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Research Article

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The European networks of research, education and training stakeholders in agroecology

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Abstract: In Europe, agroecology has become the center of many debates that animate political and professional arenas, particularly regarding the definition and scope of the concept itself. This paper attempts to understand the ways that the term agroecology is conceptualized by different participants and how these concepts circulate so as to explore the interests at stake in the institutionalization of agroecology within the research and education institutions of Europe. We address the core research question of: what dynamics emerge in the networks of European stakeholders of agroecology? By combining different approaches of institutionalization based on network and discourse analysis, we study the dynamics of research, education and training organizations. We identify 10 different concepts of agroecology, distributed among 103 organizations. The significant difference that has been observed between the agroecological concepts in research and those in education/training emphasizes the gap between these two disciplines. The latter support a more political, transdisciplinary and holistic view of agroecology when compared to the former. Moreover, collaboration among European agroecology stakeholders is limited in both research and education/training. We also found that in most cases, collaboration between scholars does not guarantee a shared notion of agroecology, and conversely, sharing the same notion of agroecology does not assure collaboration. This led us to question the feasibility of institutionalizing agroecology and the missing link between a shared vision and the collective mobilization of stakeholders around a strong agroecology programme.

Keywords: Agroecology; networks; institutionalization; circulation

1 Introduction

The use of term agroecology can be traced back to the 1930s, with a prevalent scientific orientation (Dumont et al. 2018, Gliessman 2015). The early promoters mostly originated from Europe (Azzi, Bensin, Friederichs, Papadakis, Tischler) and they had an international trajectory. Briefly, their main perspective was about plant and insect adaptations to their environments, in relation to cultivation methods and economic performance. During the 1960s and 1970s, agroecology gained momentum with community and population ecology research, and with system-level approaches. The latter were mainly dedicated to the study of agroecosystems (with a specified methodology and conceptual framework) and of farming systems. They acknowledged traditional and alternative farming strategies as relevant examples of ecologically based systems design and management. For instance, favoring field diversity and landscape heterogeneity, is a transformative agroecological strategy that represents a robust path to increasing the productivity, sustainability, and resilience of agricultural production, while reducing undesirable socio-economic and environmental impacts due to climate change (Altieri et al. 2015). Recent studies that follow this line of research have shown that diversification of agro-ecological production systems can reduce the organic-conventional yield gap (Ponisio et al. 2015), improve carbon sequestration in soils (Ghabbour et al. 2017), and the possibilities for small-farmer livelihood empowerment (Amekawa et al. 2010). By the end of the 1990s, the definition of agroecology evolved into the ecology of the entire food system, including all its dimensions and participants (Francis et al. 2003). A link was therefore created with eaters from civil society and with movements advocating food sovereignty. At the same time, educational curricula in agroecology developed in different parts of the world, especially at Masters level. The definition has thus changed, evolving into the following

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proposal “Agroecology is the integration of research, education, action and change that brings sustainability to all parts of the food system: ecological, economic, and social. It is transdisciplinary in that it values all forms of knowledge and experience in food system change” (Gliessman 2018). As a whole, such evolutions during the end of the 20th century came from scholars based in the Americas, and their networks with some European scholars or movements.

Since 2010, agroecology has become a central focus of international fora (e.g., the Food and Agriculture Organization, the Committee on World Food Security’s High-Level Panel of Experts, and IPES-Food), a major frame for social movement advocacy (e.g., the Nyeleni declaration (2015)) and the practical basis of regulations (e.g., the 2013 French agricultural law; (MAA 2018)). But what about today’s agroecology; is it really considered to be the new face of ecological or sustainable agriculture? Who considers that to be the case and at what scale (worldwide, in Europe, or only in France)?

To answer these questions, we identify through an institutional mapping, the European research and education/training actors and their visions of agroecology. As stated by Wezel *et al.* (2009), agroecology emerged in different social arenas: science, social movements and agricultural practices. The circulation of agroecology within, between and around these three spaces is our main point of entry for analysis. Indeed, the fact that this idea has circulated, and as such has left digital (and material) traces, makes it possible for us to make sense of the different agroecological notions that different actors bring to these spaces and the evolution that this circulation generates in the very notions of agroecology. By tracing the networks of agroecological actors, we can also highlight the actors’ stakes in different forms of knowledge (including ideas, tools and concepts) and understand the factors of institutionalization of certain agroecological notions. Following structuration traditions in sociology (Giddens 1984), we understand the institutionalization process to be the constitution and stabilization of networks of actors who identify themselves clearly as being ‘agroecological’. We adopt a collective vision of these actors, not as individuals, but rather as organizations. who create knowledge, rules and norms (i.e., institutions) for how to act together (North 1990). These institutions produce discourses (Phillips *et al.* 2004) about agroecology that the actors use to make sense of the concept and to legitimize it for actors in the same networks and for those actors outside of their networks. We hypothesize that each actor conveys in its network a specific vision of agroecology.

In this paper, we focus on the European research and education/training actors (EU, Switzerland and Norway), in order to analyze the dynamic of agroecology institutionalization through the emergence of interlinking organizations. We also update and analyze the research topics addressed by the scholars referring to agroecology in Europe. The first section presents the data collection and analysis methods, while the second section presents the results: first, from a general mapping; second, through the focus on specific organizational linkages in collaboration networks; and third, with a cross-cutting analysis of collaboration networks and actors’ discourses. We conclude by reflecting upon what these institutional dynamics can tell us about the role of scholars in the future development of agroecology in Europe.

2 Materials and methods

As institutionalization concerns the links between actors inside a network, we have identified these actors using different data sources. For the research actors, using the bibliographical database Scopus, we extracted papers containing keywords on agroecology and then we extracted a sub-corpus of European organizations (e.g., research labs, institutes, experiment stations) whose name contains these keywords in European languages¹ using the Scopus field *AFFILORG*. While there are already many bibliographical studies on agroecology that analyze the textual content of bibliographical records (Brym *et al.* 2016, Wezel *et al.* 2009), our approach is original in its focus on organizations that put agroecology in their name, which we interpret as a deliberate act of institutionalization. This approach also allows us to reveal organizations that have institutionalized agroecology, only to abandon the use some time later, shining the light on historical dynamics. After identifying the actors (i.e., organizations), we analyze their collaborations on joint publications using the CorText Manager software². As there is no equivalent source for training actors, we built a database through Google queries of websites to identify the definitions of agroecology publicly posted and the syllabi used (including the references). The category ‘training actors’ is made up of a variety of organizations whose actions are more or less dedicated to education and training about theoretical or practical aspects of agroecology (including organic agriculture,

¹ Nominal or adjectival written forms of agroecology: agro-écologie, agroecology, agrarökologie, etc

² <https://docs.cortext.net/>

permaculture). Additional information found on their webpages enables the identification of their collaborators. This difference in the availability and type of data for the two groups of actors explains, in part, our decision to present their results separately.

As institutionalization is also about discourse production, actors' textual productions reflect institutionalization patterns that express their « reflexive distance » from their actions (Musson et al. 2016). In methodological terms, we use co-word analysis (Callon et al. 1983), also implemented in the CorText Manager software (Chavalarias et al. 2013). Co-word analysis, that is the extraction and visualization of word co-occurrence, is a way to identify the main themes, and semantics, inside the actors' discourses that we gathered in the first step (title and abstract Scopus records and training webpages). CorText manager automates the identification of statistically specific words associated with their authors (using a χ^2 test). The software also considers all of the available variables, particularly the publication dates, which allow us to analyze network dynamics (of actors' co-citation or word links). Finally, CorText Manager enables a cross analysis of authors' information with words. It is thus possible to detect specific links between clusters of words and authors' texts, so to identify the association between versions of agroecology and the actors who use them.

Ethical approval: The conducted research is not related to either human or animal use.

3 Results and discussion

The analysis of our core database (including press releases, conference reports or articles from the training actors) provided a panorama of the networks of European actors of research and training that are diffusing their visions of agroecology. In the following sections, we identify the actors and their networks (both direct and semantic), we then link these networks and compare the differences between them.

3.1 General mapping of European agroecology research and training actors

3.1.1 Mapping and actor dynamics

A first general result is that agroecology research and training providers in Europe are numerous and diverse.

Our analysis identified 103 players in agroecology research and training in Europe, with 50 training players and 53 research ones.

Figure 1 gives an overview of actors that self-identify with agroecology. Each point on this map represents an actor. Two superimposed dots symbolize either two actors located in the same city, or a single actor present in both the research and training sectors. The actors with these two functions are present in Liege, Leuven, Helsinki, Lyon, Göttingen, Stuttgart, Seville, Uppsala and Coventry. In addition, the University of Aarhus (Denmark) has two agroecology research sites (Slagelse and Tjele) in addition to a training program in a separate site (Aarhus). This map also takes into account historical players that no longer exist, such as those present in Maynooth (Ireland) and Devon (United Kingdom), but previously identified themselves in agroecology. It is important to note that the identification of 'agroecology' actors is based on the use of the word in the name of their organization at the time of the publication (for research actors). More recent publications from organizations that have been renamed over time show up in this map because of the historical publications. The map is a static map representing those publishing organizations self-labelled with agroecology at least one time between 1970 and 2017.

Research and training actors are composed mainly of universities (50), followed by research institutes and units (24) and finally associations and social movements (9), farms (5), state agencies (3) and private companies (2). This dominance of universities and research institutes reflects the approach implemented, based on bibliographic production, which favors the academic environment for

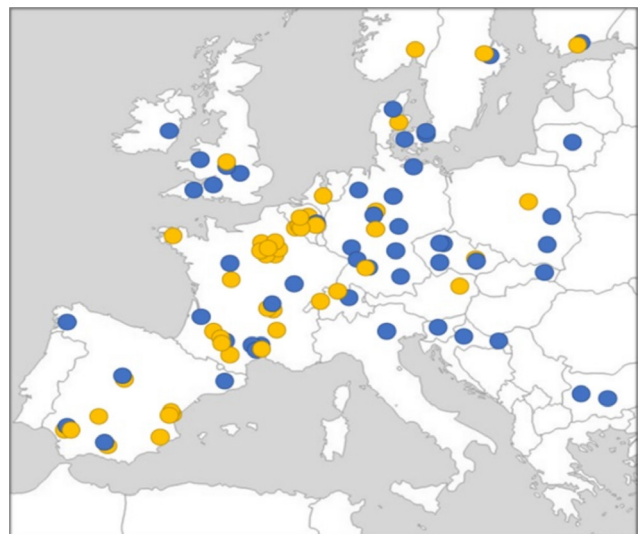


Figure 1: Mapping of stakeholders in agroecology research and training in Europe (1970-2016) (in blue: research, in yellow: training)

research and training activities. However, the diversity of actors gives an idea of the influence of agroecology across Europe. Even in research and training, agroecology affects many sectors: political (with state agencies), academic (universities and schools), economic (private companies) and social (movements and NGOs).

Our map (Figure 1) shows a high concentration of training providers in Western Europe. This discrepancy could be explained by the search method. However, a Eurostat study shows that more than 60% of European students are concentrated in 9 countries (Belgium, Germany, the Netherlands, Denmark, Austria, France, Spain, Ireland and the United Kingdom) (EUROSTAT 2017). Thus, results are actually reflective of a broader trend in Europe and cannot be qualified only as the result of linguistic bias.

There is also an almost total absence of research players self-identified with agroecology in some countries: Italy, the Netherlands, Austria, Scandinavia and most Eastern European countries. A first interpretation could come from a bias introduced through Scopus, the main database for our research results. Indeed, Scopus only lists publications of international scientific journals, usually published in English, French or Spanish, and many Italian social science journals, for example, are not included in Scopus. However, the representation of certain countries in these scientific journals is less or even absent (especially for Eastern European countries).

A second interpretation of this phenomenon stems from a bias in methodology. Since we considered only those involved in research using the terms “agroecology” or “agro-ecology” in first the publication abstracts and keywords, and then in the official names of their research organizations, it is possible that some research institutes or units do not formally identify with agroecology. Thus, while agroecology may be present in their work, they may have preferred to use other terms in their official titles for a variety of reasons. This is the case, for example, at the University of Wageningen University & Research (WUR, Netherlands), which has a department of agro-technology and food science that produces a number of articles on agroecology (Ollivier, Bellon 2010; WUR 2017). These anomalies are quite interesting for testing our hypotheses about the institutionalization of agroecology through auto-identification as these papers do emerge through co-citation networks (which we explain further on), but the concept of agroecology has not been considered as an element of identification for the group. Finally, it is also conceivable that some countries simply do not have actors working on agroecology.

3.1.2 Research actors through the dynamics of their publications

When we begin to look at the publications of the research actors, we find that they run from 1971 to 2017. Figure 2 shows the evolution of the number of publications between 1971 and 2016 (2017 not being considered, since the year was in progress at the time of analysis).

The number of publications stagnated between 1971 and 1991 (between 1 and 5 publications per year), before linearly growing since 1996 and following a near exponential rate after 2007. Over the past 25 years, the number of publications has exploded from 8 in 1992 to 84 in 2001 and 663 in 2016. These results can be compared to Wezel and Soldat (2009) and Byrm and Reeve (2016), which are slightly lower than our results because of methodological differences (they used the agroecology terms only in the titles and keywords, not in the authors’ affiliation).

This explosion accompanied a strong growth in the number of research units (Figure 3). Until 1992, less than three research units used “agroecology” or “agro-ecology” in their names. By 1992, however, the trend was on the rise towards reaching 32 in 2011. Finally, we can note a phase of stabilization around 28 between 2011 and 2017, a phase that will have to be confirmed in the coming years.

The early 1990s marked a starting point for growth in the number of actors and publications. However, this obvious correlation does not explain everything. On the one hand, some players no longer identified themselves officially with agroecology between 2000 and 2017; this disappearance is not necessarily due to the closure of an entity, but rather can be attributed to a renaming or their integration into another organization. On the other hand, from 2011 onwards, the number of publications continues to grow while the number of players stabilizes.

An important feature of this data is that the research actors do not appear to exist until 1971. Before 1980, Scopus detects only two actors: Nikola Pushkarov Institute of Soil Science and Agro-ecology in Bulgaria and Augustenberg Agricultural Technology Centre in Germany. However, a brief history of the Nikola Pushkarov Institute indicates that the first Bulgarian Agroecology Department was founded at the Bulgarian National Agricultural Centre in 1911 (Teoharov 2016), now named “*Institute of Soil Science, Agrotechnologies and Plant Protection “Nikola Pushkarov”*”. The temporal limit therefore seems to be a bias of the Scopus tool, possibly linked to the non-digitalization of older publications and/or the use of languages of writing not included in the tool. However, more generally, it is difficult to estimate how many publications and actors were not considered in this analysis.

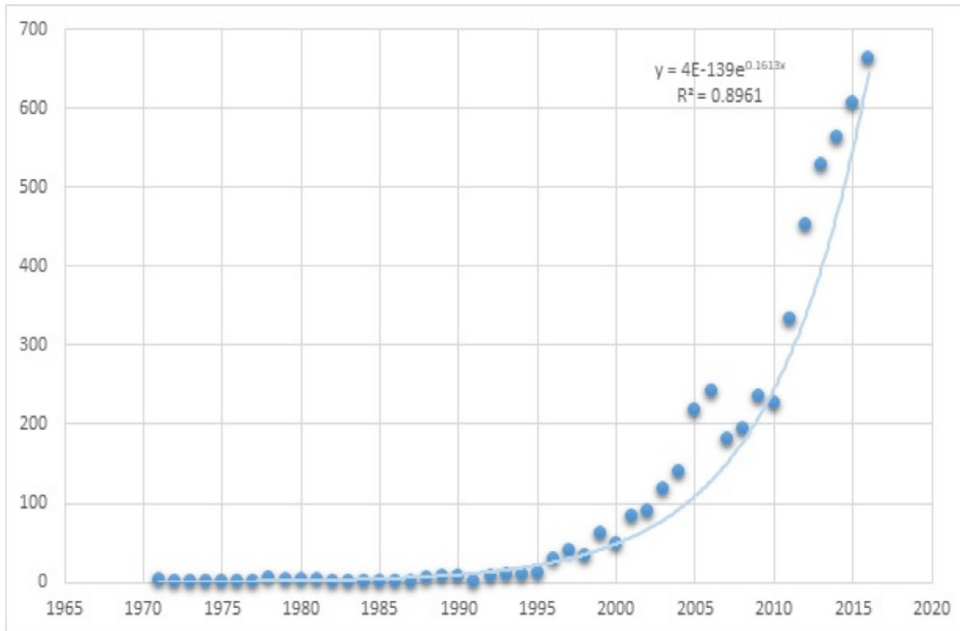


Figure 2: Number of publications by year, with its moving average trendline (1971-2016 in Scopus)

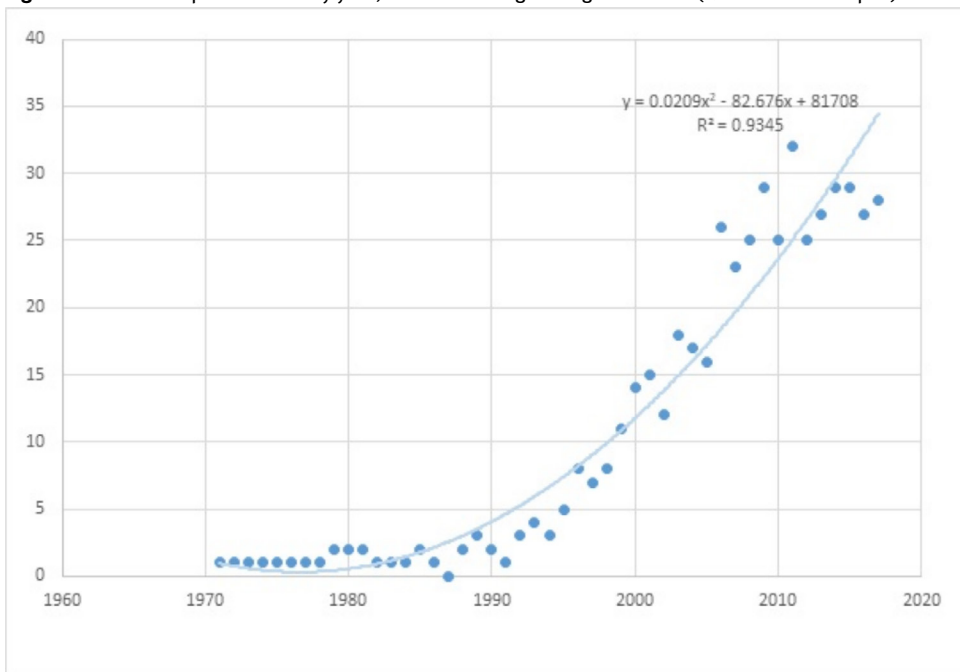


Figure 3: Number of research actors by year, with its moving average trendline (1971-2017 in Scopus)

Figure 4 also shows a spatial pattern indicating that some agroecological institutions were found in eastern Europe, certainly before our period of analysis. This seems to be coherent with the origins of some agroecology pioneers, especially Basil Bensin (1925, 1938) or Nilolai Vavilov (1957). As a consequence of our geopolitical history, one must note that Scopus, like other bibliographic

databases (Mongeon et al. 2016), is geographically and linguistically biased. Even if our method provides some interesting clues, further research on “peripheral” areas with different sources is needed.

Four main centers for the production of scientific articles are shown in Figures 1 and 4: Denmark (Department of Agroecology at the University of Aarhus);

France, with its various units of the major national research institutes (INRA, CNRS and CIRAD) that employ large numbers of researchers on the same topics (e.g., Dijon has more than 250 employees); and finally, Germany and Switzerland, with an accumulation of smaller and historically established research units. Moreover, it seems that the historical center of the actors is situated in Central Europe and in Southern Europe. Finally, the last decade has seen the emergence of fifteen or so actors in Western Europe (France, Spain, the United Kingdom, Belgium, Denmark) that are very clearly defined and productive in terms of research publications. For example, the AIDA (*Agroecology and Sustainable Intensification of Annual Crops*) research unit of CIRAD, created in 2014, designs cropping systems that respond to sustainability issues in developing countries (CIRAD 2017). Other units focus on agri-food systems and favor a more sociological and political approach to agroecology, as exemplified by the Chair of Agroecology and Food Systems at the University of Vic in Spain and the Centre for Agroecology, Water and Resilience (CAWR) at the University of Coventry.

3.1.3 Training actors

Training actors are more diverse than the research ones. They can be separated into two main groups: academic and practical training. The academic training actors are mainly found in agronomic schools or agricultural universities: Aarhus University (DK), AgroParisTech (Fr), ISARA (FR), Norwegian University of Life Sciences (NMBU) and Wageningen (NL). Some universities with a history of agroecology work, mostly in organic agriculture, are also present: the University of Göttingen and Hohenheim (Germany) as well as the University of Padova (Italy) and the University of Natural Resources and Life Sciences (BOKU, Vienna, Austria).

On the one hand, Academic actors mainly offer Masters and Bachelors degrees, continuing education and summer schools related to the theme of agroecology. Some also offer specializations in more general Masters programs on sustainable agri-food systems. Montpellier SupAgro also offers an online course (MOOC), which is gradually spreading in English and Spanish. The

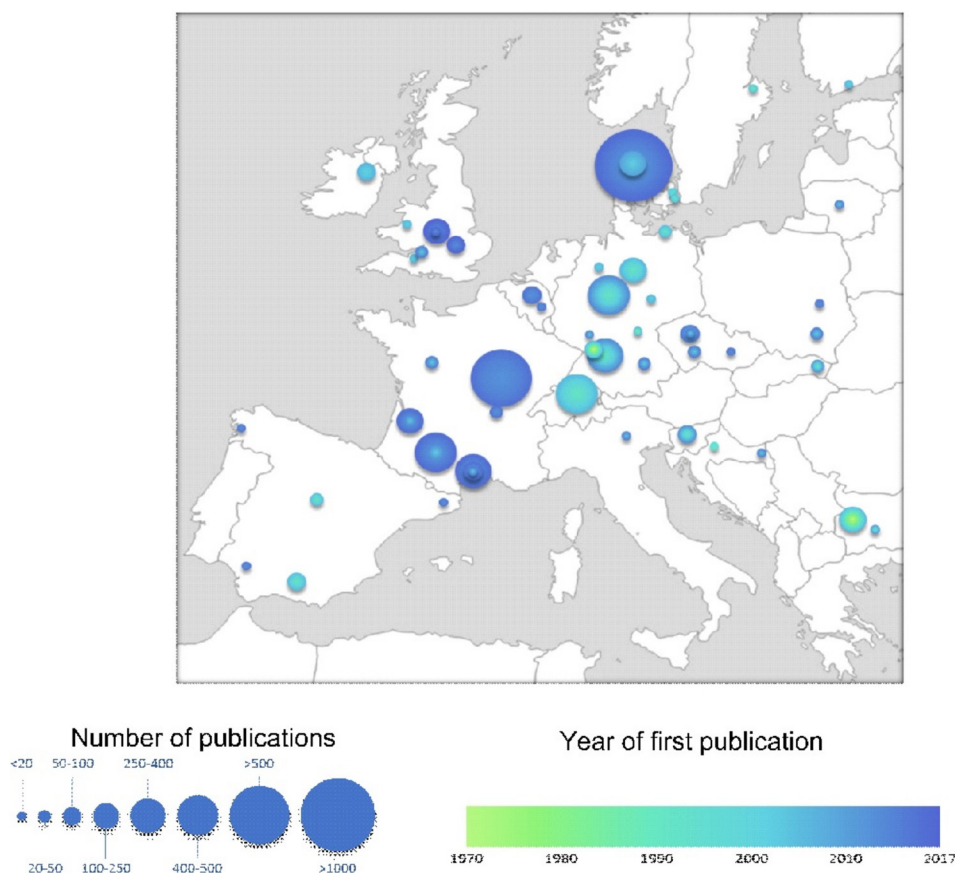


Figure 4: Dynamic of activity of research actors on agroecology (1971-2017 in Scopus)

introduction of agroecology training programs is mainly part of increased activity over the last decade. To follow the identified training courses, additional research is needed to study their evolutions, both in terms of content and participation of students. It would then be possible to understand the dynamics at work and to pinpoint the processes of institutionalization at the academic level.

On the other hand, practical training actors form a more heterogeneous group. Practical training providers offer short training courses, based on skills (know-how) and techniques. These trainings are targeted at building general practical knowledge both in their teaching and in the students they target; they are often oriented towards professionals in the agricultural sector or amateur gardeners. In France, Terre & Humanisme, the Fédération des Associations pour le Développement de l'Emploi Agricole et Rural (FADEAR) and the Centre International d'Etudes Rurales et Agricoles (CERAI) have humanistic dimensions and are part of social movements: the European Coordination of the Via Campesina (ECVC) and Nyeleni Europe and the Colibris Movement (with Pierre Rabhi as the leader). In contrast, organizations such as the Institut National de Formation des Personnels du Ministère chargé de l'Agriculture (INFOMA) or the Direction Régionale de l'Alimentation, de l'Agriculture et de la Forêt (DRAAF) of the Auvergne-Rhône-Alpes region are part of the public sector training institutes for agriculture. We also identified private consultants who are separate from both social movements nor and the state institutions (e.g., <http://www.icosysteme.com/> or <http://www.gaia32.com/>).

Many actors in practical training are not represented in this study. Indeed, data collection for this study was not easy due to a lack of resources or centralized databases that can be consulted online and because of increasing competition between actors (i.e., fewer publicly available resources shared outside of existing networks). This lack of information should not, however, obscure the increasing presence of these actors in the agroecological training landscape in Europe. Let us remember that the training actors work at a different speed relative to academic organizations. While academic training is easy to spot, with large European universities attracting large numbers of students and rapidly adapting to social and technological trends; actors in practical training attract smaller physical audiences (although their online videos have greater reach) by responding to more pragmatic needs for practical know-how, while at the same time engaging in a more social and political discourse. These characteristics suggest that there is a greater need to

explore these practical training networks more in-depth and through a wider range of material artefacts (e.g., through visual analysis of YouTube videos).

3.2 Direct networks: actor games

3.2.1 Research networks

Figure 5 shows the direct networks of research actors, i.e., those who have published together. There appears to be little evidence that research actors in Europe work together. Of the 53 research actors identified, only 14 published a collaborative article. These collaborations are centered around two core mobilizing actors: the Agroecology, Innovations and Territorial Research Unit (AGIR) of Toulouse (blue green link) and the Agroecology Department of the University of Aarhus (Denmark) (dark green link).

Several interpretations of the lack of many research networks are possible. For example, many publications may only have one author. However, this hypothesis is not verified, since less than 1% of the publications collected are single-authored. Second, some publications could have several authors from the same research units, which would not reveal any collaboration between actors. This hypothesis is confirmed to the extent that the two actors who have published the most articles (the Agroecology Department of Aarhus and the Agroecology UMR of Dijon) tend to involve several members of their teams in the same scientific contribution. The significant size and pooling of expertise within their research teams is thus an explanatory reason: the Agroecology Department of Aarhus has 270 employees and 6 major areas of study; and the Agroecology UMR of Dijon employs 250 permanent staff for 4 major areas of study. Finally, the collaborations uncovered in the database are not limited to a European research area or to links between actors who identify themselves with agroecology. This suggests that while we do see a form of institutionalization with the formation of a core research organization focused mainly on agroecology, this is still very limited within the European research area and these core teams of researchers are often collaborating outside of institutionalized settings to inform their knowledge production.

3.2.2 Training network

Collaboration among those actors involved in training takes place at two levels: international and national. Figure

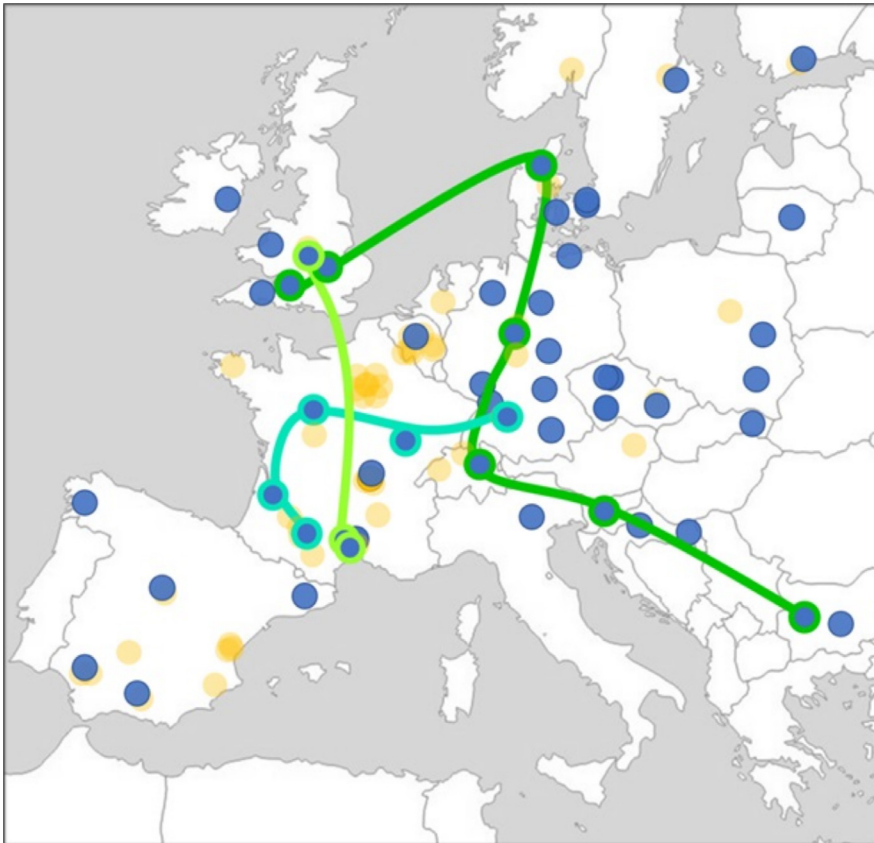


Figure 5: Direct Network Map of Research Actors (yellow dots represents training actors)

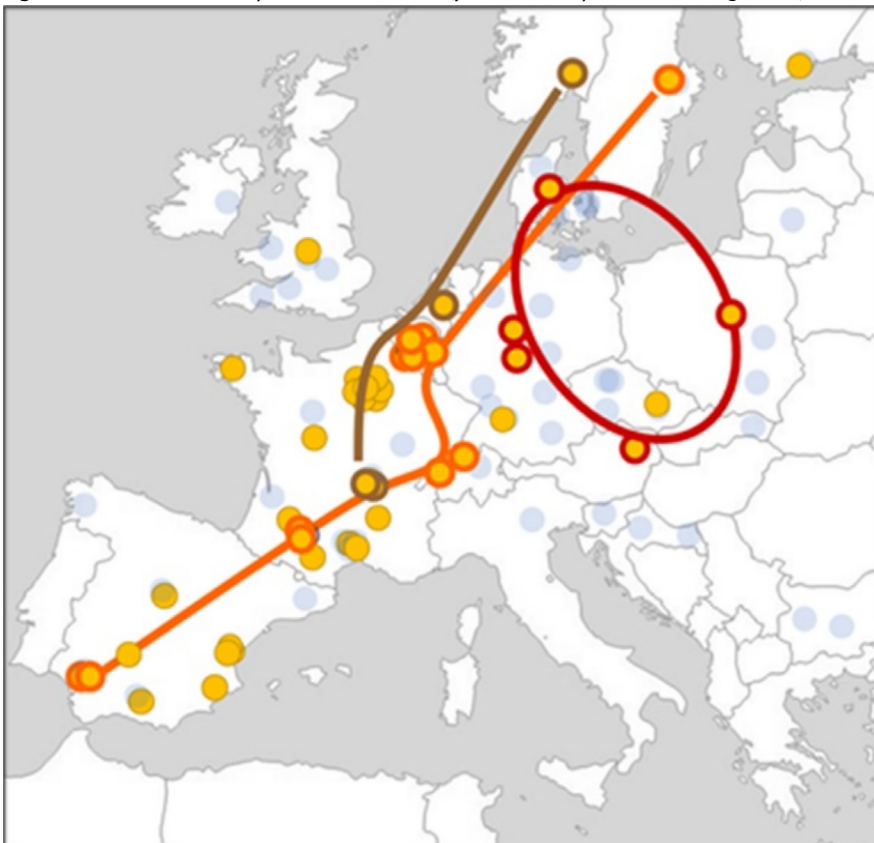


Figure 6: Direct networks map of training actors (blue dots represent research actors)

6 shows the international, direct networks of training actors, i.e., actors who are partners in the same training.

The international collaboration between training actors is explained first of all by the different joint degree programs in agroecology. For example, ISARA Lyon and the Norwegian Life Sciences University (NMBU) offer the European Masters degree in Agroecology. The ISSAE (International Summer School of Agroecology) offers summer courses annually through its various partners (the French National Graduate School of Agricultural Education and the National Institute of Agricultural Research [INRA], the University of Liège, the University of Agricultural Sciences of Sweden, the University of Pablo Olavide in Seville, the University of Neuchâtel, the Walloon Agricultural Research Centre, the Institute of Organic Agriculture Research [FiBL] and the University of Neuchâtel). There is also an international flow between the different ECVC (European Coordination of Via Campesina) members, which is not mapped here as it has been difficult to gather workable data on the ECVC and its training network.

Collaboration among training actors is also carried out through shared competency clusters and national partnerships. These clusters and partnerships are composed of universities as well as other types of actors (farms, associations, state agencies). The practical training in agroecology is concentrated around Terre & Humanisme thanks to a network of partner farms. The Federation of “Associations pour le Développement de l’Emploi Agricole et Rural” (FADEAR), present in all of the French administrative departments, make up the other practical training network. The French networks are the most robust and this type of work remains to be extended in other countries. Currently, it appears that training activities are often diffuse, and sometimes combined with technical assistance, carried out by national consulting firms.

In conclusion, the collaboration of research and training actors in Europe depends mainly on university partnerships and is far more apparent in partnerships on training than on research. What also appears in this study of direct networks is an existent, but less developed collaboration of practitioners and academics. This phenomenon is rather symptomatic of the general attitude of distancing between researchers and professionals in the sector (Brem-Wilson 2014), which is reflected even in the analysis of training networks.

3.3 Networks and interpretations of agroecology

In this section, we identify the different versions of agroecology associated with specific actors that were identified in the above-elaborated networks. We present results using co-word analysis of discourse for the Scopus database (research) and the training actors database (training).

3.3.1 Agroecology visions in research networks

The analysis presented in this section aims first of all to understand the concepts of agroecology supported by research units, which represent an institutionalized discourse and follow organizational strategies. These notions are then compared with the concepts put forward by the researchers in their publications.

Figure 7 represents the development of core topics (as identified in the titles and abstracts of 5644 publications) in the form of tubes of the semantic spheres. When creating the list of terms and the co-occurrence analysis, the abstracts and titles were divided into four homogeneous periods (1411 publications per period, the periods not extending over the same time frame). Figure 7 thus shows the different semantic currents of research actors between 1971 and 2016. The five colors represent 5 different topic streams. The overlapping periods illustrate the transformation of a stream into a new or modified topic area.

The expressions noted on each tube are the two terms that best represent the themes of the documents included in these streams and that are discrete from the other tubes. These expressions alone thus do not symbolize the theme of a tube but must be considered together with all of the associated terms within the tube’s content (and not illustrated in the figure). The thickness of a tube represents the number of publications it contains.

Overall, these five currents are (from top to bottom of Figure 8): (i) population dynamics and microbial diversity (in vineyards), (ii) resource uptake and efficiency (mainly large crops and Nitrogen); (iii) species richness and agricultural landscapes; (iv) soil structure and properties; (v) environmental impacts of agricultural systems.

While the data included in the tubes include a wide range of disciplines, the institutionalized notions of agroecology is dominated by agronomic and ecological terms, concepts, objects and issues. It anchors institutionalized notions of agroecology in themes of life and earth sciences. This dominance is partly due to the statistical

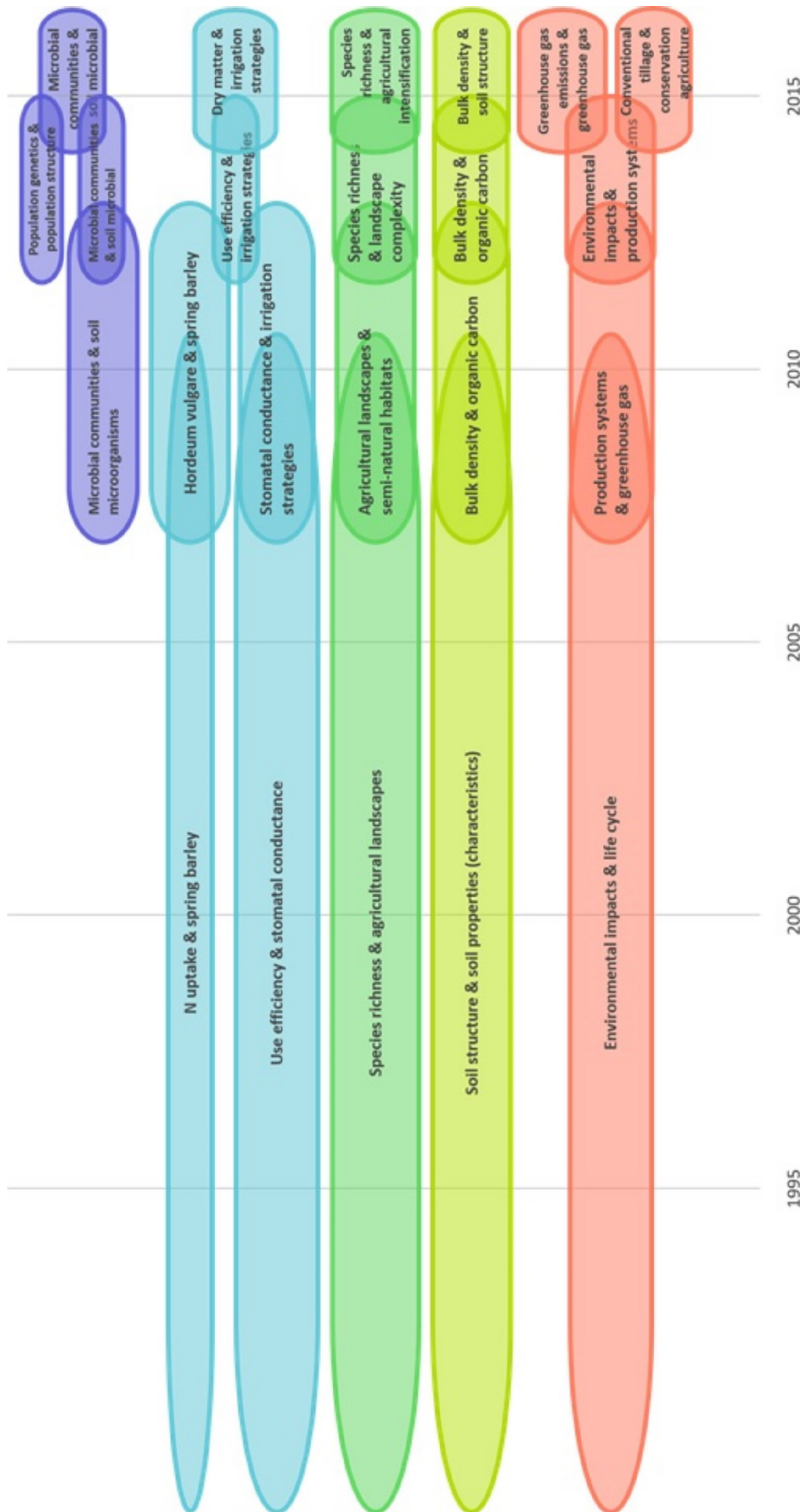


Figure 7: Development of agroecology topics (1970-2016 on Scopus database)

methods that highlights the “tip of the iceberg” but is also explained by the absence or the lack of semantic coherence of certain actors. Indeed, economic and social aspects, such as food systems, are rather absent, apart from the latter. Whereas life science disciplines share a rather common conceptual lexicon, social sciences are characterized by a greater conceptual fragmentation that also explains their lower visibility.

Finally, Figure 7 shows the divisions of agroecological specialties and their merging, which attests to the evolution of institutionalized notions of agroecology in recent years that is reflected in the emergence of new actors shown above.

In this large pool represented by institutionalized notions of agro-ecology, researchers also express the specificities of the debate. The semantic analysis of the publications included in the database of research actors and containing the terms “agroecology” or “agro-ecology” in their titles or abstract highlights these specific notions. However, the sub-corpus constituted by these publications comprises only 76 publications (1.3%) and 10 actors (18%). This thus demonstrates that institutional affiliation with agroecology covers a broad thematic spectrum and is not contained only to articles that focus specifically on a stabilized concept of ‘agroecology’. Nevertheless, this spectrum remains below the programmatic ambition expressed in reference texts (Dalgaard et al., 2003; Francis et al., 2003). In the realm of research discourse, as revealed by this analysis, agroecology remains a scientific question of interactions among agroecological sub-systems.

Even if we do find some of the actors identified during this analysis engaged in a European project (Salvatore et al. 2017), it is clear that at this stage the participants in this project do not share the same vision of agroecology. Our results thus confirm those of an earlier study (Brym et al. 2016), which showed the gap between the expectations of scientific production in agroecology and the reality of the themes addressed in publications.

3.3.2 Agroecology visions in training networks

The semantic analysis of training courses provides a different representation of agroecology concepts. For the 39 training courses with agroecology as a theme or specialization, titles and descriptions have been the subject of a co-occurrence analysis. Figure 8 shows the semantic spheres resulting from this analysis.

We can identify five teaching themes within the data:

The first network node (light blue at the top) considers agroecology as a political and transdisciplinary transition

towards agricultural sustainability. This approach is supported by 5 entities, including the University of Kassel-Witzenhausen (UKW, Germany) and the Ecole Nationale Supérieure de Formation de l’Enseignement Agricole (ENSFAE, France).

The second node (dark blue on the bottom left) considers agroecology as a set of agrarian practices applicable to small farms, urban or peri-urban farms. This theme is taught by Terre & Humanisme (France) and its strong partners (Amanins ecosite, RAF).

The third node (red on the bottom left) considers agroecology as a scientific discipline of food systems, close to organic farming. This education is mainly provided by the University of Hohenheim (UHH, Germany) and the University of Natural Resources and Life Sciences of Vienna (BOKU, Austria).

The fourth node (yellow on the bottom right) considers agroecology as the study of the sustainability of agro-ecosystems. This theme is taught by the association SOL Alternatives Agroécologiques & Solidaires (France), ISARA (France), NMBU (Norway) and AgroParisTech (France).

The fifth and final node (green on the bottom right) considers agroecology as an interdisciplinary model for the sustainable development of agricultural territories, affecting peasants and based on a social and regulatory dynamic. This education is mainly provided by CERA (Spain) and FIAES (Spain).

The teaching of agroecology is thus quite different when we compare how the actors define what they do. While some training actors link agroecology with research or practice, others offer a more political and transdisciplinary vision. The first and fifth nodes are quite similar, but the first one is more focused on public policies, while the last one focuses on agricultural actors and practices. This distinction is also explained by the actors who contribute to these nodes: the first group are academics and others are associations or activists, thus joining the latter appropriation of agroecology by Via Campesina (Thivet 2014).

If we compare the notions between research and training actors, it appears that these actors transmit quite distinct notions of agroecology. Those involved in training have a rather broad notion of agroecology, having opened up their conceptualization of the science and practice of agroecology to accommodate social and political aspects and purposes. On the other hand, research actors create a rather restrictive idea of agroecology, relying on neo-productivist approaches - which are generally at the center of agricultural research - and disciplinary approaches around ecological and agronomic subjects. At the same

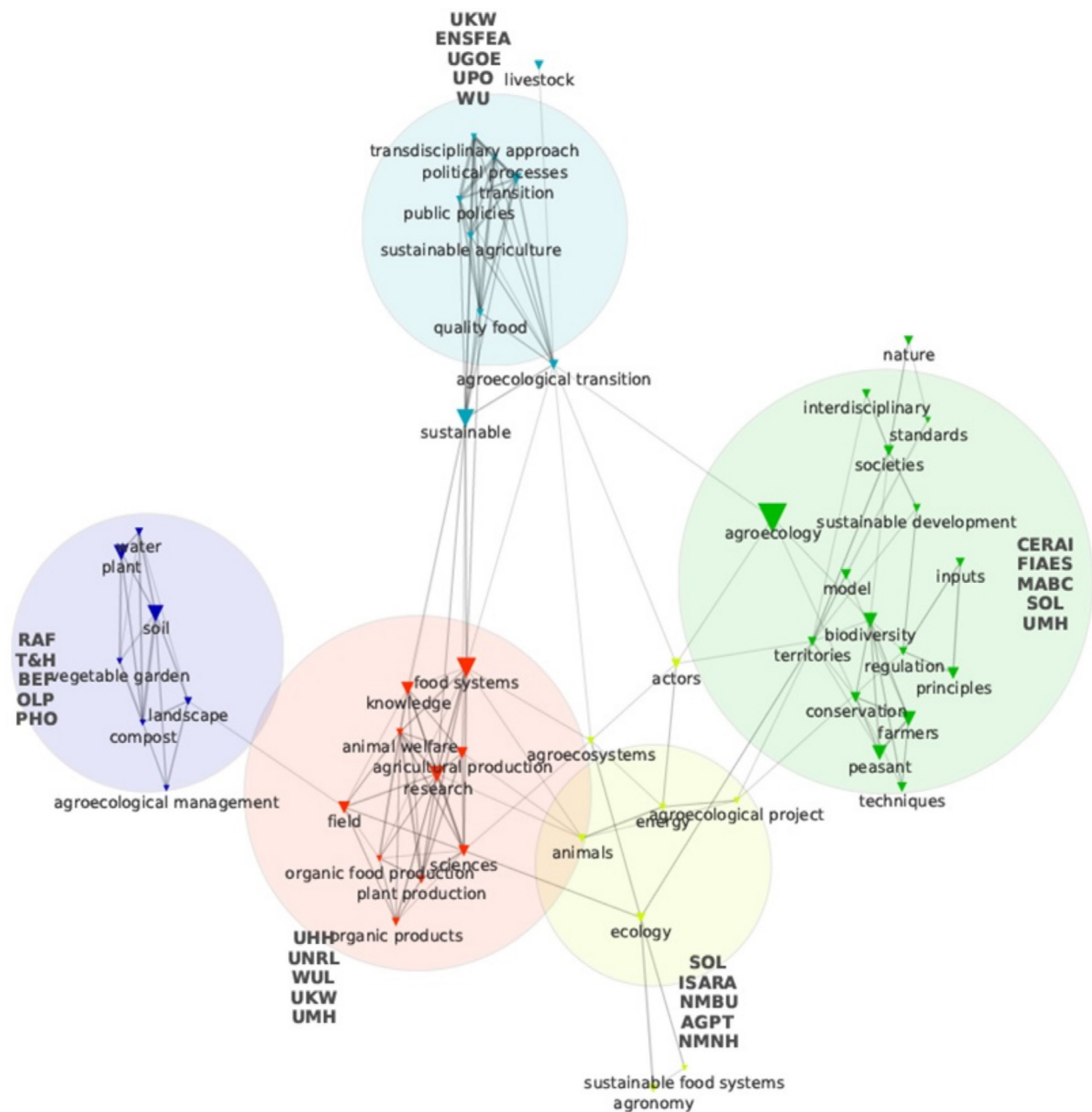


Figure 8: Representation of semantic spheres of co-occurrence and their most associated actors (based on the analysis of titles and descriptions of training courses)

time, the concepts expressed by agroecologists are indeed more specific than mainstream agricultural and agronomic research and do indeed cut across disciplinary constraints. It is this ambivalence that one CAWR member explained in an interview: “*Everyone is working on issues more or less related to agroecology, but not everyone identifies themselves as doing agroecology research*”. Agroecologists draw their information, knowledge, practices and

skills from a variety of different ways of thinking about production systems and knowledge sharing. It’s the concern with agroecology that is difficult to define and hence our approach to focus on self-identification through institutionalized structures; since even if the exact terms of agroecology are not easily define, a feeling of belonging to an organization that works on it provides a good proxy for identifying networks of actors.

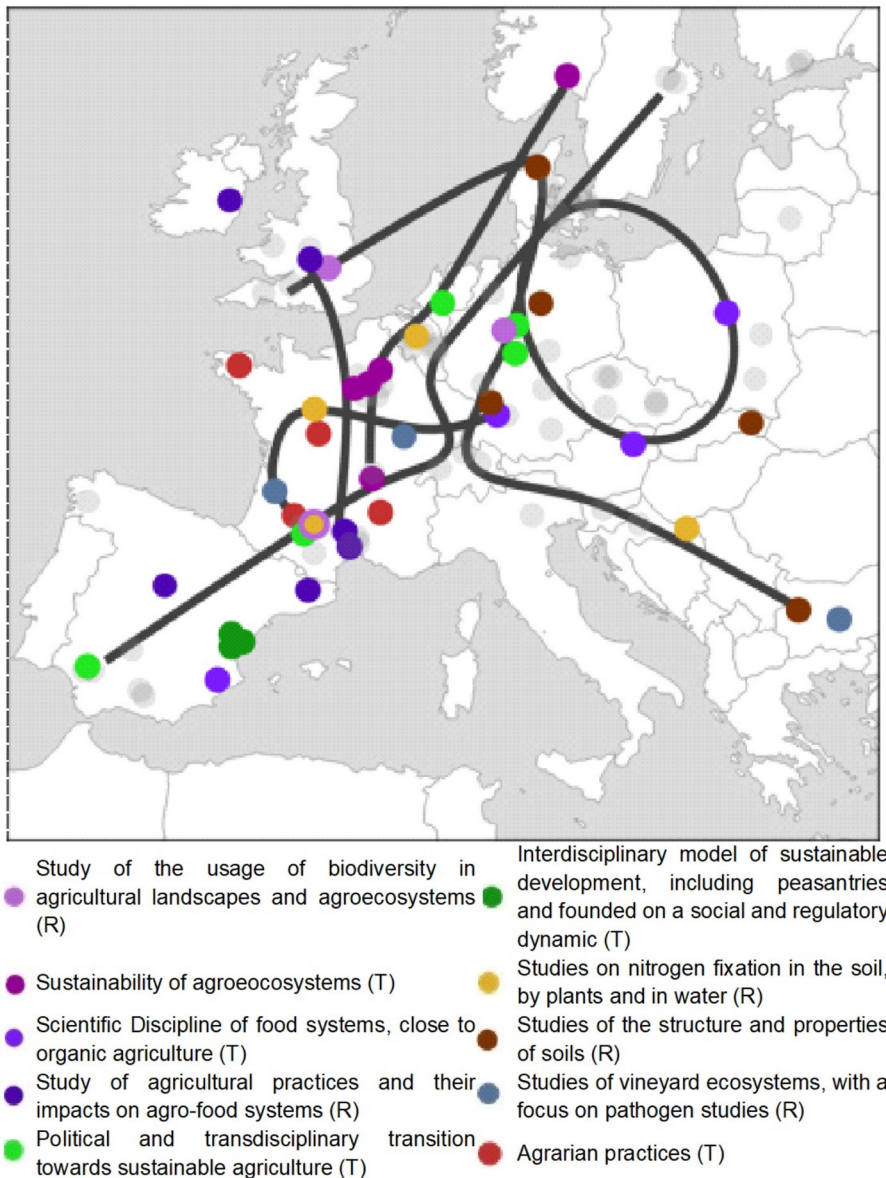


Figure 9: Direct and semantic networks of research and training actors

3.3.3 Semantics of actors and their comparison with direct networks

The presentation of the different meanings associated with agroecology within the actors discourses poses the question of whether not shared meanings of agroecology define the groups to which the research and training actors belong? The creation of shared meanings is a fundamental component of identity creation within communities of practice and demonstrates the power of discourse in institutionalization processes (Schmidt 2008, Wenger 1998). Such groups have been partially identified in the previous sections through their collaborations

through co-authorship. Yet here, represented by Figure 9, we map all the networks of actors based on the semantic analysis of their discourse in scientific publications and training content as published on the actors' websites.

The map in Figure 9 shows a rather dispersed geographical distribution of the different semantics. It is punctuated by a grouping of actors that consider agroecology as a set of agrarian practices (Terre & Humanisme, France) and those that see it more as a model for the Center of Rural Studies and International Agriculture (CERAI, Valencia, Spain). Moreover, Terre & Humanisme and CERAI use their own semantics to describe their work, which they share exclusively with their partners.

When comparing these semantic networks with the direct networks of actors (excluding national training networks), it appears that the latter (direct networks represented by continuous black lines) connect very few points of the same color. This means that direct networks and semantic networks do not have a lot of overlap. In other words, in the vast majority of cases, actors do not collaborate with those who share their same vision of agroecology, with the exception of Terre & Humanisme (red dots) and CERAI (dark green dots), which have almost identical direct and semantic networks. The CAWR and the CIRAD research units (blue-dark dots) also work together in direct and semantic networks composed of similar actors. This is also true for ISARA and NMBU (purple dots).

In summary, the research teams and their researchers do not reveal any overlap between the themes of their direct networks, revealing a result that a shared concept of agroecology does not seem necessary for collaboration to ensue. On the other hand, organizations close to social movements seem to collaborate with the same understanding of agroecology concepts. These meanings of agroecology carry with them identity and politicized values, which seem to require a unified discourse among the members in order to be part of the same social movement. These observations raise questions about the diffusion of notions of agroecology. The study carried out shows that, more often than not, having the same concept of agroecology is not a guarantee of collaboration, and conversely, that collaborating does not ensure that actors will have the same notion of agroecology unless there is a strong social and political movement driving the collaboration.

With regards to both research and training, it also appears that collaboration between actors is not synonymous with a common understanding of agroecology and vice versa. In the theoretical framework that we use to understand institutionalization; this observation opens a window for debate. Classic theories of collective action, in particular, establishes collaboration as an essential condition for mobilizing towards the creation or transformation of an institution, and this mobilization is difficult to separate from a shared frame (Benford *et al.* 2000, McAdam *et al.* 2003). While theories of new social movements have opened this relationship up towards more networked understandings of identity and common visions (Della Porta *et al.* 2006), the need for a consensus frame is still commonly supported, particularly in discussions about food (Candel *et al.* 2014, Mooney *et al.* 2009). Through this study, we have established that the collaboration of research and training actors does not

imply the structuring of a common vision of agroecology. Without a common vision, mobilization is unlikely and thus, the collaboration of actors will probably not lead to institutionalization. This finding is in line with the thesis of discursive institutionalism (Schmidt 2010), which sees institutions as actors stabilizing their networks. These actors create, maintain or transform their networks through their discourses. However, agroecology actors form networks in which different discourses are spread. Thus, agroecology networks are either in an early phase of low stability in the process of institutionalization, or they are not in that process at all. Whether we look at the situation from the point of view of theories of collective action or discursive institutionalism, the institutionalization of agroecology is debatable.

Moreover, the agroecology concepts that are already institutionalized among research actors do not reflect the notions supported by their civic training actors, who identify themselves as *agroecologists*. This observation allows us to qualify the previous remarks. Actor-network theory highlights the role of translation in network formation (Callon 1986). However, research organizations do not translate agroecology in the same way as the researchers and trainers who are members of these entities. Entities and their individuals therefore seem to belong to different networks. However, if a limited set of research entities is considered to be a network of actors, including their individual members, then the training of an actor-network must first involve the translated concepts of individuals before it can be extended to the translated concepts of research entities. Thus, this difference between individuals and research organizations reflects a process of transformation from one actor-network to another or, in other words, institutional change (Hargrave *et al.* 2006).

4 Conclusion and perspectives

This study focused on the dissemination of agroecology concepts across Europe. Through the identification of research and training actors, we wanted to understand what dynamics emerged when we looked at the stabilization and consolidation of concepts within networks, which we take to be an indication of institutionalization of the concept. To do this, we proposed an explanatory panorama of the different actors who self-identify with agroecology, which is supported by the results from a data analysis of the direct social and semantic networks since 1970.

The study identified 103 research and training organizations with different agroecological concepts that cut across scientific disciplines relating to the study of

soils, agroecosystems or agri-food systems, ecologically based agricultural practices, and political and social transitions. These conceptualizations are diverse and not very compatible in terms of creating one cohesive concept. Moreover, academic or scientific actors and civic training actors have very different visions of agroecology: the former assimilating theoretical and disciplinary notions of the term, while the latter tend towards socio-political notions. This divergence is also expressed in the diffusion of notions that we observed. Civic actors engage in some partnerships rooted in the common understanding of founding concepts, while academic and scientific actors rarely share the same vision of agroecology when they do collaborate with other European research groups, which is not the norm.

The approach we used brought together different theories that allowed us to reconcile the analysis of civic and research actors, which are generally difficult to combine. It also allowed a different perspective to be taken from the studies already produced on the subject of agroecology networks, which generally focused on individuals and eclipsed existing institutionalized networks. Our approach has thus made it possible to create an analytical link between individuals and institutional actors in the fields of research and training. However, there are limitations to this approach. The two most notable are linguistic and geographical bias, which have led us to examine networks only between European countries and focus only on a handful of languages. These limitations are certainly the source of the small number of collaborations established between the actors, as contemporary agroecology has its roots in the Americas and not in Europe. It would be important to address these limitations in future work by broadening the geographical and linguistic scope, while maintaining a comparative approach to networks of individuals and institutionalized networks.

Finally, since agroecology has a strong scientific foundation, also acknowledged by social movement actors, scholars identifying themselves in agroecology also have a responsibility towards being consistent with the transformative program of agroecology regarding agriculture and food systems. Such a position facilitates cooperation with social movements, under the umbrella of transdisciplinarity, and opens the networks to collective learning, based on the assessment or the renewal of research and training methods.

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