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RESEARCH ARTICLE

Forest and water policy integration: A process and output-oriented policy network analysis

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Abstract

Natural resource management requires cross-sectoral policy integration because the scope of current environmental and sustainability issues surpasses traditional sectoral boundaries. While the emergence of policy networks in such cases has been observed in the policy integration literature, little is known about how these networks are formed and how they influence the processes and outputs of policy integration. Accordingly, the main aim of this article is to combine the policy integration and policy network literatures to answer two research questions: How can the formation of a policy network for the case of forest and water policy integration be explained? What are the effects of the policy network on policy integration outputs? We use qualitative interviews and social network analysis to inform the study of two regional case studies in Germany and Spain. Our results show the relevance of a policy broker in steering the interactions between forest and water policy actors, combined with the presence of synergetic interdependencies, which facilitated the activation of the network. Additionally, the activities performed contributed to ideational homogenization between the forest and water sectors in terms of problem definition and preferred solutions, despite initial divergences. We conclude that a policy network perspective is an important contribution to the policy integration literature because it allows differentiating the influence of actor-level and network-level factors on integrated processes and outputs. In conclusion, both actors and their relationships should be accounted for as key intermediary variables to better understand and steer policy integration between natural resource sectors.

KEYWORDS

interdependencies, forest, Germany, policy actors, policy integration, policy network, Spain, subnational policy, water

1 | INTRODUCTION

Cross-sectoral policy integration and integrated natural resource management are increasingly regarded in both policy and scientific communities as promising governance and management principles in the endeavour to achieve sustainable development in general (Wong,

2019) and in tackling climate change and degradation of natural resources in particular (Dewulf et al., 2005). Both are broadly understood as processes for linking multiple policy sectors that govern natural resource use – including biophysical, socio-economic and political dimensions – to coordinate and achieve both environmental and socio-economic goals (Frost et al., 2006; Sotirov & Arts, 2018).

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Generally, integrated strategies are suggested when complex environmental problems need to be tackled whereby uncertainties, variability and blurred boundaries between issues and sectors pose fundamental challenges for decision-makers in policy and practice (Howlett, 2010; Pahl-Wostl, 2015). However, failed or compromised implementation of these principles in policy-making is found to be driven more by policy and governance challenges than ecological complexity (Pahl-Wostl et al., 2007). These challenges refer to the variety and changeability of the policy issues at stake (Briassoulis, 2004), problems of institutional misfit and interplay (Moss, 2004), competing interests or core values and sectoral resistance to integration (Giessen & Krott, 2009; Sotirov & Storch, 2018; Winkel & Sotirov, 2016) as well as difficulties relating to incentive allocation (Hogl et al., 2016).

In a largely parallel research inquiry, policy networks that span across multiple sectors are considered relevant because they can help reconcile competing objectives (Adelle et al., 2015). But despite the increasing recognition of the key role of actors and their interactions in the policy integration literature, few studies directly link policy integration to a policy network perspective at conceptual and empirical levels (see an exception in: Vignola et al., 2013; Zafonte & Sabatier, 1998). However, at the theoretical level, there are often contradictory assumptions about policy network formation, the role of network structures and agency mechanisms, as well as the causal interactions among these factors in policy integration studies. The literature on network governance of natural resource management has repeatedly emphasized the need for further research on understanding network mechanisms for cross-sectoral policy integration (Hukkinen, 2012, p. 16; Pahl-Wostl, 2015, p. 76). The aims of this study are thus to synthesize these main theoretical assumptions and empirically analyse the causal interactions among them.

Specifically, we focus on the formation of a policy network working on both forest and water and the role of this network in cross-sectoral policy integration (Sotirov & Memmler, 2012). Following network studies of natural resource management, in this study we define the members of a policy network as those actors who work on the “governance task at hand” (cf. Knoepfel and Kissling-Näf in Newig et al., 2010, p. 11). In particular, we address the policy issues of water quantity and quality and their interlinkages with forest policy and management (see e.g., Bálíková et al., 2019). Water quality is the central issue of water policy in Europe addressed through the EU's Water Framework Directive, which is a legally-binding legislation that member states had to implement through national actions (Borja et al., 2004). It introduced a new governance approach towards cross-sectoral policy integration and integrated land use planning across local-regional-national-European scales and was expected to increase forest-water sectors interactions (Baulenas & Sotirov, 2020; Theesfeld & Schleyer, 2013). On the other hand, water quantity is considered an emerging environmental challenge in Europe (EC, n.d.; Mekonnen et al., 2016). Whilst forest have a role in water quantity, climate change-induced repeated and severe droughts, wildfires, and storms are contributing to forest dieback and reduction of forest productivity and stability in the Mediterranean and Central European countries (Creed et al., 2019; Lindner et al., 2010; Tague et al., 2019).

The present study follows the observation that the forest and water policy sectors are increasingly facing international and European pressures to integrate across each other (Sotirov et al., 2015), but there is little knowledge about the role of policy networks therein. Additionally, research on the forest-water nexus has so far focused strongly on the biophysical dimensions despite the need for “research that integrates the scientific and socio-political spheres” (Springgay et al., 2019, p. 1). Connecting this with the aforementioned general lack of policy network analysis of cross-sectoral policy integration to date, our main research questions are: How can the formation of a policy network for the case of forest and water policy integration be explained? What are the effects of the policy network on forest and water policy integration outputs?

To explore this empirically, we analyse two European sub-national cases in Germany and Spain with the use of social network analysis (SNA) as our analytical tool. SNA has often been used in the context of studying natural resource policy and management and offers the tools to operationalize and study the factors that are the focus of this research (Hukkinen, 2012). The choice to investigate the sub-national governance level is deliberate: firstly, the literature on policy integration have largely neglected policy integration processes at the sub-national level (Hogl et al., 2016, p. 407), despite sub-national authorities, especially in federal states, having key competencies and decision making power in addressing the current environmental and climate crises (Gadani et al., 2019; Schreurs, 2008). Also, even if cross-sectoral policy integration is governed and taking place at higher governance levels (e.g., national or EU level), formal and informal agents at lower levels can oppose and offset such high level policy change processes and outputs (Briassoulis & McDonald, 2017, p. 59; Sotirov & Storch, 2018).

In the following section, we first present the theoretical and analytical framework. In the next chapter, we outline our methods for data collection and analysis. We then present the empirical results from the two case studies and close with a discussion of our theoretical framework and the state-of-the art, as well as to answer the main research questions, and provide suggestions for further research.

2 | THEORETICAL AND ANALYTICAL FRAMEWORK

The scholarly literature on policy integration distinguishes between policy integration as an output¹ in policy-making (Briassoulis, 2004; Lenschow, 2002), and as a process of conciliating interests, beliefs and differences across policy sectors understood as policy subsystems (Giessen & Krott, 2009; Winkel & Sotirov, 2016). Both can refer to the stage or type of integration reached (Howlett et al., 2017). The concern in part of this literature is to understand which facilitators and impediments contribute to cross-sectoral policy integration or disintegration (Stead & Meijers, 2009; Winkel & Sotirov, 2016). For this, some scholars use discursive (Nilsson & Nilsson, 2005; Söderberg & Eckerberg, 2013), institutionalist (Briassoulis, 2011) or actor-centred approaches (Giessen & Krott, 2009; Sotirov & Storch, 2018). Despite

the recognition of direct or indirect centrality of actors in all of these works, only few studies address empirically cross-sectoral policy integration from a policy network perspective, with this linkage only recently gaining attention in tangent policy coordination or collaboration studies (Adelle et al., 2015; Fischer, 2015).

Despite of this, the policy integration literature generates causal assumptions about actor interconnections that can be better analysed from a policy network perspective. These assumptions refer to the factors that influence causality between the two dimensions of policy integration: policy networks formation (policy integration as a process) and the policy network impact on policies (policy integration as an output) (cf. Figure 1). In the processual understanding of cross-sectoral policy integration in combination with the ideational network literature, there is the hypothesis that ideational similarities between policy actors are a key precondition for policy network formation, and a joint policy network is a necessary condition for cross-sectoral policy change (Baulenas, 2021; Candel & Biesbroek, 2016; Kisby, 2007; Sotirov & Storch, 2018). The directionality among these elements does not follow a linear path, though, but it is considered dialectical (cf. Figure 1). Dialectical refers to the “interactive relationship between two variables in which each affects the other in a continuing iterative process” (Marsh & Smith, 2000, p. 5). This dialectical structure between outputs and processes is expected due to the complexity, dynamic evolvement and non-linearity of issues at stake and the impacts of the policy responses in place as a characteristic of policy integration (Briassoulis, 2017, p. 10).

Next, we identify and justify each of the conceptual elements of the theoretical framework as shown in Figure 1.

As a conceptual starting point, we acknowledge that a policy network can be defined by its two constitutive elements: the actors that form the policy network (actor-level) and the relationships established among them (network-level) (Prell, 2012, p. 3).

2.1 | Process of policy integration: Actor-level

Policy integration scholars observe that *actors* are generally “forced” by legal or policy changes to work together (Shannon & Schmidt, 2002). Similar assumption can be found in the *environmental* policy integration literature which shows that rules “impose” interactions between actors (Nilsson & Eckerberg, 2009, p. 37). As shortly summarized above, the main hypothesis is that cross-sectoral policy-making will take place only if there is a congruence in actors' policy preferences. Conversely, ideational cleavages among policy actors are expected to lead to cross-sectoral policy disintegration (Sotirov & Memmler, 2012; Sotirov & Storch, 2018; Sotirov & Winkel, 2016; Winkel & Sotirov, 2016).

Relevant actors' ideas can refer to perceptions about the resources, issues at stake as well as the preferred policy solutions to address them. For instance, Zafonte and Sabatier (1998) studying a process of functionally imposed policy integration, suggested that beliefs about the seriousness of the problem as well as preferences for the use of policy instruments were the “glue” of a cross-sectoral policy network (Zafonte and Sabatier, 1998). Candel and Biesbroek (2016, p. 218) also consider “how a particular problem is perceived within a given governance system” as well as agreement on solutions to be relevant for policy integration. In terms of solutions, actors might additionally value policy integration because they consider the proposed strategy will adequately address the issue (e.g., if a measure targets environmental improvements) or because they are part of the technical solution to solve it (Nilsson & Eckerberg, 2009, pp. 143–144). In the policy network literature, it is assumed that “a reasonable level of mutual understanding of resource-related issues increases the likelihood that stakeholders will organize and agree upon common rules” (Crona & Bodin, 2011, p. 208). The research on forest and water policy integration exhibits similar patterns. In terms of the

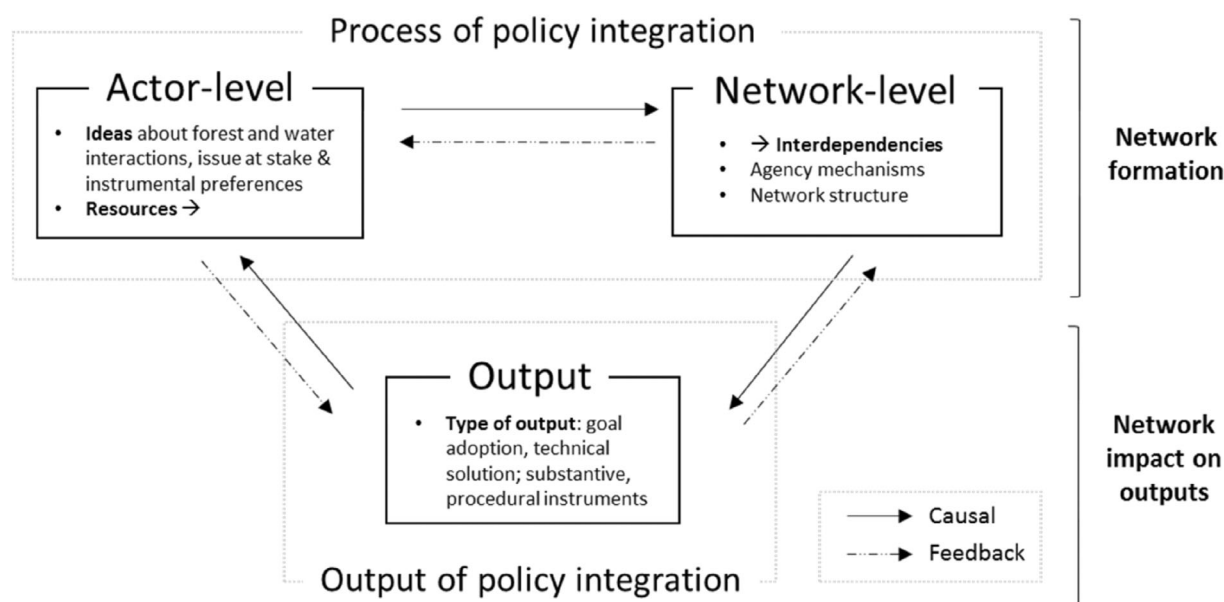


FIGURE 1 Theoretical framework of cross-sectoral policy integration from an ideational network perspective

problems, negative, positive or neutral perceptions of the effects of forest on water is shown to influence the chances of engaging in cross-sectoral integration (Baulenas, 2021). In terms of solutions, these perceptions are expected to lead to different policy preferences, such as reforestation vs. land conversion policies (Bennett & Barton, 2018; Creed & van Noordwijk, 2018; Ellison, 2018).

2.2 | Process of policy integration: Network-level

Dialectic approaches do not contrapose idealist and materialist factors, as some policy process theories do (Arts, 2012), but consider that both can have an impact (Kisby, 2007; Radulescu & Vessey, 2008). Whilst the previous theoretical arguments highlight idealist determinants of policy network formation, materialist factors also matter. At the actor level, key material resources include skills, time or authority (Kisby, 2007; Marsh & Smith, 2000). At the aggregated level of networks, these resources are best captured with the concept of actor interdependencies as defining feature of policy networks (Rhodes, 1990, 1997). The premise is that actors might require the exchange of several resources to carry out their objectives. Since some actors can be in a need of resources that are located at the hands of others, policy networks are a resource exchange platform (Crona et al., 2011; Hillman et al., 2009). For instance, private actors would seek collaboration with state actors because the latter possess direct decision-making power; reciprocally, state actors often depend on technical knowledge and innovations that can be often provided by private or research actors (Fischer, 2015).

The interplay between shared ideas and materialist factors is key because mutually supportive resource exchange can help overcome collective action problems that actors with commonly shared ideas continue to face. Fenger and Klok (2001) describe the possibility of competitive, symbiotic or absent interdependencies among policy actors. In the absence of interdependencies, a joint policy network is expected to be inactive, to face weak conflict or to face issues which require weak coordination depending on the level of ideational congruency. With competitive interdependencies, policy actors depend on and compete for the same resources to achieve their policy objectives. This means that conflicts among actors can emerge unless congruent policy ideas are present. In a situation of symbiotic interdependency, actors exchange different resources that enable them to achieve a common policy goal. The emerging policy network from this situation is most likely to avoid collective action problems. Finally, synergetic interdependencies, whereby actors have different but synergetic policy goals that they can be achieved by pooling their resources together (Nilsson et al., 2012). SNA is considered a powerful tool to study these dynamics by means of measuring resource exchange and identifying influential actors and their attributes (Crona et al., 2011, p. 51).

The policy network literature also points out that policy brokers and entrepreneurs can facilitate the formation and maintenance of policy networks and have a causal impact on policy change (Ernstson et al., 2010). Weible et al. (2010) describe that policy brokers can

facilitate cooperation and coordination across different actors, at least in collaborative policy subsystems. Feindt (2010) emphasizes that policy brokers in agriculture-environmental policy integration will tend to link actors but not always advance policy outputs. Rather a policy entrepreneur is expected to be a real pro-change motor and hence a key force in cross-sectoral policy integration outputs because it can seize windows of opportunity to implement policy reform (Candel & Biesbroek, 2016; Sotirov & Winkel, 2016). In a situation of conflicting ideas or interests, entrepreneurs can also act as facilitators for collaboration in cross-sectoral processes (Bodin et al., 2017, p. 7).

In summary, we expect actors with similar policy ideas to interact. Such relationships will be further developed and activated as a policy network in the presence of symbiotic or synergetic interdependencies facilitated by the activity of policy brokers. Policy entrepreneurs will be the causal link between policy network activity and cross-sectoral policy integration outputs.

2.3 | Policy networks and outputs of policy integration

A policy integration output can be the content of a policy including its goals, but also technical and managerial changes in cross-sectoral policy instruments (Kisby, 2007, p. 85). In this article, policy goals are understood as “the explicit adoption of a specific concern within the policies and strategies of a governance system, including its subsystems, with the aim of addressing the concern” (Candel & Biesbroek, 2016, p. 220).

The presence of a policy network will not always imply policy changes, and network analysis look for the factors than can facilitate shifts (see e.g., Bodin & Prell, 2011). Scholars suggest that the type of policy integration outputs not only will be a product of actors' ideational homogeneity, but also their type of interactions (Briassoulis, 2017, p. 59). One way of studying this with SNA is the concept of multiplexity, whereby actors are in contact for more than one reason and develop multiple types of relationships (Berardo et al., 2020). For instance, professional and friendships, but also types of activities such as information sharing and joint fact-finding activities. The former is seen as key to enhance sustainability in natural resource management (Borg et al., 2015). The later can have a crucial role in policy integration (Dewulf et al., 2005). Joining up different actors in knowledge production and transfer is expected to lead to better approaches to dealing with the full complexity of environmental management (Raymond et al., 2010). Weible (2008) also describes the presence of joint fact-finding strategies in collaborative policy-subsystems as an instrument to inform decision-making. In the context of collaborative networks for ecosystems management, the authors emphasize collaborative heterogeneity, by which there is high connectedness between actors of different kinds, such as for example, scientists with policy-makers (Bodin et al., 2017).

The density of relationships between actors in a network, as part of the network structure, can affect the outputs obtained from their activities. Varying strength of ties leads to different scenarios.

According to Granovetter (1983), weak ties can be more relevant than stronger ones for the spread of new ideas. On the other extreme, very dense networks can be counterproductive as they can disproportionately slow down any policy and planning process (Mitchell, 1990). Alternatively, a relationship with average density levels has been associated with deliberation, resilience and single-loop learning and very strongly with knowledge transmission (Newig et al., 2010). Single-loop learning implies instrumental learning of how to achieve goals with smaller incremental changes through the discovery of shared or complementary ideas and interdependencies, whilst stronger learnings are covered under double-loop learning which entails changes in objectives and in actors' ideational systems (Nilsson & Eckerberg, 2009). For double-loop learning, the network literature is still unclear about the type of structures which facilitate it (Newig et al., 2010).

For policy integration processes, the presence of subgroups is additionally expected, and bonding and bridging ties intervene. Bonding ties are the relationships established within subgroups and bridging ties across subgroups. Both are considered relevant for solving problems of collective action, with some nuances (Crona & Bodin, 2011). In the presence of groups in the network, bridging ties across sectors has been shown to improve joint goal setting (Leach et al., 1999). Bridging ties can also contribute to cohesion, and cohesion builds trust as general requirement for successful management (or co-management) of natural resources (Folke et al., 2005). However, if cohesion is too high within group with few bridging ties, conflicts may continue (Borgatti & Foster, 2003; Hukkinen, 2012).

In summary, we expect the presence of actor subgroups with bridging ties, as well as average density of ties at the policy network level, to be facilitators of policy integration outputs. Loosely connected actor subgroups with high cohesion within them is expected to lead to no change in cross-sectoral forest and water policy and management.

3 | DATA AND METHODS

A recent survey in Germany and Spain observed that positive views about forest and water were associated with greater chances of engaging in cross-sectoral policy integration – though not many stakeholders expressed negative views, with more being associated with rather neutral perspectives and context (Baulenas, 2021). In line with an embedded research design, we chose two regions in these countries with similar socio-economic and institutional factors but different situations in forest and water. The regions are Catalonia (CAT, North-East Spain) and Baden-Württemberg (BW, South-West Germany) both displayed in Figure 2. Both two regions are in charge of forests and internal watersheds, primary reason for its selection. The variance between the regions relates to the relative strength of the forest sector – high in BW and low in CAT – as well as differences in problems associated with water (quality and quantity). In a comparative study of policy integration across the forest and water sectors, these factors were all associated with different policy integration paths (Baulenas, 2021), although in the survey, stakeholder

perceptions on forest and water were less influenced by ecological factors and more by socio-institutional. We come back to this debate in the discussion. More details about the regions are found in Appendix A.

We used two types of information sources: interviews and the review of legislation in the forest, water and related sectors. To gather the data, we designed an open-ended structured interview. All stakeholders were asked the same questions. Interviews were designed to enable SNA but also to provide additional information to contrast the components of our framework, identifying perceptions about problems and solutions and reasons behind establishing interactions with the other sector, as well as the activities that were being performed with respect forest and water. Most of the interviews in CAT were performed face-to-face in October 2018, but some were done by telephone during November and December 2018. In BW, interviews were conducted by telephone during May and June 2020. The interviews were transcribed and analysed with MAXQDA. The codes represented the categories in our framework and, in the results section, we present the results of the interviews in an aggregate manner, following our theoretical and analytical framework as well as the research questions.

The next paragraphs describe how we operationalized the theoretical concepts introduced in the last chapter.

Members of the network. The members of a network imply the network boundaries as key decisions in network studies, provided its impact in internal and external validity (Berardo et al., 2020; Prell et al., 2016). The type of actors included were public officials at regional and sub-regional levels, representatives of the private and third sectors as well as researchers for both forest and water. Stakeholder lists were based on purposeful sampling aimed at having multiple representatives within each of these stakeholder categories. In the interviews to gather network data, we used a nominative approach with snowball sampling, with free recall and number of nominations (Parker et al., 2020; Prell, 2012). The boundaries were established based on the participation in forest-water related activities, which could include a non-pre-defined range from research to a policy-making process. The saturation point was established when we identified actors already interviewed or newly contacted stakeholders did not undertake activities linked to water and forest. Table 1 shows the final, anonymized respondents list.

Homophily. Homophily is understood as the degree to which actors in a network are similar in a certain attribute, in our case congruence of actors' policy ideas. We combine a mix of qualitative and quantitative tools to study its degree or its counterpart, heterophily (Prell, 2012, p. 223). Qualitative information gave input to the concept of homophily in terms of perceptions on forest-water, main problems and policy goals and solutions. For resources as measure for interdependencies, we follow the concept present in Nohrstedt, by which resources include formal legal authority, activation of supporters, access to information or skilful leadership (Nohrstedt, 2011). We link these with the stakeholder category following the institutional affiliation and validated by self-reporting, and convert it as attribute for the SNA.

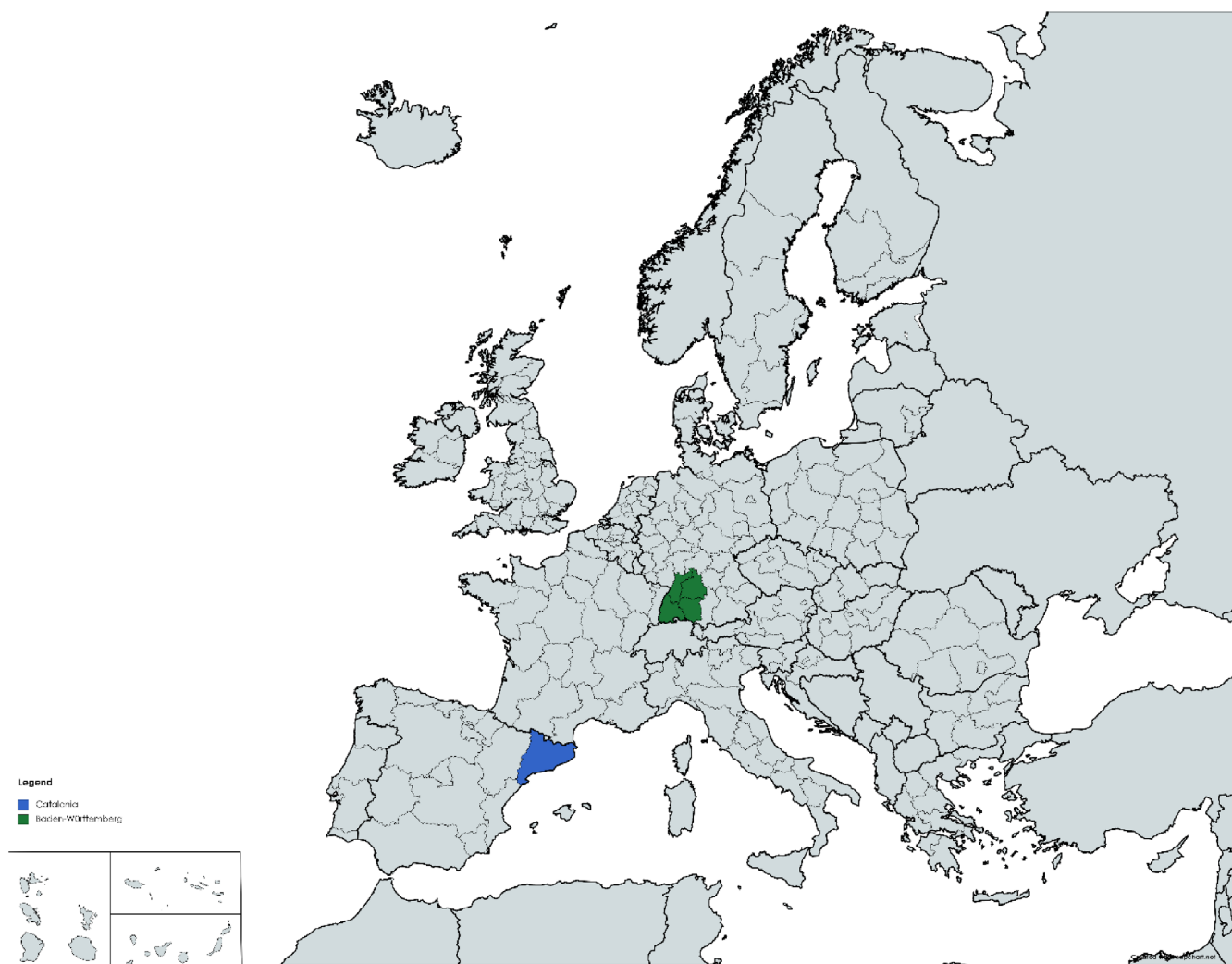


FIGURE 2 European regions map with Baden-Württemberg and Catalonia highlighted, EU NUTS 2.

Source: Obtained and adapted from map chart (mapchart.net/europe-nuts2.html) [Color figure can be viewed at wileyonlinelibrary.com]

Structure. The structure of a network involves several measures, as normalized density and centrality measures. Additionally, we observe the presence of the following discussed concepts:

1. **Density.** Measured with number of ties (i.e., actor connections) divided by the total possible connections.
2. **Multiplexity.** The types of interactions which operationalized multiplexity are shown with directed graphs from information derived inductively and categorized into information sharing, joint research, joint management and joint engagement in legal and/or regulatory change, following the same categories and definitions used in the study we conducted which justified the current research (Baulenas, 2021). Multiplexity is present when either one of the first two activities is present and one of the two last ones.
3. **Policy brokers/entrepreneurs.** We identify influential individuals through the analysis of within- and between- groups in UCINET, as well as through centrality measures. In terms of the final identification as broker or/and entrepreneur, we make use of interpretation of interview data. For policy brokers we use Ernstson et al. (2010) definition, who identify brokers as “a social network position that links otherwise disconnected social actor groups which (...) interact with ecosystem processes at different ecological (and spatial) scales”. We understand policy entrepreneurs as actors who “distinguish themselves through their desire to significantly change current ways of doing things in their area of interest”. (Mintrom & Norman, 2009 cf. Kingdon).
4. **Subgroups and overall network.** Density for the overall network and by sector (forest and water).

Policy output. The type of policy instruments in which a goal is adopted can be substantive or procedural. Here we use the typology that includes regulatory, organizational, financial or information-based substantive instruments (for forest and water see Baulenas & Sotirov, 2020). With regard to procedural instruments, we focus on participatory processes. The intention behind this was to include the views of a broad range of stakeholders, as was the case in the design

TABLE 1 Stakeholder respondents in Catalonia

(a)		
N	Stakeholder	ID
1	Forest resource manager (private forests)	F_PS_1
2	Forest resource manager (public forests)	F_PS_2
3	Forest research centre	F_R_1
4	Forest owner association 1	F_P_1
5	Forest and ecology research centre	F_R_2
6	Water resource manager (planning)	W_PS_2
7	Water research centre	W_R_1
8	Climate Change Office	C_PS_1
9	Forest NGO (Pirinee area)	F_N_1
10	Private forest owner 2	F_P_2
11	Forest owner association 3	F_P_3
12	Forest owner association 4	F_P_4
13	Sub-regional - natural park administration	F_PS_3
14	Sub-regional government (management)	F_PS_4
15	Conservation NGO	F_N_2
16	Water resource manager (quality)	W_PS_1
17	Water research centre 1	W_R_4
18	Water NGO 1	W_N_1
19	Water research centre 2	W_R_2
20	Water private company 1	W_P_1
21	Research institute 3 (Water Department)	W_R_3
22	Ecology research centre 1	O_R_1
23	Water NGO 2	W_N_2
24	Ecology research centre 2	O_R_2
25	Water private company 2	W_P_2
26	Agricultural NGO 1	A_N_1
27	Agricultural NGO 2	A_N_2
28	Climate research centre	C_R_1
29	Governance research centre	O_R_3
30	Regional Sustainability Department	F_PSSr_1
31	Federation of private forest owners	F_P_5

(b) Stakeholder respondents in Baden-Württemberg

N	Stakeholder	ID
1	Water regional government	W_PS_1
2	Nature protection regional gov.	O_PS_1
3	Water sub-regional government 1	W_PSSr_1
4	Water sub-regional government 5	W_PSSr_2
5	Water local government	W_PSSr_1
6	Water supranational agency 1	W_PSn_1
7	Water research centre (public)	W_R_1
8	Water supplier company	W_P_1
9	Water network organization	W_net_1
10	Water supplier (public) 1	W_sup_1
11	Water supplier (public) 2	W_sup_2

TABLE 1 (Continued)

(b) Stakeholder respondents in Baden-Württemberg		
N	Stakeholder	ID
12	Water supplier (public) 3	W_sup_3
13	Water research centre (2)	W_R_2
14	Water NGO	W_N_1
15	Forest regional government	F_PS_1
16	Forest resource manager (public forests)	F_man_1
17	Forest resource manager (natural park)	F_man_2
18	Forest network organization 1	F_net_1
19	Forest network organization 2	F_net_2
20	Forest research (public) 2	F_R_1
21	Forest sub-regional government 1	F_PSSr_1
22	Forest sub-regional government 2	F_PSSr_2
23	Forest protection sub-regional government	F_PSSr_3
24	Forest fire department	O_PS_2
25	Nature protection NGO 1	O_N_1
26	Forest local government	F_PSI_1

of programs of measures for river basin management in the EU (Jager et al., 2016). As mentioned in the previous section, we identify joint policy outputs as those policy instruments that contain concerns and solutions of both sectors as proxies for cross-sectoral policy integration outputs.

Table 2 below shows these codes and the main network measures:

4 | RESULTS

4.1 | Policy network formation

As the results of the interviews show,² the trigger for a policy network formation in the case of CAT is a policy broker (8) active in the climate change sector, who facilitated interactions by engaging central actors from the forest and water sectors in joint fact-finding activities. The broker's success was facilitated by synergetic interdependencies among the forest and water sectors. On the side of the Water Administration (6, 16), the main goal is maintain or improve water quality to ensure compliance with the Water Framework Directive. However, the actors have no competencies related to, and low influence on, the agricultural sector, which is the main non-point source of pollution. A partial solution to improve water quality is to increment the quantity of water to allow rivers to recover natural habitats. The aim of collaborating with the forest sector is thus to study whether financing forest management to benefit water bodies would be more cost-efficient than end-of-pipe solutions. The main reasons for prior lack of collaboration are that addressing first point sources of pollution was originally prioritized and, in more recent years, there were conflicts about the management and conservation of riparian forests as well as

TABLE 2 Summary of the main units and methods of analyses based on the theoretical framework

Framework	Content analysis of stakeholder interviews, codes (MAXQDA)	Social network analysis ^a
Network members	<ul style="list-style-type: none"> • Nomination 	Nominative approach with snowball sampling.
Actor-level	<ul style="list-style-type: none"> • Forest-water biophysical interactions • Problem-solution • Goal 	Homophily/heterophily: Ideas and type of stakeholder-resource (information, authority, networks, etc.).
Policy network	<ul style="list-style-type: none"> • Structure • Power imbalance, absence • Broker/entrepreneur • Type of activity 	Structure: <i>density</i> and <i>multiplexity</i> (analysis via di-graph, with tie intensity); <i>brokers and entrepreneurs</i> : Centrality and broker measures; <i>subgroups</i> .
Policy output	<ul style="list-style-type: none"> • Type of mention in the legislation (goal vs. technical/management change) • Substantive/procedural (instruments) 	

^aTo perform the network analysis, we used UCINET (Borgatti et al., 2002).

confusion about the responsible body about it (i.e., problems of inter-play). On the side of the Forest Administration (1, 2), the main goal is to support and restore the economic viability of the forest sector. This sector competes with the agricultural administration for (scarce) public financial resources, the latter receiving most of the grant money. As a result, it can only support a reduced number of owners in their management. At the same time, it relies on EU-funded projects to activate lines of inquiry to find solutions for a viable forest sector (1, 2, 4). After exhausting other possibilities (e.g., non-timber forest products), water was identified and considered as a key forest ecosystem service. The interest in the forest-water nexus was backed by the research performed by these stakeholders in several successive joint projects (1, 2, 3, 4).

The interviews show that in the course of these joint fact-finding activities, forest and water perceptions homogenized, as demonstrated by stakeholders' use of similar lines of argumentation. For instance, there is a common view that forest area and timber resources have increased due to forest growth processes. These forest development processes consume more water leading to a reduced amount (1, 6, 8). The causes for this increase are natural reforestation after rural-urban migration dynamics and abandonment of forest management due to low profitability. The similarity in the perceptions about "more forest, less water", is not by chance but rather is based on the work of two research institutions that, at the beginning of the 2000s, published studies based on CAT which provided evidence of these forest-water linkages (5, 17, 19). This research was not known to forest and water authorities until they participated in joint fact-finding activities at the initiative of the policy broker. Ultimately, both water and forest stakeholders see active forest management and timber use as a solution and the atomization of forest properties and associated lack of active forest management as a problem (1, 2, 6).

In the case of BW, and interpreted from interviews, we did not find an active policy network among actors from the forest and water sectors, although stakeholders had formal bilateral cross-sectoral interactions. In this region, none of the actors perceives that the other sector could help achieve their goals, and this in turn influences their

interactions (1, 15, 16). Despite this, perceptions about forest and water are very homogeneous, with an emphasis on the positive effects of forest on water. Specifically, stakeholders mention that forests are less damaging than the main stressor, agriculture, and also the charges that Germany could face if the milestones of the Water Framework Directive are not met (3, 4). One stakeholder summarized this situation as follows: "we are happy when there is forest instead of other land uses" (5). Despite the presence of this commonality across stakeholder categories and sectors, it was not a driving force for collaboration among them. At the same time, although both water scarcity and flooding are often mentioned as problems, forests are barely mentioned by water stakeholders as potential solutions, with the exception of a local water authority from the Black Forest (5). Forest stakeholders (research, private and public forest owner organizations) are nonetheless proactively looking for management solutions to reduce the impact that water scarcity will have on forests (16, 18, 20). This general lack of attention paid to the forest-water nexus by water stakeholders is also evident among the targeted stakeholders, some of whom declined or were reluctant to be interviewed because they did not see the point. From the forest side, the forest-water nexus was described as "omnipresent" (19). A perception shared only among forest stakeholders was that forest ecosystem services are not acknowledged despite their perceived importance (18, 19).

In BW, cross-sectoral interactions were sometimes driven by conflicts in fact. Some actors participated in round tables with actors from both sectors and/or one of the sectors with nature protection (14, 20). When interactions did not materialize, the reason often given was a lack of resources (both time and money). Some actors mentioned that they desired more interactions between ministries or the establishment of a working group on forest and water – which has not yet materialized (15, 21). Conflict is concentrated at the local level, described by one respondent as "local hotspots" (14). At the forest-water nexus, these conflicts relate to (i) disagreements of forest companies with water administrations and fisheries about water storage systems (22), (ii) use of pesticides: if avoided, trees (and timber production) are affected because of

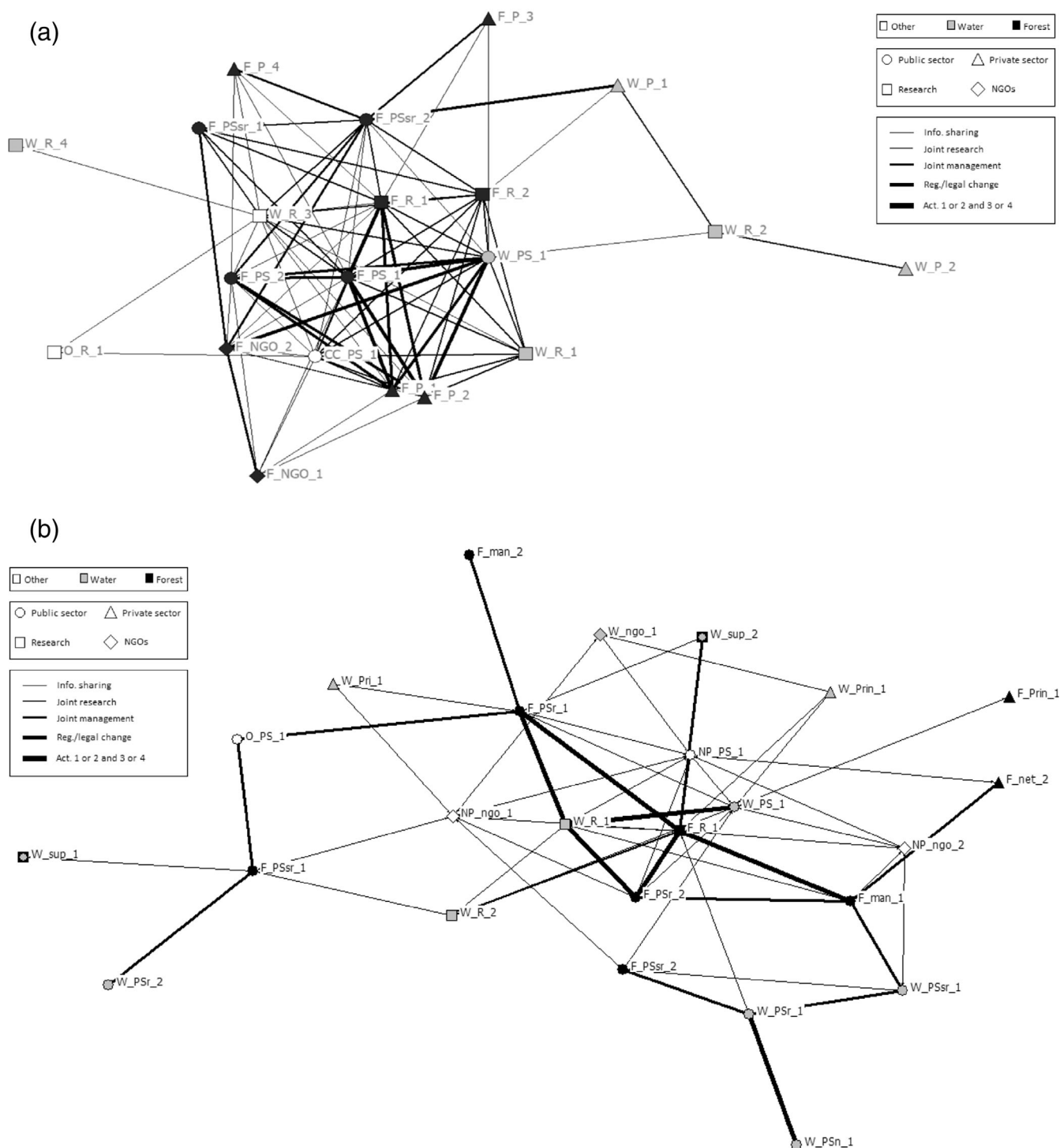


FIGURE 3 (a) Graph of the water and forest policy network in Catalonia. See Table 1 for the stakeholder list. (b) Graph of the water and forest policy network in Baden-Württemberg

plagues; if used, water quality and the industries linked to it, for example, beverage industry, are affected (21), and (iii) ecological flooding in the Integrated Rhine Program, against which there are citizens' initiatives (6). Other conflicts involved either one of the sectors (mainly forest) with nature protection stakeholders, but few were directly related to forest–water.

From an institutional standpoint, the EU network of protected areas Natura 2000 under the EU's Habitat and Birds' Directives – but not the Water Framework Directive – were often cited as a source of conflict. One NGO spoke about inter-ecological conflicts between the later and the EU' Nature Directives, but it did not affect forests (14). Forest stakeholders sometimes referred to nature protection actors as

being inflexible in their positions and difficult to reach agreement with (20). Conversely, nature protection stakeholders considered the forest sector to be opaque and noted that they “like to do their own thing” (2). Yet, the main concern of nature protection stakeholders remained the agricultural sector (14, 25), and views about the forest sector were not cohesive within this group, with some perceiving it as positive and some as negative.

4.2 | Policy networks impact on policy integration outputs

The results of the SNA show interesting brokerage dynamics.

In CAT, according to the results at regional level, a research institution in charge of the forest-water research activities and developing forest-water models (21) is the actor who according to the data would assume roles of coordination, but also potential for being a gatekeeper. The second most prominent actor in terms of brokerage is the climate change actor, with coordination and consultancy roles (8). However, when centrality measures such as outdegree (expansiveness of one's network) and indegree (prestige and popularity) were analysed (see Prell, 2012), the main two actors that appeared as main nodes were the forest administration and the water administration, showing a certain balance in the two networks in terms of power. For core-periphery dynamics, the core group is formed by 9 stakeholders from different sectors and stakeholder categories. These are (by ID): F_PS_1, F_R_1, F_R_2, F_P_1, F_P_2, W_PS_1, W_R_3, CC_PS_1, F_PSSr_2.

Figure 3a below illustrates these interactions. All interviewed actors reported some type of relationship among one or more stakeholders, but in relation to water-forest aspects, the network is small ($N = 22$) relative to the number of interviews ($N = 31$). The distance between actors [nodes] represents the geodesic distance,³ that is, distance to reach other nodes. From this visualization, this detected group of key stakeholders formed by water and forest actors can be distinguished, as well as one main actor from climate change (CC_PS_1, 8). The symbols represent different stakeholder categories and the thickness of the ties shows type of relationships. The thicker tie shows a situation of multiplexity, by which stakeholders are engaged by different means, which can include information sharing or joint research and in management or policy-making (the thickest tie). In this region, the forest network has more dense ties relative to the water network (0.759 vs. 0.474) for forest-water concerns (Figure 3a).

There are stakeholder groups missing from the network despite being mentioned as relevant for the main objectives. These were the private water sector and societal representatives. Water private stakeholders (W_P_1 and W_P_2, 6 and 16) do not directly engage with the core network in relation to forest-water, but rather only have ties with a water research institution at the sub-regional level (W_R_2, 19) which is also not involved with core actors. This situation differs for the forest sector, in which all actor categories are engaged in this initial stage of the policy-making process. The private water sector includes hydro-electrical companies and bottled water

companies. These were mentioned as water users, but they are also accountable to another law and thus beyond the influence of the water or forest administrations. Bottled companies were contacted but they had collaborations at the local level in only one case (20), informing they acquired forest surrounding their facilities. Regarding societal groups, stakeholders shared the perception that the public misunderstands the relevance of forest management and they expect resistance in case the process leads to the water administration incentivizing private forest management (1, 4, 6, 8).

Turning to subsystems interactions in BW, we found no joint fact-finding. Rather, the projects that touched upon forest and water were exclusively under the responsibility of research institutions, some of which included the presence of both forest and water research stakeholders (13, 20). Research stakeholders discussed the science-policy interface, with efforts to use the data for policy briefs for forest authorities when this was formally requested or to inform local stakeholders about the results.

In this region, according to the results at regional level, the measures of centrality across all stakeholders are low, in comparison to CAT. The three more central stakeholders in terms of out and in-degree centrality, appear to be all from the forest sector, with a research institution, the sub-regional public sector and a public forest resource manager. The brokerage roles seem to be matching with these stakeholders, with the first covering coordination and potential gatekeeper, the second with consultancy roles, and the last with a minor role, but as coordinator. The core-periphery dynamics are as follows, with five stakeholders in the core group, the majority of which are from the forest sector with one exception with a water research institution: F_PSSr_1, F_PSSr_2, W_R_1, F_R_1, F_man_1. These results seem to point out that the distribution of natural resource authorities across several governance levels as a feature of the German system, seems to be hampering integration efforts. Additionally, as the qualitative data already suggested, the forest sector is more invested in forest-water matters, than the water sector seems to be.

In general, we did not detect an active policy network relating to forest and water, despite some bilateral exchanges among stakeholders, which included both information exchange and joint management. The distance between nodes is greater, relative to the closeness observed in CAT (Figure 3b).

Within sector, both show a similarly low density of ties for forest-water matters (0.203 by the forest sector, and 0.240 by the water sector). This fact is strengthened by the presence of nature protection-related agents that had ties with both sectors, though not simultaneously. In general, we observed bilateral relationships but did not detect frequent collaboration in which various groups of actors participate. Finally, in this region the presence of NGOs in the whole network is more prominent, in contrast to the relative absence in CAT.

We present the main data on outputs in Appendix A and interpret the results in the discussion. In terms of results, the policy integration outputs are reflective of the stakeholder networks in each region. In CAT, there are several laws that include the goal of fostering

synergies between the forest and water sectors, and specifically the mention in the climate change law seem to be the output of the network activities. In BW, references to forest and water are more technical and centred on the management of forests to avoid damaging water. With regard to procedural instruments, in BW the exchanges are highly formalized, meaning that additional interactions are established through regulations (e.g., monitoring activities), whereas in CAT, the relationships started informally, through projects, and are moving towards more formalized forms of policy integration.

As a comparison, the case studies reveal some important dynamics of forest and water policy integration. These include (i) the importance of a policy broker leading to an active network; (ii) synergetic interdependence of forest and water stakeholders, above all authorities, which reinforced their willingness to maintain the network; and, (iii) the offsetting of conflicts through repeated (CAT) or punctual (BW) interactions. Specifically, with regard to (ii), in both regions, there is a focus on the improvement of water quality to ensure compliance with the Water Framework Directive as main objective of the water sectors. Whilst this triggered stakeholder interactions in CAT, this was not the case in BW. A partial explanation for this is the fact that CAT is also heavily concerned with issues of water scarcity, which the forest sector could help address. Whereas the forest sector in CAT requires funding through other sectors to incentivize forest management, the forest sector in BW has not, to date, been heavily concerned with lack of financial resources. This suggests a situation of synergetic interdependency in CAT: while the sectors do not have the same goals, there are synergies in the joint pursuit of sectoral goals. On the case of BW, this suggests the scenario of absent interdependencies whereby they do not need resource exchange to achieve at the same time different objectives.

5 | DISCUSSION

In this article, we analysed policy integration at the forest–water nexus from a process and output perspective. We compared two European case studies at regional level that display different stages of policy integration. Our aim was to understand the dynamics from a policy network perspective. Our theoretical framework was based on a symbiosis between ideational policy networks and processual understandings of policy integration, treating ideas as an intermediary variable, actor interdependencies as independent and policy outputs as dependent variable, whilst acknowledging a dialectical relationship among these. Our research questions were: How can the formation of a policy network for the case of forest and water policy integration be explained? What are the effects of the policy network on policy integration outputs? First, we expected actors with similar policy ideas to have interactions and these interactions to be activated as policy network by a policy broker in the presence of symbiotic or synergetic interdependencies. Policy entrepreneurs were also expected to be the causal link between policy network activities and cross-sectoral policy integration outputs. Secondly, and in terms of network dynamics as a process of policy integration, we expected average density of ties at

the policy network level and within subgroups –or sectors–, to be facilitators of policy integration outputs.

At the ideational level, forest and water scholars assume that negative or positive perceptions of biophysical interactions between forests and water will lead to different policy outputs or lack thereof (Creed & van Noordwijk, 2018, p. 154; Ellison, 2018). In this regard, we observed that in Catalonia, perceptions about forest–water interactions tended towards homogeneity as a product of joint fact-finding activities rather. These activities could be leading towards the policy-making process to create an incentive policy, depending on the obtained results. We identify this type of change as double-loop learning, given that some water stakeholders as a result adopted the idea, held in the forest sector, that maintaining or incentivizing forest management could be beneficial for water and environmental protection. In addition, the perception that forest and water are relevant to combat climate change was included in the climate change law, considered as a form of policy integration output. In Baden–Württemberg, there was a generally positive view on the general effects of forests on water, but it did not trigger any policy integration process. The lack of a policy broker and the context of absent interdependencies, contributed to more fragmented interactions in Baden–Württemberg, with policy outputs being rather technical and managerial.

At the network-level and in terms of actor subgroups, in this later region we observed the forest sector to be more active, but had equally low subgroup density as within the water sector. In Catalonia, the density in the forest sector was average but higher as in the water sector. This was due to missing water actors mentioned as relevant for forest–water related goals. For instance, the water private sector was active on forest–water concerns but did not have many links to any of the key stakeholders. In network studies this is the analysis of actor absences (Armitage et al., 2008). Absences might imply that certain groups are marginalized (Prell et al., 2016) or that power is being exerted through other means (Parés et al., 2015). Such imbalances in representation are identified as an obstacle to collaboration and deliberation (Christopoulos, Horvath, & Kull 2012; Crona & Bodin 2011). The (dis)integration literature also shows that some actors deliberately do not engage in cross-sectoral processes, because they fear a loss of power or costs (Giessen & Krott, 2009; Høgl et al., 2016).

When interpreted in the light of the policy integration literature, the differences in policy outputs are not necessarily negative. As some authors suggest, these show different “styles” in the materialization of policy integration, with more minimalist vs. maximalist approaches (Gabler, 2010; Peters, 1998). In fact, some authors have concluded that full or more policy integration might not always be desirable or feasible due to potential policy incoherence (Biesbroek & Candel, 2019; Candel & Biesbroek, 2016; Howlett et al., 2017). The lack of formalization of the relationships should not be considered as an obstacle for integration either, as observed in the network literature, but as mentioned requirement for other approaches to governance (Bodin & Crona, 2009; Keast et al., 2007). Based on our results and of some of the literature, informal activities can be an initiator of policy integration, and should be accounted for as such (Metz et al., 2020).

We found several plausible mechanisms for regional differences. From the perspective of vertical policy integration, they represent the dynamics of institutional interactions between the national and sub-national levels. At national level, and institutionally, Germany appears to have little tradition in the integration of forest and water in policy. On the contrary for the case of Spain, as a possible commonality across Mediterranean countries (Biot et al., 2011; Verkerk et al., 2017), there has been a century-long tradition of forest hydrology implemented by water authorities at national level. This has been taken up by regional authorities in the last decades due to processes of devolution (Baulenas, 2021; Vadell et al., 2016). On the other hand, contextual factors, such as environmental pressures. Catalonia has the added issue of water scarcity, and forest management is a considered solution. With the advance of climate change, this could also trigger movements towards more maximalist integration in Baden-Württemberg. In both regions there are nodes of expertise around forest and water: in Catalonia with the involvement of public authorities and in Baden-Württemberg in research institutions. According to network literature, these nodes might be drawn upon through the development of informal networks when this becomes necessary (Olsson et al., 2006).

Finally, there are important implications for policy-making. Although the temporal component in our research was only tangent, which we consider as a limitation of our study, Catalonia showed a succession of projects through which the network matured and the trust increased. This suggests a certain need for network management approaches as suggested by network scholars but also of European governance (Bodin & Prell, 2011; Schout et al., 2010). Additionally, networks who engage in joint-fact finding activities are apparently more ready to engage in innovative policy change, as an often required characteristic of cross-sectoral policy integration outputs (Nooteboom, 2006; Pahl-Wostl, 2009). Joint-fact finding activities is described as a key activity also of adaptive networks, which are steered by policy officers. Adaptive networks generally comprise a mixture of formal and informal processes and thus considered flexible networks (Pahl-Wostl et al., 2007), what we observed too.

For future studies, we suggest that policy integration scholars aim at addressing both process and output to enable a more holistic assessment in any given policy system, and both actors and their relationships in network perspectives of policy integration. Without considering both, assessments can lead to incomplete conclusions, for example, in cases where there is a lack of outputs or informal interactions, there may be to false assumptions of lack of integration (Metz et al., 2020). Also, observing both process and outputs and considering both minimalist and maximalist approaches can yield great insights for the study of facilitators and impediments to policy integration.

6 | CONCLUSION

In our two regions, the Water Framework Directive is an external but indirect pressure of forest-water policy integration. It is indirect because whilst it does not mention forest specifically in its core text, water authorities in both regions mention compliance as a key goal. In

both, the main threat to water quality is perceived to be agriculture but stakeholders mentioned difficulties in influencing agricultural practices. In Catalonia, triggered by the severity of water scarcity, this context led to forest and water policy integration processes in the form of joint fact-finding activities and outputs in form of joint goals in the climate change law. This was facilitated by an actor who acted as policy broker and entrepreneur simultaneously, and illustrates synergetic interdependencies, by which the different policy goals of actors can be achieved through pooling sectoral resources together, but which require a facilitator to solve collective action problems (Baird et al., 2016; cf. Provan & Kenis, 2007). In Baden-Württemberg, the forest and water sectors remain very fragmented, with occasional contact following information exchange or conflict management suggesting a situation of absent interdependencies. If the stakes were to be more clearly defined in this region, dominant actors in the forest sector could oppose integration if it would imply costs for the sector, such as in the case of sanctions (Giessen & Krott, 2009; Hogl et al., 2016; Söderberg & Eckerberg, 2013; Sotirov et al., 2015). This is likely in timber-oriented forest management countries in case the Water Framework Directive continues to emphasize forests as potential damage (Keskitalo, 2015; Sergent et al., 2016).

Finally, in Catalonia a policy broker played a key role in bridging across the forest and water sectors. In line with expectations in the literature, this policy broker used science obtained from joint-fact finding activities to support the inquiry into the benefits of adopting woodland for water payments for ecosystem services (Weible & Sabatier, 2009). We also identified this actor as policy entrepreneur, observed to seize windows of opportunity in policy integration processes (Candel, 2021). In Baden-Württemberg, stakeholders perceived forest-water collaborations as relevant but did not actively engage in advanced forms of integration. Rather, they interacted within the structure of the institutional framework. In terms of outputs, in Catalonia, with a dense network with synergetic interdependencies, many different laws emphasize forest-water, whereas in Baden-Württemberg, with absent interdependencies, policy integration is rather technical (see Appendix A).

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ENDNOTES

- ¹ In this article, we distinguish between output, as a policy developed by a policy-making process, and outcome, as the effects of the policy on the ecosystems addressed. This is often so by the policy integration literature, which can be divided into three different strands: the initial studies from public administration, which focused on policy integration as a functional process; the environmental policy integration literature; and the



third most recent set which isolates policy integration per se (Biesbroek & Candel, 2019). We address this third literature in this study.

² Numbers (#) indicate the stakeholder we are referring to: see Table 1a,b in Data and Methods.

³ Geodesic distance refers to the number of connections in the shortest path between two nodes. The distance between nodes represents shorter to longer paths and this allows for a better visualization of cohesive subgroups within a network, as well as multiplexity.

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APPENDIX A.

Background and output of policy integration by region

TABLE A1 Assessment of policy integration output in Catalonia

Background information. In data from 2012, CAT has 61% of forest coverage (ca. 2 million ha) and 73% of the forests are private property (ca. 1.4 million ha), the remaining 27% being owned by municipalities and sub-regional administrations. Fragmentation is high, with only 4.75% of owners holding more than 25 ha and these holdings representing 67.25% of the total private forest (Palero Moreno & Baiges Zapate, 2013). Of these, around 40% have a management plan (OFC, 2017). Economically, low market prices for wood have contributed to forestry accounting for 1.1% of the agricultural value added in Catalonia (Prokofieva & Gorriz, 2013) and ca. 1 million m³ being extracted yearly, despite of the demand for ca. 7 million m³ of timber in the region. At the time of the interviews (2018), forestry sits within the Department of Agriculture, Livestock, Fisheries and Food. There are two main bodies, the General Directorate of Forest Ecosystems and Environmental Management, in charge of public forests and private forests without management plans (MP), and a public agency in charge of forests with MPs and allocating subsidies. Water in the internal river basins of Catalonia is managed by the Catalan Water Agency. This agency is under the Department of Territory and Sustainability. The river basin districts have a surface area of 16.423 km² (52% of the region and 92% of the population). The water agency does not grant concessions but controls hydraulic extraction, monitors water planning, management and sanitation. In 2008, freshwater demand was at 3.123 hm³/year, ca. 40% of which is sourced from the internal river basins. Domestic and industrial consumption represents ca. 30% of the total and agricultural uses 70% for agricultural irrigation and livestock consumption (ACA, 2008).

Policy goals and technical regulation *Goal adoption and technical solutions*

Forest Law: One of the objectives is (§1.2.b) to avoid the reduction of existent forested areas and promote their reforestation to stop erosion, ensure the hydrological settlement of mountain terrain and reduce existing forest resource deficits. Other articles (§11) convey that private or public areas which have influence on the forest-hydrology system can be declared of public utility. Public forested areas in watersheds and other watercourses are declared to be also of public utility, with important consequences for the range of accepted actions (§12). §25 Attributes to the FA, the implementation of the “necessary” forest-hydrology activities.

General Plan of Forest Policy (2014–2024): This instrument establishes the technical guidelines to implement the forest policy in Catalonia. The General Plan of Forest Policy contains the strategic axis to protect the functions towards soil and water, allocating 12% of the total budget for such actions. The plan recognizes as a weakness the lack of integration of forest policy with natural disaster sectors, such as flood management.

General Territorial Plan of Catalonia: This Plan mentions hydrologic networks, rivers and streams as being of “forestry interest”, and determines to maintain the forested area in these areas for its ecosystem services.

Water Law: The Law implements the Water Framework Directive. As the WFD does not mention forests in its

(Continues)

TABLE A1 (Continued)

		<p>main text, this Law implements its guidelines and distributes the competences on water in the region.</p> <p><u>River Basin Management Plan (2016–2021)</u>: The RBM (for internal waters) does not specifically address forestry. Rather, it mentions natural disasters such as forest fires, in relation to their potential damage to water bodies. However, it has two restrictions: (1) the requirement for forest owners to seek authorization to modify riparian forest areas, and (2) in two defined areas, no concessions are available for water use for fast growing tree species. It also refers to a technical document by the WA on recommendations for management in riparian areas.</p> <p><u>Climate Change Law</u>: at §18(e) on forests and forest management, the Law mentions, “the need to coordinate forest and water policies, and the establishment of measures that allow for a forest management system that takes into account water regulation and allows for sustainable management of both forests and water”.</p>
Policy instruments	Substantial	Regulatory policy integration is covered in “concern adoption” above. No instance of organizational integration, such as Interdepartmental working groups, was found. Forest and Water are also under different Ministries (“Conselleries”). The financial integration is studied under the results of a current EU-funded project (2018–2022), which could provide the basis for designing forest subsidies to improve water bodies covered by the WA. Finally, informational integration includes the joint fact-finding activities.
	Procedural	<p>Forest owner associations interviewed for this study mentioned participating in the first participatory process for the Water Framework Directive. Evidence was also found in studies covering this process in the region (Parés et al., 2015). However, stakeholders expressed disappointment due to limited representation of their group in discussions relative to groups that do not consider forest management beneficial for ecosystems.</p> <p>Other procedural measures were found in the participatory process organized for the General Plan of Forest Policy, but we found no evidence that water stakeholders participated in this process.</p>
Sources		<p><u>Forest Law</u>: Llei 6/1988, de 30 de març, forestal de Catalunya. (DOGC núm. 978 - 15/04/1988).</p> <p><u>General Plan of Forest Policy (2014–2024)</u>: Pla general de política forestal 2014–2024. (DOGC núm. 6647 - 19/06/2014)</p> <p><u>General Territorial Plan of Catalonia</u>: Pla territorial general de Catalunya aprovat per la Llei 1/1995, de 16 de març.</p> <p><u>Water Law</u>: Directiva marc de l'aigua (2000/60/CE) - Transposició mitjançant la modificació de Llei 46/1999, i el text refós de la</p> <p>Llei d'aigües 1/2001, de 20 de juliol, per l'article 129 de la Llei 62/2003, de 30 de desembre, de mesures fiscals, administratives i de l'ordre social (BOE núm. 313, de 31 de desembre de 2003).</p> <p><u>River Basin Management Plan (2016–2021)</u>: Pla de gestió del districte de conca fluvial de Catalunya per al període 2016–2021.</p> <p><u>Climate Change Law</u>: Llei 16/2017, de l'1 d'agost, del canvi climàtic. (DOGC núm. 7426 - 3/08/2017).</p>

TABLE A2 Assessment of policy integration output in Baden-Württemberg

Background information. In BW, 38% of the land is forest (3,575,148 ha). In terms of ownership, 40% belongs to communes, 36% is under private ownership (ca. 1.3 million ha) and 24% is State-owned.^a 11 million m³ of timber are extracted every year (BIOPRO, 2009). The Ministry for Rural Areas and Consumer Protection is in charge of forestry at the top level. The Ministry for Environment, Climate and Energy Policy is responsible for water. In the Upper Rhine, and specifically in the areas under the scope of the Integrated Rhine Program (IRP), 70% of the area consists of exploited forests.^b With regard to the integration of the forest sector in this process of policy-making, the IRP enforced the performance of risk analysis for the forests alongside the river basin. However, it is not clear to what extent the forestry sector, including private owners and the industry, have been part of the process or what its stand is on the IRP or on the conflicts arising that are halting the construction (or recovery) of floodplains.

Policy goals	<i>Concern adoption</i>	<p><u>Forest Law:</u> The Law contains the following measures in relation to water. §15 stipulates that clear-cutting shall not significantly nor permanently alter the water balance. §31 states that forest can be declared “Protected”, for reasons including the “(2) protection of groundwater and surface waters as well as securing water supplies and regulating the water balance”. According to §83, it is considered an offense to use water without authorization or changes in forest use, which could lead to the drainage of water.</p> <p><u>Forest Strategy:</u> The Forest Strategy 2050 is being prepared. The Strategy will be based on the Forest Monitoring Report 2019. This document mentions the role of forests in protecting water quality and quantity, and the negative consequences of droughts on forest degradation and decay. If also using the German Forest Strategy 2020 as a benchmark, it could include the provision of woodland-for-water payment for ecosystem services as suggested measures.</p> <p><u>Water Law (v1/2019):</u> Following §20, use of surface water is allowed by local communities (“Gemeinde”) in small quantities and for harmless activities, including forestry. This use is exempt from fees (§103). §29 allows forest in the water strips (5 and 10 m), if they contribute to water protection. Fertilizers are prohibited in this area. The latter is also the case for water protected areas (§45) and fees will incur in case of damage. In this same article, it is mentioned that the Water Authority, with the understanding of the Land Management Authority, can prohibit forest management in such cases (also in §96).</p> <p><u>Territorial Plan:</u> §18(2.2) mentions that the spatial planning process will coordinate with and evaluate the immediate and indirect effect on soil, water, air, climate and landscape.</p> <p><u>Climate Change Law:</u> No mention. But the annexed “Integrated Concept of energy and climate protection” contains measures that could affect forest and water. On the one hand, (Measure 29) stimulus for building hydroelectric power plants, which could lead to the restriction of forest management. (Measure 98) forests for CO₂ absorption. The latter is seen as a trade-off with water quantity (Chisholm, 2010).</p>
Policy instruments	<i>Substantial</i>	Regulatory integration is covered above in “concern adoption”. We found no organizational integration, but stakeholders desired the establishment of intergovernmental working groups on forest and water. We also found no subsidies in relation to forest and water, but communities are not taxed to use water (to a certain extent) for forests. Finally, with regard to informational integration, there is a booklet that covers these linkages, plus some forest research institutions are investigating the impacts of water events (scarcity and heavy rainfall) on forests and possible management solutions to accommodate to these effects of climate change.
	<i>Procedural</i>	For procedural instruments, we detected that certification schemes such as PEFC include aspects related to forest and water. No stakeholder mentioned the participatory processes in the context of the WFD nor for the Integrated Rhine Program, despite both requiring the engagement of affected sectors. Finally, the State of Forests reports for the region envisages monitoring activities of water indicators in forests.
Sources	<p><u>Forest Law:</u> Waldgesetz für Baden-Württemberg (Landeswaldgesetz - LWaldG).</p> <p><u>Forest strategy:</u> Bundesministerium für Ernährung und Landwirtschaft. (2019). Waldstrategie 2020.</p> <p><u>Water Law:</u> Gesetz zur Neuordnung des Wasserrechts in Baden-Württembergs (LT-Drs. 15/4404).</p>	

(Continues)

TABLE A2 (Continued)

Territorial plan: Landesplanungsgesetz (LplG) Baden-Württemberg in der Fassung vom 10. Juli 2003 (GBl. S. 385), zuletzt geändert durch Art. 1 des Gesetzes zur Änderung des Landesplanungsgesetzes, des Gesetzes über die Errichtung des Verbands Region Stuttgart, des Naturschutzgesetzes und des Wassergesetzes vom 14. Oktober 2008 (GBl. S. 338).

^aObtained from Forstwirtschaft-in-deutschland, in the following link: <https://www.forstwirtschaft-in-deutschland.de/index.php?id=84&L=1> (undated).

^bAs mentioned in the “Risikoanalyse Wald - Praxisorientierter Leitfaden - Band 12”, obtained from the IRP dedicated page from the Regierungspräsidien Baden-Württemberg, in the following link.