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# Organic Uniformity?

How organic farmers perceive and practice  
diversity

Master Thesis

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## Abstract

Biological, cultural and social diversity are ethically required in Organic Agriculture and important for the resilience of a social-ecological system. However there is increasing concern about organic farms not being in line with the organic values in general and showing low agricultural diversity on the farms in particular.

This exploratory study conducted in Upper Austria investigated organic farmers' understanding of diversity including biodiversity, social diversity and cultural diversity as well as influencing factors especially on biodiversity and agricultural diversification. 12 qualitative interviews with full- and part-time farmers engaged in different farming activities and marketing strategies showed that farmers' connotations with the term diversity are rich and manifold and encompass planned and associated biodiversity, a sophisticated understanding of ecological interrelations and ecological functioning based on biodiversity and an affirmative mindset towards fostering and establishing biodiversity. But also economic and social aspects are associated and turned out to be important for the farmers. Diversification of marketing and purchasers is seen as an important risk reducing strategy; diversity of production however is sometimes discussed critical due to risk of dissipation and thus loss of quality of products. And social contact and social diversity, with respect to farming and in general, were found to be of high value for the organic farmers. Cultural aspects however are not linked with diversity, although there are indications that cultural aspects are nonetheless perceived as not irrelevant for the farmers. Overall farmers' attitudes and understanding of diversity in the present cases could be classified as in line with the organic values.

The analysis of influencing factors on several aspects of biodiversity showed that personal, economic and production-technical factors determine agricultural diversity. Personal interest and dedication as well as profitability and marketing turned out to be the most influential factors on diversity of the farms. It is shown that social diversity on the farm, direct marketing and cooperation (e.g. regarding machines and processing infrastructure, what allows producing economically viable in small scale) are leverage points for increasing agricultural diversity on the farm level and thus should be considered and focused on in attempts to increase biological and agricultural diversity on (organic) farms.

**Keywords:** diversity, diversification, biodiversity, organic agriculture, attitudes, perception, influencing factors

## **Zusammenfassung**

Biologische, aber auch kulturelle und soziale Vielfalt sind Grundprinzipien in der Ökologischen Landwirtschaft und essentieller Bestandteil der Resilienz sozio-ökologischer Systeme. In den zurückliegenden Jahren gab es allerdings zunehmende Besorgnis darüber, dass der ökologische Landbau nicht den Prinzipien der Ökologischen Landwirtschaft entspricht. Dabei wurde auch kritisiert, dass einige biologisch bewirtschaftete Höfe nur eine geringe biologische Vielfalt aufweisen.

Die vorliegende Arbeit untersucht das Verständnis von Vielfalt und Biodiversität aus der Sicht von Biobäuerinnen und -bauern. Es sollen die Schlüsselfaktoren ermittelt werden, welche den Grad der Vielfalt auf den Betrieben bestimmen. Dazu wurden qualitative Interviews mit 12 Voll- und Nebenerwerbsbiobäuerinnen und -bauern in Oberösterreich geführt, die in unterschiedlichen landwirtschaftlichen Produktionssparten tätig sind und unterschiedliche Vermarktungsstrategien anwenden.

Es hat sich gezeigt, dass die befragten Biobäuerinnen und -bauern ein umfassendes und komplexes Verständnis von Vielfalt aufweisen, welches sich vor allem auf die biologische Vielfalt bezieht, aber auch ökonomische und soziale Aspekte berücksichtigt. So ist vor allem die Diversifizierung der Absatzmärkte und Kunden eine wichtige Strategie um das Absatzrisiko zu senken. Vielfalt in der Produktion wird jedoch vor allem aufgrund des Risikos sich zu verzetteln und einem damit einhergehenden Qualitätsverlust oft eher kritisch gesehen. Soziale Vielfalt, sowohl in der Familie und auf dem Hof als auch in der Gesellschaft generell, wurde von den Bauern als sehr wichtig hervorgehoben. Kulturelle Aspekte werden mit Vielfalt weniger assoziiert, wenngleich sie nicht irrelevant zu sein scheint. Im Wesentlichen spiegelt das Verständnis von Vielfalt der befragten Bäuerinnen und Bauern die Prinzipien der Ökologischen Landwirtschaft wider.

Produktionstechnische, ökonomische und persönliche Faktoren sind ausschlaggebend für das Verständnis und die Praxis von Vielfalt. Neben der Einstellung und persönlichen Überzeugung haben sich vor allem die Profitabilität der Herstellung von Kleinmengen und die Absetzbarkeit der Produkte als entscheidende Einflussfaktoren herausgestellt. Auch die soziale Vielfalt und die Anzahl beteiligter Menschen am Hof sowie Direktvermarktung und Kooperationen (z.B. die gemeinsame überbetriebliche Nutzung von Maschinen, die wirtschaftlich rentable Produktion in kleinem Maßstab erlaubt) lassen sich als Schlüsselfaktoren für hohe biologische und landwirtschaftliche Vielfalt identifizieren und sollten daher verstärkt berücksichtigt und gefördert werden.

**Schlüsselworte:** Vielfalt, Diversifizierung, Biodiversität, Ökologische Landwirtschaft, Einstellung, Wahrnehmung, Einflussfaktoren

“There never were in the world two opinions alike, no more than two hairs or two grains; the most universal quality is diversity.”

Michel de Montaigne<sup>1</sup>

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<sup>1</sup> <http://www.greatest-inspirational-quotes.com/diversity-quotes.html>

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# 1 Introduction and overview

Farms are complex social-ecological systems. The shape of these systems is affected by biological, technical and social aspects including the values and knowledge of farmers, and the interrelations of the farm system with other systems in the food chain and society (Darnhofer, Fairweather, & Moller, 2010; Noe & Alrøe, 2012). Diversity (biological, cultural and social) is an important aspect of, and contributor to, resilience of social-ecological systems (Walker, Holling, Carpenter, & Kinzig, 2004). However, diversity in agriculture is increasingly lost, and also in organic agriculture, where diversity is ethically required, there is increasing concern about low diversity (Kremen, Iles, & Bacon, 2012; Lindenthal, Verdorfer, & Bartel-Kratochvil, 2007). This Master thesis investigates organic farmers' perception of diversity and which extrinsic and intrinsic factors influence agricultural diversification and agro-biodiversity. To do so, it employs qualitative interviews with organic farmers, in which leverage points are identified, that might help to develop strategies for improving diversity on farms and in the food system.

Human societies rely on agriculture as a provider of food, feed, fibre and fuel. Agricultural systems and single farms can be understood as socio-ecological systems (Darnhofer, et al., 2010), i.e. systems where social and ecological subsystems interact, and where a change in one subsystem influences the state of another (Gallopin, 1991). Resilience, adaptability, and transformability of social-ecological systems (SES) rely upon diversity (Walker, et al., 2004). Diversity creates redundancy- and response diversity effects, i.e. a diversity of responses different actors in the system have to changes and shocks, which contribute to maintaining the function. This was found to be crucial for the adaptability of ecosystems (in this case diversity of species contributing to the same ecosystem function) (Elmqvist et al., 2003; Walker, Kinzig, & Langridge, 1999). The approach is also applicable to human decisions and action in SES (Leslie & McCabe, 2013). Thus, for example, diversity of farming practices might increase human response diversity to shocks and changed socio-political, economic and environmental conditions. As a consequence we should strive for biological, social and cultural diversity in agriculture at multiple spatial and temporal scales.

However there is increasing concern that in Europe, but also in other regions of the world, we are losing biological, social and cultural diversity in agriculture at an alarming rate. Agricultural intensification in Middle Europe in the last century caused a dramatic decline of agro-biodiversity (Robinson & Sutherland, 2002). This comprises landscape diversity and diversity of associated biodiversity (Benton, Vickery, & Wilson, 2003) as well as genetic diversity of crops (Negri, 2005) and domestic animals (Rischkowsky & Pilling, 2007). On the social side the agricultural restructuring in Middle Europe in the 20<sup>th</sup> century dramatically reduced the amount of farmers (e.g. Robinson & Sutherland (2002)) and led to an increasing anonymity of actors in conventional mass food markets and food chains (Feagan, 2007; Renting, Marsden, & Banks, 2003). There is also an increasing concentration and reduction of suppliers, processors, and retailers in the European food system (Dobson, Waterson, & Davies, 2003; McCorriston, 2002). This reduction of social diversity in agriculture concurrently reduced also diversity of agricultural technology and applied farming methods and practices, thus also reducing cultural diversity.

Organic Agriculture is a value-based farming approach (Luttikholt, 2007) and it can be argued that the Principle of Care ethically requires the build-up of resilience and thus asks for biological, cultural and social diversity. The establishment of a biodiverse system is even explicitly stated in the Organic Principles (IFOAM, 2012). Organic agriculture thus takes steps to counteract diversity loss and might function as a role model for a more diverse and resilient agricultural system. However, there is increasing evidence that many organic farms can not be regarded as biologically diverse (Kremen, et al., 2012) and that there is increasingly less socio-cultural diversity in the organic food system than previously (Lindenthal, et al., 2007). This raises questions about organic farmers' understandings of diversity and about the determinants of diversity on and among organic farms. Research and knowledge on this issue is scarce. Kelemen et al. (2013) showed that organic farmers have a sophisticated, emotionally rich and holistic understanding of biodiversity. Laber (2011b) and Björklund et al. (2005) found that economic aspects have an important influence on biodiversity on organic farms. However, an encompassing approach towards the topic is lacking. This study fills this gap in a twofold way. On the one hand it investigates organic farmers' understanding of diversity. It examines what farmers associate with the term diversity and explores their understanding not only of



biodiversity, but also cultural diversity and social diversity in relation to organic agriculture. On the other hand it identifies influencing factors on agro-biodiversity and agricultural diversification (i.e. diversification of production, in other words combination of production branches and diversity of products within a certain branch) to identify leverage points for increasing these elements of diversity on (organic) farms (influencing factors on social and cultural diversity were not investigated due to time constraints) (Table 1). The focus on just these two aspects results from the fact that farmers mostly referred to these aspects in the (very open) initial phase of the interview and these issues were taken up and deepened, leaving no time for social and cultural issues. To accomplish these objectives qualitative interviews with 12 organic farmers in Upper Austria that are engaged in different production branches like arable farming, animal husbandry, vegetable production and permanent cropping were conducted and analyzed.

**Table 1: Aspects and elements of diversity in agriculture that are covered in this study and the respective research questions that deal with them**

	Definition in this study	Aspects covered in the first research question, that is farmers understanding of diversity	Aspects for whom (key) influencing factors were identified
Planned biodiversity	Biological elements like crops, domesticated animals, hedges etc. purposefully introduced by the farmer	X	X
Associated biodiversity	Living beings colonizing the agro-ecosystem depending on the management and structure	X	
Social diversity	Variety of people (concerning aspects like age, attitude, ethnicity etc.) in the agricultural and food system and the amount of social relationships and interactions between these people.	X	
Cultural diversity	Structural diversity in the food system, i.e. the amount and diversity among farms, processors, retailers and other actors in the food chain and the diversity of practices and methods applied by these actors. This includes diversity of manufactured products and of production techniques and methods applied (including farming practices)	X	
Agricultural Diversification	Diversification of production (i.e. diversity of products within a farming branch and combination of several production branches)	X	X

## 2 Objectives and research questions

This study is an exploratory case study that opens a comprehensive diversity approach that accounts for the complexity and interrelatedness of various biological, cultural and social elements in an agricultural system. It explores organic farmers' understanding of diversity based on the theory of mental concepts (e.g. Margolis & Laurence, 1999), first describing their mental associations with the lexical item, their normative evaluation of the concept, and the relation of diversity to other concepts (cf. Fischer & Young, 2007). Farmers' perceptions of the advantages and disadvantages, driving forces and constraints of different aspects and elements of planned biodiversity and agricultural diversification are explored. This allows us to find out what determinants rule the biodiversity of organic farms to identify leverage points for improving diversity at the farm, landscape and food chain level.

The following research questions guided the research process and were examined in the study:

- **RQ 1:** What does diversity mean to organic farmers?
  - **RQ 1.1:** What do organic farmers associate with the term diversity?
  - **RQ 1.2:** What relevance has diversity for organic farmers and what attitudes do farmers hold towards it?
- **RQ 2:** What influences biodiversity and agricultural diversification on organic farms?
  - **RQ 2.1:** What are advantages and disadvantages of diversity?
  - **RQ 2.2:** What intrinsic and extrinsic factors influence diversity?

## 3 Background and conceptual framework

### 3.1 Organic agriculture and diversity

Organic agriculture is a value-based farming approach that is built on the Principles of Health, Ecology, Fairness and Care (IFOAM, 2012). Diversity in organic farming is both ethically required and precondition to its functioning in practice. On the one hand organic agriculture aims to work in closed ecological cycles and tries to minimize external farming inputs (IFOAM, 2012). The establishment of high (functional) on-farm biodiversity is therefore vital to assure food production, continued viability and functioning and health of the agroecosystem (Altieri, 1999). In practice this includes a diverse crop rotation, the maintenance or establishment of wildlife refuge habitats and use of locally adapted practices, animals and crops (IFOAM, 2012).

Furthermore the Principle of Care requests acting in a precautionary manner, thus demanding build-up of resilience to ensure the long-term functioning of the system. It thus requires more than just the necessary functional biodiversity and urges for build-up of redundancy effects on farm and landscape level and response diversity in the system through diversity between farms regarding planned biodiversity and socio-cultural aspects like management.

Moreover organic farming follows a holistic approach that implies the respect for every living being and attributes an intrinsic value to all creatures on earth. A holistic ethics is characterized by “*locating ultimate value in the biotic community*” (Alrøe & Kristensen, 2003, p. 67), an attitude that is prevalent in Organic Agriculture as the Principle of Fairness states that “*Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings*” (IFOAM, 2012, p. 10). Thus it requires biodiversity conservation from an ethical perspective.

Furthermore organic takes a stance for social diversity. The Principle of Fairness requires social diversity in an anti-racist and anti-discriminating sense, in other words it requires that other peoples’ attitudes, values and norms and physical and psychological characteristics be respected or even valued. This for example implies to enable disabled people to take part in daily social life and to integrate them in society. This stance is analogous to the normative concept of diversity in the Social Sciences that implicates the affirmation and appreciation of any kind of dissimilarity and distinctness (Mecheril & Plößer, 2011). It is no coincidence that movements and approaches like Green Care and Social Farming are tightly connected with Organic Agriculture.

From its earliest beginnings the organic movement has been characterized by a high diversity of approaches and interpretations by stakeholders. Thus a wide variety of organic practices and manifestations of organic have developed. However due to the growth of the organic sector (i.e.

increasing market share of organic products and globalization of the organic food chain) a need for standards, regulation and control of practices was deemed necessary (Luttikholt, 2007). The aim of these control measures was to provide consumer security in anonymous markets and to make organic farming conceptually and practically clear and thus easier to monitor and evaluate.

There is an ongoing debate about the optimal level of detail and specificity of standards. The concern felt about very specific requirements is that this poses a considerable constraint upon the further development of organic farming and its practices. The IFOAM is well aware that regulations cut both ways. While stricter standards might help to exclude farmers that hardly comply with the standards and are not in line with the organic principles, they are more difficult to monitor and might pose a challenge especially for farmers in developing countries to enter organic, especially because of higher certification costs. Moreover they tend to be prescriptive and thus impair innovation and development of organic farming (Luttikholt, 2007). A resilient management strategy within organic needs to be flexible (Folke et al., 2002), and this is not possible with restrictive regulations. However, the growing concern that the IFOAM Organic Principles are contravened by many practices applied in organic is indeed justified (De Wit & Verhoog, 2007; Guthman, 2004; Lindenthal, et al., 2007). The difference between organic theory and organic practice has raised concerns about the effect of organic on diversity.

Although acknowledging that the organic idea would imply functional biodiversity to generate ecosystem services, Kremen et al. (2012) point out that many organic farms can not be regarded as “diversified farming systems” (DFS<sup>2</sup>). This is often caused by the authorization of a wide range and high ratio of farm-external inputs that can be used to replace functional biodiversity and thus allow simplification also of the organic agro-ecosystems. The organic regulation of the European Union for example allows purchasing of a significant proportion of feed (up to 50% in the case of herbivores, no restriction in the case of other animals), limitless buying-in of organic fertilizer as well as use of a wide range of plant protection agents. At any rate it has to be underscored that the organic principles and the build-up of resilience require more than just establishment and maintenance of the functional biodiversity necessary to enable production in closed cycles. It requires diversity on and between farms at several scales (e.g. genetic diversity of crops and domesticated animals, diversity of species used) and conservation of biodiversity in general to establish functional redundancy and to uphold response diversity (see also chapter 3.2).

Increasing specialization of organic farms with simple crop rotations, decoupling of arable farming and animal husbandry and use of conventional animal and crop breeds as well as a decline of socio-cultural diversity within the organic sector, e.g. relating to diversity of organisations and associations, are critical developments in the organic sector that have to be challenged (Lindenthal, et al., 2007) in order to achieve long-term viability of the system.

The consequences of the developing distance between the ethical theory of organic and organic practice are twofold. First of all it constitutes an ethical problem. Organic farming practices at times contravene the organic values and the resulting reduced resilience and thus impaired sustainability is problematic and questionable from an ethical point of view. Second, it may also have direct consequences on the organic farming sector. A divergence between (explicit and implicit) promises of Organic Agriculture and its realities may have a significant negative impact on the image and thus marketing perspectives of organic products (De Wit & Verhoog, 2007). Increasing standards in conventional farming may reduce distinctness of organic production and consumers’ willingness to pay higher prices. Moreover organic farmers receive significant financial support e.g. for sound environmental practices. A loss of credibility may have repercussions on political support.

The organic regulations focus on areas that can easily be operationalized and monitored (Padel, Röcklinsberg, & Schmid, 2009). Diversity can not. The complexity of the issue makes it very difficult if not impossible to manage it via specific regulations. It is impossible to determine an adequate or optimal on-farm biodiversity or agricultural diversification. The self-regulative capacity of an agro-ecosystem for example depends on a myriad of elements and interrelations and manifold ways to

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<sup>2</sup> Diversified Farming Systems (DFS) is a farming concept that builds on utilization of ecosystem services and thus implies establishment of functional biodiversity at several temporal and spatial scales, thus it is based on a similar philosophy in this respect like organic farming.

achieve it may exist. And you cannot prescribe social diversity or prohibit farmers to use the same technique, technology or crop variety to accomplish diversity in the system. This may be the main reason why specific, legally enforceable regulations in EU directives concerning diversity do not exist (Padel, et al., 2009). Instead, diversity is merely advised. Moreover to tackle diversity-related deficiencies with rigid control mechanisms like stricter standards for organic certification may erode resilience (Folke, et al., 2002) and hamper further development of the organic system (Luttikholt, 2007).

Diversity on and between farms will always primarily depend on the farmers' attitudes, values and knowledge (intrinsic factors) and on extrinsic, e.g. economic, factors, that frame the socio-economic and cultural conditions that influence farmers decisions regarding diversity. This raises the question, what does diversity mean to organic farmers? What views do they hold on (biological, social, cultural) diversity and diversification, and what do they consider appropriate and manageable diversity?

## **3.2 Resilience and diversity**

Resilience is “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker, et al., 2004, p. 2), that means it reflects a systems' ability to cope with change (Folke, 2006).

The concept of resilience, originating from ecology, is increasingly applied to social-ecological systems (SES) (Folke, 2006), i.e. systems where social and ecological subsystems interact and change in one subsystem influences the state in another subsystem (Gallopín, 1991). It is thus applicable to food and farming systems and even to single farms (Darnhofer, et al., 2010) The resilience of SES encompasses a) the absorptive capacity of a system to buffer shocks and remain within a given state, b) the ability of self-organization and c) the capacity for learning and adaption (Carpenter, Walker, Anderies, & Abel, 2001).

Especially the adaptive capacity of SES is closely linked with diversity. In biotic systems it is especially linked up with biodiversity including species and genetic diversity (Carpenter, et al., 2001; Loreau, 2000) and heterogeneity of the landscape mosaics (Peterson, Allen, & Holling, 1998). Genetic diversity provides a reservoir of variation within species to adapt to changing condition on the long run (Loreau, 2000). Species diversity in an ecosystem increases the adaptive capacity of the system due to response diversity effects, i.e. a diversity of responses to environmental change by different species contributing to the same ecosystem function, which is functional redundancy (Elmqvist, et al., 2003; Walker, et al., 1999). This idea of response diversity is also applicable to human decisions and action (Leslie & McCabe, 2013). Thus e.g. diversity of farming practices increases the response diversity to changed socio-political, economic or environmental conditions.

The ability of self organization describes the extent to which elements of the system are forced by management and external drivers instead of being self-organized within it. Regulations and institutional and economic constraints are important factors that can hamper the self-organization of a system and thus impair resilience (Carpenter, et al., 2001; Folke, et al., 2002). With regard to organic agriculture for example the controversy about level of detail of regulations (Luttikholt, 2007) and the increasing influence of food retail industry (Lindenthal, et al., 2007) come to mind. Scheffer et al. (2000) highlight that unequally distributed power among interest groups in social systems is a key problem for the resilience and adaptive capacity in SES. Carpenter et al. (2001) instance coevolved ecosystem components as prominent example for self-organized systems. The similarity to closed local farming cycles built on locally adapted crops and animals as promoted by organic farming is evident.

## 3.3 Biological, cultural and social diversity

### 3.3.1 Biological diversity

Biological diversity (or biodiversity) is most commonly (and also in this study) understood as in the Convention on Biological Diversity where it is defined as the “variability among living organisms”, i.e. “the diversity within species, between species and of ecosystems” (UN, 1992, p. 3).

Biodiversity is dramatically declining worldwide (Duraiappah, Naeem, & Agardy, 2005) and farming is the major contributor to biodiversity loss (Balmford, Green, & Phalan, 2012). A major reason therefore is the conversion of natural ecosystems to less diverse agricultural ecosystems (Balmford, et al., 2012). However also biodiversity in the long-standing agro-ecosystems of Middle Europe where a tremendous biological diversity developed is dramatically declining due to agricultural intensification (Robinson & Sutherland, 2002). This comprises landscape diversity and diversity of associated biodiversity (Benton, et al., 2003) as well as genetic diversity of crops (Negri, 2005) and domestic animals (FAO, 2007).

Species diversity in natural ecosystems was found to be positively correlated with productivity, both in the short and in the long term (Loreau, 2000). In the short term this is due to functional niche complementarities that increase the use of resources and thus collective performance is higher than single performance and selection of extreme trait values, whereby diversity is only the initial condition and following selection is leading to dominance of those species with extreme values and best performance. In the long-term productivity is higher due to a buffering effect that reduces temporal variance of production and a performance enhancing effect owing to a higher temporal mean of production. These ecological principles also seem to be applicable to and for agricultural ecosystems as many multiple cropping systems have been found to be more productive than industrialized farming systems in terms of land productivity (Francis (1986) from Altieri (2002, p. 3)). Moonen & Bàrberi (2008) state that increasing diversity in agro-ecosystems has three positive effects: a) it controls dominant weed species and prevents invasive species in natural or semi-natural habitats b) it increases (agro)ecosystem resilience and stability due to redundancy of species and c) it increases (agro)ecosystem functioning in terms of processes or magnitude of them, especially in species-poor systems at a short time scale.

Biodiversity in agro-ecosystems can be subdivided in planned and associated biodiversity (Vandermeer & Perfecto (1995) from Altieri (1999)). Planned biodiversity is purposefully introduced by the farmers, in other words the crops and domesticated animals, but it might also encompass elements like hedges or actively introduced beneficial animals or microorganisms. Associated biodiversity in contrast is not actively introduced in agro-ecosystems but mediated through planned biodiversity, i.e. it is those living beings colonizing the agro-ecosystem depending on the management and structure of it. This includes any kind of wild animals and plants emerging and established in agro-ecosystems including soil organisms, wildlife, weeds, pests and beneficial animals (as far as they are not actively introduced by the farmer) (Altieri, 1999).

A frequently emerging term in science of ecosystems and ecosystem services is functional biodiversity. It refers to the part or elements of biodiversity that provide ecosystem services (Altieri, 1993; Moonen & Bàrberi, 2008). The term “functional” derives from the so-called “functional groups”, i.e. groups of species with similar eco-physiological and life-history traits (Moonen & Bàrberi, 2008). Moonen & Barberi (2008) further fine-tuned the topic at hand and subdivided the term functional biodiversity into *bio-functionality*, i.e. the functional groups of ecosystems, and *functionality of biodiversity*, i.e. the importance of diversity within a functional group. This clarifying distinction is relevant and important especially regarding sustainability and resilience. While (short term) provision of ecosystem services relies on presence of all functional groups, resilience and ecosystem stability demands functional redundancy and response diversity, thus diversity within functional groups. Accordingly in organic agriculture the aim is not only to establish bio-functionality, i.e. the presence of all necessary functional groups what is necessary to make it work without external inputs, but to establish diversity of species within a functional group.

### **3.3.2 Cultural diversity**

Cultural diversity, encompassing “the knowledge, practices, beliefs, worldviews, values, norms, identities, livelihoods and social organisations of human societies” (Pretty et al., 2008, p. 3), is closely linked to and evolved in interaction with biological and biogeographical diversity. They influence each other via mutual feedback and there is growing evidence that a lot of our cultural diversity is threatened by the same drivers as biodiversity (Maffi, 2005; Pretty, et al., 2008). The increasingly used term bio-cultural diversity does justice to this realization of mutual interdependence. Nonetheless for analytical reasons in this study cultural diversity is treated separately, however the structural coupling of biological and cultural diversity is taken into account.

The terms cultural or socio-cultural diversity are sometimes also used to refer to the diversity of people along dimensions of race, ethnicity, gender, sexual orientation, socio-economic status, age, physical abilities, religious beliefs, political beliefs, or other ideologies. This notion is based on the sociological concept of diversity that encompasses acceptance and respect towards “different” people (Mecheril & Plößer, 2011). This notion of diversity is in this study referred to as social diversity (see below).

Cultural diversity as understood in this study encompasses the structural diversity in the food system, i.e. the amount and diversity of farms, processors, retailers and other actors in the food chain and the diversity of practices and methods applied by these actors. This includes diversity of manufactured products and of production techniques and methods (including farming practices). Moreover all other kinds of cultural expressions and activities are assigned to the subject area of culture.

### **3.3.3 Social diversity**

Social diversity is defined in this study as the variety of people (concerning aspects like age, attitude, ethnicity etc.) in the agricultural and food system and the amount of social relationships and interactions between these people. This comprises on the one hand the social diversity on a single farm that is determined by the amount and distinctness of people that live and work on the farm and on the other hand the social diversity within the food system as a whole. This involves the amount of and diversity among farmers, processors and retailers and the amount of relationships between the people in the food system, may it be in form of bargaining (e.g. direct purchasing of consumers from farmers or processors like butcheries and bakeries in addition to buying from grocery stores), cooperation, help or any other kind of relationship. Especially the latter aspects are difficult to separate from what is understood as cultural diversity as these practices constitute and generate the structure of the food system what depicts a form of culture. However the focus is especially on the (social) relationships and interactions between actors in the food chain what is considered useful to bring out as it showed to have considerable influence.

## **3.4 (Farmers’) mental concepts of biodiversity**

Mental concepts held by individuals can be understood as complex structures that can encompass specific terms labeling a certain concept, definitions of it, prototypical images that represent the concept, as well as various connotations, i.e. “mental associations that relate a concept to other ideas and evaluations” (Fischer & Young, 2007, p. 272), like normative and emotional evaluations or experiences (Fischer & Young, 2007).

In the last years there has been intensified research on people’s mental concepts of environmental issues like nature conservation and biodiversity due to the realization that public view on the particular issues and participatory approaches with public participation are crucial for the success of environmental policies (Fischer & Young, 2007; UNECE, 1998). In the case of agro-biodiversity and farmers the issue is especially relevant as agro-biodiversity developed in interplay with human action

and is maintained by farmers and the practices they apply and many agri-environmental schemes are voluntary (Soini & Aakkula, 2007).

Research has shown that rural people's and farmers' understanding of biodiversity often differs from scientific notion (Fischer & Young, 2007; Herzon & Mikk, 2007; Soini & Aakkula, 2007). Farmers often split the landscape in productive and "wild" areas, wherein the former are for production and the latter can serve biodiversity conservation requirements (Soini & Aakkula, 2007). Certain biotic elements such as weeds and pests are often excluded from farmers' notion of biodiversity (Herzon & Mikk, 2007; Soini & Aakkula, 2007). Also genetic biodiversity issues are often lacking in farmers' understanding of biodiversity, which is focused on the species and habitat/ecosystem level (Kelemen, et al., 2013).

Aesthetic and symbolic facets of biodiversity and its management play an important role in the perception of biodiversity. Landscape elements like woodlots or colorful biodiverse meadows have a positive aesthetic connotation, whereas other elements of biodiversity (e.g. fields with weeds, late mown matured meadows, unmown areas) connote amiss and lousy farming practices and are not perceived as valuable (Jurt, 2003; Soini & Aakkula, 2007). This attitude seems partly to exist also among organic farmers (Laber, 2011a). Kelemen et al. (2013) showed that organic farmers often have a sophisticated, emotionally rich and holistic understanding of biodiversity that is rooted in their daily actions. It comprises notions of complexity, equilibrium, and spirituality and attribution of existence value.

Most of these studies primarily focus on associated biodiversity, i.e. wild animals and plants. What is rather seldom targeted in already executed studies is planned biodiversity, i.e. diversity of crops and animals, e.g. amount, genetic diversity and mixture of crops and animals. Farmers' choices of crops and animals has major influence on genetic diversity but also on landscape and habitat diversity, thus significantly influencing associated diversity and provision of ecosystem services. However (organic) farmers' attitudes towards it and influencing factors are hardly researched, even in organic farming where these aspects are fundamental.

In the studies about farmers' perception of biodiversity (Kelemen, et al., 2013; Laber, 2011a) especially economic factors and constraints were mentioned as important influencing factors on biodiversity-friendly or -enhancing measures. Again these results primarily relate to associated biodiversity.

Björklund et al. (2009) found out that direct marketing (economically) enabled and encouraged diversity of vegetable production and maintenance of laborious pasture feeding, thereby maintaining genetic diversity and landscape elements that are among the most diverse in that region. A mixture of market demands, personal interest and farm optimization seemed to be the reason for vegetable farmers' decisions to diversify. Jurt (2003) found that Swiss farmers showed little concern about developments in breeding of crops and animals like increasing centralization and industrialization and the related loss of genetic diversity and autonomy. Choice of crop species and varieties was mostly determined by economic considerations, mainly the wishes and demands of (big) purchasers. Aspects like yield, resistance, stability, time of harvest and manifold usability have minor relevance. To some extent also subsidies and other political influences like market regulations are determining. Also intrinsic factors like risk-taking propensity and curiosity turned out to be influential to a certain degree. The attitude towards second generation seeds was strongly diverging, also among organic farmers, between favouring, mostly due to cost saving, and rejection because of higher effort and the argument that breeding progress would be crucial. In domestic animals the choice of breeds is often linked to social aspects like affiliation in breeding associations and tradition, conversion of the herd is rather seldom. Di Falco & Perrings (2005) found that crop species diversification is an important risk-reducing strategy of farmers. Crop genetic diversity has the same effect (Di Falco & Chavas, 2006). Financial assistance for farmers that tries to increase income stability thus might erode species and genetic diversity, e.g. if focused on a few crops.

All these studies are exemplary for revealing the manifold influences that determine a social-ecological farming system and the biodiversity within it, but a broader and general approach towards the topic seems lacking, especially also in organic farming where diversity is ethically required.

Furthermore it is well-recognized that there's a tight connection and mutual influence between biological and cultural diversity (Maffi & Woodley, 2012). But what is so far widely unknown is

(organic) farmers' understanding and attitude towards aspects like social or cultural diversity that may have crucial impacts on resilience of SES and on biodiversity-related issues.

## 4 Methods

A qualitative approach, which allows the exploration of structures of meaning (Hitzler, 2002), was chosen to conduct this study as the aim was to gather information about farmers' perception of diversity and to get detailed insight on extrinsic and intrinsic influencing factors of biodiversity on farms. Twelve qualitative interviews (semi-structured, introduced by a freelist-task) and a following in dept case study analysis should allow to carve out and to comprehend organic farmers' understandings, attitudes and the complex factors influencing on-farm diversity.

### 4.1 Sample selection

Organic farmers were selected in the area of Upper Austria as this region has a wide variety of pedoclimatic features that allows choosing farms with different environmental preconditions and production foci. Purposive sampling (Bernard, 2011) was implemented with the aim to cover the major production types, i.e. grassland cultivation, arable farming, animal husbandry, vegetable production, and permanent cropping. Because of the assumed strong influence of economic aspects on on-farm biodiversity, the significance of farming for the household income (full-time or part-time farming<sup>3</sup>; cf. Kelemen et al. (2013), Laber (2011a), Battershill & Gilg (1997)) and marketing type (direct marketing and disposal to wholesalers respectively; cf. Björklund et al. (2009)) were further selection criteria. In cooperation with Bio Austria Upper Austria an e-mail invitation to participate in a research project dealing with diversity in Organic Agriculture was sent to all organic farmers registered in the database of the regional organic association. From the replying farms seven farms were chosen that differed in the above-mentioned criteria. Following these interviews five additional cases were sought to cover all production types and contrast emerging hypotheses (cf. theoretical sampling (Kelle & Kluge, 2010)). To detect these cases the chain referral method (snowball sampling) (Bernard, 2011) and searching in the internet was used. Farms that volunteered to participate owing to the circular inquiry were deliberately avoided to prevent a major sampling bias by self-selection. Two biodynamic farms were deliberately chosen (a third one was in conversion by chance) as in biodynamic farming there is an even stronger focus on a closed farm cycle. Including animal husbandry and farm individuality is highlighted (promoting e.g. the development of farm varieties). Also the "social question" (Steiner, 2010; Steiner & Boos, 1941) has always been of major importance in biodynamic farming, which was hypothesized to have an effect on social diversity. The affiliation of the sample farms to the selection criteria is shown in Table 2, a more detailed description of the farms can be found in the appendix. Figure 1 shows the approximate location of the farms in Upper Austria.

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<sup>3</sup> Full-time farmers are defined according to the Austrian Ministry of Agriculture as farm families that spend more than 50% of their working time for farming





*Figure 1: Approximate location of the sample farms in Upper Austria*

## 4.2 Data collection

At the beginning of each interview a freelist task (Bernard, 2011; Weller & Romney, 1988) was carried out to find out which aspects of diversity farmers think of and what they associate with the term diversity. Thereby farmers were asked to name in note form everything what comes to their mind regarding diversity. This method is regarded as extremely useful at the beginning of the exploration of domains (Weller & Romney, 1988). Terms that are early mentioned by the respondent can be interpreted as more “important” or “salient” for the respective person and aspects mentioned consecutively are often linked somehow. If terms are mentioned by many respondents it indicates a shared cognitive representation of a cultural phenomena (Weller & Romney, 1988).

This data gathering method was followed by an open-guided interview (semi-narrative) (Bernard, 2000) addressing perception of and attitudes towards different elements of diversity as well as practices, influencing factors, advantages and disadvantages thereof. The free list served as a primary guide and was supplemented by an interview guide in form of a mindmap that listed different aspects of biodiversity found in literature that helped to cover all aspects relevant for the farms and their respective production foci (see appendix). All topics not addressed by the farmers themselves during the free listing were subsequently approached very openly. If relevant and not mentioned by the farmers themselves the concrete practices were requested. Therefore, no formal guide with fixed questions was applied. However, a formal question guide for basic personal and farm data was used and can be found in the appendix.

The interviews, which took one and a half to two hours, were recorded with a voice recorder and fully transcribed verbatim for the analysis.

## 4.3 Data processing and analysis

The analysis of the freelist was carried out with MS Excel and MindManager. All terms were allocated to groups and categories, and a taxonomy was developed (Figure 2). This taxonomy was to a great extent based on the previously developed taxonomy that was also used as an interview guide. Counting of the number of times a certain topic or category was mentioned allowed a semi-quantitative analysis, however a statistical evaluation was not conducted. Nonetheless, this analysis gave a valuable first insight into, and overview of, organic farmers' mental models regarding diversity, as it allowed frequent and common associations with the term diversity to be identified.

The interviews were fully transcribed verbatim and analysed according to qualitative content analysis (Mayring, 2010). The transcripts were coded with the qualitative data analysis software Atlas.ti. The coding categories were based on the initial research questions (attitude towards/perception of diversity, influencing factors, advantages, disadvantages), as well as the thematic taxonomy developed from the freelist and the guiding list for the interviews. Such codes based on the taxonomy constituted for example *mixed cropping*, *fruit trees* or *semi-natural habitats*. Additionally, a few inductive codes like *marketing* were developed and applied in the initial coding for salient and frequent phenomena, especially to structure already the broad category of influencing factors. Thus, although only to a small extent, a mixture of deductive and inductive coding was used (Miles & Huberman, 1994). In the following every topic (crop rotation, mixed cropping, animals breeds etc.) was displayed separately, paraphrased, and the paraphrases allocated to the research questions (cf. contentual structuring and deductive category application according to Mayring (2010)). All paraphrases allocated to a research question within an element/aspect of diversity were then further structured and categories developed (e.g. categories for influencing factors of diversity of crop rotation were developed). After the analysis of the specific topics, similarities, differences and interactions between the single themes were looked for and analysed.

## 4.4 Methodological reflection

This study investigated on the one hand organic farmers' understandings of the very open and broad term "diversity", starting from the consideration that not only biological diversity, but also social and cultural diversity are important factors for establishing a resilient socio-ecological system such as our food system. This approach brought some insight that besides biodiversity, which in its many forms is the prevalent understanding of farmers, also social and economic issues are mentally connected with diversity. Nonetheless, mostly because of time constraints in a two hour interview, the thematic focus in the second part of the interview dealing with crucial influencing factors on diversity lay mostly on biodiversity issues. Moreover, a clear conception of the crucial elements and issues especially regarding social and cultural diversity was only gained during the analysis. While this is the aim of an exploratory study, i.e. to detect relevant patterns and factors by approaching the issue of concern in an unbiased, open-minded way, without predefined conception, it caused an imbalanced data basis especially concerning farmers' attitude towards social diversity on the farm and the crucial factors influencing this aspect. Also the issue of organic farmers' farming techniques, their knowledge and the development and adoption of new technologies, all factors influencing the diversity of farming practices in an agricultural system, as well as the issue of local traditions and culture were not really covered by the interviews. Thus these questions could not be answered in this study. These issues are worth and would warrant separate studies for practical reasons (e.g. time requirements). Further deepening these issues is indicated, as they are major components and factors of our food system.

Moreover the breadth of the topic at hand would ideally have required a much larger sample size of estimated 25 – 35 interviews to adequately cover all farm types and relevant variables in an adequate

degree. A market producer of fine vegetables (salad, tomatoes etc.), possibly in a greenhouse production system or the like, was completely missing in this study. Thus, there is a need to further deepen the issue to get a more comprehensive view of and insight into the topic at hand.

Application of the freelisting task turned out to be a bit tricky as farmers, although explicitly requested to give only notes, mostly ended up in telling stories. While this gave valuable insight to the mental concepts of diversity of farmers and revealed already many of the influencing factors, it made establishment of a list quite difficult. Often short phrases rather than single terms had to be used. The analysis of the freelist subsequently turned out to be tricky as it was often difficult to condense the data and to decide to which category a term or phrase should be allocated, often depending on the exact question to be answered. Nonetheless, although demanding in the analysis, the freelisting turned out to be extremely helpful in the interview process. It allowed the interviewer to get a quick overview of the farmers' mental concepts of diversity. Since the topic to be covered was quite ample, and the available time limited, the freelisting approach allowed the interviewer a quick orientation of the concept.

**Table 2: Affiliation of farms to the selection criteria (production type, full-time/part-time farming, type of marketing)**

Farm Nr.	Arable	Permanent grassland	Animals	Vegetables	Permanent crops	Part time	Direct marketing	wholesale	Bio-dynamic
F1	x	x	x			x	x		
F2	x				x		x		
F3	x					x		x	
F4	x		x			x	x		
F5	x	x	x					x	
F6	x	x	x			x	x		
F7	x	x	x	x		x	x		x
F8		x	x			(x) <sup>2</sup>	x	x	
F9	(x) <sup>1</sup>				x	(x) <sup>2</sup>	x		(x) <sup>3</sup>
F10	x		x					x	x
F11	x		(x) <sup>4</sup>	x				x	
F12	x	x	x		x		x	x	

1 strawberries, rhubarb; next year vegetables  
 2 full time according to the definition applied, but described themselves as part time farmers as they obtained significant amount of income from off-farm employment  
 3 in "conversion"  
 4 horses for fun

## 5 Results

### 5.1 Farmers' associations with and mental concepts regarding the term diversity

The term diversity deliberately was stretched and not further circumscribed in this study to get an as unbiased insight to farmers' perception of the issue as possible. The freelisting task at the beginning of the interview thus turned out to be very helpful for the interviewer as it enabled to get a quick overview and to orient oneself in every respective case. The farmers did not struggle with the very open initial question (“*What comes to your mind when you think about diversity?*”) and revealed a variety of nexuses, although some sooner or later urged more detailed questions. The connotations partly were very practical and related to their daily practices, but often also philosophically and emotionally rich. The 12 interviewees altogether mentioned 139 terms in the free listing task, of which the majority were manifestations of diversity (78 items) (Table 3), but also lots of attributions (50) (Table 6) and a few practices (11) they linked with the term (Figure 2).

Although the question was explicitly concerning diversity, farmers mostly talked about and referred to biodiversity. Aspects concerning operational diversity or diversification, understood as diversity of production and the opposite of specialisation, and related aspects like risk spreading, labour issues, knowledge and organisation were also quite common and continuously raised. Biodiversity and diversification are naturally often very much related and both broad categories jointly came up in the free listing task and the following interviews. Social diversity aspects were mentioned by one third of the farmers and cultural aspects raised only two interviewees at all (regional food & recipes and cultural landscape as culture, identity and heritage (listed under attributions)).

**Table 3: Number of elements mentioned by the farmers in the freelisting according to their allocation to biological, operational, cultural and social diversity**

Category	mentions
Biological	50
Operational	12
Cultural	8
Social	1
Other	7

Especially at the beginning many farmers noted definitions of biodiversity like “flora and fauna” or “species richness”. This indicates that many farmers associate diversity primarily with the term biodiversity. That reflects findings of Laber (2011a), that Austrian organic farmers are in general familiar with the terminology, although explications deviate from scientific definitions and are often focused on the species level. This was also true in this particular case, with no one mentioning habitat/ecosystem diversity or genetic diversity in their “definitions”.

Apart from statements that refer to biodiversity general, items about crops and attributions to diversity were frequently mentioned in the beginning. Early mentioned terms are seen as more “important” or “salient” (Weller & Romney, 1988) and overall frequency of terms/categories confirms this presumption.

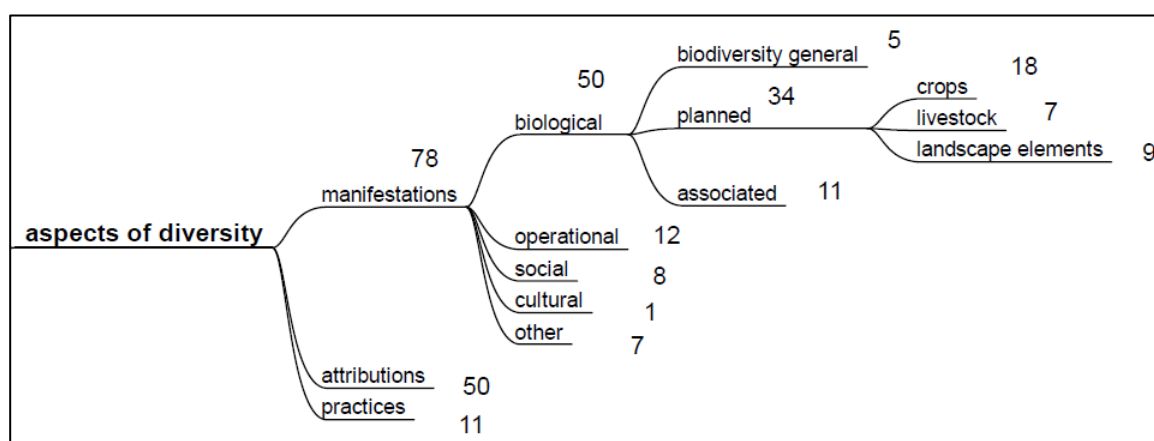


Figure 2: Taxonomy/assignment of the items mentioned in the freelisting task to groups; the numbers show the amount of items attributed to the particular group

### 5.1.1 Biodiversity

Within the stated elements of diversity (altogether 78 items) 50 account for biodiversity and thereof 34 regard planned biodiversity, i.e. those elements farmers purposefully and deliberately introduce (Figure 2)(Table 4). All farmers named examples for planned biodiversity on their farms, although two farmers were more focussing on specific practices that promote and enhance biodiversity. This reflects and underscores findings of Kelemen et al. (2013) that farmers perception of biodiversity is very much connected with their daily actions and their managed environment.

**Table 4: Number of biological elements mentioned by the farmers in the freelisting according to their allocation to planned and associated biodiversity and general references to biodiversity**

Category	Mentions
Biodiversity general	5
Planned biodiversity	34
Associated biodiversity	11

Crops represent the majority of this category with farm animals, landscape elements and semi-natural habitats being mentioned less often. An adequate crop rotation, maintenance of fruit trees and orchards and old crop varieties were prevalent indications (Table 5). This reflects the (public) attention that is given to these topics. The crop rotation is a “flagship” of Organic Agriculture and the very basis of a functioning organic arable system. Maintenance of orchards and conservation of old varieties on the other hand are important nature conservation issues that were also taken up by politics in the last decades with many support programs being established. The current discussion about the new EU seed regulation that is heavily debated also in mass media and by the general public underscores the public presence of the topic.

**Table 5: Most often mentioned elements in the categories crops, livestock and landscape elements including number of mentions**

Category crops	mentions	Category livestock	mentions	Category landscape elements	Mentions
Adequate crop rotation	5	Several species per farm	4	(Refugee) habitats	2
Fruit trees	4	Old breeds	2	Hedges	2
Old varieties	4	Mixed farm	1	Landscape elements	2
Home garden	2	-		Extensive areas	2

The finding of previous studies, that farmers, but also other non-scientists, have rich mental concepts about biodiversity (Fischer & Young, 2007; Kelemen, et al., 2013), proved to be true also in the case of the interviewed Upper Austrian organic farmers. The attributions to biodiversity reflect emotionally rich and sophisticated ideas like complexity and interwovenness, symbiosis, self-regulation, naturalness, health, joy, beauty, heritage and gift (Table 6, see also appendix). Diversity is seen as a fundamental principle in nature that keeps things in balance and going.

*“Diversity is so to say an ecological necessity, because with changing environmental conditions not adaptable varieties cannot survive, you need quasi a biological or genetic foundation, or variation, you can draw on, so it goes on.” (F4, 00:02:05)*

Diversity is perceived as a natural state, with humans often having negative or reducing impact. To work instead with biodiversity and to allow its’ development is seen as demanding but crucial.

*“To recognise diversity and also to work with it and to get oneself into the process, I think this is the challenge.” (F4, 01:58:42)*

*“It has to go with nature, as long as the balance is kept this is anyway no problem. For example we have at the moment quite a lot of crows here, of course we have the problem with the fruits that they peck a lot off the tree, but on the other side we had problems with the cockchafer grubs the last years, and the crows get them out. There are not more of them accidentally, the crows are just where is supply of food. I think nature regulates often a lot itself.” (F8, 01:01:45)*

*“I think it’s almost a contradiction to say to maintain diversity. Because diversity is here anyway, mostly you maintain the monoculture, there you have to maintain pretty much.” (F4, 01:56:48)*

Diversity is a different approach to land management that tries to adapt farming to the environment and its conditions instead of imposing nature one’s ideas.

*“I think it’s a different approach to the whole thing, one says I have an area and what do I do with it, and the other says I have a field and now I behold what it yields on its own accord and take my cue from it.” (F4, 00:26:42)*

The farmers appreciate the benefits of biodiversity and link it with related concepts like nature’s self-regulating capacity that is based on biodiversity.

*“That beneficals and pests balance each other, [...] and that is just the diversity that I’m not completely clean in the crops, meaning zero pests, but rather still a certain amount of pests, because only if I have a few pests also beneficals can establish.” (F12, 00:05:30)*

*“So it levels out time and again, nature adjusts itself anyway.” (F10, 00:22:45)*

They perceive a diverse environment as an indicator for a functioning ecosystem, as healthy.

*“Diversity... is healthy.” (F7, 00:16:46)*

The complexity and interrelatedness of elements and the resulting difficulty of managing rich biodiversity in an appropriate way is also perceived by the farmers.

*“I think that we all want to have a bit the feeling that we control our surrounding and not that our surrounding controls us, and from this point I think it’s threatening. It’s true with knowledge, that knowledge has major influence on that, if I know to some extent how things interact, but the truth is that we actually know the least.” (F4, 01:52:54)*

Still it's not just the ecological value, also social and ethical values were connected with this quality. Diversity is perceived more beautiful, especially on the landscape scale, but also on a concrete spot where it is appealing for its liveliness.

*"The absence of diversity makes you sad I think."* (F4, 00:16:15)

Many farmers give an intrinsic or "existence value" to nature and its' creatures. Many stressed that space for nature to develop should be given.

*"...,that there can be unconditional being on the farm. That is enrichment. That is an inherent value per se. That you don't have to have utility from every creature."* (F4, 01:33:25)

*"That you leave a corner for nature, that you don't mow down everything but rather just leave a corner to its' own devices"* (F6, 00:05:40)

*"Because species diversity means indeed also that weeds which are naturally present on our fields and meadows, that these are let live."* (F11, 00:08:15)

Biodiversity was portrayed and perceived very positive by all farmers and negative comments about elements of biodiversity were completely lacking. Elements like weeds and pests were seen as natural components of an ecosystem and their excessive and thus damaging appearance is more seen as an indicator for management failure.

*"Also a diversity of associated herbs develops, which as we all know engaged in organic farming, are all relevant for something in the soil, every single one has its function, and that's why I don't see them as annoying but to the contrary they show me, oops-a-daisy, here I've made a mistake, there I've made a mistake, and nothing else they do. They repair what men made wrong."* (F10, 00:12:20)

But it has to be pointed out that the personal attitude towards wildlife was not directly addressed in the interviews like for example in the study of Laber (2011a). Thus her finding that some organic farmers "don't like" certain wild animals like snakes and that according to this their attitude towards wildlife can not be rated as generally positive can not be countered for methodological reasons.

**Table 6: Repeatedly mentioned attributions of farmers regarding diversity**

Attributions	Mentions
Natural	3
Synergy/symbiosis	3
Self-regulation	3
Life/liveliness	2
positive	2
Diversion/more fun	2
Joy/delight	2

## 5.1.2 Diversification

An aspect commonly mentioned by the farmers was farm diversification, i.e. the opposite of specialization in several aspects. Respective aspects named by farmers were diversity of production and/or several income branches (i.e. not to focus only on a single product) and diversity of marketing channels.

One farmer associated more the ecological component and the negative effects of specialization, especially loss of biodiversity, with this issue. He referred both to the loss of genetic diversity of crops



in modern agriculture as well as the monotony of the landscape originating from this extreme specialization, negatively affecting associated biodiversity.

Especially full time farmers mentioned more economic issues, mostly risk spreading and stabilizing and securing farm income. Specialization is risky and makes you dependent on optimal course of events, e.g. weather conditions, and market situation. Two farmers underscored with this respect to diversify their customers, whereas others stressed to apply direct marketing instead of purchasing to wholesalers. Direct marketing in turn encourages and necessitates diversifying production. But also these farmers that stressed economic aspects turned out to be aware of the interconnections especially between specialization and loss of associated biodiversity.

Frequently associated with diversification was also the related aspect of variety of tasks. Although one farmer with this respect focussed more on the challenge of maintaining quality and doing well in many activities, most farmers stressed more the positive side of diversion and mental agility. Diversity of production was frequently mentioned to be crucial for mental health. It maintains enjoyment of work and keeps you mentally open and flexible. It exercises and broadens the mind.

*“Diversity means for me also diversity in thinking, [...] to go by nature and ones’ crops and ones’ ideas, and maintain diversity of thought. Diversity is just more fun than few and mono and concentration on one crop or a few. It’s varied and work makes much more fun.” (F9, 00:04:25)*

*“It starts in the head, you have to, you should not just be interested in things that bring you economically forward, [...] you have to arrange your interests so broad and widespread so to say, that you don’t lose delight in what is essential for you, let’s put it this way. I think this is a crucial point why diversity is important.” (F11, 00:06:12)*

### 5.1.3 Social diversity

Assertions regarding social diversity in the free listing task were relatively rare but not absent. Five farmers mentioned aspects that come under this issue; the rest did not mention social aspects in the initial exercise. However some aspects turned up later during the interviews and the topic moreover was explicitly addressed in a specific question.

Several times mentioned in the free listing task was diversity of people in general. Farmers advocated an unprejudiced stance towards people, often referring to foreigners or asylum seekers and claimed permitting social diversity in society.

*“That you are just open, not only with regard to nature but also humans. [...] not to be so prejudiced towards other people, other cultures or so, because it is always promptly railed, but one does not see that you could get so much positive things out of it, that you probably could approach somebody, such things.” (F6, 00:06:08)*

As in the case of nature, also diversity of people was said to be crucial and what makes life interesting.

*“This would be generally madness if everybody was the same, here also makes the difference that everybody is a bit different and that’s what makes it interesting, that we are no clones.” (F2, 00:16:54)*

Vegetable and fruit producers that engage seasonal labourers mostly referred to internationality of workers when asked about cultural or social diversity. Within these three farmers valuation differed between appreciation of multi-culturality of labourers as it opens up one’s horizons and a bearish attitude due to occurred problems with mixed diverse staff, in the respective case especially different religious affiliation.

Another aspect coming under the topic of on-farm social diversity is the amount of children. One farmer said that for him is very important that several generations live and work together on the farm.

Another one said that many organic farmers' she knew had four or five children, what she regarded something special.

*"What unique is I think is that there [excursion of organic farmers; S.L.] every family has four, five children, thus the size and the individuality can prosper again, what was really lost already."* (F4, 01:37:56)

This is related also to another aspect that was brought up by a farmer, the trend towards "isolation" in modern farming, meaning the aspect that due to mechanization most work on the farm is done solely by the farmer.

*"The reality is more those that the things on a farm are set up in a way that one person on his own can do it. Thus especially the simple tasks basically are just automated, and simply also because there are no people any more on the farm, so mostly it is just done by the farmer. [...] The individualization in agriculture, well I mean the isolation, probably is also not the right way."* (F7, 00:54:18)

Although many people working on the farm make things more complex and demanding regarding organization and management, this is what makes life and work pleasant.

*"The many people, they make it also complex again, but this is what makes it somehow also pleasant. So if you work on all alone, this can also be wearing."* (F7, 01:42:20)

Another young farmer noted that they often have friends and wwoofers on the farm that help them with the work to do. Moreover she said that the diversity of consumers and the contact to all these different people is what makes work pleasant and beautiful.

*"And then you just have, you meet lots of drolly people of all stripes, if you go to the market or simply through direct marketing you have lots of contact to most diverse people. That is of course also somehow fun and pleasant and this is what makes also the work pleasant."* (F9, 00:44:07)

The issue of social contact and relationships turned out to be very important for many of the interviewed farmers. Two farmers mentioned that a joint meal of all people living and working on the farm including the seasonal workers was very important for them. But it also showed up in a greater openness towards other farmers and the society in general. Three farmers were engaged in school projects, regularly welcoming school classes on their farms to make children more familiar with food production again. Two farmers also made farm festivals open for the interested general public and another was active as seminary farmer of Bio Austria. This openness was based on a strong belief in the integrity and leading role of organic agriculture in general and their practices in particular. The awareness of the negative effects of our industrial farming system and our economic system as a whole urged them to engage in explanatory work.

Another aspect that is related to the social diversity in the food system that turned out to be very important for farmers is cooperation. Two farmers named cooperation as an important aspect of diversity in the freelisting task and also many others team up with neighbours. Examples range from exchange of fodder/straw and manure to allowing the positioning of bee colonies to joint use of infrastructure and machines.

Although often and most notably taking economic advantage and utility out of these cooperations, e.g. in the case of joint use of machines and infrastructure or improved yield through animal manure, it is not solely an economic relationship. The social component, the contact to other farmers, is appreciated as well.

*"What I also find pleasant what we also have done on one occasion, [...] that we had an event on our farm where we cooperated with other farmers, it was a hiking day, where they sold their products, such cooperations."* (F4, 01:41:51)

And one farmer pointed out that cooperation enables to support (bio)diversity.

*“A beekeeper has 50 bee colonies at my place, you know, simply cooperating that life can develop again. To support something with other sectors.” (F5, 00:05:30)*

Ribisch (2012) and Darnhofer (2010) showed that cooperation is a viable adjustment strategy of organic farmers especially to cope with technological development and reduced work force availability, but it is also perceived as valuable to prevent the above-mentioned isolation. It maintains the social fabric that is considered crucial for knowledge exchange and to cope with change. And Milestad and Hadatsch (2003) found out that strong social cohesion among farmers is an important element of farmers' ideal farming system. All these findings underscore the importance of social contact for organic farmers.

Another prominent statement of many farmers that addresses an aspect of social diversity is that diversity between farmers and farms is important and desirable.

*But it hits an important point I think, namely that there should also be diversity among the organic farmers. Thus not only one direction, [...] but there also has to be diversity. Just as unique as the people are, are also the farms, and everybody has its favourite, or that what he likes to work with, and I think this is an important factor, the love to what you deal with. [...] And this can be sensed then, in the processing, in the handling. The love, may it be the love to the soil, the love to the apple or to the woolly pig. I think that this is indeed an important value.” (F4, 01:36:40)*

The connotations with social diversity were quite variable, however there was a consistent basic principle regarding any social relationship noticeable that was also explicitly addressed by some farmers: the principle of fairness. It ranges from fairness towards family members via the handling of workers to fairness within the food chain and global aspects like land grabbing.

*“Because Demeter indeed means to me live and let live, meaning that the farmer has to be able to live, the processor should be able to live and the consumer should be able to afford it.” (F10, 01:49:34)*

*That agricultural workers do not rake it in is I think generally, I wouldn't want to call it as bad at all, it is just like that, [...] I can not pay them twice as much as all the others, that is off the cards also for me, what I can personally seek, and I do this as well, is that I create living conditions, that are more liveable on the spot, that is that they have a decent accommodation, what has actually always been here is that one of the women cooks for the whole group, that is to say that there is a warm meal every day and this is in the working time of course; is of course only possible if the whole thing has a certain extent, for three, four people it hurts a bit if one is cooking the whole morning.” (F11, 01:15:25)*

Social diversity, in general but also on the respective farms, turned out to be an important value and good for the organic farmers in the study. While it can not be assessed in this study whether the importance of social aspects and the social commitment displayed is specific to organic agriculture it nonetheless reflects the systemic and holistic view of organic agriculture that considers social, technological and cultural aspects of farming. And it underscores previous findings (Darnhofer, 2010; Milestad & Hadatsch, 2003; Ribisch, 2012; Sullivan, McCann, De Young, & Erickson, 1996) that organic farmers appreciate social contact and relationships, to other farmers as well as to consumers, and that networking is perceived as an important strategy by many organic farmers to acquire knowledge and to cope with change.

That successfully working and living together in a group requires deference to one's fellows and that decision making is more demanding and might require to make compromises and to defer to majority decisions, all these things raised by the farmers with respect to social diversity, are experiences every person makes in social relationships. However the principle of fairness that was explicitly addressed

by some farmers and was found to be important also for the others may constitute the basis and reason for the successful realization and implementation of a socially diverse system, one that in turn profits everyone involved and makes life and farming more pleasant and satisfying.

#### 5.1.4 Cultural diversity

Cultural diversity aspects were scarce, both in the freelisting task (one farmer mentioned local traditional food) but also later in the interviews. Also deliberate inquiring didn't bring to light many statements. Some farmers said spontaneously not to have mental associations with cultural diversity regarding organic farming, others referred to farming traditions in general like mountain pasturing and the alp culture that however were said not to be restricted or valued differently in organic farming. Several times associated with the term cultural diversity was the issue of multiculturalism and internationality of workers that in this categorization is treated under social diversity and was already described above.

However it was mentioned that many organic farmers would check out different cultures, cultivation techniques and alternative farming approaches, thus you could learn a lot from one's colleagues. Farmers appreciate the variety of approaches that can be found within organic farming and see them as an invaluable stock for development. As already indicated above exchange with other farmers is common and valued and the openness of organic farmers and within the organic community is highly appreciated.

*"There are so many different approaches to grow organic, well I personally find that very interesting. [...] there are indeed luminaries, so I like to go to the colleagues, I think this is always interesting, everybody has tried something, has done something well or bad or, you indeed can swap ideas. That is well."* (F3, 01:16:40)

*"When we started we had a look at most different farms, we had a look at conventional and organic farms, we are out and about somewhere in Europe every year, [...] and if you come to an organic farm, there is always openness, that is to say you discuss, there are no secret-mongering about any measures, you discuss [...] how do you do it, [...] it is just much more open. On the contrary if you have a look at a conventional farm and explain that you probably also want to start with apples, then there is by far not the openness present. And you can really see this one-on-one. [...] [Organic farming] is just a much more open branch, there are so much farmers actually that I have the feeling want to make progress, [...] and from the social this is a significant difference. At least I have always perceived it like that the last years."* (F12, 01:02:20)

Organic farming was seen as innovative form of farming that is further developed decentralized on the single farms, by farmers that want to further improve agriculture. Where conventional farmers were said to all apply the same single spraying plan of the Lagerhaus, organic farmers experiment and try to find viable solutions for the respective situation.

Kummer (2011) thoroughly investigated organic farmers' experimentation practices finding experimentation, in whatever form, very common among Austrian organic farmers and as valuable tool for enhancing the resilience of the respective farms. Such a decentralized and locally varying further development of farming could furthermore greatly increase the adaption of practices and methods to local conditions and the response diversity to changes and shocks in the food system and thus the resilience of the farming system as a whole (cf. Barthel, Crumley, & Svedin, 2013).

Related to the issue of different cultures and techniques is also the so-called "butchering feast" one farmers once made were they demonstrated the differing Austrian and Hungarian ways of butchering. As mentioned above farm feasts were also conducted by another farmer what besides the social component inherent of course also displays a form of culture.

Another issue that repeatedly came up during the interviews are organic associations. One farmer said that he was happy that the small Upper Austrian organic association *Erde & Saat* survived as a form of resistance or opposition against Bio Austria.

*“Because it’s important that Bio Austria indeed feels that there are farmers that do not swallow everything. I think that if Erde & Saat didn’t exist, the development of organic agriculture would have been much more radical towards opening, towards conventional.”* (F11, 00:00:55)

Another one said that they will convert to bio-dynamic farming and join Demeter because they didn’t feel supported by Bio Austria in their approach and endeavours to operate with alternative plant protection measures like plant slurry or homeopathic methods.

*“And there we realized that at Bio Austria, if you just request and say I’m interested in this and that, do you have experience with this, you are viewed as if you were bonkers. [...] if you ask for alternative things and say do you know something about [plant] slurry, do you know something about homeopathy, do you know something about biodynamic preparations, we just never got support. [Within Demeter] people are much more open for such questions.”* (F9, 00:22:40)

And a third one said that he is member of a group that planned to establish a new organic association, but that is off the table at the moment for organizational reasons, mostly labour effort.

So the merging of the plenty initial Austrian organic associations that Lindenthal et al. (2007) mentioned as a negative and observable development seems to be eyed critically meanwhile also by many organic farmers. The diversity within the organic community seems to make it difficult for Bio Austria to act to the satisfaction of everybody and certain groups conceivably feel neglected or their values and interests not advocated adequately. To address this issue will be crucial to achieve the initial aim of the joint association to pool forces and to represent the interests of all organic farmers in Austria and advocate their interests. Whether Bio Austria will play a crucial role in the further development of organic farming in Austria will depend to a great extent in its ability to comprise and include all organic farmers in their full diversity.

### **5.1.5 Other**

Some items and brought up issues from the freelisting task could not be classified to the established categories. One topic thereof which was mentioned by three farmers was woodland, especially to establish mixed forests instead of (spruce) monocultures. Another said that heating with wood from the own forest was important for him, an aspect relating to diversification of production and self supply. Other aspects mentioned were diversity of weather and higher soil stability in organic farming compared to conventional, what was primarily traced back to chemical (salty) fertilizers (and less to any kind of diversity in the respective case). One farmer pointed out that to use dung (in addition to slurry) was important for him to bring back organic matter to the soil what would be advantageous also for soil organisms.

### **5.1.6 Practices**

Especially two farmers primarily mentioned and referred to specific practices that are related to and impact diversity. Examples are the (obligatory) abandonment of pesticides, stepwise mowing of grassland or establishment of nesting aid for animals. These practices of course relate to and concern manifestations of biodiversity, nonetheless it seemed appropriate to separately categorize them. However a significance, correlation or indication could not be found.

### 5.1.7 Theoretical perspectives and discussion

Biological diversity is clearly the prevalent issue and connotation of farmers regarding diversity. This is no wonder as farmers are primarily concerned and work with biological elements. Farming is first and foremost a productive operation in the primary production sector and primarily deals with biodiversity as source and outcome. Farmers see themselves as producers and this self-conception was fostered also by agricultural policy in the 20<sup>th</sup> century (Jurt, 2003). Also the organic farmers in this study shared this stance of being producers of food and not (primarily) being landscape maintainers or conservators of old livestock breeds or rare plant varieties. A farm is no zoo or landscape garden in their perception. However they do not put production above everything, aiming for maximisation of yields, and see the interdependencies of production and biodiversity. For them these issues are inextricably linked. They do not split agricultural production from aspects like wildlife conservation or preservation of genetic resources. Insofar organic farmers' attitude seems to differ from conventional farmers'. Soini & Aakkula (2007) found that (conventional) farmers mostly seem to favour biodiversity management outside of agriculture or productive areas, also because biodiversity friendly measures often contradict "good farming" practices (Burton, 2004; Soini & Aakkula, 2007).

The findings about farmers' associations with biodiversity underscore the existing results (Fischer & Young, 2007; Kelemen, et al., 2013) that (organic) farmers have rich, complex and multifaceted mental concepts about biodiversity. The prevalent positive normative stance towards biodiversity that includes the attribution of ecological and intrinsic value to organisms reflects the values of Organic Agriculture that are based on and were derived from the organic community all over the world (Luttikholt, 2007).

Although the primary focus was on biodiversity, also economic factors, especially risk spreading, and social diversity aspects were raised by the farmers and turned out to be important for them. With regard to both, economic and social issues, the organic principles, especially the Principle of Fairness, seemed to be well represented by the farmers.

The appearance of economic issues reflects that farming is a business and the main source of income for many farmers also in the study. This requires seeing farming also from an economic perspective. The consideration of social aspects also with respect to farming on the other hand reflects the holistic approach of organic farming. However it can not be answered in this study whether social diversity on organic farms is higher than on conventional farms or if the issue is more important for organic farmers (although one farmer indicated this and former research has yielded similar results (Sullivan, et al., 1996)). However social diversity turned out to be an important issue for the organic farmers and the following analysis of influencing factors on biological diversity on farms displayed also important interrelations. More specific and detailed research about social aspects in organic farming in any case would be necessary to get a more concrete picture about the actualities.

Cultural aspects were not really related by the farmers with the issue or lexical item of diversity and organic agriculture. This however does not mean that cultural aspects are not of importance for organic farmers or that there would not be a specific relationship between organic and culture. The mentioned "butchering feast" once conducted by a farmer exemplifies that there indeed might be much more to discover and unveil. Unfortunately due to time constraints in the interviews it was not really possible to go into detail with farmers about attitudes towards and practices related to culture, (local) traditions and so on, to deepen the issue. In any case a connection is not straight forward for the farmers. It might be that those farmers who identify with the organic values share also a common stance and attitude towards culture and cultural aspects owing to similar values; however the connection to organic agriculture is not perceived by the farmers. More research about this issue in any case would be important to be able to make reliable assertions.

Following Sutherland (2013) certain aspects and elements of diversity can be construed as symbols that represent "good organic farming practice". These symbols can be interpreted according to Bourdieu's concept of cultural capital. Bourdieu (1986) distinguishes three forms of capital, namely economic capital (material and financial property), social capital (networks of social connections and mutual obligations), and cultural capital (prestige, appreciation of symbolic objects or displays), all of which represent forms of power and can be converted among each other. Cultural capital thus can (partly) be turned into social or economic capital. He distinguishes three types of cultural capital: embodied cultural capital, i.e. the ability to recognize and utilize valued cultural objects, objectified

cultural capital, i.e. objects and symbols that are given high value by a group, and institutionalized cultural capital, i.e. formal mechanisms by which cultural standards are transferred and communicated (Bourdieu, 1986). Displayed symbols for “good farming” thus depict forms of objectified cultural capital which can create prestige and acceptance in the farming community or in other societal groups what translates into social and economic capital. Burton et al. (2008) proposed three conditions necessary for farming activities to be able to display cultural capital: the activity must be able to be distinguished from a “poor” one, the activity or outcome thereof must manifest somehow, i.e. there has to be a symbol, and this symbol must be perceptible by others. Sutherland (2013) found that organic farmers consider environmental aspects as important characteristic of “good” organic farming and landscape diversity as an important part thereof. She quotes an organic farmer who states that a “variety of crops and a variety in the landscape” make up a good farm (Sutherland, 2013, p. 435).

The results of this study indicate that especially an adequate crop rotation, perceived as opposite of monocultures and cultivation of only a few crops, seems to be perceived as what makes up organic farming and establishing one is thus constitutive for being a “good” organic farmer. Also engaging in conservation of old varieties and maintaining orchards seem to constitute important symbols of organic farmers. The husbandry of old domestic animal breeds or keeping a bathful of different animal species can be similarly considered as symbols. Also the establishment or conservation of semi-natural habitats as refugee habitats for wildlife are widespread and might function in the same way. On the other hand certain symbols in conventional farming like weed-free fields (Burton, 2004; Soini & Aakkula, 2007) seem not to be important in organic agriculture what eases biodiversity-friendly acting.

However, probably besides an adequate crop rotation in arable farming, diversity in one form or the other seems not to be the only possible objectified cultural capital or an absolute necessity. This is also underlined by the findings of Sutherland that also economic viability, animal welfare, progressive approaches and tidy farmsteads constitute symbols (although especially the last point turned out to be quite controversial among organic farmers, what was also found by Laber (2011a)). Diversity accordingly would be a possibility for organic farmers to generate cultural capital, however it is not necessary or the only option and thus it might be assumed to be primarily realized by those how have a certain inclination to diversity. The findings of this study back this assumption as many farmers noted that they would not require every farmer to diversify (at least in the same way as they did).

As described above cultural capital implies and comprises also embodied cultural capital, i.e. “the ability to recognize and utilize valued cultural objects” (Sutherland, 2013, p. 432). This capability is typically socialized and must be present within all or most members of a certain group to be effectual. This notion and idea allows to relating to another sociological/psychological concept, the theory of social representations (Flick, 1998; Serge Moscovici, [1961]1976). A social representation is a *“a system of values, ideas and practices with a twofold function; first to establish an order which will enable individuals to orient themselves in their material and social world and to master it; and secondly to enable communication to take place among the members of a community by providing them with a code for social exchange and a code for naming and classifying unambiguously the various aspects of their world and their individual and group history”* (Serge Moscovici, 1973, p. xiii). Normally this concept is used for quite abstract “everyday phenomena” like illness, madness, androgyny, democracy etc. (Wagner et al., 1999) and is perceived as essential for coping with unfamiliar and new information (Moscovici (1984) from Flick (1998)). Social representations allow to handle such notions and to talk with others due to a common basic understanding. While diversity and organic agriculture are a bit different phenomena as they are more specific and may not be as “unquestioned”, to a certain degree the concept seems to be applicable also in this case. Accordingly among organic farmers might be expected a social representation of what organic or even what diversity is. It turned out that diversity is an important aspect of what could be called a social representation of organic among organic farmers. This is reflected in the rich and sophisticated concepts about diversity and the displayed importance of diversity for all organic farmers in the study. Diversity is a crucial aspect of organic, also in the farmers’ perception. This includes an adequate crop rotation, a diverse landscape including refugee habitats for wildlife and conservation of old fruit and vegetable varieties and animal breeds. However according to the results in this study it can not really be argued that there exists a social representation of diversity that regulates what this exactly means in practice or what is adequate or required for an organic farm. This may be due to the manifold ways that exist to establish a “good” organic farm what is also seen and emphasized by the farmers. It could

be argued that in this sense there is a social representation of diversity as an ultimate value as no general rule exists or is possible to develop in the farmers' perception that could grasp diversity. The particular shaping depends on a huge variety of diverse influencing factors, from the environmental, cultural and socio-economic conditions to ultimately the diversity among people's and farmers' attitudes and preferences. The subsequent diversity is valued by the farmers, it is what makes up organic, even if some farmers might be quite pragmatic. This notion of farmers backs the concern felt about stricter regulations of organic and indicates that organic farmers rather oppose stricter regulations and requirements.

It has to be pointed out that this is not a quantitative study with the aim to give a representative overview of values of organic farmers and thus claims not to cover all attitudes at hand in the organic community. Laber (2011a) in her study about farmers' perception of biodiversity for example divided organic farmers in two groups concerning their relatedness and attitude to nature. The two groups differentiated in their attitude towards and the perception of landscape elements (primarily aesthetic approach vs. surrounding also seen as habitat), statutory regulations (seen as critical or necessary) and "tidiness" of areas on the farm (well groomed appearance of areas important vs. toleration of "wild" areas). Although in this study some farmers seemed to be in an intermediate position, none of the farmers appeared to be assignable to the first group, which Laber called "traditional farmers". This may be a sampling effect. The "traditional" farmers group may have reacted less on the email inquiry or may not be registered in the mailing list at all. And the snowball sampling may not have adjusted this bias. The same may also be true for organic farmers that are certified primarily for economic reasons and are not member of organic associations and networked with other organic farmers.

However the sample allows eliciting crucial influencing and determining factors of on-farm biodiversity for farmers that have an affirmative mindset towards biodiversity and diversification. In the following several elements of biodiversity as well as agricultural diversification are analyzed more in detail, attitudes and practices are related and determining and influencing factors on on-farm biodiversity and diversification are elucidated.

## **5.2 Influencing factors on planned biodiversity and agricultural diversification**

This second part of the study figures out influencing factors on planned biodiversity and agricultural diversification. This "imbalance" and focus on biodiversity and production is accounted for on the one hand by the fact that farmers themselves primarily referred to these issues (see 5.1) and thus automatically steered the interview in this direction and on the other hand by the focus set by the interviewer as well as time constraints that avoided deepening the issue of social and cultural aspects and figuring out the determining factors for these. It seemed to be more reasonable to focus and deepen at first the issues brought up by farmers themselves before steering into specific other directions. And to a certain degree this focus on agricultural production was for sure also caused by the interviewer itself whose focus was in the first place on this issue. This does not mean that social and cultural aspects were ignored; however it was necessary to narrow down the investigated topic to be able to get in-depth results. While this approach for sure contradicts to a certain degree the systemic approach of the study, it nonetheless was regarded more reasonable than superficially touching several topics. Additional studies that focus on social and cultural diversity are necessary to fill this knowledge gap and to round out and complement this study that was conceived as a systemic study.



## 5.2.1 Crops

### 5.2.1.1 Genetic diversity

Genetic issues of crop diversity were hardly brought up by the farmers themselves and were restricted to a few certain topics. The one primarily addressed is old apple varieties, less often also other fruits. These issues however popped up in almost every interview. This topic was very much connected with maintenance, renewal and establishment of orchards and fruit gardens as traditional and valuable landscape elements. Above all diversity of taste but also certain features like juice yield and conservation of genetic resources in general were mentioned as drivers for favouring old varieties. A lot of work regarding this issue has already been done also by official quarters what eases conservation by farmers and garden owners. The provincial government compiled a list of old local varieties and projects with selected tree nurseries all over Upper Austria were established where all of these varieties are available. A tool to be found on a homepage (<http://www.meineobstsorte.at/>) helps to find appropriate varieties according to soil type, climate and intended use.

In intensive fruit production the issue of varieties is a more difficult one. In food retailing focus is on a few globally available varieties like *Gala*, also in organic farming. Wholesalers buy in general only certain popular varieties, others often only in shortage situations and anyway pay only minor prices for these varieties. To focus on unconventional varieties is thus not economically viable in wholesaling.

Direct marketing is the only option that allows cultivation of unconventional varieties. Still it is not that easy even then. Consumers are used to and thus often prefer conventional varieties instead of old ones. The commercial apple farmer in the study offered the old apple variety *Kronprinz Rudolf* but by now took it from sale as consumers asked for old ones indeed, but in fact mostly bought conventional varieties in the end. But conventional varieties have also further advantages. Even when primarily direct marketing, potential excess supply is easily and economically acceptably marketable via wholesalers. Modern varieties are tested and lots of knowledge regarding advantages and disadvantages is available. Old varieties are traditionally grown as half-standard or standard fruit tree and behaviour as bush tree is unknown. Especially when starting with apple production it is thus highly risky not to focus on standard breeds, particularly regarding the high investment costs. Moreover modern varieties are versatile and thus optimal for a farm that is also manufacturing different apple products.

The apple farmer illustrated that nonetheless he wanted to have a certain diversity of varieties although to focus just on *Gala* would from an economical point of view be best. His primary aim for the future was to establish robust varieties in direct marketing to be able to reduce external inputs and still achieve good quality and adequate quantity.

The situation is quite similar for soft fruits. There are only few varieties in demand which have certain features like long shelf life that are required in food retailing. Direct marketing allows providing varieties that lack these properties but instead are characterized especially by extraordinarily good taste. This allows in the following to obtain high prices that make up for aspects like minor yield and higher costs of plants. The farm in the sample focuses on varieties for house gardens that feature very good taste but are difficult to chase down, especially, if possible at all, in higher amounts (e.g. for one hectare) as they are propagated only in smidgens.

Besides taste also robustness and resistance to diseases was named by the farmers as selection criteria. But especially if grown only in small amounts this latter trait becomes less crucial as probability of (severe) disease occurrence is lower. One farmer hinted that they grow four different varieties of apples that are graduated by ripening to extend harvest season.

In the interview with the vegetable farmer the topic of old and open-pollinated varieties soon came up. He stated not to be really satisfied and happy with choice of varieties as he partly used hybrid seeds of large breeding companies but argued that other varieties are often just not economically viable. They had tried already a lot but especially gherkins were said to be impossibly grown with older and open-pollinated varieties. He pointed out that in general selection of varieties is depending on the demands. He as a vegetable processor had different demands regarding special features than e.g. a direct marketing vegetable producer near a big town.

For small amounts and self supply it is more common to use old vegetable varieties and sometimes also own seed propagation is practiced. Seed availability especially for small quantities was said to be no problem as companies like *Reinsaat KG* and societies like *Arche Noah* provide mail order selling.

Although dignifying farmers that grow a huge amount of varieties of a single crop species, the vegetable farmer admitted not to want to take on the effort of direct marketing where great varietal diversity might make sense, however in any case he couldn't imagine how to cope with administrative workload.

*"I realize already if I plant two or three sets of courgettes with five or six varieties what deal of work it is to later still know where which courgette variety is, and if I then however run it that way that I have 150 varieties of tomato, like some do, then I think then you never get finished, that's impossible, I mean then you lay your focus of your work on looking where is what and above all you have to deal with how tastes what."* (F11, 00:22:45)

The farmer claimed that one difficulty is to communicate diversity to the consumer, to acquire and transmit features and properties of every special breed.

Varietal diversity of fruits and vegetables in the respective cases turned, in contrast to diversity of species, out not to be (perceived as) important or favourable in direct marketing. Detailed research about this issue and thus knowledge if varietal diversity actually can constitute economic benefit or is, if practiced, solely a matter close to the farmers' heart, is in any case lacking.

Concerning staple crops only the topic of rare cereals was mentioned in the freelisting task by one farmer who himself cultivated small spelt for self supply. Conservation of this genetic resource for the future was a major driver for him for cultivation; another farmer growing small spelt named personal interest in unconventional crops and enjoyment of trying out new things as primary reasons. Besides it went well with their farm: the crop is well suited to direct marketing and they are occupying a market niche as nobody else in the surrounding grows it. Moreover they are located in the border area of (present day) arable farming and small spelt is hardy and goes down well with the climatic conditions.

Like with other crops the focus in cereals and staple crops in general is in Europe on few breeds. This was hinted at also by some farmers. Nonetheless many farmers seemed not to see a major problem regarding this issue and some farmers commented that availability of organic seeds is in the meantime already quite good and also the assortment okay so that every farmer should find an appropriate one for his climate. As an exception sunflower was mentioned where only hybrid seeds are available and one farmer also tried to develop his own open-pollinated sunflower variety to overcome this issue. One farmer hinted at the issue of logistics and obtaining seeds when stating to use the varieties that were available at the Lagerhaus.

*"I always get this list, what varieties are available, of wheat or barley or something, but this is all nice and kind, however it regionally reduces anyway to maximum one or two. And the next thing is, when I actually buy it, the wheat, I take the one that is on-hand in the Lagerhaus. Well, such small amounts like we have, you do not really have a lot of chance. [...] If he has 100t of Element [wheat variety, S.L.] wheat at hand, I will not absolutely take the other. Because the differences are not so huge I think."* (F3, 00:44:15)

Some farmers underlined the use of the spelt breed *Ebners Rotkorn*, a variety developed by an Upper Austrian organic farmer in the Mühlviertel. But also in staple crops wholesalers and bulk purchasers often dictate certain breeds what is reinforced by an increasing integration of breeding, processing and purchasing. This was criticized frequently as a threat for diversity and the discretionary of farmers. Again direct marketing was named as an opportunity to maintain independency and flexibility. But still e.g. demands for protein content may limit the use of certain varieties. The use of second generation seeds was common among the farmers.

Another topic that was brought up by a farmer who operates also a plant nursery for regional wild plants (REWISA-certified<sup>4</sup>) is the genetic source of covercrop-mixtures and (woody) plants for hedges and biotopes. He criticized that non-local provenances are used and spread and thus threaten the genetic integrity of local (wild) ones and genetic diversity in general. He strongly missed awareness of organic farmers regarding this issue and detected also deficiencies in organic regulations and politics. What exemplifies this is that one farmer mentioned to have used Romanian oaks for his replanted woodlot.

Although conservation of genetic resources is a public issue and duty, nonetheless every farmer's decision what to grow and of who to obtain seeds shapes the structure and development of the food system and especially the seed and breeding sector. Although some farmers in the study were aware of the developments in the breeding sector and its potential unfavourable outcome, in general there seem to be few initiatives and projects regarding this issue in Austria. The topic of farm varieties generally seems to be mostly constrained to biodynamic farming (e.g. (Keyserlingk-Institut)) where this issue has a strong humanistic background. More research about (organic) farmers' attitude and decisions about seed sourcing and use would be necessary to get a more concrete picture of the prevailing situation. One reason for the lack of concern and action in this topic might be little awareness about the potential advantages of local breeds such as tolerance regarding biotic and abiotic stresses, nutrient uptake and use efficiency and quality and nutritional value (Newton et al., 2011). This may be due to the fact that advantages are not that obvious and straight forward than in the case of fruits and vegetables with the apparent diversity of appearance and taste. Participatory plant breeding projects regarding cereals and other field crops, often especially in cooperation with organic farmers, were established in several European countries like Portugal, Sweden, Hungary, France and the UK in the last decades. In the Swedish Allkorn project for example regionally groups of organic farmers further develop cereal cultivars for optimal local adaption. This is accompanied by joint marketing efforts in cooperation with local processors (Newton, et al., 2011). A similar project is performed by bio-dynamic farmers in the Bodensee-Region (Keyserlingk-Institut). These projects could serve as role models for organic plant breeding. More detailed research would be indicated to elicit organic farmers' attitudes towards this issue and the challenges for establishing similar projects in Upper Austria.

### 5.2.1.2 Crop rotation (staple crops and field vegetables)

The crop rotations found on the sample farms differed strongly according to the size and production focus of the farm (Table 7). Most farms included two or more years of clover grass or alfalfa for nitrogen fixation, soil build-up, soil resting and weed control (e.g. *cirsium arvense*). Only one vegetable farmer is mostly going without perennial crops unless weed problems make it necessary and another entirely spares perennial crops, as she claimed this could intensify dock (*rumex sp.*) problems. For all other farmers ley constituted an integral part of their cropping sequence. It is either used for feeding ruminants, exchanged for manure or sold. Especially small farmers that do not have machinery for hay or silage production let neighbouring farmers harvest their fields, in case of this one being conventional farmer then not being allowed to exchange it for manure. The farmers' focus concerning the importance of the crop rotation seemed to be primarily on nitrogen provision, soil structure and weeds. Prevention of diseases however was hardly mentioned. Three farmers highlighted the use of the "Luftensteiner Gemenge", a clover-grass mixture that contains 10% herbs, to increase biodiversity on their farm.

Crop rotations in general are quite cereal-lateral, sometimes making up more than 50%. Still all farmers put emphasis on varying the cereal type, with the same cereal in the same crop rotation only to be found in wide rotations (8 or 9 years). Annual leaf crops are quite rare, the most common is field bean that is appreciated for its preceding-crop-value and its' unproblematic cultivation. Soy and pea have been tried by some farmers but are not that cherished especially for the weed problems. One

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<sup>4</sup> Regionale Wildpflanzen & Samen (regional wild plants and seeds) ([www.rewisa.at](http://www.rewisa.at))

farmer outlined that he is planning to increase legume diversity as he was exclusively using field beans (*vicia faba*) every four years. Formerly also using peas and soy beans, he abandoned these crops as field beans were easier and more successful.

*“Especially in the beginning I deliberately grew relatively much soy and also peas, I have looked that I have peas, beans and soy relatively equal in the crop rotation, and then the field bean just crystallized out that it is the only one that really works out well and works out always. [...] Growing field bean is straightforward, everything else is arduous, right? That way it crystallizes out that field bean remains and everything else not.”* (F11, 01:34:42)

Noticing declining yields he intended to vary more in the future again. Especially on the vegetable farm the crop rotation was tailored to and all about the vegetables.

Potatoes are, if at all, mostly grown in small amounts for self supply. Free working time and workforce availability were named to be major limiting factors with this respect. Also Ribisch (2012) found that available workforce on the farm is a crucial determinant for the selection of crops. Crops that require lots of manual work are often abandoned because of lacking workforce. Examples mentioned are sugar beet and also potatoes. For root crops in general the soil type and conditions were also mentioned as constraints for successful cultivation in a region.

Crop rotations often only consist of two or three years of clover grass or alfalfa followed by two or three years of different cereals. This was especially the case with farmers having only a small arable area and whose production and income focus lies on another farm or income branch (fruits, animal husbandry (esp. ruminants), tourism). Farmers that laid their focus more on arable farming also had a more diverse crop rotation. The subordinate role of arable farming in the former case might lead to adaption of a quite simple rotation. Many farmers noted that the crop rotation is diverse enough if it works, that is if yields remain adequately high and constant.

*“Nature and the yield respectively displays it anyway to you, if the rotation is not working, it shows it one way or the other, it will dwindle with time, you accomplish only such little yield. There is anyway control by nature and by yield, you see anyway if it works or not.”* (F1, 00:09:45)

To elaborate a more diverse crop rotation may just not be worthwhile if the economic relevance of arable farming is low and other farm branches require much attention. Also logistic and marketing were named to be influencing factors. Especially for a subordinate production branch additional hassle with seed sourcing and harvest processing and purchasing is not considered worth the effort.

Multifunctional crop rotations are not easy to develop even in theory, not to mention implementation in reality. Wijnands (1999) has shown for the Netherlands that many organic farmers can not clearly outline their crop rotation and execution is all but strict. 60% of farmers departed recently from their basic cropping plan. Also Ribisch (2012) has shown that many organic farmers do not have a crop rotation. These findings proved true also for the farmers in this study. Farmers often seemed not to be really clear about their crop rotation and if it included mostly either several possibilities or they named only crop groups like “cereals”. The statement of Wijnands (1999, p. 33) that *“for most farmers crop rotation only seems to be a vague outline and notion and not a concrete and carefully planned and implemented reality”*, hits the bull’s eye. The crop rotation in general is perceived more a guideline than a rule.

*“I’m not all that sure, but it changes a bit just how it fits, but in broad outline it’s roughly like this.”* (F5, 00:20:01)

Often farmers decide on the success of the preceding crop if nutrient residues allow another debilitating crop. Performance of clover grass and annual legumes and yield of cereals or other crops serve as an indicator for nutrient leftover.

All farmers pointed out that an adequate crop rotation is crucial for them. For some farmers this was inextricably linked with diversity and change. Still it seemed that many were not always 100% clear about the special features of crops and crop groups and how they interact. Flexibility of the crop

rotation is necessary to be able to adjust to varying environmental and economic circumstances. Divergence from the basic crop rotation is not problematic as long as the basic principles upon which it is built are adhered to (Wijnands, 1999). But if farmers don't have profound knowledge to plan and assess crop rotations and short-dated changes of it, sustainability and quality of production and economic success are threatened. As traditional knowledge and lore about crop rotations has been lost in the last 50 years as it lost significance because of rationalisation and intensification (Wijnands, 1999), this topic would have to be addressed in agricultural schools and trainings much more.

**Table 7: Size of arable land and standard crop rotation of sample farms**

Farm	Arable land	Standard crop rotation
F1	15 ha	Clover grass (2 or 3 y.) – cereal – cereal
F2 <sup>1</sup>	6 ha	Clover grass (2 y.) – cereal – potatoes
F3 <sup>2</sup>	6ha	Field beans – wheat – barley – clover grass (5ha), fennel (1ha)
F4	11ha	Clover grass (2 y.) – cereals (2 or 3 y.) (wheat, barley, triticale, rye, small spelt)
F5	30ha	Clover grass (2 y.) – wheat – corn – rye/spelt – field bean – wheat – rye/spelt
F6 <sup>3</sup>	3ha	Field bean /pea – 3 x cereals (rye, spelt, triticale, small spelt, barley)
F7	5ha	Clover grass (2 y.) / permanent grassland – oat – rye / wheat – rye / spelt
F8	-	-
F9	-	-
F10	230 ha	Clover grass (2 y.) – wheat – barley – rye – field bean – wheat/sunflower – spelt – rye
F11 <sup>4</sup>	40 ha	Field bean – field vegetables – spelt – other cereal
F12	9 ha	Alfalfa (2 y.) – cereal (2 or 3 y.; wheat, barley, triticale)

<sup>1</sup> since 2009, at the moment green manure for planned tree nursery

<sup>2</sup> area leased since 2010, only one or two crops grown per year; barley or rye planned as next crop

<sup>3</sup> mixed cereal-legume cropping planned

<sup>4</sup> alfalfa cultivated if weed problems (esp. *cirsium arvense*)

### 5.2.1.3 Rare/alternative crops

Diversity of cultivated cereals was quite high on the sample farms, ranging between 3 and 6 different species. Wheat, barley, rye, triticale and spelt were common and also oat frequently cultivated. Two farms also included small spelt (*triticum monococcum*) in their rotation. Personal commitment to conserve this old species was the main driver for cultivation. Other alternative or rare crops were scarce. One farmer started planting fennel for spice production recently and one farmer once tried lupines as alternative legume. Logistics and marketing turned in general out to be the main influencing factors on economically viable cultivation of alternative crops. To get seeds was named to be quite difficult for certain rare crops, especially in bigger amounts. If a regional Lagerhaus can not provide the requested seeds long travels might be necessary. Proximity to drying plants or mills is another crucial aspect. Manipulation and processing is increasingly centralized. Going for ours by tractor to dry a few tons of lupines is neither ecologically sustainable nor economically reasonable. Increasingly bigger plants often require a certain minimum amount to even accept harvest for processing, prohibiting cultivation of small amounts. Moreover marketing is a crucial factor. If no direct marketing is performed on the farm or amounts are too big to be completely purchased directly again large transportation distances might be necessary to find a purchaser. In Upper Austria the producer group “EZG Biogetreide”, that has five collection points all over the country, facilitates manipulation and marketing of organic cereals and launched also projects with small spelt, hemp and forest bush rye (*secale multicaule*). Still for farmers in remote regions this might still impose huge effort. One farmer indicated that even purchasing organic bread wheat requires him to drive far.

*“And then again with marketing, you have to, this is already the problem with organic cereals, if I have good organic cereals and want to sell it, here, in the middle of Upper Austria, I have to drive 60km to get it off.” (F3, 00:24:25)*

Of the two farmers that cultivate small spelt one produces it only for self consumption, the other, as already mentioned above, runs direct marketing.

Alternative fodder crops can ideally be fed straightaway on-farm or submitted to a cooperating neighbouring farm. Still these preconditions are often not given, thus hampering cultivation of alternative crops, especially in small amounts. One farmer advocated a more extensive use of modern information technologies to facilitate and simplify marketing. Especially for farmer-to-farmer sales an improved network or software that pairs up supply and demand could help to ease marketing.

Closed on farm cycles (e.g. in the case of fodder crops) and direct marketing might allow for a diversified crop production, however certain constraints might hamper to establish these conditions (see 5.2.5.1, 5.2.5.2).

Moreover (re-)establishment of local infrastructure for harvest manipulation and processing might facilitate economically viable cultivation and sale of alternative crops. The present centralized and standardized production system limits the processing and marketability of small amounts and alternative crops.

#### **5.2.1.4 Catchcropping/covercropping**

Cover cropping is performed by all farmers and done if length of the growing season allows cultivation between two main crops. Plant use is quite variable and ranges from special mixtures consisting of up to ten different plants to sole use of single species like phacelia. One farmer very carefully chooses his covercrop-mixture, trying to find one with plants having different complementary features. Especially the root type was important for him, but also presence of flowering plants for insects is a selection criterion for a mixture. He claimed that meanwhile already a great range of different mixtures is available at the market. But especially diverse mixtures with lots of herbs like marigold (*calendula officinalis*) are very expensive compared to conventional mixtures. Most farmers don't make that huge effort with catchcrops. One farmer e.g. always uses an oat-pea-bean-mixture of which all components were anyway available at the farm after harvest.

*“This is my circulatory thinking, because of lacking animals on the farm I don't have it elsewhere anyway, but at least with respect to this I think, I never understood why 20 different versions of catchcrop-mixtures are available, well packaged, transported through whole Europe, and the beans and peas are brought to the Lagerhaus, I all the same can grow them, why should this not be okay as covercrop. Of course you have the same things again on the field, [...] but oat and a pea and a bean as mixture is not a jota worse than, I don't know what is cultivated, phacelia, or 100 mixtures, clover-buckwheat, isn't it? Things nobody grows here for threshing, that come from god-knows where.” (F11, 01:44:55)*

Some use white clover as undersown covercrop that is normally enriched with the shedded previous main crop. Common are legume rich mixtures to provide nitrogen for the following main crop. One farmer hinted to use field mustard also for phytopathogenic reasons.

#### **5.2.1.5 Mixed Cropping/Intercropping**

All farmers were very interested in mixed cropping and many already practiced it in one way or the other (Table 8). Three were at the moment puzzling over their first implementation next season and

could tell quite concretely what they planned. The topic seems to be a very current issue in the organic community at the moment and lots of checkout seems to take place currently.

Most common is undersowing of white clover in hoed row crops like corn, field beans or sunflowers. But also in cereals it is partly practiced, e.g. if winterkill is substantial. One farmer practices variety mixing in cereals. This has primarily to do with the fact that for a touristic project he needs a continuous rye stock without lodging. Available rye varieties he said either suffer from high winter kill or are quite high, thus having a high risk of lodging. A mixture not only optimally serves aesthetic demands, he also found substantially increased yields compared to single cultivation of a variety.

One farmer practiced intercropping of two main crops, namely summer wheat with mustard.

Especially eventual use of the harvested products determines possible implementation of a mixture of two harvested crops. Separation is costly and effortful. It only makes sense if components are valuable. Moreover distance to the next separation plant has to be regarded. To drive for longer distances only makes sense if either overall amount is high enough to justify it or so small to be able to transport it with a car trailer. If fodder crops are intercropped separation can be spared if the mixture can be fed on farm. However one farmer argued that he prefers separated crops for compilation of daily rations, thus not mixing e.g. fodder cereals and peas.

For intercropping of staple crops already a lot of knowledge was acquired in the last decades. There are many tested combinations and valid implementation formulas and knowledge seems to be quite easy available for farmers, although one farmer proposed sort of a round-up and best-practice database compiled by an organic association or a public institution. For bigger scale vegetable growing this seems not to be the case. Lots of knowledge exists concerning intercropping of vegetables in house gardens and in traditional farming systems. Also farmers in the sample use intercropping of vegetables for self supply and in small scale production for direct marketing in a minor scope. Economically viable strategies and approaches for intercropping of field vegetables and bigger market production seem to be scarce although many specific and basic studies about vegetable intercropping were conducted in the last decades (Theunissen, 1994) and also a few projects in this direction were developed in the last years (e.g. Stadler (2010), Gadermaier (2012)). The only field vegetable farmer in the study indicated interest in undersowing and mixed cropping of vegetables but missed concepts, ideas and knowledge how to implement these approaches in practice. He himself claimed to lack time to experiment being concerned a lot with marketing but would be open to participate in research projects. About the efficiency and effectiveness of mixed cropping against pests he was rather sceptical.

*“But this is more a problem of the monoculture naturally, you would have to have, I don’t know, three cabbages and then again for hectares something else. But that’s not on either, because you should also realize quantities.” (F11, 01:39:04)*

The problem of lacking knowledge and sophisticated concepts seems also to be given in fruit production. There are several approaches to further develop organic fruit production but it’s said to be tedious and protracted as farmers have to test and urge progress on their own. Mixed cropping of fruits is said to be quite difficult to implement in practice for several reasons. Different fruit species tolerate and require different amounts of plant protection agents (e.g. copper) and supporting herbal substances and have different application times. Row spacing between species differs and mixture extends ways and increases required passages, thus increasing soil impact especially in wet conditions. To arrange varieties in small blocks might be a good solution, still often plantations already exist and adaption thus takes time. Pre-establishment consultation would have to be mindful of this issue.

One farmer advocated Agroforestry systems as the future of organic farming. Although there is intensified research concerning this topic going on in Europe in the last decades (e.g. Dupraz et al. (2005)) and parts of Upper Austria were found to be target regions for silvoarable farming systems (Reisner, de Filippi, Herzog, & Palma, 2007) still in general this concept seems not to have found its way into organic farmers’ general discourse yet.

**Table 8: Mixed cropping practices on the farms**

1	Mixture of rye varieties
2	Agroforestry system with fruit trees, fruit bushes and vegetables for self supply
3	Not tried yet (missing knowledge), but plans to do it the next years
4	-
5	Summer wheat + field mustard, undersowing of clover in field beans
6	Triticale + winter peas in 2013/2014
7	Undersowing planned since long but not yet
9	From 2014 on vegetables for the market (5000m <sup>2</sup> ), will be mixed cropping
10	Undersowing (white clover, buckwheat) in corn & sunflower
11	No mixed cropping or undersowing, but considerations in that direction (white clover e.g. in gherkins)
12	No mixed cropping in field or fruit plantation

### **5.2.1.6 Diversity of vegetables, fruits and processed products**

In this section the diversity of vegetable and fruit species and products that are further processed on farms is dealt with. The focus with respect to fruits and vegetables is on farms that specialize on these crop groups and obtain their major income from these production branches (i.e. not primarily self supply). Diversity of processed products is not restricted to fruits and vegetables and might also encompass diversity of farm-made cereal, meat or dairy products. As many features and parameters of diversity of fruits, vegetables and processed products were found to be similar or identical these elements are treated together. The diversity of fruits and vegetables in this section primarily deals with different species as varietal diversity is primarily dealt with in chapter 5.2.1.1.

The sample contained three farms that specialise in vegetable or fruit production. Of the two farms producing fruits one is quite small (2ha), focussing on soft fruits and entirely direct-marketing whereas the other produces mainly apples of which the majority (ca. 2/3) are purchased to a wholesaler. 13 and 5 different fruit species are cultivated and processed further respectively. Both farms further process parts of their harvest to a wide variety of products. The apple farmer produces for example 10 different juices (mostly mixtures including apple juice), 6 different kinds of cider, 4 different vinegars and many other apple products. The small fruit farm processes jam, chutney, syrup, juice and liqueur of a wide variety of different fruits.

The vegetable farm cultivates 8 different field vegetable species and sources root crops and cabbage from neighbouring farmers to manufacture altogether up to 50 different products, mainly pickles. These are sold to grocery retailers in Upper Austria and to organic shops all over Austria. Marketing turned out to be in an intermediate position of direct marketing and selling wholesale as the farmer keeps intense contact with all single shop owners and directly provides them. Thus marketing is very time consuming and effortful although he purchases not to the end-consumer.

The reasons for diversifying fruits, vegetables and processed products are manifold but marketing turned out to be a crucial influencing factor. Focussing on one primary product entails the necessity to market at least partly via wholesalers as direct marketing of huge amounts of a single product is difficult or even impossible. This implies a strong dependency on the market and on a few or even one purchaser. The small farm did not have the opportunity to diversify production *and* produce amounts that are big enough to be interesting for wholesalers, thus was not able to spread risk in this way. As they didn't want to hinge on production and marketing success of a single fruit the implication was direct marketing and diversification of production. The bigger farm, starting with apple production when converting to organic agriculture, initially intended to purchase only to wholesalers. Request of locals for apples led to the build-up of the direct marketing branch with processing that grew in the following and makes up now about half of the income of the farm.

Direct marketing profits from offering a variety of goods through addressing more people and making it worth for consumers to drop in. Different products often serve different functions: Some, often



barley profitable themselves, serve as attractants for customers, whereas others that are often not the flagship products of the farm have a higher profit margin. Direct marketing has also a positive influence on product diversity via input and wishes of customers that sometimes are or can be realized. And not least diversification has PR-function:

*“And with what we make we do not only sell diversity, we sell a sense of life, we additionally sell an image, we convey this image. Many people that come to us [...] buy this feeling of, ah, this is the small farmer from ... that has everything. Hence diversity is very banally said a marketing instrument.” (F9, 01:39:39)*

One important motive for further processing is besides the additional value added the aim to utilize left-over and low quality primary products. This idea of optimal resource use applies also for other technical and human inputs and positively influences diversification of production. Certain machines and infrastructure are available, still use and workload for a single crop are often focussed on a short time frame. Cultivation of products with different workload peaks enables to take advantage of temporarily unused resources. This is the case not only for machines but also for workers. Cultivation of several crops with different peak times as well as processing might allow engaging labourers for a longer period or even the whole year round. This might not only be preferred by the seasonal workers, it reduces also fluctuation and workers better know the place what eases management.

Diversity of products might also enhance income stability. It provides variation for consumers and enables provision of products the whole year round. E.g. during summer consumers were said to prefer strawberries, grapes, apricots and peaches rather than apples.

Direct marketing enables also to take advantage of market niches, that is mostly products that are not interesting for supermarkets either because of certain features like shelf life or because not having enough market demand. Higher prices in direct marketing enable to provide products with special features that are not economically interesting for big scale production.

If products are purchased to food retailing diversity of products turned out not to be an advantage and often the focus on certain products strong in demand increases.

*“It has less influence on the diversity of what we produce, but it has very well an impact insofar as I have two, three, four products were the focus has increased even more and here it pertains for sure that you consciously check yourself and say okay, the other things are nonetheless not immaterial.” (F11, 00:27:58)*

Still success with one or few products can also enable to invest more time and energy in development of new products. The situation seems to be slightly different in the case of organic shops. It was said that supply of Austrian organic processed products is quite low and many products are imported from Germany. As organic consumers often also prefer regional products, shop owners are happy if the few Austrian producers supply a wide range of products to increase share of domestic products in the shelves.

Still it's not exclusively economic reasons that lead to production and product diversity on farms. As already touched upon above, diversity of production implies also diversion for the farmer and workers regarding tasks what retains enjoyment of work. Curiosity and enjoyment in checking out new crops and products were named by all farmers to partly reason diversification. The personal preference of the farmers for certain products is often the reason not to give up barley or not at all profitable products. But also the personal contact to the consumers, of whom everybody has its favorite product and who would be bitterly disappointed if a product would be abandoned is an incentive for farmers to maintain diversity.

Still it is a demanding challenge to establish and maintain a high diversity. Things must be compatible (production-technical, e.g. phytosanitary, and work related) and you need a good arrangement and organization. Nonetheless it requires high flexibility to cope with manifold challenges. It requires qualified workers that work independently and at least partly know themselves what has to be done. This gives the farmer leeway for time-consuming (direct) marketing, organization and self-improvement and further education, crucial aspects as complexity and thus management demand and knowledge requirements increase with diversity. Without proper handling and organization quality of

products suffers what farmers can not afford on a competitive market where they compete with high quality products that allow for high prices.

Especially in organic farming bureaucracy is a major hindering factor or at least a significant extra effort and expense. Obligatory recording can reach enormous dimensions if many products in small amounts are produced. It requires good organisation to remain manageable. Every single product sold has to be certified in advance, an aspect substantially restricting flexibility of marketing of small amounts of products, may it be for examination of new creations, selling of self supply excess or other sporadic or incidental products.

Altogether a mixture of economic, production-technical and personal reasons determines diversity of fruit and vegetable species on farms and the amount of different products processed. Personal interest and attitude is the most crucial diversity-fostering aspect and direct marketing allows economically viable realization. But direct marketing in turn also pushes diversification. These findings reflect results of Björklund et al. (2009) that personal inclination is determining planned on-farm biodiversity although vegetable diversity on farms in this study could not keep up with sample farms in Sweden. The result that direct marketing enables and encourages diversity of vegetable production is clearly underscored as well.

## **5.2.2 Livestock**

Nine farms in the sample are engaged in animal husbandry and issues related to this topic were also mentioned in the freelisting task. To keep several animal species on the farm was mentioned by four farmers, three of which keep 6, 7 and 10 different species on their farm respectively (Table 9). The fourth one only had fattening pigs but closely cooperated with a dairy farmer. Broiler husbandry he gave up as the effort was too high and moreover ethical considerations urged him to quit. The topic of old endangered breeds was brought up by three farmers, two of which themselves also kept old animal breeds. The farmers for which animal husbandry did not have an economic relevance mostly did not come up with the issue themselves even if keeping some.

### **5.2.2.1 Choice of breeds**

Four farmers keep old endangered breeds, a fifth from time to time fattens Swabian-Hall pigs (see Table 9). For all of them the conservation of the endangered breed was a personal matter and the main reason for choosing old races. To preserve the genetic diversity and unique features as expression thereof like robustness, adaption to local environmental conditions and good rearing properties and behaviour for the future was headed. Whilst most farmers that keep old breeds primarily pointed out the ecological value as genetic resource for further adaption, some also put an intrinsic value to them and tried to avoid extinction per se.

*“And moreover everything that is lost is gone, and that is a pity” (F6, 00:39:53)*

Still one farmer pointed out that it is not the farmers’ duty to conserve old breeds. Farming is primarily an economic operation and thus for a farmer the use value is central.

*“You have to look in the case of old races what does it yield, only because it is old is not enough. [...] It is always the question how you sell and use it. This is what you have to think about then.” (F3, 01:03:59)*

The main disadvantage of old breeds that is ever-present is the lower quantitative performance what makes them less profitable. Farmers primarily cope with this by means of direct marketing what allows higher prices to offset quantitatively lower performance.

In the case of beef, but also in goats and sheep irrespective of the breed, it is difficult to find processors and wholesalers that purchase the small and thus unprofitable animals. Thus direct marketing is often anyway the only option. Quality of the meat is often higher, also because husbandry is mostly extensive, the form of keeping these animals they are most suited to. This additionally might allow for high prices.

On two farms Fleckvieh was kept for suckler cow husbandry, one of them had also four Fleckvieh cows for milk production. Both farmers noted that they thought about using endangered breeds, but on the one hand changing a complete herd is effortful and one farmer said that the prices for animals of endangered breeds kept them from use. Also a Braunvieh farmer remarked that primarily the effort to exchange a herd has to be considered. One biodynamic farm had Waldviertler Blondvieh for milk and beef production. They initially started with this breed and used the beef primarily for self-consumption and partly direct marketing. Their advantage is that they are not depending on the income from farm products as they are a publicly financed social institution that produces mostly for self supply. Thus the lower quantitative performance especially in milk yield carries less weight.

In the case of pigs the issue of demanded meat quality turned out to be crucial. Old breeds often have a high fat amount; however consumers nowadays mostly demand lean meat. This is a key difficulty in marketing and may even restrict keeping them for self supply. One farmer raising pigs for self-consumption said they would like to keep woolly pigs but so far hesitated as their children dislike the fatty meat. One farmer explained that he prefers to produce a product that the majority of the organic consumers demand (and were a shortage exists anyway) instead of focussing on an extreme niche market. Moreover higher amounts of Mangalitza meat (he has 250 fattening pigs) might be difficult to market anyway. And the farm is not engaged in direct marketing so far and would have to start this marketing branch from the beginning. He stressed that instead it was important for him to have several breeds in the crossbreed to establish diversity, in his case Landschwein, Pietrain and Duroc.

Five farms keep laying hens of which three use standard laying hen hybrids, the other two keep the old Austrian breed Sulmtaler. The latter two primarily use them for self supply, thus having little economic pressure. The farmers that are marketing eggs, although only in a modest amount (70 and 30 hens respectively) referred to Sulmtaler when outlining the disadvantages of old breeds that keep them from shifting. Besides the fact that 70 Sulmtaler hens are quite difficult to chase down the significantly lower laying performance and the fact that they are hatching frequently discouraged them. Besides their beauty old breeds can not really put forward advantages like high product quality. Although some farmers also slaughter hens at home and use the meat for self supply and marginally sometimes market it, the chickens are primarily kept for egg production and the aspect that they are dual purpose breeds is not really taken advantage of. Nonetheless this alone could not offset the lower laying performance.

All farms in the study that keep old breeds are part time farmers that not completely depend on the farm income to make a living. This for sure lowers the economic pressure and eases to realize the personal predilection and the personal matter. Three farms keeping old breeds were only quite recently established (the oldest 1998) and started already with old races and geared their farm towards it to cope with the challenges. Public support for keeping endangered breeds is auxiliary, but it makes husbandry not economically equivalent to standard breeds, at least not in conventional marketing to wholesalers. Direct marketing is a prerequisite to achieve economic viability; anyway big purchasers often don't buy these animals at all. If preconditions for successful direct marketing are given, to make a living may be possible, still it remains primarily a question of personal conviction.

**Table 9: Animals that are kept on the sample farms, in brackets the breeds as far as known**

F1	7 horses (Haflinger) (formerly dairy cows)
F2	-
F3	- (formerly Highland cattle)
F4	60 fattening pigs incl. 9 sows + boar (Mangalitza)*, laying hens (Sulmtaler), goats, geese, rabbits, peacock, bees
F5	12 dairy cows (Braunvieh)*, laying hens (hybrids)
F6	5 ewes + ram (Waldschafe), 70 laying hens (hybrids)*, 3 horses, 2 fattening pigs (standard crossbreed), suckler cow (Fleckvieh)
F7	8 dairy cows (Waldviertler Blondvieh)*, 10 ewes + ram (Waldschafe), 3 horses (2 Noriker), donkey, 3 goats, bees, 24 laying hens (Sulmtaler), 3 ducks, 2 geese (Österreichische Landgänse), peacock
F8	16 mother cows (Fleckvieh)*, 4 dairy cows (Fleckvieh), 2 fattening pigs (standard crossbreed), 30 laying hens (hybrids), bees, fishpond, rabbits
F9	-
F10	250 fattening pigs* (Landschwein + Pietrain + Turoc crossbreed; sometimes Schwäbisch-Hällisches Landschwein (Swabian-Hall swine)) (formerly also 200 broiler chicken (hybrids))
F11	4 horses (formerly 600 laying hens (hybrids))
F12	150 geese (formerly 70 fattening pigs (standard crossbreed))

\* main income source of the farm

### 5.2.2.2 Several domestic animal species on farm

As already briefly addressed above, the issue of keeping several animal species was an important issue for one third of the farmers in the study. Three of these farms show high domestic animal diversity with six, seven and ten different species respectively (Table 9). These farmers pointed out that they liked to work with animals, animal husbandry was their passion.

*“I think that we have so many animals is not only because we are organic, but because we are somehow partial to animals. [...] We like it, we like having animals.” (F4, 01:35:31)*

All three farmers are not entirely depending on income from the farm and although all of them sell occasionally surpluses of many different species' products most are primarily for self supply and the economic relevance is low. One farmer stressed that in fact it is more a hobby because profitability is often at best low.

*“We have, starting with fish to bees, just everything ourselves, because I take to these things. Admittedly most are only for self supply. You indeed don't have to consider it as work, you have to see it as a hobby these things, because you must not count too thoroughly all the time. It is only a hobby already.” (F8, 00:15:53)*

The farmers are all directly marketing their main products, and thus have a regular clientele to dispose of surpluses easily.

The fourth farmer that mentioned high on-farm domestic animal diversity in the freelisting task only keeps fattening pigs besides arable farming. It is a large Demeter farm with the farmer not owner but only manager of the property. To fulfil the Demeter requirements a second farm with cow husbandry was detached from the property and is managed by a tenant, with both farms closely cooperating and exchanging fodder and manure. Formerly also 200 broiler twice a year were kept and marketed directly, but this was given up as effort was high and working peaks simultaneous with arable farming's. Moreover ethical considerations urged him to quit.

There is no farm in the study that obtains significant income from two or more different animal species. One reason therefore might be that the farms either have a cropping branch as second substantial income source or are only part time farmers and thus have an off-farm source of earning.

Adding a further main income branch may thus not be economically necessary and farmers prefer to spend remaining time on several self supply activities.

### **5.2.2.3 Grazing / free range animals in fruit plantations**

One farmer at times uses the edge area of his apple plantation as grazing area for his geese. As long as no other work had to be done in this section this solution was evaluated unproblematic by the farmer. The farmer focussing on berry production was very sceptical about letting chicken into the plantation. With berries it was said to be unfeasible at all as chickens would eat the berries, beneath fruit trees it was regarded risky as the birds might damage trees. Bergler & Ramsbacher (2011), who investigated combined mixed fruit production and free-range chicken husbandry, mostly found no problems with chicken damaging trees. Only one farmer had mentioned small trees being unearthed by pawing of the birds.

## **5.2.3 Landscape diversity**

### **5.2.3.1 Landscape elements and semi-natural habitats**

Research has shown that landscape heterogeneity and diversification of land use across ecological, spatial and temporal scales is a key factor for generation of ecosystem services (Kremen & Miles, 2012) and the diversity of associated animals, in the latter case often even more than organic compared to conventional management of farms (Rundlöf & Smith, 2006; Tscharntke, Klein, Krüss, Steffan-Dewenter, & Thies, 2005; Weibull, Bengtsson, & Nohlgren, 2000) (Purtauf et al., 2005) (Benton, et al., 2003; Gibson, Pearce, Morris, Symondson, & Memmott, 2007).

Organic agriculture is a farming approach that is based on the use of ecosystem services and that tries to maintain or restore biological diversity in agro-ecosystems. The IFOAM norms consequently ask for biological diversification at the landscape scale and maintenance or establishment of wildlife habitats. In the chapter “organic ecosystems” it is said:

*“Operators shall design and implement measures to maintain and improve landscape and enhance biodiversity quality, by maintaining on-farm wildlife refuge habitats or establishing them where none exist. Such habitats may include, but are not limited to:*

- a. extensive grassland such as moorlands, reed land or dry land;*
- b. in general all areas which are not under rotation and are not heavily manured: extensive pastures, meadows, extensive grassland, extensive orchards, hedges, hedgerows, edges between agriculture and forest land, groups of trees and/or bushes, and forest and woodland;*
- c. ecologically rich fallow land or arable land;*
- d. ecologically diversified (extensive) field margins;*
- e. waterways, pools, springs, ditches, floodplains, wetlands, swamps and other water rich areas which are not used for intensive agriculture or aquaculture production;*
- f. areas with ruderal flora;*
- g. wildlife corridors that provide linkages and connectivity to native habitat.”* (IFOAM, 2012, p. 32f)

All of these habitat groups (a - g) at least once were brought up also in the interviews by the farmers. All but one mentioned already in the freelisting task hedges or other landscape elements, habitats for wildlife and related practices. All of them either maintained (semi)natural areas or located and

established biotopes and areas intended for shelter and as retreat area for wildlife. Examples are ponds, hedges, riparian woodland and broad field borders. Many deliberately avoided to tidy up every corner of the landscape and allowed some “wild areas” as refuge habitats. Most farmers primarily underscored the habitat function of these (semi)natural elements and its significance as retreat area for wildlife in the otherwise quite intensively managed landscape. Establishment or maintenance of these areas was often unconditional (from an economic point of view), the farmers only emotionally appreciating the biodiversity and liveliness present and the structure and diversity of the landscape. Still it is often closely linked with certain ecosystem services. Some underscored the importance of these elements with respect to beneficial animals and thus natural balancing circles or the positive impact on the microclimate.

Especially in the case of hedges many also extensively used it and took also economic advantage of it. Blossoms and branches were used for decoration, fruits harvested and processed and partly also sold and biomass used to produce wood chips.

Although partly also taking economic advantage out of it, many stressed that maintenance and establishment of landscape elements is primarily a question of attitude and mindset.

*“You need the mental thing above [in the head; S.L.], if you don’t have this, it doesn’t delight you, you have to have enjoyment with it.” (F1, 00:10:39)*

*“But someone has to rightly, what means rightly, I say that it is right, but this one has to think in this direction, let’s put it this way, he has to have the awareness that diversity on the whole is supportive.” (F4, 01:30:11)*

Negative aspects of landscape elements were never mentioned unrequested but some admitted that some extra effort arises from maintaining landscape elements. However difficulties like mowing by hand around single trees or along hedges was accepted by the farmers and not attributed particular importance. The maintenance of the landscape elements definitely has priority. This favourable attitude however seems not to be a given mindset of all organic farmers as Laber (2011a) cites farmers that noted to maintain landscape elements as long as they do not aggravate work.

Especially in fruit production farmers explained hedges and biotopes like flower strips to be double-edged as they are potentially risky due to their optimal habitat conditions for mice and the danger of communication of plant diseases. However one fruit producer in this study who has a long hedge besides his plantation noted to never have had problems with it so far and the other explained that prudent establishment can avoid problems.

Economic losses mentioned only one farmer (who nonetheless said to plan establishing broad field borders). Direct costs for establishing hedges and biotopes are anyway quite low in Upper Austria due to governmental support (support program “Naturaktives Oberösterreich”). Still legal regulations are not only favourable. One farmer pointed out that hedges and all other not agriculturally used areas reduce entitlement for agricultural subsidies, even for organic farming, as agricultural area is reduced. This actually contradicts its own supporting aim and intention. Moreover bureaucracy and strict protection regulations make management of landscape elements effortful, inflexible and tedious. It is necessary to apply for every single management measure and especially removal of once established woody plants is legally difficult.

*“They all [farmers; S.L.] shy away from it [landscape elements; S.L.], that’s why all are careful not to let grow anything and there’s politics and those who preset the general conditions challenged to say landscape elements can change, also with different farm structures, because not everything is always the same, and if I allow change, of course, if I sweep out of the way everything it’s a different issue, but if I put away some things and others come in addition, that’s management.” (F1, 00:12:03)*

*It annoys me that I have to call the nature conservation department somewhere because I’m too stupid [to make it right, S.L.] although I established it in the first place, and that I have to ask everybody, [...] then you lose enjoyment, then it’s annoying. (F1, 00:18:23)*

Moreover especially in the case of hedges it is often just not so simple to find an optimal site for establishment. Leased areas mostly drop out as possible spots and one farmer explained that at most of his land establishing hedges was impossible due to drainages in the fields that would become clogged by the roots. On valuable extensively used areas establishment of a hedge or other woody structures might have negative effects on biodiversity and thus counterproductive from a nature conservation point of view. And especially conventional farmers are often not happy about hedges near to their land what can cause social conflicts. These obstacles inhibited some farmers from establishing the amount and density of hedges intended.

Flowering strips in arable farming were not established by any farmers. One farmer argued that fields are anyway not free from weeds and ley makes up a substantial proportion of the crop rotation in organic farming. Thus anyway enough habitats for insects would exist and separate flowering strips thus would not be necessary.

### **5.2.3.2 Size of fields**

The concrete size of fields was hardly addressed by the farmers although the topic seemed to be strongly entangled with aspects like landscape monotony and monocultures. One farmer noted that small fields improve beauty of landscape but fields should not be smaller than 1ha to be adequately machineable. Another farmer explained that the optimal field size would be 6-8ha surrounded by hedges for microclimatic reasons.

The assumption that smaller and part time farms would have a more diverse and small-scaled landscape structure with smaller fields and more crops per area as found in other studies (Belfrage, et al., 2005) can not be clearly underscored. On small farms per year often only a few or even only one crop is cultivated. One reason for this that came up is that lateral entrants in farming are often not fully mechanized and let their fields at least partly machine by wage work. Having lots of small fields with different crops with different tillage requirements (date and kind) is effortful and costly as you need to order wage labourers several times. Nonetheless the largest fields were found also on the largest farms.

However this topic was not focussed and especially addressed due to time limits, thus more assertions regarding this issue are not possible.

### **5.2.3.3 Permanent grassland**

Permanent grassland cultivation was quite extensive on the examined farms with two or three cuts (including grazing) per year. This was partly due to the environmental conditions that do not allow four or even more cuts. Still farmers turned out to be skeptical about intensive grassland management. All farmers linked times of mowing with plant diversity of the meadows. Permanent grassland only consisting of few plant species was not considered good or appropriate for organic farming. This was on the one hand because a diverse plant stand provides habitat for more different species, especially insects. The diversity of plants is closely linked in farmers perception with ecosystem functioning. Moreover one farmer underlined that diversity of plants increases fodder quality and thus animal health as feeding is more balanced. According to this a late first cut to let seeds ripen and thus to maintain plant diversity and flowering herbs was important for all farmers. Also not to cut all fields at the same time was frequently mentioned as a measure to promote biodiversity, especially insects. One farmer who keeps bees underlined the advantage of continuous existence of flowers for honey production. Another farmer mentioned that they would leave one field uncut till late in the summer every year to enable roe deer to fawn and not disturb them or even kill the offspring when mowing. Many farmers also had steep meadows that were cut only once a year. Although implying lots of work for little harvest farmers emphasized the importance of keeping the landscape open and maintaining the centuries old cultural landscape. Profound knowledge about plant species turned out to be sometimes lacking and farmers thus are not aware about the nature conservation value of certain

fields. It's more tradition, the appearance of the landscape in general and beauty of plants and a diverse plant stand that encourages maintenance and appreciation (it has to be remarked that farmers also receive subsidies for maintaining steep grassland).

One farmer remarked that fodder quality suffered a bit from late first mowing dates but explicated that this was bearable as their animal husbandry is quite extensive with no high performance breeds and animals. Thus to achieve optimal fodder quality in terms of protein etc. is not indispensable. In fact this situation was given also in the cases of the other farmers. In case of a more intensive animal husbandry the attitude towards grassland management might be different.

One farmer cultivated and maintained a wet meadow. He appreciated plant diversity for aesthetic reasons but also the nature conservation value of the biotope. He acknowledged its habitat function for many animals but also the ecological role of balancing the water budget of the landscape. He maintained from conviction and received subsidies for it, still he signaled that appreciation of the rural population for his work and the value of the wet meadow was not given, neither of farmers nor of other people. He admitted that this makes work often tedious and cultivation and maintenance would be more fun if there would be more interest in and appreciation for the value of the wet meadow.

Grazing impacts biodiversity of grassland as it maintains and establishes structural diversity of the sward canopy, what has a positive effect on plant and animal diversity (Rook & Tallwin, 2003). Compared to meadows amount of plant species may not be higher on pastures, but plant association and composition is altered, favouring especially grasses (Steffan-Dewenter & Leschke, 2003). Thus grazing in addition to mowing improves grassland diversity. Grazing and pasture area decreased in the last century in Austria with agricultural industrialization (Krausmann, 2004). As grazing is required in organic farming diversity of grassland types may be maintained or enhanced on organic farms.

Grazing practices have a considerable impact on grassland diversity and associated biodiversity but this issue was hardly addressed in the interviews. One farmer mentioned the importance of different habitats and plant associations for associated biodiversity and instanced the different plant associations in meadows and pastures. In the other interviews the issue was lacking and couldn't be especially addressed due to time constraints.

#### **5.2.3.4 Orchards**

Fruit trees and orchards were frequently addressed topics by the farmers and turned out to be a personal matter for most of them. All farmers had either an orchard or at least some fruit trees and many of them not only maintained old ones but planted new trees and expanded their orchards. The issue is very much entangled with the topic of old fruit varieties as many of them in the same breath explained to use old varieties for expansion or renewal. All of them (except for the apple farm) used it primarily for self consumption and only surpluses were sometimes purchased. Many of them made juice, cider or fruit schnaps and therefore used cooperative squeezers and filling plants of local gardening associations. These facilities were positively highlighted many times and highly appreciated by the farmers and exemplify the importance of local infrastructure for maintenance and reestablishment of on-farm diversity and local food supply. They ease and "outsource" operations that are effortful if done on farm and/or buying a separate machine for it is costly.



In this study no assessment of the actual landscape heterogeneity on the farms was conducted, thus the actual landscape heterogeneity and the area covered with semi-natural habitats are unknown. Thus it is not possible to relate statements and attitude to practices and assess the extent and quality of measures and landscape heterogeneity. Evaluation of this data anyway would be highly complex, depending on the considered aim (conservation of certain species, maximization of diversity or certain ecosystem services etc.) and based on the often unknown functional relationships between the landscape elements and the target (Fahrig et al., 2011) (Tschardtke, et al., 2005). Fahrig et al. (2011) call for enhancing “*biodiversity to the extent possible while still providing agricultural products for human consumption*” (p. 110). However what is possible depends mainly on the overall system established.

Any way maintenance and establishment of semi-natural habitats was found to be important for the farmers who instanced also many examples of execution. A study conducted in south-west England furthermore found the total area of semi-natural habitats to be higher on organic farms than on conventional ones (Gibson, et al., 2007). Although being only a vague indication it underscores the findings of this study that this issue seems to be important for organic farmers. And it backs the assumption that the theoretical requirements of organic farming regarding semi-natural habitats seem to, at least to a certain extent, transmit to practice.

## 5.2.4 Associated biodiversity

That farmers very positively commented on associated biodiversity in general was already hinted in chapter 5.1.1. This topic should be outlined a bit more in detail in this section. Associated diversity can be divided in two groups: on the one hand animals with no influence (at least no directly perceived) on farming and yield and on the other hand weeds and pests and related beneficial animals.

Many farmers appreciate associated biodiversity for emotional and aesthetic reasons. They like the seething mass of humming insects, the singing and swarming of birds in hedges and woodlots. Many show high emotional attachment towards nature and its creatures. As already addressed above farmers installed landscape elements and leave areas to their own device to enable development of wild plants and animals. In their management decisions they have, as far as practicable in their view, consideration for the needs of wildlife. This includes e.g. the use of the “Luftensteiner Gemenge”, a clover grass mixture with 10% flowering herbs or staged mowing of fields to enhance habitat quality for insects. Others remarked to install nesting boxes for birds.

Weeds, pests and beneficial animals are seen as an integral part of this whole agroecosystem. Farmers showed an unagitated stance towards these potentially negative creatures and kept them in perspective. Colourful weeds were even appreciated for their beauty. Their occurrence is seen as natural and tolerable to a certain extent, even necessary as they fulfil ecological functions and allow establishment of beneficials and natural balancing circles.

Thus their attitude can be called an holistic ethics as they locate “*ultimate value in the biotic community*” (Alrøe & Kristensen, 2003, p. 67).

To keep weeds and pests in tolerable rates is seen as possible with proper management and vice versa their mass occurrence often indicates management failure. Nonetheless some farmers hinted that certain creatures are difficult to deal with just via natural balancing circles. This is often caused by a strong human influence in intensive systems, thus heavily altering natural systems what often manifests in simplification of the biotic community. Examples are the cabbage white butterfly and scab. Also large mammals whose natural enemies were exterminated were said to require human regulation.

*“Against certain diseases nature takes care of itself, there are only very extreme diseases like scab and such things, well pests actually, is in fact no disease, pests that are just more difficult, let’s put it this way.” (F12, 00:39:05)*

*“The only thing I think that does not adjust itself is game, [...] in this case humans have to interfere for sure a bit because leaving everything to nature, to this everything is too far progressed, regarding habitat and everything.” (F8, 01:02:10)*

*“The only thing we really had problems with was in the case of cabbage the cabbage white butterfly, and in this case we sooner or later just said okay, you simply have to veil it, nothing else helps, if we don’t veil the cabbage on our fields then it doesn’t work. There is nothing to cut in autumn. [...] That the beneficial animals from the riparian woodland would have helped somehow I don’t think. But this is more the problem of the monoculture of course, you would have to have, I don’t know, three cabbages and then again something else for hectares.” (F11, 01:38:23)*

The apple farmer said to use copper preparates and lime sulphur against scab, noting that amounts of applicated copper were reduced already significantly, thus not seeing a problem in the near to middle future with soil contamination. In the long term however he hoped that more scab resistant apple varieties will be available to overcome the problem.

In the case of the vegetable farmer veiling of the cabbage proofed to be the most effective solution. At least in the presently established food system coping with these problems via increased biodiversity in form of mixed cropping or fostering beneficial insects and microorganisms seems unrealistic. Likely only a shift to a much more local and small scale food production would enable this approach, thus changes in food distribution, but also in the notion of quality of products would be necessary. Especially in the case of supply of cities such a shift would pose major logistic challenges. Dahlberg (1993) already pointed out that only a change of the whole food system in general to a more regenerative one enables sustainability of a particular subsystem, in this case agricultural production.

The farmers in this study in general showed an unagitated stance towards weeds and pests. One farmer criticized that many organic farmers meticulously fight weeds to the last herb, although this is contrary to the organic philosophy and anyway not necessary as especially late weed infestation has not that significance concerning the yield anyway.

*“[It’s interesting] that I know many farmers for whom species diversity is very important [or also old vegetable varieties], and then at home on their own field in a relatively fascistic way have a look to displant every single weed, what actually goes into the opposite direction, because species diversity indeed also means that weeds that are naturally existing on our fields and meadows, that you let them live to a certain extent.” (F11, 00:07:43)*

In the study of Laber (2011a) became clear that the economic situation was an important factor for the approach to and handling of elements of biodiversity. In the main income branches farmers are more meticulous and toleration rates of possibly negative elements are lower as occurring problems could have significant impact on the income situation. The economic pressure and the significance of a branch or crop thus seem to be important factors. Along the same line are findings of McCann et al. (1997) that higher economic pressure reduces farmers’ willingness to adopt conservation practices. Diversification of income branches and production might reduce the significance of a single income source, thus farmers probably can be more tolerable and considerate towards associated biodiversity. Also a higher amount of coverage, likely to be achieved with direct marketing or further processing, might have a similar effect.

## **5.2.5 Operational diversity / farm diversification**

In this section two further aspects of diversification are dealt with: on the one hand the combination and mix of several production branches, such as animal husbandry, arable farming, vegetable production and permanent cropping, i.e. agricultural diversification, and on the other hand diversity of input- and output channels, mainly diversity of marketing and purchasers. Diversity of products within a production branch, e.g. diversity of vegetables or crops grown or the amount of different processed food products made on the farm was already treated above in chapter 5.2.1.6 about crop diversity and is thus not addressed here again. The focus in this section is on the combination of different branches

and there especially on the integration of animal husbandry and crop production, a mix that is recommended for nutrient supply and cycling (Schiere, Ibrahim, & van Keulen, 2002). In bio-dynamic farming animal husbandry, especially cow husbandry, is in principle even a requirement, although exceptions may be approved.

### 5.2.5.1 Agricultural diversification

As already described above (chapter 5.1.2) diversification issues were frequently mentioned and brought up by the farmers themselves and besides diversity of products within a branch also diversity of production branches was mentioned. One farmer that was engaged in several income activities like coach tours and sledging, arable farming, forestry, a biomass-to-heat plant and room letting put forward the importance of income risk spreading but also emphasized the diversion of tasks what maintains enjoyment of work and the utilization of free time resources. Still this farmer was the only one in the study that deeply diversified his income branches. The full-time farmers engaged primarily in two major income and production branches. This was either a combination of arable farming and animal husbandry or of fruit or vegetable production and processing of (parts of) these raw products. The latter group mainly diversified production within its branches (see chapter 5.2.1.6). Product diversification within a branch is often easier as work compatibility may be achieved easier and often little investment in machines or infrastructure is necessary. Investments in modern farming are high, especially in animal husbandry if no basic infrastructure is available, and a certain scale of production is thus necessary to pay itself off. As processing is done whole year round and maybe even primarily in winter as in the case of the apple farmer, there are not really free time resources that would encourage to engage in other “fill-in activities”.

Animal husbandry, if done at all, for these farmers is more a hobby than an integral part of the farming system. One farmer keeps some horses, another has geese that serve also as a marketing gag and as an attractant for consumers. Both were engaged in animal husbandry in the past (600 laying hens and 70 fattening pigs per lot respectively) but quit with animal husbandry as major production branch. Both named work compatibility and hygienic aspects because of processing as major reasons.

*“But with high diversity, you just often have problems, because for example we do now quite a lot of processing and marketing, to wit juice production, and there’s then the topic hygienic aspects that are not easy to combine with animal husbandry, [...] and that is often just not the optimum.”* (F12, 00:07:22)

With success and growth of the processing sector economic importance and time requirements shifted more and more towards processing. Still animals, like special crops (fruits, vegetables, herbs) and processing, require high “basic” attention to maintain high quality, success and animal welfare. Knowledge demand is high especially in organic farming in these sectors to achieve good quality. Thus at some point they decided to focus on food processing.

*“Diversity on the farm also means a wide range of tasks, to do **many** things **well**, and this was just a bit difficult, that’s why we specialized.”* (F12, 00:07:50)

All farmers in the study not keeping animals admitted that animal husbandry is advantageous regarding nutrient supply and cycling, nonetheless all of them stated that an adequate crop rotation and composting can make up for it, at least if you (can) accept lower yields.

*“I indeed see that in the case of my neighbour, [...] that regular and [...] appropriate manure application on the fields would make sense, that wouldn’t be amiss, but if you accept that yields are on an even lower level again.”* (F11, 01:29:57)

Only one farmer from a region with short vegetation period declared that animal manure is indispensable to achieve reasonable yields as leguminous catch crops as green manure were not possible regularly.

Two full-time farmers combined arable farming with animal husbandry, in particular dairy cows and fattening pigs respectively. The dairy cow owner operates a farm that since long is engaged in cow husbandry and breeding and she underscored the optimal closed nutrient cycle that is established thereby. As they are producing bread cereals for wholesalers animal manure was said to be crucial to achieve the demanded protein content. Moreover the cows utilize grassland inappropriate for arable farming and exploit and upvalue resources like clover grass and catch crops. Still she pointed out that in the case her children want to continue with animal husbandry, infrastructure investments would be necessary. These would be quite expensive and thus are a potential impediment. At the time of conversion to organic farming the stable was just provisionally and cheaply adjusted and pig fattening was ceased then completely as infrastructure adaption to fulfil organic requirements would have been too expensive.

In the case of the bio-dynamic pig farmer the cow husbandry that had to be established as a prerequisite for conversion was outsourced to a tenant because arable farming uses up already most time resources (the farm has 230ha). Instead pig fattening was, after a short break, started again what is less time consuming and temporarily also broilers were kept (see chapter 5.2.2.2). Basic infrastructure in this case was already available.

All farmers keeping animals showed a strong dedication and affection towards animal husbandry and the pleasure in doing a certain work was also perceived a crucial determining point for diversification in general. Although most farmers in the study keep animals and all of them acknowledged the advantages of integrated animal and crop production systems especially concerning nutrient supply and cycling, none of them favoured an obligation for diversification or animal husbandry. Many farmers stressed that diversity can't be dictated and that every farmer should do what he/she is interested in, because only this ensures quality and enjoyment of work.

*"I even think that an organic farmer should have animals only because he is organic, and then probably not to be good with it. Or another farm should have a huge market garden and is not good therewith. I don't see it like that. We like it [to have animals]." (F4, 01:36:02)*

The love for one's work, to the animals, plants and the environment is seen as a crucial feature and strength of organic farming and forced conditions and strict requirements would undermine this. Moreover it might preclude dedicated organic farmers whose circumstances do not allow animal husbandry and it might hamper or delay progression in organic farming techniques and practices as farmers can not focus on their metier.

The part-time farmers in the study often establish a sublime diversity of production, however only small scale. Farmers that are engaged in off-farm employment mostly have only one major farm production branch, but are additionally engaged in various self-supply activities with some excess supply being marketed. These farmers take lots of pleasure in spreading their farming activities and to produce one's own food and enjoyment in engaging in various farming and food production activities are main reasons for diversification.

*"... because I like to work with fruits, [...], we have lots of apple juice, we utilize everything, I like to distill fruit schnaps, what many farmers don't do any more, some are specializing but just as a sideline little do it any more. We have our own cider and I simply rejoice after all if it's the own product." (F8, 00:32:22)*

Profitability of the small-scale production branches is often low but these activities are anyway more seen as a hobby than as an income source.

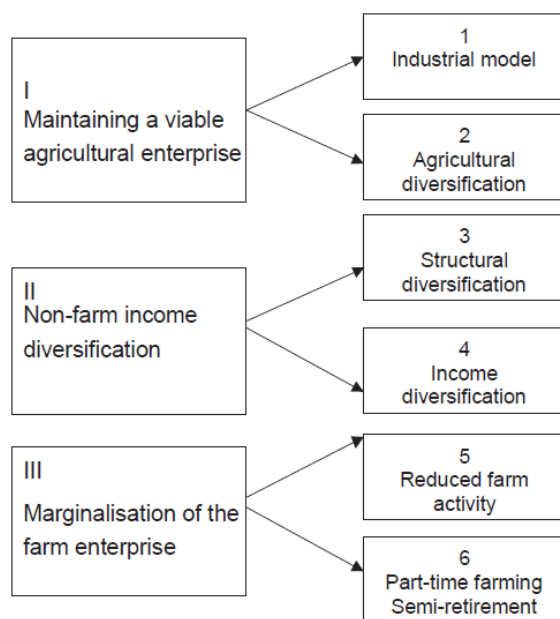
*"We have, starting with fish to bees, just everything ourselves, because I take to these things. Admittedly most are only for self supply. You indeed don't have to consider it as work, you have to see it as a hobby these things, because you must not count too thoroughly all the time. It is only a hobby already." (F8, 00:15:53)*

The (more time efficient) income from off-farm employment reduces economic pressure and allows engaging in several activities and diversifying production.

*“... because we work off-farm, because we are earning better there. Because we invest our time there, because we couldn’t earn enough for the debts, for the living costs, and much less with diversity. [...] If I knew it was possible to make a living with harvesting all elder bushes, that I properly purchase all my honey, that I sell the chickens, that I sell the geese, [...] I would do it. [...] we are lucky somehow to earn that much money in another sector to afford the financially hard times so to say.” (F4, 01:10:09)*

Examples for such small-scale activities found on the sample farms are bee keeping, fattening of some pigs, keeping some laying hens, ducks or geese for eggs and meat, vegetable and herb production and making marmalade out of wild fruits from hedges. Some farmers quite steadily produce some excess supply that is directly marketed. This is the case especially when also a main farm product is marketed directly and thus a regular clientele exists that can easily be contacted if some products are available. One farmer purchasing to wholesalers on the other hand hinted that she never started with direct marketing of eggs because then she would have to provide steady supply to keep consumers in line what also means often excess supply with no valve to purchase.

Farm diversification, understood as spreading of farm household income among both agricultural and non-agricultural activities (on and off farm), is a strategy applied by many farmers in Europe. Meert et al. (2005) (after Bowler (1992) and Ilbery (1992)) distinguish 6 possible development pathways of farms, three of which represent a form of diversification (Figure 3).



*Figure 3: Possible development pathways of farms (from Meert et al. (2005) after Bowler (1992) and Ilbery (1992))*

The type of diversification strongly depends on the necessary investments, the availability of money and the openness to risk-taking and external financial resources respectively (Bowler, 1992; Meert, et al., 2005; Whatmore, Munton, Little, & Marsden, 1987).

Agricultural diversification, i.e. establishing new farming branches, is very capital intensive (Bowler, 1992) and often already necessary renewal of machines or infrastructure leads to the decision to completely quit certain farm sectors (Ribisch, 2012) (see also above). Also a lack of availability of work force often leads to the quitting of certain labour intensive production branches (Ribisch, 2012). Structural diversification, i.e. redeploying of farm resources, encompasses very diverse strategies like farm gate sales, further processing or tourism (Meert, et al., 2005). This strategy usually requires less financial investment and is thus often more attractive for farmers that try to avoid high debt in order to remain independent and flexible. Many farmers in this study chose this development pathway of direct marketing and/or processing. Off-farm employment at last is the most risk-averse and easy way to

cope with economic problems in farming. Also this strategy was common among the farmers in the study (although some of these farmers were lateral entrants in farming that (at least so far) did not give up their job, thus their “development pathway” is reversed).

The capital intensity of modern farming technology often requires a certain specialization to earn enough money to pay off investments and to make a living. High labour costs on the other hand make abandonment of modern technologies and exchange with human labour difficult. Moreover to combine many labour and knowledge intensive farming branches like fruit and vegetable production, processing and animal husbandry seems difficult to establish, especially as quality of production is a key success factor. These income branches often eat up all time resources if performed in a cost-efficient extent.

*“In today’s marketing structure it’s partly just very difficult to concentrate on everything because you have to produce much more to have the same as, I don’t know, 50 years ago.” (F9, 01:24:52)*

Many farmers criticized low prices (relative to other products) as a challenge for diversity as it urges farmers to specialize.

Part-time farmers on the other hand often earn money more efficient in off-farm employment what reduces economic pressure and enables to diversify farming activities. This diversified small-scale production however is often not much more than cost-neutral. Off-farm employment enables them to realize their favoured diversified farm.

Bowler (1992) pointed out that a reversed evolution (i.e. agricultural diversification if structural diversification or off-farm employment was chosen) is unlikely due to competition with bigger farms and lack of capital and/or risk-averseness. Thus a strong financial support for agricultural diversification appears to be important.

### **5.2.5.2 Diversity of marketing channels and purchasers**

The second major possibility for farmers to spread income risk is via diversifying marketing channels and purchasers. This issue was brought up several times by the farmers. On the sample farms four forms of diversifying marketing could be found:

- Several bulk purchasers
- Combination of selling wholesale and directly
- Direct marketing (per se diversifies customers)
- Purchasing to (several) other farmers (esp. in the case of animal fodder)

Two farmers selling via wholesalers and grocery retailers respectively noted to deliberately sell to several purchasers and not to focus too much on a single one.

*“Well, there’s also to state for the diversity of my enterprise, that ten years ago ... got 75, 80% of our output and I’m definitely glad that this changed a bit. By now we have 5 big purchasers, with no one getting more than 15%, and this is indeed pleasant compared to before, [...] because you are broader positioned.” (F11, 00:59:43)*

Obviously this strategy is only possible if the produced amount is large enough to portion it among wholesalers. One small fruit producer for example had to focus on direct marketing for trying to avoid dependency because wholesale “wants of course quantities” (F9), so all or nothing were the options.

Not just delivering to the next Lagerhaus but looking for purchasers oneself, may it be producer groups, private processors like mills or butcheries or independent traders, is effortful, especially at the beginning, but sustains independency, allows risk spreading and even may allow for higher prices. Acting sort of as a businessman moreover was said to keep mentally agile and avoids falling into a lethargic attitude and stance.

*“And so it was an issue for me because you are challenged in the mode of thought, i.e. where do I take it. I have to make contact, I have to negotiate contracts, I’m just on the road like a businessman again. And I have not handed off all my responsibility, but have to shape my environment myself again. And that was exciting, that stirs, so to say.” (F10, 01:41:52)*

One farmer initially distributed his apples via sale on commission but local residents’ demand urged him to establish direct marketing, what by now makes up already half of the income of the farm (see also chapter 5.2.1.6). Although in the near future he does not expect problems with selling wholesale as currently a shortage of organic apples exists in Europe, he admitted to be glad to have another mainstay.

*“And that’s why I think it would work alone [with wholesaling] also very well, we are no in a situation where there are insufficient organic apples, it could occur one day the situation that there are too much organic apples, I don’t think so, but it could be, and then I of course have in direct marketing another income source what is more fixed.” (F12, 01:18:05)*

The decision for direct marketing in most cases was not primarily taken for spreading risk per se but the main intention was to sustain independency and to realize and put into practice one’s own ideas and beliefs.

*“Because we are marketing directly I do exactly what I want. And I do not let me push in a model or something and I do not need to [...] satisfy any wishes of commercial chains, I just do what I want for the price that I want.” (F6, 00:52:11)*

It is anyway often the only possibility to market the products produced on these farms, either because they are not wanted by wholesalers at all for certain inherent features, not enough demand exists or provided amounts are too small to be profitable (see also chapters 5.2.1.3, 5.2.2.1, 5.2.1.6).

Direct marketing per se also spreads risk as every consumer makes up only a little percentage of overall sales. Moreover farmers frequently mentioned the diversity of the customers buying directly from the farmers what amplifies the effect and besides encourages diversification of production (see also chapter 5.2.1.6). In addition to purchasing directly to the end consumer some farmers deliver also restaurants what constitutes sort of a second pillar within the direct marketing branch. Only one farmer temporarily sold on farmers markets. She explained that regular vending on markets was planned for the future, but getting a (place for a) market stall is difficult in her region.

As the other above mentioned private marketing options direct marketing is effortful and requires knowledge for successful establishment. Besides this a remote location of the farm might make direct marketing difficult and the social situation on the farm influences the decision for or against it. One farmer indicated that they decided against it as only one generation was living on the farm.

*“At our farm has actually always been only one generation, and then it is extremely difficult. [...] If there are two generations it is great but otherwise you have almost no freedom any more.” (F5, 00:29:52)*

Especially animal fodder (fodder cereals, grain legumes, hay and silage) is purchased by some farmers directly to other farmers, often in form of steady relationships and partly also in exchange with manure. Still one farmer purchasing his small amounts of cereals mostly via a producer group noted that especially in wine growing a much better network for selling among farmers exists, for him a model that could and should be adopted also in organic farming much more to build up regional cycles and avoid far transport.

As with production also in the case of diversifying marketing the risk of dissipation was mentioned, an issue observed sometimes in the case of other organic farmers in the region.

*“Well, I just see this with some organic vegetable farmers in the Eferdinger region, that on the one hand market a bit in direction of one or two wholesalers, and on the other side though look to*

*have maybe his their own farm shop and then maybe also go to the mart, that you just cover the whole spectrum somehow, that you also broaden regarding consumers, and I think you just tatter completely, this has to be madness, that wouldn't be anything for me.” (F11, 00:23:45)*

Nonetheless this farmer, as most farmers in the study, was very much engaged in and concerned with marketing. Almost none just delivered masses to a collection point. This has not only economic reasons. The social aspect, the contact to the consumer and the value attributed to the product are important drivers for direct marketing (see chapter 5.1.3). This reflects the findings of Sullivan et al. (1996) that many farmers, organic and conventional alike, are proud of their products and especially organic farmers enjoy the contact to consumers.

However it's not everybody's taste. One farmer in this study pointed out that many farmers in the region just do not want to market directly. With respect to this he gave major importance to knowledge and education: if properly educated the inhibition level for direct marketing would be lower. He criticized that many farm successors do not have an agricultural education anymore but are encouraged to learn another trade.

## **5.2.6 Theoretical perspectives and discussion**

This study is based on the notion of farms as systems, which accordingly consist of different subsystems and are embedded in a network of other systems that interrelate and influence each other. Correspondingly it is assumed that agricultural diversity on a farm is depending on the interrelations among different subsystems of a farm and the relations of these to other systems outside the farm. In line with this it is aimed to figure out the crucial (sub)systems that influence agricultural diversity and how they interrelate. Actor network theory was shown to be a useful tool and approach with this respect as it focuses on the heterogeneous interrelations of social, biological and technical entities in our world (Noe & Alrøe, 2012). It takes a comprehensive view on entities that make up a system that besides tangible objects like machines, plants or animals includes intangible aspects like skills, knowledge, values and goals and thus allows to bring out the complex interrelations of humans and nature (Noe & Alrøe, 2012).

In the following first a short recap and synopsis of the most important influencing factors on the respective single aspects and elements of biodiversity dealt with above is given (sub-section 5.2.6.1). Subsequently a general model of influencing factors on agricultural diversification is presented that conflates the single influencing factors detected and the connection to social systems theory and actor network theory is established (sub-section 5.2.6.2). Sub-section 5.2.6.3 deals with synergies of diversity that show and reflect the interrelations of the subsystems of a farming system and how positive feedback can boost biodiversity on farms if steps in the right direction are taken.

### **5.2.6.1 Recap of influencing factors**

Farmers recognize the crop rotation as the basis of organic arable farming. However farmers showed a quite pragmatic stance towards the crop rotation, declaring that it has to work and being quite flexible regarding their actual rotation, sometimes not being really able to outline their standard sequence. What in this context especially is critical is that knowledge about the features of certain crops and their interdependencies seemed sometimes to be quite low. Crop rotations are often quite simple, consisting only of ley and cereals, especially when the focus of the farm is on another farming branch. For alternative crops logistics (seed sourcing, processing) and marketing were named as the crucial influencing factors. Direct marketing and in the case of fodder crops the possibility to feed them to farm-own livestock (instead of selling) are important requirements for integration of rare crops. Cover cropping is regularly performed, however diverging to even contrasting opinions concerning the used plants and mixtures manifested, ranging from sophisticated selections of very diverse mixtures to



specifically improve the soil to the use of what is available on farm from harvest and denying specific crops or mixtures.

Mixed cropping, undersowing of ground-cover plants included, turned out to be a very topical theme at the moment in organic farming with lots of farmers in the study experimenting at the moment therewith.

Direct marketing and personal interest seemed to be the most important factors for the diversification of fruits, vegetables and processed products thereof. Direct marketing on the one hand fosters diversity through differing consumer demands and preferences that are served and on the other hand enables also diversification of production via higher producer prices and the possibility to purchase small amounts. However diversity requires knowledge, good management, yet flexibility, and qualified workers. Also the bureaucratic effort was said to be challenging. Mixed cropping in fruit and field vegetable production turned out to lack viable concepts so far and would require more applied research. Agroforestry was mentioned by one farmer but seems not to be a relevant topic so far among organic farmers in general.

In the case of animal husbandry the mixture of several animal species turned out to be important for many farmers, however this was especially the case with part-time farmers with lower economic pressure. The same was true for husbandry of old, quantitatively lower performing races. Direct marketing again turned out to be a requirement as it allows for selling of small amounts and enables higher prices.

Landscape diversity is appreciated by the farmers for aesthetic reasons and landscape elements and semi-natural habitats were maintained or established by all farmers as refuge habitats for wildlife and to influence the microclimate. Farmers showed a strong emotional attachment to wildlife and revealed an unagitated stance towards weeds and pests, saying to let them exist as far as economically acceptable.

As very important for all farmers turned out the maintenance, establishment or extension of orchards and the conservation of old fruit varieties that are appreciated for their ecological value as genetic source but also for their taste. Genetic diversity of staple crops on the other hand is an issue that farmers seem to be less concerned with.

Diversification across farming branches especially in the case of mixing several labour and knowledge intensive branches like animal husbandry, fruit and vegetable growing and processing turned out to be difficult to handle. Moreover high capital intensity of modern farming technology (machines and infrastructure) requires a certain specialization and is an obstacle for establishing new branches. It often even makes continuation of several branches difficult. Also quality of life especially in the context of animal husbandry is an influencing factor. Diversification within a branch (crops grown and products processed) is easier to realize as it is normally less capital intensive, compatibility problems are less likely and it allows making use of free resources (increased occupancy rate of machines, spreading workload peaks).

Part-time farmers often are highly diversified in their production, producing small-scale for self supply and direct marketing. The lower economic pressure due to the fixed off-farm income allowed for this, often faintly profitable, spreading of activities according to ones interests.

Personal interest, curiosity and dedication always turned out to be major drivers for diversification, may it be within or across several branches. This was also true for aspects like husbandry of old animal breeds or choice of crops. The economic circumstances however frame and eventually determine the specific configuration in every particular case. Direct marketing in any case turned out to be a facilitator if not a prerequisite.

### **5.2.6.2 Model of influencing factors on agricultural diversification**

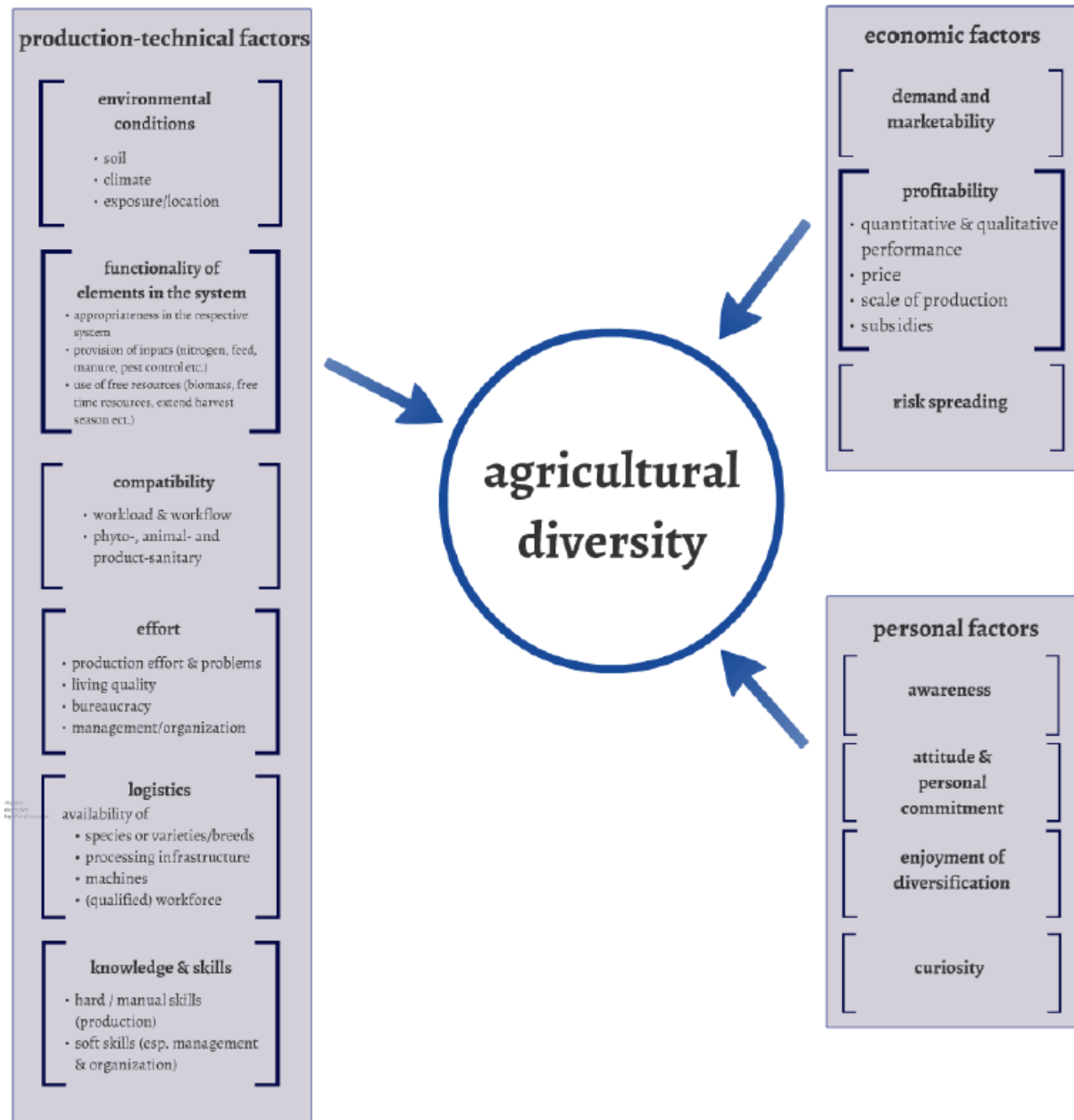
The manifold factors detected that can have an influence on the agricultural diversity on a farm can be allocated to three major groups: production-technical factors, economic factors and personal factors (Figure 4).

Production-technical factors encompass all aspects that regard the production process per se. The very basic factors with this respect are the environmental conditions, namely soil properties, climate and location/exposure of the farm, that determine what is possible to grow and produce on the farm. The

choice and combination of elements in the farming system is further determined by their function and functionality in the system. Only a prudent combination of elements that, especially if external inputs are restricted or not used, provide all necessary ecosystem services and resources, ensures viability of production. Examples are the crop rotation where ley and legumes provide nitrogen and enable soil rest, establishment of wildlife habitats for beneficial animals to achieve pest control, introduction of domestic animals for nutrient supply and cycling or introduction of fodder crops as feed for animals. Certain elements may be introduced and used to make use of certain free resources. These can constitute biomass resources like permanent grassland, legumes or crop residues that are utilized and up-valued or natural resources (e.g. sunlight or nutrients in the case of mixed cropping) but also free time resources of workers or underused machines. The choice of elements is also determined by the appropriateness for the established system. Old animal breeds for example are mostly dual-purpose breeds with lower quantitative performance and especially suitable for extensive husbandry. For a farmer focussing on dairy production thus old cow breeds might not constitute the optimal and most suitable alternative. The different elements of the system moreover have to be compatible, on the one hand regarding plant-, animal- and production sanitary issues and on the other hand regarding workload and workflow. Another quite basic condition is the availability of resources. This comprises not only availability of certain plant or animal species or varieties/breeds, but also machines, local processing infrastructure and (qualified) workforce. The distance to the supplier of seeds, plants, animals or infrastructure and the amount required/wanted for processing is thereby mostly the critical point. Also the effort bound up with certain crops, animals and products determines whether they are established or retained in the system. Effortful elements, often some which frequently cause problems, might be removed from the system. But also increased management and bureaucratic effort owing to diversification or the impact on the living quality determine configuration of the farm. And type of production not least depends on the knowledge and skills of the farmer. This covers not only hard or manual skills of production techniques but also soft skills, especially management capabilities as high diversity requires good organization.

The second major impact group are economic aspects. The profitability of certain products and production branches is important especially for farmers that receive their major income from farming. Profitability is mainly influenced by the qualitative and quantitative performance of certain crops and animals, the producer price, scale of production and eventual subsidies. The second important point is demand and marketability of products. Especially wholesalers and the retail industry demand primarily a few certain products with specific features, and those in adequately big amounts. But also in direct marketing farmers are always bound to consumers' demand. And a third economic aspect is deliberate risk spreading through diversification.

At long last personal factors significantly determine diversity, especially regarding decisions and elements that are beyond the scope of mere (short term) functioning of the system. The farmers' awareness of the importance of diversity at several spatial and temporal scales and his/her attitude towards and commitment to establishment and conservation of diversity are important prerequisites for high diversity. Moreover enjoyment of diversification and the drive to try out new things are character traits that foster diversity.



*Figure 4: Model of influencing factors that determine the agricultural diversity on a farm; agricultural diversity thereby depends on the one hand on the amount of different elements of planned biodiversity (like crops, semi-natural habitats etc.) and of production branches (arable farming, animal husbandry etc.) on the farm and on the other hand on the characteristic of these elements (e.g. which varieties, breeds etc.) and the form of production (e.g. single or mixed cropping)*

Noe & Alrøe (2012; 2003) have shown that a farm can be understood as a social system (according to Luhmann's theory of social systems), it thus constitutes an autopoietic, self-organizing and – reproducing system. The main internal process that establishes and maintains it is the generation of meaningfulness and the production of a situation of coherence. A farming system consists of many “objects” which, according to actor-networks theory, depict actants that are interrelated in a complex network of relations. These comprise not only elements like crops and animals, machines and people but also values, knowledge, skills, goals etc. The farming system is thereby not primarily defined by the elements themselves but by the role these elements play, i.e. “how and in what relations they enter as actants in the network” (Noe & Alrøe, 2012, p. 392). What kind of elements are included and how

these elements are enrolled (elements are differently conceptualized by different people) depends on the characteristics of the enterprise and the rest of the network to achieve coherence. It is this process of selection of possible elements and the definition of the role these elements play on the farm from the innumerable possibilities theoretically existing that establishes meaning and thus constitutes the system. In doing so contingency and complexity are reduced significantly what only enables self-preservation and coping with the surrounding.

*“The self-organization of social systems as autopoiesis is then a process of reducing complexity by selection of meaning. The selection of meaning must be a systeminternal and self-referential operation by which the system draws its own operational boundaries.”* (Noe & Alrøe, 2012, p. 395)

*“Any decision making system faced with such a degree of contingency needs to reduce complexity, both internally in terms of which elements are enrolled, and with regard to its environment in terms of what is important to observe and what is not. Otherwise it will break down immediately due to the overload of possibilities.”* (Noe & Alrøe, 2012, p. 394)

Specialization of farms is thus from a social systems perspective a natural and necessary development as it enables to cope with the increased complexity in the food system and in society in general. It reduces the amount of impacts to which the system has to respond and thus would be forced to restructure internally, it reduces complexity of autopoiesis.

Diversity in the conventional (and “conventionalized” organic) system is thus unviable in the long run. It depends on what Noe & Alrøe (2012) call “new structural couplings” like alternative food networks that internally regulate and thus change the responsiveness of the farm system to feedback. It is these interrelations between the manifold actants in a farm system that have to be considered and adapted to be favourable for diversity. The model established above provides an overview of the framing factors and conditions of diversity and might guide in development of strategies and “new structural couplings” that strive to increase diversity.

### 5.2.6.3 Synergies owing to diversity

Research has shown that landscape heterogeneity is a key factor for diversity of associated animals, often even more than organic compared to conventional management of farms (Rundlöf & Smith, 2006) (Weibull, et al., 2000) (Purtauf, et al., 2005) (Tscharntke, et al., 2005) (Benton, et al., 2003). Thus a diverse and small-scaled production is a key to conservation of associated animals and the ecosystem services they provide, services on which organic farming is built. Beyond that agricultural diversification turned out to often create synergies among the combined planned elements, as they appeared to be mutually supportive and positively influencing each other, thus making farming in the end easier, more profitable or enabling even further diversification besides supporting biodiversity. This supportive feature of diversification was also outlined by a farmer.

*“If it gets a flow it actually makes many things easier, or you realize if it is really diverse, then it doesn’t matter if I have 20 hens or 40, so it pays itself a bit you could say.”* (F7, 00:18:37)

The following list summarizes the key synergies of diversification that turned up during the interviews:

- Mixed farming (animal husbandry and arable farming) eases mixed cropping (e.g. fodder cereals and grain legumes) as mixtures can be fed on farm and do not have to be separated
- Mixed farming and thus available manure eases production of bread cereals (i.e. achieving adequate protein content) or vegetables, thus increasing and stabilizing income
- Food processing benefits from diverse production via availability of raw materials and conversely can ease diversification of production as it provides a valve for excess supply
  - Cow and pig husbandry on the farm is advantageous for sausage production as it requires a certain pig meat portion

- Pasta production eases establishment of a direct marketing branch for eggs as excess supply can be used for pasta
- High straw content of old cereal species like small spelt is useful or even favourable for farmers also engaged in animal husbandry
- Diversification increases occupancy rate of machines and machines for one production sector might be convenient in another (e.g. arable farming and vegetable production)
- Bee keeping urges farmers to staged mowing to constantly provide flowering plants
- Social diversity on the farm eases direct marketing and diversification of production
- Direct marketing enables purchasing of small amounts
- Husbandry of non-conventional cow breeds with lower quantitative performance enables later silaging and mowing as optimum fodder quality (energy and protein content) is of lesser importance, thus a higher plant diversity in permanent grassland can be established

This list is exemplary for the manifold interrelations between elements (subsystems) in the farming system. It shows that diversity of production not only fosters biodiversity and spreads risk, but diversity in all its aspects is supportive for the system as a whole and that if the preconditions for diversity and diversification are given, the system supports itself. Increasing planned biological diversity across and within farming branches influences the contrivable planned biodiversity of other branches in the system. Also a positive feedback between social diversity on the farm, social diversity in the food chain and agricultural diversification seems to exist that maintains and further enhances diversity of the planned and thus the associated diversity on the farm. Higher on farm biodiversity enables agricultural diversification and direct marketing what itself enables and promotes product diversification. Agricultural diversification again enables to enhance income generation on the farm and thus allows more people to make a living from work on the farm, i.e. maintaining social diversity (Figure 5). For example higher social diversity in the food system and stable producer-consumer-relationships, what might result in lower economic pressure, might enable to include more people in farming, probably even handicapped.

These synergies partly reflect closed and functioning ecological cycles, but it shows that simplifying certain operations and sections might urge to simplify also in others or vice versa increased diversity in one sector allows increased diversity in another. It reflects the correlating subsystems of a farm and the interrelations of the farm with other systems (e.g. actors in the food chain) and demonstrates how feedback within the system can boost or diminish diversity depending on the steps and decisions taken.

# 6 Conclusion

## 6.1 Farmers' attitude, diversity and resilience

Farmers' attitude towards and perception of biodiversity in this study can in general be assessed as in line with the organic principles as they seem to perceive the importance of biodiversity for functioning of the agro-ecosystem, but even more, appear to put an intrinsic value to biodiversity and therefore their ethics can be considered as holistic.

However farmers sometimes seemed not to be aware of the importance of redundancy effects for the resilience of a SES. On-farm resilience can be split up in "ecological" resilience that is, with respect to diversity, determined by the redundancy of functional groups, and in "socio-cultural" resilience, that is having a portfolio of alternative capabilities, opportunities and relationships to maintain or establish flexibility and adaptive capacity (Darnhofer, Bellon, Dedieu, & Milestad, 2011; Smit & Trigeorgis, 2006) (these two aspects of resilience are of course strongly intertwined). Farmers showed sometimes a quite pragmatic stance towards certain elements and aspects of diversity that gives priority to (short term) functionality of the system. This was for example found in the case of the crop rotation where adequacy was evaluated in view of acceptable yields. It is difficult to assess whether this "functionalistic" view is sufficient to establish redundancy of functional groups and maintains flexibility and adaptive capacity; nonetheless it poses a certain threat to undermine both. Flexibility of the single farm could be impaired for example if mere functionality as yardstick of evaluation of operations and processes leads to a (too) strong focus on certain products that leads to structural constraints and inflexibility in the system, e.g. because of economic and financial constraints due to investments to make use of economies of scale or strong specialization of machines and infrastructure (cf. Hendrickson & James, 2005). If this focus follows through in a whole region it could even lead to regionally unilateral infrastructure in the processing sector that might impair transformative resilience of the whole region. Resilience in the farming system depends also on the diversity between farms regarding production and methods applied. It can not be made a point in this study how diverging farms in a region are although there are indications that there's not a text-book version of organic farming applied by all farmers in a certain area. The farmers' attitude that every one should engage in what he/she is interested in further underscores this notion as interests can be assumed to be differing. While this approach could also lead to a (too) strong focus of a farm on a certain production branch, in general the positive aspects, as there are diversity among farmers in a region, establishment of outstanding diversity within a branch, further processing and further development of organic farming techniques seem to prevail. Diversity anyway seems to be restricted more by economic constraints than personal attitude. However more research about this topic would be necessary.

Another conspicuity is that farmers sometimes seemed to see certain elements of diversity, or activities that preserve or foster diversity, as exchangeable or selectable, in the sense of "I'm not involved in this but therefore in that". One explanatory approach therefore would provide Bourdieu's concept of cultural capital and the theory of social representations that were applied above. To engage in one of those activities might be important to obtain cultural capital, e.g. prestige, and thus to achieve acceptance in the organic community. The social representation of organic agriculture and its diversity nevertheless might require only single of such activities. However this pragmatic stance might often simply be a concession to, especially economic, realities that often do not allow perfecting the system in all aspects of diversity even if wished or intended.

As this is not a representative study the findings do not mean that there might not be organic farmers out there that do not care two figs about the organic philosophy in general and diversity in particular. This indeed poses the threat of organic production sometimes being not in line with the organic values. However farmers in general rather seem to oppose stricter regulations. Sutherland (2013) points out that conversion of pragmatic farmers might not be a problem as long as long as sufficient community mechanisms like displayed environmental (and/or diversity) symbols that reflect the organic values are

in place. Accordingly it seems more important to strengthen the organic community and solidarity among organic farmers with brisk relations and exchange of knowledge and experiences instead of separation of organic farmers in good and bad ones and risking a bifurcation of organic in “hardliners” and “pragmatists”. Nonetheless it seems adequate and also practical to limit buying-in of external farming inputs like fertilizer (manure, compost) or animal feed (especially of omnivores) at least to a certain degree as these permissions clearly oppose the organic principles and allow to avoid establishment of a more land-based system.

## **6.2 Social diversity as crucial factor for agricultural diversification**

Personal, economic and production-technical factors were found to influence actual agricultural diversity on the farms (Figure 4). In the analysis it became clear that especially social diversity, on the farm and in the food system, could play an important role in overcoming structural constraints of agricultural diversification.

Social diversity is defined in this study as the variety of people (concerning aspects like age, attitude, ethnicity etc.) in the agricultural and food system and the amount of social relationships and interactions between these people. This comprises on the one hand the social diversity on a single farm that is determined by the amount and distinctness of people that live and work on the farm and on the other hand the social diversity within the food system as a whole. This involves the amount of and diversity between farmers (regarding aspects like attitudes) and the amount of relationships between the people in the food system (see also chapter 3.3.3)

Social diversity turned out to be an important issue for organic farmers (see chapter 5.1.3) and it appeared to be intertwined many a time with biological diversity and diversification. It is argued here that, besides financial and educational support, social diversity, on the farm and in the food system, is a key component if we want to achieve agricultural diversification on farms.

### **6.2.1 Social diversity on-farm**

The amount of people working in the agricultural sector sharply decreased in Austria in the last century as mechanization of farming proceeded and thereby the amount of farms and the people working on the single farms decreased. Some farmers hinted in the interviews at this proceeding “isolation” in farming in general, with their approach and focus being a psychological one: working together with people is just more pleasant than toiling solely. This positive mindset towards social exchange and contact favours also cooperation and direct marketing, two aspects treated more in detail further below.

Besides this important psychological aspect social diversity is also coupled with diversification and diversity of production. It is well known that industrialization of farming reduced social diversity and diversity of production alike (e.g. Robinson & Sutherland, 2002), however not only specialization caused reduced social diversity, but higher production diversity vice versa requires a certain social diversity in the farming system, or at least social diversity significantly eases to achieve this goal. The finding of Ribisch (2012) that a reduction of workforce availability is a crucial change and challenge for many farmers urging them to adapt by adjusting their operation and production to be manageable by a single person, cooperating with other farmers or outsourcing of tasks exemplifies and undermines this. As a result thereof the abandonment of certain labour intensive crops like sugar beet and potatoes are instanced (see also chapter 5.2.1.2).

Organic agriculture is a farming approach that especially favours the integration of crop production and animal husbandry as well as a less intensive and large scale production and a more local food supply, thus it aims at a higher diversity of production across several production branches on a single farm than is usual in conventional farming. However many organic farms do not engage in animal husbandry or only in an insignificant extent and are often specialized on few products or a single production branch (Lindenthal, et al., 2007) (Milestad & Darnhofer, 2003), a fact that can partly be observed also in this study.

The most important factors mentioned by farmers that keep them from animal husbandry or urged them to quit were work compatibility with other sectors and the regular and high attention required, an effort not feasible if other farm activities are time consuming as well. Quality production requires high attention and knowledge especially in organic farming and farmers prefer to focus on one sector and improve and perfect there. Quality production outweighs diversification in economic considerations. Risk spreading is more realized via diversification of purchasers and diversification of products within a branch than spreading their activities over several different branches.

Higher social diversity on the farm, namely more people working on and living from the farm, might be a way of overcoming these challenges. More people on the farm enable different persons to focus on different sectors what ensures quality of production and reduces work compatibility conflicts. Moreover more people enhance operational flexibility and allow taking turns in regular tasks like stable work, thus enabling free time for the main responsible person, an important relief as constantly being bound was also mentioned for keeping farmers from animal husbandry.

*“Pigs or cows we actually didn’t want from the beginning because we said to give up life completely, that I can go away once and that I just can say so now I just leave it a month, this we both didn’t want, that’s what we both wanted to maintain, and this is simply possible with vegetable or fruit production in winter, with animals it’s not.” (F9, 00:47:27)*

Moreover the love for what you do was named to be crucial for success and quality (chapter 5.2.5.1), it is what makes up and characterizes organic farming and its products. People’s interests however differ. While prescribing diversity would neglect this and undermine the organic idea, increased social diversity enhances the likelihood of diverse interests, of a get-together of persons with different favourite activities and subjects.

In the same line is Darnhofer’s (2010) finding that diversification is also important to comply with family members’ diverse interests, a crucial factor to ensure farm succession as the satisfaction with ones work is increasingly important for young people. In the same direction hints also a statement of a farmer in this study who remarked that in former times all farmers in the region produced the same what has changed in the last 20 years.

*“If I look at the 80ies today, back then all had dairy cows, calves, produced milk and finito, all the same, those stories stopped, that all diverged. Some quit, some started here, others there.” (F1, 00:37:05)*

To be into a topic or job is a prerequisite for dedication, and its dedication that gets farmers to diversify agricultural production to a remarkable extent. Darnhofers’ (2010) finding shows that income diversification, on or off farm, is accounted for in a large part by the family members’ diverse interests. The same principle should be applicable for agricultural diversification. A stronger focus on agricultural diversification probably should be laid by politics instead of or in addition to the encouraging of income diversification towards tourism etc.

Moreover involvement of more people in farming would greatly increase operational flexibility and resilience of the system. If more people are familiar with the tasks to be done on the farm the farmer could afford to take spare time or make holidays. It might ease for him/her to study further and to improve, an important issue as indicated above. And “shocks” like illness of the farmer could be easier absorbed.



Prompting and (financially) supporting farmers' children to establish new farm branches could help to keep and bring more young people into farming again and may also have positive effects on regional development. The diversity of people and products on the farm would make direct marketing more attractive what could improve the income situation, reduce dependency on external actors in the food chain and might reduce economic pressure. Thus it might allow more biodiversity friendly measures and to take a flyer on alternative crops or old animal races.

Other examples for farming models that show a high social diversity are bio-dynamic farm communities, one sample farm belonging to this type of farms and the famous Dottenfelderhof in Germany being mentioned by a farmer in the interviews. There several families live together and manage a single farm. In the particular case more than 100 people live on and from a farm with 160ha that includes dairy cows, laying hens, arable farming, a bakery and a dairy ([www.oekolandbau.de](http://www.oekolandbau.de)).

Meyerhoff et al. (2011) investigated a model they call "associated farms" which is situated between a community farm like the above mentioned Dottenfelderhof and a classical cooperation. In this model several families live together on a single farm, with every family specializing in a economically independent farm branch.

Another conceivable possibility to increase social diversity on the farm is to establish and develop CSA-projects (community supported agriculture) as there is increasing interest of people to get involved in agriculture. The existing CSA-projects in Austria focus on vegetable growing, however it is imaginable to expand such projects on other sectors like fruit production or probably even animal husbandry. Farmers could establish orchards near villages that are at least partly managed by the inhabitants or it might be possible to find people that are willing to take over stable work regularly, maybe once or twice a week, what would be an easing for the farmer. Community funding of all people involved may be an opportunity to overcome financing challenges.

For sure such approaches require good organization and management and a principally affirmative mindset of the farmer towards such ideas. However the findings of this and other studies (e.g. Sullivan, et al., 1996) suggests that organic farmers are very open and inclined regarding social contact, cooperation and joint action and working and thus basic psychological requirements often seem to be given.

The Austrian program for rural development provides subsidies inter alia for settlement of young farmers, modernization of farms and diversification of income branches (agricultural and non-agricultural) (BMLFUW, 2014). However Meert et al. (2005) point out that social capital and social networks, the 'openness' of the farmer towards contacts, knowledge and a professional attitude are key factors for the type of diversification and thus financial support has to be accompanied by knowledge transfer and opportunities for farmers to improve skills.

Also Darnhofer (2010) noted that farmers perceived especially acquiring social competencies and soft skills to be very challenging, also because this was not part of agricultural education. These statements are approved also in this study as one farmer pointed out that diversity requires management skills, competencies many farmers are lacking.

*"What we actually mostly did not learn is that you work structured like in a company, [...] on the farm everybody contributes, what indeed makes sense and on a small farm is not the worst, but if you have the diversity you just have to organize your farm."* (F12, 01:11:38)

To lay an increased focus on these issues in agricultural schools and to provide opportunities for further education of farmers in this sector thus seems to be badly needed, especially if an increase in social diversity is targeted.

Moreover it has to be considered that new farming branches normally require more land, availability of what might be limited, although branches like vegetable and fruit production require relatively little space and animal fodder in form of clover grass might be available anyway. Further processing of raw products could in any case be a solution to improve value per acreage and enable more people to make a living.

## **6.2.2 Social diversity in the food system**

Not only on-farm social diversity turned out to be a crucial influencing factor on biodiversity and agricultural diversification, but also social diversity in the food system, or put another way, the amount of external relations of the particular farms. Two major components thereof turned out to be most influential, namely cooperation between farmers and the marketing.

### **6.2.2.1 Cooperation**

As shown in chapter 5.1.3 cooperation turned out to be very important and frequently contracted by organic farmers. Also examples in this study are manifold and variable. Two farmers exchanged their clover grass for animal manure, two others cooperated with a beekeeper who positioned his bee colonies on the farm. One used the slaughter room of a neighbouring farmer, another one the communal slaughter room of the farmers in the region. Especially farming entrants that are not fully mechanized cooperated with neighbouring farmers for tilling, but also one full-time arable farmer noted to use the communal tractor frequently. One farmer instanced the joint use of machines of organic herb farmers in the Mühlviertel as further example for the advantageousness of cooperation. Joint marketing projects with other farmers were named as well as cooperation with schools in planting of hedges (with the school allowed to harvest products from the hedge). And although not a cooperation per se also the use of cooperative squeezers and filling plants of local gardening associations for fruit juice production that was highlighted many times comes under the joint use of machines and infrastructure.

Cooperation is a possibility to take the advantages of diversity while not giving up economies of scale and remaining efficient and competitive under given market conditions. It allows establishing local infrastructure and buying machines what would for a single farmer with small-scale production neither be reasonable nor affordable. It allows keeping pace with technological developments and ever stricter regulatory requirements and to cope with the ever increasing capital intensity of agricultural production. Also Ribisch (2012) showed that cooperation is a viable adjustment strategy of farmers especially to cope with technological development and reduced work force availability. Thus cooperation seems to be a useful and viable tool to locally increase the diversity of production and to enhance the regionality of the food system.

There is little information about how common and widespread cooperation between organic farmers is and whether this is something special in organic farming (compared e.g. to conventional). However it seems that many cooperations already exist what is advantageous as a basis for development is given. Such existing cooperations probably could be intensified and potential role models might exist that could be used to further propagate such approaches.

### **6.2.2.2 Marketing**

The second crucial external relation regarding diversification is marketing. As already instanced above, direct marketing plays a crucial role in diversification as it allows for higher prices and purchasing of small amounts and thus enables to diversify and reduce scale of production. Wholesalers on the other side demand and prescribe certain products in big amounts, thus restricting farmers' choice and diversity of production. Marketing of small amounts and rare or alternative products requires additional marketing effort as it necessitates looking for ones consumers, may it be producer groups, private processors like mills or butcheries or direct marketing to the end consumer. Thus it manifolds the food chain and the relationships between actors within the food system. And vice versa diversification of marketing and serving buyers of small amounts fosters diversity of production as different customers have different preferences. The modern industrialized and increasingly integrated food chain dominated by a few big companies undermines this.

However especially direct marketing is more effortful. Especially the amount of people working on the farm seems to be a key facilitating factor as it increases flexibility and thus eases direct marketing.

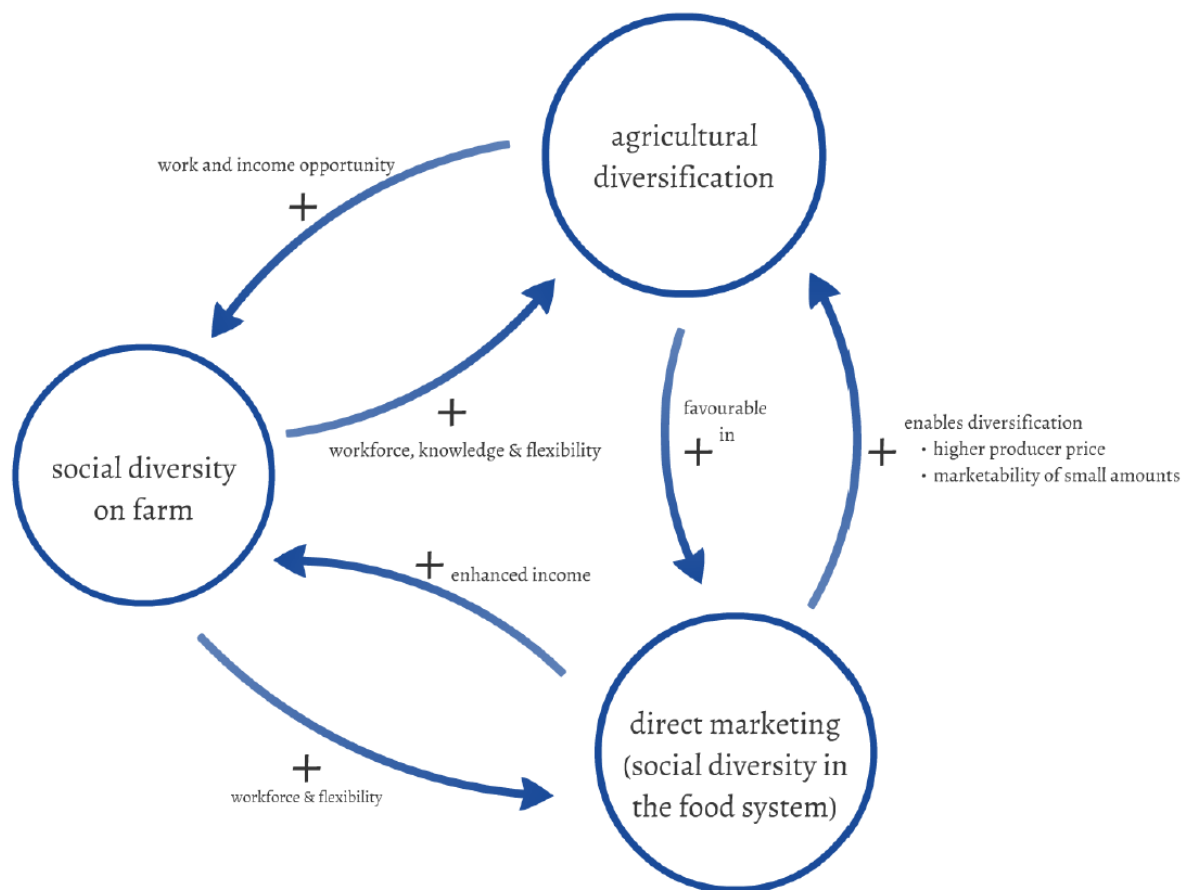
Also cooperative marketing of farmers in a joint farm shop or market stall would fulfil the same function. This option might have additional benefit as it allows selling of more different products at a spot, thus increasing not only convenience for the consumers but might allow avoiding an environmental rebound effect via carbon dioxide emissions for consumer transport. At any rate logistics has to be considered to make local food systems not only biodiversity friendly but also climate friendly (Schönhart, Penker, & Schmid, 2009).

Moreover it requires consumers that are willing to buy alternatively than in the supermarket. Although several farmers were confident that there is increasing potential for direct marketing, especially in big cities, overall relevance might remain low. More research would be crucial to find out whether, and if, under which conditions, the current food retailing system can get much more locally supplied and thus diversified. The current jump of food retailing on the regionality-bandwagon is in any case so far constrained to a marketing gag. Definitely it would require a complete change and reorientation of our food system. Horlings & Mardsen (2011) point out that the change to a sustainable agricultural system requires *“a more radical move towards a new type of regionally embedded agri-food eco-economy. This is one which includes re-thinking market mechanisms and organisations, an altered institutional context, and is interwoven with active farmers and consumers’ participation”* (p. 441, Abstract).

It’s the personal contact to the consumer, the consumers’ insight and relationship to the farmer and the product that allows overcoming the unilateral demands of anonymous mass markets that threaten diversity. Quality of products is a key success factor for direct marketing, but especially in a close relationship between consumer and processor the definition and criteria of quality change.

*“In that case there is a real customer relationship, in which the consumer accepts much more than in the grocery store where he takes the best. And if it’s from [our] own garden he suddenly is delighted at the tomatoes although maybe every one has a slight deficiency. So it is very much about relationship.”* (F7, 01:28:53)

This has major importance for diversity of production in the food system as a whole, as it allows overcoming the advantages of standardization in anonymous markets, it allows the toleration or even appreciation of the boundless diversity of appearance and inherent features of living beings.



*Figure 5: Illustration of the interconnections between social diversity on the farm, social diversity in the food system (especially direct marketing) and agricultural diversification*

## 7 Final remarks / synopsis

Organic agriculture is a farming approach that is built around and based on the concept of diversity. This explanatory study aimed at giving insight to organic farmers' mental concepts of diversity including biodiversity, social diversity and cultural diversity as well as revealing influencing factors on several aspects of biodiversity. It has shown that farmers' connotations with the item are rich and manifold and encompass planned and associated biodiversity, a sophisticated understanding of ecological interrelations and ecological functioning based on biodiversity and an affirmative mindset towards fostering and establishing biodiversity. But the term is also related with diversification of production and marketing what is perceived as important for economic, but also for psychological reasons. And not least also social aspects in general and social diversity in particular turned out to be very important for farmers. Cultural aspects however were not related to diversity; nonetheless some hints showed that cultural aspects are indeed important for organic farmers and a relationship that farmers probably do not perceive themselves directly might anyway exist.

The analysis of influencing factors on several aspects of biodiversity showed that personal, economic and production-technical factors determine agricultural diversity. Personal interest and dedication as well as profitability and marketing turned out to be the most influential factors on diversity of the farms. High capital intensity of modern farming is a crucial impediment for farmers to diversify across production branches, e.g. to include animal husbandry. Structural diversification is more often realized as well as generating income in off-farm employment what reduces economic pressure and allows diversified small-scale production. If more agriculturally diverse farms should be realized, strong financial support will be required to overcome the issue of high investment necessity. However financial incentives alone might fall short. It is argued here that if we want to improve agricultural diversification of organic farms we have to consider that this requires an increased social diversity on farms and in the food system. One reason is that many farms are geared already towards manageability by a single person what makes labor intensive crops and branches impossible and even more so several of them. The other point is that more people allow single persons to focus on a certain part what on the one hand allows to achieve certain economies of scale and to create sufficient income and on the other hand allows for a certain thematic focus and thus build up of expert knowledge to achieve quality. Presence of more people on the farm moreover increases flexibility and can enhance quality of life due to taking turns in regular work (stable work, irrigation etc.).

To provide financial incentives for farmers' offspring to set up new agricultural farming branches and to promote alternative concepts like CSA, farm communities or associated farms might be opportunities to increase social diversity. Also to support the increasing amount of people who would like to start farming but especially lack access to land would seem the thing to do.

Moreover direct marketing and cooperation revealed to be facilitators of diversity and thus should be promoted and supported. Indeed successful application of these strategies and diversity in general requires specialist knowledge as well as soft skills. Thus financial support and encouragement has to be accompanied by education opportunities and knowledge transfer.

Of course application of such "social-diversity-enhancing" approaches primarily depends on an affirmative mindset of the farmers towards such ideas. More research about the current state of social diversity on organic farms and more detailed research regarding farmers' attitudes towards social diversity, cooperation and influencing factors thereon are necessary to be able to develop appropriate measures to steer the system in the right direction. Also more applied research concerning farming methods and technology would be important to accelerate the development of organic farming.

Diversity is a question of mindset and the (economic) system within farming is embedded. Organic farming is part of our conventional food (retailing) system and thus forced to assimilate. To break out from this system is only possible as far as other actors and subsystems in the food system, especially consumers, allow and enable it. A different, more diversified food production in general requires an altered food system as whole. A re-localization coming along with regained social diversity and contact is the link to a sustainable, resilient and regenerative food system that is built on diversity. It will be a long and rocky road to achieve this goal as it requires not less than a paradigm shift.

Biodynamic farming might serve as a model and inspiration for organic farming in general and our food system and society as a whole regarding attitude towards and establishment of diversity. It is based on the idea of every farm being an individual system with unique identity. The very strong focus on a closed system entails the idea of use of farm-own seeds and offspring, whereby farm varieties and breeds are developed that are adapted to the respective farm, its physical-natural embodiment and environment. It is not a coincidence that this striking advocacy of biodiversity is accompanied by a strong consideration of social aspects. A thriving social diversity is seen as equally important in biodynamic farming. Social diversity and community are the basis and originator of (agri)cultural diversity.

Diversity in its comprehensiveness and interweaving is for sure is complex and demanding and thus might urge us to simplify, but it is what makes up life.

*“Well, that have been frequent discussions over here, whether it is not too much, or too diverse, just too complex or so. I can understand that someone bethinks to ask if it’s not too much. However the experience is simply those, you can strike off this and that and that, you’re not doing better either. [...] So less work but also less meaning of life. It’s a sort of a naïve fallacy that if it is less complex it is easier or something. You just need enjoyment of work, that’s somehow most important.” (F7, 01:37:23)*

## 8 Literature

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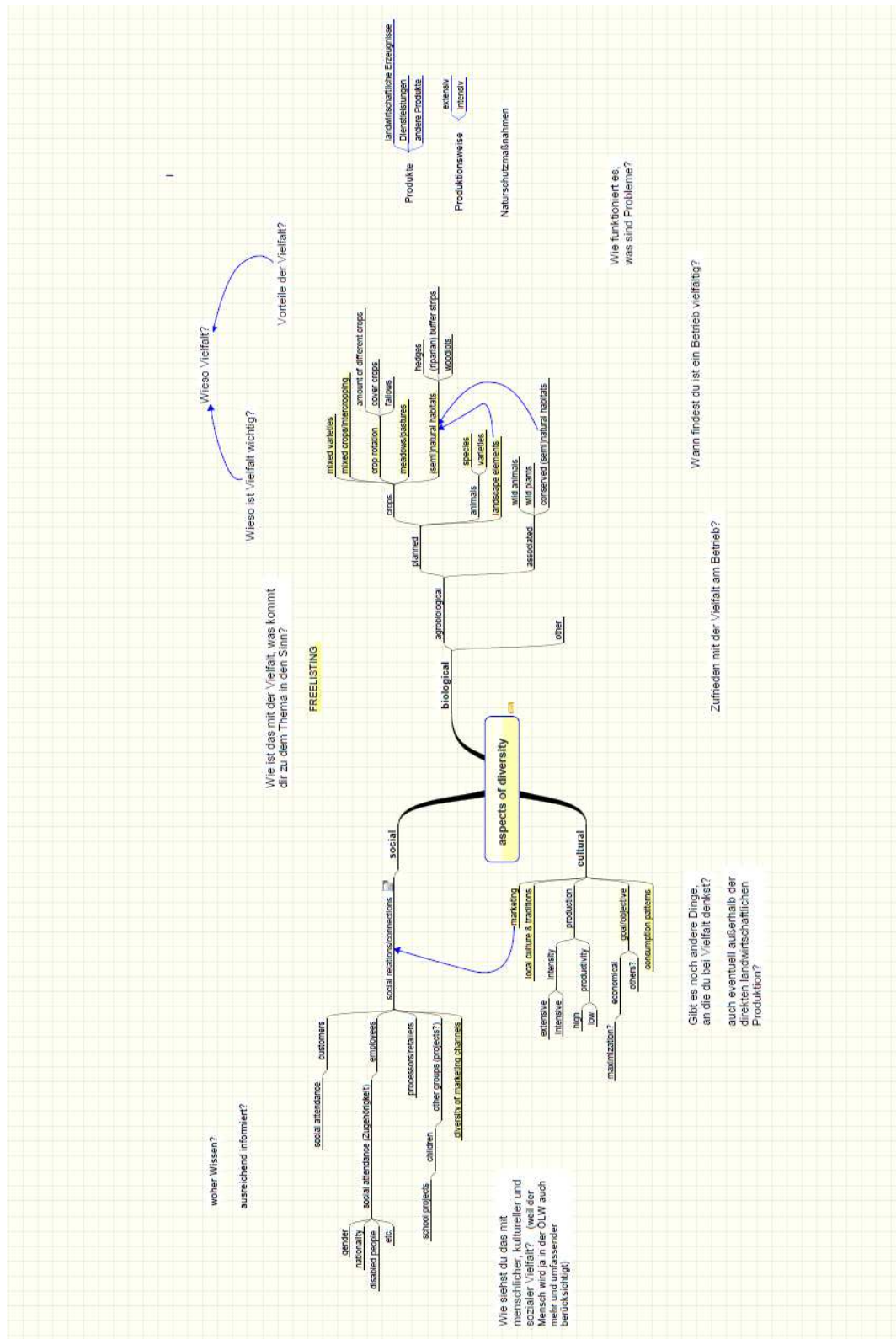
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# Appendices

Mindmap that served as an interview guide



## Interview guideline for basic personal and farm data

### Interviewleitfaden

Interviewpartner	Datum	Ort

#### Einstiegsinformation

- Präsentation des **Forschungsvorhabens**
- Qualitatives Interview = **offenes Gespräch** (Interviewte soll ganz frei alles erzählen, was für ihn wichtig ist)
- Das Interview wird **aufgenommen** und **verschriftet**, um nachher damit wissenschaftlich arbeiten zu können.

#### Persönliche Daten:

Geschlecht	
Alter	
Beruf	
Nationalität	
Höchste abgeschlossene Ausbildung	

#### Betriebsdaten:

Biozertifiziert seit	
Fläche	
Voll- oder Nebenerwerb	
Arbeitskräfte	
Produktion (was wird alles produziert, angebaut, verarbeitet, verkauft)	

Fruchtfolge bzw. Anbaudetails (Zwischenfrüchte, Mischfruchtanbau, Untersaaten, Sorten)	
Tierbestand (Arten, Rasse)	

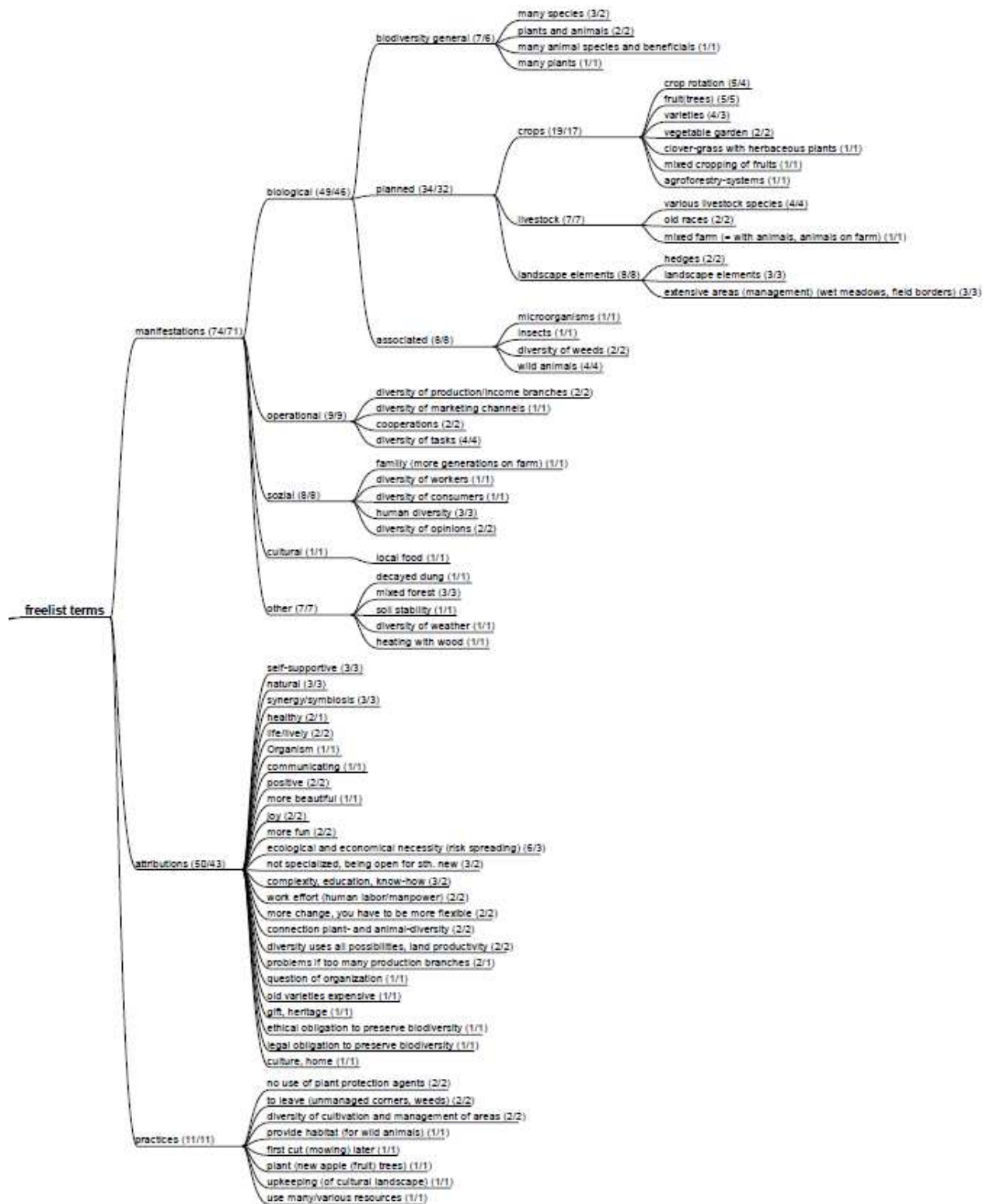
**Offene Ausstiegsfrage:** Von meiner Seite wärs das, gibt es noch etwas was wichtig ist das wir noch nicht angesprochen haben?

- Exemplar der Arbeit/Publication?
- Einverständniserklärung



## Terms/categories mentioned in the freelisting-task

All the terms mentioned in the freelisting-task structured according to their affiliation to the main categories manifestations (with 5 subcategories), attributions and practices; the numbers in the brackets show the number of mention and the number of different farmers naming the term/category respectively



## Detailed description of the sample farms

FARM 1			
Farmer (interview partner)	Age	Gender	Highest education
	57	m	Apprenticeship, professional school
Farm characteristics	Organic certified since	Size	County/area description
	1992	35ha (1ha leased)	Perg
Farm production	Crops	Animal husbandry	Sold products
	15ha arable land (clover grass, cereals (primarily fodder cereals)) 20ha wood	7 horses	Cereals
	Marketing	Other activities	Significance of farming for household-income
	Direct marketing (to friendly farmers)	Sledgings & coach tours, farm holidays, forestry, trade business (tobacconist's)	Part time farmer

<b>FARM 2</b>			
Farmer (interview partner)	Age	Gender	Highest education
	37	m	Apprenticeship, professional training
Farm characteristics	Organic certified since	Size	County/area description
	2012	8 ha (2ha wood)	Wels-Land
Farm production	Crops	Animal husbandry	Sold products
	Wild plant nursery (annuals, shrubs, wild fruits, other woody plants); 6ha arable land	-	See crops
	Marketing	Other activities	Significance of farming for household-income
	Direct marketing (farm gate sale)	-	Full time

<b>FARM 3</b>			
Farmer (interview partner)	Age	Gender	Highest education
	53	m	University degree
Farm characteristics	Organic certified since	Size	County/area description
	2009	8ha	Gmunden
Farm production	Crops	Animal husbandry	Sold products
	Field beans (2010), wheat (2011), barley (2012), clover grass (5ha) and fennel (1ha) (2013); orchard and wine	-	Arable crops
	Marketing	Other activities	Significance of farming for household-income
	EZG Biogetreide, pharmaceutical manufacturers, friendly farmers	-	Part time farmer

<b>FARM 4</b>			
Farmer (interview partner)	Age	Gender	Highest education
	55	f	Professional training
Farm characteristics	Organic certified since	Size	County/area description
	2006	11ha (3ha leased)	Braunau
Farm production	Crops	Animal husbandry	Sold products
	Wheat, barley, triticale, rye, small spelt, field beans, clover grass; orchard, vegetables and herbs	60 fattening pigs incl. 9 sows + boar, laying hens, goats, peacock, rabbits, geese, bees	Mainly meat and meat products + surpluses of self supply
	Marketing	Other activities	Significance of farming for household-income
	Direct marketing (farm gate sale, restaurants)	Farm festivals	Part time farmers

<b>FARM 5</b>			
Farmer (interview partner)	Age	Gender	Highest education
	53	m	Apprenticeship
Farm characteristics	Organic certified since	Size	County/area description
	1992	40ha (22ha leased)	Grieskirchen
Farm production	Crops	Animal husbandry	Sold products
	30ha arable land (bread cereals, field beans, corn); 10ha permanent grassland	12 milk cows (rearing of female offspring, milk fattened male calves), laying hens	Milk, meat, bread cereals, beans, corn
	Marketing	Other activities	Significance of farming for household-income
	Diary, food retailers	Active Bio Austria member	Full time farmer

<b>FARM 6</b>			
Farmer (interview partner)	Age	Gender	Highest education
	35	f	Matriculation
Farm characteristics	Organic certified since	Size	County/area description
	2007	10ha	Gmunden
Farm production	Crops	Animal husbandry	Sold products
	Permanent grassland (7ha), arable land (spelt, small spelt, rye, triticale, field beans, peas), orchard	5 ewes + ram, 70 laying hens, 3 horses, 2 fattening pigs, suckler cow	Eggs, flour, meat
	Marketing	Other activities	Significance of farming for household-income
	Direct marketing (farm gate sale)	School projects	Part-time farmers

<b>FARM 7</b>			
Farmer (interview partner)	Age	Gender	Highest education
	32	m	University degree
Farm characteristics	Organic certified since	Size	County/area description
	2000 (Demeter)	22ha	Rohrbach
Farm production	Crops	Animal husbandry	Sold products
	Permanent grassland, 5 ha arable farming (clover grass, bread and fodder cereals (wheat, rye, oat, spelt)), vegetables, orchard	8 milk cows, 10 ewes + ram, 3 horses, donkey, 3 goats, bees, 24 laying hens, 3 ducks, 2 geese, peacock	Milk, surplus of other products (mostly non-perishable products like honey, pasta, jam, juice)
	Marketing	Other activities	Significance of farming for household-income
	Dairy; direct marketing (farm shop)	Farm community with 50 people (25 handicapped persons); bakery, weaving, woodwork,	Mostly self supply, publicly financed institution



FARM 8			
Farmer (interview partner)	Age	Gender	Highest education
	48	m	Apprenticeship
Farm characteristics	Organic certified since	Size	County/area description
	2007	28ha (17ha leased)	Gmunden
Farm production	Crops	Animal husbandry	Sold products
	Permanent grassland, orchard	4 milk cows (15000l milk quota), 16 mother cows, 2 fattening pigs, 30 laying hens, bees, fishpond	Milk, meat and meat products, eggs, honey
	Marketing	Other activities	Significance of farming for household-income
	Dairy; meat, meat products, eggs and honey direct marketing (farm gate sale)	School projects	Part-time farmers

FARM 9			
Farmer (interview partner)	Age	Gender	Highest education
	37	f	University degree
Farm characteristics	Organic certified since	Size	County/area description
	2011	2ha	Vöcklabruck
Farm production	Crops	Animal husbandry	Sold products
	Raspberries, strawberries, blackberries, gooseberries, weiki ( <i>Actinidia arguta</i> ), apples, cherries, plums, pawpaw ( <i>Asimina triloba</i> ), sorbet, blackthorn, seabuckthorn, rose blooms, rhubarb	-	Berries, fruits and processed products of it (jam, chutney, syrup, juice, liqueur)
	Marketing	Other activities	Significance of farming for household-income
	Direct marketing (farm gate sale, market stall, restaurants)	WWOOF	Part-time (halftime-employment), aim is full time

<b>FARM 10</b>			
Farmer (interview partner)	Age	Gender	Highest education
	52	m	Professional school
Farm characteristics	Organic certified since	Size	County/area description
	1996 (Demeter)	230ha	Linz Land
Farm production	Crops	Animal husbandry	Sold products
	Clover grass, wheat, barley, rye, spelt, oat, triticale, sunflower, field beans	250 fattening pigs	Mainly bread cereals and pigs, partly fodder cereals
	Marketing	Other activities	Significance of farming for household-income
	Demeter-marketing, EZG Biogetreide, mills, Bioschwein Austria	Cooperation with a cow keeping farm (exchange fodder and manure)	Employed farm manager

<b>FARM 11</b>			
Farmer (interview partner)	Age	Gender	Highest education
	40	m	Professional school
Farm characteristics	Organic certified since	Size	County/area description
	1996	40ha	Eferding
Farm production	Crops	Animal husbandry	Sold products
	Field vegetables (8 different species), cereals (mostly spelt, oat), field bean, alfalfa	4 horses	Processed vegetables (pickles); preparation of vegetables for commercial kitchens
	Marketing	Other activities	Significance of farming for household-income
	Food retail markets, organic shops, wholesalers		Full-time farmers

FARM 12			
Farmer (interview partner)	Age	Gender	Highest education
	32	m	Matriculation
Farm characteristics	Organic certified since	Size	County/area description
	2009	25ha	Perg
Farm production	Crops	Animal husbandry	Sold products
	Apples (16ha), grapes, apricots, peach, pears 9ha arable land (alfalfa, cereals) and permanent grassland	150 Geese	Mainly apples (2/3 via wholesaler) and apple products (juice, cider, vinegar, dried apples; only direct marketing); geese direct marketing
	Marketing	Other activities	Significance of farming for household-income
	1/3 of apples processed and/or direct marketing (ca. 1/2 of income); 2/3 of apples via wholesaler	Farm festival, school projects	Full-time farmers