Agroforestry and Ecosystem Services: Value Capture in Silvopastoral Food Production Systems in Italy

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“In nature, nothing exists alone.”

Rachel Carson, Silent Spring

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Annotation

The citation method and formatting of the lists of literature of those chapters containing research papers follow the author guidelines of the respective journals that papers have been published in or have been submitted to, and have been kept this way. The citation method and literature list of the remaining chapters deviate from these, yet they are consistent within themselves. Figures and tables have been numbered continuously throughout the dissertation.

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List of Abbreviations

AFN	Alternative Food Networks
EC	European Commission
CAP	Common Agricultural Policy
EEA	European Environment Agency
e. g.	Latin for “for example” (exempli gratia = for the sake of an example)
ES	Ecosystem Service(s)
et al.	Latin for “and others” (et alii (m), et aliae (f), et alia (n))
EU	European Union
EU-27	European Union with 27 member states as of January 2007
EU-27_2020	European Union with 27 member states as of January 2020
EU-28	European Union with 28 member states as of July 2013
FAO	Food and Agriculture Organisation of the United Nations
GCC	Global Commodity Chain
GDP	Gross domestic product
GHG	Greenhouse gases
GPN	Global Production Network
GVC	Global Value Chain
ibid.	Latin for “in the same place” (ibidem), referring to the same author as previously
i. e.	Latin for “that is to say” (id est = that is)
IPCC	Intergovernmental Panel on Climate Change
MA	Millennium Ecosystem Assessment
MLP	Multi-Level Perspective
NGO	Non-governmental organisation
PES	Payments for Ecosystem Services
SFSC	Short food supply chain
UAA	Utilised agricultural area
UN	United Nations

1 Introduction: Ecological and socio-economic implications of ongoing agricultural change

Since the second world war, agriculture in Europe has been subject to changing and increasingly conflicting pressures. During the 1950s, productivity growth became the leading concept in agricultural policies (*Lowe* et al. 1993), influenced by concerns of food shortages and the promise of self-sufficiency (*Ward* et al. 2008; *Bishop* and *Philipps* 1993; *Pretty* 1998). National policies and the Common Agricultural Policy (CAP) of the European Community have been identified as playing major roles in this development through subsidies and loans for farm modernisation, interventionist regulation of markets through price support mechanisms, protection of markets through import restrictions or tariffs and funding of research programmes and training (*Woods* 2011; *Wilson* 2001). Increasing farm output through ongoing industrialisation during the 'productivist' era was characterised by intensification, concentration and specialisation of farming systems (*Bowler* 1985; *Ilbery* and *Bowler* 1998). This resulted in an "agricultural organization in which the function of farming was singularly conceived as the production of food and fibre, and which prioritized increasing agricultural production over all other considerations" (*Woods* 2011: 67).

In the Mediterranean countries of the EU, the rate of agricultural industrialisation is lower than in Northern European regions. High proportions of areas with unfavourable growing conditions with regard to climate, soils and topography have led to a polarised development of intense farming systems in the lowlands and gradual abandonment of extensive systems in mountainous regions (*Casas* et al. 2015). In Italy, the modernisation of agriculture was further slowed by the prevalence of a farming model closer to the "peasant model than to the economic rationality of the 'American farmer'" (*Fonte* and *Cucco* 2015: 264). Nevertheless, in the 1980s the peasant farm model was ultimately replaced by entrepreneurial farms. Yet, modernisation was selective on geography and farm types. Larger farms, which are commonly situated in the north, are more likely to be involved in dairying and livestock breeding, while smaller mixed and perennial systems with greater seasonality and thus time for diversification activities are distributed across the southern and central regions (*Fonte* and *Cucco* 2015).

Characteristics and consequences of productivism

Mechanisation, the substitution of manual labour, and increases in productivity through synthetic fertilisers, chemical plant protection, high-yielding crop varieties or animal breeds and factory-style rearing systems allowed for a higher specialisation of food production (*Abson* 2019; *Ilbery* and *Bowler* 1998; *Woods* 2011). As a consequence, farmers focussed their production on the most profitable commodities, which they were able to grow in larger quantities (*Abson* 2019). As the most profitable crops will often be those most suitable to one location (*Desrochers* and *Shimizu* 2008), this has led to a concentration of production in specific regions or countries, not least because they are favoured and supported by national policies (*Abson* 2019; *Ilbery* and *Bowler* 1998).

With the possibility to spread fixed costs over a larger production base or receive reductions on high-volume purchases of inputs such as seeds and fertilisers, plus a better bargaining position, costs per unit of production decreased as the production base itself grew ("economies of size") (*Abson* 2019; *Duffy* 2009). As a result, farmers created value and profit by relying on external inputs and increased their efficiency for high production quantities, which raised their dependence on input suppliers, labour contractors, providers of financial capital as well as fossil fuels and at the same time increased negative impacts of the production on the environment (*Lowe* et al. 1993; *Woods* 2011).

This commercialisation of agriculture lead to a growing market integration of both large businesses relying on external labour and family run farms. Yet the required changes in technology and demand of an industrialised processing industry resulted in a decrease in farm numbers and a concentration of land into larger farms (*Ilbery* and *Bowler* 1998). This, in turn, meant structural reconfigurations of rural employment, livelihoods, social structures and identities. Between 2005 and 2016 the number of farms in the EU-28 declined by about one quarter, with farm numbers in Italy decreasing by 34%. During the same period, the land used for agriculture remained mostly unchanged, with growth especially occurring in the category of holdings managing over 100 ha in the EU and over 20 ha in Italy (*Eurostat* 2018a), where the average farm size was 11 ha in 2016 (*I.Stat* n. y. a). Thus, the Italian agricultural landscape continues to be characterised by the prevalence of small farm sizes and high fragmentation, a result of the difficulties the country has shown in adopting the productivist approach (*Fonte* and *Cucco* 2015).

Along with the industrialisation of supply, in the last third of the 20th century agricultural production became part of a wider, increasingly globalised food supply system with agri-food companies, retailers and financial businesses emerging as the most important sources of external capital. As selling to the growing food processing industries increased, this in turn meant higher dependencies of European farmers on external actors e.g. through contract farming (*Ilbery* and *Bowler* 1998). Certification schemes and quality standards emerged as important new forms of governance in global supply chains (*Fonte* and *Cucco* 2015). Simultaneously with these changes, the retail sector saw patterns of consolidation since the 1950s. Major, globally acting supermarket chains superseded smaller retailers by offering a wider range of products at longer opening hours closer to residential zones (*Ilbery* and *Bowler* 1998). In doing so, retailers have become the main connection between producers and consumers by using contracts and self-governed requirements to maintain this position (*Lang* 2004).

This consolidation in the retail sector, understood as an exclusiveness to hold and share knowledge and technology (*Henderson* et al. 2002) but also to impose rules, prices and standards on suppliers (*Reardon* et al. 2003; *Munson* et al. 1999), has benefitted the food system and European consumers within it in many ways. In combination with international trade and industrial measures of food processing, preserving and transporting, it has meant an all-year round supply of essential nutrients and increased product safety while being able to support a larger number of people (*Desrochers* 2016). At the same time, the bargaining position weakened further upstream in the value chain. As a result, European farmers have become dependent on both ends of the supply chain, with the suppliers of capital, services and inputs on one end, and processers and retailers on the other. As *Marsden* et al. (1986: 502) established: “Control over production has shifted away from the farm”.

The negative consequences related to the productivist approach were not only limited to the food system per se, but had wider consequences for the “whole countryside, requiring the reconfiguration of labour relations, social structures, environmental conditions and landscapes towards support for the singular goal of maximizing agricultural production” (*Woods* 2011: 67). In the mid-1980s the productivist regime was increasingly challenged by governments and non-state actors alike (*Wilson* 2001), for issues such as overproduction caused by unbalanced state-supported subsides as well as concerns about the impact of modern farming practices on the environment, animal welfare and food

quality (*Almstedt* 2013; *Wilson* 2001). Food scandals resulting in a "crisis of confidence" (*Goodman* and *Goodman* 2009: 209) in industrially produced food and the debate on genetically modified organisms further increased consumer interest in alternative food systems with perceived high levels of traceability, safety and quality (*Feldmann* and *Hamm* 2015; *Fonte* and *Cucco* 2015). On the European level, the CAP saw changes such as payments for environmental practices, improved food safety standards, measures for extensification (e.g. set-aside, lowering of stocking rates), stimulation for farm diversification, support for organic conversion and labelling for designated origins (*Fonte* and *Cucco* 2015; *Woods* 2011; *Robinson* 2004; *Evans* et al. 2002), aimed at a "quality turn" in farming and food production (*Goodman* 2003). The struggles the Italian farming sector had had in adopting the industrial farming approach, expressed in the continuous existence of varied and diverse farming systems and food traditions, were now turned into a competitive asset in creating a quality brand for food products 'Made in Italy' (*Fonte* and *Cucco* 2015; *Brunori* et al. 2013).

Post-productivism, emergence of a new multiplicity

The change in direction in agricultural policies fostered the development of 'post-productivism', which emerged as an opposing concept to productivism between the 1980s and 1990s and was used by rural geographers and scholars from other disciplines to suggest the beginning of a new agricultural era (*Woods* 2011; *Evans* et al. 2002). According to *Ilbery* and *Kneafsey* (1997, cited from *Evans* et al. 2002) this period was characterised by agri-environmental policies promoting sustainable farming practices, a change of focus from quantity to quality, increased environmental regulation, restructuring of government support and increases in pluriactivity (i.e. supplementary off-farm income). *Ilbery* and *Bowler* (1998) even described post-productivism as a reversal of productivist characteristics towards extensification, diversification and dispersal of agricultural activities.

Yet, post-productivism as a way of describing change in rural economies has also been widely criticised and thus remains a contested concept (*Almstedt* 2013; *Wilson* 2001; *Evans* et al. 2002). Criticism arose around the issues of poor theoretical elaboration and lack of a defining framework (*Woods* 2011), a too quick and uncritical adoption (*Robinson* 2004; Ward et al. 2008), a too narrow focus on UK agriculture and Western Europe (*Ward* et al. 2008) and maybe most importantly: empirical evidences that do not

allow for the conclusion that the shift to a post-productive farming system has actually occurred (*Evans* et al. 2002; *Wilson* 2001).

Although there is evidence to suggest that extensification has taken place in some parts of Europe (*Wilson* 2001), other regions have simultaneously seen intensification of farming practices (*Pretty* 1998, *Potter* 1998). At the same time, it has been shown that the idea of quality is not only a conceptualising characteristic for post-productive settings, but also gained importance in the productivist system e.g. through quality assurance schemes (*Marsden* et al. 1997; *Evans* et al. 2002). Moreover, there is no evidence to support the argument for the reverse of concentration or dispersion of specific agricultural activities in particular areas (*Wilson* 2001). In fact, the ongoing concentration of land in Europe on larger holdings rather indicates the opposite. Indeed, it was recognised that both forms of intensive and extensive agricultural production systems co-existed, which challenged the linear notion of post-productivism superseding the productivist era (*Ilbery* and *Bowler* 1998; *Wilson* 2001, 2007; *Mather* et al. 2006).

Recognising the environmental impacts of agricultural production systems

The period between 1961 and 2017 saw an increase of agricultural production of food, fibre and feed of 240% (*IPCC* 2019), which can mainly be attributed to a growing use of productivity-increasing technologies and inputs, but also land expansion (*Steinfeld* et al. 2019; *IPCC* 2019). With agriculture being tightly embedded in the natural ecosystems it manipulates for human purposes, it is not surprising that the sector is regarded as a major driver of global environmental change (*Steinfeld* et al. 2019; *Springmann* et al. 2018). Industrial agricultural practices have shown to involve a number of negative external effects such as pollution of aquatic and terrestrial ecosystems, soil erosion and degradation, deforestation, water depletion, air pollution, biodiversity loss and not least, climate change (*EEA* 2020; *FAO* 2018a; *IPCC* 2019; *Springmann* et al. 2018). Between 2007 and 2016, agriculture, forestry and other land use accounted for 23% of the net anthropogenic emissions, and made up 13% of carbon dioxide, 44% of methane and 82% of nitrous oxide emissions from human activity (*IPCC* 2019). In 2016, agriculture was responsible for 7.1% of the total Italian greenhouse gas (GHG) emissions (*ISPRA* 2018).

Springmann et al. (2018) estimated that the environmental pressures caused by food production (e.g. greenhouse gas emissions, bluewater use, nitrogen application) are going to increase 50 to 90% if current management and consumption practices are not adapted,

crossing planetary boundaries marking a secure space for humanity to thrive. This is also reflected in the 2019 review by *Béné* et al., who assessed different drivers of change in the food system. Besides regarding technological innovations and the intensification of farming practices as major factors for supply dynamics, they, ironically, identify the adverse effects of these developments as major drivers of change. Particularly important are challenges surrounding soil degradation as well as climate change, especially with regard to temperature increase and extreme weather events, which are expected to have a negative impact on productivity for some crops in the future (*Lobell* et al. 2011; *Springmann* et al. 2016).

However, there are differences in the ecological effects of different production systems. Comparing the impacts of product types and farming systems on various environmental indicators, *Poore* and *Nemecek* (2018) found that GHG emissions, levels of eutrophication and acidification and land use are higher from even the lowest-impact livestock systems in comparison to average-impact systems of substitute vegetable proteins. The need for reducing animal-based food was also stressed by *Springmann* et al. (2018), in addition to suggesting lower nitrogen and phosphorus application and technological and management improvements to close yield gaps and increase efficiency.

The various effects livestock farming can have on the ecosystems it is embedded in or depend upon are increasingly recognised. The FAO report "Livestock's Long Shadow" (*Steinfeld et al*. 2006) comprehensively compiled data on the impacts of animal husbandry and the production of meat, dairy and eggs on GHG emissions, water use and pollution, as well as land degradation and deforestation. Livestock production globally accounts for 14.5% of total anthropogenic GHG emissions, consisting of 44% methane (CH_4), 29% nitrous oxide (N_2O) and 27% carbon dioxide (CO_2) (*Gerber et al*. 2013) and uses 30% of the terrestrial surface to produce animal products (*Steinfeld et al*. 2006). The major sources of emissions are feed production (45%) and enteric fermentation from ruminant digestion (40%), whereas manure storage and processing account for 10% and direct, indirect and post-farm energy use for around 5% (*Gerber et al*. 2013).

The per capita consumption of proteins from animal products in the EU remained relatively consistent between 2000 and 2013 with a decrease in bovine meat of almost 14% and an increase of protein intake from cheese and poultry of 15%, while cheese and pork are the most favoured protein origins (*EEA* 2017). Although meat consumption has

seen an upward trend since 2014, the European Commission (EC) projects a decline within the EU between 2018 and 2030. This is related to a growing awareness about environmental and climate problems, social and ethical considerations e.g. on animal welfare, health concerns, lower availability and an ageing population requiring less protein (*EC* 2018). Yet, the global demand for animal products is growing due to population and income increases and urbanisation trends, and it is expected to continue to do so in future (*FAO* 2019). With the UN medium-variant projection suggesting a growth to 9.7 billion people by 2050 (*UN* 2019), the consumption of meat is estimated to grow by 50% by then, compared to levels of 2012 (*FAO* 2018b).

With the negative impacts of the incumbent farming and particularly livestock systems being increasingly acknowledged, the calls for changes towards sustainable practices are gaining attention as a mere consequence in the fight against climate change, land degradation, hunger and poverty (*FAO* 2019). Limited by the boundaries of the food system, a change in *what* is farmed will have to be backed by the question of *how* it will be farmed. Acknowledging the need for a shift in food production systems, the *FAO* (2018a) promotes agroecological practices in support of the sustainable development goals to address the resilience of farming systems. Amongst the five actions set out by the *FAO* (2019: 1) to foster "low carbon livestock systems" is the call to capitalise on nature-based solutions for increasing carbon offsets, and specifically mentions the potential of silvopastoral agroforestry to increase system stability and deliver environmental as well as economic and social benefits.

Agroforestry between agroecology and economic considerations

Agroforestry is the intentional combined management of trees or other woody perennials with annual crops in 'silvoarable' or forage and grazing livestock in 'silvopastoral' systems (*Mosquera-Losada* et al. 2009; *Nair* 1993; *Jose* et al. 2019; *Cubbage* et al. 2012). It is an agroecological approach to enable agricultural ecosystems to provide ecological, economic and social benefits (*Prabhu* et al. 2015) and can increase ecosystem services provision by stimulating carbon sequestration, reducing soil erosion and wildfires, improving soil quality by intercepting nutrients and the establishment of symbioses with N-fixing or mycorrhizal organisms, increasing biodiversity and reaching higher efficiencies in nutrient cycling, thus reducing leaching (*Eichhorn* et al. 2006; *Jose* 2009; *Jose* et al. 2019; *Lawson* et al. 2019; *Moreno* et al. 2018; *Riguiero-Rodríguez* et al. 2009;

Torralba et al. 2016). Increased water holding capacities and a reduction of floodwaters from agroforestry land is furthermore a promising adaptation to droughts or floods related to a changing climate (*Lawson* et al. 2019). Besides environmental benefits, agroforestry systems enable opportunities for more efficient, stable and diverse income (*Mosquera-Losada* et al. 2009; *Prabhu* et al. 2015).

Yet, the intensification of farming practices also put agroforestry systems, which have existed in Europe for thousands of years, under increasing pressure as they were not suitable under the productivist approach. Trees were considered obstacles for machinery and were thus removed or fell victim to margin clearings in the course of land consolidation, and the focus on yield increases benefitted simplified, monocultural, instead of diverse, systems (*Eichhorn* et al. 2006). This development can also be observed in Italy, where agroforestry has been a traditional feature of landscape stewardship for centuries (*Paris* et al. 2019). Today, Italy has the fourth largest area under silvopastoral management in Europe with an estimated 1.3 million ha. The total agroforestry area is estimated at 1.4 million ha, representing about 11% of Italy's utilised agricultural area (UAA). Most of the silvopastoral systems in Italy are established in woodlands, followed by grass and shrubland with sparse tree cover, and permanent crop cultivations (e.g. olives) (*den Herder* et al. 2017).

Motivating farmers to engage in alternatives to the dominant farming practices involves dealing with both ideological and practical issues. Recent work on the attitudes of farmers and other interest groups, such as advisors or environmentalists, reveals a dichotomy between the perception of environmental benefits of agroforestry systems and economic concerns of increased management efforts (*García de Jalón* et al. 2018; *Graves* et al. 2017; *Rois Díaz* et al. 2018; *Camilli* et al. 2018). Better comprehension of marketing possibilities of products from agroforestry systems and related issues is considered one option for making a transition more attractive (*Camilli* et al. 2018).

Aims, objectives and structure of this dissertation

In order to assess which strategies are adopted by farmers in silvopastoral systems, this dissertation aims at first understanding how the values of these products are formed, who plays a part in value development, which characteristics are important for value definition and how farmers distinguish their products. Special focus will be given to the environmental character of the production system as their unique characteristic. Since

consumption preferences for environmentally friendly and local food have strongly increased in Europe (*Willer* et al. 2020a), and livestock farmers in silvopastoral systems are likely to fulfil demands put forward by environmentally minded consumers wishing to buy food locally, a second focal point of this dissertation will be the analysis of distribution channels served by farmers. The key consideration here is whether farmers are participating in alternative food networks (AFN) and what benefits or challenges this entails. Within the broader context of sustainability transitions of the food system, it can be argued that agroforestry forms some sort of niche, a place for radical innovations which can challenge and may even replace activities of the incumbent food regime (*Geels* 2011; *Kemp* et al. 1998; *Schot* and *Geels* 2008). Addressing the impact of agroforestry systems on the wider food sector was thus identified as a further focal point of the analysis for this thesis.

Based on these preliminary considerations, the aim of this dissertation is to deliver a better understanding of the possibilities and limitations of silvopastoral agroforestry production systems with regard to valuation and capture of ecosystem services, alternative distribution and marketing possibilities, as well as their contribution to an agroecological shift of the food system. In particular, this dissertation aims at assessing (i) whether environmental benefits or ecosystem services play a role in the definition of product quality for agroforestry systems, (ii) which strategies are adopted to incorporate and capture them in product value, (iii) whether the studied systems can be considered part of alternative food networks and which benefits and challenges this involves, and (iv) whether the studied systems have an impact on a wider change of the food regime through the formation of a socio-technological niche.

Due to the explorative nature of this study, a qualitative research approach was chosen to collect and analyse data from silvopastoral systems in the central Italian regions of Umbria and Lazio. Historically, agroforestry has been a part of land management in the research regions, even if today these only exist in remnants (*Paris* et al. 2019; *Caballero* et al. 2009; *Zimmermann* 2006). It is thus not surprising that Italy had one of the highest proportions of silvopastoral area in the EU-27 in 2016 (*den Herder* et al. 2017), as well as the third highest number of hectares managed organically within the EU in 2018 (*Eurostat* 2020a). Combined with olive production constituting the biggest share (28%) of main farming types for agricultural holdings (*Eurostat* 2018b), this indicates a favourable potential for agroforestry systems. Another important reason for the suitability

of Italy as a research region is the high fragmentation of both retail and farming structures (*statista* 2019; *Fonte* and *Cucco* 2015; *Fornari* et al. 2013;), indicating a greater importance of alternative distribution formats.

The following theoretical concepts form the basis of the analysis for this dissertation. The theory of *Global Production Networks* (GPN) (*Henderson* et al. 2002) and *Global Value Chains (GVC)* (e.g. *Gereffi* et al. 2005) comprise the overarching frameworks of the analytical approach for this work. As they enable a link between different stages of production, processing and distribution of silvopastoral output, while considering actor relations and embeddedness of systems, they allow for the identification of success factors, barriers and strategies adopted to distinguish the value of silvopastoral products. As one of the questions of this work relates to how value is understood and constituted by the farmers of the case studies, special focus will be given to this category. In this regard, the concept of *Ecosystem Services* (ES) (*MA* 2005) and options for their valuation will also be explored as a defining characteristic of product value.

Conceptualising *Alternative Food Networks* that have emerged as a reaction to the adverse effects of the industrial farming system (*Feldmann* and *Hamm* 2015; *DuPuis* and *Goodman* 2005; *Ilbery* and *Maye* 2005a) will be important for the analysis of food distribution systems in the studied regions. Being closely linked to developments in consumer expectations and demand, this theoretical approach is valuable for defining characteristics and explaining some of the developments observed in the marketing channels of the studied cases. Lastly, the *Multi-Level Perspective* (MLP) (*Geels* 2011, 2002) was identified as a framework for analysing the transformative importance of the studied cases for triggering sustainable change in the wider food system.

This work is structured as follows. Chapter 2 further describes the theoretical frameworks on which the analysis is based. Chapter 3 outlines the methodological approach of qualitative data collection and analysis chosen for this dissertation, and describes the research design and realisation. For contextualisation purposes, the structures of Italian agroforestry systems, agricultural production, and distribution will be presented as well as the research area in central Italy. The research papers that have already been published or were submitted as part of this cumulative dissertation are presented in chapters 4 to 6. A listing of these is included in chapter 3.3. Chapter 7 finally summarises the main findings and discusses them with regard to the established theoretical frameworks.

2 Theoretical basis: Framing alternatives for agricultural production networks

The global disintegration of capitalist economic structures in the last third of the 20th century led to a distancing between places of food production, processing, distribution and consumption, which at the same time have become more integrated into the global market (*Feenstra* 1998). The ongoing specialisation and fragmentation of food provision, which today stretches beyond regional and national borders, call for an assessment of economic activity, characteristics and consequence on a global scale. In order to capture the notion of these expanding systems, it has become necessary to think in concepts beyond business economics, which are able to track, map and decodify ongoing processes of expansion and restructuring, while acknowledging them as socio-economic phenomena under rapidly changing conditions.

Using network theories, such as global value chains (GVC) (e.g. *Gereffi* et al. 2005) or global production networks (GPN) (e.g. *Coe* et al. 2008; *Henderson* et al. 2002), allows for this analysis by including recent dynamics of production and distribution in different geographical contexts, whilst considering all relational facets of the economic process. One of the main difficulties in the analysis of environmental production systems such as agroforestry systems is the intangible nature of some of the services provided by farmers. While the environmental benefits from these systems are non-excludable and non-rival (*Farley* et al. 2011), which complicates adequate compensation, economic valuation is yet a crucial challenge for driving change in farming practices. Capturing the value of ecosystem services could act as an incentive for farmers to take up environmentally friendly approaches such as agroforestry (*Pirard* 2012, *Farley* et al. 2011).

Whilst analysing the different characteristics that are important in trading food, it is also necessary to account for the conditions under which they are sold. Considering alternative approaches to conventional modes of food distribution in alternative food networks can be helpful for understanding both the underlying opportunities and challenges farmers might be facing when marketing their produce. Extending the perspective on alternative farming practices by assessing the position of farmers in the wider food system as well as their possibilities and limitations to influence it, can help to stimulate further changes needed for a larger application of agroforestry practices.

In order to set the theoretical framework, which was applied in the analysis of the gathered information with regard to the above considerations, the following sub-chapters introduce the concepts of GPN and GVC, the valuation of ecosystem services, alternative food networks and socio-technological transitions.

2.1 Global production networks and global value chains

The global production network approach is a multi-dimensional, heuristic framework for the analysis of relationships and actions of different actors which form global economic structures and processes (*Coe* et al. 2008). While *global* production networks are operating across national boundaries (*Dicken* 2011), the concept can also be applied to smaller geographical scales (*Coe* et al. 2004). Maintaining the focus of more two-dimensional, linear approaches such as (global) value chains (GVC) (*Porter* 1985, 1990; *Gereffi* et al. 2005) or commodity chains (GCC) (e.g. *Hopkins* and *Wallerstein* 1986; *Gereffi* 1994), the transition of inputs into outputs is at the centre of the analysis. Equally, the GPN concept acknowledges the evolutionary and fragmented character of economic processes, where each subsequent activity, performed by different actors, adds value to goods or services from creation to consumption (*Dicken*, 2011; *Coe* et al. 2008). In this exchange between actors, goods or services are flowing in one direction from production to consumption, while information, e.g. on consumer preferences and demands, and money flow the opposite way in what *Dicken* (2011: 56) calls a "production circuit" (Fig. 2.1), rather than a chain.

Defined as "interconnected functions, operations and transactions through which a specific commodity, good or service is produced, distributed and consumed" (*Dicken* 2011: 56), these circuits are at the centre of GPNs, where inputs are turned into outputs. As these circuits depend on other inputs or services either concerning production or distribution (e.g. technology, energy, logistics) (*Dicken* 2011), every exchange connects economic actors with a larger "value system"; the individual value chains of other actors (*Porter* 1990: 42). At the same time, production circuits are part of the wider regulatory and financial landscapes of a given location, with financial services especially playing a crucial role for economic development (Fig. 2.1) (*Dicken* 2011).

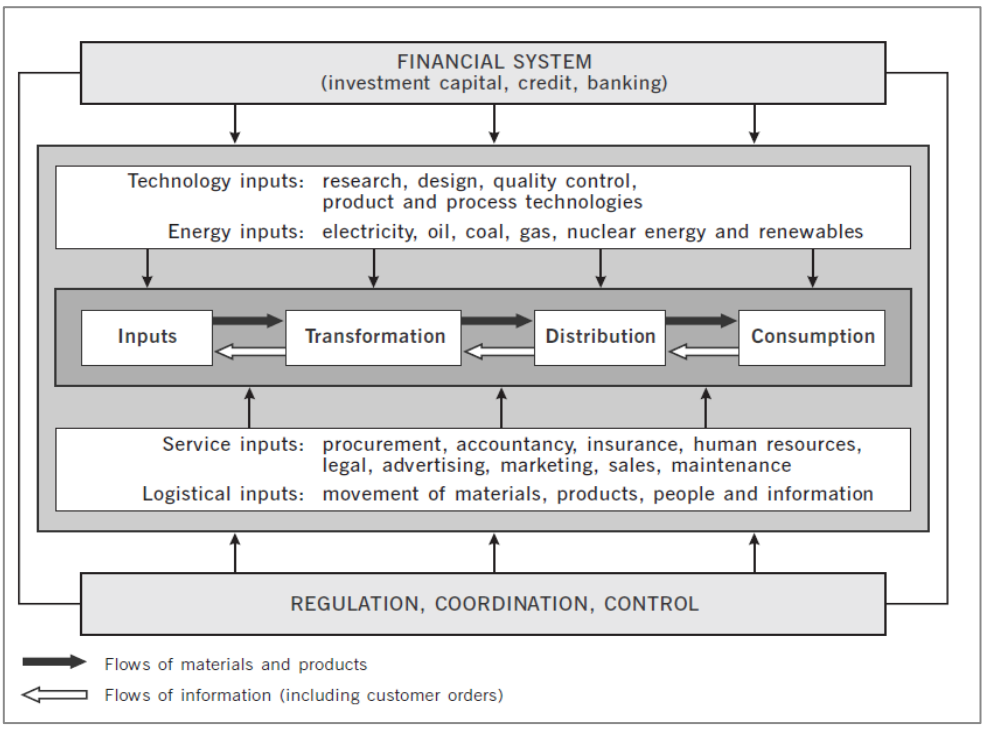

Figure 2.1: The basic components of a production circuit (Dicken 2011: 57)

Capturing this notion of interrelatedness, *Gereffi* (1994) defined global commodity chains as a summary of different socially constructed networks relating to one commodity, which connect states, firms and households of the local specifics with which they are associated. Yet, while chain approaches limit these transactions mainly to firm actors, the GPN framework considers any kind of actor relevant to the transformation process, which form the socio-economic and institutional setting in which economic activity takes place (*Coe* et al. 2008; *Henderson* et al. 2002). In a global economy these include transnational firms, labour, states, consumers and civil society organisations (*Dicken* 2011).

GVC and GCC concepts have been criticised for having too narrow a focus on governance structures, as well as for implying that firms were merely acting in response to the given circumstances of the chain organisation itself rather than developing independent strategies, and for a lack of intention to understand where these organisational differences might stem from (*Henderson* et al. 2002). As a consequence, the GPN approach considers not only the linear or vertical connections between actors of a value or commodity chain, but includes all dimensions of relationality without neglecting the directed and therefore somewhat linear character of the sequential transformation in input-output processes (*Coe* et al. 2008; *Henderson* et al. 2002). Adding to the analytical dimensions of *value* and *power*, which also form part of GVC and GCC approaches, the GPN framework

introduces a third category, *embeddedness*, for the assessment of economic processes from global to local geographical scales (*Henderson* et al. 2002; *Coe* et al. 2004).

The value category includes all processes involved in the *creation* of value by transforming inputs into a product or services through labour. This includes issues such as employment, skill, training and working conditions; exclusiveness of access to technologies or resources, inter-firm cooperation and brand establishment (*Kaplinsky* 1998) and the socio-economic and institutional conditions impacting all of these (*Henderson* et al. 2002). Value *enhancement* processes are determined by whether and how technologies are transferred in or outside of certain GPNs, whether and how firms are connecting with suppliers on improving the quality of inputs, increasing the demand for skill over time, and whether local firms start to create profits from organisational, relational or brand advantages themselves (*Henderson* et al. 2002). Whether values can be *captured* in the location of creation or enhancement depends not only on (transnational) ownership structures but also on political conditions for ensuring the retention of profits in the locality (ibid.).

The category *power* serves the analysis of power relations and exertion of corporate, institutional and collective power in GPNs (*Coe* and *Yeung* 2015; *Henderson* et al. 2002), which *Dicken* (2011: 59) described as "arenas of contested relationships". Firms with access to scarce resources, which are in demand, will have a relatively better bargaining position than those without, placing firms offering easily replaceable goods or services at a weaker position. Yet, as *Coe* et al. 2008 emphasise, this situation is not static and might change as actors gain more competencies. However, it is important to understand that one actor's behaviour towards their goal of maximising profits will not only be impacted by power held and exercised by individual actors, but also institutions or societal organisations. The third analytical category, *embeddedness*, recognises this influencing of GPNs by the socio-economic and political settings of given localities, their values and structures (*Henderson* et al. 2002).

In the GPN framework, environmental issues are treated with regard to collective power relations as represented by NGOs. Furthermore, it could be interpreted that the access to key production inputs and beneficial technologies mentioned will recognise ecological as well as social, and political circumstances embedding the production network, yet it is not explicitly mentioned by the authors. On the contrary, while recognising that economic

activity will impact the natural system by both extracting resources and imposing pollution on it through waste, *Coe* et al. (2008) highlight the lack of connection between the production, distribution and consumption of products and services, and the natural environment in networks theories. Yet, GPN analysis is viewed as a useful tool to comprehend and manage environmental problems resulting from the economic process by linking different processes evolving around it (ibid.).

Adding to this, the impact of production systems on the environment is understood as one ethical aspect in decision making by consumers, which stresses its importance for businesses (*Yeung* and *Coe* 2015). Environmental issues can be assessed as risks for economic processes and how actors respond to them, and from a power perspective by addressing how non-firm actors such as environmental NGOs influence the creation and capture of values by firms. At the same time, environmental sustainability is regarded as one of many "non-economic issues" (*Yeung* and *Coe* 2015: 51), a perspective that is valid by definition only and seems to assume that environmental aspects are addressed by non-firm actors only, ignoring their incorporation in value creation by firms, both to appease and meet external production demands, and improve economic performance.

In order to explore one possibility of incorporating the benefits of environmental farming methods into value chains, the next chapter introduces the concepts of ecosystem services and presents possibilities to capture their value.

2.2 Theorising the value of ecosystem services

Drawing on work on human benefits from the functioning of ecological systems, emerging in the 1960s and 1970s, the idea of "environmental/ecosystem functions/services" was used by several authors (e.g. *de Groot* 1987*; Ehrlich* and *Ehrlich* 1981; *Westman* 1977) to stress the dependence of humans on natural systems and generate awareness for biodiversity conservation. This initially pedagogic tool gained wider attention in the 1990s and early 2000s as it became an inherent part of the research agenda and, following that, the political agenda (*Gómez-Baggethun* et al. 2010). In 2002, d*e Groot* et al. proposed a typology for ecosystem functions, goods and services "to make comparative economic analysis possible" (*de Groot* et al. 2002: 393). Three years later, the *Millennium Ecosystem Assessment* (*MA* 2005), a UN initiated, global research offensive on the status and future of the world's ecosystems and their connection to

human well-being, defined ecosystem services as the range of functions fulfilled and services naturally provided by ecosystems to the benefit of humans (*MA* 2005).

It identified the different categories of *supporting*, *provisioning*, *regulating* and *cultural* ecosystem services. Enabling life to develop and a diversity of species to thrive in ecosystems is secured by the existence of functioning nutrient cycling through soil-microbial activity, which also contributes to soil formation and allows for primary plant production. These 1) *supporting* services form the basis of ecosystems and hence allow for such concepts as human well-being to evolve in the first place. Humans extract direct goods such as food, construction materials, fuel, fibres or fresh water from ecosystems, which the *MA* classified as 2) *provisioning* services; indirect goods such as regulated climatic conditions (e.g. carbon sequestration), clean air, reduced erosion, protection from floods, control of diseases and pests or clean water, which are grouped as 3) *regulating* services; and 4) *cultural* or spiritual goods that humans derive from the recreational, aesthetic and educational facets provided by ecosystems (*MA* 2005).

Economic processes impose a significant strain on ecosystem functioning and service provision by transformation and pollution (*Farley* 2012). Also fostered by political objectives, for instance increasing yields, modern farming practices including the use of chemical inputs or irrigation usually enhance provisioning services of ecosystems while at the same time reducing their ability to carry out regulating or cultural services (*Gordon et al*. 2010; *MA* 2005). Ecosystems provide services free of charge and non-marketed services often need to be paid for only when the environment is no longer capable of performing them (*Farley* 2012; *Farber* et al. 2002), foremost due to human activity (e.g. water treatment costs). The costs for replacing natural with artificial services are usually carried by the whole population of a country or region affected, rather than individuals responsible for the environmental impairment (e.g. farmers applying excess fertiliser), “a classic externality problem” (*Polasky* 2008: 45).

The difficulty of dealing with these externalities is an apparent shortfall of the capitalist system. Unlike provisioning services, regulating, supporting and cultural services are often not paid for by users as they cannot be individually owned or exclusively used by one person (*Farley* et al. 2011). However, there are some market-based instruments such as organic certification to enable consumers to pay for a reduced impact on agricultural ecosystems if they wish.

Addressing the question of how to incorporate the value of ecosystem services in value creation, it is helpful to consider how ecological value is understood and attributed in environmental policies. There are two main perspectives on the value of ecosystems: the instrumental or anthropocentric perspective and the intrinsic or biocentric perspective (*Farber* et al. 2002; *Goulder* and *Kennedy* 1997). The biocentric perspective understands ecosystems or nature to have intrinsic value or rights to existence and well-being regardless of its use to humans (*Goulder* and *Kennedy* 1997). Contrary to this, the anthropocentric interpretation focusses on a utilitarian understanding of ecosystem value, where only processes directly (e.g. food) or indirectly (e.g. enabling future life) related to human well-being have value.

Following this understanding, ecosystems are attributed use or non-use values for economic assessment (*Pandeya* et al. 2016). Characteristically, people derive satisfaction from non-use values without being physically involved with the natural object, e.g. by knowing about the continuity of ecosystem existence or the accessibility for other people (*TEEB* 2010; *Goulder* and *Kennedy* 1997). Use values are further differentiated into direct use values, which again can be consumptive (e.g. food) or non-consumptive (e.g. tourism), indirect use value, which are related to regulating services (e.g. water purification), and option values, which are defined as the meaning people attribute to the future existence of services for their own, individual benefit (*TEEB* 2010).

These different paradigms and distinctions need to be considered when defining the value of ecosystems. Furthermore, assigning a market value can be complicated because of the intangible characteristic of many services, which makes them non-excludable and non-rival (*Farley* et al. 2011). It is more difficult to define the market value for many regulating, supporting and cultural services (e.g. erosion control), while this is easier for many (e.g. food) but not all (e.g. straw, grass) provisioning services (*Farley* et al. 2011). Since agricultural ecosystems produce both marketable and non-marketable goods and services, the value of services can remain underestimated within free markets (*Costanza* et al. 1997). However, using, for example, stated preference techniques to value ecosystem services can also lead to an overestimation of economic value through hypothetical bias (*Loomis* 2014; *Murphy* et al. 2005).

Work on the commodification of ecosystem services started to occur in the 1970s and 1980s, when their utilitarian understanding was promoted as a communication tool, yet

work on monetary valuation increased in the 1990s in order to make the ecosystem service issue more appealing to decision makers. Environmental economics aimed at overcoming the under-valuation caused by accounting for the marketed ecosystem services alone, by developing different possibilities to put value on non-marketed services (*Goméz-Baggethun* et al. 2010).

Direct market valuation techniques use real and easily accessible data. Techniques focussing on *market prices* of goods provided by ecosystems use these prices for indicating the value for the associated services (*TEEB* 2010). Valuation of ecosystem services based on *production functions* uses the effect of one ecosystem service on a second, which is traded in markets, by assessing the change in one ecosystem service on economic activity and sold output (*TEEB* 2010). The difficulty with direct market valuation is that it can only be applied on services where data is available, i.e. marketed services, which in the case of agricultural products can at the same time be skewed due to subsidies or other market interventions, and thus prices and costs may not provide a realistic estimation of value (*TEEB* 2010).

Indirect market valuation techniques utilise costs, additional income or prices for other products or services resulting from the (absence of) service provision. Techniques such *avoided* or *replacement cost* utilise costs and expenses that may be absent when ecosystems are able to provide certain services such as nutrient cycling or flood control (*Goulder* and *Kennedy* 1997; Farber et al. 2002). *Factor income* and *Hedonic pricing* consider the added value that ecosystem services have contributed to directly related or associated goods such as water purification improving the condition of fisheries or aestetically appealing ecosystems increasing the value of houses nearby (*de Groot* et al. 2002). Difficulties with these methods arise again on the availability of data and market biases (*TEEB* 2010) as well as challenges in linking non-use services to output values (*Kontoleon* and *Pascual* 2007). Also, valuation measurements based on demand curves will subsequently be influenced by purchasing power, thus giving a greater weight to wealthier individuals in determining the value of ecosystem services than poorer people (*Farley* 2012). Furthermore, it is possible to allocate monetary values to ecosystem services through revealed preference concepts (*TEEB* 2010). Yet, it remains questionable how reliable these methods are regarding the assurance of people's understanding of the different options and possible discrepancies of stated and real-life choices (*TEEB* 2010).

In addition to considering methods of valuing ecosystem services through market valuation or stated preference concepts alone, approaching sustainability shifts in agricultural ecosystems can also involve broader economic instruments aimed at biodiversity conservation as they have been shown to foster the provision of non-marketed services (*Pirard* 2012). These include, for example:

- Regulatory price signals
- Voluntary price signals
- Tradable permits
- Direct markets
- Cosean-type agreements, incl. payments for ecosystem services

Fiscal measures, which are put in place in order to inhibit negative environmental externalities and promote positive externalities through taxation or subsidies (e.g. agri-environmental measures) are called *regulatory price signals*. While there is overlap in the result of changing the price or the production cost of a product with *voluntary price signals*, the two measures work in different ways. Regulatory price signals are likelier adopted on a broader scale as part of fiscal policies, whilst voluntary price signals need producers to communicate the positive externalities of their production to consumers in order to achieve a premium on the market price (e.g. organic certification). In contrast to price signals, *tradable permits* do not depend on the existence of a market, yet create a market for a specific environmental issue with the aim of managing scarce resources (e.g. emission trading, fishing quotas). To differentiate, *direct markets* are those markets set up to solely trade certain environmental products or services, without interference from outside (e.g. ecotourism). Lastly, *Cosean-type agreements* are spontaneous, contractual transactions without public interference that relate to specific cases in which positive externalities are paid by the beneficiaries to the producers. This category includes the widely applied scheme of *payments for ecosystem services* (PES) (*Pirard* 2012; *Wunder* 2005).

PES are voluntary transactions between at least one supplier of ecosystem services and at least one buyer or user, who pays for the provision of a well-defined ecosystem service or a land use likely to promote it, if this service is actually provided (*Wunder* 2005). This conditionality was maintained in a revised version of this definition (*Wunder* 2015), which adapted to the practical constraints of monitoring ecosystem services by referring

to "agreed rules of natural resource management for generating offsite services" (*Wunder* 2015: 241). Buyers of ecosystem services can either be direct users of the service or act like a third party for users, which would typically apply for public bodies such as governments and state agencies, but also international environmental or financial institutions and NGOs (*Engel* et al. 2008).

While PES have similarities with environmental subsidies in the sense that they incentivise desired ecological outcome, they are directed at more specific cases and aim less at a general change of production models (*Wunder* 2005) but more at the users of ecosystem services, thus being demand oriented (*Engel* et al. 2008). Payments can include, for example, product-based price premiums for ecological production practices or land-based approaches such as use-caps for an agreed amount of land (*Wunder* 2005). While Wunder recognises some overlap with environmental certification schemes, it is emphasised that these price premiums differ from PES insofar as the ecosystem services are traded in bundles as part of the product, which is traded in already existing markets (*Wunder* 2015).

Additionally, to considering how environmental value can be added to products, the following sub-chapter explores the concept of alternative food networks to understand opportunities and barriers of marketing products closer to consumers.

2.3 Alternative food networks

The industrialisation, concentration and specialisation of the food system has not only come with various consequences for the environment, but also led to a growing distance between places of food production and consumption. In the dominating systems of food supply, processing and distribution, power relations are largely hierarchical, with retailers being able to influence actors further upstream in the value chains and reaping big shares of product values. Opposition to these developments in the food sector arising on both the consumers' and producers' side was enhanced when different food scandals in the 1980s and 90s provoked a growing interest in the traceability of food (*Feldmann* and *Hamm* 2015; *Goodman* and *Goodman* 2009). In Italy, "the deep cultural value of Italian gastronomy and of regional peasant traditions as well as the regulation of products of excellence" (*Sassatelli* and *Scott* 2001: 224), which are closely linked to the perception of food as an affirmation of identity (*Brunori* et al. 2013), are important for understanding

how producers, consumers and regulators have reacted to food policy issues linked to an increasingly globalised food system (*Sassatelli* and *Scott* 2001).

The Italian context of AFNs is different from other European places such as the UK or Germany simply because agricultural industrialisation was not as far advanced when the post-productive "turn to quality" emerged in the 1980s and 90s, which "fell on fertile ground precisely because of the persistence of a differentiated, diversified system of production and a rich diversity of food traditions" (*Fonte* and *Cucco* 2015: 286). Some of the most important actors with regard to alternative food networks in Italy are the organisations Campagna Amica (Friendly countryside) and Slow Food, the organic movement and civic food networks such as farmers markets, urban gardening, social agriculture and solidarity purchasing groups (Gruppi di Acquisto Solidale) (*Fonte* and *Cucco* 2015).

The Campagna Amica Foundation was established by the farming federation Coldiretti in 2008 with one of the aims being a better connection of consumers and producers. At their core is a certification scheme with voluntary labelling, that includes matters of origin of products as well as rules for direct selling, e.g. on pricing. The Slow Food organisation places the cultural diversity of food at the centre of their narrative and therefore works towards marketing strategies aimed at encouraging consumers to buy endangered foods through the education of tastes. Solidarity purchasing groups have developed as a main feature of civic food networks. These groups of households combine their purchases of food and other goods on the basis of ethical values that include environmentally friendly production or organic methods, locality and seasonality of produce, short distribution channels, workers' rights and fair compensation alongside democracy and sovereignty of actors in the food chain. In all of this, close connections between producers and consumers are essential (*Fonte* and *Cucco* 2015).

Consumers starting to question the origins and production methods of food not only in terms of food safety, but also on issues such as pollution or animal welfare, has increased demand for local food, which is perceivably easier to monitor (*DuPuis* and *Goodman* 2005; *Murdoch* et al. 2000). Paired with the idea that local production and distribution are not only more environmentally friendly but also provide a range of economic and social advantages for ethical food sourcing, an alternative system of food production

focussing on sustainability, quality and safety has developed parallel to the existing dominant food system (*Ilbery* and *Bowler* 1998, *Ilbery* and *Maye* 2005a).

While it is difficult to define "alternativeness", it could, in its basic meaning, be understood as the deviation from the mainstream farming regime (*Fonte* and *Cucco 2015*). At the centre of these alternative food networks is the recovery of control over the production, distribution and prices outside the consolidated structures of the industrialised food system as well as the reconnection with consumers and nature as a basis for agricultural production. The focus of AFN is thereby on the quality and safety of food rather than production quantity, while emphasising trust as a centre piece of the interaction between consumers and producers (*Ilbery* and *Bowler* 1998; *Ilbery* and *Maye* 2005a). Under the productivist approach, quality, understood as the degree to which a product can satisfy consumer demands, was largely limited to attributes of availability and affordability. With a move towards more quality in food production policies, these expectations included a variety of attributes such as physical properties (taste, nutrition) but also externalities such as environmental impact, ethics, social justice or public health (*Brunori* et al. 2013).

AFNs are commonly characterised by small physical and/or social distances between consumers and producers (*Barbera* and *Dagnes* 2016; *Kebir* and *Torre* 2013), i.e. short food supply chains (SFSC). By removing retailers, power is shifted to both ends of the value chain, with producers gaining more independence from corporate supply structures and requirements. At the same time, consumers can engage more directly with farmers on what *Caswell* (2006: 651) refers to as "process attributes" of quality such as animal welfare, environmental impact or place of origin, thereby gaining greater choice, information and control of their food supply. The most frequently named advantages attributed to local foods relate to product quality (e.g. taste, freshness, healthiness), product safety (higher traceability), environmental benefits (production and transport), local community support, animal welfare and better conditions for farm workers (*Feldmann* and *Hamm* 2015).

SFSC can take on a variety of forms of direct food distribution, e.g. farmers' markets, box schemes, farm shops, pick-your-own schemes or more socially engaging forms such as community supported agriculture. There are three major types of alternative SFSCs, as defined by *Marsden* et al. (2000: 425f.). These are: 1) "Face-to-face", 2) "Spatial

proximity" and 3) "Spatially extended". While "Face-to-face" chains require personal contact for building and maintaining consumers' trust by direct interaction with producers from whom the product is directly bought (e.g. on farmers' markets), "spatially extended" chains expand over larger distances outside of the region of production. Since physical contact with producers is not possible, information on processes and origin needs to be supplied as customers will have no immediate knowledge of the region (e.g. online sales, home deliveries). In "spatial proximity" chains products are sold within the region they were produced in, yet not in direct contact with the producer (e.g. in a specialised shop). Information on the product is provided at purchase, while the customers will be familiar of the specifics of the region.

These definitions illustrate the difficulty of defining the local (e.g. *Hempel* and *Hamm* 2016; *Edwards-Jones* 2010; *Feagan* 2007; *Hinrichs* 2003) and alternative food networks. Often praised for a superiority to the concentrated food system, there is no guarantee that actors participating in local food *distribution* are necessarily *producing* more environmentally friendly than the consolidated system, or, indeed, that farmers involved with agri-environmental practices are necessarily part of local food networks (*Hinrichs* 2003). Yet, closer relationships between consumers and producers might mean higher levels of trust and therefore greater social pressure for maintaining higher standards in food production. While it can be argued that this is more a result of the relationships than spatial proximity itself (*Hinrichs* 2003), face-to-face distribution allowing exchange and some level of control is yet only possible because of the actors' localness.

Allowing to further abstract the analysis of alternative farming practices and their transformative power, the following chapter introduces the concept of socio-technological transitions.

2.4 Socio-technological transitions

When exploring opportunities for change towards environmentally friendly alternatives in the farming system, extending the perspective from value chain and production network discussions to concepts of socio-technical transitions can be helpful in framing sustainable change on a larger societal and political scale. *Markard* et al. (2012: 956) define sustainability transitions as "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption". Socio-technical systems can be

understood as the sum of links between elements required for performing societal tasks such as transport or nutrition, which need the production, diffusion and use of technologies in order to be fulfilled (*Geels* 2004). As socio-technical systems are the outcome of actions of human actors belonging to certain groups of shared characteristics such as firms, industries, public authorities, societal groups, research institutes and, not least, users, the fulfilment of tasks or sub-tasks will be shaped not only by the available knowledge, labour or capital but also values, perceptions, norms or regulations.

Changes in technology occurrence and use can thus only be understood when considering not only the technical aspects but wider societal and political dimensions (*Markard* et al. 2012; *Geels* 2004). A fundamental change or shift of socio-technical systems, which involves changes in processes on, for example, material, economic, political, regulatory or infrastructure dimensions as well as user practice is described as a socio-technological transition (*Markard* et al. 2012; *Geels* 2011, 2002). One concept for analysing and explaining the occurrence of these transitions is the multi-level perspective (*Geels* 2011, 2002). The primal understanding of this approach is a structure of technological systems consisting of *landscapes*, in which *regimes* are embedded, which, in turn, contain *niches*. Technological transitions occur as a result of processes within and between these three dimensions.

The *landscape* dimension as the macro level, in which *regimes* are embedded, represents the wider external societal, macro-economic and political context as well as beliefs and concerns of system actors (*Geels* 2012, 2002). As these are difficult to affect by processes from lower levels in the short term, changes on the landscape level develop gradually over time (*Geels*, 2011; *Geels* and *Schot* 2007; *Rip* and *Kemp* 1998). Pressures evolving from changes on the landscape level on the regime can lead to the creation of "window[s] of opportunity" (*Geels* 2002: 1262) for the introduction of new technologies (*Geels* 2011, 2002).

Regimes form the centre at the meso-level of socio-technological systems. They represent the sum of established institutions, networks, actor groups, coordinated and aligned techniques and practices, sets of rules and reproduced symbolic or cultural meanings (*Geels* 2011, 2004, 2002; *Rip* and *Kemp* 1998), "that determine the 'normal' development and use of technologies" (*Smith* et al. 2005: 1493). Since regimes are characterised by trialled, proven and established configurations, they form a highly stable and reliable

dimension of socio-technological systems. Yet, this also impedes opportunities for radical changes because innovations are often limited to the reproduction of problem-solving capabilities of the regime actors. Thus, innovations occurring as incremental adaptations move regimes along stable but slow trajectories of change (*Geels* 2011).

Niches are spaces on the micro-level of socio-technological systems. Here, actors are working on radical innovations to challenge incumbent regime practices. While the focus is often on new technologies, niches can also be spaces for old, forgotten or overturned technologies and practices (*Markard* and *Truffer* 2008). As niches are spaces for change that do not follow the established trajectories of regimes, they are less affected by lock-in effects and therefore central for the transition of socio-technological systems (*Geels* 2011). Niches often exist within protected spaces such as subsidised projects, military institutions, laboratories or sections of markets serving particular demands (*Geels* 2011; *Kemp* et al. 1998; *Schot* and *Geels* 2008). This protection is important as it shields innovations from market selection processes of the regime that can be a disadvantage (*Schot* 1998), and thereby gives room for learning processes as well as the development of social networks related to the innovation (e.g. relationships between producers and consumers) (*Geels* 2002).

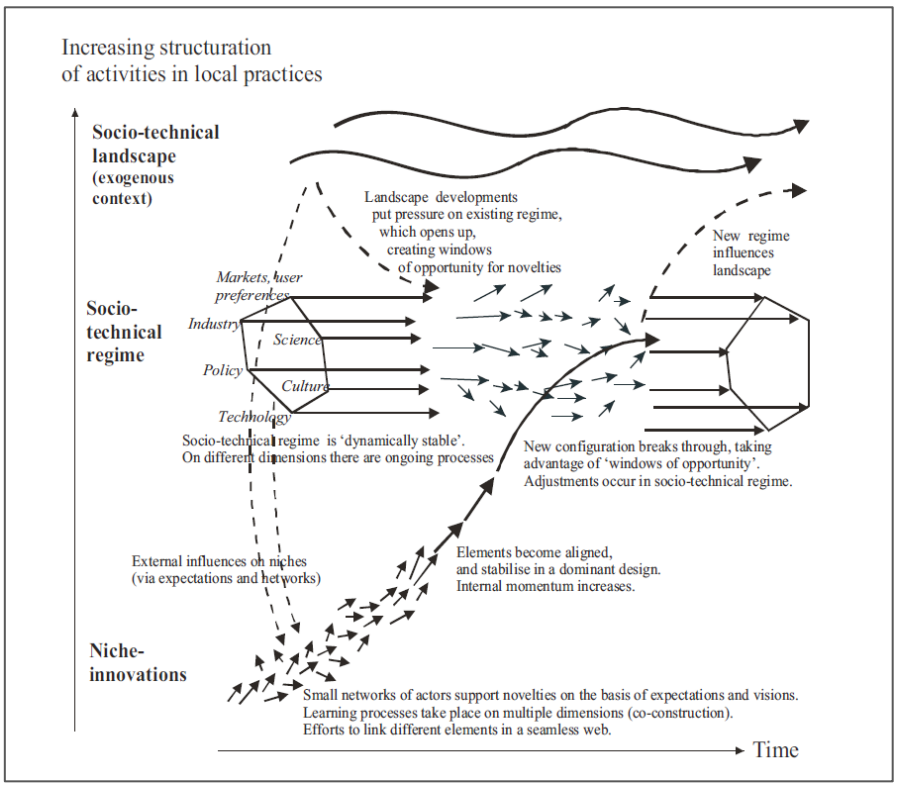

Figure 2.2: Multi-level perspective on transitions (Geels 2011: 28 (adapted from Geels 2002))

There are three main social interactions contributing to niches and their innovations gaining momentum, thus becoming a more stable part of systems and more challenging for established regimes (*Geels* 2012, 2011). These include the formulation of *expectations and visions*, which supply both guidance for niche actors and attract attention for external actors; the formation of *social networks* for a broadening of actors and capital involved; and *learning processes* of different kinds such as technical setups, market/consumer preferences, regulations or societal/environmental effects (*Elzen* et al. 1996, *Kemp* et al. 1998 cited from *Schot* and *Geels* 2008; *Geels* 2012).

Processes of system transitions follow a general dynamic, even though every transition is different (*Geels* 2012). Fig. 2.2 illustrates these dynamics on the different levels of a socio-technological system, showing that "there is no single 'cause' or driver. Instead, there are processes on multiple dimensions and at different levels which link up and reinforce each other" (*Geels* 2012: 474). These include niches and innovations gaining momentum when the above described internal interactions lead to greater acceptance of more exact and better-established ideas and procedures or the expansion of the network, especially regarding powerful stakeholders increasing legitimacy and resources (*Geels* 2011). At the same time, pressures from the landscape level and a destabilisation of regime configurations can open opportunities for niche innovation (*Geels* 2012). Thus, innovations in niches can be adapted more widely only when there is interaction with ongoing processes at the regime and landscape level and can even transform the regime from the inside when absorbed as solutions to certain problems (*Raven* 2006; *Schot* and *Geels* 2008).

The following chapter introduces the research design as well as methods used, and gives an overview of Umbria and Lazio as research areas in Italy.

3 Research design and methods

The study for this dissertation was loosely tied to the Horizon 2020 research project SustainFARM, which between 2016 and 2019 aimed at increasing the environmental and economic performance of integrated food and non-food farming systems, which include the combination of crops, trees and animals at different scales.

The research of this dissertation is embedded in the field of agroecology and a required shift towards sustainable farming practices. Agriculture can be identified as one of the major drivers of advancing climate change, soil degradation and biodiversity decline. While alternatives to the incumbent, often harmful industrial farming practices exist, for farmers a change towards sustainable farming practices needs to be economically viable. Valuing the environmental benefits provided by agroecological practices such as agroforestry can be considered an opportunity for making a transition more attractive to farmers. Yet, while there is a substantial amount of literature on the environmental benefits of agroforestry systems, less work seems to have been done from a social science perspective focussing on economic and marketing considerations. However, understanding the marketing and distribution strategies already utilised by farmers can first give an insight into how valuation of ecosystem services from agroforestry systems can be achieved, or what is required to make this possible.

After an initial review of academic literature on the possibilities of valuing ecosystem services, and attitudes of farmers and other stakeholders on economic and practical implications of farming in agroforestry systems, the research design was developed based on the theoretical concepts of GPN and GVC analysis. These were identified a suitable approach for the multiple layers of production, marketing and distribution and their implications for the overall farming systems. A qualitative research approach was found to be most suitable to explore this research field as it allows for the work on small case studies in largely untapped research fields.

Data was collected in semi-structured interviews in February 2018 with support of the Italian project partner in the regions of Umbria and Lazio, which were identified as an interesting study area due to the known existence of agroforestry systems. Subsequently, the gathered information was processed, analysed, put into writing and lastly submitted for publication.

3.1 Qualitative data collection and analysis

The methodological debate in empirical social research is split in the two directions of quantitative and qualitative methods for systematically collecting and analysing data about social phenomena. These two strands are based on different understandings of the social world: positivism and interpretivism. While positivistic researchers understand the social world as a true, unchangeable and quantifiable reality, interpretive researchers see reality as a social construct, which can be assessed and changed by subjective meaning (*Rahman* 2017; *Corbetta* 2003). This also leads to differences in the nature of findings: while quantitative methods tend to answer questions of 'what', qualitative research also asks for the 'how' and 'why' (*Lune* and *Berg* 2017). In social research, quantitative methods such as standardised questionnaires or experiments aim at measuring comparably stable patterns defining social structures through simplification and result in hypothesis testing (*Lune* and *Berg* 2017; *Auerbach* and *Silverstein* 2003). Interpretative or qualitative research, on the other hand, is useful for gaining profound understanding of the meanings underpinning those larger patterns as well as studying conditions of exceptions and special cases (*Lune* and *Berg* 2017). Qualitative methods including interviews, focus groups, observations or content analysis of media excerpts result in hypothesis generation through theoretical coding (*Auerbach* and *Silverstein* 2003).

Quantitative data is analysed by applying standardised arithmetic or statistical operations, whereas qualitative research requires a systematic interpretation of information from texts (*Franklin* 2013). Thus, qualitative research methods are particularly interesting where hypothesis formulation or selection of dependent and independent variables is not possible because too little is known about a research field, and where the answer to research questions cannot be expressed numerically because they concern subjective meaning (*Auerbach* and *Silverstein* 2003). Since there is very limited information on the strategies of Italian agroforestry farmers concerning the marketing and distribution of their products and the incorporation of ecological benefits in product valuation, a quantitaive assessment was considered an unsuitable option and a qualitative approach was chosen instead.

Yet, the focus on experiences and subjective perceptions in qualitative methods can also be considered a disadvantage, since contextual circumstance is sometimes disregarded, even though context is crucial in the formation of meanings (*Rahman* 2017;

Silverman 2010). In the present work, this issue was addressed by a desktop study of the Italian context of food production and distribution (see chapter 3.2). Another limitation of qualitative studies is the small sample size compared to quantitative studies, which is the result of the complex and time-consuming nature of qualitative data collection and analysis. In consequence, broad generalisations of results are strongly limited, whereas these are possible for quantitative methods, which allow for the assessment of large sample sizes in a comparably short time (*Flick* 2015). This is true for the results of the present study as well, which need to be considered within the research context and can only be generalised for comparable settings. It is thus not possible to formulate broad conclusions valid for the whole of the farming sector, but only those parts considered in the analysis.

Qualitative research offers a variety of methods to approach the reality of the research field e.g. qualitative interviews, focus groups, observed behaviour, participant observation or a review of documents, media and archival artefacts (*Ravitch* and *Mittenfelner Carl* 2016; *Auerbach* and *Silverstein* 2003), and it is important to be aware that these, while placing different demands on the researcher, will also be more or less suitable for collecting information on different topics. Since the information required for answering the outlined research questions was concerned with a mixture of farming operations, business transactions and not least experience, a narrative format was preferred over an observant one. Yet, information was highly dependent on the different farming conditions and individuals working with them, while being sensitive in terms of subjective opinion, motivation, marketing strategies and financial situation. For these reasons, qualitative interviews were chosen as the preferred method over the collection of data in focus groups. Furthermore, interviews allow for research settings close to the everyday life of participants, and can support a thoroughness of data collection by explication and interpretation, although this is also dependent on the behaviour of the interviewer (*Lamnek* and *Krell* 2016) and the willingness of the interviewee to share information.

There are three main types of interviews, which can be considered the mostly used method in qualitative data collection: structured, unstructured and semi-structured (*Roulston* and *Choi* 2018; *Lune* and *Berg* 2017). Structured or standardised interviews ideally produce comparable answers (*Babbie* 2007) by relying on a stringent order and wording of questions with no possibility to add questions or deviate from the given structure. This

makes these survey-style interviews interesting for uses on large projects with multiple interviewers, or for studies assessing the same phenomena at different points in time (*Lune* and *Berg* 2017).

Unstructured interviews form the opposite end of the spectrum by maintaining a loose structure featuring themes defined by the interviewer in advance, yet leaving it to participants in which order or how deep to talk about them, the interview thereby more taking on the form of a conversation (*Roulston* and *Choi* 2018). Comparing unstructured interviews to "an improvised performance in which the performers have agreed in advance on the underlying themes and purposes, but left the details to be worked out in the moment" *Lune* and *Berg* (2017: 69) conclude that unstructured interviews are a good choice in unpredictable settings with an expected diversity of answers, for accompanying observational studies or even content analysis of archival documents.

In semi-structured interviews, the interviewer uses an interview guideline to structure and steer the conversation without narrowing the subject matter too much in advance (*Mattissek* et al. 2013). It typically includes questions to be asked, yet the order and application remain flexible, which enables the altering of wording to fit it to the interviewees circumstances or adding of detailed probing questions during the interview, keeping the process open for new findings (*Lune* and *Berg* 2017; *Ravitch* and *Mittenfelner Carl* 2016; *Lamnek* and *Krell* 2016; *Mattissek* et al. 2013). Data for this dissertation was collected using semi-structured interviews as this method provides great flexibility while offering an initial level of structuring information already during the data collection process. Furthermore, the interview setting was somewhat predictable enough to prefabricate themes, questions and probes relating to the aims and research questions of this study while still keeping the process open.

3.1.1 Selection and overview of case studies

Due to ties to the EU SustainFARM project, the selection of case studies was made in the regional context of the Italian project partner, the *National Research Council – Institute of Research on Terrestrial Ecosystems*, situated near Orvieto in Umbria, Italy. The institute had previously worked with some of the interview partners, which meant a willingness of farmers to participate and a high confidence of the project partner that they would be suitable for the research questions. Further farmers were identified using the networks of the project partner, with the selection criteria focussing on the existence of a

silvopastoral system rearing livestock in olive groves, woodlands or wood pastures, so that a total of nine farms were purposefully selected for the study (Tab. 3.1). One farm (Farm 6) was excluded from the case study after data collection as its minimal output was not marketed but used only for private consumption.

Table 3.1: Summary of studied systems

Code	**Region**	**Size (ha)**	**Livestock Type**	**Products**	**Agroforestry Site**
F1	Umbria	46	Sheep	Cheese, olive oil	Olive grove
F2	Umbria	24	Pigs, poultry, rabbits	Eggs, olive oil, pork cuts, poultry, rabbits	Olive grove, woodland
F3	Lazio & Umbria	200	Pigs	Pork charcuterie	Woodland
F4	Lazio	33	Pigs, poultry, rabbits, sheep	Eggs, olive oil, poultry, pork cuts	Olive grove, woodland
F5	Umbria	23	Beef cattle	Beef cuts	Woodland, wood pasture
F6 **(excluded)**	Umbria	10	Sheep	Private use only	Olive grove
F7	Lazio	200	Pigs	Pork charcuterie, pork cuts	Woodland
F8	Lazio	500	Poultry	Eggs, olive oil, poultry	Olive grove
F9	Umbria	12	Goats, pigs	Goat's cheese, chevon, pork charcuterie	Woodland, wood pasture

Farm 1 (F1) is a 46 hectare (ha) sheep farm, who graze their livestock among olive trees. They produce and sell the cheese directly on farm, while the olive oil is marketed both directly and through production groups. Furthermore, the farmers join tasting events and have an aspiration to offer educational programmes about environmental farming practices in the future. Their main stance on quality is the ecological benefits of silvopastoral production, taste, heritage and artisan production methods.

Farm 2 (F2) is a 24 ha farm that keeps different types of poultry (e.g. broilers, laying hens, ducks, pigeons) and rabbits in their olive grove. Pigs were introduced to the farm woodland as an addition to the business at the point of data collection. They have a farm shop from which they sell meat and eggs, deliver to private households and sell to

restaurants or butchers in the region. They are planning on setting up courses on nutrition, also in collaboration with local schools.

Farm 3 (F3) is a 200 ha farm, whose wide range of activities are split across four locations. At the agroforestry site, pigs are kept in an 80 ha woodland. The animals are bred by the farmers themselves, whilst processing of the animals is contracted. The meat is sold through farm owned agritourism outlets (restaurants, holiday homes) and their own shop in Rome. The main quality attributes marketed are the artisan production, the nutritional composition of the meat and an organic certification, which is linked to production without agrichemicals.

Farm 4 (F4) is a 33 ha farm with agritourism enterprises (restaurant and holiday homes), raising different kinds of animals (poultry, pigs, sheep) also in olive groves and the farm woodland. Slaughtering of poultry and processing of the meat is undertaken on the farm and products are sold through the farm restaurant, to holiday guests, to restaurants and shops outside the farm and via home delivery. Important quality attributes are the non-industrial production methods, chemical-free meat and organic certification.

Farm 5 (F5) is a 23 ha farm integrating the management of their woodland and wood pasture with the rearing of a group of cattle. Processing of the meat is undertaken by a contractor on farm and products are sold through agritourism outlets (restaurant and holiday homes), which makes up most of the business' revenues, and through household delivery.

Farm 7 (F7) is a 200 ha farm, where among other enterprises of the farm, pigs are partly reared in woodlands. Products (mainly cured pork) are sold directly off farm, to guests of the farm's holiday homes, restaurants and shops and to export. Quality attributes include the nutritional composition of the meat and organic certification.

Farm 8 (F8) is a 500 ha poultry farm raising broilers, laying hens and turkeys in olive groves, whose activities are split to multiple locations. Slaughtering and processing of the animals is done in-house, and they own a mill for olive oil production. Products are sold through farm owned shops, to restaurants or canteens and exported.

Farm 9 (F9) is a 12 ha farm that raises dairy goats and a small flock of sheep, which are grazed on wood pastures and a group of pigs with access to woodland. Goat's cheese is produced on the farm, while the meat products (pig and goat) are processed by an external

contractor. Products are sold directly off farm, to guests of the farm's holiday homes, to restaurants, shops and through household deliveries.

3.1.2 Interview guideline and execution

The interview guideline is a tool used for qualitative data collection in interview settings. It contains a list of questions, which the researcher prepares to ask the interviewee, yet its application is not bound to a strict sequence allowing for a flexible order of topics (*Lune* and *Berg* 2017; *Mattissek* et al. 2013). While this ensures some level of comparability and triangulation, and thus loosely relates to the substance of the data collected (*Mayring* 2016), it also prevents suggestive proceedings (*Gläser* and *Laudel* 2010; *Mayer 2009).* This enables the researcher to keep the process of data collection open to new findings and ideas and to add, withdraw or exchange questions during and after interviews (*Lune* and *Berg* 2017; *Lamnek* and *Krell* 2016). In order to structure the flow of the interviews for this study, a guideline was designed, which was based on the research questions, the GPN and GVC concepts and a literature review on agroforestry benefits and practices. Understanding the questions rather as a stimulus to talk about what seems relevant for the interviewed farmers (*Lamnek* and *Krell* 2016; *Gläser* and *Laudel* 2010), it featured mainly open, leading questions, with more specific, closed questions for more targeted inquiries e.g. concerning production volumes, processes and durations, farm sizes or pricing of products. The interview guideline was broadly structured in the following groups of themes (see Annex I for the full interview guideline):

- General information on the farm and inputs
- Production and processing activities, specifically related to agroforestry systems
- Marketing and distribution of products
- Administrative and financial support
- Environmental production schemes

All interviews were conducted face-to-face on the interviewees' farms to offer a familiar and comfortable setting and permitted a tour of the farms before or after the interviews. This facilitated a more thorough understanding of the farms' production system and allowed for cross-checking of information, the recollection of more pertinent detail for farmers and more time for follow-up questions. All interviews took between one and two hours. Three interviews were conducted in English, four had to be fully translated from Italian to English during the interview and two were partly translated. While some short

answers could be translated word by word, longer explanations were summarised by the translators at the end of farmers' explanations or statements. All farmers agreed to the interviews being recorded using a dictaphone.

3.1.3 Data processing and analysis

Based on the assumption that social reality is constructed by the interpretation of actions and communications of people, to depict a state as close to this reality as possible in turn needs interpretation of gathered data on the part of the researcher (*Mayring* 2016). Due to the characteristic of openness, qualitative data collection methods can produce large amounts of material. To establish which material is relevant for answering the research questions, the researcher must interpret the collected information.

As a first step, information needs to be made usable for further analysis, which often means to transform audio or video recordings into text (*Ravitch* and *Mittenfelner Carl* 2016) through the process of transcription "rendering […] data into a new representational form" (*Gibson* and *Brown* 2009: 109). Yet, *Ravitch* and *Mittenfelner Carl* (2016) argue that the transcription process should already be viewed as an interpretative rather than mechanical/neutral action and therefore call for it to be as verbatim as possible. While acknowledging that leaving out omissions and interruptions from the transcripts as performed with the data for this dissertation reflects some kind of interpretative authority (ibid.), this was rated an acceptable minor change for improving the overall understanding of data, especially since the original grammar used by interviewees was maintained in the transcripts.

Subsequent to the transformation of recordings into text, there are two major ways of analysing qualitative data: performing content analysis or other types of categorisation aimed at a reduction of the material, or the expansion of material by producing one or more interpretations of statements, which are often longer than the original material *(Flick* 2013). Yet, as any categorisation process ultimately includes some element of interpretation and equally interpretations will begin to identify some sort of pattern at some point, both strategies are often adopted simultaneously (ibid.). In this dissertation, both approaches were applied as well. First, a content analysis was conducted in order to systematically examine and order the gathered information and create data in the form of codings (*Lune* and *Berg* 2017). These were organised based on a category system

designed to approach a state of reality capable of answering the presented research questions.

After the definition of codes, which were subject to some revision, the transcripts were sifted through multiple times and codes assigned to statements and passages using the computer software MaxQDA©. The decision to work with a software was based on high levels of clarity and overview of the category system, the ease of applying codes without crossover, the possibility to easily annotate codings and produce memos, and high levels of completeness, thus minimising the risk of overlooking statements. Categories included 6 first-level (e.g. 'Agroforestry System' or 'Output') 46 second-level (e.g. 'Livestock Operations' or 'Distribution Channels') and 29 third-level codes (e.g. 'Environmental Benefits' or 'Handling Routine'), with 1,103 codings being processed in total. A full list of applied codes and numbers of codings in each category has been included in Annex I. Coding information allowed for a more organised and focused final analysis or interpretation of the gathered information and statements relating to the common theme and research questions of this study (*Mayring* 2016; *Taylor* et al. 2016).

With data interpretation being an inductive and intuitive process (*Taylor* et al. 2016), procedures will be highly individual and difficult to universalise. This process involves a constant comparing, testing and questioning of propositions, themes, explanations and concepts, openly giving room for some to become clearer over time while some will prove unsustainable, and new ideas will be developed during the interpretation and writing stages (*Mayring* 2016; *Ravitch* and *Mittenfelner Carl* 2016; *Taylor* et al. 2016). Analysing data in such manner ultimately enables the researcher to "refine and tighten up […] ideas and gradually move to a higher level of contextualization" (*Taylor* et al. 2016: 179).

3.2 Research area: Agroforestry systems, agricultural production and retail structures in Italy

Italy is located on a peninsula of the Mediterranean Sea in the central south of Europe bordering France, Switzerland, Austria and Slovenia. Despite the Po-valley in the north and coastal plains to the south of the capital Rome, the terrain is largely dominated by mountainous areas with the Alps in the north and the Apennines forming the north-south range through the centre of the country (Fig. 3.1). A lot of the lower Apennines is in a state close to wilderness, with a variety of wild animal species such as wolves, bears or

wild boar living there (*Marino* et al. 2020). There is a distinctive imbalance of economic activity with a prosperous, industrial north and agriculturally dominated south (*CIA* 2020).

Figure 3.1: Physical map of Italy (Cartography: C. Enderle; Data: Jarvis et al. 2008)

The research regions of Umbria and Lazio are located in the centre of the country. Umbria is shaped by the upper and middle valley of the Tiber river, which is adjoined by hills on both sides, rising to the Apennines in the east. The landscape is characterised by wide basins originating from lakes or river valleys and isolated plains. While the land use for the cultivation of field and tree crops (e.g. wheat, maize, grapes, olives) is intensive, livestock rearing is extensive (*Encyclopaedia Britannica* 2015). Whilst the east of Lazio is dominated by the central Apennines, the region's western part is a coastal plain. In between lie the fertile valleys and low foothills of the pre-Apennines. The lowland areas are characterised by the production of wheat, maize, vegetables, fruit and livestock products, with vineyards and olive groves being located on the slopes (*Encyclopaedia Britannica* 2020).

According to *den Herder* et al. (2017), Italy covers the second largest area of arable agroforestry in the EU-27, of which most is managed within permanent crops such as olive, fruit and nut trees, and the rest in woodlands (Tab. 3.2). One form of arable agroforestry known as *coltura promiscua,* which alternated or mixed rows of trees and vines with arable cultivation in between rows, was a traditional, widespread feature of crop management in the central Italian regions prior to agricultural modernisation of the 1960s, yet only remains in relics today (*Paris* et al. 2019; *Zimmermann* 2006).

Table 3.2: Extent, distribution and proportion of total UAA of arable and livestock agroforestry systems in Italy based on LUCAS data (own illustration based on den Herder et al. 2017: 8, 10, 13)

	Permanent crops	**Woodland**	**Shrubland with trees**	**Grassland with trees**	**Total**	
	1000 ha	1000 ha	1000 ha	1000 ha	1000 ha	%
Arable	90.3	15.8	0	n/a	106.1	0.8
Livestock	116.2	622.4	235.2	329.8	1303.6	10.1

Agroforestry systems including livestock are occurring on a larger scale than arable agroforestry systems (Tab. 3.2). Most of these systems are established in woodlands and shrub- or grasslands with sparse tree cover and a lower proportion in permanent crops such as olives (*den Herder* et al. 2017). There are three main types of silvopastoral systems in Italy, which can be structured according to their geographical occurrence: The Alpine, Apennine and Mediterranean silvopastoral system (*Ronchi* 2009, cited from *Paris* et al. 2019). The Alpine system can be characterised as semi-extensive wood pastures including mosaics of small woods in pastures and shrubland, and low-density tree stands (e.g. larch), grazed by cattle or sheep often as part of transhumance or transterminance systems with lower areas or valleys and also Mediterranean regions (*Emanueli* and *Agnoletti* 2016, *Ronchi* 2009 cited from *Paris* et al. 2019; *Pardini* 2009).

In the central and southern Appenines, silvopastoral transhumance systems used to be of high importance for the local rural economy since the middle ages, which included the movement of animals from central lowland areas during the summer months (*Caballero* et al. 2009). Although grazing in marginal areas declined from the second half of the 20th century, there are still small herds of indigenous beef and sheep breeds grazed in wood pastures or forest clearings from the end of spring to the beginning of autumn, yet this can be considered more short-distance transterminance (*Caballero* et al. 2009;

Santilocchi and *D'Ottavio* 2005; *Longhi* et al. 2004; *Ronchi* 2009 cited from *Paris* et al. 2019). The Mediterranean silvopastoral systems include the extensive and semi-extensive grazing of beef cattle, often native breeds such as Chianina or Maremmana (*Pardini* 2009), as well as dairy sheep and goats (*Ronchi* 2009 cited from *Paris* et al. 2019). The greatest diversity and extent of Mediterranean silvopastures can be found on Sardinia, were livestock graze all year round in mostly oak-dominated systems (*Paris* et al. 2019).

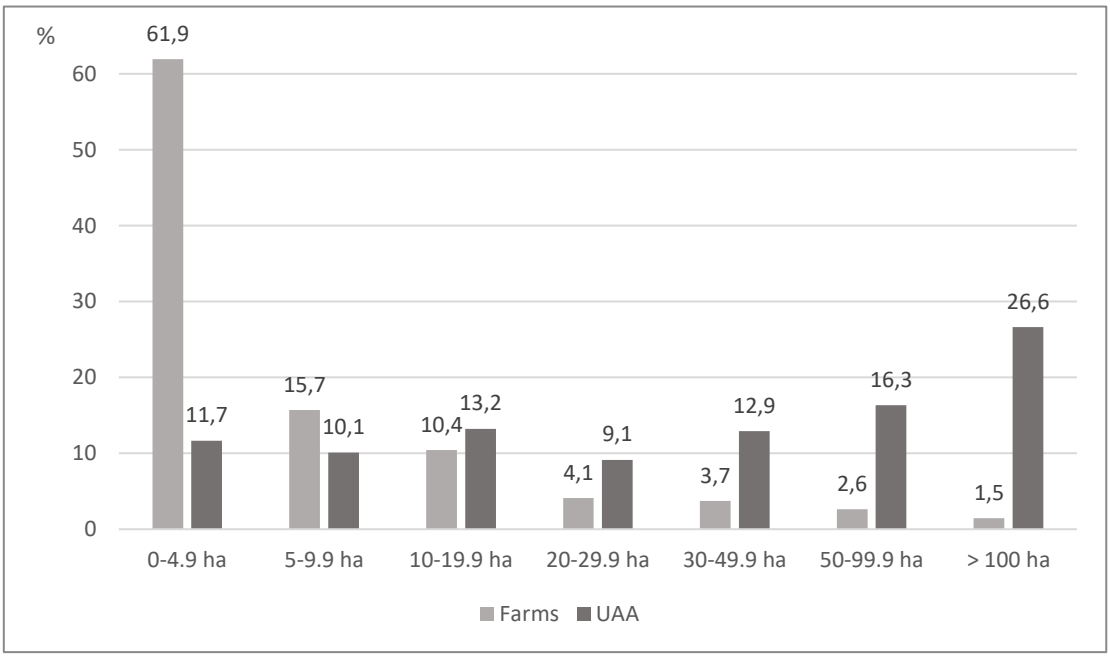

Figure 3.2: Shares of farms and utilised agricultural area (UAA) by size classes in Italy, 2016 (own calculation and illustration based on Eurostat 2018a)

In 2016, there were 1,145,710 farms in Italy; the third highest number by country in the EU-28 after Romania and Poland. Yet with 12,598,160 ha, Italy ranked only 6th place of utilised agricultural area (UAA) (*Eurostat* 2020b). With an average farm size of 11 ha per holding in 2016, the Italian agricultural sector is characterised by farms which are significantly smaller than the average 15.2 ha in the EU-27_2020 (*EC* 2020). The majority of holdings were smaller than 5 ha in 2016, while most of the UAA was farmed by a minority working with 20 ha or more (Fig. 3.2). This indicates a continuation of a concentration process of land in larger farms, which was observed for the period between 2000 and 2010, when roughly one in three farms ceased operation and the average farm size increased by 45% from 5 ha in 2000 to 8 ha in 2010 (*Eurostat* 2018b). Compared to the average distribution of farms and UAA by farm size in the EU in 2016 (Fig. 3.3), Italy shows a similar pattern of farms, apart from even lower shares in the largest classes over 50 hectares. However, UAA shares are slightly higher for the smaller size classes, and substantially lower in the largest class of over 100 ha (Fig. 3.2).

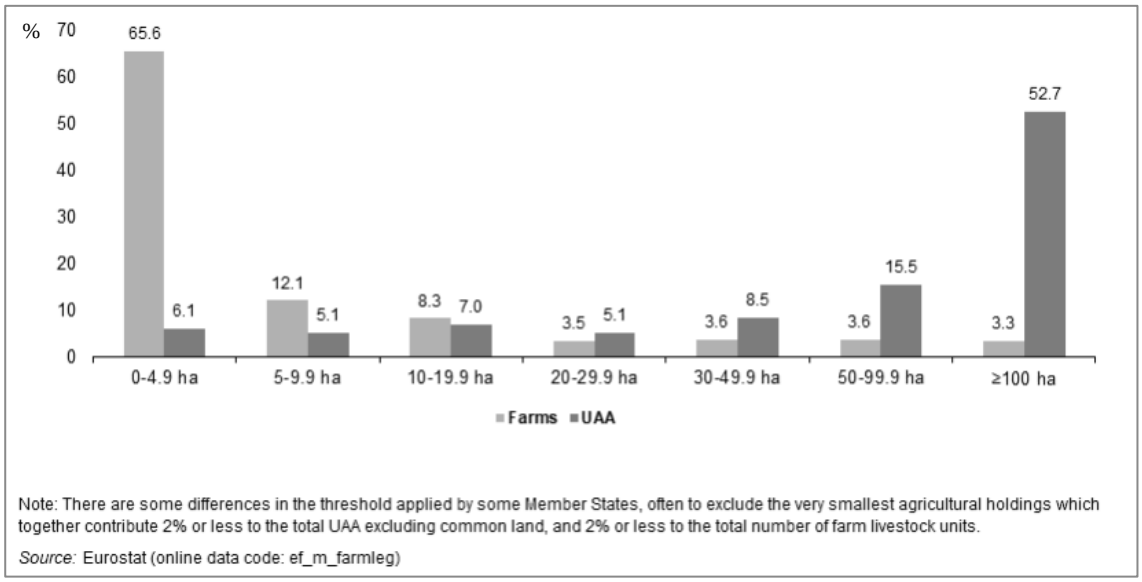

Figure 3.3: Distribution of EU farms and utilised agricultural area according to farm size, 2016 (Eurostat 2019*)*

Yet, a physical and economic divide between northern and southern regions can be observed, with sizes of holdings but also farm educational levels being considerably greater in the north. At the same time, northern regions were also more affected by concentration processes while southern regions retained some characteristics of traditional farming, with smaller farms and lower prevalence of land renting (*De Devitiis* and *Wanda Maietta* 2013). The average farm sizes in the research regions of Umbria (11.8 ha) and Lazio (9.1 ha) were only diverging slightly from the national average in 2016 (*I.Stat* n. y. a) and can thus be understood as a good representation of average farm structures.

Most of the UAA in Italy, as well as in the research regions, was used for arable production, with cereals making up the largest share in Italy and Umbria and temporary forages in Lazio (Tab. 3.3). It is notable that this share was higher in both study regions than for the national average. The second highest land use class was formed by permanent grassland, pastures and meadows, accounting for 20% in Umbria and 26.6% in Lazio, which reflects the national average of 25.7%. The same is true for permanent crops, which accounted for 17.5% in Italy and 17.9% in Lazio, whereas it was lower in Umbria with 13.1%, which can probably be explained with a higher share of land used for arable farming. While the share of olive plantations and vineyards were similar in both of the research regions while being slightly higher and lower, respectively, to the national average, the share of fruit plantations was low in Umbria and slightly higher than average in Lazio (Tab. 3.3).

In 2013 the most commonly kept livestock in the research regions were cattle and sheep (Tab. 3.4). For cattle, the average number of animals per farm was considerably lower than the national average, indicating a lower than average intensity of systems. For sheep, animals per farm were low for Umbria but higher than average in Lazio. Pigs and poultry were the next most commonly kept livestock species on farms in the study regions, where high head counts per farm in Umbria suggest more intensified systems than in Lazio. Goats and rabbits were the least commonly reared livestock type in the study regions.

Table 3.3: Agricultural area and shares of total area by crops for Umbria, Lazio and Italy in 2016 (own calculations and illustration based on I.Stat n.y.b)

Land Use	**Umbria**		**Lazio**		**Italy**	
	UAA (ha)	Share	UAA (ha)	Share	UAA (ha)	Share
Arable	**223,130**	**66.7%**	**344,218**	**55.3%**	**7,145,039**	**56.7%**
Cereals	92,944	27.8%	110,596	17.8%	3,533,860	28.1%
Fresh vegetables	4,667	1.4%	24,735	4.0%	301,353	2.4%
Temporary forages	66,306	19.8%	179,745	28.9%	2,153,889	17.1%
Industrial crops	24,966	7.5%	6,484	1.0%	429,144	3.4%
Permanent grass-land, pastures, meadows	**67,014**	**20.0%**	**165,172**	**26.6%**	**3233231**	**25.7%**
Permanent crops	**43,789**	**13.1%**	**111,425**	**17.9%**	**2,200,834**	**17.5%**
Olive plantations	30,959	9.3%	60,981	9.8%	1,032,856	8.2%
Vineyards	10,323	3.1%	12,905	2.1%	614,956	4.9%
Fruit plantations*	2,067	0.6%	36,786	5.9%	518,416	4.1%
Kitchen gardens	**685**	**0.2%**	**1,270**	**0.2%**	**19,056**	**0.2%**
Total	**334,618**	**100%**	**622,085**	**100%**	**12598160**	**100%**

*including citrus fruit

However, there is a notable difference between the regions, with Umbria showing markedly lower numbers of animals per farm than Lazio or the national average. The farms that were studied for this dissertation can be somewhat considered in contrast to the structure of livestock on farms in the regions, since most of them kept pigs and/or poultry and only one system included cattle. In 2018, Italy had the highest total number

of organic producers and processers, the second largest area of arable and permanent crops and the fourth largest area of permanent grassland under organic management in the EU *(Willer* et al. 2020b). 15.8% of agricultural land in Italy is farmed organically, making up 14% of the organic land in the EU, which is the third highest share (ibid.). Umbria accounted for 2% and Lazio for 7% of the total organic area in Italy in 2016 (*I.Stat* n.y.c).

Table 3.4: Livestock types by numbers of farms and average heads per farm in Umbria, Lazio and Italy in 2013 (own calculations and illustration based on I.Stat n.y.d)

Livestock Type	**Umbria**		**Lazio**		**Italy**	
	Farms	Heads per farm	Farms	Heads per farm	Farms	Heads per farm
Cattle	**2,038**	**22**	**10,216**	**20**	**109,417**	**49**
Pigs	**568**	**199**	**869**	**52**	**26,582**	**324**
Sheep	**2,472**	**53**	**4,001**	**145**	**60,328**	**112**
Goats	**380**	**9**	**826**	**43**	**26,849**	**35**
Rabbits	**363**	**42**	**445**	**164**	**7,636**	**902**
Poultry	**522**	**10,933**	**1,224**	**2,664**	**18,588**	**8878**
Broilers	439	8,366	575	3,376	10,912	9,232
Laying hens	381	3,495	1,147	813	14,466	2,797

In 2018, the share of agriculture to Italian GDP was 1.94% (*statista* 2020), which is almost double the share for the average 1.1 % in the EU (*Eurostat* 2020c) and agriculture accounted for 3.7% of total employment in 2019 (*EC* 2020). The majority of agricultural output in 2019 was obtained from the production of crops, of which vegetables and horticultural products formed the largest share (21.5%) of the total output, followed by wine (16%) and fruits (9.4%) (Fig. 3.4).

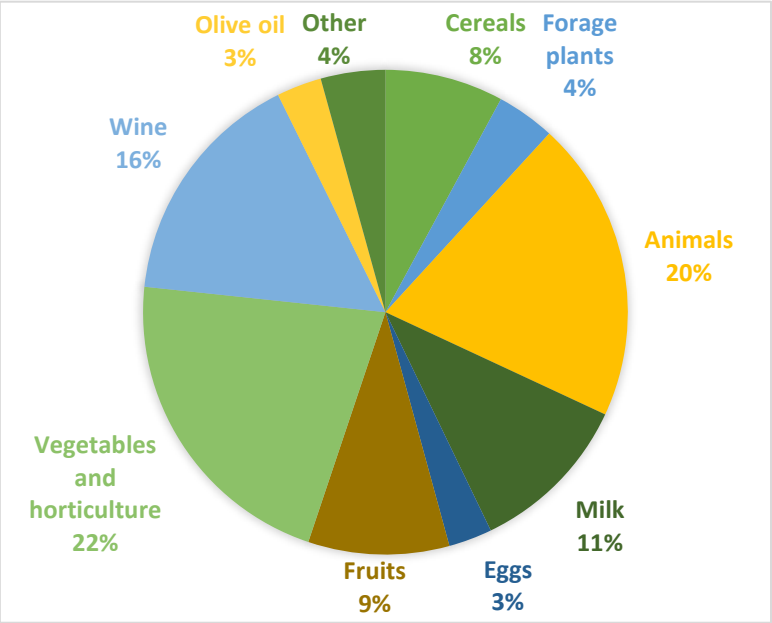

Figure 3.4: Agricultural output components 2019 in Italy (own illustration based on EC 2020; data: Eurostat)

Output from animals and animal products generated 34% of agricultural output, with milk forming the largest share of total output for this branch. Cattle and pigs contributed in equal shares to the total output (~6.3%), followed by poultry (5.4%). The share for sheep and goats to total output was low, with 0.4% (*EC* 2020).

Table 3.5: Percentage of farms by channel of product sales in Umbria, Lazio and Italy in 2010 (De Devitiis and Wanda Maietta 2013: 199)

Region	Other farms	Associations Co-ops	Consumers in markets	Consumers in house	Manu-facturers	Wholesale
Umbria	12	25	7	22	6	28
Lazio	14	24	9	21	9	22
Italy	12	24	7	15	10	33

In 2010, the main channels farmers used for the distribution of their products were wholesale, associations or cooperatives and directly to consumers on farms ("in house") (Tab. 3.5). In the research regions, selling to wholesalers and manufacturers was lower than the Italian average, while selling direct to consumers was higher indicating a greater importance of direct sales. This is still reflected in the market shares of the food retail

industry in 2018, when modern distribution formats (i.e. superstores and supermarkets, hypermarkets, discounters) made up 67.4% of food retail.

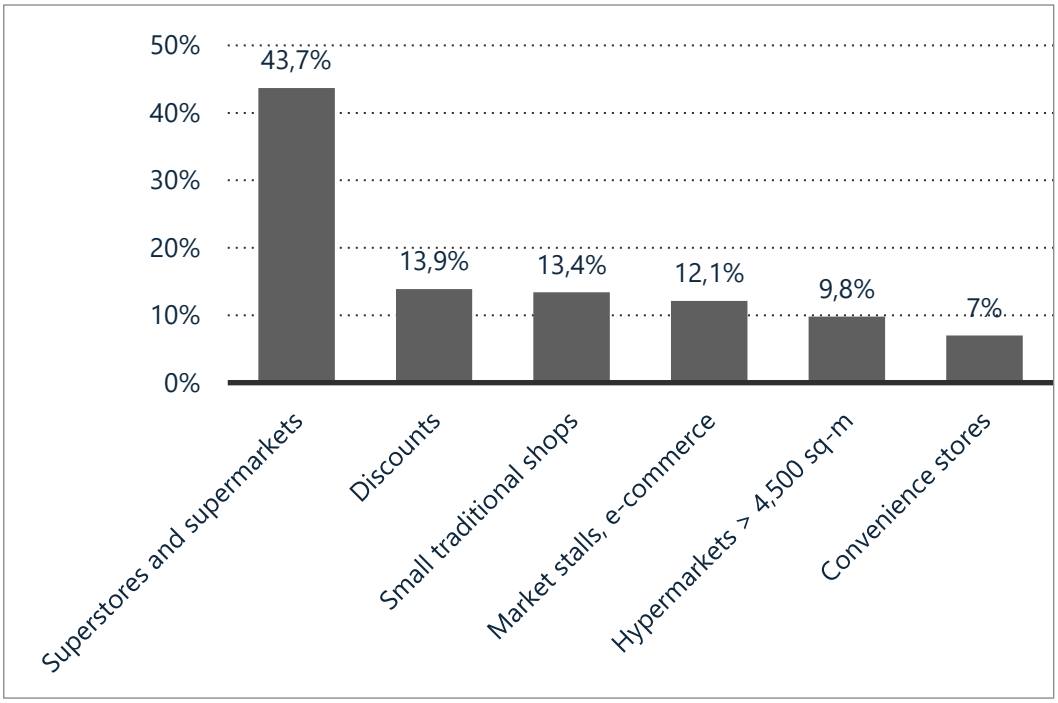

Figure 3.5: Market share of the food retail industry in Italy in 2018, by retail formats (statista 2019, data: I.Stat; Nielsen; Tradelab

At the same time, traditional modes of retail such as small traditional shops and market stalls, paired with new types such as e-commerce accounted for over a quarter of retail sales (Fig. 3.5). This shows that while the share of supermarkets and hypermarkets is greater, smallers outlets still play a significant role. For organic products this is even more pronounced with only 56% of products being sold by general retailers, while 24% are sold by specialised retailers and 20% through other channels (*Willer* et al. 2020b).

Yet, the number of traditional sales outlets has been declining since the 1970s, making their role less significant than in the past. The comparably low combined market shares of the top three retailers of 26.7% and the lack of a market leader of at least 20% (Tab. 3.6) show the high levels of fragmentation, as well as the importance of buying groups and cooperative groups (*Fornari* et al. 2013).

Table 3.6: Market share of the leading ten food retailers in Italy as of September 2019 (Distribuzione Moderna 2020: 73; data: Nielsen 2020)

Food retailer	Market share %
Coop Italia	13.4
Conad	13.3
Selex	10
Esselunga	8.9
Eurospin	6.3
Ve'Ge' Group	5.5
Carrefour Group	5
Auchan Group	4.8
Lidl Italia	4
Agorà	3

3.3 Overview of papers

The following three chapters each present one of the research papers that have been published or have been handed in for publication in the course of this dissertation. All three papers are based on data collected in February 2018. The first paper focusses on the evolution of value in silvopastoral systems and is thereby closely linked to the GPN framework and its analytical value category. The following second paper explores the choices for alternative or conventional distribution channels of the studied farms. Finally, the third paper assesses whether and how the studied farms can have an impact on the wider food system or regime.

The first paper "Capturing the value of ecosystem services: perceptions from selected Italian farms" deals with the formation and definition of value from silvopastoral systems by farmers of the studied cases. As a first step, this paper assesses whether farmers do perceive their systems to produce additional ecological values or ecosystem services. Grounded on the analytical categories of GPN theory, it is subsequently analysed how and under which circumstances these perceived values are captured by the studied farmers when selling their products. Results are further discussed with regard to different possibilities of valuing ecosystem services.

Extending the scale of analysis from the first paper, the second paper “Silvopastoral production as part of alternative food networks: Agroforestry systems in Umbria and Lazio, Italy” focusses on the regional, national and international distribution of products from the studied systems. Embedded in the contexts of alternative food networks and a growing demand for environmentally produced food, this paper assesses how farmers of silvopastoral agroforestry systems distribute their products, whether they can be considered part of alternative food networks and which consequences this entails.

The third paper “Niche formation in agroforestry: considerations from silvopastoral systems in central Italy” extends the analytical scope once more by exploring options for the studied systems to influence a wider food regime with regards to enhancing its overall sustainability. Based on the concepts of sustainability transitions and multi-level perspective, this paper assessed the positioning of the studied farmers with regards to niche formation and proliferation, identifying barriers and possible solutions.

4 Capturing the Value of Ecosystem Services from Silvopastoral Systems: Perceptions from Selected Italian Farms

Röhrig, N., Hassler, M. and *T. Roesler* 2020: Capturing the Value of Ecosystem Services from Silvopastoral Systems: Perceptions from Selected Italian Farms. – Ecosystem Services 44, 101152.

Abstract

Combining livestock and trees in silvopastoral agroforestry systems has shown to be valuable in fostering the provision of ecosystem services. For farmers, these systems provide an opportunity for diversifying their product range. This study assessed if farmers can additionally translate the ecological value into economic benefits. Applying the concepts of global value chain (GVC) and global production network (GPN) analysis, the evolution of value was analysed for eight farms in the Italian regions of Umbria and Lazio following qualitative interviews. Production benefits and ecosystem services resulting from the silvopastoral systems were perceived to contribute to product value either by (i) minimising inputs or (ii) adding value through the marketing of quality attributes such as environmentally friendly production or nutritional value. Although ecological benefits of the systems are recognised by most farmers of this study, few advertise it. Due to a lack of possibilities to label products from silvopastoral systems as such, farmers must rely on close connections to consumers for marketing or use organic certification if selling over greater distances. Designing public payments to reward the provision of ecosystem services directly could make silvopastoral farming more attractive and encourage wider application.

Keywords: agroforestry, ecosystem services, value chain, silvopasture, Italy

4.1 Introduction

The combined management of crops or animals with trees in what are known as *agroforestry systems* can be viewed as shaping "an agro-ecosystem that can create environmental, economic and social benefits" (*Prabhu et al.* 2015: 204). Integrating trees or shrubs with at least one other agricultural crop or pasture for grazing animals at the

same site (*Mosquera-Losada* et al. 2009; *Nair* 1993), *agroforestry systems* allow for multiple uses and create opportunities for more effective land use. The combination of the selected agroforestry components (e.g. trees, shrubs, hedgerows, crops, pasture, livestock) needs to be set up and managed intentionally in order to derive multiple products from the same land. Moreover, agroforestry systems can be managed intensively to sustain productivity, which may include cultivation, fertilisation, irrigation or pruning (*Gold* and *Garrett* 2009). So-called "silvopastoral systems" combine the management of trees or other woody perennials, forage and livestock on the same site (*Jose* et al. 2019; *Cubbage* et al. 2012). Managing land in agroforestry systems offers not only economic stability and income diversity (*Prabhu* et al. 2015), but can also foster the provision of regulating ecosystem services such as carbon storage, biodiversity enhancement, wild fire prevention or erosion control, supporting ecosystem services such as efficient nutrient cycling and thereby reduced leaching and cultural services such as heritage values (*Jose* et al. 2019; *Moreno* et al. 2018, *Torralba* et al. 2016; *Jose* 2009). In contrast to provisioning services (e.g. food, fibre) provided by most types of agricultural ecosystems for human use, regulating, supporting and cultural services are often not paid for by users. As they cannot be individually owned or exclusively used by one person, they are difficult to trade in markets (*Farley* et al. 2011). Yet, market-based instruments such as organic or forest certification allow consumers to pay for the provision of services. Being able to economically value these services could function as an incentive for farmers to take up farming systems such as agroforestry (*Pirard* 2012, *Farley* et al. 2011).

When considering the value of ecological systems, environmental policies resort to two main perspectives: the instrumental or anthropocentric perspective and the intrinsic or biocentric perspective (*Farber* et al. 2002; *Goulder* and *Kennedy* 1997). The anthropocentric interpretation of ecosystems' value draws on the utilitarian understanding that everything directly (e.g. food) or indirectly (e.g. enabling future life of organisms) contributing to human well-being has value. By contrast, the biocentric interpretation is expressed in the idea of intrinsic value or rights to existence and well-being, which each species upholds regardless of its use to human satisfaction (*Goulder* and *Kennedy* 1997). Carrying the anthropocentric paradigm further, ecosystem services are attributed use or non-use values for economic assessment (*Pandeya* et al. 2016). Use values can be further distinguished into direct use values, which can be consumptive (e.g. food) or non-consumptive (e.g. recreation), indirect use values, which are gained from regulating

services (e.g. water purification or pollination), and option values, which amount to the meaning people give to the future availability of services for their individual gain (*TEEB* 2010). Non-use values give people satisfaction without even being physically involved with the natural object, such as knowing an ecosystem continues to exist or that other people can have access to it in the present or future (*TEEB* 2010; *Goulder* and *Kennedy* 1997).

Yet, economically valuing ecosystem services is not only difficult because of the different paradigms and distinctions that need to be considered when defining their value, but also because of the intangible nature of many services. While it is easy to assign a distinct market value for many provisioning services (e.g. olives, eggs) but not all (e.g. straw, grass), for many regulating, supporting and cultural services it is not (e.g. erosion control) (*Farley* et al. 2011). With ecosystems producing both marketable and non-marketable goods and services, the value of ecosystem services can therefore remain underestimated within free markets (*Costanza* et al. 1997). Yet, valuing ecosystem services for example through stated preference survey techniques can also lead to an overestimation of economic value through hypothetical bias (*Loomis* 2014; *Murphy* et al. 2005).

There are a range of economic instruments available aiming at biodiversity conservation, which have the ability to promote the provision of non-excludable services (*Pirard* 2012). Following *Pirard's* (2012) classification, these include, for example, regulatory price signals, i.e. fiscal measures of taxation for negative externalities and subsidies for positive externalities (e.g. agri-environmental measures); tradable permits (e.g. emission trading, fishing quotas); direct markets (e.g. ecotourism) or voluntary price signals (e.g. organic farming) and Cosean-type agreements, i.e. a contractual payment for a specific case in which the use of natural resources might be ceased or changed to provide a service to the buyer. The last category includes the scheme of *payments for ecosystem services* (PES).

Wunder (2005) defines PES as voluntary transactions of a well-defined ecosystem service or land-use probably leading to its provision, between at least one seller of ecosystem services and at least one buyer, if this service is indeed provided. In a revised form of this definition, *Wunder* (2015) maintained the aspect of conditionality, yet by referring to *"agreed rules of natural resource management for generating offsite services"* (p. 241) adapts to practical constraints of monitoring ecosystem services. PES have similarities with environmental taxes or subsidies in the sense that they use the mechanism of

economically incentivising desired outcomes, yet they are more direct and aim less at a general change of production models (*Wunder* 2005). Additionally, they are directed towards the users of ecosystem services rather than land users and thus are demand oriented (*Engel* et al. 2008). Besides land-based approaches, where use-caps are applied to an agreed amount of land, payments can also be product based by granting price premiums for ecological production, including agri-ecological practices (*Wunder* 2005). In this regard, *Wunder* (2005) sees an overlap with certification schemes, such as organic farming, which help to monitor farming practices and increase the products' credibility or trustworthiness for consumers (*Caswell* 2006). At the same time, it is stressed that ecological price premiums differ from PES insofar as the ecosystem services provided are traded only as part of the product in commodity markets (*Wunder* 2015).

Relating this to the dichotomy between the perception of environmental gains from agroforestry systems and the financial impact of increased management inputs revealed by current research on the attitudes of farmers and other interest groups, such as advisors or environmentalists (*García de Jalón* et al. 2018; *Graves* et al. 2017; *Rois Díaz* et al. 2018; *Camilli* et al. 2018), indicates that there is scope for identifying possibilities and best practices for the marketing of ecosystem services from agroforestry systems. Acknowledging that generalisation is difficult (*Rois Díaz* et al. 2018), a closer look at the marketing of products from agroforestry, and its challenges, enables better understanding of the economic performance of these systems (*Camilli* et al. 2018) and can thereby help to create better support mechanisms for farmers. For this reason, a network perspective was chosen to review the capture of economic value from ecosystem services in silvopastoral systems from a qualitative research position. Through this, it is possible to link the different stages of production, processing and distribution of silvopastoral outputs and analyse their dynamics by employing aspects of global production networks (GPN) (e.g. *Coe* and *Yeung* 2015; *Coe* et al. 2008; *Henderson* et al. 2002) and global value chain (GVC) theory (e.g. *Gereffi* et al. 2005).

By using network theories, it is possible to track, map and decode ongoing processes of expansion and restructuring at different geographical scales (*Coe* et al. 2004). Focussing on the performance of subsequent value-adding activities by placing the product or service at the centre of the analysis, GPN or GVC provide an approach to understand at which points in the chain values are created, enhanced and captured (*Henderson* et al. 2002; *Gereffi* et al. 2005). As these processes can often be highly dispersed among actors

and regions (*Coe* et al. 2004), considering them both by themselves and as a whole is necessary to reveal mechanisms which might be benefitting some actors while disadvantaging others (*Gereffi* et al. 2005). Farmers initially create value through their work by using assets, infrastructure and skills to transform inputs (e.g. seed, fertiliser) into outputs (e.g. cereals, milk, meat) (*Dicken* 2011). In the consolidated food system, value enhancement often lies with food processers, while retailers at the end of the chain form the main contact point to consumers (*Lang* 2004) and value enhancement occurs towards both ends of the chain (i.e. retail and supply of inputs) (*Marsden* et al. 1986). Therefore, how value is produced and captured is not dependent on economic factors alone but is also subject to relational differences between actors and regulations from outside of the production network. Placing it equally among aspects of value creation, enhancement and capture, the GPN concept therefore allows for the analysis of power relations in the production system and introduces the notion of embeddedness to the economic analysis of a system (*Coe* and *Yeung* 2015; *Coe* et al. 2008; *Henderson* et al. 2002).

In order to understand the possibilities to incorporate ecosystem services in the value chain, this paper considers how product value is created, enhanced, captured and traded within agroforestry production networks. As a consequence, this paper seeks to answer three questions i) Do farmers perceive that their farming systems produce ecosystem services? ii) Do these additional services contribute to the market value of their products? And, if so iii) How are ecosystem services incorporated into product value? To answer these questions, the paper describes the qualitative study design before presenting and analysing the results, drawing on the concept and categories of GPN and GVC analysis.

4.2 Materials and methods

4.2.1 Location and farm selection

A case study was carried out in February 2018 on nine mixed farms in Italy, as part of the EU “SustainFARM” research project which aimed to improve the ecological and economic performance of integrated food and non-food production systems (see www.sustainfarm.eu). The farms were situated in central Italy, five of which were located in the region of Umbria and four in Lazio (Fig. 4.1). Using data and stakeholders available through the Italian project partner (National Research Council – Institute of Research on

Terrestrial Ecosystems), nine farms combining the production of crops with livestock rearing on site (silvopastoral systems) were purposefully selected for the study based on the existence of a silvopastoral management system and contacted via phone. After the on-site interviews, one farm (F6) was excluded from the case study as its minimal output was only used for private purposes.

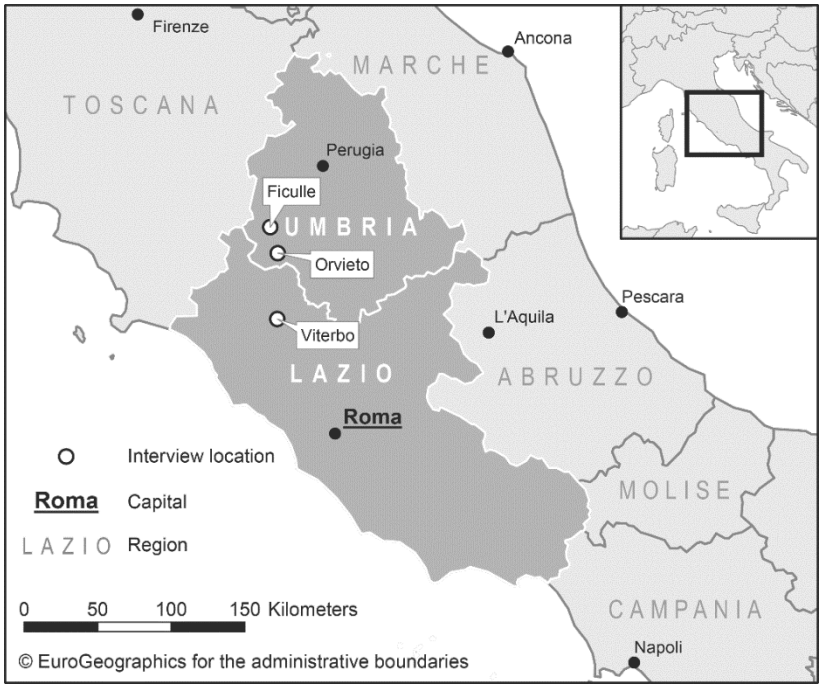

Figure 4.1: Locations of interviewed farms (Cartography: C. Enderle)

4.2.2 Data collection and processing

Data was collected with semi-structured interviews. The interview guideline featured open questions on the following subjects: general information on the farm and inputs, the organisation of labour, administrative and financial support, production and processing activities, environmental production schemes, use of waste or co-products; detailed questions on the agroforestry systems relating to motivations, benefits and challenges; and questions on the marketing and distribution of the different products, including pricing. The interviews were conducted on farm, taking between one and two hours. This offered a familiar and comfortable setting for the interviewees and facilitated a viewing of the farms prior to or after the interviews. Visiting the fields, pastures, groves and livestock allowed for a deeper understanding of the farms' production methods, as well as cross-checking of information gathered during the interviews, and allowed farmers to recall more pertinent details.

Three interviews could be conducted in English, four had to be fully translated from Italian to English during the interview and two were partly translated. Some short answers were translated word by word, while some longer explanations had to be summarised by the translators at the end of farmers' statements. The audio recordings of the interviews were transcribed and then coded in a system with 6 first-level (e.g. 'Inputs' or 'Production System') 46 second-level (e.g. 'Agroforestry Operations' or 'Organic Certification') and 29 third-level codes (e.g. 'Land Acquisition' or 'Handling Routine') using the software MAXQDA©, which resulted in a total of 1,103 codings.

4.3 Results

4.3.1 Characterisation of farms and silvopastoral systems

The size of the farms ranged from one less than 15 hectares (ha) to four farms between 23 and 46 ha and three farms working with 200 to 500 ha (Tab. 4.1). Therefore, all of the included farms were larger than the average Italian farm with a size of 11 ha of utilised farm land in 2016 and larger than both the average farms in Umbria (11.8 ha) and Lazio (9.1 ha) in 2016 (*Italian National Institute of Statistics* n. y. a). In 2010, Italy showed the second highest number of farms within the EU-27, of which 51% comprised less than 2 ha, while only 1% of holdings was bigger than 100 ha (*Eurostat* 2018). Two of the largest farms (F3, F8) split their activities to four farming locations each. Renting additional land was undertaken by four farmers, all of which were farming a total of between 23 and 46 ha, while the larger farms used owned areas only.

All interviewed farmers integrated livestock and trees at the same site by grazing animals in either olive groves (5 farms), woodlands (6 farms) and/or grassland with sparse tree cover (2 farms), thus forming silvopastoral systems. With most of the livestock agroforestry area of Italy being covered by woodlands and grassland with sparse trees and a smaller area with permanent crops (*den Herder* et al. 2017), the relatively high occurrence of olive groves suggests an overrepresentation in the current study, so that findings need to be considered within the specific contexts they were made. Four farms had practiced a silvopastoral system at the same site for more than ten years, of which two were established at least 20 years ago (F2, F8). The most commonly kept livestock type among the farms was pigs (5 farms), with another farmer planning to introduce pigs into his woodland, followed by sheep or goats (4 farms) and poultry (3 farms). Rabbits

and cattle were managed in an agroforestry system by one farm each. The farms in the study can thus be seen in contrast to the pattern of livestock kept on farms in the regions, where most farms kept cattle and/or sheep, while pig and poultry farms were lowest in 2013 (*Italian National Institute of Statistics* n. y. b).

Table 4.1: Summary of interviewed farms (management: I= integrated; PI = partly integrated**; O = organic; PO = partly organic; products from agroforestry systems in italics)*

Code	**Region**	**Manage-ment**	**Size (ha)**	**Livestock Type**	**Products**	**Agrofores-try Site**
F1	Umbria	I	46	Sheep	*Cheese, olive oil*	Olive grove
F2	Umbria	I	24	Pigs, poultry, rabbits	*Eggs, olive oil, pork products, whole poultry & rabbits*	Olive grove, woodland
F3	Lazio & Umbria	O, PI	200	Pigs, sheep	Cheese, fruit, hazelnuts, olive oil, p*ork charcuterie*, wine	Woodland
F4	Lazio	O, I	33	Goats, pigs, poultry, rabbits, sheep	*Eggs*, chevon, *olive oil*, sheep cuts, w*hole poultry*	Olive grove, woodland
F5	Umbria	PO, PI	23	Beef cattle	*Beef cuts*, flour, olive oil, pasta	Woodland, Grassland with sparse trees
F6 **(exclu-ded)**	Umbria	PI	10	Sheep	Private use only	Olive grove
F7	Lazio	PO, PI	200	Pigs, sheep	Lambs, legumes, pasta, p*ork charcuterie*, sheep milk	Woodland
F8	Lazio	I	500	Poultry	*Eggs, olive oil, poultry*	Olive grove
F9	Umbria	I	12	Goats, pigs	*Goat's cheese, chevon, pork charcuterie*	Woodland, Grassland with sparse trees

* Integrated refers to a fully combined management of trees/woodland and pasture/grazing
** Partly integrated refers to a partly combined management of trees/woodland and pasture/grazing

While sheep, poultry and rabbits were used for grazing between olive trees, pigs were exclusively kept in woodlands. Similarly, goats were not favoured for grazing among olive trees due to their browsing nature and were thus kept in grassland with sparse trees and shrubs. The areas under silvopastoral use differed significantly between the farms, with olive groves tending to be smaller than grazed woodlands. The size of grazed woodland ranged from 1 ha of woodland for 20 pigs (F2) to 80 ha of woodland for 60-80 pigs (F3), while the size of grazed olive groves ranged between 8 ha for 11,000 poultry and 60 sheep/goats (in rotation with other land) (F4) to 450 ha for 30,000 to 60,000 poultry (F8). None of the farms dedicated all their land to agroforestry, with arable crop cultivation and areas of permanent pasture on six farms each, whilst two farms featured cultivation of fruit or wine grapes.

There was a significant difference in the way olive groves and woodlands were managed. Apart from water and feed – which need to be provided to animals grazing in olive groves and grasslands – and infrastructural repair needs, woodlands were usually left untended with only occasional pruning as a source of fuel for self-consumption. At the same time, olive groves might need mowing once a year to reduce competition from grasses and weeds, especially for water, even if managed with animals. Reseeding between trees with leguminous crops like clover can also become necessary after three to four years of grazing and residues from olive pruning were mulched and left in the groves.

Most of the interviewed farms received single farm payments from the European Union under Pillar I. One farmer also received a young farmer scheme subsidy, whilst another received subsidies for areas of natural constraints (ANC). Five farmers received money from the Rural Development Programme under Pillar II, which were for example used to build processing facilities. Payments also included “Payment for Agri-Environment-Climate Commitments” (Measure 10.1) (one farm) and subsidies for organic production (four farms). Payments for agroforestry were not specifically mentioned.

4.3.2 Perception of environmental and animal welfare benefits

The interviewed farmers chose to combine the management of animals and trees for different reasons. For some it was a decision made for benefits such as weed and grass control (F1) as well as fertilisation on site (F1, F2, F4), the possibility to take two products from the same land (F2), possible savings on supplementary feed (F3) or shelter for animals (F2). For others, the motive was more practical as their woodlands, wood pastures

or orchards simply existed in the same places as the farms with animals and so combining the two seemed an obvious approach.

Asked about the environmental benefits they recognised from the silvopastoral systems, farmers mentioned different aspects and showed varying degrees of involvement with this question (Tab. 4.2). While farmers F1, F2 and F4 were able to name at least four perceived environmental benefits of their way of farming, the other farmers mentioned less or even none. The benefits most commonly mentioned were a part or complete reduction of synthetic fertiliser use and reduced pest or disease occurrence, followed by lower use or absence of chemical plant protection and an increase in biodiversity, or changes in plant species composition due to grazing (F9). Two farmers perceived a reduction in air or water pollution because the animals' management of grasses and weeds decreased the need for machinery. Lower stocking rates were also considered a benefit by one farmer, perceiving a reduction in physical soil disturbance. Better management of wild fires was considered another benefit of animals grazing or browsing in woodlands by one farmer.

Table 4.2: Farmers' perceptions of environmental benefits from silvopastoral systems (no predefined answers)

What environmental benefits are mentioned?	**F1**	**F2**	**F3**	**F4**	**F5**	**F7**	**F8**	**F9**
Reduced diseases/pests	X	X		X			X	
Less or no use of chemical fertilisers	X	X		X			X	
Biodiversity increase		X			X			X
Less or no use of chemical plant protection	X	X		X				
Reduced air pollution		X		X				
Increase of soil organic matter	X							
Increased water holding capacity	X							
Better wild fire management	X							
Reduced water pollution				X				
Reduced soil disturbance due to low stocking rates			X					

Besides the environmental benefits, some of the interviewees acknowledged the negative impact grazing animals can have on ecosystems by compaction, over- or selective grazing, or the reduction of amphibian species. Goats were especially considered unfavourable for production systems where young trees are present, as they will likely destroy the plants. Pigs and chickens disturb the soil when rooting or scratching the ground and re-sowing can become necessary. Olive groves grazed by sheep will develop higher crowns as the animals will eat the lower leaves, impacting pruning and harvest. Nevertheless, these negatives were considered as low impact in comparison to more intensive farming systems, especially if the grazed areas are managed in well-timed rotations. Farmers' answers regarding the question of how animals benefit from the silvopastoral systems were more consistent than on environmental advantages (Tab. 4.3). Animals finding different types of feed on and among the trees was mentioned as a benefit by most farmers, followed by the protection and shelter from sun, wind, rain or snow provided by the trees, more space allowance and the possibility to express natural foraging behaviours, as well as good animal health, which was mentioned specifically by smaller farms. However, it was also mentioned that foraging of some feed provided by the systems was not favoured, as, for example, it is perceived that excess acorns can cause health issues in sheep, and that olive leaves are not favourable for milk production, due to their low fibre content.

Table 4.3: Farmers' perceptions of silvopastoral systems' contribution to animal welfare (no predefined answers)

What welfare benefits are mentioned?	**F1**	**F2**	**F3**	**F4**	**F5**	**F7**	**F8**	**F9**
Animals can enjoy a more varied diet	X		X	X		X	X	X
Protection for animals from weather (sun, wind, rain, snow)	X	X		X			X	X
Animals have more space		X	X	X			X	
Animals can enjoy a more natural habitat, perform natural behaviour	X			X		X	X	
Animals are healthy		X		X	X			X

4.3.3 Product distribution and interpretation of quality

The interviewed farmers faced different challenges concerning the production in the silvopastoral systems. Feed provided by silvopastures or woodlands was not always sufficient, so that almost all farmers mentioned the need to give additional feed to their animals, some of which needed to be purchased. The two smaller farms raising poultry as well as the farm with goats bought in all or some components of the feed, mostly because they lacked the necessary land to produce it themselves. Another challenge faced by nearly all farmers were attacks on the flocks, destruction of fences or soil disturbance by wild animals such as martens, foxes, wolves and wild boar, or even hunters shooting pigs in large forest areas, all of which are difficult to control for farmers.

All farms were engaged in the processing of their products either directly, through the outline of production methods and ingredients, or the setup of owned medium or large-scale processing facilities. Three farms (F1, F2, F8) generated nearly all their income by selling products from the silvopastoral system. The other farms also sold products coming from different parts of the farming enterprise not related to the agroforestry systems. As silvopastoral systems combine livestock with the management of trees, all farms sold livestock products such as cheese (2 farms) (15-30 €/kg), eggs (3 farms) and meat (7 farms). Four farms sold either fresh or cured pork products (8-130 €/kg), with one farm (F2) planning to do so in 2019 for the first time. Three farms sold poultry meat either as cuts (8-20 €/kg) or whole birds (7-9,50 €/kg), and these same farms sold eggs (0,50-0,90 €/egg), too. One farm each sold rabbits (F2) (8,50 €/hd), beef (10-12 €/kg) (F5) and kid/goat meat (F9) produced in silvopastoral systems. Olive oil (10-15 €/l) was the only marketed product originating from the tree component of the systems.

All farms sold some of their products directly to consumers either from the farms (6 farms), through home deliveries (3 farms), own shops in cities (2 farms) or through agritourism activities (restaurant, guesthouse) (3 farms). Six farms sold some of their produce to externally owned specialised food shops and restaurants, which were partly located in Orvieto and the surrounding area but also in Rome and Perugia. One farmer (F7) also sold to organic supermarkets in Rome, Naples and Milan. Two farmers exported meat or meat products to mostly Northern Europe, e.g. to organic supermarkets in Denmark and Norway (F7) or a restaurant in the Netherlands (F8) or sold produce to the Italian food-hall chain “Eataly”, which also operates outside of Italy (F8). Olive oil was

either sold directly on farms or in the own shops but was also sold on a national scale (e.g. purchase groups) or exported due to the high number of olive producers.

Farmers reported that they felt mostly free to set prices although some stated they desired their income to be higher than it currently was. Organic certification tended to allow farmers to set higher prices and was especially important when selling over greater distances as direct consumer contact might not be possible to vocalise the differences of the production system. Higher prices could be further achieved from direct customers, especially those dining in farm restaurants. Following the classification by *Caswell* (2006), the types of quality attributes farmers linked and promoted with their products differed. The selling argument for two of the bigger farms selling cured pork (F3, F7) was food quality, defined by taste and nutritional composition of the meat as well as by organic certification. Only three farmers (F1, F2, F4), of which one is organically certified, promoted benefits of the production method as a quality attribute in direct contact with consumers or shops and restaurants. Taste and original or artisan production methods, as well as animal welfare (free range/trees as shelter), were further important attributes for farmers when marketing their products.

4.4 Discussion

The following section evaluates what constitutes value of the agroforestry products and how it is influenced by the management systems at the stages of value creation, enhancement and capture, with special regard to the incorporation of ecosystem services in product value.

4.4.1 Evolution of value in silvopastoral agroforestry systems

When analysing how farmers integrate ecosystem services into the value chain of their silvopastoral products, the concept of environmental value deployed by the farmers in this study draws mostly on an anthropocentric understanding of natural value. This is apparent where farmers name environmental benefits such as reduced pests and diseases, or better wild fire management, due to the adaption of silvopastoral management systems. However, as outlined above, the understanding of environmental benefits differed among the interviewed farmers, and so did their interpretation of the value of nature inherent in their products.

Figure 4.2 depicts the evolution of product value and thereby focuses the analysis on the value category of *Henderson* et al.'s (2002) framework for analysing production networks. It shows how value is *created*, *enhanced* and *captured* and what aspects shaping these values are likewise *perceived*, *boosted* and *promoted* by farmers. We find the differentiation between creation and perception; enhancement and boost; and capture and promotion an important one, as these stress the crucial difference between what is actually done on farms and what precisely contributes to the understanding of value or quality sold. Figure 4.2 depicts different possibilities how value evolves on the studied farms and which quality attributes are linked to the different scales of marketing. While there is some overlap between farmer's perceptions in the creation stage (Tab. 4.2), what is captured and promoted differs according to the markets supplied by the farmers. For products sold in national or international contexts, taste, tradition, the nutritional composition (in one case assessed through laboratory analysis) and organic certification are important for defining product value, whereas in local or regional sales this is accompanied by the marketing of environmental benefits and animal welfare.

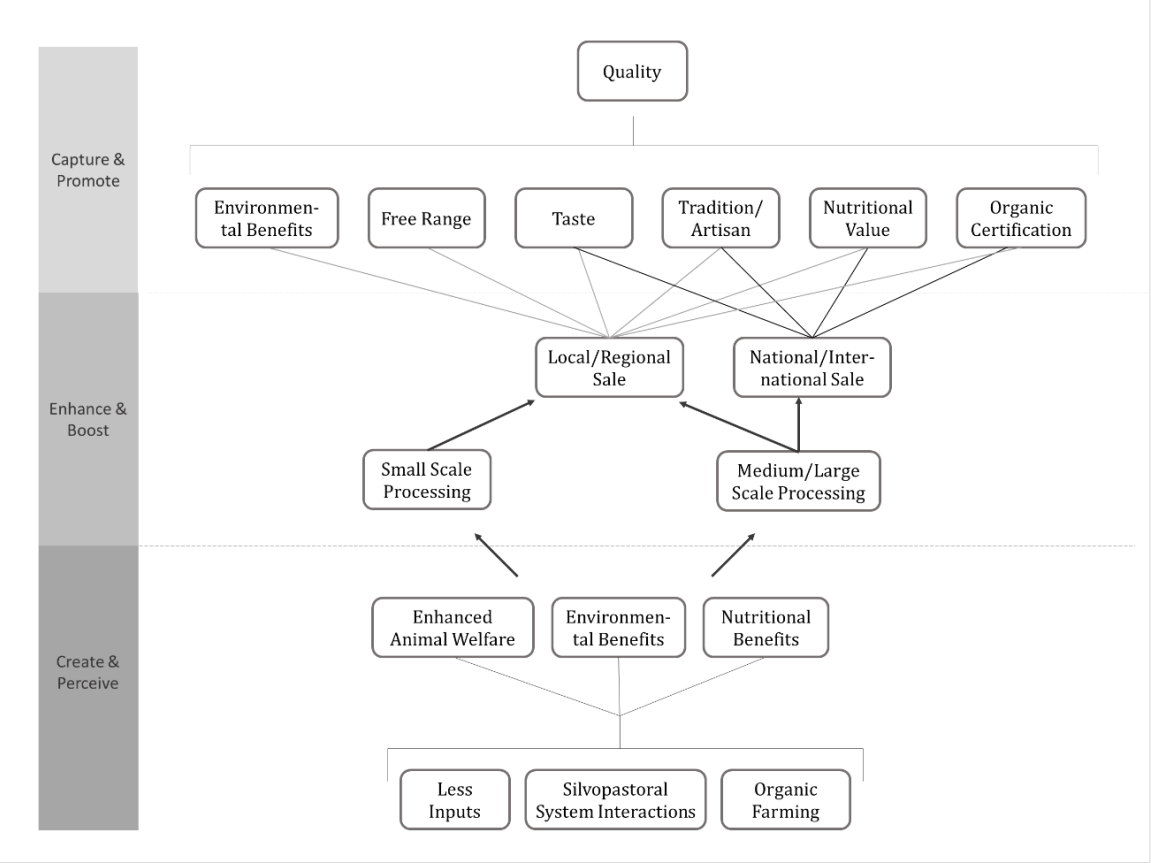

Figure 4.2: The evolution of silvopastoral value based on the categories of value creation, enhancement and capture by Henderson *et al. (2002)*

Create and Perceive

In order to generate income and achieve a profit, farmers used their own or additional labour and skills, and made investments in order to supply products and services (e.g. gastronomy) required by customers, the economic process thereby revolving around the transition from inputs into outputs (*Lipsey* and *Chrystal* 2011). In the presented case, farmers recognised a reduced need for inputs due to the provision of services such as pest and disease control or nutrient recycling, which when compared to a non-agroforestry system where farmers are using such inputs could be translated into a reduction of costs (Fig. 4.2). At the same time, more management activities can be required in agroforestry systems (*García de Jalón* et al. 2018), which could increase the costs for labour. Combining trees and livestock production was especially interesting for farms with limited space to obtain more products from their land, i.e. diversifying the product range and increasing land-use efficiency. Simultaneously, grasses and weeds, which create competition and ultimately increase costs in olive tree farming, were recognised as a resource for production, making the system as a whole more resilient:

> *"We tried to transform […] a common problem for the olive groves, […] the growing of the grasses, in an opportunity." (F1)*

Given that farmers are already managing animals on-farm and once the infrastructure is in place, combining livestock with trees allows for an easier management of grasses and weeds with fertilisation of crops on site. Yet, maintaining physical infrastructure such as fences and regularly monitoring livestock can be difficult to manage in larger woodland areas, where wild animals or hunters can be a threat. One farmer in the study additionally fertilised the olive grove with manure from their own sheep or sowed clover, in order to increase nitrogen supply (*Mc Kenna* et al. 2018), and left residues from olive tree pruning on the ground to enhance soil organic matter (*Gómez-Muñoz* et al. 2016**)**, which in turn stimulates soil microbes and thereby supports nutrient mineralisation and availability (*Tejada* et al. 2009). Additionally, farmers in the study attributed a role to livestock in mitigating plant disease outbreaks in olive trees. By eating leaves of the lower crowns, sheep encourage better aeration of the plant, which decreases humidity build-up and thus the risk of fungal infections (*Malavolta* and *Perdikis* 2018). This reduces the need to use fungicides and thereby cuts both economic and environmental costs. The same applies where chickens eat pest infested fruits or pests themselves (*Paolotti* et al. 2016) e.g. larvae

of olive flies, reducing damage without the use of insecticides. Silvopastoral systems can be able to provide feed for a longer time than common pastures when they reduce the impacts of drought stress in summer (*Mosquera-Losada* et al. 2005).

When animals like pigs, goats or sheep are left to browse in woodlands, they contribute to keeping the natural landscape open and accessible. This is a major advantage in locations of the Mediterranean where fire poses a considerable threat in summer and a reduction of fuel load by understorey browsing is a useful preventative (*Taylor* 2006; *Kramer* et al. 2003; *Flamant* et al. 1999). Furthermore, using livestock to keep land clear from shrub encroachment (*Elias* and *Tischew* 2016) or to work stony, inaccessible land is a means of saving costs for farmers as well. Although most farmers could realise one or two environmental benefits of their farming system (Tab. 4.2), only some could expand on this. Yet, only if the environmental benefits are perceived as such will farmers be able to promote them alongside other quality attributes when selling their produce for a higher price, if they are not organically certified (Fig. 4.2).

All farmers perceived distinct welfare advantages for the animals (Tab. 4.3) and some stated that the alternative management of animals enhanced nutritional characteristics and taste of products. By leaving pigs to forage on acorns for example, the nutritional quality of the meat can be improved due to an improved composition of fatty acids (*Rey* et al. 2006; *Pugliese* et al. 2005), caused by high oleic acid levels of acorns (*Rey* et al. 1997). In poultry, the protein content of meat has been reported to be higher and the fat content lower for outdoor birds, because increased exercise promotes muscle growth and reduces fat (*Fanatico* et al. 2007; *Castellini* et al. 2002), producing leaner meat (*Fanatico* et al. 2007). *Funaro* et al. (2014) find that leg meat is tougher in free-range birds compared to indoor birds. However, a study by *Michalczuk* et al. (2017) found no difference in protein or fat content between outdoor and indoor reared broilers. One farmer raising poultry also mentioned that the animals raised in their silvopastoral system required twice the amount of time to grow compared to birds in more intensive production systems. However, this observation might not only be linked to the rearing systems alone but could have also been affected by the breed used (*Li* et al. 2016; *Mikulski* et al. 2011).

Farmers stated the need to treat animal diseases was low, which again saves costs for veterinary resources. Yet, for pigs, results on whether free-range systems do result in better animal health are not conclusive with findings showing higher occurrence for some

health indicators, e.g. white liver spots, tail lesions, arthritis and bone fractures, in free-range compared to conventional indoor systems (*Kongsted* and *Sørensen* 2017), but also lower occurrence of other conditions such as leg swellings or hoof abscesses (*Kongsted* and *Sørensen* 2017; *Alban* et al. 2015). Apart from offering protection against the weather, trees also provide shelter, which is particularly beneficial in making poultry feel safe (*Dekker* et al. 2012; *Dawkins* et al. 2003). This encourages them to use outdoor areas more and therefore supports the benefits perceived by farmers as "natural habitat and natural behaviour" (Tab. 4.3). *Dal Bosco* et al. (2014) show that chickens with outdoor access enriched with olive trees were moving more, spent more time outside and used a larger area of the outdoor pen compared to chickens with outdoor access without trees.

At the same time, authors found that foot lesions and breast blisters were lower in chickens where outdoor access were enriched with olive trees, although current literature has not supported a reduction in foot lesions in enriched free-range systems compared to indoor systems (*Stadig* et al. 2017). However, it has been shown that a higher percentage of chickens used an outdoor run where short rotation coppice was included in comparison to chickens provided with artificial structures (*Stadig* et al. 2017), which concurs with findings from *Dawkins* et al. (2003) who show that chickens prefer outdoor areas with trees. Encouraging greater use and better distribution of poultry in outdoor runs by providing artificial (*Zeltner* and *Hirt* 2003) or natural structures (*Stadig* et al. 2017) could minimize the impacts of high nutrient loss found in closer proximity to henhouses (*Dekker* et al. 2012) and thereby decrease pollution from poultry systems.

Enhance and Boost

Global Production Network (GPN) analysis not only considers how values are created but also investigates how much of this value can be enhanced and captured by actors (*Henderson* et al. 2002). Regarding the second stage of value enhancement or boosting of natural product value, it is important to stress that all farmers were engaged in processing of their products, although the scale differs among farms (Fig. 4.2). All of them have invested, e.g. in processing facilities, to increase the properties, quality or uniqueness and thus the value of products. However, it can be argued that this strategy of "product upgrading" (*Kaplinsky* and *Morris* 2001) could be adopted by any farm regardless of the agroforestry system. Being involved in the processing of products gives

farmers an opportunity to ensure constant quality and flavours, something that can be difficult to control in outdoor systems, which consumers are looking for:

> *"Here the client, when they eat the product, they want every time the same. For this we take the food, the same food production here for our pigs, the pigs live in that same country, for that we have the constant quality." (F7)*

Capture and Promote

For the third sub-category of value capture or promotion, distinctive differences can be observed in what is ultimately marketed and sold. Farmers reported to feel mostly free in setting prices for their different outlets, with higher prices being obtained from direct customers, especially if they are eating on the farms, and lower prices from restaurants and shops, partly because the products need less packaging or other preparation. However, this is independent of the way the products were produced or other quality characteristics. Some stated it was not possible for them to inform customers about their production systems on the labels, so that awareness of the production methods may only become apparent if the customer visits the farm. Three farmers notice the potential to communicate how they manage animals and land, whilst one of the bigger farms (F8) states it makes little sense to explain the system as consumers would not be able to understand the differences. Only three farmers were actively explaining their production systems to customers when they were buying on the farm (F1), when selling to restaurants or shops (F2) or by offering courses on environmental (food) education (F4). One farmer (F2) was planning to set up such courses on his farm, as well as engaging with local schools for courses on food and nutrition. However, more farmers stressed the importance of creating an understanding and engaging with customers, not only because people might be more willing to pay higher prices but also to keep the production transparent and create trust. This, in turn, can be useful in establishing long-lasting sales relationships:

> *"Because people, when they know about me, about the process, they accept to pay some euro more" (F1)*

As only a small number of farmers explained the agroforestry system to consumers, promoting the production system or the ecosystem services that can evolve from it does not seem to be necessary for farmers in order to sell their products. Other retail incentives mentioned by farmers such as nutritional/physical characteristics, taste, heritage or origin,

animal welfare, as well as organic certification, must therefore be more important or perhaps easier to explain than environmental benefits or ecosystem services of silvopastoral systems. However, as no consumers were questioned for this study, it is not possible to discern why they bought certain products. When asked about the perception of benefits themselves, farmers seem to focus on the management practices, both included and omitted in their systems, rather than the ecosystem services they can promote (Tab. 4.2). A better understanding of the positive outcomes and ecosystem services stemming from interactions in the silvopastoral systems could enable farmers to engage in possibilities to capture a so far largely untapped layer of product value.

4.4.2 Incorporation of ecosystem services in product value

In network theories environmental issues are often treated in respect of the risk to economic processes and how actors address them. *Coe* et al. (2008) likewise state that GPN analysis allows environmental problems resulting from the economic process to be comprehended and managed by linking different processes evolving around it. In this study we show that both arguments can be taken further. Some farmers were faced with environmental problems in their production system, yet not only does silvopastoral management help to mitigate these risks, but can even allow farmers to turn them into an economic advantage, e.g. by reducing the need for inputs or higher product value, e.g. due to nutritional composition. In this study, benefits of the silvopastoral systems emerge at two stages of the valuation process, i.e. the creation and capture of value, and are thereby commodified by two means: 1) they reduce the need for inputs and 2) they add to product quality in terms of nutritional and heritage attributes and credibility attributes (*Caswell* 2006), such as environmental and animal welfare benefits. However, the provision of ecosystem services is captured directly only where farmers are able to explain their environmental production methods to customers, and indirectly through organic certification. In essence, it is therefore the management of these systems that is rewarded, rather than their outcome in terms of ecosystem services provided or disservices reduced, as these are not monitored.

Coe et al. (2008) emphasise that there is a lack of connection between economic processes and the natural environment, despite that economic activity will impact and be impacted by the natural system by both extracting resources and imposing pollution on it through waste. *Yeung* and *Coe* (2015) acknowledge ecological impacts as one ethical aspect in

decision making by consumers and thus their importance for product development. Yet, this can only be partly observed in the presented case. As few farmers communicate the production system's characteristics and benefits to customers, the reasons people buy their products possibly lie elsewhere than in the ecosystem services supplied by the agroforestry systems. On the other hand, four of the farms in the study are organically certified, which is considered an important quality and marketing attribute reflecting a demand for ethical purchases. Voluntary price signals (*Pirard* 2012) allow farmers to capture the value of environmental practices arguably related to ecosystem services provision and attain higher prices for their products, yet there are also costs linked to certification.

Advertising production methods on a label becomes more important with greater physical and relational distances between producers and consumers, and organic certification offers a possibility to bridge this gap as a well-established information medium recognisable for consumers. At the same time, it replaces the need to explicitly explain the agroforestry system and related ecosystem services provision. However, by uniting a multitude of practices besides agroforestry, organic certification leaves little room for further differentiation of environmental practices and explicit services provided. For this reason, price premiums attained from organic farming cannot be considered PES as they are paid for a bundle of certified practices traded in markets (*Wunder* 2015). Organic certification is not possible for or desired by all farmers in the study due to limitations such as farm size or costs, beside a lack of trust in the inspection process. This should also be viewed in relation to an expression of discontent by some farmers in this study with the organisation and handling of EU payments by the regions. Farmers collaborating in shared processing facilities or marketing cooperatives could furthermore be an option to distribute costs more broadly and benefit from marketing opportunities of a wider product range.

The lack of possibility to formally claim a premium for the provision of potentially identical services by non-organic farms stresses the need for the design of an applicable measure allowing for direct economic valuation of ecosystem services in terms of Coasean-type agreements (*Pirard* 2012) or PES (*Wunder* 2015; 2005), which proved to be a successful measure for encouraging farmers to implement silvopastoral techniques (*Pagiola* et al. 2007). However, changes in regulatory price signals (*Pirard* 2012) on an EU level might be necessary to foster wider change towards increased ecosystem services

provision from agricultural ecosystems. This indeed needs to be embedded in a wider discussion on necessary simplification, producer and consumer education and understanding, and, not least, regulation, monitoring and payment governance.

4.5 Conclusion

In this paper we showed that applying the analytic categories introduced by GPN theory offers some understanding of what constitutes value of silvopastoral products for the current study, at what stage differences in the formulation of quality and value occur and in which cases value of ecosystem services is captured. If and how much of the marketed ecosystem services are truly provided by the systems is subject of an additional study, as in this paper we assessed only farmers perceptions of ecosystem services or environmental benefits provided. The environmental benefits and interactions of the production system contribute to product value by reducing the need for inputs and adding to product quality in terms of nutritional, heritage and credibility attributes (*Caswell* 2006) (e.g. environmental and animal welfare benefits). This allows some farmers to charge higher prices.

Most farmers in this study do perceive environmental benefits of the silvopastoral systems they operate. Yet, there is a tendency to define these benefits by the absence of environmentally harming farming practices rather than positive outcomes or ecosystem services, indicating a possible lack of understanding and perhaps even hindering how these services are marketed. Since no consumers were questioned for this study, it is not possible to understand their motivation for buying certain products. However, as only a few farmers explain the agroforestry system and its benefits to customers, it can be concluded that other quality attributes such as nutritional/physical characteristics, taste, heritage or origin, animal welfare, as well as organic certification, are more important for marketing and possibly easier to explain. This raises the question of whether there is an understanding of and market demand for ecosystem service provision.

Promoting an outcome-based approach rather than focusing on production methods or management practices, and thus truly rewarding ecosystem services provision, might give possibilities to enhance value for agroforestry products. This would not only involve voluntary price signals (e.g. FSC Ecosystem Services Procedure for forest management), voluntary carbon markets, Coasean-type agreements (*Pirard* 2012) or PES (*Wunder* 2015; 2005), but maybe more importantly, normative and governmental shifts in EU-

payment schemes, which could in turn encourage wider application of agroforestry practices.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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5 Silvopastoral production as part of alternative food networks. Agroforestry systems in Umbria and Lazio, Italy

Röhrig, N., Hassler, M. and *T. Roesler* 2020: Silvopastoral production as part of alternative food networks. Agroforestry systems in Umbria and Lazio, Italy. – Agroecology and Sustainable Food Systems.

Abstract

Silvopastoral agroforestry systems combine the management of livestock and trees or other woody perennials on the same land. Aside from giving farmers an opportunity to diversify their income and reduce inputs, these systems have been shown to provide a number of ecological benefits. Given the growing demand for environmentally produced food, this paper assessed how farmers of silvopastoral agroforestry systems distribute their products in the context of alternative food networks (AFN). Applying Global Production Network (GPN) analysis, the distribution of output was assessed for eight farms in two Italian regions (Umbria, Lazio) following qualitative interviews. While farmers of the case studies partly rely on conventional supply channels and markets, all of them engage in alternative forms of food distribution, such as off-farm sales, home deliveries, and farmer owned shops enabling direct exchange with customers. Paired with a focus on high product quality, it can be argued that these farmers also form part of alternative food networks. This practice does result in higher prices for directly marketed products, an easier management of product information at the point of sale as well as high levels of traceability. Yet, only few farmers advertising the environmental benefits of their production systems indicates some potential for further value enhancement, which could allow farmers to capitalize on the synergy of alternative production and distribution.

Keywords

agroforestry, alternative food networks, local food, silvopasture, Italy

5.1 Introduction

Agroforestry is the intentional combination of trees and agricultural components (crops or livestock) on the same land (Nair 1993). One form of this is silvopastoral systems, which are defined as linking the management of livestock with forage and trees or other

woody perennials on the same land (Cubbage et al. 2012; Jose, Walter, and Kumar 2017). Besides management advantages for farmers and the possibility to diversify their businesses, agroforestry systems provide a range of ecological benefits, such as reduced leaching, and thus water quality improvement, biodiversity enhancement, carbon sequestration, climate regulation, erosion prevention, and wildfire control (Rois-Díaz, Mosquera-Losada and Rigueiro-Rodríguez 2006; Rigueiro-Rodríguez et al. 2009; Jose 2009; Jose, Walter, and Kumar 2017; Moreno et al. 2017). In Italy, agroforestry has been a traditional feature of landscape maintenance for centuries (Paris et al. 2019). Today, it has the fourth largest area under silvopastoral management in Europe with an estimated 1.3 M. ha, or 10 % of its used agricultural area. Most of these systems are established in woodlands, followed by grass and shrubland with sparse tree cover and permanent crop cultivations (e.g. olives) (den Herder et al. 2017).

Consumption preferences for environmentally friendly food have strongly increased, as reflected by the ongoing rise in production capacities and consumption of organic food (Willer et al. 2020). Over the past two decades, the wish to consume more eco-sensitive products has been complemented by the idea that local production and distribution are not only more environmentally friendly but also provide a range of economic and social advantages for ethical food sourcing, as well as higher levels of traceability. This aspect gained special consumer interest after food scandals (Feldmann and Hamm 2015) that resulted in a "crisis of confidence in mass-produced 'placeless and faceless' food" (Goodman and Goodman 2009: 209). Therefore, alternative food systems such as agroforestry may be considered a response to such adverse effects as pollution and intensive livestock farming, which are perceived as the results of the ongoing industrialisation of farming **(**Heffernan, Hendrickson, and Gronski 1999; Murdoch, Marsden, and Banks 2000; Coe and Hess 2005; DuPuis and Goodman 2005; Ilbery and Maye 2005a; Feldmann and Hamm 2015). It may also stem from a desire to close the gap between production and consumption.

Reducing distances between food production and distribution is at the centre of alternative food systems or networks (AFN). The different methods and practices of AFN are characterised by the common feature of small physical and/or social distances between consumers and producers (Renting, Marsden, and Banks 2003; Kebir and Torre 2013; Barbera and Dagnes 2016). By reducing conventional modes of retailing (Watts, Ilbery, and Maye 2005) and thereby reclaiming control over prices, consumer information and

capture of values, farmers have developed various forms of direct food distribution. These include farmer's markets, box schemes or subscription sales, farm shops, 'pick-your-own' systems or more socially engaging forms such as community supported agriculture, and online sales (Heffernan, Hendrickson, and Gronski 1999; Hinrichs 2000; Holloway and Kneafsey 2000; La Trobe 2001; Ilbery and Maye 2005a; Bos and Owen 2016). In these forms of distribution power is shifted from the retailers to both ends of the value chain, with producers gaining more independence from the structures and requirements of corporate supply chains and consumers engaging more directly with farmers on what Caswell (2006, 651) refers to as "process attributes" of quality, for instance animal welfare, environmental impact, place of origin, in addition to changing preferences.

As a result of shorter spatial distances, AFNs are often associated with consumer-producer relationships based on trust and high levels of social embeddedness (Ilbery and Maye 2005a). Yet, direct consumer contact in AFNs means producers have to create and maintain sufficient credibility amongst a larger number of people, when compared to selling through the consolidated system with less direct accountability to consumers and more accountability to an institutionalised regulatory system (Renting, Marsden, and Banks 2003). Closer relationships between consumers and producers might also mean higher levels of informal accountability of production practices. However, it is a simple misconception that local food networks necessarily operate in a manner that is more environmentally friendly or have higher welfare standards than the consolidated system or that, vice versa, farmers engaging in agro-environmental production methods are necessarily part of alternative networks (Hinrichs 2003).

Satisfying not only quality and safety demands, but also environmental concerns, are the primary reasons people buy food locally (Feldmann and Hamm 2015). In their review article on attributes linked to local food production, Feldmann and Hamm (2015) show that the most frequently named advantages attributed to local foods relate to product quality (e.g. taste, freshness, healthiness), product safety (higher traceability), environmental benefits (production and transport), local community support, animal welfare and better standards for farm workers.

Marsden, Banks, and Bristow (2000, 425f.) define three major types of alternative *Short Food Supply Chains* (SFSC): 1) "Face-to-face", 2) "Spatial proximity" and 3) "Spatially extended". For the first type, personal contact is central for ensuring trust in direct

interaction with producers, from whom the product is directly bought, e.g. in farm shops or market stalls. The latter requires information on processes and origin to be supplied by means other than personal exchange, as customers will have no immediate knowledge or experience of the region, e.g. when buying online (Ilbery and Maye 2005a). For the intermediate type, products are sold in outlets in the region or locality in which they are produced, and information on this is provided at purchase. This classification shows the necessity of carefully distinguishing amongst *local, short* or *alternative* food supply chains. While "Face to Face" and even "Spatial Proximity" can be considered as supplying food locally, this is not the case for the "Spatially Extended" type. It may still draw on modes of distribution, which shorten the supply chain and can be different from the conventional chain. In this sense, "Spatially Extended" could be considered an *alternative* or *short* food supply chain. Additionally, characterising types of products, producers or food networks as *non-local* or *conventional* and *local* or *alternative* can be difficult as the two are not as distinct as is often advocated since producers might resort to both types of marketing channels (Ilbery and Maye 2005b). Even if selling locally, they can still be connected to the conventional food network e.g. through suppliers of inputs, abattoirs or wholesalers in what Ilbery and Maye (2005b, 341) call "hybrid food systems and spaces".

Farmers managing their land and livestock in silvopastoral agroforestry systems are likely to fulfil demands put forward by environmentally minded consumers wishing to buy food locally. For this study, we therefore set out to focus on silvopastoral production systems in order to determine how farmers were marketing their produce, what benefits emerged from it and what was hindering the marketing through certain channels. In this paper, we seek to answer the following questions: i) *Are farmers of the studied cases part of alternative, local food networks*; ii) *If so, what are the advantages* and *iii) what prevents farmers from entering localised food systems*?

To address these questions, a qualitative research approach was found to be best suited as it allows for the work on small case studies in largely untapped research fields. Therefore, the results described in this paper need to be viewed in the specific contexts of the studied systems, while generalization is neither possible nor intended. We applied the concept of global production networks (GPN) (e.g. Henderson et al. 2002; Coe, Dicken, and Hess 2008; Coe and Yeung 2015) and alternative food networks (e.g. Marsden, Banks, and Bristow 2000; Ilbery and Maye 2005a) to assess the means and conditions of silvopastoral

product output, as well as distribution and embeddedness within local and global production systems. By connecting the different stakeholders involved in the production, distribution and consumption of food and analysing these links, network theories such as global value chains (GVC) (e.g. Gereffi, Humphrey, and Sturgeon 2005) or global production networks (GPN) (e.g. Henderson et al. 2002; Coe, Dicken, and Hess 2008; Coe and Yeung 2015), allow us to understand the ongoing processes of restructuring of different food sectors at varying geographical scales (Coe et al. 2004). Placing the product or service at the centre of this analysis, network theories further enable us to assess what contributes to, fosters or hinders value creation, enhancement and capture for different stakeholders (*Henderson* et al. 2002).

5.2 Methods

The study was conducted on nine mixed farms in the Central Italian regions of Umbria and Lazio in February 2018. It was embedded in an EU research project aimed at improving the ecological and economic performance of integrated food and non-food production systems (www.sustainfarm.eu). Farmers managing livestock within olive groves, woodlands or wood pastures, i.e. in silvopastoral systems, were purposefully selected for the study and recruited by the Italian project partner. Five of the farms were situated in Umbria and four in Lazio (Fig. 5.1). After data collection, one farm (F6) was excluded from the case study owing to small output for private use only.

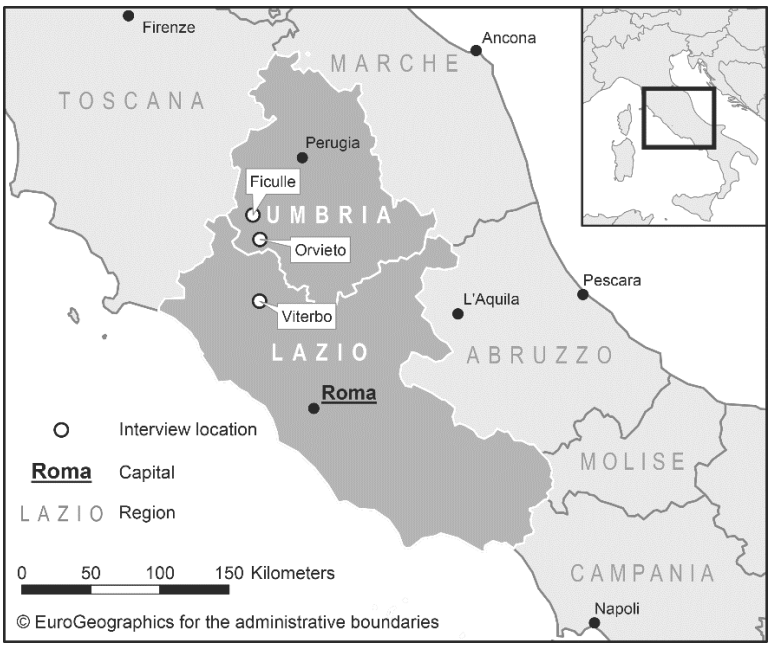

Figure 5.1: Locations of studied farms (Cartography: C. Enderle)

Data were collected with semi-structured qualitative interviews on the farms. The interview guideline featured open questions on subjects such as farm history and ownership, inputs and suppliers, production and processing activities, the organisation of labour, political and financial support and environmental production schemes. Particular detail was given to questions relating to the silvopastoral systems from the broad perspective of motivations, benefits and challenges, as well as questions on the marketing and distribution of the different products, including pricing.

The interviews took between one and two hours and were conducted on the farms in order to create a comfortable atmosphere for the interviewees. Furthermore, this facilitated an observation of the farms prior to or following the interviews, allowing for a deeper understanding of the farms' production practices, and fostering better recollection of details by farmers. It also enabled cross-checking of information gathered during the interviews. Two interviews were partially translated from Italian to English during the interviews, four were fully translated and three were conducted in English. Some shorter statements could be translated word-for-word, but some longer explanations were summarised by the translators at the end of the farmers' answers. The audio recordings of the interviews were transcribed and then coded in a system with 6 first-level, 46 second-level and 29 third-level codes using the MAXQDA© software. This resulted in a total of 1,103 codings. Subsequently, these codings were assessed by applying qualitative content analysis (Flick 2013) with categories based on the theories of GPN, GVC and AFN approaches.

5.3 Results and discussion

5.3.1 Characterisation of case studies

There was great variation in farm sizes of the studied systems. Two farms comprised less than 15 ha, four farms between 23 and 46 ha and three farms managed 200 to 500 ha (Tab 5.1). Farmers of large and small farms owned all their land, while the four medium-sized farms (23 to 46 ha) rented additional land. All of the included farms were larger than the average Italian farm of about 11 ha of utilised farm land in 2016, and were larger than the average size of farms in Umbria (11.8 ha) and Lazio (9.1 ha) in 2016 (Italian National Institute of Statistics n. d. a). Italy had the second highest number of farms within

the EU-27 in 2010, of which 51% comprised less than 2 ha, while only 1% of holdings were bigger than 100 ha (*Eurostat* 2018). Two of the largest farms (F3, F8) split their activities amongst four locations, while the others maintained the farm at one location only.

Silvopastoral systems were mostly established in woodlands or wood pastures (6 farms) and/or olive groves (5 farms), where livestock is left to graze, browse, scratch and root. The relatively high occurrence of olive groves under silvopastoral management (Tab. 5.1) suggests an overrepresentation, as most Italian livestock agroforestry area is covered by woodlands and grassland with sparse trees with far fewer incorporating permanent crops (den Herder et al. 2017). Most farms managed pigs kept in woodlands (5 farms) with another farmer planning on introducing them. This was followed by poultry (3 farms) and sheep (2 farms), which grazed among the olive trees, as did rabbits managed by one farmer. Goats and cattle were managed by one farm each to graze and browse wood pastures and woodlands. Therefore, these case studies cannot be seen as representative of the pattern of livestock kept on farms in Umbria and Lazio since most farms managed cattle and/or sheep in 2013, while pig and poultry farms were the least represented (Italian National Institute of Statistics n. d. b). Additionally, arable crop cultivation and permanent pasture were found on six farms each, and one farmer (F3) also managed fruit orchards and cultivated wine grapes. Some farms have had combined animals and trees for more than ten years (4 farms), some of these even 20 or more years (F7, F8).

Table 5.1: Summary of interviewed farms (F6 excluded)

Farm	**Size (ha)**	**Agroforestry Site**	**Livestock Type in Silvopastoral System**
F1	46	Olive Grove	Sheep
F2	24	Olive Grove, Woodland	Pigs, Poultry, Rabbits
F3	200	Woodland	Pigs
F4	33	Olive Grove, Woodland	Poultry, Pigs, Sheep
F5	23	Woodland, Wood Pasture	Beef Cattle
F6	10	Olive Grove	Sheep
F7	200	Woodland	Pigs
F8	500	Olive Grove	Poultry
F9	12	Woodland, Wood Pasture	Goats, Pigs

5.3.2 Output, income and quality in silvopastoral production systems in Umbria and Lazio

All farmers produced and sold a variety of products and materials. Four farms sold products coming from different parts of the farming enterprise but unrelated to the agroforestry systems, such as fruits and nuts (F3), meat or milk (F3, F4, F7), pasta (F5, F7), flour (F5), legumes (F7), olive oil (F3, F5) or wine (F3). All farmers were involved in the processing of products either directly, by outlining production methods and recipes, or by establishing their own medium or large-scale processing facilities. All farms sold livestock products such as cheese (2 farms), eggs (3 farms) and meat (7 farms) (Tab. 5.2). Since pigs were the most commonly raised animal in the studied farms, four farms sold either fresh or cured pork products. Three farms sold eggs and poultry as cuts or whole birds. One farm each sold rabbits (F2), beef (F5) and goat meat (F9). Olive oil was the only marketed product originating from the tree component of the silvopastoral systems.

Table 5.2: Products from silvopastoral systems

What agroforestry products are sold?	**F1**	**F2**	**F3**	**F4**	**F7**	**F8**	**F9**
Goats or Sheep Cheese	X						X
Olive Oil	X	X		X		X	
Poultry Meat		X		X		X	
Pork (fresh)				X	X		
Cured Pork			X		X		X
Eggs		X		X		X	

Products were sold directly to consumers from the farms (6 farms), through home deliveries (3 farms), farmer-owned shops in cities (2 farms), and farmer-owned restaurants and holiday accommodations on-farm (agritourism) (5 farms) (Tab. 5.3). The latter are often linked to customers purchasing products off farm, in addition to consumption associated with their stay. Agritourism has also successfully attracted customers from longer distances, educating them about production methods on site. Guests can easily become consumers while staying on the farm or beyond their stay. One farm stated that most customers have previously visited as holiday guests. The two

biggest farms (F3, F8) sold most of their produce in their own shops in cities away from the farm. One of the farmers owned a shop in Rome where products originating from elsewhere are also sold. Another farmer owned five shops in Viterbo, Prato and Rome, exclusively focused on selling their own products comprised of poultry, eggs, pasta and olive oil.

Table 5.3: Distribution channels for products from silvopastoral systems

How are agroforestry products sold?	**F1**	**F2**	**F3**	**F4**	**F5**	**F7**	**F8**	**F9**
Directly off-farm	X	X		X	X	X		X
Home delivery		X		X	X			X
Own shops in cities			X				X	
On-farm restaurants/ holiday accommodations			X	X	X	X		X
Restaurants/Canteens		X		X		X	X	X
Shops/Butcheries		X		X		X		X
Export						X	X	

Five farms sold some of their produce to specialised food shops and restaurants, partly located in Orvieto and the surrounding area but also in Rome and Perugia. One farmer sold to organic supermarkets in Rome, Naples and Milan (F7). Two farmers were exporting meat or meat products to mostly Northern Europe, e.g. organic supermarkets in Denmark and Norway (F7) or selling produce to the Munich store of “Eataly” (F8), a food-hall chain, where, according to their website, “people can eat, shop and learn, all about high-quality food” (Eataly 2015). Home deliveries were conducted by the farmers themselves or their staff. One farm delivered in the region only (F2), while two other farms mainly delivered to Rome and Florence (F4, F5). Of the farms doing weekly home deliveries two (F2, F4) used their own vans and another (F5) rented a truck once a year. Olive oil was either sold directly off the farm or in farmer owned shops and also on a national scale (e.g. purchase groups) or even exported owing to the high number of olive producers in Italy.

Directly selling to consumers was the favoured form of distribution by some, in particular smaller farmers looking for higher profitability. Another reason for selling directly to consumers is the opportunity to strengthen relationships between farmers and consumers. These customers were especially prized in that farmers recognized them for being increasingly interested in how their food is produced or in seeking original taste and production methods. For this reason, one farm (F2) engaged with restaurants selling various types of chickens from different farms for different prices, enabling the consumer to make informed choices about their meals.

The interviewed farmers characterised their consumers as families with medium to high incomes, older people in search of traditional tastes and people looking for high quality food. The farmers selling cured meat or cheese in Rome especially benefit from a higher number of customers able and willing to spend more money on food. Two farmers indicated that they would prefer having more variety among their consumers, as well as making their food available to a wider range of people, rather than those with higher incomes only. In this sense, alternative systems can be considered as exclusive or elitist phenomenon (Hinrichs 2003; DuPuis and Goodman 2005), meaning that products are harder to access for people outside of the given location or with lower buying power.

Farmers were mostly satisfied with the prices they set, but some preferred a higher income. Higher prices can be achieved from selling directly to customers, especially when they are eating in farm restaurants. Selling to restaurants and shops outside the farm will result in lower prices, in part because less preparation and packaging is required. Even though initially negotiating over price, farmers were able to explain how prices are calculated and why they might be more expensive. At the same time, farmers may find it difficult to cope with consumer expectations about prices when they are used to average market prices. For one farmer, selling fresh pork to consumers was not a priority because it proved difficult to compete with prices of a more industrialised production system.

"People instantly think: You cost three times as much. But the fact is that that price is wrong, not mine because that is not food; it's junk" (F4)

In order to promote their products, some farmers organised tasting events at their farms or shops, sometimes in collaboration with other farmers, or organisations like "Slow Food" or local governments. Explaining the differences and specifics of their food, the way it is made and why it costs more than other products was conveyed by only few

farmers in personal exchange with customers. However, some regarded these discussions as essential for the success of their farming businesses as it increases the willingness to pay higher prices. Just three farmers stated that they are engaged in actively explaining their production systems to customers, two of them as part of an on-farm shop or negotiating with restaurants and shops (F1, F2) and the other by offering courses on environmental (food) education in addition to off-farm sales (F4). Other farmers (F1, F2) were planning to set up such courses on their farms, too, alongside engaging with local schools for nutritional courses.

Satisfaction regarding generated income was variable between farmers. Some farmers stated that it could be higher, although a stable if low income from agriculture is still appreciated, and that, in general, agriculture, as a business, is unlikely to produce large profits. At the same time, this prevents farms from expanding as it becomes increasingly difficult to afford additional land. Land is the most valuable asset, and without it and capital necessary to run it, it would be impossible to keep a big enterprise afloat. For some smaller farms, a key issue was external labour, as this often means striking a balance between staffing up, while not having the resources to meet payroll. Volunteerism was suggested as a solution by one farmer. Whilst hiring and paying more workers is an issue with some farmers, finding local skilled workers in both processing and animal care was regarded as a challenge as well. Four of the farms (F1, F2, F5, F9) employed one additional non-family worker, with additional seasonal staff, e.g., for olive harvest or agritourism. Two farms (F4, F7) employed five people for administration, farm work or tourism activities, whilst two others (F3, F8) employed ten or more staff, partly seasonal, for farm work, slaughtering, administration, sales and tourism activities.

Most of the interviewed farms received single farm payments from the European Union under Pillar I, with one also receiving a subsidy for young farmers and another eligible for areas with natural constraints. Five farmers received money from the Rural Development Programme under Pillar II (e.g. for building processing facilities) and four farms obtained subsidies for their organic production as well. One farm received payments for Agri-Environment-Climate Commitments (Measure 10.1). Payments for agroforestry were not mentioned by farmers. Some of the interviewed farmers criticised the way subsidies were handled and reported that funds were received late, remained unexhausted and were then cut, despite sufficient demand, further commenting on the chaotic manner in which regional administrations were processing applications.

Talking about the environmental benefits they realised as a result of silvopastoral production, farmers mentioned different aspects and showed different levels of involvement. Most farmers commented on partial or complete reduction of chemical fertilisers, reduced prevalence of pests and disease outbreaks, decreased chemical plant protection and increased biodiversity. Regarding animal welfare, farmers name such benefits as the availability of varying types of feed among trees, which in pig systems, was linked to better nutritional quality of the products (F3, F7). Further advantages included protection from weather by trees, greater space allowance, the opportunity to express natural forage behaviours and good animal health.

However, what is communicated to consumers differed among the farms. The selling point for the two bigger farms selling cured pork (F3, F7) was quality, as defined by taste and nutritional composition of the meat, as well as by organic certification. Only three farmers (F1, F2 and F4) promote ecological value, something that is made easier over long distances by organic certification (F4).

"When someone comes here they really don't [care] if I have a certified label or not because people see the farm, they see me and they decide […]. When I sell my chicken in Rome […] they need something more than the speech of the butcher" (F4)

Coincidentally, none of the other farmers used chemicals or synthetic fertilisers on their farms. Some even claimed to produce "organically", only without certification, stating various reasons for not wanting to apply for certification. One farmer stated that production in an organic system was more expensive but he also recognised that it would be more environmentally friendly towards farm ecosystems. Another farmer saw a conflict of interest between certification and control inspectors, as farmers need to pay for these services themselves. Besides considering this as unfair he also feared that this conflict would lead to certification that was not always authentic, a notion supported by another farmer, who further claimed that belief in organic certification and labels had been declining. At the same time, farmers argued that organic labelling was not necessary when they can establish close and direct relationships with consumers. To avoid fraud, farmers suggested more governmental involvement in controls and less third-party action. This was also echoed by an organic farmer who questioned the need for an intermediary institution and criticised the way in which farms are controlled.

5.3.3 Silvopastoral systems as part of alternative, local food networks

In contrast to the consolidated system, value creation in silvopastoral systems comes at lower costs as expenses for controlling weeds, pests and diseases or maintenance work will be saved through livestock managed within trees. Animals grazing the space amongst trees reduce the need to treat weeds, while simultaneously fertilising the land. Furthermore, farmers claimed that livestock are able to prevent or mitigate disease and pest infestations in olive trees, as sheep encourage better aeration when browsing on the lower crowns. This helps decrease the chance of humidity build-up and therefore the risk of fungal infections (Malavolta and Perdikis 2018). Chickens will also eat pest-infested fruits or pests themselves (e.g., larvae of olive flies) (Paolotti et al. 2016).

For farmers interviewed in the present study, this has reduced the need to use chemical fertilisers and sprays, and most farmers claim they use none at all. As a result, the production system gives farmers an initial benefit in reducing input costs, while also cutting ecological costs. At the same time, preliminary work is required for setting up fences or feed and water supplies, but this is made easier if livestock is already kept on the farm. For most farmers, this was the case and integrating their animals with trees was merely a practical and obvious solution. Offering more than one product, sometimes also from other producers, is a strategy that farmers employed to give people a wider choice and thus make it more attractive to buy from them. If one product works well and has an established consumer base, it can furthermore be easier to introduce a new product.

All of the interviewed farmers processed the products obtained from the silvopastoral systems, thus adding value before either selling them without a third party or turning them over to a processor, who will then return the products to the farmers for sale (Fig. 5.2). This provides an opportunity to stay in control of ingredients and processes, and allows for an increase and consistency in the desired quality, taste and uniqueness of products. Subsequently, large-scale processers are mostly removed, leaving the value enhancement phase of the products with the farmers and substantially shortening the food chain, one of the characteristics of alternative food systems (Renting, Marsden, and Banks 2003; Kebir and Torre 2013; Barbera and Dagnes 2016). The production of olive oil is an exception, as only one of the interviewed farmers has her own olive mill (F8). The processing facilities of farms differed in terms of size, use of external labour, number of ingredients supplied by outside vendors, product complexity and size of output. As a consequence of

larger farm size and higher number of outputs, work is more formalized, and labour is divided.

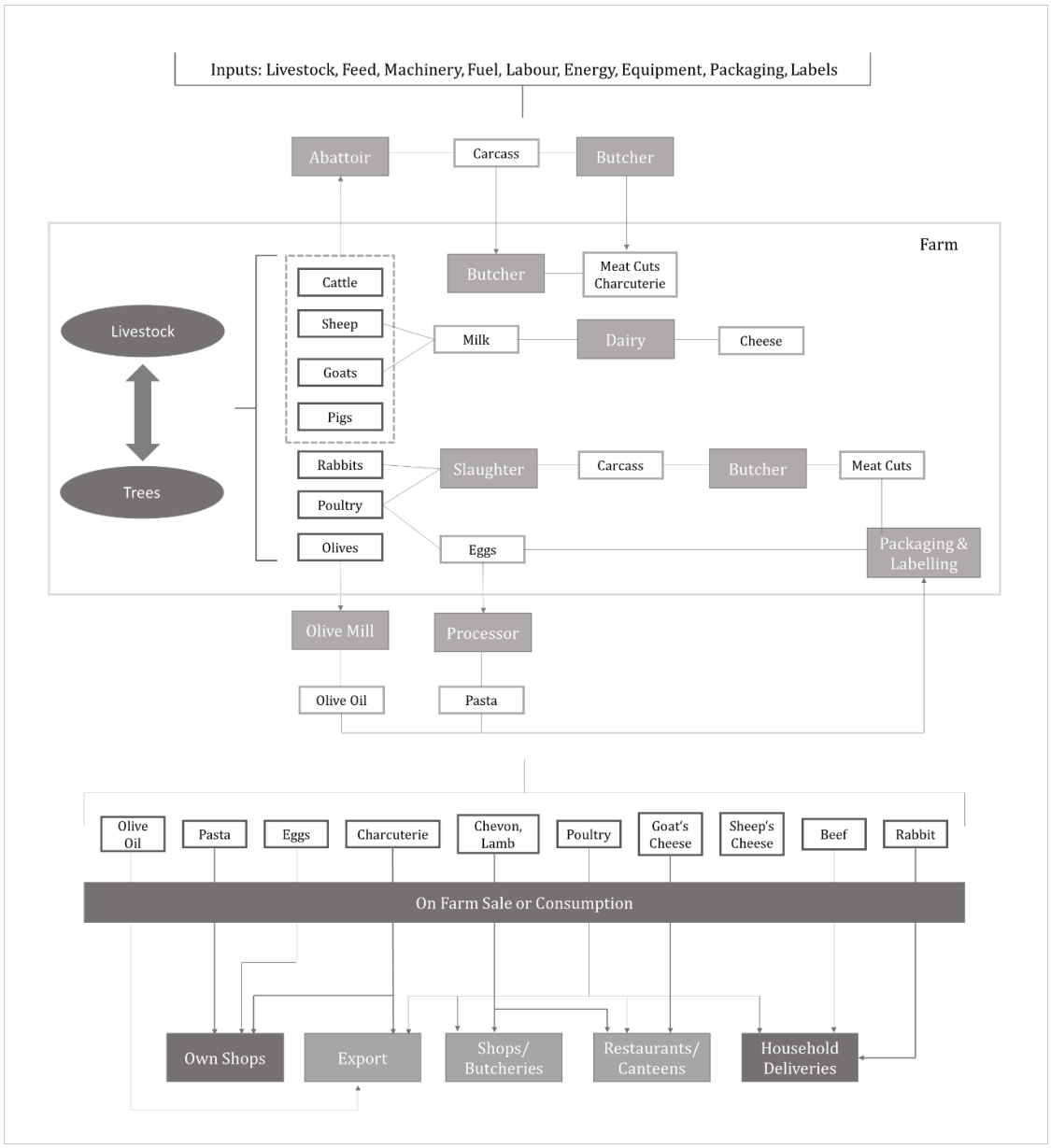

Figure 5.2: Processing and distribution of silvopastoral systems

All farmers of this case study sell at least some of their products directly to consumers on their farms, through home delivery, in their own shops and restaurants or on-site holiday accommodations on the farms. This again reduces the numbers of actors involved in the food chain and strengthens the position of farmers. A further important characteristic of AFN is an emphasis on quality (Ilbery and Maye 2005a; Feldmann and Hamm 2015) rather than quantity in the conventional regime (Ilbery and Bowler 1998). In that regard, it is important to understand what type of *quality* or what quality attributes (Caswell 2006) are promoted by farmers of this study.

For some, high product quality means original taste and outstanding nutritional composition, which add product value when used as a selling point, justifying higher prices. Leaving pigs to forage on acorns, for instance, can influence the nutritional quality of the meat as the composition of fatty acids improves nutrition (Pugliese et al. 2005; Rey et al. 2006) as a result of high oleic acid levels of acorns (Rey, Bote, and Arias 1997). Since some farmers related the nutritional composition of their products directly to the management of animals in woodlands, it is fair to argue that silvopastoral production can be related to higher product quality, translating into higher prices. This complements findings of Feldmann and Hamm (2015), who showed that product quality, meaning freshness, healthiness and taste, were the advantages people most associated with local food.

Another advantage attributed to local food systems is environmental benefits (Feldmann and Hamm 2015). However, only three farmers promoted the environmental benefits of the silvopastoral production by explaining the production system directly to customers or providing educational courses. This is important, as doing so raises understanding and a willingness to pay higher prices. Yet, farmers do not always realise this potential. The absence of marketing the environmental benefits might indicate that promoting them is not essential for farmers in order to sell their products. Consequently, other attributes such as taste, origin, organic certification, animal welfare or nutritional composition must be of higher priority. One farmer also stated that consumers were not capable of understanding the specifics of the production systems, which could be another reason for the lack of promoting these. At the same time, those farmers marketing their products as sustainable usually do so by dint of cultivating personal relationships. Also, advertising the agroforestry system through labelling is not possible.

For some farmers, organic certification can expand the number of customers likely to be those for whom animal welfare and environmental values are important. Without organic certification, this is only possible within the personal sphere, as noted above. Closer relationships between customers and farmers and trust in the specific person or farm as a basis for business are other elements central to AFN. Apart from explaining the implications of the production system, good communication with consumers is also necessary to establish desires and expectations as well as persuading them that that the food is of a certain quality, made in a specific way and can be reliably delivered.

"Because people start to want […] the thing which is made in a certain way. So, you have to be able to explain […] and you have to be able to guarantee what you say." (F9)

This closer relationship and direct exchange between farmers and consumers shift the power towards producer and consumer and away from any intermediary. That is, farmers who gain consumer trust can sell their products with the freedom to decide the fate of their own production base, methods of operation and price setting. Farmers in the present study reported feeling mostly free in setting prices for their different outlets, with higher prices being obtained from direct customers, especially those dining on the farms, while receiving lower prices from off-farm restaurants and shops. Direct selling enables farmers to accurately inform consumers, something which can be beyond their control when selling to third parties, such as restaurants or shops. In this power shift, consumers then have better choice about whether to accept or decline what a farm can offer and an opportunity to drive change if certain products do not meet their needs. Subsequently, consumers become able to hold farmers accountable to what they promise. According to DuPuis and Goodman (2005, 361), "if global is domination then in the local we must find freedom". Expanding on this concept, freedom comes at the price of higher involvement for consumers and greater transparency for farmers, with self-determination gained on both ends.

Yet this is only valid when products are sold directly or with few intermediaries. Gaining and maintaining consumer trust through close and direct relationships is important especially for smaller farms, but might be less feasible as farm size and output grow so that certification, e.g. for organic farming, might become more important as the need to sell over greater distances arises. Moreover, restaurants may find it more difficult to source their ingredients only from farms producing in innovative ways. Some farmers were aware of this and of the limitations this puts on their ability to foster changes within the farming system.

"It's a small farm considering the actual size of the meat industry." (F4)

This correlates with farmers noticing a negative development of general knowledge about food and farming within the society. They criticise an ever-growing distance between farms and food production on one side and consumers on the other. Asked about their customers, one farmer criticises the format of the food hall chain "Eataly", which sources

products from small producers and sells them in a commercial setting, thereby losing the traditional and cultural rooting.

"I do not like this because […] this system destroy[s] what Italy still has left, which is really these local fantastic products. It's a tradition, culture and I think you shouldn't take that and put it in a fancy supermarket." (F9)

Some farmers additionally stated that a lack of nutritional education in schools and a decreasing personal connection to farming leads to misinterpreted expectations of flavours and production systems. One farmer explained that consumers are increasingly trying to avoid fat in fresh meat, which is why they decided to offer processed pork products rather than fresh meat. To bridge this consumer gap, some farmers offer education and knowledge exchange or food tasting events. Recognising a growing awareness for the environmental dimension and consequences of food production, one farmer saw an opportunity to change consumption patterns by educating people about how food is produced and traded.

"I would like to change the knowledge of people about the food chain, this would be the best result ever. Because from this comes everything else." (F4)

Considering the question of how locally or regionally invested farmers of silvopastoral systems are, it makes sense to take a closer look at the entire length of the existing value chains. Although information regarding the sources of farm supplies was not collected for all farm inputs, it is safe to argue that not all supplies originated from close by, nor were they necessarily from "alternative" sources. Whether by choice or necessity, production systems did draw on conventional sources for supply (e.g. hatcheries, feed mills). Yet, the number of farming inputs required is reduced owing to the silvopastoral system, with production becoming more engaged or embedded within the semi-natural conditions of managed lands. Most of the processing and preparation of products was undertaken on the farms, with the slaughtering of larger livestock being the principally outsourced component (Fig. 5.2). Various farmers mentioned the wish to be able to slaughter animals in smaller or mobile abattoirs close to, or on, the farms. Another farmer shared the idea of processing facilities which could be used by smaller farms collectively, enabling an even higher level of processing by the farmers themselves.

The distribution of products is – to some extent – highly regional or even local. Figure 5.3 illustrates the spatial range of distribution channels for the different farms by farm sizes.

Figure 5.3: Spatial range of distribution channels with regard to farm size (based on Marsden, Banks, and Bristow 2000, 427 Fig. 1

The distribution pattern of most farms fits into either the "face-to-face" or "spatial proximity" short food supply chain schemes described by Marsden, Banks, and Bristow (2000: 425). This means that they might have multiple channels for the same product that stretch from direct sales off-farm to sales in farmer-owned shops in Rome. It is noticeable that only farms on the larger end of the spectrum engage in export activities. All of the farms of this study can be seen as part of alternative food networks as they engage in direct forms of distribution with no external actors between them and the consumers and focus their production on high product quality. Simultaneously, farmers may also sell through more conventional modes of food distribution (e.g. restaurants or shops). With this, alongside the use of conventional suppliers or processors, farmers are creating what Ilbery and Maye (2005b, 341) call "hybrid food systems and spaces", where producers flexibly use alternative or conventional links of food chains. This highlights the limitations with which these alternative systems are confronted. For farms, increasing direct sales is desirable as it yields higher prices, but the number of people in a given locality is limited, since most people live in urban areas, which, in turn, limits consumption. This makes it necessary for farmers to expand their distribution beyond

local/regional levels at some point. However, increasing farm size does not necessarily mean that environmental benefits will be reduced. Likewise, the number of products that are – or in fact can be – produced in a locality is limited, too.

5.4 Conclusion

In this paper, we show that farmers practicing silvopastoral production can in part be considered to engage in alternative types of food distribution and thereby form part of alternative food networks. This is based on the existence of direct distribution channels such as off-farm sales, food deliveries and sales in farmer-owned restaurants or shops, enabling direct consumer contact and exchange, as well as a focus on high product quality rather than a large number of outputs. Farmers may or may not participate in regionally or locally embedded product distribution, depending on farm size and quantity of output. Yet, we have learned that the bigger farms maintain their own, regional channels of selling even when they supply consolidated chains with products from the silvopastoral systems. The way in which products are sold provides an opportunity for enhancing product value on farms practicing silvopastoralism, further enabling the promotion of certain values or quality attributes to consumers.

Benefits related to alternative distribution as highlighted by farmers in this study include higher prices for directly marketed products and better management or control of information provided for consumers, while allowing higher levels of traceability, understanding and transparency. However, only a few of the interviewed farmers use positive environmental implications of the silvopastoral systems when marketing their products, indicating some potential for further value enhancement. Silvopastoral agroforestry practices add yet another layer of alternativeness from the production side, an attribute often overlooked in the conceptualisation of alternative food networks. We consider the synergy of environmentally beneficial production methods, their communication, and food distribution in alternative networks as key to secure both the environmental advantages and economic positions of farmers when scaling up systems, and for making a transition towards environmentally beneficial practices such as agroforestry more appealing to farmers.

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Declarations of interest

None of the authors has any personal or financial relations which could influence the content of the paper.

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6 Niche formation in agroforestry: considerations from silvopastoral systems in central Italy

Röhrig, N., Hassler, M., and *T. Roesler* (submitted to *Area*): Niche formation in agroforestry: considerations from silvopastoral systems in central Italy.

Abstract

With the incumbent food system facing different ecological challenges, the need for a change of farming practices on a system level becomes ever more important. The FAO promotes agroecological farming practices in order to create resilient systems able to mitigate climate change, biodiversity decline and soil degradation. Yet, food system transitions are multi-faceted processes, largely complicated by the involvement of many actors and their interests, and their pace and success are slowed by strong lock-in effects in the agri-food system. Assessing the positioning of silvopastoral farming systems in the Italian regions of Umbria and Lazio with regard to niche formation, we find that the systems are operating on the verge of the incumbent farming regime, yet have not succeeded in forming a technological niche. There are several reasons for this. Farmers of these systems have evolved while being part of the dominant farming regime that they have continued to compete with. While having managed to build and maintain a market niche for high-quality, heritage and often regional produce, agroforestry practices are often not part of the product narratives. The systems thus lack an overall vision for a niche of agroforestry systems. This is tied to the existence of only loose connections between actors of the systems. With sustainability shifts requiring changes of both distribution and production methods, we further identify the lack of possibilities to distinguish production methods on labels as a barrier. We conclude that the building of a social network, especially involving regime actors, could not only lead to increased resources for enhanced learning processes, but also stimulate the institutional recognition of this farming practice with the possibility to have a wider impact on the regime.

Keywords

agroforestry, food system transitions, Multi-Level Perspective, strategic niche management, Italy

6.1 Introduction

In recent decades, growing productivity and a rise in land use for agriculture and forestry have added to an increase of greenhouse gas (GHG) emissions, loss of natural ecosystems and biodiversity decline (IPCC, 2019). The planet's natural boundaries face the threat of being crossed under predicted population increase and consumption practices (Springmann et al., 2018), with agriculture being a major driver (Campbell et al., 2017). Current agricultural production is focused on short-term productivity, specialisation and economic efficiency (Nicholls et al., 2016), making a shift towards more sustainable practices of food production, distribution and consumption difficult. This can be explained by the characteristics of sustainability transitions: 1) They are oriented towards a common goal, which private actors have limited interest or incentive to pursue; 2) Financial incentives of sustainable alternatives are often below established methods and do not reveal a direct user benefit (which relates to the first characteristic); and 3) Strong lock-in mechanisms such as infrastructures, competencies or economies of scale, while giving systems stability, create path-dependencies and unsustainable trajectories, in turn giving large firms such as supermarkets or food manufacturers a strong position, as opposed to pioneers, who often first create sustainable solutions (Geels, 2011).

In their 2019 review of drivers of change in the food system, Béné et al. identified technological innovations, for example related to input management, mechanisation, plant breeding or irrigation, and the intensification and homogenisation of agricultural practices, as having major impacts on agricultural supply dynamics. At the same time, they recognise the adverse effects of intensification of farming practices such as soil degradation as well as climate change, in particular related to temperature increase and extreme weather events, which are expected to be expressed in a decrease of productivity of some crops in the future (Lobell et al., 2011; Springmann et al., 2016). Recognising the need for a shift in food production systems, the FAO (2018a) promotes agroecological practices in support of the sustainable development goals in order to address climate change mitigation and adaptation, resource use efficiency and the resilience of farming systems (FAO, 2018a, b).

Combining the management of crops or animals with trees in agroforestry systems is one agroecological approach to shaping agricultural ecosystems capable of providing ecological, economic and social benefits (Prabhu et al., 2015). Agroforestry systems

enable opportunities for land to be used more effectively and efficiently by integrating trees or shrubs with at least one other agricultural crop or pasture for grazing livestock at the same site (Mosquera-Losada et al., 2009; Nair, 1993). Besides economic stability and income diversity (Prabhu et al., 2015), this combination can foster carbon sequestration, reduce soil erosion and wildfires, improve soil quality by intercepting nutrients and the establishment of symbioses with N-fixing or mycorrhizal organisms, increase biodiversity and lead to a higher efficiency in nutrient cycling, thus reducing leaching (Eichhorn et al., 2006; Jose, 2009; Jose et al., 2019; Lawson et al., 2019; Moreno et al., 2018; Riguiero-Rodríguez et al., 2009; Torralba et al., 2016). An increase in water holding capacities and thus a reduction of floodwaters from agricultural land integrating trees also makes agroforestry systems a promising adaptation to droughts or floods due to a changing climate (Lawson et al., 2019). While these are promising benefits in the light of current environmental crises, transforming current farming practices seems equally challenging. Understanding how transitions of established routines can take place is therefore an important basis for supporting actors in adapting environmentally friendly practices and driving wider change.

One approach for exploring how environmental innovations are created and can transform current systems is the multi-level perspective (MLP) (Geels, 2011, 2004; Rip & Kemp, 1998). The different levels of socio-technological *regime*, *landscape* and *niche* are understood as analytical and heuristic concepts, enabling an understanding of the processes and dynamics of socio-technical change (Geels, 2011, 2002). The *regime* as the core of the meso-level is the sum of established actor groups, their links, coordinated and aligned activities, reproduced symbolic or cultural meanings and a shared set of rules (Geels, 2011, 2004, 2002; Rip & Kemp, 1998). While all of this generates a high level of stability, it implicates that innovations are also largely limited by the capabilities and reproduced solutions of the regime community. Hence, socio-technological regimes move along stable trajectories as the result of incremental occurrence of innovations leading to small adaptations (Geels, 2011). In contrast, actors at the micro-level of the *niche* work on radical innovations that challenge regime activities. Niches are protected spaces such as subsidised projects, laboratories or small market niches serving particular demands, which gives actors the room to develop innovations outside of the competition on the mainstream market (Geels, 2011; Kemp et al., 1998; Schot & Geels, 2008).

The macro level of the MLP is those of socio-technical *landscapes*, which form the wider societal, economic, political and cultural context, in which regimes and niches operate and are influenced by. While these landscapes are difficult to affect by regimes or niches in the short term, change in landscapes usually occurs slowly over time (Geels, 2011, Rip & Kemp, 1998). Transition processes result from pressures from the landscape level on the regime, whose destabilisation creates opportunities for new technologies (Geels, 2011, 2002), and from niches gaining momentum through greater acceptance of more exact and better-established ideas or the expansion of the network, especially regarding powerful stakeholders (Geels, 2011). Thus, innovations in niches can be adapted more widely only when there is interaction with ongoing processes at the regime and landscape level. Niche innovations can then become part of regimes first in market niches and may at some point lead to the transition of the regime when innovations are adopted as solutions to certain problems (Raven, 2006; Schot & Geels, 2008).

Yet, the emergence of new technologies from protected niche spaces onto the mainstream market is difficult as this does not only involve a gradual lifting of protection from markets forces, but also the stabilisation or shared rules and designs (Schot & Geels, 2008). Strategic niche management (Schot et al., 1994; Kemp at al., 1998) tries to approach this issue from the premise that niches can be adjusted in order to stimulate sustainable transitions (Schot & Geels, 2008). Based on Elzen et al. (1996) and Kemp et al. (1998), Schot and Geels (2008) summarised which processes lead to successful technological niche development. These include the formulation of *expectations and visions*, formation of *social networks* and *learning processes* of different kinds, such as technical setups, market/consumer preferences, regulations or societal/environmental effects. A failure in niche development has been observed as results of unclear expectations, little participation of external or regime actors in niche development and thus too little resources and institutional involvement as well as a shortage of second-order learning (Hoogma et al., 2002; Schot & Geels, 2008). This was also related to the nature of social networks, since broader networks including more external actors tended to stimulate more second-order learning processes as well (Schot & Geels, 2008).

A further important notion is the recognition of a two-levelness of niche development at the local and global scale. Local projects can be considered as “test beds for […] diffuse ideas and spaces for the elaboration of new ideas” (Schot & Geels, 2008: 543), whose internal learning processes and comparisons with other local projects might eventually

lead to the articulation and stabilisation of rules and ideas at the global niche level. In this, local networks include actors directly involved in the projects and global networks can be understood as emerging communities (Geels & Raven, 2006). In order to transform local lessons into generic rules, it needs activities such as standardisation or the formulation of best practices in order to codify knowledge (Geels & Raven, 2006). In order to address how agroforestry systems can play a role in transitioning towards a more sustainable food systems, this paper aims to assess the position of selected silvopastoral agroforestry farming systems in central Italy within the niche or regime level to understand barriers and requirements for niche formation.

6.2 Methods and case studies

The study for this paper was embedded in the EU research project "SustainFARM" (see www.sustainfarm.eu) aimed at improving the ecological and economic performance of integrated food and non-food production systems. Farmers combining the management of livestock with olive groves, woodlands or wood pastures, i.e. silvopastoral systems, were purposefully selected for the study and recruited by the Italian project partner. Five of the farms were situated in Umbria and four in Lazio. Data collection was undertaken in February 2018.

A qualitative research approach was chosen for data collection using semi-structured interviews. The conceptual approach to analysing the collected data was based on global value chain (GVC) (e.g. Gereffi et al., 2005) and global production networks (GPN) theories (e.g. Coe et al., 2008; Coe & Yeung, 2015; Henderson et al., 2002). Interviews took between one and two hours and were conducted on farm in order to create a comfortable atmosphere for the interviewees. This also facilitated a viewing of farms. Two interviews were partly translated from Italian to English during the interviews, four were fully translated and three were conducted in English. Some shorter statements could be translated word by word but some longer explanations were summarised by the translators at the end of farmers' answers. The audio recordings of the interviews were transcribed and then coded using the software MAXQDA©.

Table 6.1 summarises some key characteristics of the different cases. Farm 6 (F6) was excluded from the analysis due to a minimal output for mainly private use. Some farms had combined animals and trees for more than ten years (4 farms), some of these even 20 or more years (F7, F8). Most silvopastoral systems were established in woodlands or

wood pastures (6 farms) and/or olive groves (5 farms). Pigs, which were mostly reared in woodlands, were the most frequently kept livestock (5 farms), with another farmer planning on introducing them. Three farms reared poultry and two farms managed flocks of sheep, both of which had access to olive groves. Goats and cattle were managed by one farm each to graze and browse on wood pastures and in woodlands.

Table 6.1: Characteristics of interviewed farms (F6 excluded)

Farm	Size (ha)	Agroforestry Site	Livestock Type in Silvopastoral System
F1	46	Olive Grove	Sheep
F2	24	Olive Grove, Woodland	Pigs, Poultry, Rabbits
F3	200	Woodland	Pigs
F4	33	Olive Grove, Woodland	Poultry, Pigs, Sheep
F5	23	Woodland, Wood Pasture	Beef Cattle
F6	10	Olive Grove	Sheep
F7	200	Woodland	Pigs
F8	500	Olive Grove	Poultry
F9	12	Woodland, Wood Pasture	Goats, Pigs

All farmers were part of the processing of products either directly, by outlining production methods, or by creating their own medium or large-scale processing facilities. While all farms sold livestock products such as cheese, eggs and meat, olive oil was the only marketed product from the tree component of the agroforestry systems. Products were sold through a mixture of alternative and conventional channels. Alternative channels included direct sales on the farm (6 farms), home deliveries (3 farms), farmer-owned shops in cities (2 farms) and on-farm agritourism outlets (restaurants, holiday accommodations) (5 farms). The sales region for direct channels stretched as far as Rome for farmer-owned shops, and even to Florence for home deliveries. The conventional channels included sales through specialised food shops and restaurants, partly located in Orvieto and the surrounding area but also in Rome and Perugia. Furthermore, one farmer also sold products to organic supermarkets in Rome, Naples and Milan, and two farmers were exporting products to mostly Northern Europe, e.g. organic supermarkets in Denmark and Norway or the food-hall chain “Eataly”. Olive oil was equally sold through direct outlets on farm or in farmer-owned shops, but also on a national (e.g. purchase groups) or international scale.

6.3 Farm system positioning and niche formation

The combination of agricultural production with a tree component in agroforestry systems is not a novelty (Eichhorn et al., 2006). To talk about agroforestry still stands to reason when addressing the topic of sustainability transitions in agriculture, because its ecological divergence from dominant farming practices makes it novel despite its age and justifies its treatment as a radical innovation. Even with innovation studies often focussing on new technologies, niches can also be places for old technologies (Markard & Truffer, 2008). What is more, with the systems being engaged in alternative modes of food distribution, the innovative stance of these systems is also a social and organisational one (Bui et al., 2016).

Yet the question arises whether it is appropriate to call the application of agroforestry methods a technological niche or simply an innovation on the verge of the existing regime. There are several points supporting the latter option. First, the studied systems are not protected from competition from the rest of the food sector, which is one important characteristic of technological niches (Geels, 2011; Schot & Geels, 2008). Moreiver, few of the interviewed farmers seem to acknowledge the differentness of their silvopastoral management from current farming practices in terms of its environmental advantages. Even though for some the decision to combine trees and livestock was a decision made consciously for management, cost and animal welfare benefits, for others, motivation was more a practical consequence of the given land structures. We can therefore not argue that all of the agroforestry systems were "informed, initiated and designed in response to sustainability problems perceived in the regime" (Smith, 2007, p. 436), which is a characteristic of green niches. Ironically, the natural suitability of the silvopastoral approach to the conditions in the studied cases is thus in some way a barrier for niche formation.

Some of the farms in this case study have combined the management of animals and trees for more than ten or even 20 years. It is thus fair to argue that these actors have been able to successfully establish and maintain a space for the alternative management of livestock and trees diverging from regime practices. While farmers have been able to form a market niche, which is characterised by specific selection standards e.g. consumer preferences (Markard & Truffer, 2008), it remains questionable how important the agroforestry practices are for this niche to exist. As only a few farmers of the studied systems promote

the silvopastoral management and its benefits to consumers, it can be argued that incentives for people to buy the products might be more related to other attributes mentioned by farmers such as nutritional/physical characteristics, taste, heritage or origin, animal welfare, as well as organic certification. Surely, some of these attributes will be available elsewhere; it doesn't necessarily need an agroforestry system to produce them, even though some farmers directly related the management of animals, e.g. pigs, to the nutritional composition of their products. The lack of possibilities to label products from agroforestry systems as such, the difficulty to explain practices to consumers outside of personal exchange as well as the overlap with other environmental farming practices complicates a distinct definition and formation of a *silvopastoral* market niche, which makes it necessary for farmers to draw on established mechanisms of the regime or other niches (e.g. organic certification).

All of the studied farmers can to some extent be considered to be engaging in alternative types of food distribution and thereby form part of alternative food networks. Farmers selling their products directly off-farm, through food deliveries and in owned restaurants or shops gain direct exchange with consumers and focus on high product quality rather than a large number of outputs. They thereby work diametrically opposed to the current food regime favouring productivity increases (Pretty et al., 2018). In this sense, farmers have managed to create a market niche for high-quality, artisan and often regional food products that are sold outside the conventional channels of the current regime. Advantages of the alternative distribution mentioned by farmers included higher prices for directly marketed products, better management and control of information and education provided by farmers to consumers, higher levels of traceability, and understanding and transparency throughout the food chain. At the same time, we see two of the larger farms rely especially on both alternative and conventional modes of food distribution through sales off-farm and through own shops, but also to supermarkets, canteens and even exported products.

Having established that farmers of the studied cases can be considered as pioneering a radically different practice of production and distribution on the verge of the existing regime (Smith, 2007), taking a closer look at the development and status of these activities can be important for evaluating the current impact on the regime and barriers for expansion, especially concerning the (missing) incorporation of silvopastoral agroforestry practices as a defining niche characteristic. Relating the findings from this

study to the processes identified for successful niche development, i.e. expectations and vision, social networks and learning processes (Elzen et al., 1996; Kemp et al., 1998), it can be noted that some of the farmers have ideas and an active interest or even a *vision* for changing the ways the food system operates. One farmer already offers educational courses with two others aspiring to do so in future to create a better understanding of food production and nutrition. Some of the interviewed farmers characterise their customers as families with medium to high incomes, older people in search for traditional tastes and others looking for high quality in food showing an increased interest in how food is produced. Two farmers indicate that they would prefer having more variation among their consumers as well as making their food available to a wider range of people, rather than those with higher incomes only. However, these views can only be interpreted as individual views rather than a unified vision for a silvopastoral agroforestry niche. The existence of a well-defined niche and its expansion over years may well lead to changes on the regime level (Weber et al., 1999).

Social networks built around a novel technology help to connect relevant stakeholders and support the provision of financial, human and knowledge resources (Schot & Geels, 2008, Geels, 2011). These also enable *learning processes*, which will be taking place on many farms to be shared and likely translated into changing intellectual frameworks of the niche (Schot & Geels, 2008), not only on a local but broader community level (Geels & Raven, 2006). Even though two to three of the farms were engaged in an organised exchange on agroforestry systems at the point of data collection, this was described as rather soft, with farmers relying on advisors or agronomists, farmers associations, specific experts and fellow farmers for their day-to-day management questions on a specific component of the agroforestry system (e.g. olive trees or goats). Although some farmers would welcome an increase in knowledge exchange and collaboration (e.g. shared processing facilities), it was also acknowledged that this would be a time-consuming job, which should ideally be taken over by a third person. The expansion of the social network with participation of large, powerful actors, who might not only bring capital for improved exchange, but also raise the importance of the subject to the political and subsidy agenda (*Geels* 2011), can thus be considered an especially promising lever for niche formation.

6.4 Conclusion

Following the approaches of multi-level perspective and strategic niche management, this paper assessed the position of silvopastoral farmers in the Italian regions of Umbria and Lazio. Although farmers are engaged in a radically different form of agriculture, they do so at the verge of the existing regime rather than in a niche. We identified several reasons for this. First, most farmers did not establish a different form of farming as an opposition to the unsustainable practices employed in the regime, but as a solution for different management issues. They therefore lack not only a unifying and niche defining vision, but often also the recognition for the radicality of their approach and the opportunity that comes with it. Secondly, farmers continue to operate in the market setting of an industrialised farming system, which they constantly have to compete with. They were hence neither sheltered from market forces, nor were they given the space or resources by external institutions for exploring silvopastoral agroforestry practices. Thirdly, actors were only loosely connected, so that social networks and shared learning processes were only happening on a limited scale.

With all farmers of this study engaging in some method of alternative food distribution by using direct distribution channels, farmers have succeeded in forming a market niche for high-value, high-quality, heritage and often regional produce. In some way, these farmers have thus already managed to maintain an alternative position in the dominant regime. Although organic certification is an important defining feature for some of the products, suggesting that environmental benefits do have a role for shaping product value, the ecological advantages of silvopastoral agroforestry specifically are seldom addressed in marketing settings, even though most farmers were aware of some. Despite a potential lack of knowledge of agroforestry practices among consumers, the lack of possibilities to label products adequately makes the promotion of production methods more difficult beyond direct sales situations. Yet, for a sustainable shift of the food regime, it is both the farming practices and distribution methods that need to change, which is why it is important to give meaning to the agroforestry component and its advantages in product valuation and marketing.

Yet, farmers of the case study going new ways in terms of environmental production practices, alternative forms of distribution and marketing, their aspiration to educate people, the disagreement with current farming practices, and a vision for more localised

farming systems in future, with increased equity in access to food, are all important features for driving change on a regime level. Assessing the question what farmers would need in order to develop a successful niche, we identified the lack of a social network connecting the different agroforestry actors as one main obstacle. Since sustainable development needs both technical and social shifts, building relations for formulating a vision for the agroforestry niche, the exchange of knowledge and experiences and the broadening of connections to stakeholders outside the niche setting are all important for not only extending the application of agroforestry but can help answering questions of scalability, economic incentives and inclusiveness.

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7 Summary and discussion

The second half of the 20th century saw substantial changes to agricultural production systems in many parts of the world through the introduction of chemical inputs, enhanced mechanisation and selective breeding. Accompanied by production increases and greater availability and choice of food products in the industrialised Western countries, this has led to a concentration and consolidation of farms, land, food businesses and, ultimately, power. Value chains have become more fragmented and embedded in a globalised financial and corporate agri-food system. Value, understood as the monetary equivalent provided in exchange for a good, is initially created by farmers, who through their work transform inputs (seed, fertiliser, feed) into outputs (cereals, milk, meat). But as these goods are often mere raw materials for the final product, value enhancement lies with processers and retailers, who are also able to capture the highest share of product value at the point of consumption. With the transition of mixed farms of low or medium productivity levels to specialised places of high production, farms had to become reliant on structures capable of processing and distributing the volumes that they now provided. In doing so, farmers have been losing power towards downstream sectors (*Ilbery* and *Bowler* 1998).

Besides the socio-economic implications this has had for farmers and the wider rural community, recognition of the environmental consequences of a more industrialised farming regime is increasing. With simplification of farming systems at the centre of the productivist approach, alternative methods aim to increase diversity on farm, but also beyond. Yet, these systems are confronted with a powerful regime of established actors and rules locked in unsustainable trajectories and mindsets.

At the same time, the demand for food from environmentally less harmful systems is growing and consumers are becoming more aware of the shortfalls of the conventional food regime. This gives room for actors of alternative farming practices to explore possibilities to produce and distribute food in novel or unconventional ways. The concentration processes in agriculture are ongoing, but so is the expansion of demand and supply of sustainable and regional food. This dissertation is situated in the field of alternative, sustainable food production networks and food system transitions and set out to deliver a better understanding of the conditions, possibilities and limitations of alternative silvopastoral systems relating to the valuation of environmental value or

ecosystem services, alternative distribution practices and contributions to an agroecological shift of the food system. In this, the GPN approach (*Henderson* et al. 2002) served as a basis for the analysis of the structures and dynamics revolving around the production and distribution of silvopastoral products.

Italy and more specifically the regions Umbria and Lazio were chosen for this analysis for several reasons: (1) Italy has one of the highest shares of agricultural land under silvopastoral management in Europe and (2) the third largest expansion of land under organic cultivation in the EU in 2018, indicating high awareness and willingness by farmers to take up environmentally farming practices; (3) retail structures are fragmented and smaller, traditional but also online formats made up a quarter of retail sales in 2018, showing opportunities for alternative retail formats; (4) production of olive trees constitutes the largest share of main farming types in Italy, indicating scope for the combination of animals and trees and (5) agroforestry has historically been part of land management approaches in Umbria and Lazio.

While agroforestry farmers are competing with a powerful system of conventional farmers and agri-food businesses, they also hold the benefit of additional environmental service production over many of these competitors. Yet, environmental gains from agroforestry systems are often conflicting with the financial implications of increased management efforts (*García de Jalón* et al. 2018; *Graves* et al. 2017; *Rois Díaz* et al. 2018; *Camilli* et al. 2018). Exploring possibilities to incorporate these environmental advantages into product value can thus help to better understand the under-researched economic performances of these systems (*Camilli* et al. 2018) and ultimately aid the creation of support and incentives for farmers to take up agroforestry practices (*Pirard* 2012; *Farley* et al. 2011).

In order to understand if and how environmental value is included into product value, chapter 4 addressed the different ways in which farmers of silvopastoral agroforestry systems define the value of their products. This gave the opportunity to identify existing strategies and reasons for either including, excluding or not considering ecological value when marketing products. Furthermore, it is discussed whether the understanding of environmental issues presented in GPN literature is sufficient for analysing environmentally complex production settings, especially regarding intangible output.

Aside from the individual perceptions and choices which are shaping product value at farm level, it is also the distribution channels which determine the possibilities for an expansion of agroforestry methods. Since farmers were likely to fulfil assumptions on demands and expectations often related to regional or local produce, it was assessed whether farmers could indeed be considered part of alternative systems. Therefore, chapter 5 analysed the distribution settings of the case studies within the discourse of benefits and limitations of alternative food networks. Further scaling up the level of analysis, chapter 6 explored the positioning of agroforestry farmers in the wider food system and their possibilities for enabling change towards a more sustainable farming regime.

This chapter summarises and discusses the empirical findings of this dissertation with regard to the initially introduced research questions.

i) Do environmental benefits or ecosystem services play a role in the definition of product quality and how are they incorporated and captured in product value in agroforestry systems?

Environmentally friendly production systems such as agroforestry are capable of producing additional ecosystem services. Since these are not often traded in markets, increased management activities and costs can be considered as obstacles for transforming to agroforestry systems (*García de Jalón* et al. 2018; *Graves* et al. 2017; *Rois Díaz* et al. 2018; *Camilli* et al. 2018). Incorporating the value of these services into product value could then be an incentive for managing livestock and trees in combined systems. Nevertheless, farmers of this study had different motivations for establishing agroforestry systems. While for some the management was an obvious approach for the conditions at their respective localities, others also made this choice because of management benefits such as fertilisation from animals or weed or grass control, saving costs on feed and increasing the number of products from the same piece of land. None of the farmers mentioned a purely environmental motivation for managing livestock and trees on the same site, whereas animal welfare considerations did play a role for some.

Perceptions of environmental benefits of agroforestry systems were mixed across the farms, with only a few farmers seeming to be aware of and acknowledging the environmental benefits of their systems. Perceptions of animal welfare benefits in the systems were more consistent and most farmers were able to name several advantages.

Since communicating the environmental benefits of production methods could be a powerful tool for farmers in distinguishing themselves and their products, a lack of awareness for potential benefits already indicates untapped potential for marketing additional ecosystem services with silvopastoral products.

Nevertheless, the interrelated processes of the agroforestry systems have an impact on product value. Relating to the three GPN sub-categories of value creation, enhancement and capture (*Henderson* et al. 2002), the evolution of value was analysed for these three stages. Farmers perceptions of the contributions to value at the initial stage of creation were largely coherent and included the reduction of external inputs as well as positive interactions of the different elements of the systems (e.g. animals fertilising trees on site, trees providing shelter). Leading not only to cost savings, but also enhanced ecosystem service provision and animal welfare, as well as improved nutritional value of products, some farmers perceived these benefits as a direct result of the management system.

Views on generated income were mixed across farms. While some farmers stated they wished it was higher, it was also stated that this was not expected from farming and stable but low incomes were still appreciated. Nevertheless, farming is a resource intensive business, with land being viewed as the most valuable asset by some farms. Besides land availability and access, another challenge related to external labour. Especially for some smaller farms this meant balancing an increase in staff requirements against financial resources. However, finding local staff with the necessary skills was another issue reported by some farmers in this regard.

Concerning value enhancement, some level of product upgrading (*Kaplinsky* and *Morris* 2001; *Humphrey* and *Schmitz* 2000) could be observed for all farmers as they were engaged in the processing of their products, even if the scale of operations differed. Farmers were either directly processing their products themselves or turned them over to a processor, who then returned the products to the farmers for sale. However, processing was not explicitly linked to the agroforestry systems, i.e. product upgrading was not necessarily a result of silvopastoral management. Being in charge of processing activities allowed farmers to stay in control of processes and ingredients and allowed them to increase and maintain consistency in taste and quality. The collaboration of farmers in shared processing facilities or marketing cooperatives was mentioned by some interview partners as ideas for cost sharing and wider distribution opportunities.

The largest differences for the evolution of value was noticed for the category of value capture. It could be shown that the distribution scale and setting was crucial for the marketing of specific attributes. Marketing of environmental benefits and animal welfare incentives was largely confined to local or regional sales, while quality attributes in national or international contexts focussed on taste, tradition, nutritional composition and organic certification. This was closely linked to the possibilities offered by direct marketing strategies deployed in local and regional contexts, since these allow for more informal modes of consumer engagement and thus proved easier in explaining the production system. A lack of possibilities to inform consumers about the agroforestry system on labels was identified as an obstacle in promoting environmental benefits over larger distances. Only three farmers actively informed their customers about these advantages where people were buying directly on their farms or through environmental and food education courses. For farms selling over greater physical and relational distances, organic certification was important for defining product value.

For farmers not advertising the agroforestry system or its benefits to consumers, promoting these seemed not to be of prime importance for product marketing. Moreover, farmers tended to perceive these benefits in the absence of environmentally harming farming practices rather than positive ecological outcomes, which might hinder the marketing of ecosystem services. Seemingly, other retail incentives such as animal welfare, taste, heritage and not least nutritional or physical product characteristics must be of greater importance. The role that ecosystem services play in the definition of quality is therefore limited to direct distribution settings or a partial recognition in organic certification, where applicable. In essence, ecological benefits or ecosystem services were incorporated by farmers at value creation and capture stages: 1) the need for certain inputs was reduced due to the interactions in the agroforestry systems; and 2) silvopastoral production practices added to product quality by improving nutritional characteristics and credibility attributes (*Caswell* 2006) such as animal welfare or environmental advantages. In this regard, an improved understanding and communication of the positive environmental outcomes from interactions in the silvopastoral systems could allow another level of capturing a so far largely untapped dimension of product value.

ii) Can the studied systems be considered part of alternative food networks and which benefits and challenges does this involve?

The Italian retail sector is characterised through relatively high fragmentation amongst modern retail companies and overall formats. Underlining the importance of buying- and cooperative groups (*Fornari* et al. 2013), there is also room for alternative, direct sales relationships. In Umbria and Lazio, directly selling to consumers either in house or at markets made up 30% of product sales from farms in 2010 (*De Devitiis* and *Wanda Maietta* 2013). Traditional modes of retail (e.g. traditional shops, market stalls) and e-commerce accounting for over a quarter of sales (*statista* 2019) further indicates strong potential for alternative modes of distribution.

All farmers of this study are involved in alternative distribution channels by directly selling products on their farms, via home delivery, in farmer-owned shops and at holiday accommodations or restaurants on farm. By removing large-scale processors from the value chain, the numbers of actors in the value chain is reduced, leaving most of the value enhancement and capture with the farmers. At the same time, this allows for the evolvement of closer relationships and exchange between farmers and consumers, strengthening both of their standing in the food network. In this relationship based on trust, farmers enjoy the freedom of making their own decisions of their production methods and price setting. Yet prices differed between distribution channels, with higher prices being obtained from direct customers and lower prices from independent restaurants and shops, i.e. more conventional modes of product distribution. However, consumer expectations on prices might also be distorted by average market prices of more industrialised production systems, which farmers might see themselves unable to compete with. Good communication on the differences and benefits of agroforestry systems is thus key in fostering consumer understanding and willingness to pay, as well as influencing consumption patterns more widely.

In this regard, better management and control of information provided for consumers is another advantage of selling through alternative and direct distribution channels. While this creates a better understanding of production methods, it also enhances the traceability, transparency and accountability of the production process and allows consumers to make informed choices or communicate changing demands. Nonetheless, informing customers can be difficult for farmers as some have witnessed a decline in the

general understanding about food and farming and a growing distance between farms and food production in society. The rise of the food hall chain 'Eataly' was criticised as a vivid example of this disconnection, by sourcing produce from small producers and putting it in "a fancy supermarket" (F9). Moreover, farmers blamed a lack of nutrition education in schools and decreasing personal connections to farms and the countryside for mismatched expectations of flavours and production systems in the wider societal context. In order to overcome these gaps in knowledge and expectations, some farmers are offering educational programmes or tasting events on their farms.

In direct sales contexts, some farmers described consumers as being increasingly aware of the environmental and ethical dimension of food production and were subsequently interested in how food was produced. As this directly contradicts observations made about the general lack of understanding of farming, this suggests a growing divide in society. Furthermore, farmers recognised that some people were seeking what they referred to as an original taste of products. Broadly speaking, consumers were characterised as medium to high income families, older people looking for traditional tastes and others in search of high-quality food. Farmers selling in Rome especially benefitted from a higher number of customers with higher incomes. Some farmers saw this exclusivity as a hindrance as they preferred greater variety among their consumers and making their food available to a wider range of people, rather than those with higher incomes only.

Another important characteristic in alternative food networks is the focus on product quality rather than quantity (*Ilbery* and *Maye* 2005a; *Feldmann* and *Hamm* 2015). For some farmers of this study, quality was defined by original taste or an outstanding nutritional composition of meat. Since this was directly related to the management of pigs in woodlands, it is fair to conclude that silvopastoral production can be connected to higher product quality, which may translate into higher prices. Farmers have thus been shown to fulfil people's demands for buying local foods for freshness, healthiness and taste (*Feldmann* and *Hamm* 2015). Although environmental benefits are another characteristic often attributed to local food systems, few farmers used this as selling point in direct sale settings. While this could be interpreted as untapped potential for further value enhancement, this also indicates that promoting environmental benefits is not yet essential for farmers in order to sell their products. The lack of opportunies to advertise the agroforestry system through labelling further complicates conveying the meaning of

the production systems over greater distances, so that some farmers rely on organic certification for customers who favour animal welfare and environmental values, yet are too far away from the farm to learn about these in direct exchange.

Overall, the distribution channels range between local, regional or even international export settings, yet these are noticeably limited to farms on the larger end of the size spectrum. Most farms have multiple outlets for the same product in the "face-to-face" or "spatial proximity" SFSC categories described by *Marsden* et al. (2000: 425), which extend from off-farm sales to sales in farmer-owned shops in Rome. Creating so called "hybrid food systems and spaces" (*Ilbery* and *Maye* 2005b: 341), farmers simultaneously engage in more conventional modes of food distribution (e.g. restaurants or shops) but also processing and supply. This shows the boundaries of the alternative systems in terms of provision for a limited number of people in a given locality. Moreover, the local or regional embeddedness of farming systems is also compromising in terms of farm supplies and processing facilities. It is safe to argue that not all supplies originated in the same regions as the farms, nor were they necessarily from 'alternative' sources, so that farmers drew on conventional sources for supply (e.g. hatcheries, feed mills) but also processing (e.g. abattoirs). However, the necessity to use these is closely linked to consolidation and concentration processes in the agri-food sector and stresses that alternative networks are still heavily influenced by the industrialised food system. Nevertheless, most of the preparation of products was conducted on farm, and where this was not possible (e.g. slaughtering larger animals) farmers expressed the wish for smaller and/or mobile abattoirs, or interjected the idea of shared processing facilities which could be used by multiple farmers. Both of these examples show a desire for further decoupling from the dominant farming regime.

iii) Do farmers contribute to a wider change of the food regime through the formation of a socio-technological niche?

To assess the contributions to a regime shift in the Italian food and farming system, understanding the characteristics of the current food regime is crucial. The Italian agricultural sector is characterised by mostly small farms (i.e. <5 ha), yet just 7.8% of holdings account for 55.8% of the utilised agricultural area. Still, concentration of land in larger farms (i.e. >50 ha) is low at 4.1%, compared to other European countries such as Germany (30.6%), Denmark (35.3%), France (41.3%), or Luxembourg (51.8%), which

have substantially higher shares of farms larger than 50 ha (*Eurostat* 2018a). Due to geographical and socio-economic disparities on the suitability of land and organisational models, farm modernisation of the 20th century was not a homogenous process in Italy. This resulted in differences on farm specialisation, intensification and concentration amongst geographical areas. Nevertheless, entrepreneurial farms are the mainstay of agriculture in Italy today (*Fonte* and *Cucco* 2015).

In this sense, combining trees with a crop or livestock component while being engaged in different social and organisational forms of food distribution (*Bui* et al. 2016) can be considered as a radically different approach worth exploring with regard to sustainability transitions in agriculture, even if agroforestry is technically not a novel idea (*Eichhorn* et al. 2006). Yet, it still needs to be discussed whether agroforestry systems can be considered as forming niches or are simply an innovation on the edge of the existing regime. One important deviation from the characteristic of niches is the lack of shielding from the rest of the food sector (*Geels* 2011; *Schot* and *Geels* 2008). The studied systems were not operating in any kind of protected space yet had to compete with other market actors. At the same time, the lack of awareness of the environmental benefits of the systems by some farmers indicates that not all of the silvopastoral systems were established in opposition or response to some of the unsustainable practices of the incumbent food regime, which is characteristic of green niches (*Smith* 2007). This is partially related to the fact that the systems simply offered convenient and suitable solutions for reccurring farming challenges.

However, farmers have been able to establish and maintain spaces to rear livestock and grow trees in the same space for sometimes even 20 years or more. They have thus succeeded in diverging from current regime practices in forming a market niche, which is characterised by specific selection standards such as consumer preferences (*Markard* and *Truffer* 2008). Since only a few farmers communicate these different management practices it is nevertheless debatable how central the agroforestry system itself is in the definition of this market niche. Even though some farmers directly related the quality of their products to the agroforestry management, some of these attributes can be found outside of these systems. In this sense, the inablity to advertise agroforestry on labels is a barrier for a distinct niche definition, as consumer information and education remains limited to personal interactions. Hence, it is not surprising to find that farmers resort to

established communication mechanisms of the regime or other niches such as organic certification.

Yet, being engaged in alternative types of food distribution, all farmers of this study can be considered in working at least in divergence from the conventional distribution chains. Nevertheless, speaking of an established agroforestry niche would be misleading for several reasons. The partly observed absence of silvopastoral practices and benefits as a product defining characteristic reveals a missed opportunity for identifying and formulating the agroforestry niche as a somewhat opposing concept to the industrialised farming regime. Drawing on concepts and processes identified as success factors for technological niche development (e.g. *Elzen* et al. 1996 and *Kemp* et al. 1998, cited from *Schot* and *Geels* 2008), the formulation of expectations and visions is central for the successful establishment, maintenance and progression of socio-technical niches. Yet, some farmers have ideas or maybe even a vision for changing the food system, for example related to education, consumer expectation or greater access to their products for a more diverse customer base. However, without interactions amongst the farmers, these ideas remain individual views rather than a contribution to a unified vision of a silvopastoral agroforestry niche.

Social networks will not only enable the connection of relevant stakeholders, which, in turn, can help to foster the provision of human, financial and knowledge resources (*Schot* and *Geels* 2008; *Geels* 2011), but also allow learning processes. Possibly taking place on many farms as is, sharing and channelling these processes can help to change intellectual frameworks not only of the niche (*Schot* and *Geels* 2008), but also on broader community levels (*Geels* and *Raven* 2006) and finally, after time, spill over to the regime level (*Weber* et al. 1999). The engagement of large, powerful actors might further raise the importance of the subject to the political and subsidy agenda (*Geels* 2011). Some of the interviewed farmers participated in an organised exchange on agroforestry systems, yet this was described as rather soft. Some farmers expressed an interest in knowledge exchange activities and collaboration with other farmers, yet the time investment required was seen as an obstacle.

Based on the findings of the research questions, contributions to the theoretical debate are explored and summarised in the following section.

The first contribution relates to the scope of evaluating environmental issues in GVC or GPN analysis. It could be shown that the analytic categories defined by *Henderson* et al. (2002) are useful in understanding the constitution and evolution of value from silvopastoral systems. Nevertheless, the disconnection between the natural environment and the production, distribution and consumption of goods or services observed for network theories (*Coe* et al. 2008) somewhat limits the validity of findings not only for networks with the environment at its centre. In fact, GPN analysis is understood as useful for assessing and managing *negative* environmental externalities of economic processes (*Coe* et al. 2008).

Thus, the integration of an environmental dimension in the analysis of production, distribution and consumption is limited to the assessment of negative consequences as well as risks of economic activity (*Yeung* and *Coe* 2015). Furthermore, it can be addressed in the context of power with regard to the influence of non-firm actors (*Coe* et al. 2008), which includes environmental NGOs, on value creation, enhancement and capture. As a result, positive externalities of the economic process might not be receiving enough attention if they are not captured by actors. Yet, this does not mean that they do not exist, and they should be acknowledged as an asset, even if currently untapped.

The present work addressed this by considering if and how environmental benefits were included in the evolution of value from silvopastoral systems. It could be shown that actors involved with value creation, enhancement and capture processes perceive an environmental dimension of their economic activity, which goes beyond the consideration of risk. Indeed, some farmers used the silvopastoral management and its beneficial environmental interactions and outcomes as a strategy to manage issues occurring in their production systems. The reduced need for inputs and higher product value as observed for some farms in this study are examples for economic benefits derived from the silvopastoral systems at the value creation and capture stages. It can be concluded that all forms of upgrading activities (i.e. process, product and functional) (*Humphrey* and *Schmitz* 2000) could be found in the assessed cases. Yet, only process and product upgrading could be directly linked to the silvopastoral management e.g. in the reduction of input costs or higher prices for products. While functional upgrading, understood as the adoption of new functions in the value chain (ibid.), could also be observed, for example in the processing of milk to cheese, their occurrence cannot be solely attributed to the agroforestry system.

Yeung and *Coe* (2015) identified environmental impacts of production systems as part of ethical considerations of consumers, acknowledging the importance of conveying information of these ethical aspects to them. Surprisingly, they also define environmental sustainability as one of many "non-economic issues" (*Yeung* and *Coe* 2015: 51). Besides being problematic on a conceptional level, this perspective also fails to admit that environmentally beneficial production practises can be more than mere abstract ideas. This study showed that they can become economic variables if they are incorporated as a factor in value creation by both reducing costs and justifying higher prices. Beyond theoretical conceptions, financially valuing those positive externalities is indeed a real necessity in the market setting to give farmers a competitive advantage over conventional farms, since they not only reduce negative externalities but may even support the provision of additional ecosystem services.

With greater physical distances between producers and consumers, the use of certification schemes and labels might become more important as a means of information, traceability but also dependability. However, there is currently no label for agroforestry systems, with some farmers opting for organic certification. While it is a well-established and recognisable label, it was not supported by all farmers in the study due to concerns over the inspection process or financial and structural limitations. Apart from these practical reasons, this can also be discussed on a theoretical level. Organic certification unites a variety of practices and therefore gives little possibility for distinguishing different production methods or specific ecosystem services provided. However, this originates very much from the nature of organic certification, which as a voluntary price signal rewards a bundle of environmental practices, which while being arguably connected to ecosystem services, do not explicate certain service provisions (*Wunder* 2015). Ultimately, organic certification rewards the management of production systems, rather than the outcome in terms of ecosystem services provided or disservices reduced.

Therefore, price premiums attained from organic farming are not payments for ecosystem services in the technical sense since they are bundles of certified practices traded in markets, rather than contractual agreements adhering to the specific provision of services paid by its user (*Wunder* 2015). None of the non-organic farmers of the studied systems were able to formally claim compensation for the additional services that their systems potentially provided. While this work was not concerned with measuring the actual service provision, this reveals an untapped potential for encouraging and motivating

farmers to change their production systems *(Pagiola* et al. 2007). With valuation techniques based on market functions or stated preferences (see chapter 2.2) requiring appropriate data which will not be readily available or accessible, direct economic valuation of ecosystem services in terms of Coasean-type agreements (*Pirard* 2012) or PES (*Wunder* 2015; 2005) offer a more straightforward way of rewarding environmental service provision. At the same time, they require a considerable amount of knowledge and self-initiative from farmers as well. Focussing on an outcome-based approach in subsidising farms on an EU level that is truly rewarding ecosystem services provision, might give possibilities to enhance value for agroforestry products. However, this would require a complete shift in normative understanding and governmental structures of the CAP. Within the current structures and limitations of the EU farming system, farmers of the studied agroforestry systems can only capture the environmental value in close personal links with consumers, or by using organic certification for long-distance distribution.

This links with the contribution made by this work on the debate on alternative food systems or networks. It was established that all farmers of this study can be considered to be selling through direct distribution channels and focus on high product quality, and thus, by definition, are considered part of alternative food networks. Yet, this definition needs to be viewed with caution as a lot of the literature on AFN relates to the Western European context. When the "quality turn" (*Goodman* 2003) took place, which was linked to calls for a shift towards more extensive farming systems, the initial situation of the farming sector in Italy differed from places like Germany or the UK. In other words: as the baseline characteristics of the farming sectors differ, so must our definition of alternativeness "intended to denote something different from the mainstream model" (*Fonte* and *Cucco* 2015: 285).

While the Italian farming sector is characterised by greater fragmentation and persistence of small-scale farms, and distribution is less concentrated upon supermarkets, it is nevertheless governed by an entrepreneurial production model with an (international) market orientation (*Fonte* and *Cucco* 2015). Yet, the large variety of farming formats also indicates demand for specialised, regional, artisan and heritage produce of lower quantities. Proceeding from a perspective of globalised agri-food networks, it is easy to argue that most of the considered farming systems of this study function in different ways mainly due to the way products are distributed. Proceeding from a perspective of the

Italian farming sector, it is the difference in production methods, i.e. silvopastoral production, in combination with direct distribution channels, and a focus on high product quality and origin, which determine the alternativeness of these systems. Thus, the opportunity for value enhancement and capture for silvopastoral systems arise from the combination of alternative management and distribution.

Farmers in the presented case may or may not participate in regionally or locally embedded product distribution, and two of the larger farms even export products, however they also retain regional channels of distribution. Smaller farms with lower output were mostly engaged at local, regional or national levels, in both alternative distribution methods e.g. off-farm sales, household delivery or sales in owned shops in cities, and conventional modes of distribution e.g. through restaurants, specialised food shops or production groups. This shows that farms' contribution in alternative food networks needs to be understood not as a static in-or-out decision based on beliefs and values but as an adaptation strategy to demand pressures, where farmers are making use of both alternative and conventional modes of distribution as they see fit.

Identified by *Ilbery* and *Maye* (2005b: 341) as "hybrid food systems and spaces", it is where these regional activities expand to the scale of the international or global agri-food networks where this is conceptually related to the discussion on strategic coupling in GPN (*Yeung* 2015; *Coe* et al. 2004). However, other than as described by *Yeung* (2015), in the context of this work it was not regional institutions linking local actors to GPNs, but the individual actors themselves. Therefore, advocating for the consideration of more straightforward and inclusive attempts in explaining the process and conditions of strategic coupling for food producers seems appropriate. While this was beyond the scope of the presented work, exploring the international activities identified could give greater understanding of the modes of operation, power relations and network embeddedness of these globalised links.

Within the presented papers, thoughts on the GPN dimensions of embeddedness and power were addressed in a limited manner due to the focus of the gathered data. However, there are some observations that can be made with regard to these categories. The degree to which farms are embedded in the local or regional economies varies. Yet, it can be established that they are all somehow linked to their respective locations when it comes to distribution channels, even if other channels are stretching beyond the region at the

same time. The degree of embeddedness is therefore closely linked to the means of value capture, as direct sales are not only possible for people because of a farm's geographical location, but also the culture of regions. Tasting events, also organised in collaboration with intra-regional partners such as Slow Food, further enhance this rooting in cultural, taste and heritage values.

In this sense, the local or regional embeddedness of the silvopastoral systems can lead to a new "freedom" from a global "domination" (*DuPuis* and *Goodman* 2005: 361). In this, the embeddedness itself becomes a tool in the shift of power from actors further downstream the value chain to producers and consumers alike, which can result in better understanding and compensation of farmers, and greater influence and transparency for consumers. Furthermore, direct relationships with consumers can be a powerful tool for promoting ecological values on quality. Yet, the boundaries of regional, alternative networks relating to limited supply and accessibility of localities also place some level of exclusiveness to these systems (*Hinrichs* 2003; *DuPuis* and *Goodman* 2005), with some farmers of this study themselves wishing for greater variety amongst their clientele. From this perspective, it was important to consider how silvopastoral production could mature to a regime-relevant technology making its products available more widely beyond the regional level.

Applying the concepts of multi-level perspective and strategic niche management allowed for a better placement of the studied agroforestry farms within the food system. The main challenge with this lay in the question of whether the studied systems can be considered as forming a niche, as understood by *Geels* (2002, 2011) and others. It was concluded that even though farmers are engaged in a form of agriculture that substantially diverges from mainstream methods, this is not enough to call it an agroforestry niche. However, the combination of alternative and conventional distribution methods also indicates that farmers operate rather at the edge of the existing regime than in a niche. This notion is supported by the absence of protection from market forces, a lack of unifying vision and generally low engagement and organisation among agroforestry farmers. While farmers manage to establish marketing channels for artisan, high quality products, in the Italian context this is not novel or diverging enough to argue for the existence of a niche. In fact, one might even state that the farming regime is simply more diverse than in other places.

Nevertheless, farmers of this study are still diverging from the farming regime in terms of environmental production practices and alternative forms of distribution and marketing. The wish to educate people, the disagreement with widespread farming practices and the idea of more localised farming systems with increased accessibility and equity can also be interpreted as initial features of a vision capable of challenging the regime level. On the other hand, this work has also revealed a partial lack of recognition of ecological advantages of silvopastoral agroforestry by farmers themselves, and even though most farmers were aware of some, they were rarely promoted for marketing purposes. For a sustainable shift of the food regime both the farming practices and distribution methods need to change, which is why it is important to give meaning to the agroforestry management as well. The fact that farmers are continuing to operate in and compete with the conventional market and the lack of external resources for both exploring agroforestry practices and establishing social networks further inhibits the formation of an organised niche.

Projects fostering a cooperation and exchange between farmers could thus be an opportunity for exploring ideas. However important, they can only be a first step in the formulation of niche ideas and practices. Aside from a suggested lack of understanding of agroforestry methods among consumers, farmers also quoted the lack of possibilities to label products adequately as a barrier to marketing their products. However, the recognition of farming practices in an established, certified label is not a straightforward process, which needs both persistent and energetic representation. Raising pressure on regime actors therefore becomes a matter of agency, which in the assessed case is missing completely for changes on a larger scale. In this sense, this work can also be seen as important for policy makers to help break down the barriers faced by farmers in terms of recognition and certification as well as consumer education. As this possibly applies not only to agroforestry systems but other underrepresented agroecology practices, this could support a change on different topics relating to scalability, economic incentives and inclusiveness of sustainable future farming systems.

Zusammenfassung

Seit dem Ende des zweiten Weltkriegs ist der landwirtschaftliche Sektor zunehmend verschiedenen, teils widersprüchlichen, Anforderungen ausgesetzt. Bis in die 1980er Jahre hinein verfolgte die Politik auf EU-Ebene, aber auch in vielen Nationalstaaten, einen produktivistischen Ansatz mit Fokus auf der Steigerung von Produktivität. Für landwirtschaftliche Betriebe bedeutete dies eine Zeit starker Modernisierung, die vor allem durch Intensivierung, Spezialisierung und Konzentration im Landwirtschafts- und Nahrungsmittelsektor geprägt war. Betriebe gerieten zunehmend unter starken Anpassungsdruck und wurden abhängiger von sowohl Zulieferern (z. B. für Betriebsmittel oder Kapital) als auch Abnehmern des Lebensmitteleinzelhandels und der -industrie.

Seit den 1980ern wurden die negativen Auswirkungen dieser Form der landwirtschaftlichen Produktion zunehmend wahrgenommen, was z. B. zu Reformen in der gemeinsamen Agrarpolitik auf EU-Ebene führte. Auch wenn sich daraufhin in einigen Regionen eine Extensivierung und Diversifizierung der Produktion feststellen ließ, so kann heute dennoch keine komplette Umkehr der produktivistischen Strukturen in der Landwirtschaft festgestellt werden. Die Notwendigkeit, landwirtschaftliche Systeme nachhaltig umzugestalten ergibt sich aus den vielfältigen Herausforderungen, vor denen nicht nur die Landwirtschaft noch immer steht wie z. B. die Mitigation von bzw. Anpassung an den Klimawandel, Biodiversitätsverlust und Umweltverschmutzung.

In dem Zusammenhang ist die Betrachtung von alternativen, umweltfreundlichen Anbauverfahren wie Agroforstsystemen von zentraler Bedeutung. In diesen Systemen werden die landwirtschaftliche Produktion wie Viehhaltung (silvopastoral) oder Ackerbau mit dem Anbau bzw. der Nutzung von Bäumen auf derselben Fläche kombiniert. Während dies die Flächeneffizienz steigert, können sich aus den Interaktionen der verschiedenen Systemelemente auch einige ökologische Vorteile oder Ökosystemdienstleistungen ergeben (z. B. Reduzierung von Bodenerosion, effizientere Nährstoffnutzung und weniger -auswaschung, Steigerung der Biodiversität, Verbesserung des Wasserhaltevermögens und somit Prävention von Überflutung). Darüber hinaus ermöglichen Agroforstsysteme auch eine Diversifizierung von landwirtschaftlichen Einkommen.

Um Landwirte und Landwirtinnen zu motivieren, auf umweltfreundliche Alternativen zum dominierenden Landwirtschaftsmodell umzustellen, bedarf es der Überwindung ideologischer, aber auch praktischer Herausforderungen. Forschung zu den Einstellungen von Landwirten und Landwirtinnen und anderen Interessensgruppen zeigt, dass sich Agroforstwirtschaft in einem Spannungsfeld zwischen der Wahrnehmung von positiven Umweltleistungen und Bedenken hinsichtlich eines größeren Arbeitsaufwandes durch neue Praktiken bewegt. Ein besseres Verständnis von Vermarktungsmöglichkeiten wird in diesem Zusammenhang als eine Option erachtet, um Transitionen in diesem Bereich zu fördern.

Aus diesem Grund untersucht diese Dissertation, welche Strategien von Landwirtinnen und Landwirten in silvopastoralen Agroforstsystemen angewendet werden, um ihre Produkte und die damit verbundenen Ökosystemdienstleistungen zu vermarkten. Im Fokus stehen hier zunächst die Bildung, Steigerung und Erfassung von Werten. Eine Schwierigkeit in der Analyse von ökologischen Produktionssystemen ist, dass viele ihrer Vorteile immateriell sind, was die wirtschaftliche Inwertsetzung erschwert. Gleichzeitig kann gerade diese aber als Anreiz für die Umstellung auf nachhaltige landwirtschaftliche Verfahren verstanden werden. Vor dem Hintergrund, dass Konsumenten und Konsumentinnen verstärkt auf regionale und umweltfreundliche Alternativen zur konventionellen Produktion von Lebensmitteln achten, liegt ein weiterer Schwerpunkt der Analyse auf der Vermarktung in alternativen Lebensmittelnetzwerken und den Vorteilen bzw. Herausforderungen, die sich hieraus ergeben. Des Weiteren wird die Rolle, welche Agroforstsystemen in der Transition zu einem nachhaltigen Nahrungssystem generell zukommen kann, analysiert.

In Zeiten anhaltender Fragmentierung, Spezialisierung und Globalisierung von wirtschaftlichen Prozessen im Nahrungs- und Landwirtschaftssektor bedarf es Analyseinstrumenten, die es ermöglichen, wirtschaftliche Strukturen und Prozesse ganzheitlich zu erfassen. Es ist nötig, in Konzepten zu denken, die über betriebswirtschaftliche Untersuchungen hinausgehen. Aus diesem Grund bilden die Theorien der Globalen Wertketten (z. B. *Gereffi* et al. 2005) und Globalen Produktionsnetzwerke (z. B. *Henderson* et al. 2002) die Basis für die Analyse in dieser Dissertation. Darüber hinaus wurden die theoretischen Konzepte zu alternativen Lebensmittelnetzwerken und sozio-technologischen Transitionen (z. B. *Geels* 2002) hinzugezogen, um die zugrundeliegenden Bedingungen und Konsequenzen von

verschiedenen Vertriebswegen besser einordnen zu können und abzuschätzen, inwiefern die Positionierung der Landwirte und Landwirtinnen im weiteren Lebensmittelnetzwerk zu dessen nachhaltiger Transition beitragen kann.

Diese kumulative Dissertation besteht aus drei Forschungsartikeln, die auf für die Analyse erhobenen qualitativen Daten basieren.

Der erste Artikel "Capturing the Value of Ecosystem Services from Silvopastoral Systems: Perceptions from Selected Italian Farms" befasst sich mit der Entstehung, Definition und Erfassung von Wert in silvopastoralen Systemen und ist damit eng mit der Analysekategorie "Wert" aus dem GPN Ansatz verknüpft. Zunächst wurde untersucht, ob und wie die befragten Landwirte und Landwirtinnen (ökologische) Vorteile ihrer Agroforstsysteme wahrnehmen und wie sie diese definieren. Basierend auf den Unterkategorien der GPN Analysekategorie "Wert" wurde in einem zweiten Schritt untersucht, ob und unter welchen Bedingungen diese wahrgenommenen Vorteile oder Werte vermehrt und durch den Verkauf abgegriffen werden bzw. erhalten bleiben. Des Weiteren wurden Möglichkeiten diskutiert, wie Ökosystemdienstleistungen durch die Produkte inwertgesetzt werden können.

Der zweite Artikel "Silvopastoral production as part of alternative food networks: Agroforestry systems in Umbria and Lazio, Italy" untersucht die Entscheidungen für den Vertrieb der Produkte aus den untersuchten silvopastoralen Systemen auf alternativen oder konventionellen Vermarktungswegen. Während die Analyse im ersten Artikel stark auf die einzelnen Betriebe beschränkt war, wird diese im zweiten Artikel auf einen regionalen, nationalen und teilweise sogar internationalen Kontext ausgedehnt. Konzeptionell ist der Artikel in den Kontext von alternativen Lebensmittelnetzwerken und das wachsende Bewusstsein über Umweltproblematiken in der Landwirtschaft eingebettet. Vor diesem Hintergrund wurde untersucht wie Landwirte und Landwirtinnen ihre Produkte verkaufen und ob sie Teil von alternativen Lebensmittelnetzwerken sind.

Der dritte Artikel "Niche formation in agroforestry: considerations from silvopastoral systems in central Italy" analysiert inwiefern die untersuchten Systeme Einfluss auf eine nachhaltige Veränderung auf das weitere Nahrungs- und Landwirtschaftssystem nehmen können. Basierend auf den theoretischen Konzepten von Nachhaltigkeitstransitionen und der Multi-Level Perspektive werden die Positionierung der Landwirte in Bezug auf

Regime und Nischen sowie Möglichkeiten und Hindernisse für das Herbeiführen von nachhaltigen Veränderungen auf Ebene des weiteren Nahrungssystems untersucht.

Die Ergebnisse dieser Dissertation lassen sich wie folgt zusammenfassen: (1) Die Wahrnehmung von ökologischen Vorteilen der Agroforstsysteme war zwischen den Landwirten und Landwirtinnen unterschiedlich ausgeprägt und nur einige unter ihnen schienen diese in ihren positiven Auswirkungen anzuerkennen. Das deutet auf ein bisher ungenutztes Potential in Bezug auf die Wertsteigerung durch die Einbindung von Ökosystemdienstleistungen in den Wert von Produkten hin. (2) Die Prozesse in den Agroforstsystemen haben dennoch einen Einfluss auf den Wert bzw. die Rentabilität der Produkte, da zum einen die Zahl von und somit Kosten für externe Inputs reduziert werden konnten und die silvopastorale Produktion in einigen Fällen die Produktqualität erhöhen konnte (z. B. verbesserter Nährstoffgehalt; Umweltfreundlichkeit). (3) Die Art des Verkaufs ist ausschlaggebend für die Vermarktung von bestimmten Qualitätsattributen. Alle Betriebe verkaufen ihre Produkte zumindest teilweise in alternativen, direkten Kanälen (z. B. Ab-Hof-Verkauf, Lieferung an Privathaushalte, eigene Geschäfte in Städten). Der Verkauf findet darüber hinaus auch im nationalen und internationalen Kontext statt.

(4) Das Fehlen eines Agroforst-Labels wurde als Hindernis für die Vermarktung von ökologischen Vorteilen aus diesen Systemen über weitere Distanzen verstanden. (5) Das Vorhandensein von Mischformen von konventionellen und alternativen Zulieferern und Vermarkungswegen deutet auf die Grenzen von regionalisierten Lebensmittelsystemen bezüglich einer limitierten Zahl von Konsumenten und Konsumentinnen sowie der Verfügbarkeit von Betriebsmitteln hin. Das alternative Lebensmittelnetzwerk ist somit weiterhin stark vom konventionellen Landwirtschaftssystem beeinflusst. (6) Auch wenn die Landwirte und Landwirtinnen eine Form der Landwirtschaft betreiben, die stark vom industrialisierten System abweicht, ist dies nicht genug, um vom Vorhandensein einer "Agroforst-Nische" zu sprechen. Vielmehr bewegt sich das System am Rand des vorhandenen Lebensmittel- und Landwirtschaftsregimes. Der Beitrag zu einer nachhaltigen Transition des Landwirtschaftsregimes ist damit begrenzt. Eine bessere Kooperation zwischen Akteuren aus dem Agroforstbereich wäre ein möglicher erster Schritt, um Lernprozesse zu fokussieren und Aufmerksamkeit auf Regimeebene zu erzeugen.

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Appendix I

Interview guideline

Note: Questions in italics are lead questions; the points below are topics to be covered in the answers and possibly need to be followed up in subsequent questions

Introduction

- Greeting; Thanking that interview can take place; brief overview on the addressed issue
- Ensure anonymity; Record interview? Questions?

Part I: General Information on the Farm and Inputs

For a start I'd like to get to know the characteristics of your farm. Can you outline the history/ development of the farm and describe what you are doing here?

- Ownership, Age, Buildings

Please describe the land you are farming with regards to size, quality and ownership. How is land acquisition taking place and why?

- Size in hectares; owned/leased; what **actors** are involved; **conflicts/difficulties** arising with the acquisition/leasing of land; **quality** of land (sufficient for what is done with it/what else would he like to do with the land)

Can you estimate the shares and/or hectares of the different kinds of land use on your farm?

- arable (incl. perennial field crops), cultivated grassland, pastures, fallows, forests/woodland/orchards, short-rotation-coppices, other

How big is the area under silvopastoral use? On what basis was the land selected? Why have you decided to put it under silvopastoral and no other use? How did you hear from this type of system?

Are there any hedgerows, uncultivated field margins, conservation strips, buffer strips on the land? Why/ why not? Since when?

Can you please outline how farm labour is organised?

How many employees work on the farm? How many of them are **family members**?

education/training of people working on the farm; enough qualified people; r**elevance of** education, experience, training; offering professional training; Why, why not?

kind of work done by employees, by the farmer; **costs** for labour in one month/year (both employed and farmer)

What types of machines do you own and use, especially in the silvopastoral context?

kind of machines; silvopastoral context; where purchased from and why; **repairs**, maintenance; agricultural **wage agencies** for which services (esp. in silvopastoral context) Why/why not?

What kind of supplies do you have to buy, especially in the silvopastoral context and where from? Can you describe quantities and cost as well?

criteria for choosing suppliers: Cost (e.g. seedlings/seeds, fuel, feed, water, fertilisers, plant protection, equipment for fencing, medicine, animals; utilities for processing of products); largest expenses (shares, absolute); **shortage** of supply?

Part II: Embeddedness and Support

What sort of subsidies/project money are you receiving?

Do you think the way subsidies are given is **appropriate**? If not: what needs changing?

Do you feel supported in the way you farm by politics, society, media…?

How important are interest groups (e.g. farmer unions, NGOs) on the development of policies regarding agroforestry?

advice, help, support; where would you like to get advice from; are information given useful; in touch with other farmers performing agroforestry; importance of customers' **opinions**

Part III: Production on the Farm

Which products or services do you produce, how and why?

- Livestock type; purpose, offspring staying on the farm; breeds, why this breed?
- Processing done? Why, why not? **challenges**/barriers related to processing (finance, employees, skill, facilities, hygiene standards...)

Do you reuse any co- or waste-products? If not, what do you do with them?

Are you planning on expanding or reducing the production range or amounts? Why?

Do you follow any environmental or social production standards or schemes (e.g. organic, fair trade; private or public)? Why? Why this one? Is it viable?

Are you member of a farmer cooperative/ production group? Why, why not?

Part IV: Agroforestry System

Can you describe the production within the silvopastoral system for one year, including types, numbers, management and maintenance of trees, understorey, animals?

How, **when and why** was the silvopasture system established? **Difference** in the product compared to a product from a 'normal' production system?

What ecological and economic benefits does this system have?

Do you think the system provides any additional '**ecosystem services'** compared systems without trees? Are you considering changing the production system? Why?

Part V: Output and Marketing

Please describe the marketing and distribution of your products. Could you track the flow of the product until it reaches the consumer? Please estimate the revenues and labour for each of the distribution channels.

How and to whom are you selling your products? **How much** of the produce is sold through each of the channels? **most rewarding** (financially but also personally); which involves most **labour**; which product needs most labour?

What is your largest share of **income**? What are the total revenues for each product group (and channel if product is split over several)?

Why are you selling the products through these channels? Do you think this way of marketing is beneficial? Would you like to **change** anything about how you sell your products?

Does the production in the silvopastoral system influence the marketing of the products? Is the production system mentioned for marketing purposes?

How are prices defined in these channels?

Do you consider them being **fair** (for farmers but also consumers)? Do prices represent the true costs/benefits from the production system? Do you charge more or less than you would if produced in a system without trees?

What difficulties occur regarding selling your produce (for the different channels)?

How would you characterize the market and your consumers for your products?

How big is **competition** in the market? How does this show? characterize main consumers; why are people buying your products?

How would you describe the recent **market development** for the products you offer? What influences it?

If you could change anything you want – what would need changing to make your farming situation more satisfying?

Acknowledgements

Overview of codes and codings

First level		Second level		Third level	
Farm	255	Size, division & ownership of land	40	Land Abandonment	6
				Land Acquisition	21
		Products	29		
		Management (e.g. organic)	7		
		History/Age of Farm	19		
		History of Region	8		
		Livestock	24	Offspring	13
				Breeds	16
		Annuals	7		
		Perennials	14		
		Labour/employees	25		
		Infrastructure, Energy	8		
		Future Plans	18		
Agroforestry System	149	Size of agroforestry	8		
		Livestock in agroforestry	21		
		Types of trees	2		
		Benefits		Social	19
				Economic	39
				Environmental	25
		Challenges	25		
		Motivation	10		
Inputs	77	Inputs Farm General		Machinery	9
				Knowledge	15
				Contract Farming	8
		Inputs Processing	10		
		Inputs Livestock	20		
		Financial Constraints	15		
Production Process	230	Livestock Operations		Handling Routine	13
				Feed	32
				Production Cycle	26
				Livestock Prod. Challenges	8
		Agroforestry Operations	19		
		Field Operations	7		
		Agritourism Operations	12		
		Agri-environmental Education	8		
		Production Challenges	20		
		Waste/Residuals	11		
		Processing		Organisation	12
				Facilities	27

				Techniques	26
				Processing Challenges	9
Output	238	Distribution Channels		Shares	10
				Directly Off Farm	15
				Restaurants & Shops	18
				National Delivery	11
				Export	5
				Selling Organisation	11
		Marketing		Strategies	13
				Trade-Offs	6
				Influence Agroforestry	13
				Relationship with customers	17
		Product Quality	28		
		Pricing	40		
		Income & Profits	11		
		Selling Challenges	23		
		Customer Characterisation	17		
Embeddedness & Support	154	Subsidies	35		
		Policy & Media	21		
		Regulation & Control	21		
		Organic Certification	30		
		Advice & Knowledge Exchange	20		
		Society, Values & Awareness	16		
		Market & Sector Development	11		

Eigenständigkeitserklärung

Hiermit versichere ich, dass ich meine vorliegende Dissertation

„Agroforestry and Ecosystem Services:
Value Capture in Silvopastoral Food Production Systems in Italy“

selbstständig, ohne unerlaubte Hilfe Dritter angefertigt und andere als die in der Dissertation angegebenen Hilfsmittel nicht benutzt habe.

Alle Stellen, die wörtlich oder sinngemäß aus veröffentlichten oder unveröffentlichten Schriften entnommen sind, habe ich als solche kenntlich gemacht. Dritte waren an der inhaltlich-materiellen Erstellung der Dissertation nicht beteiligt; insbesondere habe ich hierfür nicht die Hilfe eines Promotionsberaters in Anspruch genommen.

Kein Teil meiner Dissertation wurde und wird in keinem anderen Promotions- oder Habilitationsverfahren verwendet und hat noch keinen sonstigen Prüfungszwecken gedient.

Mit dem Einsatz von Software zur Erkennung von Plagiaten bin ich einverstanden.

Vorname Nachname _____

Datum, Unterschrift _____