



Community forest and mushrooms: Collective action initiatives in rural areas of Galicia

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ABSTRACT

Galicia is a region situated in the northwest of the Iberian Peninsula where community forests are very much spread. This kind of ownership is held by local communities that, collectively, decide how to manage the forest and its mycological resources as part of its non-timber forest products. In this work, we characterize and analyse the existing governance modalities for the collective use of mycological resources in both their material and immaterial aspects, and we do it by applying a social-ecological system framework combined with a knowledge economy model. Up to 21 mycological use initiatives have been identified and inventoried. Most of them manage the common resource through mycological reserves (open or closed), but there are others that produce and sell mushrooms. The work shows how communities use their governance mechanisms to define rules aimed at improving sustainability and the influx of revenues. In addition, we analyse how some of these initiatives are starting to manage their common immaterial resources (associated with values such as quality and with eco-certifications, etc.), and to develop innovative strategies (short supply chains) for the purpose of improving their position in the value chain. The text discusses community management as a strategy that allows combining sustainability objectives in the management of mycological resources with the raising of revenues in the long term. Finally, we underline the need for public policies that support successful experiences and strengthen the capacity of community institutions to appropriate the value they generate.

1. Introduction

There has been an ongoing discussion on the most efficient systems for the management of common pool resources (CPRs) (Anderies et al., 2011; Araral, 2014). This discussion takes place in a socioeconomic and environmental context characterized by high consumption of natural resources (UNEP, 2011) and significant environmental impacts that are damaging irreplaceable ecological functions (Daly, 1991) and highlighting the need to advance towards more sustainable management models (Agrawal, 2014). In this context, sustainability is understood as the ability to conserve a resource over time within the capacity of the ecosystem (Kajikawa, 2008). Some researchers support property rights and markets as the solution for CPR-related environmental and sustainability problems and recommend their privatization or nationalization (Hardin, 1968; Libecap, 2008). Others points to the management of CPRs by collective action institutions as more efficient and desirable

in terms of sustainability (Ostrom, 1990); this alternative has become increasingly relevant. Thus, a great part of the scientific literature on commons has focused on analysing collective action initiatives, endogenous and exogenous changes and challenges in social-ecological systems, and how these processes affect the depletion of common resources such as forests, fisheries and/or local agricultural productions (Mosimane et al., 2012). Special attention has also been paid to analysing strategies for the management of material/immaterial resources and how these strategies are conditioned in a complex and conflictive manner by the socioeconomic and political-institutional context at different levels.

From the point of view of governance, prior works have shown how the material sustainability of CPRs requires the combination of formal and informal institutions to regulate their usage (Ostrom, 1990), because the exclusion of users is difficult (and expensive, in the case of external users) and when an individual appropriates some of the

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resources there are less of them available for the rest of the group. Therefore, CPR-governance systems are conditioned by the establishment of rules that restrict access to the system and determine which agents (local or external) have the right to gather resource units in order to guarantee the system's sustainability (Sikor et al., 2017; Tepper, 2019). Brooks (2010) discusses how institutions and rules managing CPRs may be the result of top-down or bottom-up processes. Epstein (2017) argues that the prospects of compliance and cooperation tend to increase when stakeholders participate in the process of developing the rules that affect them. On the other hand, there is a growing interest in the role that collective action plays in the management of immaterial common resources and symbolic capital (Macías-Vázquez and Alonso-González, 2015a, 2015b).

Immaterial resources are considered the “new commons” and, in contrast with provisioning services (linked to material resources), are culturally created, non-competitive and non-exclusive, and can therefore be globally distributed and used by an unlimited number of people (Hess and Ostrom, 2007). Local peasant communities tend to focus on the management of provisioning services and are not aware or are paying less attention to the management of immaterial resources and symbolic capital (Rullani, 2004). Common immaterial resources are the result of a historical crystallization of a set of practices, social relations, values and ideas developed by a human collective, which, in a field of struggles between different social actors (Bourdieu, 1990), are transformed into symbolic capital, allowing them to be valued as different by other groups and markets. Many communities struggle to generate new forms of appropriation of value related to the management of immaterial resources and to new and fairer agrifood models (Macías-Vázquez and Alonso-González, 2015a), where agroecological propositions have a more influential role (Wezel et al., 2020; Pérez-Neira et al., 2021).

Within the sphere of commons, community institutions, which are allocated a set of allowances to manage the use of CPRs (Ostrom, 1990), have a great importance at a global level. It is estimated that almost 8.5 billion hectares are collectively owned by rural communities, of which 513 million are specifically occupied by forests that have been officially acknowledged as the property of indigenous populations and/or local communities (Graziano-Ceddia et al., 2015). Among the provisioning services that forests provide, timber products are of course relevant, but there are others that have been classified in the literature as non-timber forest products (NTFP). This category includes mushrooms, small fruits, honey, medicinal plants, etc. (Sisak et al., 2016; Harbi et al., 2018). These resources, as in the Galician case, are essential for the management of the environment and the generation of socioeconomic activity (Brooks, 2010; Jumba and Angelsen, 2007), and are, consequently, important drivers of sustainable rural development (Adam et al., 2013).

Galicia is a region located in the northwest of the Iberian Peninsula (Fig. 1) where the use of mycological resources has a great potential as a strategy for diversification given the region's large forest area (almost 2 million hectares, equivalent to 67% of the total area) (Ministerio de Medio Ambiente y Medio Rural y Marino – MMARM, 2011). However, decades of neoliberal public policies have favoured the expansion of monocultures of fast-growing forest species and the dismantling of extensive livestock farming, reinforcing the peripheral role of the rural world in post-industrial development models, and causing numerous environmental and socioeconomic problems (fires, depopulation, etc.) (Corbelle and Crecente, 2008; Fuentes-Santos et al., 2013). Almost one fourth of the Galician forest territory is community-owned (22.5% of the forest area) (Consellería do Medio Rural – CMR, 2019). These areas are regionally known as Montes Vecinales en Mano Común (MVMC). These MVMC, which are collectively managed by Comunidades de Montes Vecinales en Mano Común (CMVMC), are subject to the conditions of indivisibility, inalienability, imprescriptibility and immunity from seizure, and are one of the most significant elements of the rural ownership system in Galicia (Balboa et al., 2006).

In Galicia, there are presently 2900 CMVMC distributed across 254 municipalities (Consellería do Medio Rural – CMR, 2012) (see Fig. 1),

with an average area of 230 ha per community (Marey-Pérez et al., 2010), which amounts to a total of 664,000 ha (Consellería do Medio Rural – CMR, 2019). Participation in a CMVMC is directly linked to residence in the place where the MVMC is located. This condition is inclusively applied, i.e., every individual moving to a place with a constituted CMVMC may join the community and become a *comunero* or *comunera*, which is the name given to the members of the community who participate in decision-making processes and the use of forest resources, as approved by the assembly. There is a specific regional norm that has regulated the use of mycological resources since 2014 (Consellería do Medio Rural e do Mar – CMMR, 2014a, 2014b) and has recently been updated (CMMR, 2020). The Galician regulation expressly indicates that forest owners have the right to enclose their land in order to control the use of mycological resources. Thus, forest owners may decide how to use the mycological resources of their territories in the community assembly and establish specific rules for that usage according to two different modalities: i) self-consumption, and ii) commercial purposes.

1.1. Precedents and objectives of the study

At an international level, different studies have analyzed how the efficient planning and management of common mycological resources may be a sustainable source of income (Montoya et al., 2008). Cai et al. (2011) have shown the potential, in terms of rent and employment, associated with the generation of a small wild mushroom collection industry in Finland, while Zhang et al. (2014) and Marshall and Nair (2009) have highlighted the social revitalization potential of the production of shiitake (*Lentinula edodes*). Other studies have proved how mycological resources may strengthen the local community's bond with the forest and, consequently, the sustainable management of the latter (Serra et al., 2017). Prior research works on Galician CMVMC have focused on their governance from an institutional perspective (Caballero, 2014), their compliance with the principles of collective action as defined by Ostrom (Alló and Loureiro, 2016), the amount and cause of conflicts associated with community ownership (Gómez-Vázquez et al., 2009), the environmental services (cultural, recreational, productive, etc.) provided by their territories (Rodríguez-Morales et al., 2020), or the human processes linked to these institutions and their potential as spaces for transformation (Nieto-Romero et al., 2019). Despite these relevant precedents, there are no previous studies focused on the analysis of governance and management of mycological resources for commercial purposes at local level (Galicia), and they are also rare at the European and international level. For instance, Cai et al. (2011) have studied the generation of income derived from mushroom collection in rural areas of Finland, and De Frutos et al. (2019) have analyzed the sale of mushroom harvesting permits in Castilla León (Spain). There are also no prior research works that analyse the management of immaterial resources through collective strategies and innovation and differentiation processes, and how this relates and affects the models for the management of mushrooms grown in MVMC.

Consequently, in order to fill in these knowledge gaps, the main objectives of this work are the following: 1) to analyse and characterize the models for the governance of the use of mycological resources in Galicia developed by community institutions (CMVMC), and 2) to analyse the strategies for the management of material and immaterial resources linked to the use of mycological resources, as well as the collective social innovation¹ processes that allow the generation, capture and distribution of new income associated with the sustainable use of common resources. In order to achieve these two objectives, we

¹ In the present work, the term “social innovation” refers to the reconfiguration of social practices that, in response to social challenges, seeks to improve social welfare indicators and necessarily includes the participation of civil society actors (Klůváňková et al., 2018).

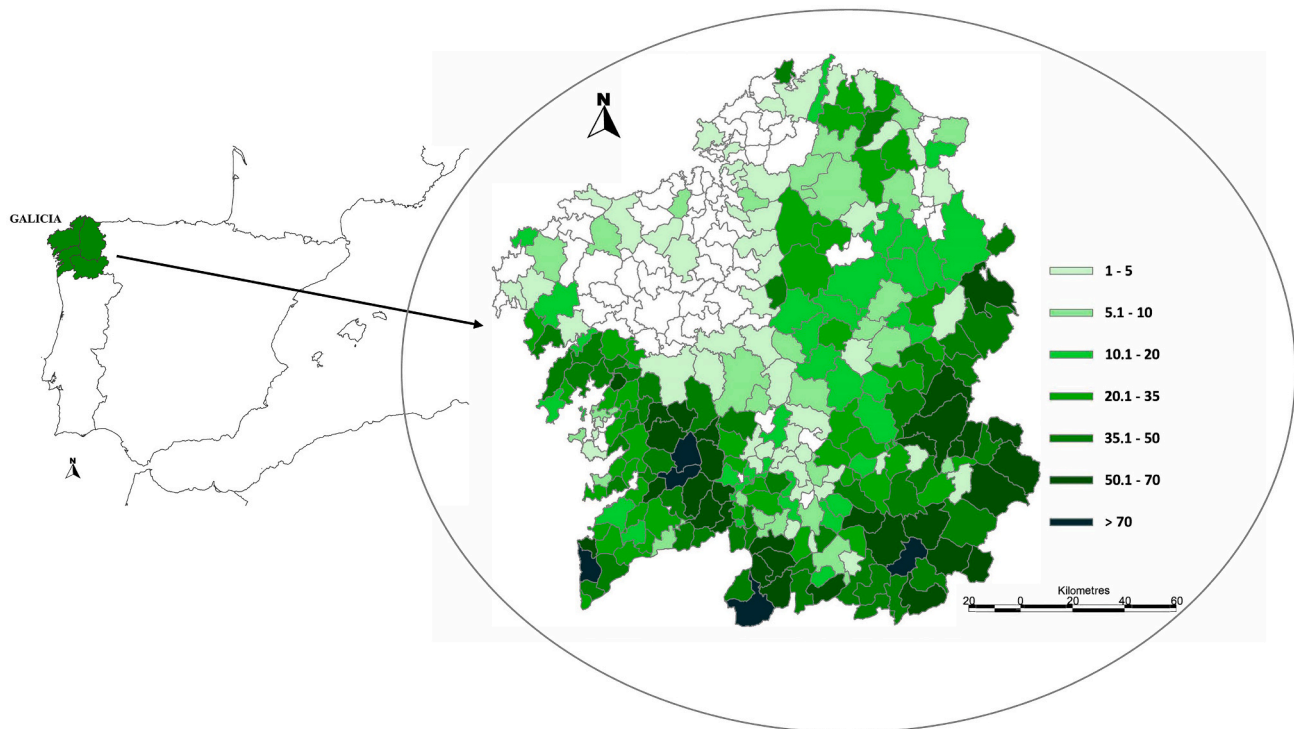


Fig. 1. Geographical location and community ownership in relation to total area by municipality in Galicia (%). Own elaboration from data drawn from [Consellería do Medio Rural – CMR \(2012\)](#).

carried out a preliminary work of search, identification and inventory of community initiatives managing mycological resources in the whole Galician territory. The inventory allowed making visible and working directly with the communities of reference. From this initial result, primary information was gathered through the conduction of semi-structured interviews, a field work that was later completed with information collected from secondary sources (reports, newspapers, websites of CMVMC, etc.).

2. Material and methods

2.1. Analytical framework

For the analysis of the management and usage of mycological resources in community lands, we have used the social-ecological system (SES) framework (Ostrom, 2007, 2009). In addition, we have researched into the management of immaterial commons by using a knowledge economy model (Rullani, 2004). SES consists of: i) ecological systems that provide the basis for ecosystem services; ii) social systems that diverge according to the different groups of stakeholders; and iii) political and governance systems and instruments at different levels (Ostrom, 2009). The main components of the SES framework are resource systems, resource units, governance systems and actors (Ostrom, 2009). Both resource systems and resource units are environmental commons (Cox, 2014). Thus, a resource system is a reserve that, in favourable conditions, provides the maximum of resource units without damaging the system, while a resource unit is that which the user appropriates in the resource system, as it happens with NTFP. Therefore, SESs are integrated complex systems that include social and ecological subsystems in a bidirectional feedback relationship (Berkes et al., 2016), and may be diverse and managed from different perspectives (Binder et al., 2013). In SES, the social system shapes the ecosystem through management. This way, the ecosystem establishes the boundaries and conditions the management through biophysical factors that are rendered more complex by their combination with sociocultural

factors (Torralba et al., 2018).

This work identifies the resource system with the forest where the use of mycological resources takes place; the resource units with the units of wild or produced mushrooms; the governance system with the different regulations, the rules established by the actors, and the decision-making spaces within the community; and, finally, the actors with the agents that interact with the resource. In this sense, the research focuses on the components and interactions of governance systems and actors in order to understand the participation and responsibility mechanisms concerning the management of mycological resources as environmental commons. In relation to the governance system, the attention is placed on the institutions (CMVMC) and on the models they implement for the management of their common resources. We observe and analyse to what extent and through which mechanisms local communities are able to draw up rules that allow improving the management of common resources under sustainability and equity principles with no need to resort to any external authority (Ostrom, 1990). In particular, we analyse the rules that define the rights over the commons, regulate the use of the resource, and distribute the benefits derived from it. Among the actors, we identify the ones that are essential to the process, mainly those who are responsible for making decisions on the use and management of the resource. In our case, the main actors are the *comuneros*, i.e., the persons who belong to the CMVMC (internal users), but we also take into account the role of external actors participating in the process (users, firms that purchase and commercialize mushrooms, etc.). As regards the environmental commons, the analysis focuses on the resource units, the mushrooms, considered as NTFPs, and on how the management of the resource system can affect the sustainability of the resource units.

Additionally, to deepen the analysis we have implemented a value generation model for a knowledge economy (Rullani, 2004), which allows us to understand how collective action institutions display their capacity to territorially appropriate the value generated by immaterial resources that are perceived as different in other markets. The value of knowledge—and, in general, of the new commons—derives from the

combination of three drivers (Rullani, 2004): the consumers' capacity to interpret the values and meanings incorporated in mycological production (v), the number of times that these meanings and values are disseminated and replicated (n), and the local communities' capacity to appropriate the value thus generated (p). We refer to mycological exploitations that opt to commercialize their resources for the purpose of improving their income levels, while still taking into consideration that it is the whole production, including the part of it intended for personal consumption, that constitutes the material base for the crystallization of immaterial common resources. In this line, the literature has highlighted different strategies to establish symbolic connections between local production systems and the sphere of consumption. Thus, for instance, producers and consumers are linked through short supply chains or direct sale, building narratives focused on the protection of the environment, health care, support to peasant communities or conservation of gastronomic diversity. Through these and other strategies, local producers try to improve their position in the value chain (Macías-Vázquez and Saavedra-Gallo, 2020). Sometimes they do it by adopting instruments that protect their incomes, such as eco-certifications and geographical indications; some other times, the symbolic bond with the consumers is less abstract, less codified, making it more difficult for the most concentrated stages in the value chain to parasitically appropriate local incomes through their marketing, advertising and promotion strategies.

In addition to via the usual certifications, symbolic relations could be articulated through ethnohistorical narratives about each product variety, their organoleptic and nutraceutical properties, as well as the social activities and ways of doing around them, including the artisanal techniques used in their production. In relation to value generation processes in an economy based on knowledge and immaterial commons, we have mainly focused on collective initiatives that collectively manage environmental commons to guarantee the sustainability of the resource by using differentiation and value generation strategies for the benefit of local communities. Previous studies (Macías-Vázquez and Alonso-González, 2015a, 2015b; Macías-Vázquez and Saavedra-Gallo, 2020) have shown that the lack of capacity of local communities to appropriate the value generated may have negative effects on the sustainable development of the territories and, in the long term, on the valuation that consumers make of local productions. These premises have served as an analytical guideline for the management of immaterial commons in the specific case of mycological resources.

2.2. Data collection and analysis

The collection of data was structured in two large blocks: 1) secondary sources, and 2) primary information. In the first block, information was gathered from documents and statistics published by the Consellería de Medio Rural of the regional government of Galicia, as well as documents that comprise the regulatory framework and affect community institutions in Galicia. The analysis of these secondary sources consisted in the collection and study of the existing regulations and public statistics. This work allowed contextualizing the quantitative importance of community ownership (which represents 22.5% of the Galician territory) and understanding the possibilities for action and the restrictions that the institutional framework imposes on the use of mycological resources. The collection of primary information in the second block was structured in three steps. First of all, the implementation of a snowball methodology, i.e., once a mycological use initiative was identified and contacted, we asked its representatives about other experiences and so on until no more new experiences were found. The contact and direct involvement of the research team (visits, phone calls, etc.) with CMVMC during a long period (10 years) was key for the success of the sampling process. Secondly, a specific semi-structured questionnaire was designed to be used during the field work in visits to the communities or in phone calls to the actors.

The semi-structured questionnaire addressed the characteristics of

the CMVMC and of the mycological reserve for the purpose of identifying their own specific norms on participation, possible forbidden practices, etc. There are questions about the main motives for the creation of the mycological reserve, as well as about the species collected and the sale prices in case they are commercialized. The field visits and phone calls for the interviews were made between 2018 and 2021 by the authors of the research work. In total, 22 interviews were conducted. This information was completed with data provided by the Consellería del Medio Rural (on the total area of the mycological reserves) and the Consello Regulador de Agricultura Ecolóxica de Galicia (on the area and the species of mushrooms collected). Drawing from the information gathered, a database of mycological use initiatives in MVMC (Base de datos sobre Experiencias de Aprovechamientos Micológicos en MVMC, BEAMM) was designed to synthesize the data of the identified experiences (municipality, area, type of management, etc.). Finally, using the information thus obtained, the experiences of mycological resource management identified were systematized and categorized using the above-described SES framework and the value generation model for a knowledge economy.

3. Results

3.1. Management and governance models in community initiatives on mycological use

From the primary and secondary information gathered and systematized in the BEAMM, 21 experiences related to the community management of mycological resources in Galician MVMC were identified. They were classified into two large categories (Table 1): i) wild mushroom collection (MC) in mycological reserves, and ii) mushroom production (MP), illustrated with the production of shiitake (*Lentinula edodes*). Within the first category, we differentiated two subcategories: i. a) wild mushroom collection in closed mycological reserves (MCC), where the gathering is made by the *comuneros*; and i.b) wild mushroom collection in open mycological reserves (MCO), where external actors allowed to enter upon payment of a fee. The main groups of actors involved in decision-making processes and the management of the resource were identified for each subcategory. In all the different experiences, the *comuneros* are the main actors with decision-making powers, regardless of whether they exploit the resource or not. External actors were also identified, particularly mushroom gatherers who, not being *comuneros*, make use of the resource. Finally, with regard to the level of governance, it varies depending on whether additional rules are added to the ones included in the regulatory framework, or whether specific processes of social innovation or collective management of immaterial are also developed. In this sense, it has been determined that, in CMVMC where the existence of additional rules and/or social innovation processes is confirmed, there is a high level of governance. In the rest of the initiatives, where at least an assembly agreement is required for the creation of a mycological reserve, a medium level of governance has been identified.

The initiatives identified (see Table 2) are distributed across the four Galician provinces (Fig. 2). The ones located in the mid-mountain rural areas of the interior are the most numerous. The main use of mycological resources made by CMVMC in Galicia is linked to closed mycological reserves, of which we identified fourteen. The number of open mycological reserves identified was five. These are found in three main geographical locations: the mountain district in the province of Lugo, the mountain municipalities in the province of Ourense, and some areas near the Atlantic coast of Pontevedra and A Coruña. Only two collective initiatives for the production of saprophytic mushrooms have been catalogued, where immaterial resources are collectively managed and social innovation processes are being implemented.

Table 1
Summary of the categories of mycological use initiatives in MVMC.

Category of mycological initiative	Subcategory	Level of governance	Main actors	Characterization
Wild mushroom collection in mycological reserves (MC)	Closed mycological reserve (MCc)	Medium	<i>Comuneros</i> (gatherers or non-gatherers)	Enclosure of the resource system (forest) for the collection of resource units (wild mushrooms) exclusively by the members of the community (<i>comuneros</i>).
	Open mycological reserve (MCo)	High	<i>Comuneros</i> (gatherers or non-gatherers) and external gatherers	Enclosure of the resource system (forest) for the collection of resource units (wild mushrooms) by both the members of the community (<i>comuneros</i>) and people not participating in collective ownership who pay a fee set by the community to collect the resource. Establishment of specific internal rules and additional control mechanisms.
Mushroom production (MP)	Production of shiitake	High	<i>Comuneros</i>	Production of saprophytic mushrooms by the community connected to the use of endogenous timber resources. Self-management of the resource throughout the year and social innovation processes to reinforce the experience.

Table 2
Initiatives on the use of mycological resources by CMVMC in Galicia.

Category of use	Subcategory of use	CMVMC	Municipality	Province	Area of the mycological reserve (ha)	Innovation and management of immaterial resources
Wild mushroom collection in mycological reserves	Closed	Froxán	Lousame	A Coruña	100	No
	Open	Raño	Irixoa	A Coruña	339.7	No
	Open	Baroña	Porto do Son	A Coruña	100	No
	Closed	Castromaior	Abadín	Lugo	496.4	No
	Closed	Santa Cruz	Guitiriz	Lugo	847.4	No
	Closed	Lousada	Xermade	Lugo	800	No
	Closed	Couto das Louxeiras e Xemil	Pastoriza	Lugo	224.8	No
	Closed	Tenente e Xistral	Muras	Lugo	650	No
	Open	Carballo	Friol	Lugo	457.9	Eco-certification/ short supply chains
	Closed	Negradas	Guitiriz	Lugo	510.8	Eco-certification
	Closed	Figueiras	Mondoñedo	Lugo	1069	No
	Closed	Labrada	Abadín	Lugo	2100	No
	Closed	A Vilavella e A Canda	A Mezquita	Ourense	1094	No
	Closed	Quereño e Vilar de Xeos	Rubiá	Ourense	599	No
	Closed	Pepín	Castrelo do Val	Ourense	585.8	No
	Closed	Pedroso	Riós	Ourense	550	No
	Open	Salgueirón de Mos	Mos	Pontevedra	500	No
	Closed	Paraños	Covelo	Pontevedra	80	No
	Open	Rebordelo	Cerdedo-Cotobade	Pontevedra	9.4	No
	Production of saprophytic mushrooms		Couso	Gondomar	Pontevedra	Not applicable
		Coruxo	Vigo	Pontevedra	Not applicable	Short supply chains

Source: Own elaboration from data gathered through field work, *Consellería do Medio Rural – CMR (2019)* and *CRAEGA (2020)*.

3.1.1. Wild mushroom collection initiatives in CMVMC

3.1.1.1. Closed mycological reserves. The MCc modality involves the harvesting of wild mushrooms only by members of the community. In municipalities located in the interior of Galicia, there are examples of CMVMC that, applying their governance system, decided in assembly to fence their property and limit the use of wild mushrooms to the collection and direct sale of the resource by the *comuneros*. In this modality, the CMVMC places a sign at the entrance of the forest to indicate that mushroom picking is forbidden and manages the area in ways that favour the maintenance of the mycological resources over time. Our field work shows how closed reserves in MVMC were created by local communities many years before the passing of a specific legislation, especially in the areas of Lugo and Ourense, where mushroom picking is relevant from an economic point of view. These initiatives are developed for the purpose of ensuring the sustainability of the resource and facilitating the raising of revenues. For instance, in Figueiras (Mondoñedo), the community, formed by 23 *comuneros* of high average age, unanimously decided in assembly in 2006 to restrict the collection of resource units in the 1068 ha of their resource system exclusively to the inhabitants of the area. As in the rest of the cases identified, this conservationist initiative was undertaken because of the need to maintain the

resource over time, given the increasing pressure on the resource perceived by the *comuneros* and the use of bad harvesting practices by actors outside the community (which cause the degradation of *v*). In the cases studied, no joint sales mechanisms² and/or instruments for the collective management of immaterial commons by the *comuneros* were found (which hinders the strengthening of *p*). Selling the resource to business intermediaries is the usual practice, although it is worth mentioning that some of the initiatives are currently considering adopting an open reserve model.

3.1.1.2. Open mycological reserves. The other wild mushroom collection modality consists of an open reserve in the resource system, where resource units (wild mushrooms) can be collected by both the main actors, the *comuneros* who belong to the collective institution, and external actors to the CMVMC. The decision in assembly is to allow mushroom picking by persons who acquire a permit sold by the collective entity. The cases found in Galicia indicate that these persons can pay a specific fee per day or per season, and obtain different types of

² The joint sale by the community of the mushrooms separately collected by the *comuneros*.

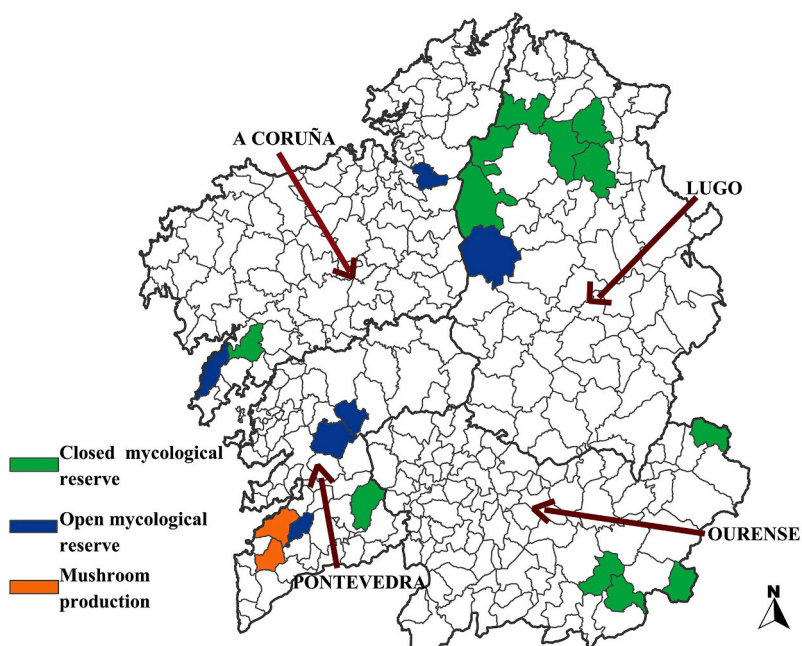


Fig. 2. Galician municipalities with initiatives on the community use of mycological resources.
Source: Own elaboration from data gathered through field work and [Consellería do Medio Rural – CMR \(2019\)](#).

permits depending on their origin and the purpose of the activity. For instance, at the reserves of the CMVMC of Baroña, Mos and Carballo, collection for self-consumption by the *comuneros* is free, while for people outside the community the cost ranges from EUR 10 to 15 per season, depending on whether the collection is for self-consumption or for commercial purposes. In open mycological reserves it is possible to establish internal rules that determine such aspects as the maximum amount of resource units that can be gathered, the collection methods, the profiles of those allowed to pick, the forbidden practices, etc. (see [Table 3](#)). These rules are approved for the purpose of fostering the perpetuation and sustainability of mycological resources and raising revenues for the local community (given that they improve v).

3.1.2. Wild mushroom production (MP) initiatives in CMVMC

Two initiatives were identified as belonging to this category: the CMVMC of Couso (Gondomar) and that of Coruxo (Vigo). The CMVMC of Couso built, in 2014, a plant for the production of saprophytic mushrooms on wood logs from the forest within the property. The community is the promoting entity of these 2 ha-big installations for the cultivation of mushrooms for the benefit of the local community. This pioneering initiative aims at creating employment, using endogenous resources and boosting local socioeconomic development. The production process takes place within a space-intensive production system which accumulates wood trunks of the community and has a controlled irrigation system to improve the development of the activity. The raw material consists of wood logs from broad-leaved trees obtained from felling, pruning and other forest activities carried out by the local community. There are currently around 1000 logs in production. After being inoculated with mushroom spawn obtained from the mycelium of shiitake, which is currently an external input, and a maturing period of between six and nine months, the logs produce mushrooms for their subsequent transformation and/or commercialization. The initiative of Coruxo is incipient, because it was only started in 2019 with 150 wood logs, and the mushrooms are only now being commercialized in specialized local establishments (as a way to increase v). Up until now eucalyptus logs from the property have been employed, thus providing an alternative usage to this fire-tolerant species, which is being replaced in the area.

3.2. Income, social innovation and the collective management of immaterial resources associated with mushrooms

Mycological reserves for the collection of mushrooms are an important source of income in rural areas. For instance, communities in Ourense and Lugo can obtain revenues of up to EUR 6000 per season and household in a favourable year. These revenues are not insignificant, especially in social contexts where the average age of the population is high. Ourense and Lugo are, in fact, the second and third provinces in Spain with the highest ageing rate (INE, 2021), and the monetary resources of their older populations are limited, because their pensions are among the lowest in the country ([Vázquez Taín, 2016](#)).

The way in which mushrooms are commercialized has a notable effect on the income earned. The field work shows how, in the last few years, the average sale price to intermediaries of first-class *Boletus edulis* (the main species harvested in these communities) ranges from EUR 6 to 7 per kilogram, with minimum/maximum values ranging from EUR 4 to 12 per kilogram, and from EUR 1 to 2 per kilogram for second-class mushrooms. It is important to highlight that there are some incipient attempts at sales innovation through mechanisms linked to short supply chains and direct sale. The regulation currently in force limits commercialization to a maximum of 500 kg of mushrooms per person and year ([CMRM, 2014a, 2014b](#)), and lists the marketable species ([Ministerio de la Presidencia, 2009](#)). In this sense, the *comuneros* of the CMVMC of Carballo have developed some collective direct sale strategies to sell wild mushrooms gathered in their forest to urban stores despite difficulties related to the type of product, which is perishable and unprocessed. Given the characteristics of production and of the existing regulation, the increase of v seems to be incompatible with a parallel increase in n . However, another example of collective action and innovation can be found in the CMVMC of Baroña, which will soon undertake an initiative aimed at increasing the added value of mycological resources through the commercialization of dehydrated mushrooms. This strategy could allow an increment in n without reducing v .

On the other hand, it is interesting to confirm that some CMVMC have taken an additional step towards differentiation and the creation of added value through the sale of wild mushrooms, and have consequently and parallelly improved v and p . In effect, the CMVMC of As Negradas

Table 3
Example of internal rules for the management of mycological reserves in CMVMC.

General collection norms	Prohibitions
Collection will be made with baskets or other containers that allow the aeration of mushrooms and the fall and spreading of spores. The use of plastic bags, hermetic backpacks or similar containers is totally forbidden, except when the collection is for scientific purposes, in which case transportation in hermetic containers will be allowed.	Moving the soil in a way that alters or damages the superficial vegetal layer, whether by hand or using any kind of tool. Using pickaxes, rakes or any other tool that may alter the vegetative part of the mushroom. In any case, the blade of the tool will not be longer than 11 cm. Picking mushrooms and fungi by night, regardless of the intended use or the species. For this purpose, the night will comprise the period that goes from sunset to sunrise, according to the sunrise and sunset tables.
Once the unit is extracted, in a way that does not damage the mycelium at the base of the mushroom, the hole in the soil will be covered.	Breaking or damaging units that will not be gathered, except for the exceptional breakage of a unit in order to make a correct taxonomical identification. When collecting units, special care will be given to not affecting the regeneration of the mycelium by picking them whole. Picking mushrooms in the first and final phases of their development, i.e., when the units are too new or too old, for the purpose of ensuring the reproduction of the species.
Collection may be made using a knife or a similar tool, the blade of which will have a maximum length of 11 cm.	Picking, damaging or destroying units of protected species. Picking non-edible species, except with scientific authorization. Damaging signs, fences, walls or any other infrastructure in the property or forest. Littering the environment.
Pickers must carry their permit at all times when gathering mushrooms, together with an identity document, which they will present any time they are required to do so by CMVMC representatives or law enforcement officials.	Collecting more than 2 kg per person and day for self-consumption purposes.

Sources: Rules established by the CMVMC of Carballo for the collection of mushrooms (commercial permit and self-consumption permit).

(Gutiriz) and the CMVMC of Carballo (Friol) have had part of their forest certified by the Consello Regulador de Agricultura Ecolóxica de Galicia (CRAEGA, Galician Regulatory Council for Ecological Agriculture) for the collection of organic wild mushrooms. In particular, these two communities have an eco-certification that allows the hunting of species such as *Boletus aereus*, *Boletus edulis*, *Boletus pinophilus*, *Lactarius deliciosus*, *Cantharellus cibarius*, and *Hydum repandum*. Finally, the production of shiitake in Couso and, more recently, in Coruxo are examples of dynamism and use of endogenous resources. Under the multifunctionality principle, the CMVMC of Couso is developing uses that are differentiated according to quality, for which purpose it has obtained an eco-certification for its products. The community has also achieved the economic resources required to develop a mushroom production plant by involving the local population through social innovation processes based on microloans, which support and reinforce the experience from an economic point of view. Small monetary amounts are provided by the local residents in the form of loans that prove the local support to the initiative. The CMVMC of Couso is trying to commercialize shiitake by implementing a direct sale strategy, namely packing its mushroom production to be sold under an organic label (which, in addition to increasing p , could result in an increment of n through the process of codification).

4. Discussion

4.1. Governance and mycological management models in community forests

In Galicia, as in other parts of the world (Montoya et al., 2008), the use of mushrooms as a forest resource is related to self-consumption practices (within the family or across family networks) and commercial purposes. In the forest resource system, the production or collection of wild mushrooms is an important opportunity, not only in economic terms, but also in terms of forest management and rural enhancement. At the regional level, mushroom sales are estimated to generate between EUR 24 and 30 million per year (Rodríguez-Barreira et al., 2009). In line with the work by Ostrom (1990), our study sheds light on how certain community initiatives are developing successful collective management models for the use of mycological resources through implementing assembly-based governance models, which are built bottom-up and supported by the logic of the common good, and which allow improving the economic results and the conservation of resource units over time. Far from encouraging the logic of individualism, awareness of the existence of bad collection practices and overharvesting of the resource has motivated local communities to decide (as a way to avoid the degradation of v) on the economic exploitation of their resource and on the creation of mycological reserves. It has also prompted the imposition of rules adapted to the context and aimed at improving and promoting more sustainable uses of the resource, with the mind set on the benefit of the future managers of the community forest. The way in which communities establish those rules and effectively limit access to their properties is key to guarantee the system's sustainability and its flow of benefits (Tepper, 2019). In this sense, there is a wide range of initiatives and processes that can be developed to determine the rules that will help manage the resource (see Brooks, 2010) in a context where the use of mushrooms for commercial purposes is relatively new and where, consequently, there is a lack of traditional norms on that matter.

Thus, some initiatives only allow the members of the community to use the resource, which makes it possible for them to gather larger amounts of mushrooms and increase their family incomes, whereas other initiatives have opened access to external actors through the sale of permits, as it is done, for instance, in certain areas of Italy (Bassi and Carestiato, 2016). In the case of Galicia, no examples have been found of resource allocation or concession granting to firms or external collecting entities, which is another management option (Martínez Peña, 2003). The revenues obtained from the mushrooms, although seasonal, have a regular (yearly) nature and are especially relevant in rural areas of the interior where the level of economic activity is low or very low (see also Cai et al., 2011). Thus, it is not strange that an increasing number of local communities in Galicia are starting to consider the resource of wild mushrooms in their management plans, as is also happening in Mexico (Klooster and Masera, 2000).

4.2. Social innovation and management of immaterial commons in Galician forest communities

As it happens in other SES, most Galician CMVMC focus on the management of provisioning services and are not acquainted, or do not address it sufficiently, with the management of immaterial resources associated with the forest and with mycological resources (Macías-Vázquez and Alonso-González, 2015a, 2015b). The management of immaterial resources and the new forms of social innovation are strategies that may allow improving the communities' position in the value chain and, as a result, increase the value obtained in material production processes (Rullani, 2004). This field is still to be explored by most communities using mycological resources for commercial purposes. Valorisation processes usually escape local control, because they involve the role of consumers, norms and regulations, marketing processes, etc., as well as larger capital investments (infrastructure, packaging).

However, in contrast with other products, such as olive oil or wine, the value chain of wild mushrooms is not strongly globalized. Consumption is mainly organized at the regional level and only a few firms corner the market (Pasquinelli, 2008). On the one hand, the limited capacity to increase n makes it difficult for external actors to re-signify local material resources as a way of reducing p at the local level. On the other hand, the short supply chains hinder the valorization of the production at a higher scale (increasing n).

Some community initiatives have perceived this as a collective opportunity, and understand the potential that the management of immaterial common resources, as well as the development of alternative value chains that allow improving their position in the market, could have. Through codification, a parallel increase of the three drivers could possibly be achieved. In this process, these pioneering communities are adopting different strategies (eco-certifications, alternative supply chains, etc.), which nevertheless have a common denominator: the collective work intended to improve the capacity to interpret and disseminate the symbolic knowledge, meanings and values associated with the community management of forests and mushrooms, including sustainability, quality, community and/or local development (Rullani, 2004).

In a postindustrial society, organic mycological resources have become an important source of immaterial valorisation, because their consumption is closely linked to values that are increasingly important, such as health care, environmental protection, support to peasant communities or conservation of gastronomic diversity. There is really an important potential margin to increase v . However, biotechnology and trading companies, placed in later phases of the value chain, are usually better acquainted with and capable of managing these narratives, as well as of using marketing to project imaginaries of collaboration on these local communities. Through these strategies, they increase the differential between the price of the raw material and the final price paid by the consumer. This shows that, even though there is ample room for immaterial valorisation, it is being appropriated in a parasitic, rentier way by the firms (Serres, 2014). In this sense, the administration is not regulating in favour of local productions and endogenous development. Influenced by the neoliberal discourse according to which employers are the ones effectively generating value (Hanlon, 2014), the legal norms established by the regional government limit the capacity of local producers to enter the mushroom marketing and processing spheres at a larger scale. In fact, in consonance with Rullani's model, the local producers' capacity of appropriation is very narrow, despite the implementation of eco-certifications. This quality management model is insufficient in the current circumstances (Pasquinelli, 2008), as it happens with other forest, agricultural and stockbreeding products (Macías-Vázquez and Alonso-González, 2015a, 2015b).

5. Final considerations

As shown in this work, community management is an economic strategy that seeks to combine an improvement in the sustainability of resource management models and the raising of revenues for the local community. For this purpose, communities use their governance systems to establish different management models and rules according to the local contexts. The most effective governance strategies are those aimed at strengthening the position of local communities in the value chain. Pioneering communities enhance their actions through social innovation processes and the management of immaterial common resources associated with the work of administering and maintaining their forests and mycological resources. These initiatives are still a minority, but they could be a spearhead for others. This outcome makes us wonder, in what could be a future research line, about the differential elements that encourage communities to follow one direction or another in their management strategies. From a political point of view, it may be timely to invest in reinforcing these initiatives and to expand successful management models by supporting differentiation processes and the

communities' capacity to appropriate the value they generate in the market. In this sense, it would be necessary to articulate collective action mechanisms on an extraterritorial scale that could integrate various communities, both horizontally and vertically, around narratives related to the promotion of immaterial common resources. Additionally, the need to continue studying other territories and shed light on successful good practices in the community management of mycological resources and in revenue-raising processes in local communities, while favouring local social dialogue and empowerment, is also worth highlighting. In this sense, it would be interesting to address, in future research works, the income flows generated in rural areas from the exploitation of mushrooms, as well as the possible improvements in these flows associated with the implementation of alternative differentiation and commercialization mechanisms.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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