CHAPTER 9

The Food System Approach in Agroecology Supported by Natural and Social Sciences

Topics, Concepts, Applications

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CONTENTS

9.1 INTRODUCTION

The expected growth of the world population for at least the next four decades will demand not only increased food production worldwide, but also improved food availability and fair production and distribution of food at local, national, and global scales. This demands a concept of sustainable agricultural and food systems that not only addresses quantitative production issues, but also increasingly considers environmental issues of agricultural food production, such water and air pollution, biodiversity loss, and land degradation. In addition, social and economic aspects have to be taken into account, such as economic viability of farmers, organization and efficiency of supply chains and markets, communication and coordination among stakeholders, and farmer–consumer relationships. These aspects can no longer be analyzed in isolation if we wish to establish sustainable agricultural and food systems. Thus, global and holistic approaches are required. Such approaches have been, for example, developed in recent years in the framework of agroecology, applied to the food system, whereby agronomic, ecological, economic, and social dimensions are taken simultaneously into account at different scales (Francis et al. 2003; Gliessman 2007; Wezel and David 2012).

Although agroecology as a scientific discipline has existed for many decades, the food systems approach in agroecology has only recently been discussed (Wezel and Soldat 2009; Wezel and Jauneau 2011). Current research is focused on outlining more clearly and precisely the concepts, topics, and applications of the food system approach, as well as defining specific models and methods. Besides agroecology as a scientific discipline, other interpretations, such as agroecology as a practice or as a movement, are present to different degrees, depending on the geographical and institutional context (Wezel et al. 2009).

The scale and dimension of research in agroecology have been enlarged from (1) the plot, field, or animal scale to (2) the farm or agroecosystem scale, and (3) finally, in the last years, to the dimension of the food system, which is increasingly cited as a major outlook for agroecology (Wezel and Soldat 2009).

At the plot/field/animal scale, agroecological research aims to develop new farming practices, for example, in improving nutrient cycling, in more efficiently using natural resources, and in enhancing diversity of soil organisms, crops, and livestock to provide healthier systems. At this scale, research does not really consider the interactions and implications of these techniques for the agroecosystem, or the environment at a larger scale, or the food system.

The agroecosystem approach is a second major approach in agroecology. Here, ongoing research focuses on the agroecosystem scale, including exchange with, and impact on, the surrounding environment. Agroecological analyses focus, for example, on plant and animal communities and food web interactions for biological control, biodiversity and nature conservation, and drinking water pollution and land degradation in agricultural landscapes and agroecosystems. Within the agroecosystem approach the definitions and concepts might vary, depending on the delimitation of an agroecosystem. Sometimes, the farm is seen as equivalent to an agroecosystem where the relations between farmers' practices and natural resources are analyzed (Conway 1987). For others an agroecosystem is larger, that is, a local or regional landscape where relations between different types of agriculture and the natural resources of the landscape are investigated.

The food systems approach is the most recent and broadest approach in agroecology. It was first defined by Francis et al. (2003) as "the integrative study of the ecology of the entire food systems, encompassing ecological, economic and social dimensions," or more simply "the ecology of food systems." Gliessman (2007) defined agroecology as "the science of applying ecological concepts and principles to the design and management of sustainable food systems." These two definitions are based on former definitions of Altieri (1989, 1995, 2002).

Since the beginning of the 2000s, several authors have demanded that agriculture be analyzed in a holistic manner. For example, Robertson et al. (2004) stated that agricultural research needs long-term, system-level research at multiple scales, and that natural and social sciences must be better integrated. Gliessman (2007) stated that "to recognize the influence of social, economic, cultural, and political factors on agriculture, we must eventually shift our focus from sustainability of agroecosystems to the sustainability of our food systems." Nevertheless, it is still difficult to outline clear concepts, theoretical models, and methods that specify and translate these demands, and in particular the expanded definition of agroecology of the food system, into concrete cases and applications. So far, very few papers have applied agroecological concepts and theory to the food system; examples include Francis and Rickerl (2004) and Wezel and David (2012).

In the field of social sciences, numerous research works have dealt with alternative food systems to conventional agribusiness systems. An increasing number of research topics on food systems, local food networks, and alternative food systems such as direct selling, farm stores and short supply chain, farmers' markets, community-supported agriculture, consumer cooperatives, or quality labels for local or regional products have been developed since the mid-1980s (Feenstra 1997; Jarosz 2008; Marsden et al. 2000; Maye et al. 2007; Renting et al. 2003; Tregear 2011). Other works have dealt with change of farmers' practices and production of knowledge allowing changes toward more sustainable systems (e.g., conversion to organic farming, adoption of no-tillage practices, commitment to agri-environmental measures) (Hall and Mogyorody 2001; Lamine and Bellon 2009;

Walford 2003), as well as with social relationships in food systems (Guptill and Wilkins 2002) or consumers' practices (O'Hara and Stagle 2002). These research topics were mainly developed in the field of social sciences, and have been increasingly linked to agroecology in recent years.

Today, a broad diversity of food system topics is covered in literature dealing explicitly with agroecology. The topics include food sovereignty (Altieri and Nicholls 2008; Altieri and Toledo 2011; Altieri et al. 2012; Cohn et al. 2006; Reardon and Pérez 2010; Rosset et al. 2011), alternative and local food networks (Gliessman 2007), social agricultural networks (Warner 2005, 2007a,b), food crisis (Gliessman 2011), food security (Chappell and LaValle 2011), right to food (De Schutter 2012), agri-food systems (Thompson and Scoones 2009), food markets (Lockie and Carpenter 2010), and consumers (Stassart and Claes 2010).

In this chapter we will first provide a conceptual analysis of the food system approaches in the natural (ecology and agronomy) and social sciences, emphasizing fields of research topics and scientific disciplines involved. Second, we will take three varied examples to illustrate specificities and common aspects of natural and social sciences approaches to analyzing and assessing food system questions and topics. The first example will illustrate a research program that was initially dominated by a natural science approach (organic grain production), the second will show an example dominated by a social science approach (Associations pour le Maintien de l'Agriculture Paysanne (AMAP)—a community-supported agriculture system), and the third will illustrate a simultaneous natural and social sciences approach (organic agriculture and drinking water catchments). Finally, we will discuss to what degree the different approaches enrich the concept of agroecology of the food system, and will look more specifically at the added value of an interdisciplinary approach.

9.2 NATURAL AND SOCIAL SCIENCES APPROACHES TO AGROECOLOGY OF THE FOOD SYSTEM

In recent years, there has been an important ongoing debate in agroecology about the interest and the value of the food system approach of agroecology. The major questions deal with how to approach food system issues, what research concepts have to be used, and what methodology has to be developed. It is broadly acknowledged that for food system issues a global and systemic approach is needed (Francis et al. 2003; Gliessman 2007). According to Wezel and David (2012), the concepts of holism with a systemic approach including different scales and interdisciplinarity exist already, so they can now form the basis for research and analyses for the agroecology of the food system. Nevertheless, research approaches to the agroecology of the food system show themselves to be quite different when driven by either the natural or the social sciences. In addition, the specific research subjects and topics dealt with at the different scales may vary considerably for the two groups of disciplines.

9.2.1 Natural Sciences Approach

With the natural sciences approach, food-related research questions are often first dealt with at the scale of the field, and in fewer cases directly at the farm/agroecosystem scale (Figure 9.1). The increasing scales used for the food system approach of the natural sciences have caused the involvement of an increasing number of disciplines to deal with the increasing complexity of research questions and objects. The basic disciplines for the natural sciences approach to agroecology are agronomy and ecology, but currently it is still necessary to design concepts to handle the level of the food system as well as to deal with the high complexity of research questions at this scale. In general, the natural sciences research approach is based on an upscaling approach from the field level to the food system. A typical example of research in agroecology driven by a natural sciences approach will be illustrated by the first example in the second part of this chapter.

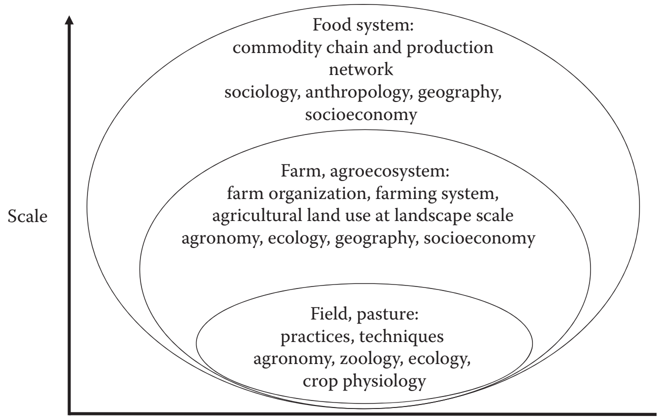

Figure 9.1 The natural sciences food system approach in agroecology illustrated for different scales, the major research subjects, and the disciplines involved. Agronomy and ecology are the basic disciplines for the natural sciences approach. With increasing scale, other disciplines are integrated in order to be able to deal with the increasing complexity of research questions.

For the natural sciences approach, the major research subjects and topics generally dealt with at the field/pasture scale are farmers' practices and techniques, crop or animal performance, and input and output fluxes. More specifically, this may include nutritional or protein content of crops in relation to agricultural practices, or the effect of vegetation composition and fodder quality on animal growth or milk quality. At the farm/agroecosystem scale, research topics are mainly farm organization, inputs and outputs at the farming system scale, or agricultural land use at the territory or landscape scales. More specifically, the questions of diversification of food production at the farm level as well as food transformation on-farm are analyzed. Finally, at the food system scale, the main research subjects are the analysis of the commodity chain and production networks of farmers and other stakeholders, although these food system topics are still seldom integrated into agroecological research initiated by natural scientists.

9.2.2 Social Sciences Approach

Here we look more generally at the social sciences approaches to food system topics and research. So far, we cannot explicitly speak of social sciences approaches in agroecology, because the increase of social sciences topics in agroecology research has only recently begun. However, an extensive corpus of literature on food systems topics and their recent developments can be revealed, some of which are mobilized today in agroecology. In contrast to the natural sciences approaches, the social sciences approaches do not follow a progressive enlargement of scales and subjects, but are centered on different research questions and topics (illustrated in the second example). The evolution of research questions and subjects can be quite complex, even if we limit this to the disciplines and approaches we could frame with agricultural sciences in the larger sense, with economic, social, technical, and biological knowledge creation in respect to agriculture. Three levels or scales can be distinguished: the farmer and farm, the local level, and the global level (Figure 9.2). At the farm level, research topics are mainly farm organization or decision making, economic performance, and farmers' social representations and knowledge. At the local level, topics dealing with collective organization of farmers, short supply chains, and relationships between farmers and consumers are the more frequent, whereas at the global level analyses on long supply chains and markets trends prevail. The basic disciplines for all levels are economy, sociology, and geography.

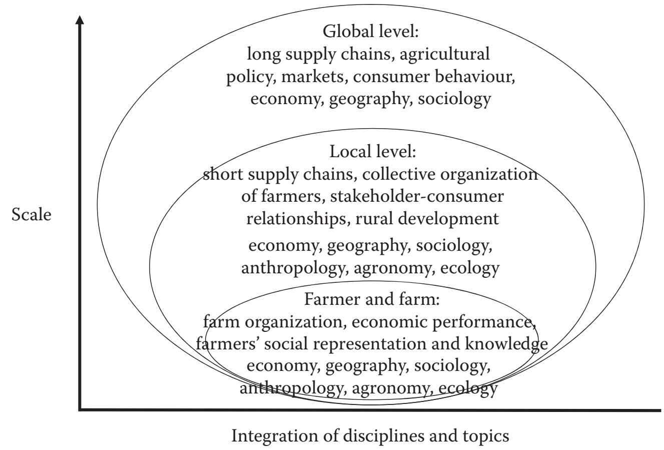

Figure 9.2 The social sciences food system approaches illustrated for different scales, the major research subjects, and the disciplines involved. Economy, sociology, and geography are the basic disciplines at all scales. The social sciences approach does not follow a progressive enlargement of scales and subjects, but is more constructed around certain research questions and topics.

As the social sciences approaches to the food system are more centered on different research questions and topics and less on scales, we will present here the three main approaches. The first refers to the analysis of supply chains and commodity chains either at the local (short supply chains) or at the global scale (long supply chains). A supply chain is centered on a basic agricultural product and its successive complete or partial transformations (Fraval 2000). It is, thus, an approach by fluxes: linkage between vertical flux of products, money, or both between the different stakeholders of the supply chain. This can start from the production and production factors toward the consumption, or the reverse.

The second approach focuses on stakeholders and their networks. It analyses the strategies and behaviors of stakeholders, and the relationships between these stakeholders as they are integrated into a larger collectivity or network (Frayssignes 2005). The vertical supply chain approach is here enlarged by also studying the horizontal relations (Mikkola and Seppänen 2006; Murdoch 2000), or even taking into account the connections with other supply or commodity chains, as well as with other stakeholders not directly linked to the supply chain. Here, the actor-network theory (Granovetter 2000; Law 1992) is often used to analyze the shape and composition of a network, which is given not simply by its socioeconomic components, but by all the linkages between all the enrolled entities (Murdoch 2000). In this context, the contribution of local agricultural products to territorial development is studied in relation to stakeholders' networks. This contribution can be twofold (Tregear et al. 2007): (i) favoring the constitution of an active network of producers, which allows increasing employment and income in the interior of the network; and (ii) creation of relations between biophysical (landscapes, local flora and fauna), cultural (techniques, local know-how), and economic (employment) resources, thus obtaining supplementary added value.

The third approach concentrates on the contribution of food systems to the economic and social development of local or regional areas. For this, connections between the rural agro-industry and the territory are investigated in analyzing the organization of productions and services (farm unities, food production enterprises, commercialization enterprises, catering enterprises) and their links to the characteristics and the management of a specific area. It refers to areas where the relations between the environment, people, products, enterprises, traditions, and consumption habits are handled in a holistic way and developed to produce a specific and localized organization of the food systems. This refers to the concept of a localized agro-food system (Muchnik and de Sainte Marie 2010). These systems are often seen as a potential alternative to globalized and standardized food systems.

9.3 EXAMPLES OF AGROECOLOGY OF FOOD SYSTEM RESEARCH AND NATURAL AND SOCIAL SCIENCES APPROACHES

In the second part of this chapter, we will use three research examples dealing with different food system topics to illustrate how the natural and social sciences approached the topics differently, and which scientific disciplines have been involved. In addition, we will evaluate how the different approaches allow us to consider the holistic approach to the agroecology of the food system, but also which constraints still remain with the different approaches. The three chosen examples are:

1. *Organic grain production*: applied research program initiated with a natural sciences approach focused on field level, with a progressive extension toward farm and food system issues.
2. *The AMAP system in France—an example of community-supported agriculture*: a social sciences approach to analyze different topics of a local food system at different scales.
3. *Organic agriculture and drinking water catchments*: an interdisciplinary initiative crossing social and natural sciences approaches to consider simultaneously agronomic, ecological, social, and food system topics from the plot/field to the food systems scale.

For the three examples we will describe the scale of analyses and the contributions from the interdisciplinary approaches carried out, but also their limits.

9.3.1 Organic Grain Production: From Wheat Production at Field Scale to Wheat Baking

This first example, previously published in Wezel and David (2012), illustrates a research project on organic grain production, where the central question was to improve nitrogen management of organic wheat and the baking quality of wheat flour.

The on-farm research program on organic wheat was initiated to identify the main limiting factors (David et al. 2004) and improve N management (David et al. 2005a) and weed management (Casagrande et al. 2009), to increase wheat performance (Figure 9.3). This first phase had been set up on 17 farms in two different agroecosystems in France (Diois, Plain de Valence), first, to take into account a wider range of growing conditions; second, to benefit from farmers' expert knowledge when research on organic grains systems was still very limited; and, finally, to

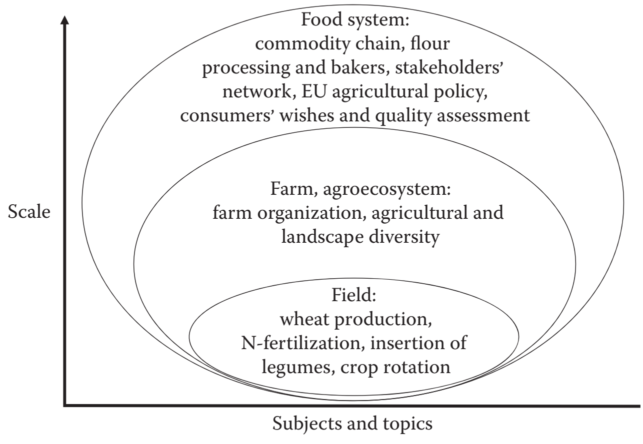

Figure 9.3 Main research topics and subjects of the organic wheat production and commodity chain example. Initially a natural sciences approach was carried out at the field scale, which was subsequently complemented with social sciences topics at larger scales.

consider the entire farm system and its socioeconomic parameters. Nitrogen and weed management were investigated on more than 40 organic fields from 1993 to 1998 by testing various techniques and equipment (field scale, agronomy). From 1998 to 2004, management of N fertilization had also been studied on experimental farms under controlled conditions, to produce references for N nutrition of organic and low-input wheat from off-farm organic N sources (David et al. 2004). This research also allowed the development of a decision support system to manage N fertilization of organic wheat (David et al. 2005b; David and Jeuffroy 2009) to improve grain yield and grain protein content. During the second phase of the program, research went beyond the restricted field scale analyses in integrating farm management aspects. A multivariate analysis of quantitative and qualitative data such as grain yield, protein content, crop management, and farming system management from 97 organic farms demonstrated, for example, the effects of crop management conditions, such as cultivar, preceding crop, N fertilization, and weed control, but also the effects of soil and climatic conditions, such as water deficit and temperature, on grain yield and protein content (field and agroecosystem scale; agronomy). Furthermore, interviews with farmers, which had been started in the first phase, increased in the second phase and have now become a key element of the research program, enabling a more complete study of farm management (field, farm, and food system scale; agronomy, economy, and sociology). In parallel, the analysis of the wheat-flour food chain allowed determination of the interactions between producers, collectors, processors, and consumers (David and Joud 2008). Also, a structured organic food chain supported by cooperatives and bakers improved the economic viability of farms.

The major results so far are that the agroecosystem characteristics of the studied areas strongly influence the farming systems, but also the food system. In general, different factors limiting organic crop production, such as weed and pest infestation, soil compaction, or climatic conditions like water stress and hot temperatures, could be determined (Casagrande et al. 2009; David et al. 2005a).

The Diois agroecosystem consists of limited areas with fertile soil in the Drome Valley, where cereals are produced in a long-term and diversified crop rotation of 8–11 years, surrounded by large areas with low soil fertility occupied by vineyards, lavender fields, permanent pastures, and (semi) natural ecosystems (Figure 9.4). The agricultural productivity is limited in this area. In contrast, the high agricultural diversity, together with the Drome River and the adjacent Vercors Mountains, make it a beautiful landscape and give it high value for tourism, for which farmers produce local

Figure 9.4 (See color insert) Diois agroecosystem with cereal production and viticulture, southeastern France.

food, wine, and lavender as well as offering accommodation. Conversion to organic production allowed the economic value of low-input agricultural productions such as wine, grains, and aromatic plants to be maintained. Moreover, the marketing of these organic products, promoted by cooperatives, is associated with identity and origin, and supported by traditional varieties and specific products, for instance by the Clairette de Die, a famous sweet sparkling wine produced exclusively in this area.

As the agroecosystem of the Plain of Valence consists of a large fertile plain, the yield performance of dominant grain production is much higher compared with the Diois. Organic grain systems differ only slightly from conventional systems. Cropping systems are based on a balanced proportion of spring crops, mostly irrigated, such as maize and soybean, associated in a crop rotation of four–six years with winter cereals such as wheat, barley, or triticale. The organic grains are collected by conventional cooperatives, where a limited organic sector has been developed to answer farmers' requirements. Tourism is very limited in the Plain of Valence area; thus, direct selling, provision of local food products, and accommodation on farms are rare.

The agroecosystem characteristics of the two subareas do not only influence the farming systems, but also involve differences in the food systems. For instance, in the Diois, the wheat-flour–bread chain is essentially based on a small niche market for traditional organic bakers or organic retailers looking for a specific flavor obtained with ancient varieties, but also providing identity as originating from the area. On the contrary, the wheat-flour food chain in the Plain of Valence is essentially based on standardized quality requirements, for example, protein content over the conventional threshold of 11.5 g per 100 g and no mycotoxins, applied to mass distribution or enterprises (David and Joud 2008). In general, it can be concluded that diversification of farm production and activities, off-farm employment, and professional and social networking contributed significantly to farm viability (David et al. 2010).

The ongoing research project now integrates many different scientific disciplines, such as agronomy, food technology, economy, and sociology, and works simultaneously at different scales, namely the field, the farm, and the food system levels, to develop a more holistic approach. Thus, the present research objectives are to improve nitrogen management, not only from additional fertilizers but also through innovations within crop rotations. Intercropping or undersowing systems with leguminous species, and also reduced tillage, have been tested to improve wheat production, as well as baking quality and nutritional value, and avoid mycotoxin contamination. Recently, agronomical and technological methods to improve the technological quality and safety of wheat have been determined (David et al. 2011). Further research questions are how local and regional processing, marketing, distribution, and selling enterprises in the region can be established or better implemented in the region, considering the increasing requirements from processors for quality and safety of organic wheat, as well as the demand from the regional and national organic food markets to decrease the variation in offer and quality as well as to limit price instability. And, last but not least, how can the organic farmers become better integrated in this food chain network, also considering the different support payment systems at national and European levels for organic agriculture?

This example shows the evolution of a natural sciences-oriented research program in which research objectives and methodology have slowly developed from technical questions on nitrogen management of organic wheat, supported by agronomists and applied at field scale, to overall agroecological questions around organic grain producers in which the social sciences (economists, sociologists, and food technologists) have been increasingly integrated, focusing on the wheat-flour food chain, stakeholder networks, and quality and safety issues of wheat, applied at the farm and food system scales. Finally, after several years, a more holistic approach to the agroecology of the food system has been established. Nevertheless, the program is still dominated by natural scientists, with the result that some more social sciences-oriented topics, such as stakeholder networks and marketing of organic food products, are somewhat neglected in achieving a balanced holistic approach.

9.3.2 Community-Supported Agriculture: The Case of the French AMAP System

In France, modes of direct selling with food boxes have strongly developed in recent years. Among different systems, the AMAP system is the best known. URGENCI (2012) describes this system as "local solidarity-based partnerships between producers and consumers." AMAP is an association based on mutual engagement between a group of consumers and a farmer. Each consumer signs a contract at the beginning of the season with a commitment to buy part of the production, which is then periodically delivered to him at a constant price. The engagement of the consumers normally also involves a contribution to the association, such as organizing the locality for distribution or distributing information, but can go as far as participation in practical work on the farm. On his side, the farmer makes a commitment to deliver quality products and to respect the rules of the AMAP charter (Alliance Provenance 2003).

The principles were born in Japan at the end of the 1950s (Amemiya 2007). At the same time, similar systems emerged in Switzerland and Germany, and since 1985 also in the United States (Cone and Myhre 2000; Cooley and Lass 1998; Fieldhouse 1996), called "Community-Supported Agriculture" (CSA). Similar systems are today also found in Canada, England, Australia, New Zealand, Brazil, Sweden, and Norway. In France, this system is more recent, but is strongly developing (Lamine 2008; Mundler 2007). According to MIRAMAP (2012), the number of AMAP systems reached 1600 at the end of 2011, with more than 66,000 involved consumers and a global turnover of 40 million euros. Even if the management of the CSA systems may be different from country to country, all these systems claim to offer an alternative to the conventional industrialized agri-food system (Fieldhouse 1996; Hinrichs 2000), and benefits such as education and social capital have been widely demonstrated (Cooley and Lass 1998; Sharp et al. 2002).

As the AMAP systems can vary significantly, they cannot be analyzed without taking into account the diversity of social and geographical contexts. In the following we will summarize research results about these systems in the Rhône-Alpes region, looking at different research topics mainly analyzed with a social sciences approach. Our research objective was to assess different components of the sustainability of the AMAP systems: their stability and persistence, their internal management, the economic viability of farmers, their capacity to produce quality products to all types of consumers having different incomes, and the environmental efficiency of the delivery of the products.

The Rhône-Alpes region is the second of 22 regions in France in terms of economic weight, numbering slightly more than 6.2 million inhabitants. The region is characterized by larger areas of the high mountains of the French Alps, mid-altitude mountainous and hilly areas, some urban agglomerations, and some smaller areas of plains dominated by agriculture. Its agriculture is distinguished by smaller farms (37 ha in average) compared with the French national average (55 ha), a large diversity of agricultural production, an important rate of production with quality labels, and a shared concern for environmental issues in agriculture (Mundler 2008). The AMAP systems have shown a strong development since 2004 in the Rhône-Alpes region. According to MIRAMAP (2012), AMAPs delivered to more than 10,000 families in 2010.

Different research questions were analyzed by economists and sociologists, mainly at farmer and consumer levels, but also at the scale of the AMAP system (Figure 9.5). Those farm enterprises that process their products and deliver them in short supply chains created more work units per farm: 2.1 annual work units for direct-selling farms compared with 1.3 work units for traditional farms (Capt and Dussol 2004). Direct selling with food boxes (Figure 9.6) allows family farms to be maintained, although income remains modest, and can be lower than in conventional supply chains (Mundler et al. 2008). The perception of risk for famers also changed. Even though the contracts of engagement are signed for 6–12 months, the farmers feel less subject to fluctuating market prices for standard agricultural commodities.

On the social level, the subjects and topics analyzed are mainly focusing on the collective and the territorial scales. It can be shown that the AMAP systems are competitive in comparison with

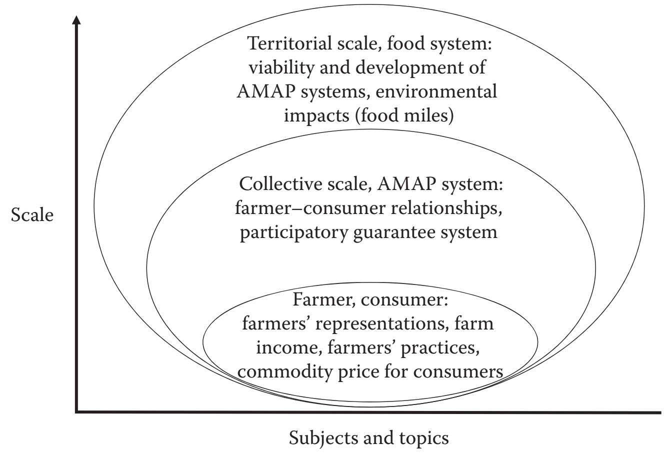

Figure 9.5 Subjects and research topics at different scales for community-supported agriculture illustrated with the case of the AMAP system in France. The research approach was dominated by a social sciences approach.

Figure 9.6 Food baskets and boxes and their distribution with an AMAP system. (Courtesy of Alliance PEC Rhône-Alpes. With permission.)

other modes of distribution (Mundler and Audras 2010). The consumers of the AMAPs are a population with strong social and cultural values, but are not distinguished by higher income. Those consumers who do not favor buying their food products in an AMAP system are more characterized by having a social and cultural distance from this kind of system, but not adhering because of a question of price. Another important fact is the social and professional recognition for farmers in short supply chains (including the AMAP). This recognition concerns satisfaction with their work and better socialization due to their relationships with clients, but also better financial recognition (Dufour et al. 2011). The consumers engaged in the AMAP system also insist on the educational role implicated in the supply of the food boxes: education of taste and the link between health and alimentation. Finally, the support and engagement of consumers for AMAP farmers have contributed to the implementation of different types of actions by territory-based organizations of stakeholders to protect land tenure of farmers and to favor short supply chains (Mundler et al. 2008).

If we look at environment-related questions, the farmer and farm scale and the territorial food system scale are important. Here, the dominant social sciences approach is complemented by the disciplines of agronomy and ecology. The charter of the AMAP system (Alliance Provenance 2003) mentions that the products from AMAP should "respect nature, environment, biodiversity, and soil fertility, and the production has to be managed without synthetic pesticides and fertilizers and responsible water use." In fact, the majority of AMAP farmers are certified for organic agriculture.

But the AMAP system even wants to be enrolled in an evolutionary progress approach that goes beyond organic farming in the sense of a social, economic, and ecological practice. This approach is opposed to the conception of organic farming as being too technical and instrumental, and exclusively defined by the production guidelines (Sylvander et al. 2006). In this conception, the AMAP systems have implemented a participatory guarantee system that associates consumers and farmers in the evaluation of the applied practices in the partner farm enterprises of the AMAP (Mundler and Bellon 2011). In some cases, this evaluation goes beyond the question of farmers' practices by also mutually evaluating other social and ethical questions, with the final objective of guaranteeing close relationships between the stakeholders.

Another important point is that the AMAP system favors local agriculture (Mundler 2009) and the consumption of seasonal products. Stakeholders see this as an advantage, based on the assumption, widely discussed in the literature, that these systems provide environmental benefits in reducing food miles, the distance travelled by a food product between the field and the plate. Several recent publications have questioned these benefits, showing the low efficiency of transport of low quantities (Coley et al. 2009; Edwards-Jones et al. 2008; Schlich and Fleissner 2005). In contrast, when the practices of the stakeholders in AMAP systems in France were analyzed and compared with other types of food distribution, it was shown that the AMAP systems had good efficiency (Mundler and Rumpus 2012).

In conclusion, the AMAP example represents a typical food system research topic that is often driven by a social sciences approach. For economic and socially related questions a lot of information is available already; however, less information is so far available on the impact of AMAP systems on certain practices of farmers, as well as on environmental issues such as biodiversity conservation or management (Maréchal 2008). In our example, this fact is mainly due to a low involvement of natural sciences approaches. We assume that the willingness to provide the possible largest diversity of products to consumers might induce agricultural practices favoring cultivated biodiversity. We also assume that receiving consumer members of an AMAP on the farm might promote the establishment of landscape elements such as hedges or herbaceous vegetation strips, thus favoring natural biodiversity. Nevertheless, these assumptions still have to be verified with interdisciplinary reseach involving agronomists, sociologists, economists, and ecologists.

9.3.3 Organic Agriculture and Drinking Water Catchments

In the last decade, different initiatives by national, regional, or local authorities in many countries in the world have been started to improve water quality in catchments for drinking water. The proposed solutions applied for catchments where agricultural land use is dominant are (i) to limit pesticide and nutrient inputs from conventional agricultural practices, (ii) to purchase agricultural land by the institution managing the catchment and to lend it to farmers with fixed rules for agricultural practices, (iii) to conduct reforestation, or (iv) to convert partially or completely to organic agriculture (Fleury and Vincent 2011).

In relation to organic farming, different approaches are carried out to favor conversion in drinking water catchment areas. In general, replacing conventional with organic farming practices normally results in a significant decrease of nitrate leaching and contamination with synthetic pesticides, as they are forbidden in organic agriculture (Haas 2010; Wilbois et al. 2007). Other, larger-scale approaches are (i) to promote collective catering with organic food for schools or other local catering facilities (as in the case of Munich, Germany (Stadtwerke München 2012) and Lons-le-Saunier (Martin 2010)), or (ii) to promote the establishment of local and regional market structures for organic raw products as well as to provide more information and establish better exchanges with farmers showing an interest in converting to organic agriculture (Haas 2010; Hermanowski et al. 2008; Wilbois et al. 2007). Often a combination of different options is favored in the different areas concerned.

This third research example deals with the issue of drinking water catchments and the potential contribution of organic agriculture to improving water quality. In contrast to the two preceding cases, it is an example in which a combined natural and social sciences approach was carried out from the beginning of the research project, with scientists from the fields of agronomy, ecology, hydrology, geography, sociology, and economics. In the project, initiated by the regional water agency, three drinking water catchments in southeastern France are analyzed and evaluated simultaneously at the field, farm, agroecosystem/local area, and food system scales. Different stakeholders were integrated from the beginning of the research project. The project analyzes and evaluates the contribution of organic agriculture to improving water quality in three territories where problems exist with nitrate and pesticide concentrations in the groundwater (Figure 9.7). Each territory includes a drinking water catchment, but is considered as a much larger area without specific delimitation to take into account different food system issues.

At the field scale, the different cropping and livestock production practices are analyzed to assess their potential risk for groundwater pollution (Figure 9.8). The project also investigates how similar they are to organic farming practices, which are generally considered to be less polluting, and evaluates the feasibility of changing or adapting certain practices. The initial results show that in one catchment certain crop rotations dominated by maize rely on intensive use of fertilizers,

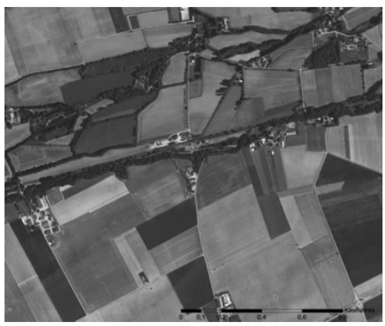

Figure 9.7 **(See color insert)** Area dominated by agriculture in a drinking water catchment in southeastern France.

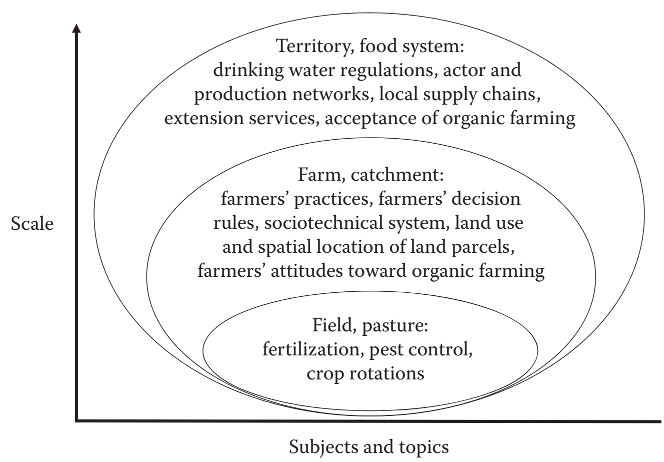

Figure 9.8 Different subjects and research topics are dealt with in a simultaneous social and natural sciences approach for analyzing and evaluating the potential contribution of organic agriculture to improving water quality in drinking water catchments.

pesticides, and irrigation. Also, some farmers seem to be already close to organic agriculture practices, but have not yet considered or decided to convert to organic agriculture. Many farmers indicated in interviews that they (i) will face major technical constraints to changing their practices, (ii) fear that their incomes will decrease, (iii) cannot imagine changing their farming system to organic, and (iv) would need technical and financial assistance when converting to organic agriculture.

At the scale of the drinking water catchments, the spatial location of farms and their land parcels and their respective practices are analyzed to evaluate zoning effects, such as concentration of certain "polluting" practices in certain zones, and the possibility of exchanging land parcels or modifying crop rotations, or even farming systems in certain zones (Figure 9.8). The field and water catchment scale analyses are led by natural sciences investigations, but also take into account social sciences aspects such as farmers' motivations for respective farming systems or practices and their decision rules for fertilization or pest control practices.

In interviews with farmers, the analysis of their farming practices and their spatial arrangement showed that especially intensive crop rotations in one catchment are located in zones with a high risk of transfer to the groundwater, and that farmers would be reluctant to locate them elsewhere because of difference in soil types, access to irrigation water, and distance from the farm buildings. In the second catchment, farmers have already adjusted their N-fertilization of crops in the core zone of the catchment relatively well, for example with fractionated application, which makes it difficult for them to improve this type of fertilization further. In addition, these fertilization practices are managed differently depending on which commune the farm is located in, as certain communes impose stronger regulations than others. For some mixed crop–livestock farms in the same catchment, it also became evident that they could not easily relocate their temporary pastures within their systems because of restricted access with their livestock to potential other land parcels, or because of remoteness of land parcels from the farm stable.

Simultaneously with the abovementioned mainly natural sciences analyses, a social sciences approach is carried out, analyzing stakeholder networks, sociotechnical networks, existing organic food commodity chains and production networks, but also farmers' flexibility and willingness to convert to organic agriculture. The latter are linked to the farm and water catchment scale, but the other analyses focus on the "territory" of stakeholder networks or even go beyond this when dealing with commodity chains or production networks.

Many farmers indicated in interviews that, besides technical problems and their low willingness to change to organic agriculture mentioned above, they would not know where they could place their products in the commodity supply chain if they converted to organic agriculture. The supply chain analyses have shown so far that short supply chains are more or less nonexistent and would need to be established first. Also, the development of collective catering with organic food in one of the study territories is in an initial state. Although longer supply chains for organic products exist on a regional scale, they are still under development. Interviews and meetings with stakeholders showed that so far there is little cooperation or coordination among many stakeholders, and that farmers are often not aware or well informed about the issue of drinking water quality and the different courses of action of certain stakeholders, such as the local or regional water management institutions.

This third example clearly illustrates the benefits of involving different scientific disciplines from the beginning of a research project in a simultaneous natural and social sciences approach, and at different scales. Without this, there would probably have been a risk of favoring certain more technical short-term solutions to improve farmers' practices at the field or the catchment level, without adequately taking into account the fact that a conversion to organic agriculture (or to conventional systems with practices close to organic practices) is not currently feasible, as the necessary network of collectors, raw product processors, retailers, technical advisors, and local to national markets for their organic products is presently underdeveloped or even nonexistent for the studied territories.

9.4 DISCUSSION AND CONCLUSION

Different authors demand that agroecology of the food system requires a holistic approach to guarantee that the different facets, subjects, and topics of the food systems are sufficiently considered. Nevertheless, two major questions remain: when is a holistic approach accomplished, and how much integration is needed from either natural or social sciences?

In our opinion, a holistic approach can be assured in considering at least the first three of the four prerequisites for food system research in agroecology, as mentioned in Wezel and David (2012):

1. Agroecological research has to be carried out simultaneously at different scales.
2. Agroecological research has to integrate different scientific disciplines as well as stakeholders from the different food system networks.
3. The potential environmental, social, and economic impacts of the expected research results have to be anticipated during the development of a research project and its hypothesis.
4. The recommendations from agroecological research have to be impact assessment-driven for the different scales.

The fourth prerequisite goes somewhat beyond the pure research approach, as it also defines the use of research results. Thus, it might not always be applied by the different research communities, as this last step is not automatically integrated or planned in many research projects.

In practice, this means that when starting to build a research program the focus is often on special subjects and topics, for example, analysis of short supply chains, and research is often led by only one or two scientific disciplines. But, if the intention is to build an agroecology program with a holistic approach, a second step is needed, in which additional subjects and topics are also taken into account. In the case of the short supply chains, these could include, for example, impact on farmers' income, farmers' practices, family work organization, food quality, food miles, and presence of (agro)biodiversity elements on farms. In adding these topics, the question of scales will appear automatically, as well as which other disciplines have to be integrated to analyze the additional topics adequately.

The second question, "how much integration is needed from either natural or social sciences to achieve a holistic agroecology of the food system approach?", probably cannot be answered satisfactorily.

Indeed, the status of agroecology from an interdisciplinary viewpoint remains ambiguous. For many social sciences researchers, agroecology is not yet a research object with clearly outlined frontiers or scales. Therefore, it remains an object with vague contours; the concept expresses an intention, a horizon, a process in constant evolution, claimed by a diversity of actors, which themselves can be in strong disagreement. From this viewpoint, the debates around sustainable development have to be reconsidered for agroecology and social sciences. For example, should agroecology be restricted only to alternative approaches to the agro-industry? Which agricultural practices should be considered, or not, for agroecology? Numerous questions remain. Sustainable development can be defined as "a vector of desirable social objectives, that is a list of attributes which society seeks to achieve or maximize" (Pearce et al. 1990); therefore, agroecology could be handled as a set of technical, social, environmental, and economic practices aiming at favoring a permanent transformation of agriculture, with the objective of better taking into account ethics of exchanges, a social and economic cohesion, and the preservation of natural resources adapted to a certain territory. In this sense, agroecology is a movement, not only in the sense of a social movement, but in the sense of flexibility and a permanent adaptation of technical and social practices in each particular context.

Can agroecology be seen as an interdiscipline or a metadiscipline that is able to associate and integrate natural and social sciences? In our opinion, yes, if it stimulates research associating researchers from different disciplines and practitioners in a permanent mutual learning process, allowing them to preserve natural resources, to improve the efficiency of practices in reducing external inputs, favoring control of pests and maladies with biological control, and to redesign agroecosystems based on ecosystem services and adapted to social and environmental conditions specific to each territory.

The required interdisciplinarity for agroecology research needs, therefore, an evolution in the way to design programs and research objects. As shown with the third research example, there exist disjunctions between the ecological and agronomic functional areas (a drinking water catchment and farmers' fields), the management area (the farm territory, the collecting area for an agricultural commodity, or even the territory of a local interest group of actors), and the areas used by the citizens. It is, therefore, necessary to establish coherence and a common perspective for the varied knowledge of different origins that concerns the objectives, the sectors, and the different scales. Ecology and agronomy, historically the basic disciplines of agroecology, contribute to a holistic approach with their capacity to analyze changes of farmers' practices and their production and environmental consequences, as well as applying the concepts and methods of ecology for food chain analyses, such as matter fluxes and transformation, to the evaluation of food systems, something the social sciences are not able to carry out. The social sciences have historically developed and continue to develop theories, concepts, and methods to deal with different issues in agriculture and food systems. The individual in interaction and exchange with other actors is, therefore, at the center of analyses, and increasingly these analyses are carried out in a participatory way. To progress toward a global and systemic vision of agroecology of the food system, therefore, both interdisciplinary and participatory research is needed (Petit et al. 2011).

In this regard, the third example, about organic agriculture and drinking water catchments, is an example in which all the prerequisites for research into the agroecology of the food system have been considered from the beginning of the research program, and thus a holistic approach has been established. This, of course, does not guarantee that the final research results will automatically provide satisfactory solutions for stakeholders and farmers, but it provides assurance that relevant research topics from natural and social sciences have been considered in order to analyze the whole food system at different scales.

In contrast, the first example, about organic wheat production and wheat baking, clearly shows that a holistic approach was not accomplished in the first years of the project, as it was guided only by the natural sciences. Although social sciences topics were gradually integrated thereafter, a bias still exists, with natural sciences questions dominating. We could call this a "biased holistic approach," in which a broad variety of relevant research topics were integrated, but with a remaining weakness and insufficient depth in the analyses of certain social sciences topics.

With the second example, about the AMAP system, we find an even stronger bias. Here, an almost complete dominance of social sciences topics and subjects prevails. Natural sciences topics are so far only marginally integrated. Therefore, a holistic approach to the agroecology of the food system is not yet achieved.

To conclude, the challenging questions of today's agriculture and food systems can only be adequately solved if interdisciplinary research is carried out from the beginning, integrating natural and social sciences, as well as concerned stakeholders. For this, the holistic approach to the agroecology of the food system seems very promising, as it is based on interdisciplinarity, multiscale analyses, stakeholder integration, and anticipation of environmental, social, and economical impacts from the expected research results.

REFERENCES

Alliance Provence (Réseau régional des AMAP). 2003. Charte d'Alliance Provence sur les AMAP. http://www.allianceprovence.org/La-nouvelle-Charte-des-AMAP.html (accessed: 5 February 2014).

Altieri, M. A. 1989. Agroecology: A new research and development paradigm for world agriculture. *Agr Ecosyst Environ* 27:37–46.

Altieri, M. A. 1995. Agroecology: *The Science of Sustainable Agriculture*. Boulder: Westview Press.

Altieri, M. A. 2002. Agroecology: The science of natural resource management for poor farmers in marginal environments. *Agr Ecosyst Environ* 93:1–24.

Altieri, M. A., F. R. Funes-Monzote, and P. Petersen. 2012. Agroecologically efficient agricultural systems for smallholder farmers: Contributions to food sovereignty. *Agron Sustain Dev* 32:1–13.

Altieri, M. A. and C. I. Nicholls. 2008. Scaling up agroecological approaches for food sovereignty in Latin America. *Development* 51:472–480.

Altieri, M. A. and V. M. Toledo. 2011. The agroecological revolution in Latin America: Rescuing nature, ensuring food sovereignty and empowering peasants. *J Peasant Stud* 38:587–612.

Amemiya, H. 2007. Le Teikei: La reference japonaise de la vente directe de produits fermiers locaux. In Amemiya, H. (ed.), *L'agriculture participative. Dynamiques bretonnes de la vente directe*, pp. 21–48. France: Presses Universitaires de Rennes.

Capt, D. and A. M. Dussol. 2004. Exploitations diversifiées: Un contenu en emploi plus élevé. *Agreste Cahiers* 2:11–18.

Casagrande, M., C. David, M. Valantin-Morison, D. Makowski, and M. H. Jeuffroy. 2009. Factors limiting the grain protein content of organic winter wheat in south-eastern France: A mixed-model approach. *Agron Sustain Dev* 29:565–574.

Chappell, M. J. and L. A. LaValle. 2011. Food security and biodiversity: Can we have both? An agroecological analysis. *Agr Hum Values* 28:3–26.

Cohn, A., J. Cook, M. Fernandez, R. Reider, and C. Steward. 2006. Agroecology and struggle for food security in the Americas. London, England: International Institute for Environment and Development (IIED), Yale School of Forestry and Environmental Studies (Yale F&ES), IUCN Commission on Environmental, Economic and Social Policy (CEESP). http://pubs.iied.org/pdfs/14506IIED.pdf (accessed: 17 March 2012).

Coley, D., M. Howard, and M. Winter. 2009. Local food, food miles and carbon emissions: A comparison of farm shop and mass distribution approaches. *Food Policy* 34:150–155.

Cone, C. A. and A. Myhre. 2000. Community-supported agriculture: A sustainable alternative to industrial agriculture? *Hum Organ* 59:187–197.

Conway, G. R. 1987. The properties of agroecosystems. *Agr Syst* 24:95–117.

Cooley, P. J. and D. A. Lass. 1998. Consumer benefits from community supported agriculture membership. *Rev Agr Econ* 20:227–237.

David, C., F. Celette, J. Abecassis, et al. 2011. AGronomical and TEChnological methods to improve ORGanic wheat quality (AGTEC-Org). EU-Project no. ERAC-CT-2004-011716. Final report, p. 53. http://www.coreorganic.org/research/projects/agtec-org/index.html (accessed: 3 June 2012).

David, C. and M. H. Jeuffroy. 2009. A sequential approach for improving Azodyn crop model under conventional and low-input conditions. *Eur J Agron* 31:177–182.

David, C., M. H. Jeuffroy, J. Henning, and J. M. Meynard. 2005a. Yield variation of organic winter wheat: A crop diagnosis on a field network in south-east of France. *Agron Sustain Dev* 25:1–11.

David, C., M. H. Jeuffroy, F. Laurent, M. Mangin, and J. M. Meynard. 2005b. The assessment of a decision making tool for managing the nitrogen fertilization of organic winter wheat. *Eur J Agron* 23:225–242.

David, C., M. H. Jeuffroy, S. Recous, and F. Dorsainvil. 2004. Adaptation and assessment of the Azodyn model managing the nitrogen fertilization of organic winter wheat. *Eur J Agron* 21:249–266.

David, C. and S. Joud. 2008. Etats des lieux de la collecte du blé biologique panifiable en France. *Industries des Céréales* 159:21–26.

David, C., P. Mundler, O. Demarle, and S. Ingrand. 2010. Long-term strategy and flexibility of organic farmers in Southeastern France. *Int J Agr Sustain* 8:305–318.

De Schutter, O. 2012. Agroecology, a tool for the realization of the right to food. In Lichtfouse, E. (ed.), *Agroecology and Strategies for Climate Change*, *Sustainable Agriculture Reviews*, vol. 8, pp. 1–16. Dordrecht: Springer Verlag.

Dufour, A., C. Herault-Fournier, E. Lanciano, and N. Pennec. 2011. L'herbe est-elle plus verte dans le panier? Satisfaction au travail et intégration professionnelle de maraîchers qui commercialisent sous forme de paniers. In Traversac, J. B. (ed.), *Circuits courts. Contribution au développement regional*, pp. 71–85. Dijon: Editions Educagri.

Edwards-Jones, G., L. Milai Canals, N. Hounsome, et al. 2008. Testing the assertion that "local food is best": The challenges of an evidence-based approach. *Trends Food Sci Tech* 19:265–274.

Feenstra, G. 1997. Local food systems and sustainable communities. *Am J Alternative Agr* 12:28–36.

Fieldhouse, P. 1996. Community shared agriculture. *Agr Hum Values* 13(3):43–47.

Fleury, Ph. and A. Vincent. 2011. Water quality protection and organic farming development in France. In *3rd Scientific Conference of ISOFAR*, vol. 2, pp. 51–54. IFOAM, Seoul, South Korea, 27–30 October 2011.

Francis, C., G. Lieblein, S. Gliessman, et al. 2003. Agroecology: The ecology of food systems. *J Sustain Agr* 22:99–118.

Francis, C. and D. Rickerl (eds). 2004. Ecology of food systems: Visions for the future. In *Agroecosystems Analysis*. Agronomy 43, pp. 177–197. Madison, WI: American Society of Agronomy.

Fraval, P. 2000. Éléments pour l'analyse économique des filières agricoles en Afrique sub-saharienne. Bureau des politiques agricoles et de la sécurité alimentaire DCT/EPS, Ministère des Affaires étrangères. DGCID, p. 100.

Frayssignes, J. 2005. Les AOC dans le développement territorial. Une analyse en terme d'ancrage appliqué aux cas français des filières fromagères. Thèse de doctorat en géographie. Institut National Polytechnique de Toulouse.

Gliessman, S. R. 2007. *Agroecology: The Ecology of Sustainable Food Systems*, p. 384. New York: CRC Press, Taylor & Francis.

Gliessman, S. R. 2011. Agroecology and the growing food crisis. *J Sustain Agr* 35:697–698.

Granovetter, M. 2000. *Le marché autrement*. Essais de Mark Granovetter. Paris, Desclée de Brouwer, p. 238.

Guptill, A. and J.-L. Wilkins. 2002. Buying into the food system: Trends in food retailing in the US and implications for local foods. *Agr Hum Values* 19:39–51.

Haas, G. 2010. Wasserschutz im Ökologischen Landbau: Leitfaden für Land- und Wasserwirtschaft. Report, Bundesprogramm Ökologischer Landbau, p. 61. http://orgprints.org/16897/1/16897-06OE175-agraring-enieurbuero-haas-2010-wasserschutz.pdf (accessed: 7 February 2012).

Hall, A. and V. Mogyorody. 2001. Organic farmers in Ontario: An examination of the conventionalization argument. *Sociol Ruralis* 41:399–322.

Hermanowski, R., A. Bauer, B. Schwab, and D. Pfennigwerth. 2008. Wenn Markt und Ökologie an Einem Strang Ziehen. *Ökologie & Landbau* 147:47–49. http://orgprints.org/8451/ (accessed: 7 February 2012).

Hinrichs, C. C. 2000. Embeddedness and local food systems: Notes on two types of direct agricultural market. *J Rural Stud* 16:295–303.

Jarosz, L. 2008. The city in the country: Growing alternative food networks in metropolitan areas. *J Rural Stud* 24:231–244.

Lamine, C. 2008. *Les AMAP: Un nouveau pacte entre producteurs et consommateurs*? p. 163. Paris: Editions Yves Michel.

Lamine, C. and S. Bellon. 2009. Conversion to organic farming: A multidimensional research object at the crossroads of agricultural and social sciences. A review. *Agron Sustain Dev* 29:97–112.

Law, J. 1992. Notes on the theory of the actor-network: Ordering, strategy and heterogeneity. *Syst Pract* 5:379–393.

Lockie, S. and D. Carpenter. 2010. *Agriculture, Biodiversity and Markets: Livelihoods and Agroecology in Comparative Perspective*. London, England: Earthscan.

Maréchal, G. 2008. *Les circuits courts alimentaires: Bien manger dans les territoires*. Dijon, France: Educagri.

Marsden, T., J. Banks, and G. Bristow. 2000. Food supply chain approaches: Exploring their role in rural development. *Sociol Ruralis* 40(4):424–438.

Martin, L. 2010. Agriculture et qualité de l'eau: Le dispositif de Lons-le-Saunier, Evolution des jeux d'acteurs. Unpublished master thesis, ESITPA, Mont-Saint-Aignan, France.

Maye, D., L. Holloway, and M. Kneafsey (eds). 2007. *Alternative Food Geographies: Representation and Practice*. Bingley, UK: Emerald Group.

Mikkola, M. and L. Seppänen. 2006. Farmers' new participation in food supply chains: Making horizontal and vertical progress by networking. In Langeveld, H. and N. Röling (eds), *Changing European Farming Systems for a Better Future: New Visions for Rural Areas*. The Netherlands: Wageningen Academic Publishers.

MIRAMAP. 2012. Mouvement Interrégional des AMAP. http://miramap.org/spip.php (accessed: 7 February 2012).

Muchnik, J. and C. de Sainte Marie (eds). 2010. *Le temps des Syal: Techniques, vivres et territoires*. Versailles: éditions Quae.

Mundler, P. 2007. Les AMAP en Rhône-Alpes, entre marché et solidarité. *Ruralia* 20:185–215.
Mundler, P. 2008. L'agriculture en Rhône-Alpes, une multifonctionnalité évidente? In Cornu, P. and J.-L. Mayaud (eds), *Nouvelles questions agraires: Exploitants, fonctions et territoires*, pp. 275–298. Paris: Editions Boutique de l'Histoire, coll. Mondes ruraux contemporains.
Mundler, P. 2009. Les associations pour le maintien de l'agriculture paysanne: Solidarité, circuits courts et relocalisation de l'agriculture. *Pour* 201:155–162.
Mundler, P. and A. Audras. 2010. Le prix des paniers, analyse de la formation des prix dans 7 AMAP en Rhône-Alpes. Colloque INRA-SFER-CIRAD, Rennes, 9–10 December 2010.
Mundler, P. and S. Bellon. 2011. Les systèmes participatifs de garantie. Une alternative à la certification par organismes tiers? *Pour* 212:57–65.
Mundler, P., J. M. Ferrero, A. Jan, and R. Thomas. 2008. Petites exploitations diversifiées en circuits courts. Soutenabilité sociale et économique. Research report. Lyon, France: Isara.
Mundler, P. and L. Rumpus. 2012. The energy efficiency of local food systems: A comparison between different modes of distribution. *Food Policy* 37:609–615.
Murdoch, J. 2000. Networks—A new paradigm of rural development? *J Rural Stud* 16:407–419.
O'Hara, S.-U. and S. Stagle. 2002. Endogenous preferences and sustainable development. *J Soc Econ* 31:511–527.
Pearce, D. W., E. B. Barbier, and A. Markandya. 1990. *Sustainable Development*. London: Earthscan.
Petit, S., C. Mougenot, and Ph. Fleury. 2011. Stories on research, research on stories. *J Rural Stud* 27:394–402.
Reardon, J. A. S. and R. A. Pérez. 2010. Agroecology and the development of indicators of food sovereignty in Cuban food systems. *J Sustain Agr* 34:907–922.
Renting, H., T. K. Marsden, and J. Banks. 2003. Understanding alternative food networks: Exploring the role of short food supply chains in rural development. *Environ Plann* 35:393–411.
Robertson, G. P., J. C. Broome, E. Chornesky, J. R. Frankenberger, P. Johnson, M. Lipson, J. A. Miranowski, E. Owens, D. Pimentel, and L. A. Thrupp. 2004. Rethinking the vision for environmental research in US agriculture. *Bioscience* 54:61–65.
Rosset, P. M., B. M. Sosa, A. M. R. Jaime, and D. R. A. Lozano. 2011. The Campesino-to-Campesino agroecology movement of ANAP in Cuba: Social process methodology in the construction of sustainable peasant agriculture and food sovereignty. *J Peasant Stud* 38:161–191.
Schlich, E. and U. Fleissner. 2005. The ecology of scale: Assessment of regional energy turnover and comparison with global food. *Int J Life Cycle Ass* 10:219–223.
Sharp, J., E. Imerman, and G. Peters. 2002. Community Supported Agriculture (CSA): Building community among farmers and non-farmers. *J Extension* 40. Online. www.joe.org/joe/2002june/a3.html (retrieved March 2012).
Stadtwerke München. 2012. Trinkwasser-Schutz und Organischer Landbau. http://www.swm.de/privatkunden/m-wasser/gewinnung/wasserschutz.html (accessed: 7 February 2012).
Stassart, P. M. and C. Claes. 2010. Agroécologie: Le chainon manquant. Rôle de consommateurs et d'ONG dans les processus émergents d'apprentissages. In *Proceeding of ISDA* 2010. Montpellier, 28–30 June 2010. http://hal.archives-ouvertes.fr/docs/00/52/14/06/PDF/STASSART-CLAES_AgroA_cologie_Le_chainon_manquant_Final.pdf (accessed: 7 February 2012).
Sylvander, B., S. Bellon, and M. Benoît. 2006. Facing the organic reality: The diversity of development models and their consequences on research policies. In *Proceedings of European Joint Organic Congress* "*Organic Farming and European Rural Development*", pp. 58–61. Odense, Denmark, 30–31 May 2006. http://orgprints.org/8247/ (accessed: 5 May 2012).
Tregear, A. 2011. Progressing knowledge in alternative and local food networks: Critical reflections and a research agenda. *J Rural Stud* 27:419–430.
Tregear, A., F. Arfini, G. Belletti, and A. Marescotti. 2007. Regional foods and rural development: The role of product qualification. *J Rural Stud* 23:12–22.
Thompson, J. and I. Scoones. 2009. Addressing the dynamics of agri-food systems: An emerging agenda for social science research. *Environ Sci Policy* 12:386–397.
URGENCI. 2012. The international network of community supported agriculture. www.urgenci.net (accessed: 7 February 2012).
Walford, N. 2003. Productivism is allegedly dead, long live productivism: Evidence of continued productivist attitudes and decision-making in south-east England. *J Rural Stud* 19:491–502.

Warner, K. D. 2005. Extending agroecology: Grower participation in partnerships is key social learning. *Renew Agr Food Syst* 21:84–94.

Warner, K. D. 2007a. *Agroecology in Action: Extending Alternative Agriculture through Social Networks*. USA: MIT Press.

Warner, K. D. 2007b. The quality of sustainability: Agroecological partnerships and the geographic branding of California winegrapes. *J Rural Stud* 23:142–155.

Wezel, A., S. Bellon, T. Doré, C. Francis, D. Vallod, and C. David. 2009. Agroecology as a science, a movement or a practice. A review. *Agron Sustain Dev* 29:503–515.

Wezel, A. and C. David. 2012. Agroecology and the food system. In Lichtfouse, E. (ed.), *Agroecology and Strategies for Climate Change*, Sustainable Agriculture Reviews, vol. 8, pp. 17–34. Dordrecht: Springer.

Wezel, A. and J. C. Jauneau. 2011. Agroecology—Interpretations, approaches and their links to nature conservation, rural development and ecotourism. In Campbell, W. B. and S. López Ortiz (eds), *Integrating Agriculture, Conservation and Ecotourism: Examples from the Field*. Issues in Agroecology—Present Status and Future Prospectus, vol. 1, pp. 1–25. Dordrecht: Springer.

Wezel, A. and V. Soldat. 2009. A quantitative and qualitative historical analysis of the scientific discipline agroecology. *Int J Agr Sust* 7:3–18.

Wilbois, K.-P., M. Szerencsits, and R. Hermanowski. 2007. Eignung des Ökologischen Landbaus zur Minimierung des Nitrataustrags ins Grundwasser. FiBL Deutschland. http://orgprints.org/13270/ (accessed: 7 February 2012).