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Land Use Policy

Privately owned forests and woodlands in Spain: Changing resilience strategies towards a forest-based bioeconomy

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ABSTRACT

Some marginalized Spanish forest areas view the circular bioeconomy proposal as an alternative solution and an opportunity required by both global and local challenges. This article aims to contribute to decision-making and to a forest-bioeconomy proposal design from a qualitative perspective by analysing resilience strategies in the south of the aragonese region on three levels, namely private forest owners (PFO) practices, resources/assets, and governance, and three scales, forest, community and territory. The literature review on a resilience thinking approach and stakeholders' perceptions have contributed to the design of a resilience strategic framework (RSF) as an analytical tool for measuring the possibilities of substantial change in the socio-ecosystem with associated attributes in five resilience strategic areas. The study concludes that PFO current strategies (persistence and safeguarding) do not suffice alone to create a territorial policy plan and change scenarios. New attributes based on adaptation, creation and transformation towards rural recapitalisation are required. The change would target increasing interdependence (between sectors, stakeholders and territories), improving capabilities in the context and increasing stakeholder and community control. This would involve overcoming current barriers and designing 'resilience governance' based on integration, innovation and future orientation to rural transformation.

1. Introduction

Mobilising forest resources, particularly underused and barely managed forests and woodland, is beginning to appear on the forest policy agenda (Schmithüsen and Hirsch, 2010) (EC, 1998; EC, 2013; EC, 2015) linked to agricultural policy, rural development policy and, more recently, demographic policy.

In Spain there are two strategic lines that are gaining traction in the design of public sustainability policies. The first is the link between the ecological transition issue and the demographic challenge, one example of which is the recent creation of the Ministry for Ecological Transition and Demographic Challenge (known by the abbreviation MITECO in Spanish). The second is the national and regional political commitment to emerging socio-economic models, such as the bioeconomy, connected with the sustainability transitions. The latter have been defined as 'long-term, multidimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption' (Markard et al., 2012:956). These change processes go hand in hand with socio-technological and socio-ecological innovations (Melnykovych et al., 2018), which condition the transition pathways to be defined for a particular area, with unique governance and stakeholders (Reed, 2008).

This study analyses the implementation of rural resilience strategies aligned with the bioeconomy proposal and with private forest management. The forest-based bioeconomy in Spain is an interesting case because combines the forest sector's current weak position with a potentially major future contribution for rural development and sustainability transitions. In addition, the attention to private forest management is interesting and socially relevant because the private forest ownership (individual or collective) is extremely important in Spain, where it accounts for around 72.7 % (Spanish Government, 2019:6) and because there is no real political concern about the importance of private forest management, nor awareness of it being impossible for sustainability transitions to progress without changing private forest owners (PFO) behaviour (Feliciano et al., 2017).

Bioeconomy strategies are being implemented in numerous countries and regions around the world, including the European Union (EU). The European Bioeconomy Strategy (EBE) (European Commission, (EC, 2012; 2018) understands that the bioeconomy 'includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services' (European Commission (EC, 2018:4). The EBE is a benchmark for designing public policies to promote new ways of innovating, producing and creating

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jobs by placing sustainability and resilience at the heart of its proposal and triggering expectations, especially for the most vulnerable rural locations. The EBE incorporates a human approach to move towards successful and equitable welfare societies (Nussbaum, 2011; Sen, 2017), not leaving behind people, communities or regions (contained in the Sustainable Development Goals, SDG) (UN 2030 Agenda, 2015) and promoting behavioural and lifestyle changes to achieve zero global emissions (UN 2030 Agenda, 2015; Paris Agreement, 2015).

In Europe, the number of private forest holdings and the area of European private forests have increased considerably since 1990 (Forest Europe, 2015r; Živojinović et al., 2015).

Expectations and demand for forest products, including bioenergy, have also increased (Elands and O'Leary, 2002). Some countries (Germany and Finland, especially) have opted for significant forest-based bioeconomy strategies after identifying the forest sector as crucial. European countries' commitment to the forest-based bioeconomy is advantageous for rural areas and for sectors that are not as well provided for in a fossil-fuel economy. European forests account for 1% of GDP, employ 2.6 million people and play an important role in European culture (European Union (EU), 2019).

Spain, which has many sectors associated with the bioeconomy (Lainez et al., 2018:90), specified its bioeconomy strategy in 2016 (Spanish Government, 2018). Since then, many Spanish regions and stakeholders view the circular bioeconomy proposal as an alternative solution to society transitions required by both global and local challenges (Ovando, 2017; Lainez et al., 2018; Verkerk et al., 2018; Sanz-Hernández et al., 2019a). In fact, the notion of resilience has become popular in territorial analyses (Sánchez-Zamora et al., 2017), partly as a reaction to the notion of rural decadence (McManus et al., 2012).

Concerning rural resilience strategies, an interesting debate between academia, governments and development agencies focuses on the resilience of socio-ecological systems (SES). These can be defined as complex systems comprising social (human) and ecological (biophysical) subsystems with two-way feedback and impact (Ostrom, 2009; Berkes et al., 2016; Nijnik and Miller, 2013). Recent approaches based on the resilience thinking adopted in this paper require the socio-ecological interactions of forest needs to be further explored in a variety of contexts to gain more insights into their complexity and multidimensionality (Sarkki et al., 2017) in response to the uncertainty of incremental and transformational change (Adger et al., 2005; Flood and Schechtman, 2014; Jozaei et al., 2020). Authors are demanding an analysis of how change occurs in real-life contexts (Sellberg et al., 2018), which some view as a rural recapitalisation process. Focusing on this debate, some studies coincide in predicting the growing relevance of socio-cultural dimensions in the future study of SES (Daniel et al., 2012; Plieninger et al., 2013) based on a comprehensive theoretical approach that considers the flows, interactions and complexity of every SES, and human behaviour and governance and socio-technological innovations (Melnykovych et al., 2018).

Resilience thinking is having an influential impact on redefining governance (Jozaei et al., 2020) and on different approaches to studying it. Emerging from cross-fertilisation between several notions, 'resilience governance' builds on adaptive (Garmestani and Benson, 2013; Chaffin et al., 2014), collaborative (Ansell and Gash, 2008), integrated (Sotirov and Arts, 2018), integrative (Živojinović et al., 2015; Winkel and Sotirov, 2016) and innovative management, whose control is limited by uncertainty, diversity and conflict (Dietz et al., 2003). Here, governance in a forest-management context is understood as 'the system of institutions, including rules, laws, regulations, policies, and social norms, and organisations involved in governing environmental resource use and/or protection' to assure people, communities and areas that changes will be addressed (Chaffin et al., 2014:1).

Based on resilience thinking and a qualitative methodological approach, this paper focuses on how improve the resilience strategies in vast depopulated and marginalised rural areas, in which forests can play a more important role and in which forest-based bioeconomy is seen as an opportunity to increase rural resilience. The improvements would affect three different scales (forest, community and territory), and refer to five strategic areas of resilience: persistence, safeguard, creation, adaptation and transformation.

To answer this main research question, three specific objectives are set. The first is to analyse the resilience attributes of a rural Spanish forest area. These attributes are linked to three levels correspond to major gaps in research about resilience strategic frameworks (RSF): the analysis of stakeholders' practices and participation (Drews and van den Bergh, 2016; Matthias et al., 2011); the identification of resources and assets to improve rural resilience (Ashkenazy et al., 2018); and the complexity of linking public forest policies with resilience governance mechanisms without resulting in incompatibilities and imbalances (Vogel et al., 2007; Weiland, 2010).

The second objective is to reflect on factors organising the pathways to changing resilience strategies (dependence, capacity and control), towards governance in a bioeconomy framework. Finally, the third objective is to examine the main barriers and policy implications of this change process to support policymakers who are demanding pointers for the design of roadmaps in each region.

Two main contributions are made: 1) The interpretative theoretical framework can serve as a reference to analyse the position and implementation of new resilience strategies in forest management. 2) The empirical novelty includes collecting and analysing new types of data from vulnerable and small populations (Sovacool et al., 2018).

The paper has the following structure: section 2 contains the theoretical background and literature review, while section 3 describes the contextual and methodological framework. Section 4 shows the key results and analysis for pathways to overcome rural resilience strategies and build the forest-based bioeconomy model, including the main barriers and policy implications. Section 5 contains the conclusion.

2. Theoretical background: resilience thinking and barriers to the forest-based bioeconomy model

The notion of resilience has received much theoretical attention and has become part of both political and academic discourses (Ashkenazy et al., 2018). It was originally defined as a SES attribute to respond to change: the system's ability to absorb disruptions and reorganise itself, while undergoing change, and to keep essentially the same function, structure, identity, and feedback systems (Gunderson, 2000; Carpenter et al., 2001). The dominant perspective has been the static focus that views resilience as a means to revert to SES, particularly in risk contexts and after a disaster or crisis (Cutter et al., 2008; Prior and Hagmann, 2014; Sánchez-Zamora et al., 2017). Walker and Salt (2006) introduced the term 'resilience thinking' as a frame of mind (Jozaei et al., 2020) or an attitude that promotes non-lineal thinking, recognises complexity and accepts uncertainty (Folke et al., 2005; Davoudi, 2016) and change as a constant (Magis, 2010). Based on this approach, Walker et al. (2004) highlighted the SES capacity to address knockbacks by conserving (persistence), confronting (adaptation) or completely modifying (transformation) systemic functions and structures (Berkes and Seixas, 2005; Berkes, 2007; Folke, 2003; Roberts et al., 2017). SES are also able to self-organise with associated capacities for safeguarding (sedimentation) or creation (experimentation and innovation) (Sanz-Hernández et al., 2019b). Resilience thinking, as adopted here, focuses on analysing where SES are resilient, but, above all, it involves a frame of mind that embraces change (Walker and Salt, 2006; Armitage et al., 2017; Jozaei et al., 2020). There is a growing interest in establishing strategic response frameworks based on prospective (Sánchez-Zamora et al., 2017), multidimensional and future-oriented (Berkes, 2007) approaches. Some authors have emphasised the need to identify resilience pathways (Wilson, 2012; Skerratt, 2013), and best governance conditions in uncertain future scenarios (Jozaei et al., 2020) aiming for sustainable development (Maru et al., 2017; Aggestam and Wolfslehner, 2018).

Forest communities are vulnerable contexts 'at demographic risk' that are arousing political, media and social interest (Sanz-Hernández, 2016) and that are at the centre of new economic models for sustainability transition, such as the unfinished bioeconomy model that is yet to be constructed (van den Bergh et al., 2011) and is not exempt from criticism (Birch et al., 2010).

The barriers to implementing the bioeconomy proposal and its capacity to have a positive impact on the area are related to aspects that the literature on forest management underscores. Firstly, the area's internal aspects such as PFO practices are identified in the most recent studies as barriers to an area's development. Authors highlight the European trend towards a forest management characterised by owner absenteeism (Kittredge, 2005), detachment and alienation due to their scant participation in forest management (Ficko et al., 2019). They also mention negligent and neglected management (Lawrence and Dandy, 2014) and passive or indifferent management (Živojinović et al., 2015) by owners who are less economically dependent (Matilainen et al., 2019), more disconnected and emotionally detached from forests than previous generations (Grubbström, 2011; Weiss et al., 2018), more misinformed and less committed (Stoettner and Ní Dhubháin, 2019). Other internal aspects are socio-cultural styles in transition (Ziegenspeck et al., 2004), and local identity and place attachment that are key socio-cultural elements to understanding the high level of socio-ecological resilience in terms of persistence (Davidson-Hunt and Berkes, 2003; Bengson et al., 2011; Grubbström, 2011; Stoettner and Ní Dhubháin, 2019). Socio-demographic (Holmes and Argent, 2016) and local economic aspects (Canadas and Novais, 2014), and governance and decision-making dimensions (Rounsevell et al., 2010; Silver et al., 2015) are also relevant.

Secondly, authors highlight other external dimensions such as normative aspects, institutions, governance and the political nature of both the forest-based bioeconomy policy and rural resilience objectives (Pike et al., 2010). Each SES is a cultural space of identification (of belonging) (Medeiros, 2009), which, as it is imagined by several groups, gradually reconverts the area into a project appropriated by some groups to the detriment of others. It also forms a space of power founded on an institutional framework, whose efficient governance and capital redirection are crucial for development (Jeziorny, 2016). Furthermore, implementing a forest-based bioeconomy model is conditioned by a global cultural framework whose paradigms are shifting. Both local rural and urban populations are experiencing dual processes of both denaturalisation (distancing from nature) and renaturalisation. These trends in the relationship between humans and their environment show how important socio-cultural dimensions are in environmental and forestry research (Abel and Stepp, 2003) and highlight several divergent and dissenting attitudes that are not conducive to sustainable regional development, especially when one of the pivotal factors for sustainability lies in improving the entire system's resilience, not simply in optimising its isolated components (Walker and Salt, 2006). In all cases, the impact is forged by the type of rural areas where the forests are located (Dhubháin et al., 2009) and by the stakeholders who can create or facilitate successful resilience dynamics.

The focus on resilience can provide tools for making decisions, identifying the best conditions for implementing it and consolidating the mainstays of the forest-based bioeconomy model: integration and interdependence of stakeholders, sectors and levels (Geels, 2002; Hermans, 2018), convergence and symbiosis of production sectors (Velenturf, 2017), knowledge and transfer challenges (Cavallo and Gerussi, 2015; Berkes, 2007; Allen and Holling, 2010) and innovation and inclusion (Sanz-Hernández et al., 2019a). The resilience thinking approach can also contribute to redefining the relevance of each of these three bioeconomy capitals—monetary, biological and social— (Giurca and Metz, 2018), and the relationship between them. Both resilience dynamics linked to resources/assets (capitals) and governance, and barriers to renewed forest management (especially PFO practices) are often expressed by authors and stakeholders as 'decapitalisation'

(Chen et al., 2013). In these cases, the design of future scenarios involves a transition process from rural communities and decapitalised territories to new recapitalised areas (Sanz-Hernández et al., 2019b).

Several disciplines have linked the concept of resilience to the notion of capitals. It has been used in economic and geographical analyses of areas and communities (Hudson, 2010; Chesire et al., 2015; Sánchez-Zamora et al., 2017) based on considering them as an asset with resources associated with five types of capital (economic, human, social, cultural and environmental) (OECD, 2001; Camagni, 2008; Sánchez-Zamora et al., 2017). Besides relevant contributions for studying social capital (Putnam, 1993; Portes, 1998), sociology has led to the livelihoods approach (Scoones, 2009) and the strategies approach (Bourdieu, 1994), besides others, by identifying the practices of owners, as the main rural stakeholders, and also by explaining their actions in relation to various asset types: 'human capital (education, skills, health and time), social capital (family, community and social networks), natural capital (soil, water, forests, etc.), produced capital (physical and financial assets) and cultural capital (resources and symbols)' (Craviotti, 2012:645). Both sociological approaches, accused of economicism and reproductivism, have been supplemented by another based on rural sociology, which emphasises the central importance of proactive individuals and collective human agency (Maguire and Cartwright, 2008; Davidson, 2010; Magis, 2010), and promotes research more focused on stakeholders, which highlights the 'knowledgeability' and 'capability' to process social experience and design ways of living even in the most adverse conditions (Ploeg, 2004; Long, 2007). Social, cultural and institutional recapitalisation cannot take place without an efficient governance structure acting both inside and outside the area. Innovation is indispensable in a bioeconomy-based resilience context, but societal and environmental innovations should be fully integrated into general policy (Collier, 2015).

3. Context and method

3.1. Case study

Spanish marginal rural areas depend on agriculture, forestry or other small natural-resource-based industries that have fallen into a vicious circle of declining employment, population ageing and depopulation. The demographic challenge is encouraging social movements in the depopulated mountain interior to demand the reassessment and effective management of forest resources (e. g. 'Together for Forests' initiative or esMontañas, the Spanish Association of Mountain Municipalities).

Spain is certainly one of the European countries with the most plant diversity—with three well differentiated biogeographical regions associated with climate diversity and relief. It is the third most forested European country after Sweden and Finland (European Union (EU, 2019) and has recorded the highest rise in woodland in recent decades—with an annual increase of 3.42 compared with the European average of 0.97 (Congreso Forestal Español (CFE, 2009). However, the forestry and timber sectors are not as central to the Spanish national economy as we might expect and the lack of active forest management poses a serious problem (Tolosana, 2016).

The Spanish forest sector is significantly less valued than the agricultural sector due to: a) the decline in prices for wood with an international timber trade polarised by certain countries (Lovrić et al., 2018); b) the undervaluation of wild forest products that are exchanged in informal markets despite their potential to generate income (Cai et al., 2011); c) the lack of social recognition or compensation for forest owners for providing it (Thorsen et al., 2014); and d) forest changes and challenges that are the same in forestry worldwide (Farcy et al., 2019; Secco et al., 2019), and rural communities in transition (Bowditch et al., 2019). Furthermore, a significant proportion of the forest area of the country is not actually a forest ('*bosque*' in Spanish)—that is, a group of densely growing trees—but mixed woodland and scrubland areas

(called '*montes*' in Spanish and referred to hereafter as 'woodland'); this has an impact on these areas' products, ecosystem services, population's demands and management (Miguel and Ayanz, 2010).

The Spanish law governing forest policy, Law 21/2015, dated 20 July, which amended Law 43/2003, dated 21 November, on Woodland ('*Montes*'), takes its name from this notion. It examines the interdependence of forest land and the rural world and the balance between the three essential mainstays of sustainable forest management (economic, social and ecological) based on the notion of multifunctionality, it classifies woodland into disjoined groups based on ownership and its impact on general interest, it promotes planning, and it values forest certification. It also enables the 17 Spanish autonomous communities to establish a series of standard forest-management models for each of the woodland types in their community based on their size, structural simplicity and other reasons.

This study has focused on Aragón, a region of north-eastern Spain. (detailed context information is shown in Technical Annex). The economic value of Aragonese forest ecosystems is estimated at 13,193 million euros, divided as follows: 26 % production, 23 % leisure and 51 % environmental nature (Aragonese Government, 2018b). The Aragonese Government wants to spearhead two important national challenges: economic transformation and the demographic challenge. In January 2020 it presented its 'Circular Aragon Strategy' to the media, highlighting the goal of transforming the region into a bioeconomy benchmark to lead ecological transition in the region.

At present, forest management is governed by Law 15/2006, dated 28 December, on the Woodland of Aragon and later amendments. However, although there is a great need for a Forest Plan for Aragon, it has not yet been completed (currently in progress) as it is extremely complex (Aragonese Government, 2018a), due to the considerable fragmentation of private woodland and property, unknown owners and even some legal loopholes and administrative complexity arising from the process of replacing traditional Spanish community ownership by other forms of land ownership (Guadilla-Sáez et al., 2020; Karrera Egialde, 2010; Aragonese Government, 2016) (Technical Annex, figure 2).

The two Teruel districts selected, Sierra de Albarracín and Gúdar-Javalambre, are in the Mediterranean biogeographical area of Spanish mountains, which combines continental Mediterranean forest (holm-oak, Kermes-oak and juniper groves alongside species such as the Pyrenean oak, gall oaks and Scots pine in the wettest areas) with mountain vegetation in colder areas: pine, fir, birch or herbaceous formations and creeping undergrowth (Galician Forestry Sector Association, 2017). Both districts have 24 rural forest municipalities with low percentages of cropland and high percentages of forest land of which approximately half is directly managed by the regional government. They also have a larger surface area of timber-yielding woodland compared with other districts in the province, mostly in unplanned, non-certified forests. Finally, they are districts with hardly any infrastructure and complicated access to few basic services (schools, hospitals, etc.), and in an area with severe climate and morphological conditions and a low population density of 5.5 inhabitants/km^2. (Technical Annex, Table 1).

3.2. Methodological framework

The research design includes a qualitative multi-method methodology (Lincoln and Denzin, 1994; Patton, 2002; Lichtman, 2014), using both the case study design for the research plan and the qualitative content analysis to form the theoretically conducted sample (Mason, 2010), analyse the data and construct the theory (Eisenhardt and Graebner, 2007; Elo and Kyngäs, 2008; Díaz Andrade, 2009).

The data was collated with a mixed method to increase the quality of the information and acquire data from a variety of sources (Bryman, 2015): secondary sources, observation and interviews with PFO and stakeholders in the area using both the more traditional (face-to-face)

and the walking interview versions (Evans and Jones, 2011). The interviews were held at different times from 2019 to 2020 following an interview guide with two distinct parts. The script was more open and flexible in the first part that inquired about the global vision of private forest management, based on three aspects: owners' practices, local forest resources and governance mechanisms. The second part was structured and sought to assess the usefulness of resilience thinking to inform about forest governance for future regional development aligned with a bioeconomic model. The content of the transcripts was thematically coded, following a mixed coding system: 1) a deductive method from resilience thinking (Folke, 2003; Walker et al., 2004; Berkes and Seixas, 2005; Berkes, 2007; Roberts et al., 2017) and previous studies in the region (Sanz-Hernández, et al., 2019) to create the main a priori codes; and 2) an inductive method to create subcategories and attributes during the simultaneous coding process. The thematic analysis of the data generated a series of codes and subcategories that correspond to context attributes related to both resilience practices, resources/assets and governance, as well as to strategic areas, factors and attributes associated with the context's ability to generate, maintain or strengthen certain resilience processes. At the same time, the analysis of the similarities, differences and interrelations between the interviewees' statements highlighted three theoretical categories that are presented as organising and mediating factors in changing resilience strategies: dependence, capacity and control (Table 1).

The network of 34 key informants was established following a theoretically led sampling in which the starting organising element was a link to private forest management (mainly owners, managers or policymakers).The process involves advance and regression in the sampling, data collection and analysis phases, until data saturation or the lack of relevance in the new collected information (Mason, 2010). An interview matrix (Appendix A) was designed based on the types of private forest property predominant in the study area, the size of forest properties (small-scale, 93 % of properties with a surface area below 10 ha.), and the position/role of interviewees in the management of private woodland. All considered the three resilience spaces related to private forest management.

4. Results and discussion

4.1. Resilience attributes of rural forest areas

There is a high respondent consensus on the characterising attributes of the rural forest context and the aspects that reduce its ability to adapt and change in relation to the three considered levels (Appendix B).

4.1.1. PFO practices and minimal forest management

PFO show clear distinctive features that could at first sight be identified with the profile called passive/resigning owners, which contrasts with other types of owners identified in other contexts (Ficko et al., 2019). This can be observed above all in individual small-scale owners and in collective woodland owners. They are described and describe themselves as disconnected owners with no formal economic objectives (I-07; I-18), conservationists and individualists. Their position and action are static and resistant to change: a '*culture of putting up with the situation*' (I-05). They feel isolated in their resilience position and doubt that either the ecosystem or themselves will manage to improve in the medium term. They are aware of the negative development of the current traditional management model: '*worse every day*' (I-05). Nevertheless, minimal instrumental and controlled acceptance of the imposed socio-technical system could be accepted to maintain their PFO position and condition.

Their forest practices also display a logical resistance to technology and markets that results in conservatism, decommercialisation, hermeticism and localism (distrust of 'outsiders'). These are defensive reactions stemming from viewing possible innovations with apprehension

Table 1
Methodological framework.

INTERVIEW	DATA COLLECTION	CODIFICATION	BUILDING THEORY	
Relevant areas in the interview script	Data	Codes/subcategories	Similarities, differences, interactions	Conceptual categories
Perception on privately owned forest management practices	Traditional practices Current Forestry Works Forest management	*Persistence* Keeping functions Reproducing structures *Safeguarding* Retaining socio-ecological memory (sedimentation) *Adaptation* Reconnection Resignification Redefining identity Review Improvement Reorganisation Diversification Learning	Dependence Capacity Control	RESILIENCE
		Creation Innovation Cocreation *Transformation* Identity affirmation		
Vision on local forest resources	Historical value of the woodlands	Impact		
	Current value of the woodlands	Two-way transfer		
	Importance of the woodlands for the community and territory	*A priori codes (subcategories) referring to the system's capacity to address knockbacks by conserving (persistence), confronting (adaptation) or completely modifying (transformation) systemic functions and structures based on Berkes and Seixas, 2005; Folke, 2003; Walker et al., 2004; Roberts et al., 2017. The subcategories of safeguarding and creation are based on Sanz-Hernández et al., 2019a).		
Life experiences in a forest	Place of birth	**Simultaneous codes (attributes in table 4) from constant comparison method.		
community	Place of residence Motivation to remain in the territory			
Position in relation to Forest rules, law and institutions	Personal attitude Opinion on governance mechanisms Opinion on position other stakeholders			
Perception present/future Forest scenarios	Current capabilities within the context Necessary capabilities Proposals for change Barriers for change			
CONSTANT COMPARISON METHOD AND THEORETICAL SAMPLING				

as they would only be accepted to consolidate and safeguard their forest ownership.

Lack of management is firstly an issue of profitability (I-19–I-23; I-24). Most small-scale holdings have been abandoned, which explains why much of the woodland lost in the last decade has ended up as public (I-19). There is no willingness to make private investments in unprofitable basic holdings whose management may be profitable in the medium term (I-22; I-27). Furthermore, many owners of medium holdings live in large cities, have other professions and obtain a minimum '*opaque*' (I-20) profitability from hunting areas, grazing or the unplanned and non-certified use of wood (I-20; I-25), and, therefore, they '*are holdings that do not generate any added value*' (I-19): '*It's like having a rented out flat; I know I have the asset, but I don't have the capital. I'm not interested in having more either*' (I-26). In contrast, in collectively owned woodland (woodland owned by residents or partners) at least inertial management can be observed stemming from the traditional century-old regulation of Spanish community forests inherited from the

woodland excluded from the 19th-century confiscation. Instead of being an active opportunity-based management it is based on need (I-19). Many owners have been distrustful of external professionals and have kept up their property with no minimal management for decades (e.g. I-19, I-23 and I-08). Furthermore, they do not perceive the value of 'active management' or the risk of no management such as fires, desertification (it is estimated that 21 % of the surface area is at high risk and another 29 % at medium risk in the province of Teruel), erosion, which seriously affects half of the regional surface area (Government of Aragon, 2018a:50−51) and forest pests and diseases, especially the pine processionary and mistletoe (*Viscum album L.*) (I-24).

Nevertheless, for many PFO, their woodland is a link with their family, community and nature. All this results in identity and place attachment, but not robust ownership awareness capable of encouraging sustained action and generating dynamics in the area, through a '*new 21*st-*century involvement through associations that seems impossible here*' (I-14), or small business projects aiming for comprehensive

management that are, however, viewed as possible, profitable and sustainable (I-15; I-17; I-25; I-27) with new policies.

The owners' lack of motivation is aggravated by the lack of public economic support and of clear, decisive (I-23) and non-interventionist policies. This context makes self-organisation and mobilisation difficult. In fact, only medium owners show some openness to intra and cross-sectoral partnership association initiatives and express a business and commercial viewpoint (I-24; I-26; I-32).

4.1.2. Resources and assets: property reassessment and area recapitalisation

When asked about forest resources, most of the owners resident in the area emphasise their perception of a 'lack of value' or 'devaluation of their asset' on a forest scale, and of the loss of 'capitals' on a community and area scale. Some collective owners are undergoing a process of reflection as they anticipate losing their 'capital' to ensure the survival of their legal and heritage properties.

The non-business stance shown by smallholders contrasts with the potential seen by other more proactive interviewee groups (I-19; I-24; I-27; I-30) in the context of comprehensive development models reverting to being multipurpose and expanding to new woodland uses that do not necessarily arise from direct woodland productions. For example, the intensification of truffle growing has considerably increased the market value of land, especially in the Gúdar-Javalambre district (I-27; I-30). Other expanding activities are: hunting, which has a great deal of potential in the area (I-22); mycology (I-12; I-21; I-22; I-32); beekeeping (I-30); and energy (biomass and renewable energies) (I-19). Whether traditional forest uses are compatible with new ones, such as wind farms, is still a matter of debate and analysis in local areas and districts (I-27). (Technical Annex, figure 3)

The lack of private and public investments (monetary capital), the loss of population, especially young and qualified people (human capital), the non-existence of forest associations (social capital), the lack of business culture (cultural capital) and the view that forest resources lack value are attributes of the analysed context perceived by all interviewees. Lastly, there is a series of cultural dimensions and attributes related to local identity and place attachment that are especially mentioned by descendants of owners (I-01; I-03). The owners' lack of roots in the area, their distance from their holdings and the weakening of the individual-forest-community connection are aspects linked to cultural capital that have become less central than others such as economic or social attributes.

4.1.3. Perceptions on governance mechanisms

The lack of leadership is perceived as a serious problem. It forms the basis of other features, such as the lack of stakeholder collaboration, improvisation, the lack of transparency in decision-making (I-27) and the non-existence of real participation in the policy design process (I-08). Figures are needed to solve conflicts and manage the complexity. Some government experts believe that the weakness of national and regional forest policies is partly linked to the large number of stakeholders involved and the diverse nature of their interests (I-21; I-22; I-27): '*No one has wanted to politically tackle the forest issue because they'd have to sit down to negotiate with a lot of people with very different interests and also without a plan or a budget*' (I-20).

4.2. Pathways to changing resilience strategies

The anticipation of future forest-based bioeconomic scenarios depends on differentiating between resilience attributes in current scenarios and the attributes needed for change of RSF (Table 2), and also on considering observed barriers to making that change effective.

4.2.1. Resilience strategies in current scenarios

Current forest scenarios are based primarily on persistence strategies, such as reproducing traditional structures to consolidate their

ownership, ensure forestland continuity and not to lose control over them (e.g. the only inheritance strategy owners of historic community forests consider is sharing or transferring property to people who guarantee to preserve the capital in the same condition and commit to being '*there for it*'(I-05). Secondly, there are safeguarding strategies seeking to renew the link with the forest, the community and the sense of belonging to the land through retaining socio-ecological memory and connection between the owners and their forestland. Plans made by some medium-scale owners are also a way of safeguarding their woodland; in this case, motivation is linked more to economic objectives than cultural or identity ones (I-20; I-21).

Thirdly, timid adaptation strategies materialise in three ways: as isolated initiatives to recoup the traditional multipurpose function of their woodland (resignification) (I-30), and local knowledge (review) (I-23; I-25); as the government's interest and commitment to '*governance reorganisation*' (I-19) and to encourage intersectoral cooperation and collaboration; and, lastly, as the rural cultural tradition of productive diversification (cultural capital), this, together the rural population's motivation and great capacity to learn even though it is ageing, are important resilience attributes to consider. '*Rural residents are a very resilient society because we're capable of learning and overcoming things*' (I-04).

Fourthly, isolated creation strategies based on innovation processes and entrepreneurship are being promoted above all by medium-scale owners and entrepreneurs to initiate and maintain dynamic and vital community attitudes, to release '*the tremendous economic potential of forests within our grasp … with no complexes or feeling that the woodland is being misused*' (I-13).

Finally, medium-scale and collective owners (and also professionals and entrepreneurs) and forest community managers are showing an interest in designing resilience strategies to impact how people view their future and their attitude towards it to empower rural forest communities (I-10; I-25; I-27), and to build a vision that encourages action and also prevents '*disillusionment*' (I-04; I-15; I-18). They are also implementing another third transformation strategy: active participation in alliances to transfer own and others' knowledge considering the power of networking and the consensus-agreed combination of approaches, (such as esMontañas or 'Together for Forests' initiatives) (I-10; I-25).

4.2.2. Factors organising a change in attributes towards governance in a bioeconomy framework

In all its areas and factors, RSF encompasses three elements that organise a change in attributes towards governance in a bioeconomy framework: dependence, capacity and control.

4.2.2.1. Dependence. It is expressed in three main statements: individual-woodland connection, convergence of economic sectors and interdependence of individuals, communities and areas (both urban and rural).

-Individual-woodland connection. PFO stress two essential ways to relate to forests. The first is looking after the heritage legacy ('*it is family and community inheritance*', I-01) and experience ('*the lived-in woodland*' is a space containing memory and identity, I-03). The second is overprotectionism as a generalised dangerous and worrying social trend. '*Rural people here understand that woodland has to be managed to be in good condition. We don't share that city attitude towards woodland here, although if we keep changing, we will.*' (I08). The change is especially obvious among young people '*who have become disconnected from the forest despite living in small towns*' (I-03). Disconnection results in significant identity disruption that manifests itself in several ways in PFO and their descendants and has three dimensions: employment (involves disruption in economic and occupational dependence), family (involves disruption in the family way of life and asset legacy) and community (detachment and uprooting of both the forest and the community). Disconnection also comprises three component types: cognitive

Table 2
Resilience strategic framework (RSF).

Strategic areas	Strategic factors	Attributes
Persistence Action (agency) for as long as functions and structures last	Keeping functions	Generating resources and assets
	Reproducing structures	Keeping structures
Safeguarding Action (agency) to protect and safeguard own capital	Retaining socio-ecological memory (sedimentation)	Fostering a sense of collective belonging
		Economic investment strategies and perpetuating all forms of capital
		Educational and normative reproduction strategies
		Openness to/rejection of anything outside the community
	Reconnection	Strengthening the relationship between people and the forest
		Re-establishing bonds between people and the forest
		Re-connect the urban and the rural with new ways of innovating, producing and creating jobs
Adaptation Action to accommodate functions, structures and meanings in response to external changes	Resignification	Recovering the perception of the central importance of forests for the planet's wellbeing and future
		Redefining the very notion of a forest
		Valuing ecosystem services
		Educational and normative reproduction strategies
	Redefining identity	Redefining local identity devices (the forest)
		Localism
		Promotion of local markets
	Review	Recovering and updating local knowledge
		Educational strategies: local-based cultural recapitalisation
	Improvement	Incorporating scientific knowledge (resourcefulness)
	Reorganisation	Aligning several governance levels
		Intersectoral cooperation and collaboration (cross-sectoral partnership)
		Establishing/strengthening reliable networks (social capital) between stakeholders
		Fostering connectivity
		Creating support structures
		Cohesion strategies
		Educational and skill acquisition strategies
		Local government/authority leadership
	Diversification	Change strategies
		Establishing new and diverse functions: multiple functions of forests
		Educational strategies: knowledge to create value chains
	Learning	Educational and normative reproduction/change strategies
		Knowledge for anticipation: identifying threats/opportunities/risks
		Knowledge for conflict management
		Knowledge of new forms of participatory governance
		Knowledge to design management mechanisms
Creation Action to incorporate new functions, structures and meanings	Innovation	Institutional innovation and new participatory governance practices
		Environmental educational innovation
		Normative and regulatory innovation: new legal frameworks
		Socio-technological innovation
	Cocreation	Social-based promotion of entrepreneurship
		Co-creation of knowledge
Transformation Action to substantially change SES	Control	Identity affirmation within communities
		Assuming responsibility for the future
		Time management
		Proactive and transformative local governance
		Communication strategies
		Regulations in the market and taxations
	Impact	Identity affirmation within communities
		Empowering communities and severing dependency relationships
		Rethinking future scenarios without disillusionment
	Two-way transfer	Active participation in alliances for knowledge flow and transfer
		Communication strategies with other communities and companies

(knowledge about the forest), affective (emotional and experiential bonds) and legal (legal ownership of the forest).

Respondents propose to overcome the social distancing of forests through resignification processes of the relationship between people and forest with the following strategies: a) returning to the view that forests are not '*an isolated bubble*' but a '*multifunctional space of coexistence*' (I-04) on both a community and territorial scale; b) updating the value of forests, and emphasising their vital importance and role to address global challenges such as climate change or food sovereignty (I-

04; I-12; I-16); c) establishing a price for all ecosystem services (I-08; I-12): '*We're profitable because we're maintaining an area that cannot be maintained any other way. How much does that cost?*' (I-17); and d) communication and participation in the population's changing values and attitudes (I-09; I-16).

-Sector convergence. The RSF includes aligning governance levels and shifting towards more integrated forest management with intersectoral cooperation and coordination, even though it can be a threat to those who prefer to keep sector boundaries intact (I-08; I-16). Sector

convergence is based on creating value chains with forest resources as the central element (I-19), and it should be built on recouping traditional local practices and knowledge (I-09), and economic diversification (I-14; I-19). Diversification is viewed as a strategy '*to encourage people to return to the countryside and to ensure that forests, which are the most depopulated areas in Spain, regain their leading role as the driving force behind an economic movement based on multifunctionality.*' (I-04).

-Interdependence of individuals, communities and areas. Fostering interdependence involves strengthening value chains, promoting intersectoral and interlevel relations, improving communities' capacity for self-organisation, mobilisation and connectivity.

4.2.2.2. Capacity. The process of changing attributes to improve resilience has been explained as a pathway from area decapitalisation towards recapitalised scenarios around three essential capitals (forest-based economy, society and culture). Changing attributes is based on adaptation and creation strategies, although not all the respondents place the same importance on the capitals as intervention areas to generate more resilient contexts.

-Above all, owner and entrepreneur sectors emphasise the need to activate processes in the area to generate new resources and assets (economic capital) by incorporating new functions, adapting/changing structures, and new regulatory frameworks (I-17; I-30). Small local businesses believe that the government's active role in planning the economy—by guiding private companies' actions and participating in the market with public corporations—is not the most adequate forest policy. They call on governments and authorities to provide strong support that is economic (regulation of incentives, compensation), but especially technical and conducive to establishing synergies among stakeholders, not discriminatory of the countryside, helps micro-enterprise, facilitates intra and intersectoral involvement through associations and recognises the key role PFO play in the process of adapting to new demographic and climate challenges by '*supporting and stimulating active forest management*' (I-07).

-Attributes linked to social capital are less important than economic attributes; however, non-owners especially highlight the need to facilitate processes that increase connectivity and facilitate establishing and strengthening reliable networks between stakeholders (multi-scale and multi-sector) to overcome PFO isolation and individualism (I-23; I-24) in a context with a high rate of small-scale holdings that makes it virtually impossible for owners to address forest management (I-28; I-29). The few forest association initiatives in the past were not successful (I-19; I-21), although there is a level of community involvement through association that could be a good catalyst. Initiatives in which owners have established another type of alliance, for example sharing management costs, are also few and far between (I-21; I-25).

-Finally, attributes linked to cultural capital are the least highlighted factors, although they gain central importance for academia and central and regional governments. They propose identity strategies and learning strategies. The first group refers to an identity affirmation (both internal and external) and redefining identity in which the forest is an important identity device and the individual and collective selves recognise that they form part of ecosystems (I-12). It would essentially involve environmental education strategies and local governance strategies based on '*active localism*' (I-04) and the community scale becoming more prominent. '*They say a country town cannot achieve anything on its own in its area, etc. I no longer believe that discourse … if you forget that you have to look after your own backyard first, you'll fail.*' (I-03). Learning strategies concern learning and developing skills to adapt to change, but also to transformation. Stakeholders' motivation towards learning must be accompanied by education institutions playing an active role to enhance both the '*forgotten, demonised and constantly ridiculed*' (I-04) rural world and forest management in particular, through specific training and higher wages for rural jobs. Educational decapitalisation is related more to the emigration of the Young population than to the lack of skills or abilities in the area (I-10; I-19). New skills to

contribute to the cultural recapitalisation would be incorporated in two ways: reviewing and updating all local knowledge, especially relevant cultural experience for future forest management without nostalgia but with entrepreneurial spirit, and adding external knowledge in a regional context with highly rated education and research institutions (I-16; I-17; I-23). However, in general the respondents share the idea of the need for professional and technical management and applying knowledge to forest management (I-09; I-21). At a local level, acquiring skills for conflict resolution and management is crucial to reconcile public and private stakeholder uses and interests, to renew local governance structures and to establish consensus-agreed and equitable normative frameworks (I04; I-20; I-23; I-24).

A third strategy would be two-way transfer (inward and outward) (I-17; I-30) that would be efficient and successful if it could mobilise, unite and involve the local population and create links with other networks. This should also help mitigate the severe loneliness of both small PFO and communities and to give dignity, significance, visibility and vitality to forestry.

4.2.2.3. Control. It is expressed as the assumption of agency and collective responsibility to be proactive: '*We rural residents have to fight tooth and nail wherever we are. (…) People who sleep today might not wake up tomorrow.*' (I-04).

Control is also expressed in future actions through creation and transformation strategies. Future scenarios that the interviewees visualise are described in differing contexts ranging from despair to enthusiasm and include ambiguity: '*It's an opportunity despite how bad everything is*' (I-27). Stakeholders see the need to implement strategies to redesign three action frameworks—cultural, legal and socio-technological—based on innovation with a social basis for micro-enterprise and regional development and participatory processes (co-creation).

1 A new cultural framework. Stakeholders propose '*releasing the tremendous economic potential of forests within our grasp … with no complexes*' (I-13) overcoming views steeped in nostalgia, paternalism or 'erroneous' interpretations of modern currents such as environmentalism, ecologism and animalism.

2 A new legal framework based on rural knowledge that accompanies micro-enterprise. PFO emphasise the need for the government not to interfere and to allows 'private initiative to create economic activity' (I-03). While, politicians and experts express the urgency of a facilitating regulation for community and common forests and the need to review the allocation of environmental property rights (and the setting of corresponding standards). Furthermore, compensation actions and stakeholders should be identified.

3 A new socio-technological framework more inclusive. Most of the respondents have harshly criticised the rural technological and digital policy agenda that is essentially urban and creates an insurmountable gap and limits the innovative possibilities of other non-urban spaces (I-21; I-22; I-28).

The innovations in all this action frameworks support building additional enabling approaches to equitable rural transition based on innovative micro-niches in localities and internal projects to reinvigorate community vitality instead of models imposed by external experts linked to temporary investments with hardly any social impact (I-16).

Its impact should also increase self-management, autonomy and independence: '*This is not about giving sporadic subsidies to projects, but about empowering, encouraging, turning small projects into something big.*' (I-04). But only actual social participation in forest governance would achieve control, leadership for change (I-19; I-25), collaboration among stakeholders (agents and institutions) (I-16; I-23), transparent and inclusive decision-making (I-16; I-27) and the incorporation of effective conflict management mechanisms. Reorganising governance and improving it are seen as essential in change processes (I-19), especially by government. Local political leaders again play a key role in 'creating a

Table 3
Barriers and policy implications.

Strategic areas	Strategic factors	Barriers	Policy implications
Persistence strategies	Keeping functions	Lack of PFO motivation Lack of interest and knowledge, and distancing of descendants	Facilitating traditional economic diversification (return to multiple functions)
	Reproducing structures	Divergent approaches among PFOs	Contexts facilitating consensus and reconciling individualist–collaborative standpoints
		Mistrust among stakeholders Lack of knowledge of possible innovations	Strengthening effective traditional structures
Safeguarding strategies	Retaining socio-ecological memory (sedimentation)	Economic disruption Emotional disruption	Creating facilitating conditions to create employment Recapitalisation schemes (natural, educational, social, cultural)
		Identity disruption	
	Reconnection	Overprotectionism	Environmental education programmes
Adaptation strategies	Resignification	Denaturalisation of society	Active policies to raise awareness of the value of forests Shaping public opinion in favour of sustainable management Activating volunteer programmes
	Redefining identity	Individualism, local population's lack of community vision	Supporting policies to consolidate local governance
		Generation gap	Empowering local councils and giving powers to political representatives
			Political recapitalisation
	Review	Generation gap	Activating cultural dynamics led by the local population Activating volunteer programmes
	Improvement	Lack of interest Mistrust of expert knowledge	Support for R&D&I and transfer to the local population, owners and entrepreneurs
	Reorganisation	Government/authority passivity Slow government/authority response No comprehensive plans	Forest policies are more relevant Promoting planning with economic and technical support Coordinating and fostering trust between governments and authorities
		Power struggles in multi-level government Partisanship	Participatory forest governance
	Diversification	Government/authority passivity Spanish economic tradition (SME), state control Generation gap: there is neither generational turnover (depopulation) nor the skills to make it happen (loss of educational capital)	PFO incentive policies Support for local entrepreneurship Reducing government interventionism and prioritising the interests of large forest companies
	Learning	Older population Depopulation Loss of educational capital	Environmental education programmes Forest policies are more central Specific training designs in rural aspects Giving the countryside dignity: higher wages for jobs
Creation strategies	Innovation	Silencing collective memory and forgetting cultural baggage Lack of political will	Contributing to a new cultural framework: new environmentalism Designing a new facilitating legal framework: respectful legislation that consolidates local identities. Reviewing the allocation of environmental property rights
		Lack of skills in the area Weak social capital No networks or participation in them	Fostering contexts of socio-technological innovation
		Imperfect or inadequate outlining of environmental property rights Complex process of internalising environmental social costs Invisibility in the urban digital agenda	Incentive scheme for PFOs and forest communities Strengthening social capital and facilitating associationism and network creation Activating participatory processes for collective territorial project designs based on innovation Designing spaces for reflective processes, anticipation and projects
		Lack of community vitality to design a territorial project	
	Cocreation	Loss of educational capital and skills in the area	Participatory governance Less state interventionism
Transformation strategies	Identity affirmation	External pressure for forest exploitation	Ending use of political discourse to stigmatise comprehensive exploitation of forests Integrated and participatory rural development policies
		Scant community vitality Depopulation	Facilitating positive communication strategies
	Impact	Lack of support from government and authorities	Accompanying measures to consolidate self-motivation, action by PFOs and entrepreneurs
		Subsidy policy	Not creating a culture of dependence on subsidies but helping them to empower them
	Two-way transfer	Shortage of investment, willingness and attitude Lack of political commitment and favourable legal framework Disillusionment	Media complicity Involvement of social movements and the local population

community', breathing vitality into the district so that it becomes the real driving force.

4.3. Barriers to change and policy implications: towards resilience governance

The similarities, discontinuities and interactions between the various abovementioned resilience attributes describe a scenario with limitations or barriers to change due to the wide range of resilience strategies, the complexity of applying them to specific contexts and the lack of agreement on routes to follow. The majority have already been commented on in previous paragraphs and are shown in Table 3.

The socio-political implications arising from the thematic analysis are remarkable given that the Spanish government has not perceived the lack of governance of privately owned woodland as a public problem (I-19; I-23). Informants propose a drastic change in policies on all levels that must be accompanied by '*a socio-cultural change that won't happen spontaneously*' (I-04). This new policy should be based on 'resilience governance' whose features would be:

1. Integrated governance. Policies should be comprehensive, cross-cutting and not focus on isolated areas and aspects (I-08; I-16; I-27). It is impossible to promote a forest bioeconomy without an overarching and integrating vision that includes the demographic challenge of the specific territory and global climate challenge. It is also related to a policy that focuses more on the area and less on unrelated spheres of influence (I-19).
2. Integrative governance. Policies exploring opportunities for new political actions based on future inclusive and sustainable territorial projects capable of overcoming partisanship and reconciling individualistic and collectivist standpoints within society (I-08; I-16; I-19).
3. Updated and innovative territorial governance. The result of institutional innovation that brings quality to local forest governance and unambiguously and enthusiastically refocuses on the demographic challenge, on climate change adaptation and mitigation, ecological impact assessment and sustainability impact assessment (I-14).
4. Recapitalising governance. Public policies must first re-establish positive social capital that protects the importance of community and local aspects and coordinates a public–private partnership that currently does not exist. Special attention should also be paid to recapitalising education and developing institutional skills in the area that can nurture a 'spirit of innovation' (I-09; I-12).
5. Transformative governance. No strategy for improving rural resilience based on the forest bioeconomy can be put forward without public policies addressing the denaturalisation of the society phenomenon and, in short, the urgent need to '*open minds*' (I-08) as a mechanism to rethink the forest–society relationship. Policies must centre around ignored rural people without creating gaps between regions. Spanish public policies '*have ignored what the countryside was experiencing and its powerful and complex connection with forests*' (I-04).

5. Conclusions

The fact that the destiny of most of Spain's inland forests is in the hands of a highly heterogeneous group of PFO, characterised by a lack of dynamism, motivation and entrepreneurial vision in a generalised context of rural flight should mobilise and concern the Spanish political class more than it currently does. Forestry policies in Spain focus mainly on protecting public utility forest, generating a wide catalogue of protected areas and neglecting the management of private forests. These have been deprived of public support lines, active national and regional policies and strategies and also sufficient attention by academia.

The 'resilience thinking' perspective has proved to be useful approach to reflect on the subjects' capacity to act into SES, the possibilities of generating/modifying structures, the pathways to changing strategies and finally the design of a 'resilience governance' with the guidelines that should be followed to rethink public policies to further develop the forest-based bioeconomy model.

RSF is proposed as an analytical tool for measuring the possibilities of substantial change capable of invigorating the area. It analyses three levels (PFO practices, resources/assets and governance mechanisms) and also the socio-political conditions for their improvement based on three organising factors: dependence, capacity and control.

Several key ideas and main conclusions emerge from the analysis. Firstly, it concludes that PFOs current practices and resilience strategies (persistence and safeguarding) do not suffice alone to create a territorial policy plan and change scenarios. Passivity and lack of connection with the land have resulted in an unconcerned management without economic motivation and even forest area abandonment. New attributes based on the strategic areas and factors of adaptation, creation and transformation are required.

Secondly, stakeholders have emphasised that public policy should be reconsidered in view of the consequences of decapitalisation and dismantling structures that provided territorial sustainability and rural resilience. Thus, changing resilience strategies should focus on rural recapitalisation, notably by a) improving capabilities in the context, (tradition, own and attracted knowledge), organisational skills and communitarian competences to social cohesion and community revitalization; b) driving innovative movements with a broad internal and external social base to change the cultural, legal and institutional frameworks; and c) capturing political attention and economic investment to overcome identified barriers and to apply a long-term public policy with a 'resilience governance' based on integration, innovation and future orientation to rural transformation.

Thirdly, the `resilience governance' in a forest-based bioeconomy should be built on the close links between three interdependent scales into the analysed SES: forest, community and territory. Stakeholders perceive a lack of awareness in Spain of forests' axial role and multiple functions, their great potential as an economic resource, society's enormous global dependence on them and the serious consequences of population loss to sustain ecosystems. Forest exploitation can be an incentive and an opportunity for local development and to create opportunities in rural depopulated areas. Forest-bioeconomy development is largely based on forest stakeholders' resilience skills and strategies and on their management's economic orientation and timeframe. It also involves a commitment to reviving innovation and promote intra and intersectoral connectivity to strengthen value chains that give prominence to local resources and markets with new products and services gained from ecosystems.

Finally, change would necessarily involve recapitalising the context in all its forms, in places capable of promoting change based on collective and political commitment. Thus, local authorities and regional entities need to be committed to lending their support and to design forest policy understanding the interdependence between economic sectors, stakeholders and society.

CRediT authorship contribution statement

Alexia Sanz-Hernández: Conceptualization, Methodology, Data curation, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

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