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Conciliation or a confrontation of agricultural visions? A characterisation of the networks and key actors for sustainable agrifood transformations in the Bauges

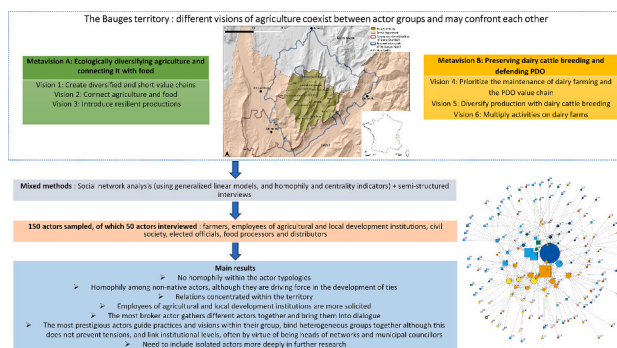
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HIGHLIGHTS

- Within a given territory, different groups hold different visions of what should be agriculture and may confront each other
- The study aims to understand how the different groups interact, and to characterise the key actors and their roles
- The article uses mixed methods: social network analysis and semi-structured interviews among a diversity of agrifood actors
- Results showed no homophily within the actor typologies, but there was homophily among non-native actors
- Key actors can play three roles: guide visions within their group, bind heterogeneous groups and link institutional levels

GRAPHICAL ABSTRACT



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ABSTRACT

CONTEXT: In French mountain territories, origin-linked quality schemes have been widely used to address competition from more productive regions, but such schemes have tended to specialise a territory's agriculture around specific products. Today, these territories are marked by the arrival of "left-returned" and new residents, who develop alternative production methods and grassroot initiatives based on agroecological principles and food production relocation. The different groups within the territories hold different visions of what should be agriculture and may confront each other. Sustainable agrifood transformations need to account for the diversity of visions among the variety of actors to enrich transition pathways.

OBJECTIVE: The aim of this article is to analyse relationships among a diversity of agrifood actors who have different visions of agriculture in a territory in order to characterise the structure of their relationships and the key actors. More specifically, it seeks, first, to analyse whether actors sharing the same characteristics interact more or not, and whether individual attributes stimulate or constrain relations among the diverse range of actors; and second, to characterise the key actors (i.e. prestigious and brokers) and their roles.

METHODS: The study was conducted in a French alpine territory specialising in extensive dairy cattle breeding to produce protected designation of origin (PDO) cheese. We use mixed methods, combining a social network analysis (regression models, and homophily and centrality indicators) with semi-structured interviews to analyse

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the discussion network of the diverse actors involved in agriculture and food in the Bauges (including farmers, elected officials, processors, distributors, members of civil society, and employees of agricultural and local development institutions).

RESULTS AND CONCLUSIONS: The analysis showed that there is no homophily within the actor typologies, and that relations were concentrated within the territory. Some actors were more important for developing ties, especially the employees of agricultural and local development institutions, who were more solicited by others. However, the results revealed homophily among non-native actors, although they are driving force in the development of ties, demonstrating both their ability to forge links and relational barriers with natives. After that, the most influential broker actor was the park employee in charge of agriculture, who holds a pluralist vision and has a central role in gathering different actors together and bringing them into dialogue. The most prestigious actors were the park employee, a civil society actor, and four farmers. These actors all fulfil three main functions: to guide practices and visions within their group as key actors often hold a clear-cut vision, to bind heterogeneous groups together (although this does not prevent tensions and conflict with these actors), and to link institutional levels, often by virtue of being heads of networks and municipal councillors. However, the methodology did not allow the integration of more isolated actors, especially dairy cattle breeders, who should be included more deeply in further research.

SIGNIFICANCE: To better understand the dynamics of sustainable agrifood transformations, the relational approach enables analysis of the patterns of relationships between multiple actors with different agricultural visions, and to characterise the key actors and their roles. From the perspective of accompanying agrifood transformations, it is helpful to understand the relational structures between the actors in order to avoid the possible conflicts that could arise in such research. Moreover, it is useful to identify and mobilise key actors in order to facilitate researchers' entry into a territory and increase participation.

1. Introduction

Sustainable agrifood transformations depend on the involvement of a wide range of actors (farmers, advisors, elected officials, processors, distributors, civil society, etc.) to enable the co-construction of transition pathways (Coquil et al., 2018; Hazard et al., 2022; Hazard et al., 2020; López-García et al., 2021). Within a given territory,¹ a diversity of visions is carried by a variety of actors, which mean that sustainability transformations are complex dynamics. Visions are considered as ways to understand an object or a situation, and reflect collective references to be defended or criticised (Pachoud et al., 2024). Transformation dynamics require the integration of the diversity of visions in order to be inclusive and to address conflicts (Lamine et al., 2021). From the perspective of accompanying agrifood transformations, it therefore appears crucial not just to identify the visions (Penvern et al., 2023), but also to understand how the different groups interact, and to characterise the key actors' orientating visions and linking different groups of actors together.

The aim of this article is to analyse the relationships among a diversity of actors who have different visions of agriculture in the Bauges territory in order to characterise the key actors there and the structure of their relationships. More specifically, it aims to answer the following questions: Do actors sharing the same characteristics interact more, or not? Which individual attributes stimulate or constrain relations among this diverse range of actors? Who are the key actors, and what are their roles?

This study employs Social Network Analysis (SNA), which offers a set of methods to analyse human relational structures. Many studies have used SNA to understand innovation processes in agriculture, most of which have focused on farmers' networks and the relations that surround them, especially with regard to extension agents, in innovation processes (Aguilar-Gallegos et al., 2015; Aguirre-López et al., 2020; Cofré-Bravo et al., 2019; Dolinska and d'Aquino, 2016; Isaac, 2012; Ramirez et al., 2018; Skaalsveen et al., 2020; Wood et al., 2014). These studies have shown that a good balance of interactions between peers and with experts is necessary to foster the process and adoption of innovation. Some researchers have also analysed networks among a

larger diversity of actors of agrifood systems (Cholez et al., 2023; Pachoud et al., 2019, 2020; Polge and Pagès, 2022) and demonstrated the role of cooperation among different actors in promoting change within the agri-food system, and also with institutional actors to fulfil advocacy functions. In addition, a growing body of literature focuses specifically on the roles of actors and explores how they can stimulate or block innovation (Gaitán-Cremaschi et al., 2022; Hermans et al., 2013; Klerkx et al., 2010; Klerkx and Leeuwis, 2009) or facilitate sustainable transformation processes (Kivimaa, 2014; Kivimaa et al., 2019; Martiskainen and Kivimaa, 2018). Three main functions of key actors have been described: knowledge co-creation, brokerage, and interactions with institutional levels, each of which can vary according to the needs and phases of the innovation process.

SNA is yet to be mobilised to understand the relationships among actors with different visions in a context of sustainability transformations. Indeed, characterising the key actors and their roles, and understanding how actors with different visions interact is crucial to support sustainable changes in territorial agrifood systems (Penvern et al., 2023). Moreover, prior studies are usually limited to some commonly pre-identified actors (e.g. farmers, institutional actors), while a diversity of agrifood actors can play a role in agrifood transformation dynamics (Polge and Pagès, 2022). This study seeks to build the necessary understanding by including a diversity of actors in the analysis (farmers, agricultural and local development institution employees,² processors, distributors, local elected officials, and members of civil society).

In this article, we analyse the Bauges territory, located in the French Alps.³ The majority of agricultural land in the Bauges is used for extensive dairy cattle breeding to produce 'Tome des Bauges', a cheese with a protected designation of origin (PDO) certification. From the 1980s onwards, more and more farmers, most of whom had recently settled but also some returned residents, developed diversified forms of

² This term includes all agricultural advisors and technicians, and territorial facilitators working in connection with agriculture.

³ This study is part of the TransforMont transdisciplinary research project, and is financed by the cluster of excellence "Innovations and Transitions in Mountain Territories - ITTEM" of University Grenoble-Alpes. It focuses on the analysis and support of sustainable agrifood transformations in the Bauges. This research is a response to a request from civil society actors on how to increase mutual understanding among local actors and was carried out in collaboration with the Regional Nature Park of the Bauges Massif.

¹ Removing its political connotations, we understand territory as space which is socially constructed, culturally marked, and institutionally regulated. It is an outcome of the relations both between human actors and with non-humans within a relatively homogeneous portion of space.

production, usually in organic farming, alongside citizen food initiatives engaging with the idea of food relocation (e.g., cooperative grocery shops, shared gardens, etc.). Pachoud et al. (2024) identified six visions of agriculture among a diversity of actors (farmers, elected officials, employees of agricultural and local development institutions, and members of civil society) in the Bauges: (1) Creating diversified and short value chains, (2) Connecting agriculture with food, (3) Introducing resilient production, (4) Prioritising the maintenance of dairy farming and the PDO value chain, (5) Diversifying production with dairy cattle breeding, and (6) Multiplying activities on dairy farms (see Table 1). These visions can be categorised more globally into two metavisions that may appear antagonistic, and may therefore lead to tensions and conflicts between groups of actors. The two groups particularly disagree on the place and future of dairy cattle breeding in the territory, the possibility of other forms of production, the perimeter of food autonomy and the best form of agriculture ecologisation (PDO vs organic farming labels). Firstly, metavision A, which encompasses visions 1, 2, and 3, mostly includes organic diversified farmers and processors, along with civil society actors. Then, metavision B comprises visions 4, 5, and 6, and includes cattle breeders producing milk to make PDO Tome des Bauges. Elected officials and employees of agricultural and local development institutions are present in both metavisions A and B.

We analyse the discussion network of the diverse actors involved in agriculture and food in the Bauges using regression models, homophily and centrality indicators, and semi-structured interviews. Discussion relationships refer to relationships featuring formal and informal discussions on concerns about agriculture and food issues (i.e., people who discuss their concerns about the agriculture and food issues in the territory, such as climate change, access to land, agricultural diversification, etc., and with whom). Focusing on discussion relationships makes it possible to integrate a wide diversity of actors related to agriculture and food into the analysis (i.e., farmers, employees of agricultural and local development institutions, elected officials, members of organised civil society, and food processors and distributors). Moreover, examining relationships which engage in discussion of concerns about

agriculture and food issues enables the analysis to focus on visions and agri-food transformations, including how actors are committed to responding to the issues they mention. Snowball sampling was carried out from 15 seed actors who were deemed to be central in preliminary interviews and represent a diversity of typologies (three farmers, three agricultural and local development institution employees, three civil society actors, two elected officials and one processor/distributor⁴). Actors cited more than twice were then also interviewed. A total of 55 actors were interviewed to analyse their discussion relationships (34 farmers, nine agricultural and local development institution employees, six civil society actors, three processors and distributors, and three elected officials). These semi-structured interviews with the 55 actors supplemented the information provided by the network analysis, particularly with regard to the actors' social characteristics, practices, visions, and tensions. In the end, the network included 150 actors: 55 actors who were interviewed, and 95 actors cited but not interviewed.

To respond to the objectives of this article, we firstly analysed whether ties are more frequent among similar actors (homophily) based on four individual attributes (actors' typology, being native or non-native of the Bauges, localisation, elected in municipal councils or not), using a homophily indicator (*E-I* Index). We assumed that balanced intra- and intergroup relationships facilitate exchanges and mutual understandings among a diversity of actors, while supporting changes within groups (Aguilar-Gallegos et al., 2015; Dolinska and d'Aquino, 2016; Kratzer and Ammering, 2019; Newman and Dale, 2007). Secondly, we analysed how different individual attributes shape the network structure, using linear regression models. The aim was to establish whether certain actors' attributes (actors' typology, being native or non-native of the Bauges, localisation, elected in municipal councils or not), facilitate the development of ties (degree), and more specifically, solicitation for discussion (indegree). We hypothesised that actors with particular social characteristics, in particular a higher formal status and geographical proximity, facilitate the formation of ties (Pachoud et al., 2019, 2020). The individual attributes were obtained through semi-structured interviews. Thirdly, we identified and characterised the key actors by means of indicators measuring actors' centrality coupled with semi-structured interviews. We identified the most prestigious actors, who were the most cited (Wasserman and Faust, 1994), and the brokers, who connect different groups of actors (Burt, 2014). We hypothesised that key actors, due to their individual characteristics, may play a guidance role in orienting visions and in circulating visions among actors in heterogeneous networks and towards hierarchical institutional levels (Hermans et al., 2013; Klerkx et al., 2010). These roles seem complementary in sustainable agrifood transformation, in terms of increasing mutual understanding, proposing new ways of doing and thinking locally, and advocating for institutional change.

In the next part of the paper, we present the Bauges context. In the third part, we develop the methods. In the fourth and fifth parts, we outline the results and discussion respectively. Finally, we present the conclusion in the sixth part.

2. The Bauges territory

The mountainous territory of the Bauges (in French: *Coeur des Bauges*) is located in the French Pre-Alps in the department of Savoie. It includes 14 municipalities and has around 5000 inhabitants. The Bauges territory is located in the Regional Nature Park of the Bauges Massif (hereinafter referred to as 'the park') and in the community of municipalities of Grand Chambéry (see Fig. 1). The vast majority (>99%) of the agricultural land in this territory is used for dairy herd grazing and

Table 1

The two metavisions and related visions, as analysed in the Bauges.

Metavision A: Ecologically diversifying agriculture and connecting it with food	Metavision B: Preserving dairy cattle breeding and defending PDO
<ul style="list-style-type: none"> - Support for small-scale and diversified value-chains, which rely on organic farming labels - Wish to increase food autonomy in the territory - Critical of agricultural specialisation in the Bauges and the lack of resilience of dairy cattle breeding in the face of climate change 	<ul style="list-style-type: none"> - Preservation of extensive dairy cattle breeding in the Bauges, based on pedoclimatic and historical arguments - Defence of the PDO specification and collective organisation - Wish to rationalise farms to make them more economically viable
<p>Vision 1: Create diversified and short value chains Diversify production based on organic farming and develop the local market in the context of the territory's specialisation.</p> <p>Vision 2: Connect agriculture and food Produce to feed local inhabitants, with the objective of food autonomy.</p> <p>Vision 3: Introduce resilient production Develop agricultural production in a way which adapts to global warming, and most importantly, is resilient to droughts.</p>	<p>Vision 4: Prioritise the maintenance of dairy farming and the PDO value chain Maintain dairy cattle breeding and PDO cheese production in cooperatives as the main value-chain. Diversify other production on marginal land not dedicated to dairy cattle breeding.</p> <p>Vision 5: Diversify production with dairy cattle breeding Maintain dairy cattle breeding in the territory via complementary production as a way to address climate change.</p> <p>Vision 6: Multiply activities on dairy farms Diversify the production activities on dairy farms (e.g. milk, meat, cheese) and emphasise direct sales to reduce external shocks.</p>

⁴ Processors and distributors were grouped together because they represent fewer actors, and because this particular actor is the director of both a dairy cooperative and a supermarket.

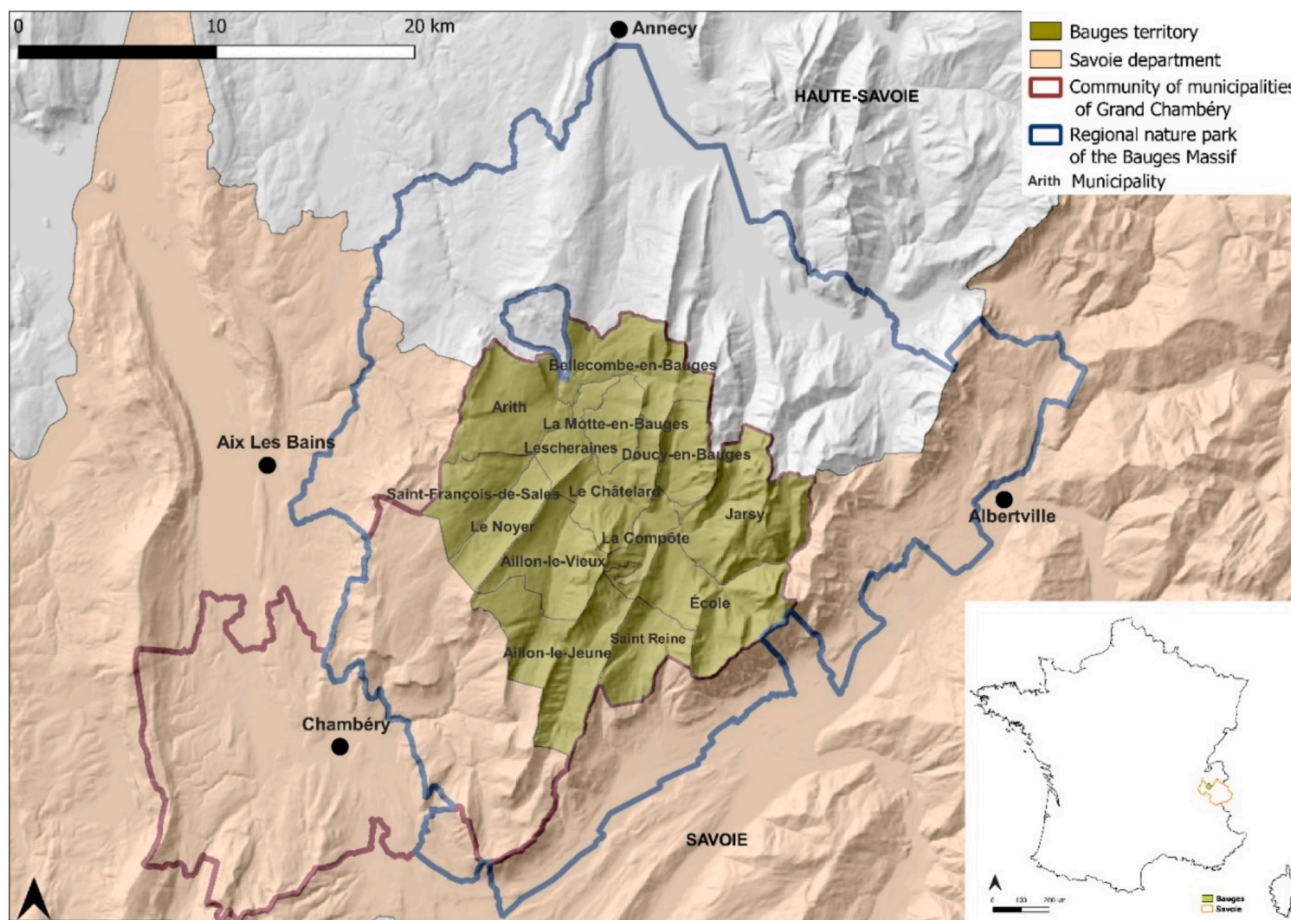


Fig. 1. Location of the Bauges territory and its associated administrative regions.

forage production (Registre parcellaire graphique RPG, 2021). In order to remain competitive with lowland areas, actors in the dairy value-chain created directly-managed cooperatives in the 1980s and obtained PDO certification in 2002. Today, 95% of the milk produced there is valued as PDO Tome des Bauges. The cheese is mostly sold within the Savoie department, although some is also sold nationally.

The PDO certification imposes exacting specifications that made it possible to limit intensification on farms, including a limitation of production per cow to 5500 kg/year, and stipulations that at least 50% of the herd are composed of two local breeds (Tarine and Abondance) and that 70% of the fodder must come from the designation area. Despite its territorial anchorage, the extensive breeding model relies on external inputs for the cows' feed concentrates and pasture fertilisation. Moreover, most farms involved in the origin-linked quality scheme have become increasingly capitalised and technologised. The farmers' economic model is largely based on aid per hectare from the first pillar of the EU's Common Agricultural Policy (CAP), which has led to an expansion of farms. Nowadays, the origin-linked quality scheme tends to give priority to economic performance, while the ecologisation of practices is generally not the main objective (today, only one dairy farm in the Bauges is organic). Moreover, because the PDO milk price is above the national average, there is no pressure to diversify production. However, climate change, and in particular summer droughts, render the dairy cattle system increasingly vulnerable, as droughts reduce grassland productivity and impact forage autonomy.

The Bauges experienced a steep population decline until the 1980s. This decade marked the beginning of a new period of demographic growth, with the arrival of "left-returned" and new residents that still persists today. Some of these inhabitants have developed alternative agricultural production methods, most of which are certified organic,

alongside farm-marketing or short marketing channels. These forms of agricultural production mainly concern fruit, vegetables, medicinal and aromatic plants, and goats and sheep for cheese production. However, diversification remains limited to production that is marginal in terms of surface area compared to dairy farming, and which is often established on land with poorer agronomic qualities. Access to land is a major issue for farmers wishing to set up in the Bauges. Nevertheless, alternative practices are increasingly challenging the origin-linked quality scheme in the Bauges, which is increasingly considered part of the conventional model (Frayssignes et al., 2022). Moreover, the appeal of local products is somewhat at odds with the rationale behind origin-linked qualification schemes, which generally aim to move products out of their territory of origin for sale. However, Frayssignes et al. (2022) affirmed that the relevance of some founding principles of PDO production need to be reasserted if they are to acquire legitimacy in sustainable transformations, such as the strong collective dimension, high quality control, and links to the territory.

With a growing demand for local, organic, and diversified products, some inhabitants, most of whom are new residents, are getting involved in a wide range of citizen initiatives that aim to link agriculture based on agroecological principles with food. The defenders of these alternative models emphasise their autonomy, their direct relationship with consumers, and their greater awareness of ecological issues (Pachoud et al., 2024). The most visible citizen initiative is the cooperative Croc' Bauges, a grocery store created by a group of local inhabitants in 2014, which offers a variety of local and organic products. A second such initiative is the Et Maintenant association, created in 2019, which aims to be a place for reflection and action among residents wishing to engage in an ecological transition in the Bauges. One of the initiative's strategic themes is "feeding ourselves", and it advocates for greater food

autonomy in the territory. Among its main actions has been the creation of shared gardens.

The different groups of actors linked to different production systems inevitably have different visions of agriculture in the Bauges. Pachoud et al. (2024) identified six visions, which are presented in Table 1, below. The visions are grouped into two metavisions, which are mainly divided in terms of the place and future of dairy cattle breeding in the territory, the possibility of other forms of production, the perimeter of food autonomy, and the best form of agriculture ecologisation (PDO vs organic farming labels). These points of disagreement may lead to tensions or even conflicts between the groups of actors. Metavision A, which encompasses visions 1, 2, and 3, includes mostly organic diversified farmers and processors, alongside some civil society actors. A second metavision, B, comprises visions 4, 5, and 6, and notably includes cattle breeders producing milk to make PDO Tome des Bauges. Elected officials and local and agricultural development institution employees are present in both metavisions A and B. The analysis also showed that some actors held plural visions combining the two metavisions.

3. Methods

3.1. Sampling and data collection

Initially, meetings were held with actors from the regional nature park and the Et Maintenant association to understand the context and agri-food issues in the territory. Twenty-eight actors were then identified as interview participants in order to gain a deeper understanding of the territory's agri-food context and to analyse the different visions held by these actors (see Pachoud et al., 2024).

Based on this preliminary work, fifteen actors were selected as the initial sample group for the network analysis. The use of cross-interviews (Grossetti et al., 2011) in a preliminary work to characterise agricultural visions (see Pachoud et al., 2024) enables the identification of seed actors. These actors were regularly cited in interviews and identified as important in relation to agriculture and food in the Bauges. They were also selected according to their typology in order to ensure the inclusion of a variety of profiles. Initially, the sample included three dairy farmers, three non-dairy cattle farmers, three agricultural and local development institution employees, three civil society actors, two mayors, and one processor/distributor.

A name generator was used to document the social network (Waserman and Faust, 1994). This method involves asking interviewees to cite the names of individuals who they are connected with. We looked for discussion relationships and asked each actor to name the people with whom they shared formal or informal discussions about their concerns regarding the territory's current or future agricultural and food issues (i.e., "With whom do you formally or informally discuss your concerns related to agriculture and food issues in the Bauges?"). The aim was not to collect details of all discussions relating to agriculture and food (e.g., technical advice). The issues raised in the discussions were first identified through semi-structured interviews, and were mainly related to climate change, in particular summer droughts, access to land to develop new farms, land use conflicts, the possibility of diversifying production, marketing techniques and consumer habits, the ecologisation of farming practices and related labels, the different visions present in the territory, and any underlying conflicts. In instances when the interviewee had difficulty in understanding the question, the semi-structured interviews allowed the interviewer to direct the question to issues mentioned previously (e.g., "With whom do you formally or informally discuss your concerns about summer droughts?"). Formal or informal discussions were sought in order to include a diversity of actors and discussions in the sample (e.g., professional discussions with agricultural advisors, informal professional discussions between farmers, informal discussions between farmers and civil society, and so on). To ensure that the interviewees did not omit any categories of actors, each typology was specified following the question (i.e., farmers, agricultural

and local development institution employees, elected officials, civil society actors, food processors, and distributors). Discussions linked to concerns about agriculture and food issues also allowed the analysis to focus on transformation dynamics, as it was possible to understand how the actors felt about the issues raised, and how they imagine the future of agriculture and food in the territory.

Based on the citations gathered from the initial fifteen actors, snowball sampling was carried out, resulting in actors who were cited more than twice being interviewed. The snowball sampling was not limited to the Bauges, so it revealed whether local actors had established contacts outside the territory. We decided to focus on actors mentioned more than twice, as interviewing all the actors linked to agriculture and food in the Bauges and beyond would have required amounts of financial resources and time which were not compatible with the funding and timeline of the project. In the end, we stopped snowball sampling having interviewed 55 actors (see Table 2) who were selected according to the decreasing number of citations in the course of the interviews.

Semi-structured interviews were also conducted with the 55 actors. In each case, the semi-structured interview was performed before the name generator to try to make the interviewee feel more comfortable and confident. Actors were asked to introduce themselves, and to specify whether or not they were natives of the Bauges (i.e., whether their parents were from the Bauges and if the actor grew up in the Bauges). If they were from the Bauges, they were asked whether they had already moved away (e.g. to study). If they were new residents, they were asked to give the date of their arrival in the Bauges and their region of origin. In addition, actors were asked if their parents were farmers, to state their current job, and to list the agrifood collectives in which they were involved (associations, unions, etc.). Then, they were asked to talk about their activities and/or engagement in agriculture and food, to explain the issues they had encountered or were aware of, and the concerns they had, to explain their current and future vision, and to describe any tensions or conflicts they knew of. The farmers were asked to describe their practices and cite any label certifying their production. The semi-structured interviews enabled us to position the actors according to the vision they most closely represented.

Most of the actors interviewed were located in the Bauges. Three farmers (an aromatic plant producer, a market gardener, and a PDO cattle breeder) and a mayor in charge of agriculture at the park were located in municipalities bordering the Bauges territory. Of the employees of agricultural and local development institutions, only two were located in the Bauges, while seven were in Chambéry (the departmental prefecture of Savoie, located in the Bauges massif) (see Fig. 1).

Ultimately, a total of 150 actors were cited in the discussion network: 55 of those actors were interviewed, and a further 95 were cited but not interviewed. Among the 95 actors who were only cited, 16 were cited twice and 79 once (see Table 4)

3.2. Social network analysis

We analysed the directed discussion network generated by the formal and informal discussion relationships cited by all the interviewed actors. Our two aims were to qualify the network's structure and to characterise the key actors in the network. These analyses were conducted with R version 4.3.0, using the package igraph (Csardi and Nepusz, 2006), for measures of homophily and centrality and linear regression models.

In order to analyse homophily, i.e., the ties observed at a higher rate among similar rather than dissimilar individuals (Hoffman and Chabot, 2023), we used the E-I index proposed by Krackhardt and Stern (1988). This index captures the relative prevalence of between- and within-group ties and can be interpreted as a measure of homophily. The equation is:

$$E - I \text{ Index} = EL - IL / EL + IL$$

Table 2
Typology of actors interviewed.

Typology	Total number	Production	Number			
			PDO	PDO and organic	Organic	Without label
Farmers	34	Dairy cattle breeders	7	1	1	1
		Dairy cattle and small ruminant breeders	2			
		Small ruminant breeders			4	1
		Pig farmer				1
		Producers of aromatic and medicinal plants			6	
		Fruit growers			5	
		Market gardeners			3	
		Horticulturist				1
		Mushroom producer			1	
Elected officials	15 ¹	Title			Number	
		Mayors			2 ²	
		Municipal councillors			12 ³	
Organised civil society	6	Mayor in charge of agriculture at the regional nature park (neighbouring municipality of the territory)			1	
		Croc Bauges volunteers			4	
Employees of agricultural and local development institutions	9	Et Maintenant volunteers			2	
		Park employee in charge of agriculture			1	
Food processors and distributors	3	Tome des Bauges union employee			1	
		Chamber of Agriculture advisors			4	
		Land engineer at the land development and rural establishment company			1	
		Employee in charge of agriculture at Grand Chambéry			1	
		Employee in charge of agriculture at the Savoie department			1	
		Organic brewer			1	
		Organic cider			1	
		Director of a dairy cooperative and a supermarket			1	

¹ Twelve elected officials also belong to another typology (see ² and ³).

² One actor is both a mayor and a dairy cattle breeder.

³ Among the twelve councillors, nine are also farmers (of which four are dairy cattle breeders), one is from organised civil society, and one is an employee of an agricultural institution.

EL: external ties; IL: internal ties.

In order to analyse whether or not individual attributes play a role in developing discussion relationships (degree: total number of links to and from a node), and more specifically in an actor being solicited for discussion (indegree: links to a node), we used a generalised linear model (GLM) (Nelder and Wedderburn, 1972), with Poisson distribution. The outdegree effect was not measured, as citations were not collected from actors who were not interviewed.

The attributes we selected for the analysis of the network structure (homophily and (in)degree) are listed in Table 3, below. Information was obtained through the semi-structured interviews with the actors. The estimate coefficients of the GLM were interpreted in relation to a reference attribute. The hypotheses upon which the reference attributes were chosen are presented in Table 3. They were formulated on the basis of field observations, previous analysis (Pachoud et al., 2024), and a literature review.

In order to identify the key actors in the discussion network, we computed two indicators to measure each actor's centrality. First, the indegree centrality represents the number of edges incoming to a node and is commonly used to measure popularity and prestige (Wasserman and Faust, 1994). Then, the betweenness centrality measures the number of times a node lies on the shortest path between other nodes (Borgatti et al., 2018). It allows the identification of actors in brokerage positions, which means those who act as "bridges" between other actors or groups in the network, and specifically if they are givers or receivers of links (Burt, 2014).

4. Results

4.1. Typology of the actors sampled in the discussion network

Fig. 2 presents the discussion network among the interviewed actors.

Number of nodes: 150

Number of ties: 386

Density (ratio between the number of ties present and the number of possible ties): 0.02

Reciprocity (proportion of nodes mutually cited): 0.30

Transitivity (proportion of two nodes linked together also linked to a third node): 0.19

Table 4 presents the typology of actors interviewed for the study and cited, sorted by geographical location.

The discussion network thus includes a wide range of actors linked to agriculture and food in the Bauges. Most of the actors we interviewed, and therefore those who were most frequently cited, are located in the Bauges. Relationships are thus concentrated in the territory, except for the agricultural and local development institution employees who are mainly located in Chambéry. Only three of the interviewed farmers are located in neighbouring municipalities, but they maintain strong links with the territory, as one farmer used to live there, another is the president of a local farmers' association, and a third is on the board of directors.

A posteriori, we were able to compare the number of farms sampled (through the farmers cited or interviewed) with a list of all the farms in the Bauges. Among the 45 dairy cattle farms in the territory, breeders from ten farms were interviewed, those from 19 farms were cited, and the remaining 16 farms were not sampled. Among the 37 non-dairy cattle farms, farmers from 20 farms were interviewed, those from four farms were cited, and twelve farms were not sampled. Moreover, we checked that every agricultural and local development institution employee working in the Bauges was cited or interviewed.

In relation to most of the typologies, the majority of actors were cited but not interviewed (as they only received two or one citations). However, non-cattle farmers and employees of agricultural and local development institutions were proportionally more interviewed than other

Table 3
Individual attributes used for analysing the (in)degree and homophily effects.

Individual attributes	Description	Hypothesis indicating the reference attribute
Typology	Type of actors (i.e., dairy breeders, non-dairy farmers, civil society, employees of agricultural and local development institutions, elected officials ¹ , food processors and distributors)	Employees of agricultural and local development institutions develop more ties (degree) and are more likely to be solicited for discussion (indegree) (based on field observations and Pachoud et al., 2019)
Category	Length of life in the Bauges (native, not native, or living outside the Bauges)	Non-native residents develop more ties (degree) and, more specifically, are more likely to be solicited for discussion (indegree) (based on actor narratives and Pachoud et al., 2024)
Localisation	Localisation of the actors (Coeur des Bauges, other municipalities in the massif, in the valley's cities, other locations outside the Bauges)	Actors located in the Coeur des Bauges develop more ties (degree) and are more likely to be solicited for discussion (indegree) (based on field observations)
Municipal council	Elected to a municipal council in the territory (yes, no, or not located in the territory)	Actors elected to municipal councils in the Bauges develop more ties (degree) and, more specifically, are more likely to be solicited for discussion (indegree) (based on field observations and Pachoud et al., 2019)

¹ Only the two mayors and the councillor in charge of agriculture and food in one municipality were placed in the "elected officials" typology, because the other councillors were usually cited according to the other typology to which they belonged (see Table 2). Moreover, one mayor is also a dairy cattle breeder. However, he was classified as a mayor in the analysis because he was specifically cited by others in his role as mayor. To analyse the effect of being elected to the municipal council (mayors + councillors), the attribute "municipal council" was computed.

typologies. This means that they received a minimum of more than two citations. Moreover, non-cattle farmers had established more links in the massif or at upper levels than the other typologies (25 of the farmers cited are located outside the territory).

Turning now to elected officials, based on our list of all the territory's municipalities, it is clear that not many of them were cited. Focusing solely on mayors, two were interviewed and three were cited, from the total of 14 mayors in the territory. The two interviewed mayors are committed to attracting new farmers in their municipality by offering communal land. These mayors have direct links with agriculture, as one is a farmer and the other comes from a farming family. One other municipality, where one councillor is in charge of food and agriculture, is also committed to agrifood issues and wishes to relocate food production as much as possible by offering communal land to future farmers, and also to raise awareness of agri-food issues among local residents by organising theme days.

Turning to organised civil society, six people in this typology were interviewed and 13 were cited, all located in the Bauges. However, it was not possible to compile a complete list of civil society actors involved in agrifood initiatives, as they are volunteers with varying degrees of involvement over time.

In addition, only three food processors and distributors were interviewed, with three others cited once. According to our data, there are at least ten other food processors working in the territory (bakers, brewers, jam makers, a chocolatier, an ice-cream maker, etc.). However, they seem not to interact much with other agri-food actors, probably because they mainly source their raw materials from outside the Bauges, except for the dairy cooperatives which are the main processing facilities for cheese production from local milk. Local products from the Bauges are

generally otherwise processed by the farmers themselves (e.g. cheese makers, jams and cider by fruit growers, syrups and herbal teas by aromatic plant producers, farmhouse goat's and sheep's cheeses, and so on).

4.2. Analysis of homophily

The E-I index found for each individual attribute analysed are presented in Table 5. An E-I score of 1 means complete heterophily and -1 means complete homophily.

These results reveal more heterophily than homophily for the various attributes tested. Homophily was only detected in relation to four attributes.

Concerning the typology, dairy breeders, non-dairy farmers, and agricultural and local development institution employees have an E-I score close to 0. Elected officials and processors and distributors have a strong heterophily. Heterophily is lower for civil society. The absence of strong homophily for each typology suggests that the different typologies are linked to different actors beyond their group. More specifically, the results of around 0 for breeders and farmers mean that they balance their relationships both within and between groups. A stronger heterophily was expected among employees of agricultural and local institutions, as part of their job is to engage in dialogue with a diverse range of actors, including farmers. A score of near 0 suggests that they collaborate equally with their colleagues. Heterophily was expected for elected officials, as a reflection of their representative functions. It was also expected that civil society actors develop relationships with diverse actors beyond their group, gathered through their local initiatives (e.g., the cooperative grocery). Finally, the processors and distributors were few in number, and did not seem connected to each other or to collaborate, even within the same sector.

Then, there is homophily among non-native actors, as the E-I index was near 0 for native and external actors. We expected that neorural people will open up relationships with a diversity of actors, as they tend to have a greater ease in communicating with a diversity of people because of their supposedly higher cultural capital and their previous experiences that have enabled them to expand their network (see Pachoud et al., 2024). Surprisingly, native actors have balanced relationships between the different actor categories, with a slight tendency towards heterophily. We then did not expect to observe homophily between the external actors because most of them do not know each other. These results also suggest that a typology is not associated with the actor's origin, as both native and non-native actors are usually present in a same typology.

Unsurprisingly, there is strong homophily among local actors of the Bauges, as relationships are strongly concentrated in the territory. On the other hand, we expected to observe heterophily for actors located outside the territory because they are not likely to know each other beforehand.

Lastly, there is strong heterophily among actors elected to municipal councils (as elected officials), meaning that municipal council actors relate more to other actors than each other. Actors not elected to municipal councils are rather homophile. As previously mentioned, we assumed that elected officials are linked to different groups of actors in order to fulfil their representative functions. In contrast, non-elected actors tend to connect less with elected actors, because elected officials represent a small part of the population.

4.3. Analysis of the degree and indegree effects

In this section we investigate whether individual attributes have a significant effect on the development of discussion relationships (degree) and on the reception of links in particular (indegree). Table 6 presents the individual attributes included in the model. All the estimated coefficients, standard errors, residuals repartition, and histograms are presented in the Appendix.

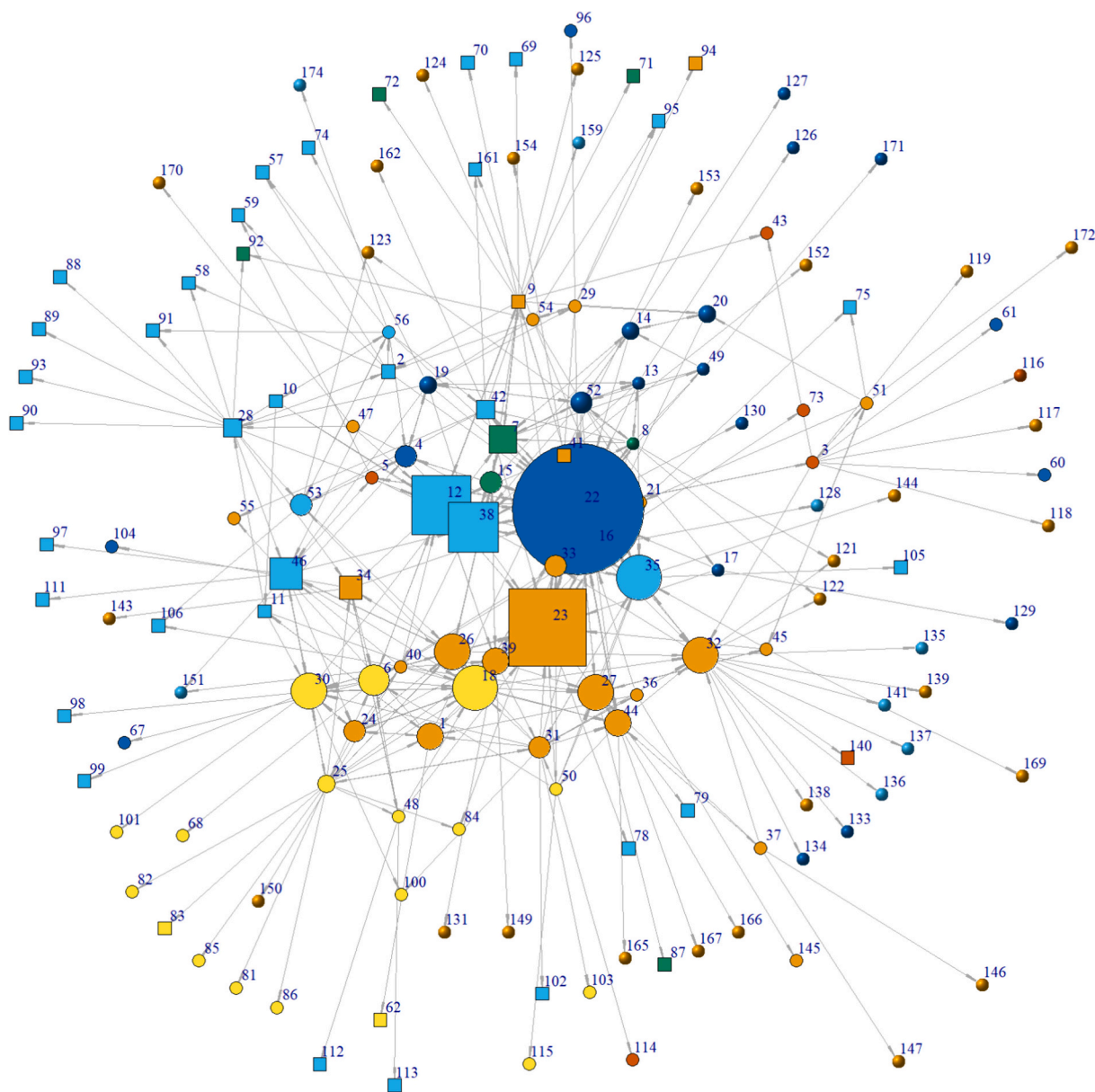


Fig. 2. Discussion network.

Node size = indegree, square = actors from the Bauges, circle = new residents, sphere = actors located outside the Bauges, light blue = conventional dairy cattle breeders, orange = non-conventional dairy cattle farmers, green = employees of local development and agriculture institutions, dark blue = elected officials, yellow = organised civil society, red = food processors and distributors.

Table 4

Typology of actors interviewed and cited sorted by location.

Location	Dairy cattle breeders		Non-dairy cattle farmers		Elected officials (mayors and councillors)		Organised civil society		Employees of local or agricultural development institutions		Food processors and distributors	
	I	C	I	C	I	C	I	C	I	C	I	C
Bauges territory	11	25	20	4	13	9	6	13	2	5	3	3
Remaining municipalities within the nature park	1	9	2	16	2	3	0	0	0	0	0	1
Nearby cities	0	0	0	0	0	0	0	0	7	6	0	0
Locations outside the nature park	0	0	0	9	0	N.A. ²	0	0	0	1	0	0
Total	12	34	22	29	15 ¹	12 + ²	6	13	9	12	3	4

I: interviewed; C: cited.

¹ Twelve elected officials also belong to another typology (see Table 2).

² Information not available.

Table 5
E-I index of the different attributes.

Actor typology	Dairy breeders	−0.03
	Non-dairy farmers	0.08
	Agricultural and local development institution employees	0.08
	Elected officials	0.88
	Civil society	0.18
	Processors and distributors	0.69
Actor category	Native actors	0.07
	Non-native actors	−0.20
	External actors	0.04
Localisation	Bauges territory	−0.68
	Other municipalities of the Bauges massif	0.16
Elected to municipal councils	Valley cities	0.36
	Yes	0.65
	No	−0.17
	External actors	0.04

Table 6
Estimated coefficients and standard errors for the significant parameters of the model.¹

Terms		Estimates (standard errors)	
Degree	Actor typology (reference: employees of agricultural and local development institutions)	Dairy breeders	−0.34 (0.03) *
		Civil society actors	−0.49 (0.001)***
		Processors and distributors	−0.97 (3.4e-05)***
	Actor category (reference: not native residents)	Native residents	−0.69 (1.0e-09)***
		External actors	−2.60 (0.0004)***
	Localisation (reference: the Bauges)	Actors located in other municipalities of the massif	0.75 (2.7e-06)***
		Actors located in valley cities	1.46 (6.8e-14)***
	Elected to the municipal council (reference: elected)	Not elected to the municipal council	−0.44 (1.4e-06)***
		Dairy breeders	−0.60 (0.004)**
		Non-dairy farmers	−0.42 (0.01) *
Indegree	Actor typology (reference: employees of agricultural and local development institutions)	Elected officials	−0.72 (0.006)**
		Civil society actors	−0.72 (0.0005)***
	Actor category	Processors and distributors	−1.30 (0.0002)***
		Native actors	−1.33 (0.03) *
Elected to the municipal council	Not elected to the municipal council	−0.57 (6.65e-06) ***	

¹ Parameter estimates are expressed in log-odds with their standard deviation in parentheses. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

First, the results show that dairy breeders ($-0.34, p < 0.05$), civil society actors ($-0.49, p < 0.001$), and processors and distributors ($-0.97, p < 0.001$) develop fewer relationships when compared to employees of agricultural and local development institutions. There is no significant difference between employees of agricultural and local development institutions' relationships with non-dairy farmers on the one hand and elected officials on the other hand. Concerning the indegree, dairy breeders ($-0.60, p < 0.001$), civil society actors ($-0.72, p < 0.001$), processors and distributors ($-1.30, p < 0.001$), non-dairy

farmers ($-0.42, p < 0.05$), and elected officials ($-0.72, p < 0.001$) are less likely to be solicited for discussion than employees of agricultural and local development institutions. The latter are therefore driving actors in the development of relationships, as are non-dairy farmers and elected officials. However, non-dairy farmers and elected officials are not as important in solicitation for discussion, while employees of agricultural and local development institutions are prioritised by different types of actors seeking to discuss agricultural issues.

Then, native residents ($-0.69, p < 0.001$) and external actors ($-2.60, p < 0.001$) develop fewer discussion relationships compared to non-native residents. Moreover, native actors are less often solicited for discussion than non-natives ($-1.33, p < 0.05$). These results confirm the hypothesis that neoinhabitants are more active in network building, and more requested for discussion, due to their supposedly better ability to communicate (Pachoud et al., 2024).

Surprisingly, actors located in other municipalities of the Bauges massif ($0.75, p < 0.001$) and in nearby cities ($1.46, p < 0.001$) appear to develop more ties than actors located in the Bauges. However, there is no indegree effect, meaning that external actors are not solicited for discussion more often than actors from the Bauges. As relationships are concentrated in the territory, we expected higher degree and indegree effects for actors located in the territory. The actors located in cities are in fact the employees of agricultural and local development institutions, which confirms that these actors are central in the development of the ties. This result is more surprising for the actors of neighbouring municipalities, who comprise breeders, farmers, and elected officials.

Last, actors who were not elected to municipal council tend to create fewer ties ($-0.44, p < 0.001$) and to be solicited less often for discussion relationships ($-0.57, p < 0.001$) than elected actors. These results validate the hypotheses that elected officials are more active in the formation of ties and solicited more for discussion relationships.

4.4. Characterisation of the key actors

In this section, we identify and characterise the prestigious and broker actors, using a combination of descriptive indicators for network analysis (i.e., centrality indicators) and the data gathered in the semi-structured interviews.

The majority of actors received between one and eight citations, and we chose a threshold of ten citations to identify the most prestigious actors. In terms of the betweenness centrality score, the majority of the actors' scores were distributed between 0 and 800, and one actor stood out strongly, with a score of 3179. The most prestigious actors and the strongest broker actors are presented in Table 7.

First, a diversity of typologies is observable among these key actors. The most prestigious actors are four farmers, one employee of an agricultural and local development institution, and one member of organised civil society. Breeders are the most represented typology among the prestigious actors. The employee in charge of agriculture in the nature park was by far the most cited and therefore can be regarded as the strongest broker actor in the network.

A diversity of life paths is also evident among the key actors. There are as many natives as new residents, although the natives may have moved or move regularly to other places (e.g. for study, because the chamber of agriculture is in the city). Farmers come from both family and non-family agriculture backgrounds. The key actors are evenly distributed in terms of gender, and they also share similarities: they are relatively young, at between 30 and 45 years old, are all located within the territory, and tend to be concentrated in the central municipalities.

Among the central farmers, three out of four are organic - and only one breeder representing the PDO value chain is among the most prestigious. The three organic farmers are the territory's pioneers in alternative practices (organic dairy breeding, organic market gardening, supporting the local farmers' market, etc.). According to the results of the semi-structured interviews, they can either act as models or proofs of success, or be the subject of criticism depending on the groups of actors.

Table 7
Characteristics of the key actors (indegree and betweenness centrality) in the discussion network.

Centrality indicator	Id	Typology	Activity	Native or not native of the Bauges	Municipality council	Other mandates	Metavision	Vision	
Indegree centrality (number of citations)	29	22	Employee of local development or agricultural institutions	Employee of the park	Not native	No	No	B	5
	17	23	Non-cattle Farmer	Organic market gardener	Native	Yes	Board of directors of a farmers' association	A	1
	13	12	Cattle breeder	Organic and PDO dairy cattle breeder	Native	Yes	No	A	1
	10	18	Organised civil society	Employee of an association	Not native	No	No	A	2
	10	35	Cattle breeder	Organic dairy cattle breeder	Not native	Yes	No	A	1
	10	38	Cattle breeder	PDO dairy cattle breeder	Native	No	President of an agricultural institution	B	4
Betweenness centrality (index)	3179	22	Employee of local development or agricultural institutions	Employee of the park	Not native	No	No	B	4

In addition, most of these central actors are heads of networks or involved in agricultural organisations, and are often representative of a certain type of visions. The employee of the association is a figure of trust for new residents in defending alternative practices of agriculture, especially for members of organised civil society. The PDO breeder is the president of an agricultural institution and a trusted figure among dairy breeders and institutional actors (advisors and mayors), who cited him the most. Then, the market gardener is on the board of directors of a farmers' association, and initiated the local farmers' market. In addition, the three organic farmers share common sales outlets, such as Croc'-Bauges and farmers' markets, as well as direct sales on their farms. Both organic breeders used to deliver milk to the dairy cooperative, but then left it when they gained organic certification. In fact, the cooperative did not offer a higher price for organic milk, as the low amount of organic milk meant it could not be valued separately from conventional milk. Moreover, the three key farmers with alternative practices hold elected positions in their municipality, giving them higher visibility and formal status.

Concerning the two metavisions, four of the six actors adhere to metavision A (Diversify agriculture ecologically and connect it with food). Except for one conventional breeder, the vision of the farmers is closer to vision 1 (Create diversified and short value chains) in metavision A. The park employee tends to hold a combined vision at the interface of the two metavisions presented in Table 1 (Pachoud et al., 2024). The park employee coordinates a farmers' association and works with all typologies of actors linked to agrifood issues (i.e., breeders, non-dairy cattle farmers, civil society, mayors, etc.). She enjoys a high level of trust from a diversity of actors. Moreover, her geographical location in the Bauges allows her to build closer relationships than other colleagues based in the city.

However, the type of vision held by the key actors does not presuppose that they have oriented relations with actors sharing the same visions, and they tend to exchange with different groups. Nevertheless, the semi-structured interviews showed that relations with different groups of actors sometimes contained tensions. Thus, the central civil society actor defends food autonomy (vision 2: Connecting food and agriculture), as did many actors engaged in civil society (Pachoud et al., 2024). Her radical stance on food autonomy was, however, widely criticised by actors defending the territory's dairy production. Nevertheless, she also has discussions with actors with divergent visions in order to gather information and promote understanding between different groups of actors (elected officials, breeders, employees of agricultural and local development institutions, etc.). Next, the PDO

breeder defends vision 4 (Diversifying other production at the margins) and is often criticised by actors adhering to metavision A. Nevertheless, this actor has often provided assistance to non-dairy cattle breeders, even recently settled ones, by lending them land or offering to carry out agricultural tasks with his equipment. Meanwhile, the organic PDO breeder is positioned at the interface of the different groups of farmers in terms of practices (PDO and organic milk production). However, the interviews revealed some tensions with conventional breeders, who did not understand his decision to go organic (as they believe that PDO certification provides a territorial anchorage for production). He believed it was important to get organic cow feed concentrates in addition to the PDO certification and to have a smaller farm in terms of number of cows per worker, which would be enabled by the higher organic milk price.

5. Discussion

In this section, we will first discuss the results of the study, before reflecting on the methodology and presenting some of its limitations.

In the network structure analysis, we were surprised to find no strong homophily within the actor typologies. In agriculture, studies generally show the importance of homophily to the sharing of knowledge and norms in innovation processes, and of heterophily in enabling the circulation of resources, new ideas, and practices (Giroux et al., 2023; Isaac, 2012; Levy and Lubell, 2018; O'Sullivan et al., 2022; Wood et al., 2014). A good balance between intra- and intergroups relationships therefore appears useful in supporting transformation dynamics in the Bauges. In fact, interactions among actors in different typologies, who often hold different visions (see Pachoud et al., 2024), enable mutual understanding and collaboration to be built. However, elected officials, and processors and distributors, respectively, were not noticeably connected. On the one hand, elected officials should be more connected in order to implement projects at a territorial level. For example, it would be easier to find available land for future farmers or finance processing infrastructure at the territorial level than at the municipal level. On the other hand, the processors had few links with local actors, as most raw materials are externally sourced, and competition seems to take precedence over cooperation (among local breweries, for example). However, the strengthening of such relationships seems necessary to better link agriculture and food, and to meet local needs in terms of processing and sales infrastructures.

After that, the analysis showed that agricultural and local development institution employees are a driving force in the creation of links,

and are more likely to be sought out for discussion. The role of experts in supporting change, linking different groups of actors, and increasing mutual understanding has been widely demonstrated in the literature (Aguilar-Gallegos et al., 2015; Bourne et al., 2017; Isaac, 2012; Pachoud et al., 2019). This study also shows that other typologies of actors can be important in the formation of ties, such as non-dairy farmers, members of civil society, and elected officials. Non-dairy farmers mainly adopt alternative practices (organic, on-farm sales, and diversified production) and their ability to develop relationships enables them to circulate their practices throughout the territory. In addition, non-dairy farmers have more links with the outside world, which may facilitate the local adoption of alternative practices and visions. Then, members of civil society appear to be central actors in raising awareness among a diversity of actors. As Cheyns and Daoud (2023) recently showed, civil society supports agroecological transformations through the efforts of volunteers and bottom-up initiatives. For example, the Croc/Bauges cooperative provides a major marketing channel for organic farmers in the Bauges. Initially criticised for its alternative nature, this grocery shop has now become a prominent part of the local agri-food landscape. Lastly, elected officials were solicited for discussion more often because they have greater visibility and higher formal status (Pachoud et al., 2019). Municipalities can play an important role in accelerating agri-food transformation as they have local decision-making power. However, most of the municipalities have been criticised for their apparent lack of interest in agrifood issues, as was also found in Pachoud et al. (2019).

Moreover, the results confirm homophily among non-native actors. There seems to be a contradiction between some of their discourses on willingness to open up to all actors and their actual relational practices. In the context of sustainable transformation, however, homophily may initially be useful in enabling the development of alternative visions and practices in a territory, in tension with the dominant ones. Homophily provides an opportunity to seek support from similar individuals. At the same time, it seems important that this group exchange knowledge with native actors, who might know the local context better. Moreover, some past experiences can serve as inspiration for sustainable agri-food transformation (e.g., the history of cooperative creation and collective production rules). In a second step, alternative practices need to circulate in the territory, but the Bauges does not offer many formal discussion arenas in which the different groups of actors can meet. Some municipal councils have mixed participation, composed of natives and neoresidents. Moreover, the farmers' park association and the dairy cooperatives' collective sales outlets, which also sell diversified and local products from non-dairy cattle breeders, enable both established and new farmers to work side by side. However, these arenas need to be reinforced and/or multiplied. In this respect, our participatory research aims at increasing interactions between the different groups. To achieve this, we organised a discussion workshop where different actors gave accounts of their experiences to increase mutual understanding.

The degree and indegree analysis, however, showed that neoresidents develop more relationships and are more sought after for discussion. Furthermore, non-native actors were more numerous in the network (247 non-native versus 90 native actors). The results imply that the new population tend to have a greater desire to communicate and build new links. Moreover, the sampling methodology did not allow us to sample more isolated actors, and most notably native actors including breeders did not appear in the network. It is possible that these actors are more closely interconnected. For example, Pachoud et al. (2020) showed that breeders in a dairy cooperative in the Italian Alps were highly connected. In further research, it would be interesting to identify the reasons limiting interactions between non-natives and natives in order to try to improve them.

The study also found that interactions were strongly localised in the territory. In the context of sustainability transformations, territory-based relationships appear central in engaging collective dynamics and building cohesion among actors, while prior studies also show the

importance of a certain degree of openness to the outside world in order to bring new ideas and practices into the territory (Cofré-Bravo et al., 2019; Kratzer and Ammering, 2019).

After that, measuring both the indegree and betweenness centrality indicators was useful in detecting the most prestigious and broker actors. Prestigious actors (indegree centrality) are trusted actors. In this study, they are more frequently consulted by others for their opinions on issues linked to agriculture and food in the Bauges (climate change, access to land, certification labels, etc.). They can therefore play a role in orienting visions and practices. The present results revealed a diversity in key actors' typologies, as they have different backgrounds. Moreover, the results confirmed that the park employee is a strong broker (betweenness centrality). Brokers facilitate the development of ties, network cohesion, and the circulation of visions and practices.

Based on the literature, the key actors identified here have three main functions (Gaitán-Cremaschi et al., 2022; Hermans et al., 2013). First, they are crucial for learning and collaboration among a group to enhance the development of knowledge and the adoption of new practices (Hermans et al., 2013). Such actors play a guiding role in orienting visions and practices in their groups. They are usually at the head of network initiatives that bring together actors sharing the same vision, such as the farmers' markets, agricultural institutions, citizens initiatives, etc. Moreover, the majority of the key actors identified (four out of six) have visions and practices based on organic farming, the relocation of food production, and short marketing channels, thereby aiming to enhance sustainability in agrifood transformations (Pachoud et al., 2024). We can therefore hypothesise that such visions and practices may spread over the territory in the future. In the literature, Albizua et al. (2020) showed, for example, that the central position of intensive farmers is key to the spread of intensive farming practices in a Spanish region.

Prior studies have generally highlighted the neutrality of intermediary actors in innovation processes (Klerkx and Leeuwis, 2009; Klerkx et al., 2010; Kivimaa, 2014). This study instead shows that, apart from the park employee who has a pluralistic vision, the key actors tend to have marked visions advocating a certain position. Such actors, who have a clear normative orientation and connect different actors, are called intermediary champions by Martiskainen and Kivimaa (2018). In her neutral stance, the park employee enables different farmers to encounter one another in the framework of a farmers' association. Based on the work of Klerkx and Leeuwis (2009), we consider this actor to be a systemic broker who contributes to systemic interactions between a large range of actors and to play a leading role in transformation process. From a support perspective, it seems important to rely on this type of actor to facilitate transformation dynamics, as they can discuss and spread ideas among a diverse group of actors and enhance participation.

Secondly, key actors exchange ideas with a diverse range of actors holding different visions. Thus, they allow different types of actors to connect with one another, and facilitate communication in terms of visions and social learning. Some studies have already shown the function of connecting heterogeneous groups of actors, and called this the 'out-scaling' function (Gaitán-Cremaschi et al., 2022; Hermans et al., 2013; Klerkx and Leeuwis, 2009). In the literature, Lamine and Cambien (2011) found that the growth of organic farming is due to certain farmers acting as mediators between the organic and conventional models. Interestingly, the present study shows that the interface position of key actors does not prevent tensions and conflicts across groups holding different visions. Conflicts are considered important levers for collective learning and sustainability transformations if actors are engaged in resolving them (Skrimizea et al., 2020; Young et al., 2016).

Thirdly, this study also identified the function of linking institutions to upscale changes (Hermans et al., 2013; Klerkx and Leeuwis, 2009). Most of the key actors identified here, especially farmers, have elected mandates within municipalities or agricultural institutions. They perform a political function within the network, allowing them to engage in lobbying and translate their vision. Some have a role in the

political policy making. For example, the Chamber of Agriculture's strategic objectives are largely focused on maintaining the dairy value chain, while the charter of the park mainly centres around diversification and local food relocation, along with supporting traditional production methods. The key actor from civil society also holds a role which involves lobbying and interacting with elected officials to promote food autonomy.

Concerning the methodological approach adopted here, it is, to the best of our knowledge, the first study to combine quantitative and qualitative methods to include a plurality of agrifood actors within a territory. A snowball sampling method was implemented to identify the agri-food actor network, by selecting actors from the most to the least frequently cited. This method enabled us to quickly identify the key actors. Indeed, from the very first interviews, the gap in the number of citations rapidly widened. This method also enabled us to include actors who are generally less studied by scholars, such as food processors and members of civil society who are often difficult to identify.

However, some limitations of the chosen method need to be highlighted. The main one is that we only represented the core of the network in this study, and many other actors were not interviewed. In fact, this method did not allow us to meet the more isolated actors, who were less cited. Furthermore, non-dairy farmers were interviewed more than other types of actors (see Table 2). Moreover, the semi-structured interviews highlighted many tensions between groups of actors holding different visions in the Bauges. Although the snowball sampling method is valuable in identifying central actors, it only enables the most communicative actors and those closely related to them to be identified for interview. For a more systematic analysis of the network structure, the sampling method would need to be improved, either by further extending the snowball sample or by combining it with additional methods, such as relational chains (e.g., Polge and Pagès, 2022). In addition, it is possible that by adding more isolated actors, the results on homophily, degree, and indegree may differ. From the perspective of accompanying agroecological transformations, we are convinced of the necessity to integrate multiple actors from the territory, not just the central ones, to facilitate diverse ways of doing and thinking (Gasselin et al., 2020). This diversity should ensure that the research is not perceived to be in favour of some groups over others, which may lead to the refusal of certain groups to participate.

Other limitations of the methodology should also be mentioned. First, the name generator method relies on the spontaneous memory of the actors involved, and can therefore lead to omissions. Some actors may also have deliberately hidden relationships, especially in the context of a degree of tension among some groups of actors. Second, each actor's understanding of what a discursive relationship on agri-food issues represents may have differed. Although we tried to be as precise as possible in formulating the question, it is possible that some actors may have included other actors with whom they have off-topic discussions. Third, some individual indicators, such as education level, were not analysed - and these might offer further relevant insights into the network structure. Last, prior studies have demonstrated that the role of actors tends to evolve over time (Gaitán-Cremaschi et al., 2022; Hakkarainen and Hyysalo, 2016; Kivimaa et al., 2019; Moss, 2009). The present study is more of a freeze-frame of the actors' relationships at a certain point in time. It would be interesting to extend this study over the long term to monitor how the roles of the actors evolve in the context of the territorial pathway.

6. Conclusion

Since the 1960s, agriculture in the Bauges has specialised in extensive dairy cattle breeding for the production of PDO Tome des Bauges. Recently, more and more diversified lines of production, as well as various agrifood citizen initiatives, have emerged in the territory, all of which promote the diversification of small-scale value chains and the links between agriculture and food. The different actor groups have

different visions of agriculture that may lead to tension and conflict. The network analysis found no homophily within the actor typologies, and that relations were concentrated on the territory. Some actors were more important in developing ties, most notably employees of agricultural and local development institutions, elected officials, members of civil society, and non-dairy farmers. However, the results also showed that there was homophily among non-native actors, although they are a driving force in the development of ties, thus simultaneously demonstrating their ability to forge links and relational barriers with natives. After them, the most influential broker actor was the park employee in charge of agriculture, who holds a pluralist vision and plays a central role in gathering different actors together and bringing them into dialogue. Overall, the most prestigious actors identified here were the park employee, a civil society actor, and four farmers. These key actors fulfil three main functions: to guide practices and visions within their group as key actors often hold clear-cut vision, to bind heterogeneous groups together (although this does not prevent tensions and conflict among these key actors), and to link institutional levels, often due to being heads of networks and municipal councillors. However, the methodology did not allow the integration of more isolated actors, especially dairy cattle breeders, who should be represented in further research. From the perspective of accompanying agrifood transformations, it is helpful to understand the relational structures between the actors in order to avoid the possible conflicts that could arise in such research. Moreover, it is useful to identify and mobilise key actors in order to facilitate researchers' entry into a territory and increase participation.

CRedit authorship contribution statement

Carine Pachoud: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of competing interest

Carine Pachoud reports financial support was provided by University Grenoble Alpes. Carine Pachoud reports a relationship with University Grenoble Alpes that includes: funding grants, non-financial support, and speaking and lecture fees. Carine Pachoud has patent pending to No. The authors have no additional relationships or activities to declare.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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