	Scope of action (N = 146)	
	International	15.7%
	National	42.9%
	Regional	22.4%
	Inter-municipal	5.4%
	Local	13.6%
	Domain of action (N = 152)	
	Practices for biodiversity management	58.3%
	Sociopolitical actions	20.0%
	Research and conservation	21.7%

[1] Categorization based on the number of employees according to OECD criteria. [2] The different number of observations (N) results from the different aspects of stakeholders' profiles when respondents are unfamiliar with issues or refuse to answer (thus answering "Don't know/No answer").

4.2. Interest and Influence on Public Forest Management Policies

Figure 2 shows that 74.7% of stakeholders reported a low level of influence regarding the management of Matas do Litoral, while only 11.5% reported a high level of influence. On the other hand, 22.4% mentioned a low level of interest, but 66.7% stated they had a high level of interest in the management of Matas do Litoral. As it becomes clear from these results, there is a discrepancy between the reported levels of interest and influence in the planning and management of Matas do Litoral, demonstrating the existence of a "capital of interest" that may indicate a further wish to be involved in those processes.

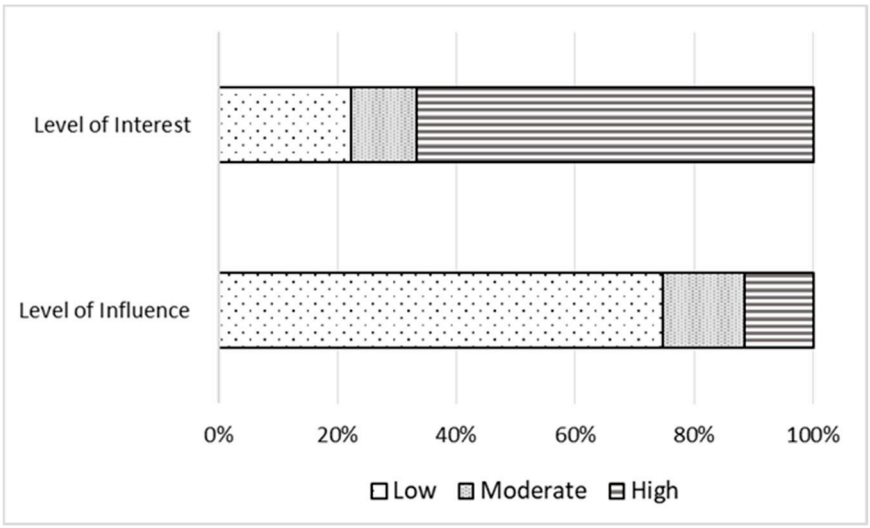

Figure 2. Level of interest and influence regarding the management strategies of Matas do Litoral.

In addition, we sought to identify the profile of stakeholders with greater interest and influence in the management of these territories. Figure 3 compares the level of interest by stakeholders' profiles, revealing that a high level of interest is relatively independent of the profile. Nevertheless, some differences among stakeholders can be identified. For instance, large companies register higher levels of interest (88.9%), with a limited percentage of respondents reporting low interest (11.1%), whereas micro companies state lower levels of interest (60.6% high and 27.3% low). Likewise, GOs revealed a larger difference between low (14.9%) and higher (78.75) levels of interest, especially compared to NGOs and private firms.

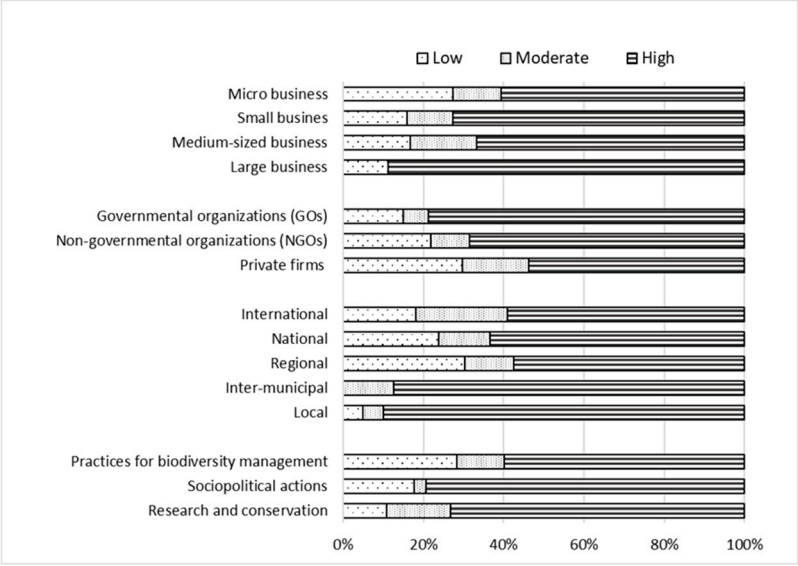

Figure 3. Level of interest reported by stakeholder profile.

There are also differences considering the scope of action, as around 90% of stakeholders acting at the inter-municipal and local level demonstrated a high level of interest in Matas do Litoral management, while only 50% to 60% acting at the international, national, and regional level stated a high level of interest in the territory under analysis. Stakeholders whose domain of action is related to the sociopolitical area and research and conservation actions demonstrated a high level of interest (more than 75%). This contrasts with the 59.8%

of other stakeholders reporting high levels of interest and almost 30% indicating low levels of interest.

In sum, despite stakeholders generally revealing a high level of interest in Matas do Litoral management, that interest depends on their profile, type of intervention, and proximity to the territory.

Figure 4 displays the breakdown of the level of influence perceived by stakeholders according to their profiles. Despite the existence of a general pattern of a low level of perceived influence (see Figure 1), it can be observed that the level of influence in Matas do Litoral management varies according to the size, type, and intervention of stakeholders.

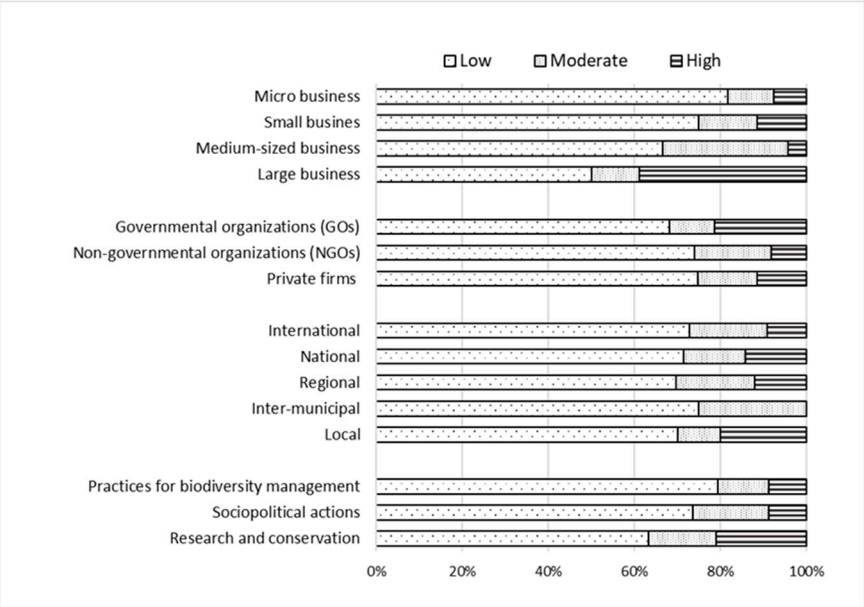

Figure 4. Level of influence reported by stakeholders' profiles.

Regarding companies' size, the smaller their dimension, the lower their perceived level of influence in Matas do Litoral management policies. On the contrary, stakeholders classified as large companies more often consider that they have higher influence levels (Figure 3). Considering stakeholder type, the results show the prominence of GOs, which more frequently report higher levels of influence in the Matas do Litoral management strategies than private companies. In turn, private companies consider to have higher levels of influence than NGOs.

Figure 4 also reveals some differences regarding stakeholders' perceived level of influence according to their scope of action. Local actors generally perceive a higher level of influence on Matas do Litoral management than the other stakeholders. Regarding the domains of action, the results demonstrate that the stakeholders engaged in forest research and forest conservation activities tend to perceive higher levels of influence than those related to sociopolitical activities and biodiversity management practices.

Comparing the data from Figures 3 and 4, it can be stated that the stakeholders that reported higher levels of influence in the Matas do Litoral management strategies are mainly large companies and GOs, acting locally and linked to forest research and conservation activities.

4.3. Knowledge about and Involvement in Public Forest Management Policies

As mentioned above, knowledge about and involvement in the Matas do Litoral management policies were also analyzed (Figure 5).

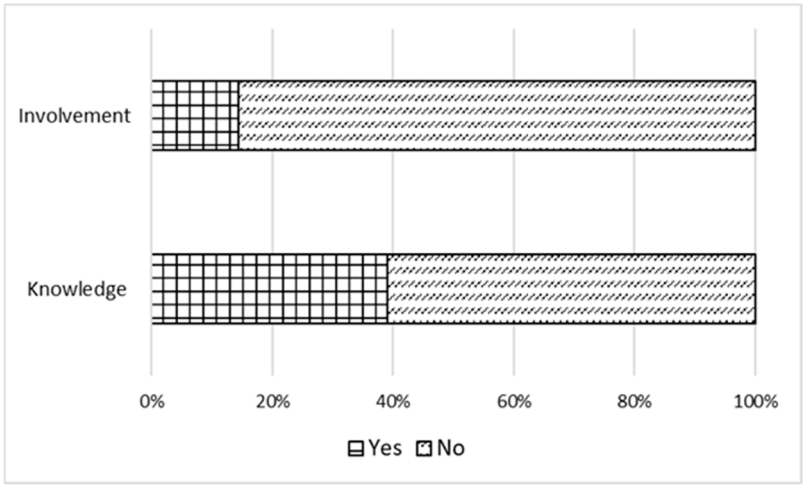

Figure 5. Knowledge about and the involvement of stakeholders in the Matas do Litoral management policies.

As can be observed from Figure 5, 85.6% of stakeholders do not consider themselves to be involved in the Matas do Litoral management strategies. However, almost 40% of the stakeholders reported knowing the Matas do Litoral management policies. These results reveal a discrepancy between knowledge and involvement.

Table 2 shows that the lack of knowledge leads to a lack of involvement in the management policies (93.4%). Furthermore, among the stakeholders that declare to have knowledge about the Matas do Litoral management policies, only 26.5% state they are involved in those processes. However, the chi-square test performed indicates that there is a statistically significant difference between the level of involvement of stakeholders who declare to know the Matas do Litoral management policies and those who do not.

Table 2. Relationship between knowledge about and involvement of stakeholders in Matas do Litoral management policies.

	Knowledge		
	Yes	**No**	**X^2 Test *p*-Value**
Involvement			
Yes	26.5%	6.6%	0.000 ***
No	73.5%	93.4%	

*** $p < 0.001$.

Those stakeholders who reported being involved in the management strategies of Matas do Litoral were asked about their modes of engagement, according to four types of initiatives (Table 3). The results demonstrate that stakeholders involved in Matas do Litoral management policies mostly promote awareness-raising and citizenship actions. On the other hand, the areas in which they collaborate the most are more diverse: actions to protect and conserve nature and biodiversity; actions for the recovery of burnt areas; actions to fight fires and defend forest areas; the implementation of forestry operations (e.g., fuel management and plantations); and the definition of management strategies. Therefore, collaboration includes both initiatives related to forestry research and conservation and practices for biodiversity, while promotion involves mostly sociopolitical actions.

Table 3. Type and means of involvement of stakeholders in Matas do Litoral management policies.

Type of Initiatives	Forms of Participation Relative Frequency *		
	Promote	Collaborate	Don't Know/ Do Not Participate
Practices for biodiversity			
Definition of management strategies	16%	52%	32%
Definition of measures and interventions for the Matas do Litoral	16%	28%	56%
Forestry certification	0%	12%	88%
Implementation of forestry operations	28%	52%	20%
Sociopolitical actions			
Awareness-raising and citizenship actions	44%	28%	28%
Surveillance and enforcement actions	16%	40%	44%
Research and conservation			
Actions to protect and conserve nature and biodiversity	24%	56%	20%
Actions for the recovery of burnt areas	24%	52%	24%
Provision of services in the area of tourism and recreation	12%	32%	56%
Actions to fight fires and defend forest areas	12%	52%	36%
Research	4%	32%	64%
Others			
Exploitation of wood products	12%	8%	50%
Exploitation of non-wood products	8%	4%	88%
Hunting and fishing activities	0%	28%	72%

* N = 25, corresponding to stakeholders that answered that they participated in forest management policies.

Table 4 presents the comparison between stakeholders' profiles, their levels of influence and interest in the Matas do Litoral, and their knowledge and involvement in these areas' management policies. To explore the influence of these variables on the levels of influence and interest, a chi-square test was carried out. The results show statistically significant differences in knowledge by the level of influence and interest, correspondingly at the 5% and 1% significance levels. Additionally, a significant statistical difference regarding involvement in the Matas do Litoral management policies by the level of influence was found at the 1% significance level. These results highlight a relationship between knowledge about Matas do Litoral management policies and stakeholders' levels of influence and interest in those processes, while involvement and participation in these processes only impact the level of influence.

Table 4. Stakeholders' profiles and levels of influence and interest in the Matas do Litoral territory in terms of knowledge and involvement in management policies in these territories.

	Knowledge			Involvement		
	Yes	No	χ^2 Test *p*-Value	Yes	No	χ^2 Test *p*-Value
Stakeholders' interest						
Low	5.9%	32.7%	0.000 ***	8.0%	24.7%	0.173
Moderate	14.7%	9.3%		12.0%	11.3%	
High	79.4%	57.9%		80.0%	64.0%	
Stakeholders' influence						
Low	61.8%	83.2%	0.006 **	36.0%	81.3%	0.000 ***
Moderate	20.6%	9.3%		16.0%	13.3%	
High	17.6%	7.5%		48.0%	5.3%	

Table 4. *Cont.*

	Knowledge			Involvement		
	Yes	**No**	**χ^2 Test *p*-Value**	**Yes**	**No**	**χ^2 Test *p*-Value**
Stakeholder type						
Governmental organizations (GOs)	41.2%	18.0%	0.007 **	40.0%	24.7%	0.365
Non-governmental organizations (NGOs)	33.8%	46.5%		40.0%	42.0%	
Private firms	25.0%	35.5%		20.0%	33.4%	
Business size						
Micro business	37.5%	47.7%	0.390	27.3%	46.2%	0.106 *
Small business	32.8%	26.1%		40.9%	26.9%	
Medium-sized business	14.1%	17.0%		9.1%	16.9%	
Large business	15.6%	9.1%		22.7%	10.0%	
Scope of action						
International	17.5%	13.5%	0.077 *	8.7%	16.3%	0.410
National	38.6%	46.1%		39.1%	43.9%	
Regional	15.8%	27.0%		21.7%	22.8%	
Inter-municipal	5.3%	5.6%		4.3%	5.7%	
Local	22.8%	7.9%		26.1%	11.4%	
Domain of action						
Practices for biodiversity management	52.9%	62.3%	0.066 *	44.0%	61.1%	0.153
Sociopolitical actions	16.2%	21.7%		20.0%	19.5%	
Research and conservation	30.9%	16.0%		36.0%	16.5%	

*** $p < 0.001$; ** $p < 0.05$; * $p < 0.1$.

Concerning the stakeholders' profiles, some statistically significant differences were also found both in terms of knowledge about Matas do Litoral management policies and involvement and participation in these processes (Table 4). There are significant differences regarding knowledge by stakeholder type at the 5% significance level, but also by scope and domain of action at the 10% significance level. On the other hand, the chi-square test showed only a significant difference in the involvement in the Matas do Litoral management policies by the companies' size, at a significance level of 10%.

To explore the impact of different levels of agreement with Matas do Litoral management policies and the stakeholders' levels of interest and influence, as well as their profile, a Kruskal–Wallis test was performed (Table 5). As can be seen in Table 5, statistically significant differences were found for the level of influence, stakeholder type, and business size, at a *p*-value < 0.05. Stakeholders with a high level of influence tend to agree more with the Matas do Litoral management policies, compared to others with low levels of influence. Concerning stakeholder type, the results demonstrate that despite having knowledge about the management process, NGOs tend to disagree with Matas do Litoral management policies.

Table 5. Mean agreement score with Matas do Litoral management policies.

	Agreement Mean Score	Kruskal-Wallis Test *p*-Values
Stakeholders' interest		
Low	3	0.312
Moderate	3	
High	3	
Stakeholders' influence		
Low	3	0.004 **
Moderate	3	
High	4	
Stakeholder type		
Governmental organizations (GOs)	3	0.025 **
Non-governmental organizations (NGOs)	2	
Private firms	3	
Business size		
Micro business	3	0.046 **
Small business	3	
Medium-sized business	3	
Large business	4	
Scope of action		
International	3	0.552
National	3	
Regional	3	
Inter-municipal	4	
Local	2	
Domain of action		
Practices for biodiversity management	3	0.418
Sociopolitical actions	3	
Research and conservation	3	

N = 68, corresponding to the number of stakeholders who answered that they know forest policy management. Agreement level on a scale of one to five with one equal to *Strongly Disagree* and five equal to *Strongly Agree*. ** $p < 0.05$.

5. Discussion

Overall, our results indicate that, despite more than half of stakeholders reporting that they have knowledge about Matas do Litoral management policies, only a small share is in fact involved in those processes. This may indicate, as [34] pointed out, that in addition to being vague, broad, and unreliable, knowledge may not necessarily be "functional, useful, and a generally good thing" ([34], p. 999), at least to get stakeholders involved in the management of this public forest. Knowledge is, nevertheless, an important variable in determining stakeholders' levels of interest and influence, according to our results. As shown, stakeholders (mainly GOs) with higher levels of influence and interest tend to report higher knowledge regarding Matas do Litoral management strategies. This result is in line with the idea that knowledge can be exploited to exercise power, which in turn makes knowledge possible [34]. Stakeholders revealing a higher level of agreement with those policies generally also declare higher levels of influence (again, mainly GOs). Finally,

stakeholders who are involved in the management strategies of Matas do Litoral tend to perceive higher levels of influence.

In fact, the empirical evidence analyzed here demonstrates a discrepancy between the (generally high) level of interest and the (globally low) level of influence perceived and reported by the stakeholders surveyed, which draws attention to the existence of a "capital of interest" that might represent further opportunities for stakeholder involvement, although it is more difficult to act than to simply express interest which is in line with [59]. According to several authors [10,12,13], stakeholders' influence and interest in forest policies and management may be important indicators of their power to help design policy strategies that may reconcile conflicts of interest and promote more informed management strategies. Based on the relationship between the levels of influence and interest, the present study highlighted the existence of stakeholder groups that are not able to influence other actors (low level of influence) but can form alliances with other stakeholders who want to be engaged in developing forest management policies and practices (high level of interest), increasing their level of influence in these processes, corroborating previous findings about the multiplicity of interests regarding forest territories [41].

Comparing the levels of interest and influence using stakeholders' profiles, our findings highlight some interesting differences. Although most of the stakeholders surveyed reported higher levels of interest than influence, there is a particular group that reported having higher levels of both interest and influence. As expected—given the public ownership and management of Matas do Litoral—this group is mainly composed of large companies and GOs, especially those acting locally in domains linked to forest research and conservation, as well as to sociopolitical activities. They may be seen as key players [10], demonstrating at the same time the relevance of proximity in the levels of interest and influence in forest management policies, corroborating, among others, the studies by [7,17,45].

The heterogeneity and complexity of the stakeholders analyzed here, both in terms of their actions, needs, interests, and capability of influencing the management processes and strategies, contribute to explaining the discrepancy observed between the (generally) high levels of interest and the (often) low levels of influence, in line with [17]. The centralized management of the Matas do Litoral may, as well, explain that discrepancy, since stakeholders' actions are mediated by previous and centralized regulations, not considering, therefore, their actions as part of their participation in the decision-making processes.

As discussed in the second section of this article, one possible meaning of knowledge is the understanding and interpretation of information in a specific context [1]. On the other hand, stakeholders' involvement has been perceived as improving corporate legitimacy and promoting proactive environmental actions and strategies [1,57]. Our results demonstrate that there is a significant percentage of stakeholders who have knowledge about Matas do Litoral management policies, although they are not involved in its design and implementation, as they could and should. This may be explained by the ways in which participatory initiatives are developed or the narrow advisory role to which these stakeholders are relegated, with restricted influence over both the way knowledge claims are presented, and the choices made based on them [43]. Furthermore, there are statistically significant differences in the levels of influence and interest between those stakeholders who have knowledge of those policies and those who do not. Additionally, significant statistical relationships between the levels of stakeholder involvement and levels of influence in forest management policies emerged from our analysis, which is in line with [15] who state that different patterns of engagement for different stakeholders lead to contrasting impact patterns. These results demonstrate the relevance of knowledge in fostering participation and involvement Therefore, as stated by [31], the management of Matas do Litoral should include processes that promote knowledge about these and, on the other hand, properly include and benefit from stakeholders' knowledge and subsequent involvement.

All in all, the empirical evidence analyzed here demonstrates that GOs are the most knowledgeable stakeholders regarding Matas do Litoral management policies, and also

report higher levels of interest and influence, together with greater involvement in those processes. These results corroborate previous stakeholder analysis studies [10,14,42] and may be explained by several factors. First, understanding knowledge as an accumulation of skills and experiences may explain the higher levels of interest and influence amongst the "more knowledgeable" stakeholders, also highlighting the relevance of proximity to decision-makers and processes. In this vein, following the findings of [2], it is not surprising that GOs emerged as the most knowledgeable, interested, and influential stakeholders in our results, also considering that Matas do Litoral are publicly owned and managed territories. This is somehow corroborated by the GOs' higher levels of agreement with the management strategies implemented in those territories. In fact, when compared with other often knowledgeable stakeholders, as is the case of NGOs, GOs reveal higher levels of agreement that might be explained by their proximity and similar type of logic (State-oriented) to the public institutions managing Matas do Litoral. This may be also understood considering the different power levels and strategies of the diverse stakeholders surveyed (following the findings of [41]) that determine their ability to act and influence, with GOs having more options to fulfill their interests based on their power and even their capacity for coercion.

6. Conclusions

The aim of the present article was to contribute to a still underexplored topic within the (public) forest management literature and research: the role of knowledge in predicting stakeholders' interest, influence, and involvement in forest management strategies. To this end, a set of publicly owned and managed forest territories—Matas do Litoral—were used as a case study, and an online survey was directed to all the stakeholders acting and/ or benefiting from those territories.

The empirical evidence discussed here demonstrates that knowledge is an important variable helping to predict the levels of interest and, mainly, the levels of influence and consequent promotion of stakeholders' involvement in forest management policies. Our results, therefore, corroborate the findings of [57] regarding the relevance of stakeholders' involvement in managing complex environmental issues, improving corporate legitimacy and promoting proactive environmental strategies. Our findings reveal that knowledge is a key factor in the development of a participatory process in which several groups of actors, such as experts, policymakers, and stakeholders, collaboratively share knowledge and experiences. Additionally, they express and materialize diverse needs, interests, and perspectives, contributing to more inclusive and socially sustainable management strategies. Therefore, our study emphasizes the need to promote dialogue and open communication between different stakeholders while integrating the latter's views in forest policies, aiming at more sustainable management strategies.

This article presents an innovative theoretical approach by combining stakeholders' knowledge and involvement with public forest management, to understand the power of information in stakeholder analysis. As knowledge is an interpretation of the information in a context, stakeholders' experiences, skills, capabilities, and insights are crucial in shaping their perceptions and attitudes towards public forest management. Consequently, knowledge management, through the provision of the right information to the proper agents, should be part of forest management policies and plans. This is particularly relevant if the aim is a sustainable forest management policy, and stakeholders' involvement and engagement are intended. Coordination and knowledge exchange among all stakeholders and policymakers are therefore also highly recommended.

Presumably, these results suggest that improvements to the democratic decision-making process are possible, more inclusive, democratic, and sustainable forest management policies, and to guide policymakers in designing more adequate and effective stakeholders and public involvement strategies, our study reveals some limitations. First, the relatively small dimension and the public nature of the case study analyzed hamper more general conclusions, especially regarding other types of forest areas, namely private

forests. In fact, dealing with publicly owned and managed forests, our study focuses on particular types of stakeholders that are—at least in part—different from the private forest actors and stakeholders. This unveils the need to extend the research both to other forest public areas and, especially, to private forest territories and stakeholders. Second—as discussed—knowledge is a complex and multidimensional notion that needs further research when dealing with different stakeholders and also with a complex context, such as the public forest management policies (especially after catastrophic events, such as the wildfires of October 2017), to be able to unveil all the different dimensions and aspects shaping stakeholders' knowledge and experiences. Further research is thus needed to explore in more detail the different types of knowledge identified in the literature and their specific impact on stakeholder engagement. The same can be said about involvement, influence, and interest levels, which are equally multidimensional and complex notions. This is particularly true when considering the different power structures and relationships between diverse stakeholders. Finally, the use of a structured data collection method—such as a questionnaire—although it has unequivocal advantages in terms of data collection and analysis, should be complemented in future research with data from semi- or non-structured interviews to better unveil the dimensions and experiences underlying stakeholders' knowledge, motivations, interests, and willingness to be involved (and why) in forest management strategies.

Author Contributions: Conceptualization, C.F. and M.E.F.; methodology, C.F., M.E.F. and E.F.; validation, C.F., M.E.F. and E.F.; formal analysis, C.F. and M.E.F.; investigation, C.F. and M.E.F.; resources, C.F., M.E.F. and E.F.; data curation, C.F., M.E.F. and E.F.; writing—original draft preparation, C.F. and M.E.F.; writing—review and editing, C.F., M.E.F. and E.F.; project administration, M.E.F. and E.F.; funding acquisition, M.E.F. and E.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Portuguese Foundation for Science and Technology (FCT, IP), through the funding of the research project 'ShareFOREST-Sharing decisions in forests-participatory methodology for public and stakeholder engagement in the protection and valorization of forests in Portugal', grant number: PCIF/GRF/0050/2019. This work was also financially supported by the Research Unit on Governance, Competitiveness and Public Policies (UIDB/04058/2020) + (UIDP/04058/2020), funded by national funds through FCT/MCTES as well as by National Funds of the FCT-Portuguese Foundation for Science and Technology within the project [UIDB/04928/2020].

Data Availability Statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy restrictions.

Acknowledgments: The authors want to express their gratitude to Cristina Ribeiro, Sandra Valente, and Irene Ciccarino for their support in an earlier stage of the questionnaire design and of the collection of data, to Eduardo Oliveira for making the map in Figure 1, and to the Portuguese Foundation for Science and Technology (FCT, IP) for funding the research project 'ShareFOREST-Sharing decisions in forests-participatory methodology for public and stakeholder engagement in the protection and valorization of forests in Portugal' (PCIF/GRF/0050/2019) from which this article is derived.

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

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