

Emerging circular bioclusters: A comparison of two forest-based bioclusters in southern France

Circular bioclusters are emerging as regional models capable of combining economic development and environmental preservation, particularly in rural areas rich in bioresources. Based on the systemic integration of productive activities, they aim to optimize material and energy flows while anchoring value at the local level. Despite their documented potential—reducing emissions, maintaining local employment, and adding value to co-products—their practical implementation remains uncertain. Many initiatives fail in the early stages due to a lack of sustainable coordination between stakeholders or collective ownership of the resource.

This article focuses on the still little-studied emergence phase of bioclusters, during which interactions, tensions, and convergences around bioresources remain informal and fragmented. The central hypothesis is that the activation of a bioresource as the basis for a circular project depends less on technical conditions than on social, symbolic, and institutional dynamics. The objective is therefore to identify the conditions of governance and communalization that enable local actors to organize collectively around a bioresource in order to initiate a circular biocluster.

The analysis is based on a combination of several theoretical frameworks. Work on clusters highlights the importance of geographical proximity and interdependent networks in stimulating innovation. Research on circular bioclusters adds to this the principles of the bioeconomy and the circular economy, emphasizing the cascading valorization of biomass and territorial industrial ecology. However, these approaches often remain focused on techno-economic performance, neglecting the relational dynamics that drive emergence.

To fill this gap, the article draws on the concept of communalization, inspired by the theory of commons and transition communities. The emergence of a territorial collective is based on three interdependent dimensions: shared representations (common constructs), coordinated actions, and feelings of belonging and trust. Bioresources are viewed as malleable resources, invested with multiple meanings that can generate controversy or convergence. The economy of proximity sheds light on how geographical, cognitive, social, and institutional dimensions promote—or hinder—cooperation. Finally, multi-level governance allows us to analyze the relationship between local bottom-up dynamics and top-down institutional frameworks in the stabilization of collective projects.

The research is based on a comparative study conducted in the forest socio-ecosystem of the Cévennes, focusing on two bioresources: the chestnut tree (*Castanea sativa*) and the maritime pine (*Pinus pinaster*). These two resources coexist in the same territory but have contrasting trajectories in terms of economic development and collective

structuring, which makes it possible to isolate the social and institutional mechanisms at work.

A comprehensive qualitative approach was favored in order to capture the representations, controversies, and relational dynamics specific to the emergence phase. Twenty-four actors were interviewed in fifteen individual interviews and four group interviews. The sample includes forest owners, professional organizations, processing companies, public institutions, and research organizations. The thematic analysis combines deductive coding, based on three community dimensions (representations, actions, feelings), and inductive coding focusing on forms of proximity and governance mechanisms. This method aims to reveal sometimes latent social dynamics, rather than to measure stabilized economic performance.

The comparison highlights that similar institutional and sectoral architectures can produce profoundly divergent dynamics of emergence. In both cases, there are comparable actors (owners, companies, professional organizations, public institutions, researchers) and formal coordination mechanisms. However, the processes of communalization differ significantly.

The chestnut tree is characterized by a plurality of loosely articulated representations. A dominant heritage narrative places it firmly in the collective memory, but tends to sacralize the resource and hinder its exploitation. A second, declineist narrative emphasizes its decline and lack of profitability, fueling a sense of economic deadlock. A third, more marginal narrative promotes an ecological and multifunctional vision. These narratives do not converge towards a common strategic vision, producing contradictory injunctions and fragmenting collective action. The cooperation observed remains local and informal (mutual aid between owners, ad hoc associations) without translating into a structured value chain. Geographical and identity-based proximities exist but remain dormant, lacking the mediation capable of activating them. Furthermore, multi-level governance appears disjointed: the superimposition of regulatory mechanisms and the absence of legitimate key players perpetuate a game of passing the buck, preventing the consolidation of a collective project.

Conversely, the maritime pine is benefiting from active symbolic reclassification. Long stigmatized, it is now the subject of a credible productive narrative, supported by concrete demonstrations (experiments in resin tapping, furniture prototypes, processing projects). These socio-technical demonstrators function as mediating objects: they transform forward-looking narratives into tangible evidence, reduce uncertainty, and highlight the interdependencies between forestry, processing, and commercial outlets. Formal (forestry charters, interprofessional organizations) and informal cooperation are linked in a cumulative learning process. Trust is built through action, supported by intermediaries capable of translating local initiatives into institutional frameworks.

Multi-level governance appears more coherent: public mechanisms prioritize the resource and support experimentation, reinforcing the legitimacy of the project.

Thus, the emergence of a circular biocluster depends not only on the presence of the three community dimensions, but also on their articulation through socio-technical mediation, activated proximities, and governance capable of linking local initiatives and institutional frameworks. The contrast between chestnut and maritime pine illustrates how similar resources can follow opposite trajectories depending on the territory's ability to transform latent potential into stable collective commitments.

This study aimed to understand how a territory can initiate the emergence of a circular biocluster around a local bioresource. It analyzed the progressive structuring of a territorial community around the bioresource. To this end, we used an analytical framework that articulates the systemic framework of Labrousche et al. (2025), the community framework of Christiansen et al. (2025), proximity economics (Boschma, 2005; Torre & Rallet, 2005), and multilevel governance (Bache & Flinders, 2004; Hooghe & Marks, 2010). The systematic comparison of two Cévennes forest bioresources (i.e., chestnut tree and maritime pine) enabled to isolate analytically the mechanisms that contribute to explaining why territories with very similar structural set ups may follow radically divergent pathways.

The results confirm that the emergence of a circular biocluster is based on a communication process but reveal that the simple co-presence of Christiansen et al.'s (2025) three dimensions does not guarantee a stable dynamic. Their effectiveness depends on their coupling with complementary mediations: concrete demonstrations converting narratives into tangible evidence, institutional engineering closing the value chain, and legitimate pivot actors capable of translating between heterogeneous registers. The case of chestnut tree illustrates how dormant and negative proximities, combined with dysfunctional governance characterized by the unarticulated coexistence of bottom-up and top-down levels, may prevent emergence despite real local dynamics and significant inherited territorial capital. The maritime pine case shows conversely how functional multilevel governance, supported by sectoral relay actors and socio-technical boundary objects, may support communalization.

On the theoretical level, this study makes three main contributions. It introduces the concepts of dormant and negative proximities, enriching proximity economics which traditionally treats these dimensions as static endowments (Boschma, 2005; Ayrapetyan & Hermans, 2020). It highlights the role of socio-technical mediations as critical catalysts for activating passive proximities, a dimension absent from classic frameworks but consistent with work on boundary objects (Star & Griesemer, 1989; Vinck, 2009). It finally reveals that multilevel governance does not constitute an external framework but actively co-produces communalization through its capacity to articulate bottom-up initiatives and top-down frameworks, thus enriching the propositions of Bache & Flinders (2004) and Hooghe & Marks (2010). On the methodological level, the mobilized design enables demonstrating that observed divergences do not result from differences in territorial endowment but from specific social and institutional processes, opening the way to a finer analysis of causal mechanisms at work in bioeconomic transitions.