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EXPLORING AUSTRIAN FARMERS' VIEWPOINTS TO BETTER UNDERSTAND SOIL MANAGEMENT DECISIONS

Master thesis

submitted by:

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Abstract

Soil degradation can have serious negative effects on agricultural production and the natural environment. However, in turn agricultural mismanagement is a major cause for the continuous process of soil degradation. Land rental is often suspected to mediate a focus on short-term economic goals. Furthermore, the high demand for land rental and rising rental fees might put increased pressure on soils. Understanding how farmers themselves perceive factors influencing their soil management practices is therefore crucial to face this challenge. Thus, this thesis examines a) how Austrian arable farmers themselves perceive drivers of their soil management practices, (b) if farmers report any differences in their soil management practices on owned and rented plots, (c) how farmers perceive their relationship with nature (HNR). Making use of Q methodology, these questions are examined from the perspective of 33 arable farmers located in the Austrian federal states of Burgenland, Lower Austria, Styria and Upper Austria. The goal is an integrated understanding of what influences farmers in their soil management practices. First, we find four different viewpoints: the Innovative Stewards, the Neo-Traditional Producers, the Profit Maximizers and the Self-reliant Environmentalists. All viewpoints show attributes related to soil conservation, however expressed by different, viewpoint-specific statements. Second, the farmers do not report differences in their soil management between owned and rented plots. Third, the results confirm that farmers hold multiple human-nature relationships, including a nature-focused relationship shared by all interviewees. Furthermore, in contrast to other studies we found a remarkably strong presence of the Master across the interviewed farmers. The heterogeneity across farmers' viewpoints could be taken into consideration to better-target soil conservation policies.

Keywords: property rights; land rental; soil conservation; human-nature relationships; Q method

Kurzfassung

Bodendegradation kann gravierende Auswirkungen auf die landwirtschaftliche Produktivität und natürliche Umwelt haben. Gleichzeitig gilt landwirtschaftliches Missmanagement jedoch als eine ihrer Hauptursachen. Landwirte nehmen daher eine Schlüsselposition im Kampf gegen den Verlust fruchtbarer Böden ein. Es wird angenommen, dass die Pacht landwirtschaftlicher Flächen kurzfristige wirtschaftliche Ziele verstärkt in den Fokus rückt. Die hohe Nachfrage nach Pachtflächen und steigende Pachtpreise verstärken womöglich zudem die Belastung landwirtschaftlicher Böden. Darum ist es wichtig zu verstehen, wie die Landwirte selbst ihren Umgang mit dem Boden wahrnehmen. Deshalb untersucht diese Forschungsarbeit, (a) welche Einflussfaktoren die Landwirte als relevant für ihre Bodenbearbeitung erachten, (b) ob sie Bodenschutzmaßnahmen auf eigenen und gepachteten Flächen variieren, (c) welche Mensch-Natur Beziehungen österreichische Ackerbauern charakterisieren. Mithilfe der Q Methode wird ein integriertes Bild der unterschiedlichen Sichtweisen von 33 interviewten Ackerbauern aus den österreichischen Bundesländern Burgenland, Niederösterreich, Steiermark und Oberösterreich bezüglich ihrer Bodenbearbeitung erstellt. Es wurden vier Sichtweisen identifiziert: Innovative Stewards, Neo-traditional Producers, Profit Maximisers und Self-reliant Environmentalists. Alle vier weisen Merkmale mit Bezug zu Bodenschutz auf, welche jedoch von bestimmten, charakterisierenden Merkmalen überlagert sind. Die interviewten Landwirte geben an, in ihrer Bodenbearbeitung keinen Unterschied zwischen eigenen und gepachteten Flächen zu machen. Zudem verfügen die Landwirte über multiple und u.a. ökozentrische Mensch-Natur Beziehungen. Die Akzeptanz des Masters steht dabei in Kontrast zu bisherigen Erkenntnissen. Die Vielfalt unter den Landwirten zu erfassen und gezieltere agrar- und umweltpolitische Maßnahmen zu schaffen, stellt eine vielversprechende Investition für die Erhaltung der Bodenfruchtbarkeit dar.

Keywords: Eigentumsverhältnisse; Pacht, Bodenschutz, Mensch-Natur Beziehungen, Q Methode

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1 Introduction

The cultivation of land to obtain food and other natural resources stands for one of the foundations of human civilization, but can also lead to external effects, such as the loss of biodiversity or soil degradation (DeFries et al., 2004), which eventually can render arable land unproductive (Pimentel et al., 1995). Reasons for soil degradation appear to be manifold and the most significant determinants are the soils erodibility (determined by the chemical, physical and biological soil properties), the released energy of the eroding agent and the natural characteristics of the plot (Verheijen et al., 2009).

The agricultural sector is a direct driver of land degradation, as agricultural mismanagement is a major cause of soil degradation (Hamdy and Aly, 2014; United Nations, 2017) and declining soil quality (Jangid et al., 2008; Mbuthia et al., 2015). Nowadays, the agricultural sector occupies 38 % of the worlds' land surface and stands for the largest human use of land, with an increasing trend (Foley, 2011; United Nations, 2017). The effects of soil degradation are estimated to be considerable. While humans obtain more than 99.7 % of their food calories from the land (Pimentel, 2006), 20 % of the world's cropland show a decreasing trend in productivity and about 10 million ha of cropland are lost each year due to soil erosion (United Nations, 2017; Pimentel, 2006). Additionally, soil losses proceed up to 40 times faster than the rate of soil renewal (Pimentel, 2006). Hence, soil degradation is one of the most critical human challenges and therefore addressed in the 2030 Agenda for Sustainable Development by the United Nations (United Nations, 2017).

For Europe, Verheijen et al. (2009) reported that the actual soil erosion rates on tilled, arable land overrides the upper limit of tolerable soil erosion on average between 3 to 40 times. The annual loss of crop productivity on the 12 million ha of agricultural areas in the European Union (EU) through soil erosion amounts to 0.43 %. This loss in agricultural productivity results in annual costs of around 1,25 billion € (Panagos et al., 2017).

While the world's arable soils are threatened, the constantly growing world populations' demand for food and other ecosystem services raises. This puts increased pressure on the current food supply system, resulting in a need for more productive land and increased productivity (United Nations, 2017). The agricultural sector plays a key role in the battle against the continuous process of soil degradation, as the extent of degradation depends highly on farmers' management choices (HAMDY and ALY, 2014). Agricultural soil degradation is partly a physical process, determined by several factors like the climate conditions, bio-physical determinants and technical ones (i.e. tillage practices), but also supported by the socio-economic, cultural and political context, in which farmers operate (Blaikie, 2016; Boardman et al., 2003; Enters, 1999; Prager and Posthumus, 2011; Stocking et al., 2013).

Latest developments on land markets show that the share of rented agricultural land among the EU member states is high and increasing (Ciaian et al., 2010). Since the 1960s, the share of rented land has more than doubled in Austria and continues to rise (Holzer et al., 2013). While 402.286 farms were counted in Austria in 1960 (BMLFUW, 2017: 165), the number declined to 161.317 in 2016. However, the cultivated land per farm increased from 10.4 ha in 1960 (BMLFUW, 2017: 165) up to 19.85 ha in 2018 (Statistik Austria, 2018: 85). Rather than on land purchases of abandoned land, these farm enlargements are based on a rising share of rented land. In 1960, tenants rented 351.660 ha of agricultural land (Holzer et al., 2013), whereas in 2016, 1.03 million ha of Austrians agricultural area were leased-out or rented. This corresponds to 38.5 % of Austria's total agricultural land (Statistik Austria, 2018: 170). Also, nearly 100.000 ha were provided by landowners to land users without financial compensation. However, the share of rented land differs between the federal states of Austria as shown in Table 1. Especially the federal state of Burgenland stands out with a share of 60 % of rented land of its total area used for agricultural cultivation.

Table 1: Ownership status of agricultural land in the examined areas (adapted from Statistik Austria, 2018: 170)

Federal state	Owned land		Rented out		For management submitted		Rented		For management received		Total agricultural area
	Agricultural area										
	ha	%	ha	%	ha	%	ha	%	ha	%	ha
Burgenland	70.647	39	5.893	3	296	0.2	109.058	60	7.150	4	180.694
Lower Austria	516.800	59	27.493	3	2.993	0.3	374.564	42	22.033	3	882.911
Upper Austria	357.509	70	17.120	3	763	0.2	163.686	32	7.177	1	510.470
Styria	258.453	69	14.832	4	1.428	0.4	117.340	31	15.537	4	375.070
Kärnten	157.618	75	10.880	5	1.416	0.7	58.010	28	6.988	3	210.321
Salzburg	139.724	78	3.484	2	160	0.1	34.124	19	8.898	5	179.103
Tirol	184.495	74	4.828	2	1103	0.4	52.094	21	17.578	7	248.236
Vorarlberg	43.451	56	984	1	56	0.1	30.081	39	5.520	7	78.012
Wien	3.505	55	887	14	9	0.1	3.284	52	466	7	6.357

Since early days of agricultural economists, it has been argued that land rental may lead to suboptimal resource allocation and soil degradation (Johnson, 1950), due to differences in the length of farmers' planning horizons (Arora et al., 2015). Farmers, who rent their land, have no guarantees that they will reap the benefits of long-term soil conservation. Therefore, they are expected to strive for short-term returns from the rented land (Fraser, 2004). On the other hand, studies suggest, that ownership encourages a stronger focus on long-term economic and social goals, going hand in hand with more soil conservation practices (Arora et al., 2015;

Fraser, 2004). Concerning the constantly increasing rental shares in many EU countries (Ciaian et al., 2010), it is important to understand the various impacts of land ownership and land rental on farmers' soil management strategies. However, empirical literature on the linkage of property rights and soil management is scarce for developed countries and often shows ambiguous, mixed or region-specific results. The ongoing structural changes in agriculture and the general lack of studies investigating the effects of ownership and land rental on farmers' soil management in Europe show the imminent need to explore this subject more in depth. Literature suggests that particularly insights from behavioral sciences and social psychology might be helpful to understand the relationship between tenure structures and soil management practices (Wauters and Mathijs, 2014).

Soil conservation measures such as reduced tillage, intercrops are considered effective means to reduce soil degradation (Knowler and Bradshaw, 2007; Rajendran et al., 2016). In order to encourage farmers to adopt such soil conservation measures, policy programs are based on monetary incentives (BMLFUW, 2016). So-called agri-environmental schemes (AES) are designed to amend farmers' soil management through financial incentives and are believed to be a key tool for the conservation of agricultural land (BMLFUW, 2016; Guillem and Barnes, 2013). Many different variables affect farmers' adoption or non-adoption of such conservation measures but there are few if any universal variables that regularly explain their adoption (Bartkowski and Bartke, 2018; Knowler and Bradshaw, 2007). Furthermore, on an institutional level, legislation and other policies (e.g., cross-compliance measures within the Common Agricultural Policy and laws) affect farmers' soil management (Posthumus and Morris, 2010). Such formal institutions regulate farmers' soil management decisions by determining the institutional framework under which farmers operate (Posthumus and Morris, 2010; Prager and Posthumus, 2011).

Besides external factors, farmers' soil management is driven by socio-psychological factors (Bartkowski and Bartke, 2018; DEFRA, 2008; Gowdy, 2008; Knowler and Bradshaw, 2007; Prager and Posthumus, 2011). Socio-psychological variables such as values (SCHWARTZ, 1992; Steg et al., 2014; Teel and Manfredo, 2010), beliefs (de Groot and Steg, 2008), attitudes (Sattler and Nagel, 2010; Teel and Manfredo, 2010) or norms (Onwezen et al., 2013) are known as potential drivers of farmers' motivation and behavior. Furthermore, Hammond et al. (2017) found that barriers to behavioral change tend to be ideological rather than material. Farmers are anything but a homogeneous group of people (Darnhofer et al., 2005; DEFRA, 2008) and hold a great number of unique combinations of beliefs, attitudes, values, and goals (Brodt et al., 2006). This shows the need to recognize the diversity across farmers by policymakers in their efforts to nudge farmers towards more sustainable soil management (Bartkowski and Bartke, 2018; DEFRA, 2008), as ill-advised governance and poorly

understood contextual factors can lead to unwanted and undesired outcomes (Kotchen and Young, 2007).

Additionally, the relationships humans hold with nature can help to understand environmental behavior (Braito et al., 2017). People hold varying relationships with nature (Flint et al., 2013), which affect their behavior, especially if people act with or in the natural environment (Celio et al., 2014). The exploration of the relationship of humans towards nature may help to better understand environmental behavior, as there is evidence that HNRs may relate closer to environmental behavior than values (Braito et al., 2017). Therefore, literature suggests that policy and sustainability efforts should consider the relationship an individual holds towards nature (Braito et al., 2017; Gosling and Williams, 2010). HNR appear to be a beneficial tool for awareness-raising efforts and communication strategies to enhance people reflections on their relationship with nature (Braito et al., 2017a), what is essential for change to happen (Liu and Lin, 2015).

However, an isolated analysis of individual factors can guide to misleading results (DEFRA, 2008; Wilson, 1997). Assembling this complex bundle of institutional and socio-psychological variables, which determine farmers' soil management decisions (DEFRA, 2008; Gowdy, 2008; Knowler and Bradshaw, 2007) and including farmers' surroundings, where their actions takes place (Kollmuss and Agyeman, 2002; Mattison and Norris, 2005) under a common framework, appears to be more appropriate (DEFRA, 2008). Additionally, segmenting farmers into behavioral groups helps to unravel the different underlying motivations and values (Wilson et al., 2013).

The goal of this thesis is to understand farmers' perception on their soil management decisions more deeply. Therefore, this research identifies farmers' different viewpoints to better understand their soil management.

Due to the bundle of manifold variables that might drive farmers' soil management decisions, the current changes on Austria's land markets and the need to assess the role of HNR for soil management, the objectives of this research are:

(i) to explore and contrast farmers' different viewpoints on soil management,

(ii) to examine if farmers manage the soil on owned and rented plots differently, and

(iii) to discover what role farmers' human-nature relationships play in different viewpoints.

To identify, describe and compare the manifold viewpoints that farmers hold, this thesis applies the Q methodological approach. It is considered a valuable method to unfold the mental frameworks of humans in a particular context, also regarding farmers' motivations in the

context of changing policies (Davies and Hodge, 2007). By combining the results of the Q methodology with qualitatively analyzing the interviews allowed to draw a more holistic picture of farmers' perspectives on their soil management. The rich insights on farmers different viewpoints is important to improve the effectiveness, efficiency and legitimacy of soil governance (Bartkowski and Bartke, 2018).

The following chapter 2 reviews literature that conceptually and empirically investigates farmers' soil management. New paradigms that focus on the improvement and conservation of the soil are not merely based on soil management practices such as no-tillage but also on broader concepts such as conservation agriculture or environmentally friendly land management. These approaches to soil conservation are not separate but more likely elements of a continuum of conservation approaches (Dumanski and Peiretti, 2013). Thus, this thesis includes literature on influencing variables on farmers' land-use in general and soil conservation in particular, which get bundled under the umbrella-term **soil management**. Findings from the literature inform the conceptual framework of this thesis and are used to phrase Q statements that guide the Q Methodology. Chapter 4 describes the collection and analysis of the empirical data. In chapter 5 the four extracted viewpoints are explained, illuminating their differences as well as their similarities. Chapter 6 compares and contrasts the different viewpoints with regard to the research questions. Selected comments from the interviews are used to strengthened and enlighten the diversity of the viewpoints. Subsequently and in the last chapter, the thesis discusses policy recommendations on how-to better tailor governance and communication strategies to address all viewpoints accordingly. The thesis ends with highlighting possible directions for future research.

2 Farmers' land-use behavior

Land use is understood as a dynamic "interaction and relationship of anthropogenic activities with the environment" (Gessese, 2018: 8) and can be defined as the number of "human activities, which are directly related to land, making use of its resources or having an impact on it" (FAO, 1995: 21). In this regard, agriculture represents a typical example of human land-use activity (FAO, 1995: 8). Agricultural land not only stands for a source of food, feed or fiber but also provides a large range of services and non-commodity goods like the conservation of the countryside or the protection of biodiversity (Ahlheim and Frör, 2003). However, agricultural land-use produces negative external costs as well, such as exploitation, degradation, chemical residuals, nutrient leaching or **soil erosion** (Van Huylenbroeck et al., 2007) and affects soil quality. Thus, the effect of farmers' soil management is not limited to their own farm. As soils are regarded as public goods due to their multi-functional role and strong linkages with other public goods (Kutter et al., 2011), farmers' soil management also produces social costs.

Understanding humans in general and farmers' behavior in particular is anything but simple (Braito et al. 2017a). Multiple factors and variables determine farmers' decisions on how to behave in a certain context (Mills et al., 2017). The understanding of farmers' soil management and actions needs an examination of both, the external context in which farmers operate and internal factors, which influence farmers' intrinsic behavioral motivation (DEFRA, 2008). Farmers' decision-making is determined by the ability and the willingness to adopt particular management practices (e.g., pro-environmental measures) (Dwyer et al., 2007; Mills et al., 2017). The profession of a farmer has many facets and requires from an individual farmer not only to cultivate the soil, grow crops, raise livestock or other agricultural activities but also to manage and run a business in the form of their farm (McElwee, 2004). Thus, farmers must consider many different variables in their decision process. Consequently, farmers' soil management decisions are underpinned by a mix of environmental, economic and institutional factors (Hamdy and Aly, 2014; Karali et al., 2014; Knowler and Bradshaw, 2007; Mattison and Norris, 2005; Prager and Posthumus, 2011; Rajendran et al., 2016). Furthermore, farmers' ability and willingness to adopt certain soil management practices cannot be reduced to a single factor. It is more likely a complex interaction of agronomic, social, cultural, environmental, institutional and psychological determinants that varies under different contexts (Bartkowski and Bartke, 2018; Prager and Posthumus, 2011; Siebert et al., 2006).

Theory suggests, that the farmers' ability and intention to act is affected through socio-psychological and socio-economic factors on different levels. On the farm and farmer level, the individual farmer and its socio-psychological patterns, as well as the particular farm and household characteristics (including economic considerations) and household dynamics have

been found to influence farmers' decision-making (Mills et al., 2017; Prager and Posthumus, 2011). Furthermore, the environmental settings in which the farm and operators are embedded, affect further farmers' soil management (Prager and Posthumus, 2011).

Beyond the farm gates, farmers' management decisions can be influenced by the farmers' reference groups (local farmer networks, farmer groups, neighboring farmers) and through social norms (Defrancesco et al., 2007; Mills et al., 2017). On the broader societal level, farmers' decisions are affected by public and consumer concerns (Mills et al., 2017). In addition, formal institutions such as property rights, agri-environmental schemes (AES) and governance structures under which farmers operate, are found to be influential on farmers' decision-making. (Karali et al., 2014; Prager and Posthumus, 2011). Figure 1 unscrambles this afore-mentioned complexity.

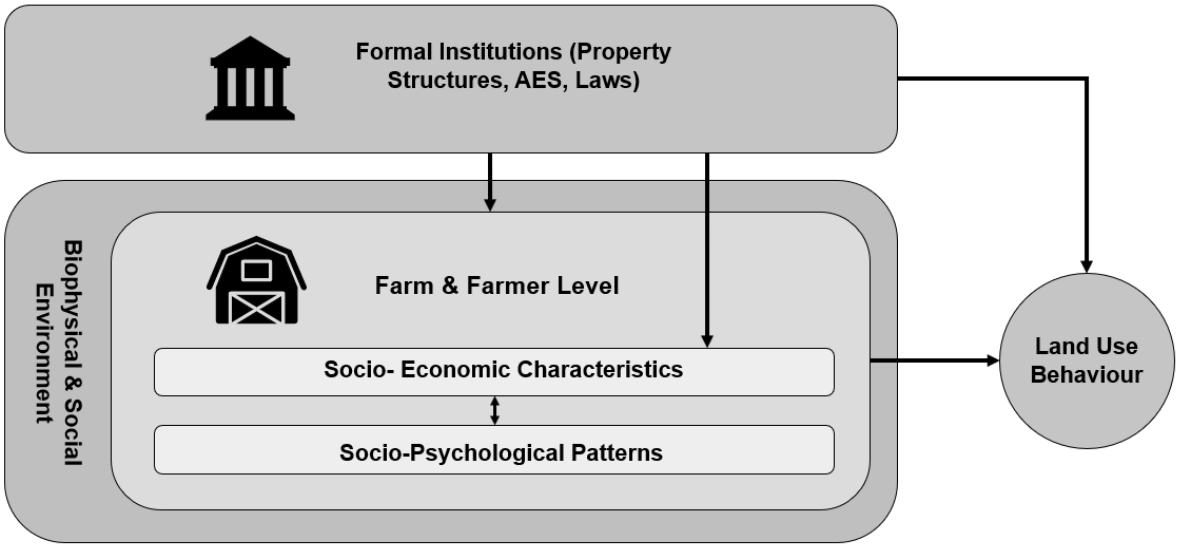

Figure 1. Different levels of influence and key drivers of famers' soil management

Following the framework presented in Figure 1, the next chapters examine explaining factors on farmers' soil management, to provide a comprehensive basis for the Q-analysis. The next subchapters give an overview of theoretical explanations and empirical insights on farmers' soil management practices as discussed in literature. The thesis first addresses formal institutions and then reviews farm and farmer characteristics, including socio-psychological theories.

2.1 Formal institutions explaining soil management

Institutions represent humanly weaved constraints, which reduce through the political and economic setting they create the uncertainty where humans behavior is embedded (North, 1990). Farmers' soil management is affected by various determinants on an institutional level

(Karali et al., 2014; Prager and Posthumus, 2011), which shape to some extent the idea how farming should be (Aldrich, 1990). Many studies argue that land rental may be one source of soil degradation (Arora et al., 2015; Fraser, 2004; Myyrä et al., 2007; Sklenicka et al., 2015). On the other hand, policy tries to mitigate the effects of soil degradation through their legislation or agri-environmental schemes (AES), which are considered an effective response against inappropriate soil management and soil degradation (Batáry et al., 2015).

2.1.1 Property structures

The most common definition of property rights has its origin in Roman law, which distinguishes between the right to use the land, the right to make use of the land's yield, the right to alter the land and the right to sell or rent out land (Laschewski and Penker, 2009). In agricultural practice, the term "rented land" covers land leased-out by owners to others, who use the land as tenants based on written or verbal contract agreements (Statistik Austria, 2018: 35). The Austrian federal law defines land rental as the provision of a business opportunity for a "reasonable fee" over a specified period of time (*BGBl. Nr. 451/1969)*, e.g., the transfer of a specific plot of agricultural land, forest land or agricultural farm against payment (Landwirtschaftskammer Oberösterreich, 2016).

In order to avoid uncertainties or disputes, the written form is recommended (Landwirtschaftskammer Oberösterreich, 2016). Rental agreements can be set up on a temporary or permanent basis. Rental contracts based on an indefinite period remain upright until one of the contractual partners terminates the lease. In this case, the termination agreements laid down in the contract must be followed. If no termination modalities were settled, the legal termination dates and notice periods must be applied. The legally determined termination dates for rental contracts of agricultural land in Austria are the 31st of March or the 30th of November. If the landowner or tenant wants to terminate the contract, the other party must be informed no later than six months before the termination date. Temporary land leases end after a specified period, without any need for termination (Landwirtschaftskammer Oberösterreich, 2016). In a contractual land rental agreement both, landowners and tenants have to follow particular rights and obligations (Landwirtschaftskammer Oberösterreich, 2016):

The landowners' rights and obligations:

- Handover of a viable rental subject
- Basic maintenance obligation of the rental subject (can be transferred to the tenant through contractual details)
- Extraordinary right to cancel the arrangement

The tenants' rights and obligations:

- The obligation to manage the rented field properly

- Payment of the rental fee
- Ordinary maintenance of the buildings, as far as that can be obtained from farm revenues
- Returning the land in the state, in which it was initially rented
- The possibility of a sublease (if it does not lead to a disadvantage for the landowner and if it is not excluded in the contract agreements)

Rental agreements differ from country to country. Some have more detailed regulations, while others neither regulate land sale prices nor other contractual terms (Ciaian et al., 2010). Similar differences can be observed on land rental markets, comprising, for example, differences in minimum or maximum prices or durations (Ciaian et al., 2012). This is of relevance, as there is evidence that the ownership status can affect farmers' uptake of soil conservation measures. Scientists argue, that insecure tenure of land increases the farmers' risk aversion and consequently decreases its willingness to take expensive investments in soil conservation with time-lagged returns/results (Myyrä et al., 2007).

For the United States (US) Lee and Stewart (1983) examined the effect of differing property rights on the adoption of minimum tillage by using regression analysis. In contrast to expectations (e.g., Myyrä et al., 2007), they found owners less likely to adopt such soil management practices than tenants. Two decades later Soule et al. (2000) concluded their study with opposing results. In Europe, Boardman et al. (2003) found no evidence that owners are more likely to conserve soil than tenants. Sklenicka et al. (2015) instead found that owners in the Czech Republic undertake soil conservation measures significantly more often than tenants.

Similarly, Myyrä et al. (2007) simulated long-term land improvements under insecure land tenure conditions on rented land, finding a decreasing trend of land improvements on rented plots. Most recently, (Varble et al., 2016) found that renters more likely apply conservation practices, but rotate their crops less frequently than owners. Other studies, investigating the effect of (unsubsidized) adoption of a broader range of conservation measures often included land property rights among their explanatory variables, finding region specific or mixed results with regard to ownership and land rental (Kabii and Horwitz, 2006; Karali et al., 2014; Knowler and Bradshaw, 2007; Prokopy et al., 2008; Wauters et al., 2010)

2.1.2 Governance structures (agri- environmental schemes, laws)

In Europe, policymakers designed **agri-environmental schemes (AES)** to mitigate the negative effects of farming activities on agricultural land. AES provide farmers an additional income for the voluntary application of farming practices that conserve farmland from degradation (Batáry et al., 2015; Falconer, 2000; Pe'er et al., 2014). Hence, AES aim to modify

farmers' soil management practices through financial incentives. Since their mandatory introduction for all EU Member States in 1992 (EU Regulation 2078/92), AES became the main policy tool to conserve the European farmland (Batáry et al., 2015).

In Austria, 79.6 % of the agricultural land is managed under the guidelines of the voluntary agri-environmental ÖPUL scheme, standing for one of the highest shares among the EU member states (BMLFUW, 2017: 208). However, in the long term, the share of agricultural land covered under this program shows a decreasing trend, from 92 % in 1995, when the scheme was introduced, down to 79.6 % in 2016 (BMLFUW, 2017: 208). Additionally, the funds provided by the EU, the government and the federal states of Austria, including payments for the first and second pillar of the common agricultural policy, decreased over the last decade from 2.32 billion € in 2009 down to 1.93 billion € in 2016 (BMLFUW, 2017, 201). This trend should be observed with caution, since decreasing financial incentives could render AES less attractive for farmers and lead to an increasing non-participation (Rode et al., 2015). Similarly, Hodge (2001) found that, if payment rates are not competitive, participation in AES can decrease with rising commodity prices. Other authors showed that financial incentives can displace an agent's willingness to perform the task for its own sake (d'Adda, 2011; Frey and Jegen, 2000.; Rode et al., 2015) and might erode specific attitudes for long-term pro-environmental behavior (Braito et al., 2017b), creating the opposite of what was intended (Gneezy et al., 2011; Vatn, 2010). Nonetheless, monetary rewards remain an important driver to predict the participation in AES (Defrancesco et al., 2007; Kelley et al., 2013; Prager and Posthumus, 2011; Van Herzele et al., 2013; Wilson and Hart, 2001).

If designed and carried out in the right way, AES have the potential to be beneficial (Zechmeister et al., 2003), not only for the environment. Wilson and Hart (2001) found that farmers learned new management skills through their participation in environmental schemes, from which we can assume that AES can also act as guiding tools for farmers soil management. Similarly, Pavlis et al. (2016) found the possibility to learn new skills through scheme participation to be an important motive for participation. On the other hand, Hodge (2001) stated, that AES can limit farmers' leeway regarding their management decisions through contractual restrictions. Furthermore, Karali et al. (2014) found no evidence to suggest, that AES result in a long-term shift towards more environmentally friendly soil management. On the other hand, Mason and Holmes (2015) concluded, that AES have the potential to initiate attitudinal changes across farmers.

Nonetheless, AES represent an important institutional tool regarding farmers' conservation practices (Wilson and Hart, 2001), as they have a strong influence on farmers' decision-making regarding their soil management (Boardman et al., 2003). However, as such schemes can only be branded as successful, if they change the farmers' mindset towards long-term and comprehensive pro-environmental way of thinking (Wilson and Hart, 2001), it is important to

explore the diverse drivers behind farmers soil management decisions, among them socio-psychological ones and HNR (see below). But first, further institutional drivers will be discussed.

Farmers' soil management is also affected by **other regulations** (e.g., cross-compliance). Cross-compliance programs provide income support for farmers, tied to compliance standards (cross-compliance rules), with the goal to protect the environment (Posthumus and Morris, 2010). However, too stringent rules might hinder the adoption of soil conservation measures, as they sometimes are not appropriate or applicable for particular farms (Posthumus and Morris, 2010). Similarly, Gorton et al. (2008) argue that Europe's Common Agricultural Policy (CAP) imposes too many restrictions. Furthermore, innovation constraints might come with participation in environmental policy measures. Relevant information about soil conservation and related policies must be accessible for farmers, to provide them the opportunity to adopt pro-environmental soil management practices (Prager and Posthumus, 2011). In the Austrian Law, the protection of soil is appointed only as a subchapter in the national law on environmental protection (BGBl. Nr. 491/1984). Laws and regulations on soil protection are not implemented on a nation-wide scale but are regulated by the respective federal states (umweltbundesamt.at, n.d.), leading to different sets of soil conservation rules across the nine Austrian federal states (Juritsch, 2014)

2.2 Farm and farmer level

Although farmers act in response to various exogenous stimuli, the resulting soil management practices differ from farm to farm, due to personal disposition (Robinson, 1999). The following subchapters reviews such dispositions, including socio-economic considerations.

2.2.1 Socio-economic characteristics explaining farmers' soil management

Various authors examined in their studies the impact of farm and farmer characteristics on farmers' soil management decisions. Variables such as farm size (Carlisle, 2016; Prokopy et al., 2008; Sattler and Nagel, 2010; Wilson and Hart, 2000) and farm type (Sattler and Nagel, 2010; Wilson and Hart, 2000) were found to influence farmers' soil management. Others debunked labor (Carlisle, 2016; Dwyer et al., 2007; Karali et al., 2014; Prager and Posthumus, 2011) to play an important role in farmers' decision-making. According to Karali et al., (2014), the required labor input is a main reason for farmers not to adopt labor-intensive, more environmentally friendly farming practices. Additionally, Dwyer et al. (2007) identified time as a major constraint for farmers' capacity to change their soil management practices. However, also farm-household conditions and demographic factors, such as succession status and age (Prager and Posthumus, 2011; Wilson, 1997) can affect farmers' intention to alter their soil

management. Younger farmers were found to change their farming practices more likely than older ones (Carlisle, 2016) In Switzerland, Karali et al. (2014) found farmers who plan to pass their farm to their successors disposed to invest in environmental improvement measures. Conversely, farmers lacking a successor and close to retirement age appeared less willing to change. Similarly, Gorton et al. (2008) found farmers' intention to keep a farm running for a successor to be a main reason for farmers to find ways to continue farming. Furthermore, personal factors, like health concerns have also been listed along influential factors on farmers' soil management decisions by various authors (Cranfield et al., 2010; Karali et al., 2014; Knowler and Bradshaw, 2007)

In the UK, Wilson (1997) examined farmers' participation in AES and identified education and knowledge to influence farmers' management decisions. Similarly, Bielders et al. (2003) stated in their study about erosion control in Belgium that farmers with higher levels of education are more likely to adopt erosion mitigation measures. In this context, Carlisle (2016) highlighted the importance of own, first-hand experience as a highly effective source of knowledge. Once farmers adopted soil conservation practices, they were likely to continue it. Similarly, past experiences or the use of practices with known outcomes was found to help farmers to cope with the uncertainty of their surrounding environment (e.g., the weather, economy and government policies) (Karali et al., 2014). Finally, Burton (2014) identified experience as a direct effect of age.

Based on the assessments of the global KASSA project, Lahmar (2010) found lacking knowledge on soil conservation practices to aggravate management changes. In the U.S., Arbuckle (2012) highlighted farmers' desire for more information about soil conservation practices. Farmer networks can provide farmers adequate access to knowledge and innovation (Carlisle, 2016; Coughenour, 2003; Falconer, 2000; Karali et al., 2014). However, farmers must also be willed to try out new things (Knowler and Bradshaw, 2007; Reimer et al., 2014), as the uptake of new soil conservation practices can be understood as farmers accepting an innovation (temporary or permanently) (Prager and Posthumus, 2011).

Among dedicated literature on farmers' land and soil management, there is evidence that economic considerations affect farmers' management decisions. It is scientifically broadly confirmed that finances (Dwyer et al., 2007) or the dependency on farm income (Kabii and Horwitz, 2006) are influential to farmers' management decisions. A Swiss study by Karali et al. (2014) found that a farm's dependence on off-farm income not only affects farmers' management decisions but also influences in some cases farmers' future farming plans. Robinson (1999) debunked cost reduction to be more important among UK farmers in southeast England to implement soil conservation practices than the erosion danger itself. Similar conclusions were reached by Barbayiannis et al. (2009) in a Greek case study, finding that economic factors like market prices for products or costs for fuel determined farmers'

management decisions. In North West Europe Lahmar (2010) also found financial considerations highly important, concluding that the adoption of reduced tillage was driven either by subsidies for the adoption of the practice or the farmers' intention to reduce costs of labor, machinery or fuel. Similarly, in a case study in the Czech Republic, Prazan and Dumbrovsky (2009) found financial motivations to be the main driver for farmers to implement sustainable soil management practices, resembling other countries in western Europe. Boardman et al. (2003) showed further the difficulty to change farmers' soil management practices on high-value agricultural land, as they have little stimuli to change their economically successful short-term practices.

Furthermore, authors found evidence that the bio-physical environment (e.g., climate and biological, geological, physical and geographical conditions of the farmed land), in which the farm is embedded, also determines farmers' soil management (Prager and Posthumus, 2011; Wilson and Hart, 2001). According to Bielders et al. (2003), farmers who are aware of an erosion hazard or already facing erosion problems were found to take up more likely erosion control measures. Robinson (1999) examined the perceptions of farmers in southeast England on climate change and erosion hazard. In contrast to Bielders, Robinson discovered that most farmers consider erosion hazard as a minor threat to farm profitability, with a marginal impact on their soil management practices. Karali et al. (2014) argued in a study about constraining factors on farmers' participation in environmental conservation measures, that climatic conditions and extreme weather conditions to affect farmers' management decisions. Furthermore, the biophysical and environmental characteristics of the farmland appeared to hinder farmers in the uptake of more sustainable soil management practices.

But not only characteristics relating to the farm and the farmers themselves determine farmers' soil management and their intention to change. On a broader societal level, farmers' decisions are further not solely influenced by the government (e.g., AES), but also by customers' and food industries' demand, limiting farmers' freedom (Karali et al., 2014; Mills et al., 2017). These findings imply further the assumption that farmers consider their "freedom of action" as important to themselves.

2.2.2 Socio-psychological frameworks to understand farmers' soil management

There is evidence that farmers do not always behave in accordance with economic textbooks (Bloemmen et al., 2015). When examining farmers' behavior, agricultural economists seem to reduce farmers to the picture of the self-interested homo economicus, whom some scholars see to be far off the actual human nature (Zawojska, 2010). This narrow vision of humans as individualistic and egoistic profit- and utility- maximisers has lately been criticized (Bloemmen et al., 2015). Ryan et al. (2003) found economic motivations (e.g., payment for the adoption of conservation practices) to be the lowest-rated driver within farmers' motivations to adopt

conservation practices. In Germany, Sattler and Nagel (2010) reviewed the farmers' acceptance of conservation measures, concluding that the associated risk and the effort to implement a particular measure have at least an equal if not stronger effect on farmers' willingness to implement sustainable soil management practices than financial considerations.

Besides farmers' soil management practices are determined by external socio-economic and demographic factors, farmers' willingness to adopt such practices is ultimately influenced by the farmers' personal characteristics (Greiner and Gregg, 2011).

Various theoretical frameworks illuminate the interaction of socio-psychological factors and environmental behavior. The **Value-Belief Norm (VBN)** by Stern et al. (1999) explains human environmental behavior via values and moral norms and their influence on human actions. Stern's VBN is based on the Norm Activation Theory (NAT) (Schwartz, 1977), which assumes, that pro-environmental behavior depends on personal norms, which are based on individual's core values (Johansson et al., 2013; Schwartz, 1977).

Ajzens' (1991) **Theory of Planned Behavior (TPB)** represents another theory explaining environmental behavior. According to the TPB, an individual's action results from the intention to perform it, which depends on the individuals' attitudes and in accordance with the beliefs they hold and the perception of the perceived ability to perform the behavior (perceived behavioral control). As attitude alone as a predictor of response showed some weaknesses, Ajzen (1991) added subjective norms (i.e., social pressures connected to a certain behavior) to his linear model, in order to consider social influences. These three factors together result in a positive or negative intention to act. Nigbur et al. (2010) expanded the TPB by including social and self-identity to the concept of planned behavior. The authors argue that self-identity is significantly and positively related to the intention to engage in pro-environmental behavior, concluding, that identity can influence behavior. These results are in line with a previous finding identified by Terry et al. (1999).

The **Identity Control Theory (ICT)** explores human behavior by focusing on persons' identities within a social environment, where the identities are embedded. (Burke, 2007). Accordingly, individuals want to verify their identities. This verification process is based on feedback loops, where an individual's identity is evaluated in response to a particular social situation. Subsequently, feedback is made in relation to an identity standard. If the feedback matches the standard, the identity is verified. If there is a mismatch, the identity is not verified and consequently the individual has to decide whether to act differently, in order to support its identity or to change the identity standard (Burke, 2007).

Within the presented socio-psychological frameworks the following key variables are used to enlighten and investigate farmers' decision-making process:

Values (e.g., general values) are understood as abstract principles for which people aspire in life and are understood as the basis of peoples inner psychological processes (Mosler, 2005) and imply further preferences for a certain kind of action (Triandis, 1980). Values are culturally determined (Giddens, 1984). They support an individual on the selection of their goals (Triandis, 1980). Schwartz et al. (2012) showed that collective and self-transcendent values can predict cooperative, altruistic or environmental behavior. Beharrell and Crockett (1992) found that differences in the value-system and the underlying beliefs between organic and conventional farmers determined why farmers changed their farming style to organic farming and conventional farmers not. Greiner and Gregg (2011) found statistical evidence that farmers' values and related worldviews affect farmers' motivation and the way they perceive constraining influences by different sets of circumstances on the realization of their goals. In Switzerland, Schneider et al. (2010) explored reasons for farmers' uptake of no-tillage practices and identified the farmers' value system to be a crucial variable in farmers' soil management decisions.

Personal norms are described in literature as a sense of responsibility, awareness of need, awareness of consequences, the extent to which an individual identifies actions that might relieve the need (efficacy) and the ability to perform the respective behavior (Schwartz, 1977). Since people wish to be morally responsible and want to maintain positive self-concepts, it is assumed that personal norms can affect behavioral changes (Mills et al., 2017). Recently, Fang et al. (2018) identified a direct link between pro-environmental behavior and personal norms, concluding that pro-environmental behavior of young farmers' is directly affected by personal norms, as they might be more receptive for developing their knowledge and sense towards environmental behaviors. In the Mid-western U.S. for example, Ryan et al. (2003) found that farmers hold awareness of responsibility to conserve their farmland for future generations. **Social norms** have a legitimating role in people's decisions, as they define a set of moral rules, **valid in a particular social environment** (Giddens, 1984). They can be defined by other farmers' behavior (descriptive norms) or through opinions of groups (informal) on, e.g. water access (prescriptive norms) (Feola and Binder, 2010). There is a broad range of evidence in scientific literature that the communities in which farmers live affect farmers' decision-making. Michel-Guillou and Moser (2006) identified environmental commitment to be more dependent on social factors than on increased awareness for environmental issues. Similarly, (Fang et al., 2018) found an indirect link between social norms and the environmental behavior of younger farmers, through perceived behavioral control and personal norms. A Swiss study found that the goal to achieve social recognition influenced farmers in their decisions to apply environmentally friendly management practices. Most important to farmers

was their direct social environment (e.g., community and family) (Karali et al., 2014). Others highlighted the importance of social acceptance on farmers' decisions, finding that farmers often apply conservation measures to meet increasing environmental concerns from wider society, often without being aware of their environmental benefits, attempting to improve their self-image (Atari et al., 2009; Michel-Guillou and Moser, 2006; Uthes and Matzdorf, 2013) or to bring their management practices in line with the practices applied by neighbors (Atari et al., 2009; Karali et al., 2014). Ryan et al. (2003) highlighted that farmers adopt more likely conservation practices they considered as aesthetically pleasing, which carries the message that the landowners are good stewards over their land. This is of special interest regarding the findings of Carlisle (2016), who found evidence in dedicated literature, that neighbors tend to evaluate one another's farmland visually. Similarly, for Switzerland Schneider et al. (2010) found social aspects and aesthetics to occupy a crucial role in farmers' soil management decisions. Regarding farmers' social environment, Ryan et al. (2003) found further awareness among farmers, that their management practices can have an impact on their nearby environment (e.g., neighbors).

Attitudes are understood as a belief, expression, opinion, evaluation or preference of disfavor or favor about a specific person, place or thing (Sulemana and James, 2014). In the attempt to explore farmers' motivations for adopting conservation agriculture, Lalani et al. (2016) and Wauters et al. (2010) identified farmers' attitudes to be the strongest predictor of the uptake of soil conservation practices, similarly to Wynn et al. (2008), who found attitude to be determinant to attract farmers interested in conservation for early entry in conservation schemes. Prokopy et al. (2008) showed in a comprehensive literature review that pro-environmental attitudes are positively related to the adoption of sustainable agricultural management practices. Defrancesco et al. (2007) explored farmers' predisposition towards participation in AES. The study's results highlighted the importance of farmers' beliefs and attitudes and local behavioral influences for the design of pro-environmental measures. Finally, by using the TPB, Borges et al. (2016) showed, that attitude, subjective norms and perceived behavioral control have a strong impact on Brazilian cattle farmers' to adopting soil conservation practices.

The construct of **identity** expresses an individual's general outlook on itself (Sulemana and James, 2014). A persons' identity is underpinned by a set of meaning and defines how a person thinks and views him or herself and the world around him/her (Sulemana and James, 2014). Various authors suggested that there is a relationship between a person's identity and the set of values and life goals (Crompton and Kasser, 2009; van der Werff et al., 2013), beliefs and attitudes (Sparks and Shepherd, 1992) that person holds. Although identity is a personal construct, it can be reinforced or changed by the social environment in which an individual develops its identity (Brandth and Haugen, 2011; Sulemana and James, 2014). Therefore, the

identity verification process in most applications of the ICT starts in the social situation. Farmers' specific socio-psychological patterns (e.g., beliefs, attitudes) and experiences are the key constructs on which farmers develop their person identities and farmer role identities. Sources for this variables are family members, education, other farmers, community standards, the use of previous farm practices as well as interactions with the local environment in which the farm is embedded (McGuire et al., 2015). Further, all humans have **unique personalities** and during their lifetime, they belong to various groups and perform different roles. Thoits and Virshup (1997) proposed a distinction between *personal identities* (which often are also defined as self-identity (e.g. Cook et al., 2002; van der Werff et al., 2013), *role identities and social identities: Personal identities* can be defined as a definition of oneself, based on a person's unique characteristics, while *role identities* reflect the identification of the self through the performance of a particular social role. *Social identities* describe how people identify the own self with a social group. As a consequence, all humans hold multiple identities (Stryker, 1980). It is here, where identity hierarchy comes into play, which is a ranking of identities, in which the most salient (or active) identity stands on top, while the less important or active identities are ranked at lower positions. A specific identity is activated, if an individual is confronted with relevant meanings for his or her identity within a social situation (McGuire et al., 2015). If we, for example, assume that a farmer may want to introduce an innovative faming practice into the farm management system, but does not so, because a parent (who in this hypothetical scenario still owns the farm) is opposed to the farmers' plans, then the son's identity is more active than his farmer identity

Van der Werff et al. (2013), examined the relationship between environmental self-identity and environmentally friendly behavior. Their findings revealed that peoples' environmental self-identity relates to their feelings of moral obligation (i.e., moral-based intrinsic motivation) to show pro-environmental behavior, affecting in turn pro-environmental behavior. Most recently, Carfora et al. (2017) found pro-environmental self-identity of individuals to influence strongly both, pro-environmental behavior and pro-environmental intentions. Burton (2004a) introduced the concept of farmer identity to understand why farmers were not adopting voluntary conservation schemes to reforest their cropland. His findings showed that a farmers' role identities are closely related to their self-identity.

2.2.3 Human-nature relationships

Human-nature relationships (HNR) represent a different approach to understand human behavior. The concept of HNR describes how people relate to nature and how people see their appropriate relationship with nature (van den Born, 2007). According to Braito et al. (2017: 6), the concept of HNR can be seen as "an umbrella construct somewhere among the bundle of values, beliefs, attitudes and perceived norms of how humans interact with nature", as HNRs

overlaps, but is distinct from this constructs (Flint et al., 2013). As shown by van den Born (2008), all people hold different views about their relationship with nature. Moreover, HNRs and values are interconnected and therefore HNRs are considered to be a helpful tool to better understand the complexity of human behavior (Braito et al., 2017), especially if the respective behavior takes place with or in the natural environment (Celio et al., 2014). First conceptualizations about HNR are rooted in philosophical and religious belief-systems. However, more recently also emerged from ecological concepts. Several attempts have been carried out to classify how humans relate to nature. Mostly, conceptualizations about how people relate to nature are arranged along human-focused and nature-focused perspectives (Flint et al., 2013).

Many scientists tried to bundle and classify the views how people relate to nature under a common typology, inferring different results (Bauer et al., 2009; de Groot and de Groot, 2009; Flint et al., 2013; Kellert, 1993; Teel and Manfredo, 2010; van den Born, 2008). Based on a comprehensive literature review on HNR scales and typologies, Braito et al. (2017) tested the various HNR scales empirically. In doing so, they ended up with a refined scale of HNR typologies (i.e., seven HNR typologies) and the respective narratives, on what characterizes each type. Since this scale arises from an extensive review of relevant literature and is profoundly tested, this thesis makes use of the HNR scale (Braito et al., 2017: 9), with two exceptions, leaving out the typologies of the *User* and the *Nature Distant Guardian*, as they were not identified as relevant for the context of this research, ending up with a HNR scale of five typologies (see Table 2).

Table 2. HNR typologies and the characterizing narratives (adapted from Braito et al., 2017: 9)

HNR type	HNR narrative (scale)
Master	They think they have the right to alter nature. Technological progress enables them to tame and improve upon nature. They believe they have the right and obligation to protect themselves from natural threats.
Steward	They think their actions may have an impact on nature. They feel responsible to protect nature. They think that mankind can be a threat to nature. They would like technological interventions to be regulated in order to minimize negative effects on nature.
Partner	Nature is important and enjoyable for them. They try to understand natural processes in order to reflect on their influence on nature. According to them, technological interventions are allowed only in cases where both humans and nature benefit. In their opinion, humans and nature are of equal value.
Participant	They feel like part of nature. The physical and emotional bond between self and nature is important for them. They think that too few humans recognize the power, value and beauty of nature. According to them, they do not have the right to use technology to alter nature.
Apathy	In their daily life, nature does not play a role. They think they are not dependent on nature to survive. In their opinion, their behavior does not have an impact on nature. They think that engagement for the benefit of nature should not be given too much weight.

In literature, the *Master* is described as separate from nature and hierarchically above it (De Groot, 1992), whereas the perception of the *Steward* differs among authors. De Groot (1992) interpreted the *Steward*, similarly to the master as separate and standing above nature, while Flint et al. (2013) categorized it in between the human-focused and nature-focused polarity.

Recently, Braito et al. (2017b) interpreted it as nature-focused HNR. In the context of this thesis, the *Steward* is categorized among the nature-focused HNR, as within the concept of the *Steward* humans feel responsible for nature's care (Braito et al., 2017a; Flint et al., 2013). The *Partner* and *Participant* are perceived as equal in importance respectively as part of nature itself (De Groot, 1992). In contrast to that, the concept of *Apathy* describes the absence of the relationship towards nature itself (Flint et al., 2013). Figure 2 visualizes the positionality of human-nature-relationships. Literature suggests further, that all people hold multiple and also competing HNRs (Teel and Manfredo, 2010; van den Born, 2007) and that they can differ across time or under changing circumstances (Flint et al., 2013). For example, Braito et al. (2017) found people who identified themselves with the *Master*, also perceived statements regarding the *Steward* and *Partner* as relevant for themselves. This demonstrates that HNRs are not mutually exclusive. They also found the different HNR typologies to be interconnected.

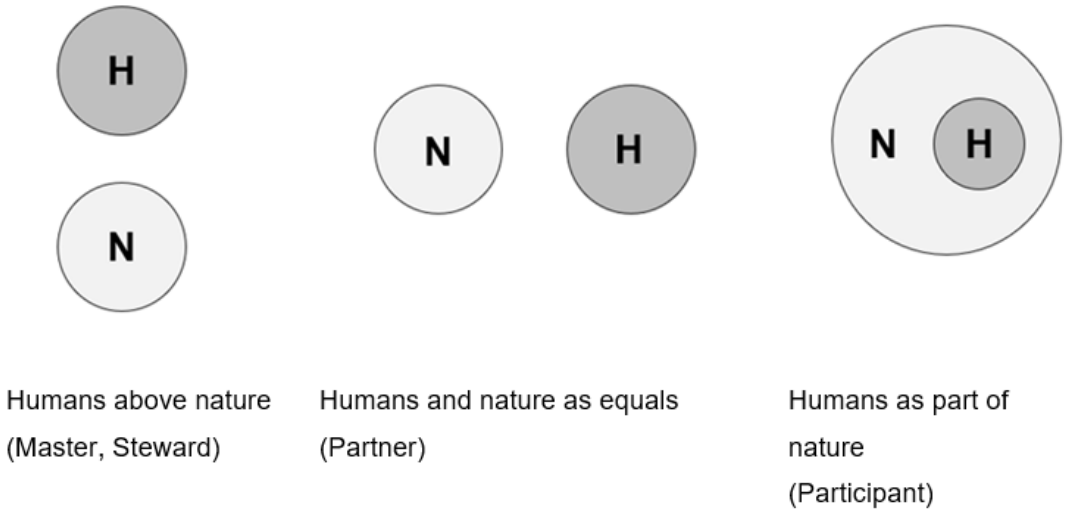

Figure 2. Positionality of human-nature relationships (adapted from Flint et al., 2013)

Most of the past socio-psychological research on farmers' conservation practices focus on the bunch of values, attitudes and other socio-psychological constructs (Schultz et al., 2005). Until now only very few authors reviewed the role HNR hold on farmers management decisions. A first study from Illinois, U.S. (Yoshida et al., 2018) investigated the impact of farmers' HNRs on watershed conservation. However, for Europe no comprehensive HNR analysis on soil management was detected. A study from Ireland ventured a push into the topic and found that farmers who hold nature-focused perspectives more likely to convert farmland into forestland (Howley et al., 2015). Since HNRs have been identified to explain human environmental behavior and due to the lack of empirical research on the impact of HNRs on farmers' soil management decisions in general and especially regarding Austria, this thesis applies the

adapted version of the HNR scale (Braito et al., 2017a) to explore the relationships Austrian farmers hold towards nature.

2.3 Farmer typologies

Farmer typologies are found to be a promising tool in enhancing farmers' soil management, as they capture the heterogeneity and variety among farmers (Walder and Kantelhardt, 2018). They offer not only a basis for describing and understanding farmers' management decisions but subsequently also to alter their behavior, making it more environmentally pleasant (DEFRA, 2008). However, the classification of farmers into different types and the use of these constructs has not received much prominence so far. However, the concept of farmer typologies offer options for tailoring specific programs and targeted use of agricultural policy instruments (Emtage et al., 2007, 2006). Studies, which try to classify farmers share the goal to surmount the common assumption of farmers as a mainly homogenous group (Walder and Kantelhardt, 2018). However, the most effective policy should be designed and established on the basis of a clear specification of the respective targets groups (DEFRA, 2008).

Burton (2004b) remarked that many studies explored farmers' management decisions solely from an attitudinal approach, ignoring cultural and social factors. However, as seen in the previous chapters, these variables have also been found to influence farmers' soil management. Recent studies structured farmers from different angles. Barnes et al. (2011) for example used cluster analysis to explore farmer types in Scotland and identified three types of farmers: the *multifuncionalist* holding strong environmental attitudes, the *efficiency-driven* and the *economy-driven* farmer. Pedersen et al. (2012) used farmers' attitudes to cluster them and found that some farmers are more economically motivated than their counterparts, who put their focus on their production and are less driven by economic considerations. Moreover, the authors found that both types differed in their responses to policy instruments (Pedersen et al., 2012). Daloğlu et al. (2014) conducted a literature review about farmers' adoption of agricultural conservation measures to identify four types of farmers: *traditional* small operators, which rely mainly on their farm income, *supplementary* small farmers which depend strongly from their off-farm income, *business-oriented* farmers and investor and/or absentee *non-operators* farmland owners. Burton and Wilson (2006) picked up and enlarged the concept of *farmer identity* and developed a typology of farmers and categorized them in four typological groups: "Agricultural producer", "agribusiness person", "conservationist" and "diversifier" and suggest, that farmers' perception of themselves is still dominated by the traditional producer-farmer identity. They showed further that a farmer is categorized as one type may also hold attributes that belong to other typologies. Others found that farmers perceive themselves as business/entrepreneur people (Burton, 2004a; Vesala and Vesala, 2010). McGuire et al. (2015) instead identified four different kinds of farmer identities: the *Productivist*, the

Conservationist, the *Naturalist*, which were activated more likely by soil and water policies, while the *Civic-minded* one appeared to be significantly against more monetary incentives for conservation, fearing more regulations. Schmitzberger et al. (2005) examined farming styles across Austrian farmers and distinguished between environmental-business, production-oriented – multifunctional or traditional-modern farming styles.

2.4 Farmers' viewpoints

Capturing farmers' subjective viewpoints and comparing their personal perspectives towards a given phenomenon, situation or issue is another approach to look at how different actors understand a given issue to depict diversity among respondents. Davies and Hodge (2007) used Q methodology to identify different environmental management styles across arable farmers. They identified five distinct viewpoints: the ecocentric *Environmentalists*, the *Progressives*, with a strong focus on technological innovations, business-focused *Commodity Conservationists*, a more *traditionalistic, community-focused perspective* and lifestyle focused *multifunctionalists*. Similarly, Brodt et al. (2006) characterized different farming approaches by exploring farmers' goals and management styles. They found beside the "Networking Entrepreneurs" with stronger interests in off-farm activities and social interactions evidence for either business or environmental oriented viewpoints among farmers. In Austria, Walder and Kantelhardt (2018) identified four different perspectives: the *Diversity-maintaining*, the *Context-depending*, *Economic Aspects-emphasizing* and the *Change-promoting* viewpoint.

These findings suggest that farmers are anything but a homogenous group when it comes to their decision-making. Furthermore, current research shows, that different types of farmers show different responses to policy measures. However, when examining the diversity across farmers, most authors place their focus solely on the more ecologically oriented or the more economically oriented viewpoints, while other traits are often treated with less attention. Besides the study carried out by Walder and Kantelhardt (2018) on environmental behavior and the farming styles across Austrian farmers (Schmitzberger et al. 2005), I did not find any attempts to capture viewpoints of typologies of Austrian farmers. Since now there is further no analysis on Austrian farmers' viewpoints on soil management.

3 Research questions

Based on the problem definition and the research gap identified during the literature review the following research questions will be addressed:

(i) How do farmers themselves rank factors influencing their soil management practices?

(ii) Which role does the duration of future land cultivation (ownership vs. rental) play in different viewpoints?

(iii) Which role do human nature relationships (HNR) play in different viewpoints?

4 Material and methods

Due to the explorative nature of the research questions and the little knowledge we hold about subjective viewpoints and concepts of human-nature relationships shared by farmers and how they interrelate with property rights, a semi-qualitative approach was chosen. The research questions were addressed with q-methodology (explained in 4.1) and qualitative content analysis of semi-structured farmers' interviews. The latter particularly helped to get a deeper insight into the interpretation and discussion of results on the question on ownership and HNR

4.1 Q methodology

Q methodology offers the possibility to explore subjectivity systematically (Brown, 1993). Back in 1935, William Stephenson first introduced the Q methodology in the research-field of psychology (Stephenson, 1935) and more recently Stephen Brown has popularized it in political sciences (Brown, 1980). Stephenson established the Q methodology with a simple adaption of the quantitative factor analysis, by inverting the conventional factor analysis (Stephenson, 1936). This has the consequence, that the surveyed persons or participants become the variables of interest in a Q study (Watts and Stenner, 2005) In other words, Q studies explore "correlations between persons or whole aspects of persons" (Stephenson, 1936) instead of statistical tests. Q methodology "neither tests its participants nor imposes meanings a priori" (Watts and Stenner, 2005). It rather asks, what participants perceive as meaningful (and what not) from their perspective. This methodological change distinguishes the Q methodological approach from other statistical approaches (e.g., R methodologies) (Watts and Stenner, 2005).

A participant is presented with a bundle of statements about the topic of interest in the form of a Q set. The Q set is a collection of statements which the respondents will sort (Watts and Stenner, 2005). Respondents are asked to rank- order the set of statements from his/her own point of view. By doing so, they reveal their subjective viewpoints towards the topic of research. (Brown, 1993). Correlating these viewpoints in a subsequent factor analysis makes it possible to get insights into shared viewpoints, based on the relative ranking of the statements (items). This offers the possibility to explore and describe both, similarities and differences among the different viewpoints (Brown, 1980).

Q methodology is an exploratory technique in principle. Thus it cannot prove hypotheses. Rather, Q methodology delivers a sense of coherence to research questions which may have manifold, potentially complex answers (Stainton Rogers, 1995). Despite its explorative nature, Q methodology is classified as a semi-quantitative approach, as the analysis always includes factor analysis and subsequent rotation.

4.2 Q set – The Statements

Following Brown (1993: 99), the main goal in selecting a Q set is “to provide a miniature which, in major respects, contains the comprehensiveness of the larger process being modeled.” Usually, a Q set is constituted by a set of statements, among which each one makes a different assertion about the subject of research (Watts and Stenner, 2005). Hence, the research question plays at this point a significant role, because it dictates the way in which the structure of the Q set must be generated. It will act as an “instructor” how the participants have to rank-order the statements. Thus, the research question guides the actual sorting procedure (Watts and Stenner, 2005). As the aim of this thesis is to highlight farmers’ soil management decisions, farmers were confronted with the following research question: “What influences me when dealing with my soil?”.

A Q set represents a meaningful subsample of statements derived from a broader discourse on the topic of interest and is usually formed by reducing the subject matter into key themes. (Brown, 1993; Watts and Stenner, 2005). The Q set has to be tailored to the demands the research question aims to answer and the requirements of the investigation (Watts and Stenner, 2012). In practice, the Q set can be extracted from any kind of sources (Watts and Stenner, 2005). According to this, the applied Q set in this thesis is based on explorative expert interviews and a broad literature review about the influential factors on farmers’ soil management. Subsequently, the large number of potential statements got cut-down in an iterative process with the goal to form a manageable but still broadly comprehensive Q set that suits the aim of this research (see reference to Brown 1993, beginning of this sub-section). To achieve that, the most illustrative statements for the diversity of viewpoints on farmers’ soil management were identified and classified among the following categories: *formal institutions*, informal institutions and other *farm and farmer level* aspects (Table 3). As proposed by (Watts and Stenner, 2012), the single statements were to some extent standardized in their phraseology to ease the sorting-job for the respondents. Subsequently, the Q set was pre-tested to guarantee that the generated set of statements can deliver viable results and that no potential viewpoint gets discarded up front. Hence, every farmer can offer his subjective viewpoint towards the whole Q set.

Table 3. List of statements (for original wordings in German language see Table 9, Appendix)

	Topic	Statement	Evidence
Formal institutions	**Tenure security**	The number of years that I will still farm a plot determines how I deal with my soil	(Carlisle, 2016; Daloğlu et al., 2014; Karali et al., 2014; Myyrä et al., 2007; Sklenicka et al., 2015; Soule et al., 2000)
	Agri-environmental schemes	How I deal with my soil depends on agri-environmental schemes	(Batáry et al., 2015; Boardman et al., 2003; Hodge, 2001; Uthes and Matzdorf, 2013; Zechmeister et al., 2003)
		Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	(Pavlis et al., 2016; Wilson and Hart, 2001)
	Legal regulations	How I deal with my soil is determined by laws and governmental sanction	(Gorton et al., 2008; Karali et al., 2014; Posthumus and Morris, 2010; Prager and Posthumus, 2011)
Farmer and Farm Level	**Risks and time constraints**	When dealing with my soil I pay attention to my health	(Cranfield et al., 2010; Karali et al., 2014; Knowler and Bradshaw, 2007)
		I would deal with my soil differently if I had more time	(Dwyer et al., 2007)
		When dealing with my soil I want to avoid risks	(Karali et al., 2014; Sattler and Nagel, 2010)
	Knowledge transfer	When dealing with my soil I rely on my own education and experience	(Arbuckle, 2012; Carlisle, 2016)
		I attend training and extension services to learn more about soil	(Arbuckle, 2012; Carlisle, 2016)
		Traditional and passed-down knowledge determines how I deal with my soil	(Karali et al., 2014)
		I try new things when dealing with my soil	(Knowler and Bradshaw, 2007; Prager and Posthumus, 2011; Reimer et al., 2014)
		Experiences of colleagues give me guidance for dealing with my soil	(Coughenour, 2003; Falconer, 2000; Karali et al., 2014)
	Bio-physical environment	When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	(Bielders et al., 2003; Prager and Posthumus, 2011; Wilson and Hart, 2001)
		The weather determines how I deal with my soil	(Karali et al., 2014)
		By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	(OECD, 2014)
	Economic considerations	The profitability of my farm is top priority for me when dealing with my soil	(Barbayiannis et al., 2009; Boardman et al., 2003; Carlisle, 2016; Defrancesco et al., 2007; Dwyer et al., 2007; Lahmar, 2010; Robinson, 1999)
		The distance between a plot and my farm determines how I deal with my soil	(Barbayiannis et al., 2009; Lahmar, 2010)
		When dealing with my soil I avoid expensive investments	(Carlisle, 2016)
		When dealing with my soil I go by the requirements and expectations of my customers	(Karali et al., 2014)
	Socio-psychological aspects	When dealing with my soil I have a responsibility for employees and assisting persons	From pre-test
		When dealing with my soil I think about future generations	(Ryan et al., 2003)
		When dealing with my soil I pay attention to the tidiness and neatness of my plots	(Ryan et al., 2003; Schneider et al., 2010; URBAN, 2005)
		When dealing with my soil my freedom as a farmer is my main concern	(Karali et al., 2014)
		Dealing with my soil ought to give me pleasure	From pre-test
		My duty to provide food for society shapes how I deal with my soil	(Burton, 2004a; Mills et al., 2017); from pre-test
		I implement expectations of society in how I deal with my soil	(Karali et al., 2014; Mills et al., 2017; Uthes and Matzdorf, 2013)
		How I deal with my soil ought not to have any negative impact on my neighborhood	(Ryan et al., 2003)
		I coordinate with my neighbours when dealing with my soil	(Atari et al., 2009; Karali et al., 2014)
		When dealing with my soil I avoid doing things that would make me the subject of gossip	(Karali et al., 2014)
	HNR	When dealing with my soil I steer nature for my own use	(Braito et al., 2017a)
		When dealing with my soil I have a responsibility for nature	(Braito et al., 2017a)
		When dealing with my soil I work together with nature	(Braito et al., 2017a)
		When dealing with my soil I feel as a part of nature and its cycles	(Braito et al., 2017a)
		When dealing with my soil I do not think about nature	(Braito et al., 2017a)

4.3 P sample – The respondents

According to Brown (1980), the P sample is not randomly assembled but is rather theoretical in nature. The P sample should guarantee that no potential viewpoint is missed up front. Q methodology does not require a large number of participants. Indeed, too many participants can rather be problematic (Watts and Stenner, 2005). Since the aim of a Q study is to reveal favored viewpoints of the participant group, a too large number of participants could cancel out complexities, fine nuances and hence essential qualities in the data (Watts and Stenner, 2005).

The sample of respondents, (in Q methodology defined as P sample) for this research consists of 33 farmers. Due to the aim of this thesis some selection- criteria were set: All interviewees had to cultivate to some amount arable land. Hence, solely farmers situated in the provinces of Lower Austria, Upper Austria, Burgenland and Styria were selected, since these areas show a strong presence of crop production. Another main criterion was, that interviewees farm both, owned and rented plots. Beyond that, participants were selected following the aim to cover a broad range of different farm types and farmers to meet the given requirements by Brown. Respondents were recruited through several channels: an open call via a newsletter sent out by the Chamber of Agriculture, direct contact lists, provided from farm advisors of the Chamber of Agriculture, contacts via extension services and environmental NGOs and finally also through a call among students of the University of Natural Resources and Life Sciences, Vienna (BOKU), ending up with a P sample of 33 respondents (see Table 5 in the chapter 5).

4.4 Sorting procedure

Respondents have to rank-order each of the 34 statements of the Q set. In this procedure, defined as Q sorting, respondents rank-order the statements according to their subjective meaning by placing it into a ranking grid (see Figure 3). In other words, every respondent has to assign to each item a ranking position in a fixed quasi-normal distribution (Watts and Stenner, 2005). The possible ranking values range from +4 (*most agree*) to -4 (*most disagree).* The ranking grid also “dictates” every respondent the number of statements he/she can rank under the respective ranking value, whereby the distribution is symmetrical about the middle (Brown, 1993). For this reason, the sorting procedure is defined as a forced distribution (Watts and Stenner, 2005). Both, the value ranking as well as the forced distribution are arbitrary, hence, they do not affect the subsequent statistical analysis (Brown, 1993).

Before the actual sorting procedure into the ranking grid starts, respondents get instructed to read through all the statements and to pre-sort the statements into three piles: those they perceive as agreeable in one pile, those experienced as disagreeable into the second pile and the remainders in the third pile. This procedure has the aim to provide the respondents with a first impression of the range of opinions regarding the issue and to settle their mind into the

situation. Dividing the statements into three piles follows the goal to ease the sorting process for the respondents, as the effect of spreading the large number of statements physically creates a first sense of distribution (Brown, 1993). Then, the actual Q sorting procedure starts. Respondents are asked to rank order the respective statements, beginning with the one they agreed with the most on the top of the ranking grid (+4). If the rank-ordering of the statements the respondent agrees with is finished, then the sorting continues with the ones the respondents disagree with, following the same instructions. Finally, the statements on those the respondents hold indifferent viewpoints are added to the remaining slots into the ranking grid. During the sorting process, respondents can ask questions, if there appear some uncertainties about some statements (Watts and Stenner, 2012).

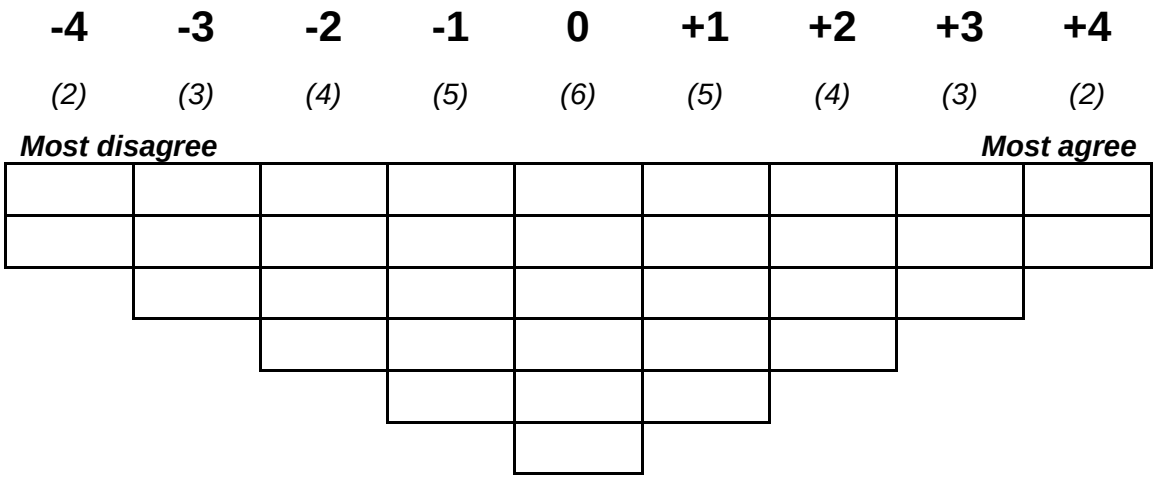

Figure 3. The ranking grid used for this thesis; ranking values are marked in bold, with the respective allowed number of statements marked in italic (adapted from Watts and Stenner, 2012).

When the sorting procedure is finished, following Watts and Stenner (2005) a brief post-sorting interview is conducted to gather information from the respondent to investigate (a) how the respondent has interpreted the statements, especially the ones he/she ranked the highest and the lowest in his/her Q sort, (b) if there are further items the respondent would like to pass a comment (which might be especially important to the respondent and why they are important) and (c) if there are any other items he might would have included in his/her own Q set and why.

4.5 Statistical analysis

In the following statistical analysis, the overall configurations (Q sorts) produced by the respondents are intercorrelated. The resulting correlation matrix reflects the relationship of each Q sort with every other Q sort (Watts and Stenner, 2005). The correlation between any Q sort shows the degree of similarity between any two q sorts and can range from -1 to +1

(Brown, 1993). Subsequently, this correlation matrix is subject to a factor analysis. The factor analysis produces a set of factor arrays onto which the respondents load, depending on the configurations (Q sorts) they created. The loading of each respondent on each of the extracted factors explains to what extent a participant corresponds (what can be either positively or negatively) to each viewpoint (Schmolck, 2002). The factor arrays are calculated according to the method of weighted averaging. Hence, participants with higher loadings on the respective factor are given higher weight in the averaging process, as they better exemplify the factor. Thus, two respondents that load significantly onto one factor have created very similar Q sorts. Each of the produced factor arrays looks like a single complete Q sort which merges the different viewpoints, shared by the respondents who load onto it. (Watts and Stenner, 2005).

The statistical analysis was conducted with the PQMethod software. The software helped to detect patterns among the Q sorts and to extract different viewpoints, by using Principle Component Analysis (PCA). Crucial to this is to decide how much factors should be selected for interpretation. Literature suggests various approaches to define the appropriate number of factors. One main requirement is to choose only factors with eigenvalue in excess of 1.00 (Watts and Stenner, 2005). Furthermore, literature recommends extracting only factors with at least two loading participants, as the interest of the use of Q methodology relies on the examination of shared interests (Watts and Stenner, 2005). According to the eigenvalue criterion, it would have been possible to extract up to seven factors. However, three of them had only one loading participant. After testing different outcomes and following the decision criteria cited above, four factors were extracted.

Then, following the instructions of Schmolck (2002) a Varimax Rotation was carried out, to maximize the amount of explained variance by the produced factors (Watts and Stenner, 2005). Additionally, following Watts and Stenner (2012), the factors were subsequently rotated by hand, to actually represent the qualitative overall-impression of the interviews. To obtain the best result possible, we combined the strengths of both methods: Varimax rotation can provide better solutions statistically, however, it might cuts out Q sorts that, on occasion, might reflect more accurately the reality (Watts and Stenner, 2012). In fact, by only using Varimax rotation when extracting the four factors, the results included 18 loading participants with a total explained variance of 67 %. After rotating the results modestly by hand, the total explained variance still accounts 67 %, however with 23 loading participants. Furthermore, stricter limit values were set than usual. As mentioned by Brown (1993), a Q sort can be considered as significant, if it loads on a factor in excess of ± 0.50. However, this is more likely a rule of thumb. After testing different solutions, the limit value for this study was raised to 0.55, in order to guarantee a greater resemblance of the loading Q sorts to the respective factor array. Therefore, in this master thesis, a Q sort was considered to load on a factor if the individual loading exceeds 0.55 and further, if there is no loading on another factor which exceeds the

calculated significant factor loading of ±0.44[1] at the p < 0.01 significance level. The significant correlation between factor scores for this thesis is calculated by using the same equation[2] (Watts and Stenner, 2012). Consequently, correlations between factors can be considered as statistically significant, if the correlation values are equal or greater than ± 0.44.

4.6 Interviews

In addition to the Q ranking, each of the 33 interviewees (see Table 5) was interviewed following an exploratory semi-structured interview guideline. The guideline covered various topics: general information about the farm, farm rental conditions and questions about applied soil management practices (see Figure 5 Appendix). The interviews lasted between 45 and 90 minutes. They were recorded transcribed (mostly by myself and also by scientific and non-scientific employees of the institute) and analyzed according to Mayring's (2014) qualitative content analysis (see Leonhardt et al., 2019). Although the interviews are not the focal empirical tool of this master thesis, selected statements are used for interpretation and discussion of the results in chapter 6.

[1] Significant factor loading for the study. For p < 0.01: $2.58 * \frac{1}{\sqrt{n}}$, where n equals the number of items in the Q study

[2] Significant correlation for the study at the p < 0.01 level: $2.58 * \frac{1}{\sqrt{n}}$, where n equals the number of items in the Q set. Note: this is the same equation used to calculate a significant factor loading (see (Brown, 1980: 283-4; Watts and Stenner, 2012: 202)

5 Results

From the overall 33 Q sorts, 23 were used to form the four factors. Six Q sorts got excluded (Q sorts 10, 12, 15, 22, 23, 24), as they were confounded. Those Q sorts exceeded the calculated significant factor loading of 0.44 at the $p < 0.01$ significance level on more than one factor. Five Q sorts (Q sorts 17, 19, 26 and 27) were not loading high enough on any factor. The four factors and the corresponding factor loadings of each participant are shown in Table 4. The defining Q sorts for the respective factor are marked in bold. The explained variance by the four factors amounts to a total of 68 %. Factor 1 explains 27 of the total variance and includes 12 loading participants, what correspond to the highest number of defining Q sorts along all four viewpoints. Another remarkable result is the high correlation scores between factor scores of Factors (see Table 5) Factors 1 and 3 (0.64), Factor 1 and 4 (0.68), Factor 2 and 3 (0.46) and factor 3 and 4 (0.54), which exceed the calculated significant correlation for this thesis of ± 0.44 at the $p < 0.01$ level. Only factor 1 and 2 (0.42), as well as factor 2 and 4 (0.35), stay within the limit value of ± 0.44. According to (Watts and Stenner, 2012: 143), these factors can be interpreted as alternative manifestations of a single viewpoint". Even though these factors appear to share several important aspects, after evaluating solutions with fewer factors the decision was made to opt for a four-factor solution. This provides the most valuable insights into the details which differentiate the extracted viewpoints.

Table 4. Factor characteristics

Farmer	Factor[3]			
	1	2	3	4
1	0.4116	0.3767	**0.5514**	0.0752
2	0.3668	0.336	**0.6832**	-0.0864
3	0.2048	0.1346	**0.6795**	-0.0082
4	0.4219	-0.0163	0.2266	**0.5913**
5	**0.6356**	0.3461	0.2357	0.3777
6	0.2943	0.3111	**0.5943**	0.353
7	**0.7299**	-0.2319	0.2558	0.1952
8	**0.7193**	0.211	0.4339	-0.0481
9	**0.7073**	0.3264	0.2665	0.206
10	0.3891	0.1065	0.5449	0.5521
11	0.439	**0.6303**	0.2532	0.2175
12	0.5109	0.0287	0.6101	0.2124
13	0.24	-0.0099	0.3756	**0.7539**
14	0.1073	0.0889	**0.7598**	0.2434
15	0.6323	0.4565	0.411	0.2749
16	**0.7241**	0.1479	0.2237	0.1817
17	0.2578	0.5378	0.21	0.541
18	0.0081	**0.8676**	0.1718	0.0586
19	0.4199	0.3092	0.3982	0.5393
20	**0.5794**	0.2943	0.2168	0.4258
21	**0.7512**	0.1706	0.2371	0.2185
22	0.5543	0.0697	0.4814	0.0037
23	0.2507	0.574	0.257	0.541
24	0.58	0.4722	0.2191	0.2975
25	**0.612**	0.1373	0.1699	0.1809
26	0.4996	0.312	0.2454	0.4826
27	0.3121	0.448	0.4688	0.3477
28	**0.7087**	0.0694	0.1287	0.2901
29	**0.6606**	0.4447	0.1134	0.294
30	**0.6243**	0.4189	0.1504	0.3242
31	0.3432	0.3869	0.0605	**0.7334**
32	**0.674**	0.1423	0.3194	0.3388
33	0.0567	-0.0092	**0.6556**	0.2661
Number of defining variables (total 33)	12	2	6	3
Explained variance in % (total 67 %)	27	12	16	13
Eigenvalue	8.91	3.96	5.28	4.29
Correlation between factor scores				
Factor 1		0.4214	0.6386	0.6807
Factor 2			0.4635	0.3507
Factor 3				0.5438

[3] F1 = *Innovative Stewards*; F2 = *Neo-traditional Producers*; F3 = *Profit Maximisers*; F4 = *Self-reliant Environmentalists*

The participants' age ranges from 24 to 69 years (Table 5) and have been working in the farming business on average between 0 and 43 years. Farm sizes range between 6 and 800 ha, from which 51.43 % are rented land. Thirty participants (90.91 %) are male farmers, three are women. The majority of the interviewed farmers completed a vocational education (55 %). Twenty-seven farmers (82 %) work as full-time farmers on their farms. Regarding the farming types, 14 farmers farm field crops exclusively (42 %), while the other 19 farmers (58 %) run mixed farming systems. Finally, nine farmers (27 %) run organic farming businesses.

Demographics (Table 5) are used to characterize the Q-sort socio-economically

Table 5. P sample (n = 33) and demographic factor characteristics

	P sample (n=33)		F1 (n = 12)	F2 (n = 2)	F3 (n = 6)	F4 (n = 3)
			Mean (min/max)			
Age	46.64 (24/69)		46.4 (24/65)	30.5 (30/31)	47.5 (38/67)	53 (52/55)
Experience as a farmer (years)	16.36 (0/43)		17 (0/31)	3.5 (2/5)	18.5 (4/43)	23 (16/30)
Farm size arable land (ha)	100.87 (6/800)		87.99 (10.87/270)	122.5 (55/190)	96.33 (19/320)	15 (6/21)
land tenure (%)	51.43 (0/400)		60.44 (9.5/216)	47.03 (17/120)	44.03 (3.5/200)	23.81 (0[4]/8)
	N	%		n (%)		
Gender (male)	30	90.91	11 (92)	2 (100)	6 (100)	2 (66.7)
Level of education						
Vocational	18	55	6 (50)	2 (100)	6 (100)	2 (66.7)
Secondary	6	18	2 (16.7)	-	-	-
University	5	15	1 (8.3)	-	-	1 (33.3)
Other	4	12	3 (25)	-	-	-
Employment status (full-time)	27	82	10 (83.3)	2 (100)	5 (83.3)	3 (100)
Type of farming						
Field crops (exclusively)	14	42	5 (41.7)	1 (50)	2 (33.3)	1 (33.3)
Field crops (mixed)	19	58	7 (58.3)	1 (50)	4 (66.7)	2 (66,7)
Milk	6	18	4 (33.3)	-	1 (16.7)	-
Animal fattering	2	6	-	-	-	1 (33.3)
Pig	10	30	3 (25)	1 (50)	3 (50)	1 (33.3)
Poultry	1	3	-	-	-	-
Organic farming	9	27	3 (25)	1 (50)	-	2 (66.7)
Direct Marketing	11	33.3	4 (33.3)	None	2 (33.3)	3 (100)

[4] One participant lost all rented plots shortly before the interviews were conducted. Due to the brief time-period in between, we decided to include his Q set into our results.

5.1 Farmers' viewpoints towards their soil management

The following subsections depicture all four factors and elaborate their underlying viewpoint. The factor scores for the respective statements obtained from statistical analysis (Table 6) are used to characterize the four resulting factors, to create a comprehensive picture of the different viewpoint's farmers hold towards their soil management. First, by using the most salient statements at the two "poles" (±4 and ±3), including distinguishing statements, which differ significantly from other factors. Further, crib sheets (see Table 10, Table 11, Table 12, Table 13) as described by (Watts and Stenner, 2012), were additionally used to complete the interpretation.

Table 6. List of statements and factor scores. a,b

	Statements	Factor scores			
		F_1	F_2	F_3	F_4
1	When dealing with my soil I pay attention to the tidiness and neatness of my plots.	**-1**	4	2	1
2	I attend training and extension services to learn more about soil tillage.	2	3	2	**-1**
3	My freedom as a farmer when working with my soil is important to me.	-2	3	-1	2
4	When dealing with my soil I avoid expensive investments	-3	-4	-1	0
5	Traditional and passed-down knowledge determines how I deal with my soil	-1	**3**	-1	0
6	My duty to provide food for society shapes how I deal with my soil	1	**3**	0	**-2**
7	How I deal with my soil depends on agri-environmental schemes	-2	-2	0	-2
8	When dealing with my soil I do not think about nature	-4	-1	-2	-3
9	When dealing with my soil I go by the requirements and expectations of my customers	0	2	-2	-1
10	When dealing with my soil I have a responsibility for employees and assisting persons	0	**2**	-3	-1
11	When dealing with my soil I steer nature for my own use	1	**-2**	1	1
12	When dealing with my soil I want to avoid risks	-1	0	1	-1
13	Experiences of colleagues give me guidance for dealing with my soil	0	**-3**	-1	0
14	When dealing with my soil I rely on my own education and experience	1	0	3	2
15	I coordinate with my neighbors when dealing with my soil	-3	-2	-4	-4
16	*When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.*	*2*	*1*	*3*	*2*
17	When dealing with my soil I feel as a part of nature and its cycles	4	-1	0	3
18	*When dealing with my soil I pay attention to my health*	*0*	*0*	*0*	*1*
19	Dealing with my soil ought to give me pleasure	2	2	1	4
20	I try new things when dealing with my soil	1	0	0	0
21	When dealing with my soil I avoid doing things that would make me the subject of gossip	-4	-2	-3	-3
22	The profitability of my farm is top priority for me when dealing with my soil	-1	1	**4**	0
23	How I deal with my soil is determined by laws and governmental sanction	-2	-3	**0**	-4
24	By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	2	0	1	0
25	I would deal with my soil differently if I had more time	-3	-4	-4	**1**
26	When dealing with my soil I think about future generations	3	1	2	2
27	Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	0	-1	-1	-3
28	The distance between a plot and my farm determines how I deal with my soil	-1	-1	-3	-2
29	*The number of years that I will still farm a plot determines how I deal with my soil*	*-2*	*-3*	*-2*	*-2*
30	How I deal with my soil ought not to have any negative impact on my neighborhoods	1	-2	1	1
31	I implement expectations of society in how I deal with my soil	0	0	-2	-1
32	When dealing with my soil I have a responsibility for nature	3	0	3	2
33	When dealing with my soil I work together with nature	3	2	2	4
34	The weather determines how I deal with my soil	4	1	4	3

a Distinguishing statements for the respective factor ($P < 0.01$) are marked in bold

b Consensus statements ($P > 0.01$) are given in italics

5.1.1 Innovative Stewards (F1)

This viewpoint is shared by 12 significantly loading participants and it explains 27 % of the study's variance. It has an eigenvalue of 8.91.

Eleven of the loading participants are men, one is female. The loading participants' age ranges from 24 to 65 years and have been working in the farming business between 0 and 31 years. Farm sizes range from 10.87 to 270 ha, from which 60.44 % are rented land. The amount of rented land ranges from 9.5 up to 216 ha. Two (16.7 %) of the participants are part-time farmers, the remaining ten (83.3 %) work as full-time farmers. Regarding the farming types, five farmers cultivate field crops exclusively (41.7 %), while the other six farmers (58.3 %) run mixed farming systems. Three participants run an organic farm (25 %) and four participants (33.3 %) sell their products via direct marketing. Half of the loading participants completed a vocational education (50 %), two a secondary education degree, one farmer completed a university degree and three farmers another educational degree.

The *Innovative Stewards* consider themselves as a part of nature and its cycles, as told by *participant 28*, *"from the ground you were taken, and to dust you shall return."* Further, they hold a collaborative approach towards nature when they deal with their soil. (17: +4; 33: +3). Although the weather conditions and the natural conditions command their soil management, (34: +4; 16: +2)., the *Innovative Stewards* are aware of nature's vulnerability and feel themselves responsible for it, as they know about the possibility to avoid damages through natural influences by proper soil management practices (32: +3; 8: -4; 24: +2). This viewpoint enlarges this expression of stewardship, by including thoughts on future generations in their management decisions, as their *"[soil and] farm are only borrowed from future generations" (*comment participant 16*)* (26: +3).

Farmers are willed to attend training and extension services to enlarge their knowledge and are (in contrast to other viewpoints), more open to try out novel approaches: "[…] in the winter months I think about certain things, make plans […] and when I leave a [training] seminar, I think about how I could apply that during the coming year" (*comment participant 30*) (2: +2; 20: +1). Moreover, they appear open-minded for colleagues' expertise and advice (13: 0). In doing so, the *Innovative Stewards* put less value on traditional-passed down knowledge (5: -1). Instead, they invest much time in soil management and do not strive for a sense of freedom and independence (25: -3; 3: -2).

Opposed to the other viewpoints, the societal value of aesthetic plots is unimportant as well as another people's gossip talk (1: -1; 21: -4). Further, the *Innovative Stewards* uncouple their soil management decisions from their neighbors' soil management (15: -3).

Formal institutions such as land tenure and agri-environmental schemes have no impact on their soil management decisions (29: -2; 7: -2). Instead, unlike others, these farmers perceive voluntary programs and schemes as a potential tool for guidance, on how to deal with the soil (27: 0). Expensive and risky investments are not considered of much relevance (4: -3; 12: -1). In line with that, the *Innovative Stewards* rank profitability comparatively low, as *"profitability results automatically anyway" (comment participant 29)* [with proper soil management] (22: -1).

5.1.2 Neo-traditional Producers (F2)

This viewpoint has two significantly loading participants and it explains 13 % of the study's variance. It has an eigenvalue of 3.96.

The two loading participants are men and 30 and 31 years old. They have been working in the farming business on average between 2 and five years. Farm sizes range from 10.87 to 270 ha, from which 47.03 % are rented land. The amount of rented land ranges from 17 up to 120 ha. Both farmers are full-time farmers, whereas one cultivates exclusively crops and the other farmer runs a mixed farming system. One farmer runs an organic farm, none sells its products via direct marketing. Finally, both completed a vocational education.

The *Neo-traditional Producers* are characterized by a productivistic and traditional attitude, as *"the provision of food is something beautiful for every farmer"* (comment participant 11) (6: +3). They pay close attention to the aesthetic appearance of their plots and invest a lot of time in their soil management, to ensure *"that it [the plot] is also attractive for the eye"* (*comment participant 18*) (1: +4; 25: -4). Opposed to the other viewpoints, farmers' soil management is driven by their customers' requirements (9: +2).

To ensure their farms' profitability, they are willed to invest continuously, but think twice before trying out new, risky approaches (22: +1; 4: -4; 20: 0; 12: 0). To achieve that, farmers do not let restrict themselves by laws, governmental sanctions and agri-environmental schemes in their soil management decisions (23: -3; 7: -2). To reach their farming goals, they try to work together with nature (33: +2). Despite that, the *Neo-traditional Producers* want to deal with their soil as they wish (3: +3): they appear disconnected from nature and show no sense of responsibility towards it (17: -1; 32: 0). Farmers are apathetic towards the possibility to avoid damages through natural influences by proper soil management practices (24: 0). Rather, they feel themselves more responsible for their employees and assisting persons (10: +2). In contrast to the other viewpoints, these farmers do not put as much value on the weather conditions, as they feel unable to steer nature for their own needs, since *"[it is a] heavy, heavy, heavy [task]"* (*comment participant 11*). (34: +1; 11: -2)

The *Neo-traditional Producers* ignore the possibility of negative impacts on their neighborhood through their management decisions and neither coordinate their soil management with their

neighbors nor accept any advice from colleagues on how to deal properly with their soil (30: -2; 15: -2; 13: -3). However, their soil management decisions are driven by strong moral norms. They cultivate all plots in the same way, regardless how long they are entitled to farm rented plots, as they perceive that *"somewhere as a little code of honor"* (*comment participant 11*) (29: -3).

Distinct from the other viewpoints, their own education and experiences play only a secondary role (14: 0). Building upon passed-down, traditional knowledge, farmers prefer to attend continuously training and extension services, to improve their skills (5: +3; 2: +3). In contrast to that, voluntary programs and schemes are not perceived as a helpful tool for guidance regarding their soil management (27: -1).

5.1.3 Profit Maximisers (F3)

This viewpoint is shared by six significantly loading participants and it explains 14 % of the study's variance. It has an eigenvalue of 5.28.

All six loading participants are men. The loading participants' age ranges from 38 to 67 years and have been working in the farming business between 4 and 43 years. Farm sizes range from 19 to 320 ha, from which 44.03 % are rented land. The amount of rented land ranges from 3.5 up to 200 ha. One farmer (16,7 %) is a part-time-farmer, the remaining five (83.3 %) work as full-time farmers. Regarding the farming types, two farmers cultivate field crops exclusively (33.3 %), while the other four farmers (66.7 %) run mixed farming systems. No farmer runs an organic farm while two (33.3 %) sell their products via direct marketing. All loading participants completed a vocational education.

Profitability stands for the top priority, when the *Profit Maximisers* deal with their soil, since *"the soil is important for profitability […] [and] without profitability you are gone"* (*comment participant 33*) (22: +4). To ensure that, farmers are ready to invest as much time as needed, to deal properly with their soil (25: -4). The *Profit Maximisers* are ready to make the necessary investments and to try out novel approaches (4: -1; 20: 0), but solely if they are no too risky (12: +1).

Their own education and experiences are of high importance in their soil management decisions (14: +3). Therefore, they attend regularly training and extension services to learn more about soil tillage (2: +2). On the other hand, experiences of colleagues and traditional, passed-down knowledge are of minor importance (13: -1; 5: -1). They are not willed to coordinate with their neighbors but appear disposed to compromise (15: -4; 30: +1).

However, the determining variables in soil management are still the weather and the natural conditions of the plot (34: +4; 16: +3). Consequently, the *Profit Maximisers* think about nature in their soil management decisions and show a collaborative approach towards it (8: -2; 33: +2). However, they follow the goal to benefit from the natural resources but are still committed

to protect it (11: +1; 32: +3). At the same time, they do not feel obliged to take care of their employees and/or assisting persons (10: -3).

Distinct from other viewpoints, the *Profit Maximisers* appear thoughtful about the impact of voluntary programs and schemes as well as laws and governmental sanctions on their soil management, since *participant 14* told, *"they [the government] tell me what to grow […] everything is regulated, to 99 percent*" (7: 0; 23: 0). Consequently, voluntary schemes have no guiding impact on their soil management decisions (27: -1). Similarly, exogenous expectations from wider society or their customers do not influence farmers' soil management strategies, as *"they all have no idea – unfortunately" (comment participant 14*) (31: -2; 9: -2). Finally, the same accounts for the expected period which farmers farm rented plots (29: -2)

5.1.4 Self-reliant Environmentalists (F4)

This viewpoint is shared by three significantly loading participants and it explains 13 % of the study's variance. It has an eigenvalue of 4.29.

Two loading participants (66.7 %) are men, one is female (33.3 %). The loading participants' age ranges from 52 to 55 years and have been working in the farming business between 16 and 30 years. Farm sizes range from 6 to 21 ha, from which 23.81 % are rented land. The amount of rented land ranges from 0 up to 8 ha. All farmers operate as full-time farmers. Regarding the farming types, one farmer cultivates field crops exclusively (33.3 %), while the other two (66.7 %) run mixed farming systems. Two farmers run an organic farm (66.7 %) and all sell their products via direct marketing. Two of the loading participants completed a vocational education (66.7 %), one completed a university degree.

First at all, the *Self-reliant Environmentalists* want to enjoy their work, as told by participant 13: *"I want to enjoy how I work with it [the soil] and what then results from that,"* (19: +4). Unlike others, they pay close attention to their well-being and strive for independence (18: +1; 3: +2). Formal institutions such as laws and governmental sanctions are *"not relevant"* (comment participant 31) (23: -4). Same applies for voluntary schemes or programs and the status of rented land (7: -2; 29: -2). Farmers across this viewpoint appear self-centered: they trust exclusively in their own education and experiences (14: +2). Input from voluntary schemes as well as training and extension services are not attractive to them (27: -3; 2: -1). The duty to provide food for society as well as expectations from the general public are not relevant for them (6: -2; 31: -1). Moreover, they absolutely show no willingness to cooperate with neighbors in their soil management decisions but tempt to avoid negative impacts on their neighborhood (15: -4; 30: +1).

The *Self-reliant Environmentalists* show a strong connection to nature. Since the weather conditions play a crucial role in their soil management decisions, farmers try to work together with nature and see themselves as a part of its cycles (34: +4; 8: -4; 33: +4; 17: +3).

Nevertheless, they still try to steer nature for their own use, as "*you just try to control that [nature], in a natural way [...] so that I obtain appropriate yields"* (comment participant 4) but are aware of its vulnerability (11: +1; 32: +2). However, farmers appear to be indifferent to the possibility to avoid negative impacts through natural influences by their management decisions (24: 0).

Those farmers appear disposed to take some risks and are not afraid to do things, that would make them the subject of gossip and (12: -1; 21: -3). However, thy appear doubtful towards novel approaches and think twice before making expensive investments, as participant 4 told, "*they [the farmers] have to invest over and over again […] the investment is not even repaid and they [the farmers] have to do the next one [investment]. They [the farmers] are stuck in a treadmill"* (20: 0; 4: 0).

5.2 Consensus statements

The statistical analysis identified three consensus statements. Hence, the ranking of the statements 16, 18 and 29 do not significantly differ across all factors (at p > 0.01) Furthermore, there is also no significant difference across factors regarding the ranking of statements 18 and 29 at p > 0.05. When taking a closer look at the three identified consensus statements, results reveal, that all farmers among the four viewpoints "*take account of the natural conditions of the plot*." Except for the *Self-reliant Environmentalists*, all viewpoints appear indifferent regarding their health status when dealing with their soil. Important to this thesis, all viewpoints rejected statement number 29. This implies that farmers loading on these viewpoints perceive "*the number of years*" they still farm a plot do not determine their soil management decisions. Thus, this shows that in our P sample soil management decisions does not depend on tenancy structures.

Table 7. Consensus statements with the respective factor scores. All statements are non-significant at (*p* > 0.01; * *p* > 0.05.)

		F1[5] Innovative Stewards	F2 Neo-traditional Producers	F3 Profit Maximisers	F4 Self-reliant Environmentalists
No.	**Statement**				
16	When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	2	1	3	2
18*	When dealing with my soil I pay attention to my health*	0	0	0	1
29*	The number of years that I will still farm a plot determines how I deal with my soil*	-2	-3	-2	-2

5.3 HNR types among farmers

The ranking (Table 8) of the HNR statements shows that farmers representing the viewpoints hold multiple relationships with nature. In general, the four viewpoints strongly associate with the *Partner and the Steward* and less with types of *Participant* and *Master*. None of the four viewpoints shows an apathetic relationship towards nature. Thus, all viewpoints predominantly hold nature-focused HNRs. Figure 4 visualizes the extent on how strong farmers agreed/disagreed with the statements for the respective HNR types.

Table 8. Q-ort rankings of the HNR statements with the respective HNR typologies

No	Statement	HNR's	Factors			
			F1	F2	F3	F4
			Innovative Stewards	Neo-traditional Producers	Profit Maximisers	Self-reliant Environmentalists
8	When dealing with my soil I do not think about nature	Apathy	-4	-1	-2	-3
11	When dealing with my soil I steer nature for my own use	Master	1	-2	1	1
32	When dealing with my soil I have a responsibility for nature	Steward	3	0	3	2
33	When dealing with my soil I work together with nature	Partner	3	2	2	4
17	When dealing with my soil I feel as a part of nature and its cycles	Participant	4	-1	0	3

The statistical analysis reveals that the *Partner* is the dominating relationship towards nature among the four viewpoints. Thus, when dealing with their soil, farmers see themselves as working together with nature. More differentiated results can be observed when looking at the *Participant*, the other nature-focused type in the applied HNR scale. Here farmers' responses differ the most. While the *Innovative Stewards* and the *Self-reliant Environmentalists* strongly agree with this HNR type, the *Profit Maximisers* appear indifferent towards it (0), whereby the *Neo-traditional Producers* reject the *Participant* completely (-1).

The results show further that none of the four viewpoints rejected the concept of stewardship towards nature. Despite the *Neo-traditional Producers*, which neither agreed or disagreed (0) with the *Steward*, the other three factors strongly agree with it. Similarly, the *Innovative Stewards*, the *Profit Maximisers* and the *Self-reliant Environmentalists* agreed all to the same extent with the anthropocentric *Master* (+1). The *Neo-traditional Producers* instead rejected the *Master*, feeling unable to steer nature (-1). Finally, none of the four viewpoints appeared apathetic towards nature.

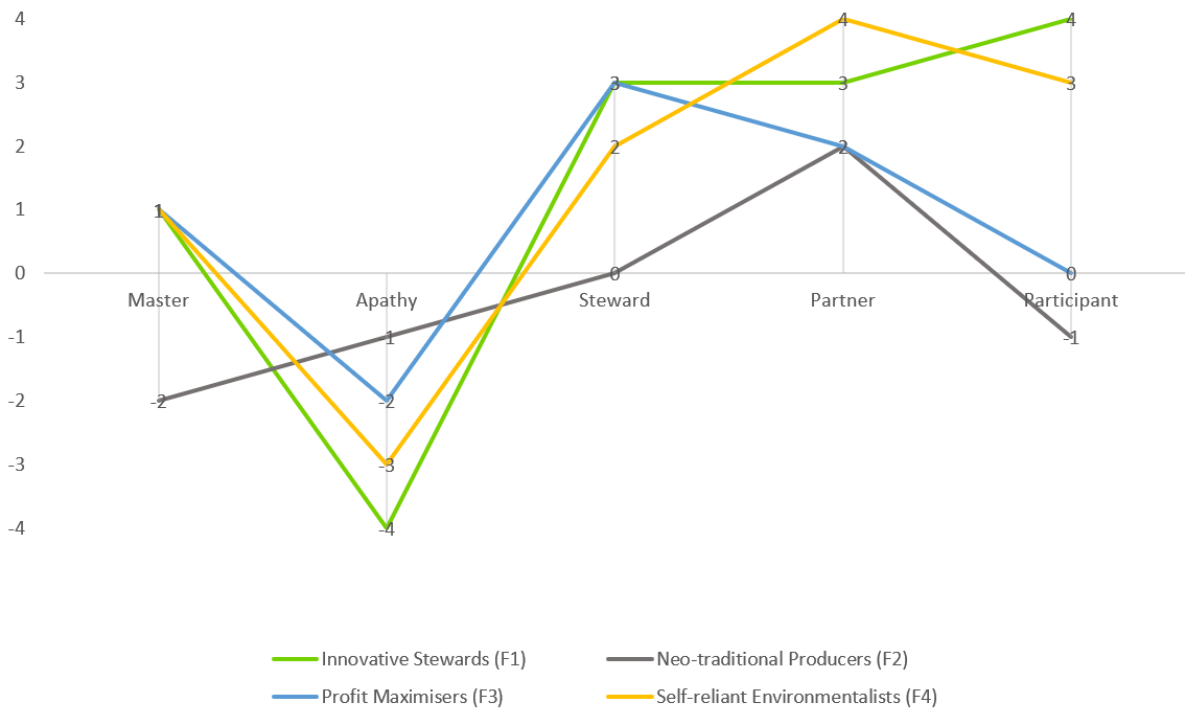

Figure 4. Viewpoints and the respective HNR rankings

6 Discussion

This thesis has investigated farmers' perception of their soil management to identify and describe the different viewpoints' characteristics. First, the four derived viewpoints are discussed, looking at the most striking and relevant similarities as well the differences among them. Special focus is put on differences in subjective perspectives on soil management and how the four viewpoints might respond to land-use policy measures. Second, the thesis discusses the role of future land cultivation (ownership vs. rental) on farmers' soil management decisions across the four viewpoints. Third, the role of HNR to better understand farmers' soil management is discussed.

6.1 The four typologies of farmers' soil management

At first glance, the results show rather high correlations between viewpoints. We see this however as the logic consequence, since in contrast to other studies (see Brodt et al., 2006; Walder and Kantelhardt, 2018) the main focus of this thesis was relatively narrow (soil management) and the P sample was more homogenous. All loading farmers among the four viewpoints have the same operational main focus (arable land) and all (except participant 31) participate in the voluntary environmental ÖPUL scheme. Furthermore, all farmers representing the viewpoints are located in East Austria. Consequently, they are to some degree more similar compared to participants in the other studies. Furthermore, the rather high correlations between the *Innovative Stewards*, the *Profit Maximisers* and the *Self-reliant Environmentalists* can be referred to the similarities in the rank-ordering of the Q statements related to the HNR and the biophysical environment (e.g., weather conditions, natural conditions of the plot).

The most evident similarity across all viewpoints is that farmers' soil management is strongly affected by the bio-physical environment of their farm and the weather conditions. This is not surprising, since farmers act in and with the natural environment (Tanentzap et al., 2015) and it is well known by scholars who found the bio-physical environment influential to farmers' soil management (Bielders et al., 2003; Prager and Posthumus, 2011). Furthermore, policy instruments (AES) seem to play a minor role in farmers' viewpoints towards their soil management practices. This finding is in line with previous studies (Gowdy, 2008; Howley et al., 2015).

However, the results show also considerable differences on what farmers perceive to affect them how they deal with their soil. In the following subsections, the four viewpoints on soil management are presented and discussed in more detail. Basically, the four viewpoints can be differentiated into two environmentally focused types (subsection 6.1.1), namely the *Innovative* S*tewards* and the more self-centered *Self-reliant Environmentalists*, as well as into

two production-/business- oriented types (subsection 6.1.2), which in this thesis are defined as the *Neo-traditional Produces* and the *Profit Maximisers*. In contrast to the more production-/business-oriented viewpoints, the *Innovative Stewards* and the *Self-reliant Environmentalists* emphasize a stronger connection towards nature and are less focused on the profitability of their, on average smaller farms. This distinction between more environmentally- and production-/business- oriented farmer types is not new (Brodt et al., 2006; Davies and Hodge, 2007; Sulemana and James, 2014; Walder and Kantelhardt, 2018). However, the results of this research could not derive a type with a pure productivistic viewpoint towards soil management. Indeed, all viewpoints hold attributes related to conservation, which are however, covered by different, viewpoint-specific statements. Incorporating concepts of HNR for deriving the typology was found to be very effective, particularly for interpreting the different viewpoints (subsection 6.3).

6.1.1 The environmentally focused viewpoints

The *Innovative Stewards* show the most pronounced nature-focused soil management, having the strongest sense of responsibility towards both, nature and future generations. That sense of responsibility was already found in previous typologies, identifying farmers who try to conserve their farmland for future generations (Ryan et al., 2003). Furthermore, the *Innovative Stewards* are open-minded and the most innovative farmers among all four viewpoints. Indeed, farmers across this viewpoint are the only ones who agreed that they can learn from AES, no matter whether they formally participate or not. This is of relevance, as it confirms that AES have the potential, even though only indirectly through knowledge transfer, to affect farmers' soil management practices. Similarly, Wilson and Hart (2001) found that farmers learn new environmentally friendly management skills through participation in AES. However, as the results across the other viewpoints show, this depends on the farmers' willingness to learn. Indeed, in accordance with the results discussed here, a forward-looking orientation was found to promote the uptake of new technologies. Thus, the *Innovative Stewards* may be potential early adopters of new, innovative technologies. This environmentally centered viewpoint resembles strongly the *Environmentalists,* described by Davies and Hodge (2007) and the *Diversity-Maintaining viewpoint,* identified by Walder and Kantelhardt (2018), but also holds similar characteristics of the *Environmental Stewards* (see Brodt et al., 2006). However, their emphasis on innovation distinguishes them from these viewpoints, which in other studies was often related to more business-minded (Brodt et al., 2006) or technology-focused viewpoints (Davies and Hodge, 2007).

The *Self-reliant Environmentalists* also show strong pro-environmental attributes but accompanied by their more self-centered focus. They rely strongly on their own experience and are the only viewpoint to reject training and extension services. This however may be related to their age, being the oldest farmers with the most experience, an effect already discussed in literature (Burton, 2014; Carlisle, 2016). In addition, the *Self-reliant Environmentalists* represent the only viewpoint emphasizing that they would deal differently with the soil if they had more time. This perceived lack of time seems to be related to labor rationales. The *Self-reliant Environmentalists* in our sample run small family-farm businesses. Furthermore, all farmers across the *Self-reliant Environmentalists* operate as direct-marketers (except one, which however plans to start with it). Consequently, to guarantee that their farm business runs properly, they not only have to cope with their tasks related to soil management but also how to sell their products, resulting in high labor demand. Similarly, Dwyer et al. (2007) found smaller farms, with less labor support having more time pressure. Social norms appear to have a minor impact on farmers' soil management decisions across this viewpoint. In contrast to the other viewpoints, the *Self-reliant Environmentalists* appear to be less concerned to match the concept of the 'good farmer' (Burton, 2004a), as they do not see themselves as providers of food for society. Due to their self-centered stance, their higher levels of experience (Atari et al., 2009; Siebert et al., 2006) and due to their perceived lack of time (Dwyer et al., 2007) farmers across this viewpoint seem to be highly resistant to adapt their soil management practices according to external influences. However, in our sample this viewpoint is represented by farmers that are close to retirement age and already hold a strong pro-environmental outlook on their soil management practices. Since now, this viewpoint seems not to be clearly described among literature, however, they resemble in some important characteristics the *Idealist* farming type, identified by (Schmitzberger et al., 2005)

6.1.2 The production/business-oriented viewpoints

In contrast to the two viewpoints discussed above, the *Neo-traditional Producers* appear to be least concerned about their natural environment, having the least ecocentric HNRs. This viewpoint appears in similar manifestations among literature described as *Production Maximisers* (O'Rourke et al., 2012) and *Yield optimizer* (Schmitzberger et al., 2005). Farmers with this viewpoint hold strong traditional and productivistic attributes. Additionally, they have attributes related to conservation, but to a lower extent than all other viewpoints. The socio-demographical attributes of this viewpoint help to better understand that mindset. They are the youngest and least experienced group of farmers but run the largest farms. Thus, they seem to be more concerned to reach their farming goals than societal goals. This might be striking for soil degradation, since farmers who were building up their farm business were found to show a stronger focus on agribusiness ideals and perceive conservation not as a main priority

(Burton and Wilson, 2006). Moreover, the results show that the *Neo-traditional Producers* share a strong willingness to acquire knowledge on soil management and rely on the passed-down knowledge of their predecessors as a starting point. According to Carlisle (2016), this can be explained by the importance of first-hand experience as a major source of knowledge. Interesting to mention, *Neo-Traditional Producers* soil management is strongly influenced by social norms. They strive to live up to what it means to be a 'good farmer', as they put a lot of value on their plots aesthetics and see themselves as providers of food for society. This confirms Burton (2004a) that farmers may set their focus largely on soil management practices that could be visibly assessed from others, outside the farm. It also confirms that farmers with lower sense of custodianship/stewardship hold the deeper belief, that the agricultural production should be maximized on productive agricultural land to fulfill their mission to feed the world (Mills et al., 2017), in order to claim the social position as caretakers of the peoples food supply (Burton, 2004a). Accordingly, the *Neo-Traditional Producers* might therefore be more attracted by practices they consider as aesthetically pleasing or relevant for 'agricultural productivism' (Burton, 2004a; Carlisle, 2016).

The *Profit Maximisers* have the strongest focus on the farms' profitability among all four factors. Although these farmers have similar conservation attributes than the two environmentally-focused viewpoints, these attributes are restrained by the farmers' strong focus on the farms' profitability. As literature shows, economic motivations and income gain are still a main motive for many farmers for participation in AES (Pavlis et al., 2016). Their strong focus on the economic performance of their farm business may explain, why farmers representing this viewpoint appear to be the only ones to be thoughtful on the impact of formal institutions (i.e. laws, AES) on their farm businesses. A similar viewpoint, the *Commodity Conservationists,* was identified among arable farmers in the UK (Davies and Hodge, 2007). Their averse viewpoint towards society might be related to public discussions, which lately often tend to draw a negative reputation of farmers by accusing them to apply unsustainable practices. This might affect farmers' attitude towards broader society (Mills et al., 2017). Despite a strong financial focus, they perceive conservation practices as important for their farms' wealth and therefore consider AES substantial for the conservation of land. Thus, they may be the easiest ones to reach through AES measures, satisfying both attributes of the *Profit Maximisers*: a strong focus on economic considerations and a sense of responsibility for nature.

6.2 The effect of land rental on farmers' soil management

When looking at research question 2, this thesis aims to investigate once more whether farmers make a difference in their soil management between owned and rented plots. So far, empirical studies show ambiguous results. The results of this thesis reveal that differing property status of arable land does not determine farmers' soil management decisions across the four identified viewpoints. All viewpoints rejected that the number of years that they will still farm a plot determines their soil management. Thus, being one of the consensus statements this is an indicator that farmers make no difference in their soil management decisions between their own and rented plots. However, due to the exploratory design of the Q set (only one among the 34 statements was about property status), the results from this Q study do not explicitly reveal why differing property status has no impact on farmers' soil management decisions.

However, a question on the effect of differing property status on farmers' soil management decisions was discussed in the post-sorting interviews, which were analyzed and discussed by Leonhardt et al. (2019). Besides the social (property) relationship between the farmer and the owner and the (perceived) tenure security, they identified farmers' general attitudes as a main reason for making no difference in soil management between owned and rented plots. This may connect with the results from the Q study which show, that farmers among all viewpoints share a nature-focused relationship towards nature and hold to some extent conservation attributes. Furthermore, all four viewpoints hold a feeling of stewardship towards future generations. The *Neo-Traditional Producers* however appear to be least concerned about their natural environment but hold strong moral norms since they perceive the careful cultivation of rented plots as a code of ethics. Hence, reasons to treat plots equally, independent from different tenancy structures, appear to be a matter of principle for farmers. Therefore, conserving soil and land can be considered an intrinsic motivation to Austrian farmers. This may be related to the self-identity theory. (van der Werff et al., 2013). Accordingly, pro-environmental self-identity relates to peoples' intrinsic motivation (moral obligation) to act environmentally friendly. Farmers' self-identity could make them resistant to potential property effects, as their strong pro-environmental self-identities are fostering pro-environmental behavior (van der Werff et al., 2013). Moreover, pro-environmental self-identity was found to influence both, pro-environmental intentions and behaviors (Carfora et al., 2017). Promoting farmers' pro-environmental self-identity could consequently promote pro-environmental behavior (Carfora et al., 2017), and in turn mitigate potential negative effects of tenure insecurity.

However, there was evidence that under some circumstances soil management practices differ between owned and rented plots. Again, the post-sorting interviews provide deeper insights

(see Leonhardt et al., 2019). Regarding the statement related to differing property status (statement 29)[6], (a) insecure rental and (b) the near or imminent end of a rental relationship were found to be two hypothetical reasons for differences in soil management practices between own and rented land. Regarding insecure rental conditions, *participant 7* commented the relative ranking of statement 29 (+4) as following: *"[…] if I don't know how long I am still enabled to farm the plots, what's the point of that if I put a lot of effort into it?* […] *and in the end, it can happen that I have worked hard and invested a lot [into the soil] and it was all for nothing."* Insecure rental conditions are an already well-known obstacle for investments in long-term soil conservation (Fraser, 2004; Karali et al., 2014; Myyrä et al., 2007). Second, the hypothetical scenario of a near or imminent end of the rental relationship with no prospect of renewal was brought up by *participant 14*. Despite his disagreement with *statement 29* (-2), he told that "[…] *in that case I would [due to economic considerations] cut down on fertilization, at least with phosphorus and potash*." The participants' strong focus on its farm profitability (*statement 22*[7]*:* +3) underpins his comment. This finding connects to Myyrä et al. (2007), who conclude that with increasing probability of non-renewal of the rental contract, farmers appear to decrease irreversible investments (e.g., fertilization) in land improvement with a long pay-back period. However, both farmers consider their rental agreements as secure and long-term and appear willed to invest in long-term measures for soil improvement.

These contradictory results between the Q study and the qualitative results of those farmers rely in the nature of these two methods. While qualitative interviews allow to explore a topic or specific response more in detail (Gill et al., 2008), the Q methodological approach bundles subjective meanings about a specific topic into shared viewpoints (Brown, 1980). Thus, the Q methodological interpretation communicates a shared viewpoint and do not deliver veridical depiction of a single participants' opinion (Watts and Stenner, 2005). Furthermore, Q methodology captures only the participants' perceptions in a specific moment in time. When our respondents accomplished their Q sets no farmer across the four viewpoints was near to the termination of a rental contract. Hence, exploring farmers' viewpoints towards their soil management practices with rental arrangements near to termination appears to be an interesting topic for future research.

[6] Statement 29: The number of years that I will still farm a plot determines how I deal with my soil.

[7] Statement 22: The profitability of my farm is top priority for me when dealing with my soil.

6.3 HNRs across Austrian arable farmers

Highlighting research question 3, the results of this study confirm once more that HNRs are not mutually exclusive (Braito et al., 2017b; Flint et al., 2013). Consequently, it is not possible to ascribe farmers to a specific concept of HNRs. All farmers representing the four viewpoints agreed with the nature-focused HNR-concept of the *Partner*. These results are in line with findings from dedicated literature (Yoshida et al., 2018). The strong agreement with the *Partner* statement shows that farmers understand themselves as working together with nature and tailor their soil management practices to the natural conditions of the plot. The results also support Yoshida et al. (2018), who found the *Steward* to be present across diverse farmers. Accordingly, farmers are conscious that they have to collaborate with and to look after nature, in order to keep their farms operative. This might be particularly the case for this Q studies P sample: nearly all respondents operate as full-time farmers and depend on their farm income. The most contrasting results were observed when looking at the ranking of the *Participant*. Solely the two environmentally-focused viewpoints agreed with it. Again, (Yoshida et al., 2018) found similar patterns of HNRs across farmers, with the *Steward* and *Partner* to be more present across farmers than the *Participant* type.

All farmers represented by the four viewpoints rejected the concept of *Apathy*. Farmers' rejection of the *Apathy-type* is not very surprising, as farmers act in and with nature (Tanentzap et al., 2015). However, it contradicts Yoshida et al. (2018), who found some farmers to hold an *apathetic* relationship towards nature.

The most interesting result of this thesis is the strong presence of the *Master* across the interviewed farmers. It seems that farmers' perception of their relationship with nature appears to be different from the general public. So far, most HNR studies were not able to verify this *mastery* HNR (Braito et al., 2017a) or identified a general rejection (de Groot et al., 2011). Possibly, because they did interview people from the general public and not farmers, who work with nature and cultivate it. Yoshida et al. (2018) instead found patterns of *mastery* across farmers, however to a much lower extent. Indeed, it seems plausible that farmers agree with the *Master*, as they shape the natural environment (Van Huylenbroeck et al., 2007) and behave for that in accordance with the *Master* concept. Farmers use land for cultivation. The term 'cultivate' is commonly defined as 'to prepare land and grow crops on it' (Cambridge English Dictionary, 2018). Exactly this explanation might be key to understand the role of the *Master* in farmers' HNR: all farmers steer nature to some extent for their own use to produce food for themselves and the society they life in. Otherwise we would might all still live as hunters and collectors. Furthermore, the simultaneous appearance of the *Master* and the *Participant* among most farmers stays in contrast to the common HNR positionality. Across current literature the *Master* is likely seen as a nature-opposed viewpoint, separated from nature, set

up in opposition to the nature-focused HNRs (Flint et al., 2013). However, the results of this study question this.

The *Neo-Traditional Producers* showed a more differentiated HNR pattern. They appear to be the least nature-focused viewpoint. All HNR-related statements were ranked lower by this viewpoint than by any other. According to Burton and Wilson (2006), this can be related to their strong focus on the productivity of their farms, who found farmers with a strong focus on agribusiness ideals to perceive conservation not as a main priority.

People hold multiple HNRs and translate them into behavioral patterns in and for the natural environment (Braito et al., 2017b). Thus, a deeper exploration of farmers' HNRs might be an interesting pathway to better understand farmers' soil management decisions, especially regarding the design of better-targeted policy measures.

7 Policy implications

It appears reasonable that all viewpoints hold attributes related to conservation, since the protection of the productive capacity of agricultural land is essential for any kind of farming (Davies and Hodge, 2007; Hamdy and Aly, 2014). Apart from the *Innovative Stewards*, the observed conservation attributes across the viewpoints are covered by different, viewpoint specific variables and may result in different manifestations. Also, Davies and Hodge (2007) identified in their Q study attributes related to conservation across all viewpoints. They suggest that different policy instruments might have different impacts, due to the variation among motivations and interests across the viewpoints. The different manifestations across the four viewpoints may dictate how farmers interpret and translate conservation attributes into practice. In general, farmers are more likely to adopt conservation practices, if they perceive that an innovation will foster the achievement of their personal goals (Pannell et al., 2006). Therefore, these differences in farmers' outlook might be relevant to the design of agri-environmental policies (Bartkowski and Bartke, 2018).

Furthermore, the results obtained verify that farmers represent a heterogeneous group of individuals (Darnhofer et al., 2005; DEFRA, 2008). However, current policy strategies are mostly based on economic incentives and have been criticized for that (Gowdy, 2008; Howley et al., 2015). Non-economic factors influencing farmers' soil management should not be rashly set aside (Bartkowski and Bartke, 2018). The following section aims to provide some additional pathways to current policy efforts to better address the diversity across farmers.

7.1 AES

Despite often criticized (Gowdy, 2008; Howley et al., 2015), the results of this study have shown, that interviewees see AES as influential for their soil management. First, directly through financial incentives (e.g*., Profit Maximisers*) and second, indirectly through knowledge transfer. In the current light of decreasing financial support for farmers through AES (BMLFUW, 2017), such measures might lose efficiency and miss the effect for what they were designed for. Moreover, as seen that solely the *Innovative Stewards* appeared open-minded to include input from AES into their soil management decisions, these results agree with recent literature for changes towards more targeted policy measures (Schmitzberger et al., 2005; Walder and Kantelhardt, 2018). However, while the aimed long-term effect of AES in shifting farmers' attitudes towards more "green thinking" is still questioned (Karali et al., 2014), there is evidence that AES already have the capacity to induce attitudinal changes across participating farmers (Mason and Holmes, 2015). Most interviewees told they recognized environmental and related farm-business benefits of the AES. They had to introduce environmentally friendly management practices and some of these were new to them. This suggests that participation

in AES may induced a shift towards more environmentally friendly thinking by introducing farmers into more environmentally-friendly farming practices

Taking into consideration the heterogeneity among farmers when redesigning those measures, might be a promising approach to develop more specifically targeted policy instruments to enable the aimed long-term effect of those measures.

7.2 Addressing farmers' ecocentric HNRs

Multiple nature-focused HNRs (Partner, Steward, Participant) appeared throughout all four viewpoints, agrees with the proposition of (Braito et al., 2017a) to address the multiple HNRs people hold. This might be a promising approach for governance strategies in enabling farmers to reflect more deeply on their soil management strategies.

7.3 Training services

Since most farmers are disposed to expand their knowledge (except the *Self-reliant Environmentalists*), training services and education courses can be used to better spread information and knowledge about new, innovative technologies across farmer. Given the high participation across Austrian farmers (79,6 % of the agricultural land is managed under the guidelines the ÖPUL scheme (BMLFUW, 2017), training services might be one of the most effective channels to address farmers. Moreover, little efforts would be required by policymakers when using training services for that purpose, since participation in training courses is already mandatory in Austria for participants of the voluntary ÖPUL-scheme (BMLFUW, 2016).

7.4 Social networks

Social networks across farmers were found to be an effective tool to spread knowledge and new technologies across farmers and further to support them when adopting innovations. (Coughenour, 2003). In addition, the presence of early adopters in farming regions was found to increase the access to knowledge and equipment for other farmers (Morton and McGuire, 2011; NW, 2012). Especially the *Innovative Stewards* and the *Self-reliant Environmentalists* (which are the most difficult viewpoint to approach via AES) appear to be accessible through social networks. Furthermore, the *Innovative Stewards* could occupy a key role in such networks, since they were identified as potential early adopter of new technologies.

7.5 Raising farmers' social reputation

As it is known, that social norms influence farmers' pro-environmental behavior (Fang et al., 2018; Mills et al., 2017), raising farmers' social reputation (e.g. by emphasizing their important contribution to soil conservation besides the production of food) to close the observed cleavage

between some farmers and broad society might help to make such society-averse farmers again addressable through social norms. Emphasizing and acknowledging their expertise, abilities and skills in working with nature might help to strengthen nature focused HNR (e.g., Steward, Participant) over Master and Apathy

Furthermore, farmers' were found to undertake pro-environmental management practices because they felt obligated to do so, as it contributes positively to their societal image (Mills et al., 2017). For that, this approach might also appeal to farmers who already hold pro-societal social norms.

8 Conclusion

As the world's soils undergo a continuous process of degradation, we aimed to enhance the understanding of how farmers themselves perceive their soil management practices. Since farmers' soil management is influenced by a complex set of variables, this thesis tried to create a comprehensive picture of what farmers themselves perceive as influential when they deal with their soil. More specifically, we examined: (a) how farmers themselves perceive factors influencing their soil management practices, (b) the role of the duration of future land cultivation (ownership vs. rental) across different viewpoints and (c) what role HNRs play in different viewpoints.

First, when examining how farmers perceive factors influencing their soil management practices, the study has proven that Q methodology is a reliable and valuable tool to capture a magnitude of perspectives and to derive different viewpoints. In fact, farmers show more complex traits than often assumed, making them a heterogeneous group of individuals. The results confirm the previously observed spectrum between mainly environmentally oriented and more production/business focused farmer types. Furthermore, the results show that all viewpoints hold attributes related to conservation, which might be an encouraging aspect to address when designing policy measures. However, these conservation attributes appeared in different manifestations and with varying goals. Q methodology only demonstrates the presence of this different viewpoints but does not deliver information about the relative spatial or qualitative distribution of these types among Austrian farmers. This would clearly be of high relevance from a policy perspective, since a farmer community dominated by *Innovative Stewards*, for example, will get attracted by other policy efforts than the *Neo-Traditional Producers*. Given that, exploring the wider distribution of different perspectives farmers hold across Austria may be an interesting pathway for future research.

Second, the obtained results show across the four viewpoints that farmers do not see their soil management practices to depend on tenancy structures. However, the Q study delivers no explanation for why they not do so. Qualitative interviews give more comprehensive insights: (a) the (perceived) tenure security (b) the social relationship between the farmer and the owner and (c), the general attitude of the farmer. However, there are indications that under insecure or soon ending rental agreements farmers might make differences in their soil management practices between rented and owned plots. A limitation of this study is that Q methodology captures only a snapshot of a specific moment in time and explores the viewpoints people hold about a specific topic at the moment when they accomplished their Q sets. Therefore, exploring farmers' viewpoints near the termination of a rental contract might be an interesting pathway for future research. In this context, farmers' subjective meaning about a specific statement could be different than when they completed the Q sorts presented in the data here.

Third, the results obtained from this research confirm previous findings, as all viewpoints hold multiple and predominantly nature-focused HNRs. Nearly all interviewed farmers also perceive themselves as Masters. Since this was a first attempt to capture the HNR patterns across Austrian farmers, a deeper exploration of farmers' HNRs and the role of *Mastery* within that context might help to better frame policies to tune in with farmers' motivations, attitudes and concepts of human-nature relationships.

Based on the knowledge of the socio-psychological heterogeneity across farmer groups and their perceptions of their social, socio-economic, institutional and bio-physical environment, policy instruments could be further refined, targeted or newly developed. Besides the need for further research about the heterogeneity across farmers, this diversity must be taken into consideration and integrated into the development of new policy measures. By doing so, a mix of more specifically tailored policy measures can be developed and help to support a long-term shift towards a "green thinking" mindset across Austrian farmers. Setting up such a long-term approach could be a worthwhile investment for the future.

9 References

Ahlheim, M., Frör, O., 2003. Valuing the non-market production of agriculture Bewertung nicht-marktlicher Agrarproduktion 14.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process., Theories of Cognitive Self-Regulation 50, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Aldrich, H.E., 1990. Using an Ecological Perspective to Study Organizational Founding Rates. Entrep. Theory Pract. 14, 7–24. https://doi.org/10.1177/104225879001400303

Arbuckle, J.G., 2012. Attitudes Toward Cover Crops in Iowa: Benefits and Barriers. Iowa Farm Rural Life Poll 12.

Arora, P., Bert, F., Podesta, G., Krantz, D.H., 2015. Ownership effect in the wild: Influence of land ownership on agribusiness goals and decisions in the Argentine Pampas. J. Behav. Exp. Econ. 58, 162–170. https://doi.org/10.1016/j.socec.2015.02.007

Atari, D.O.A., Yiridoe, E.K., Smale, S., Duinker, P.N., 2009. What motivates farmers to participate in the Nova Scotia environmental farm plan program? Evidence and environmental policy implications. J. Environ. Manage. 90, 1269–1279. https://doi.org/10.1016/j.jenvman.2008.07.006

Barbayiannis, N., Panagiotopoulos, K., Psaltopoulos, D., Skuras, D., 2009. Case Study Greece sustainable agriculture and soil conservation (SoCo Project). Publications Office, Luxembourg.

Barnes, A.P., Willock, J., Toma, L., Hall, C., 2011. Utilising a farmer typology to understand farmer behaviour towards water quality management: Nitrate Vulnerable Zones in Scotland. J. Environ. Plan. Manag. 54, 477–494. https://doi.org/10.1080/09640568.2010.515880

Bartkowski, B., Bartke, S., 2018. Leverage Points for Governing Agricultural Soils: A Review of Empirical Studies of European Farmers' Decision-Making. Sustainability 10, 3179. https://doi.org/10.3390/su10093179

Batáry, P., Dicks, L.V., Kleijn, D., Sutherland, W.J., 2015. The role of agri-environment schemes in conservation and environmental management: European Agri-Environment Schemes. Conserv. Biol. 29, 1006–1016. https://doi.org/10.1111/cobi.12536

Bauer, N., Wallner, A., Hunziker, M., 2009. The change of European landscapes: human-nature relationships, public attitudes towards rewilding, and the implications for landscape management in Switzerland. J. Environ. Manage. 90, 2910–2920. https://doi.org/10.1016/j.jenvman.2008.01.021

Beharrell, B., Crockett, A., 1992. New Age Food! New Age Consumers! With or without Technology Fix Please. Br. Food J. 94, 5–13. https://doi.org/10.1108/00070709210018979

BGLB, n.d. , Nr. 451/1969: 451.

Bielders, C.L., Ramelot, C., Persoons, E., 2003. Farmer perception of runoff and erosion and extent of flooding in the silt-loam belt of the Belgian Walloon Region. Environ. Sci. Policy, Socio-economic Factors in Soil Erosion and Conservation 6, 85–93. https://doi.org/10.1016/S1462-9011(02)00117-X

Blaikie, P., 2016. The Political Economy of Soil Erosion in Developing Countries. Routledge. https://doi.org/10.4324/9781315637556

Bloemmen, M., Bobulescu, R., Le, N.T., Vitari, C., 2015. Microeconomic degrowth: The case of Community Supported Agriculture. Ecol. Econ. 112, 110–115. https://doi.org/10.1016/j.ecolecon.2015.02.013

BMLFUW, Bundesministerium für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft, 2017. Grüner Bericht 2017 - Bericht über die Situation der österreichischen Land- und

Forstwirtschaft. Bundesministerium für Land- und Forstwirtscahft Umwelt und Wasserwirtschaft, Wien.

BMLFUW, Bundesministerium für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft, 2016. Agrarumweltprogramm ÖPUL 2015 – Landwirschaft, Umwelt und Natur.

Boardman, J., Poesen, J., Evans, R., 2003. Socio-economic factors in soil erosion and conservation. Environ. Sci. Policy 6, 1–6. https://doi.org/10.1016/S1462-9011(02)00120-X

Borges, J.A.R., Tauer, L.W., Lansink, A.G.J.M.O., 2016. Using the theory of planned behavior to identify key beliefs underlying Brazilian cattle farmers' intention to use improved natural grassland: A MIMIC modelling approach. Land Use Policy 55, 193–203. https://doi.org/10.1016/j.landusepol.2016.04.004

Braito, M., Böck, K., Flint, C., Muhar, A., Muhar, S., Penker, M., 2017a. Human-Nature Relationships and Linkages to Environmental Behaviour. Environ. Values 26, 365–389.

Braito, M., Flint, C., Muhar, A., Penker, M., Vogel, S., 2017b. Individual and collective socio-psychological patterns of photovoltaic investment under diverging policy regimes of Austria and Italy. Energy Policy 109, 141–153. https://doi.org/10.1016/j.enpol.2017.06.063

Brandth, B., Haugen, M.S., 2011. Farm diversification into tourism – Implications for social identity? J. Rural Stud. 27, 35–44. https://doi.org/10.1016/j.jrurstud.2010.09.002

Brodt, S., Klonsky, K., Tourte, L., 2006. Farmer goals and management styles: Implications for advancing biologically based agriculture. Agric. Syst. 89, 90–105. https://doi.org/10.1016/j.agsy.2005.08.005

Brown, S.R., 1993. A primer on Q methodology. Operant Subj. 16, 91–138.

Brown, S.R., 1980. Political Subjectivity: Applications of Q Methodology in Political Science.

Burke, P.J., 2007. Identity control theory, in: In Ritzer, G. Blackwell Encyclopedia of Sociology, Blackweil Publishing.

Burton, R.J.F., 2014. The influence of farmer demographic characteristics on environmental behaviour: A review. J. Environ. Manage. 135, 19–26. https://doi.org/10.1016/j.jenvman.2013.12.005

Burton, R.J.F., 2004a. Seeing Through the 'Good Farmer's' Eyes: Towards Developing an Understanding of the Social Symbolic Value of 'Productivist' Behaviour. Sociol. Rural. 44, 195–215. https://doi.org/10.1111/j.1467-9523.2004.00270.x

Burton, R.J.F., 2004b. Reconceptualising the 'behavioural approach' in agricultural studies: a socio-psychological perspective. J. Rural Stud. 20, 359–371. https://doi.org/10.1016/j.jrurstud.2003.12.001

Burton, R.J.F., Wilson, G.A., 2006. Injecting social psychology theory into conceptualisations of agricultural agency: Towards a post-productivist farmer self-identity? J. Rural Stud. 22, 95–115. https://doi.org/10.1016/j.jrurstud.2005.07.004

Cambridge English Dictionary, 2018.

Carfora, V., Caso, D., Sparks, P., Conner, M., 2017. Moderating effects of pro-environmental self-identity on pro-environmental intentions and behaviour: A multi-behaviour study. J. Environ. Psychol. 53, 92–99. https://doi.org/10.1016/j.jenvp.2017.07.001

Carlisle, L., 2016. Factors influencing farmer adoption of soil health practices in the United States: a narrative review. Agroecol. Sustain. Food Syst. 40, 583–613. https://doi.org/10.1080/21683565.2016.1156596

Celio, E., Flint, C.G., Schoch, P., Grêt-Regamey, A., 2014. Farmers' perception of their decision-making in relation to policy schemes: A comparison of case studies from Switzerland and the United States. Land Use Policy 41, 163–171. https://doi.org/10.1016/j.landusepol.2014.04.005

Ciaian, P., Kancs, D., Swinnen, J.F.M., 2010. EU land markets and the common agricultural policy. Centre for European Policy Studies, Brussels.

Cook, A.J., Kerr, G.N., Moore, K., 2002. Attitudes and intentions towards purchasing GM food. J. Econ. Psychol. 23, 557–572. https://doi.org/10.1016/S0167-4870(02)00117-4

Coughenour, C.M., 2003. Innovating Conservation Agriculture: The Case of No-Till Cropping. Rural Sociol. 68, 278–304. https://doi.org/10.1111/j.1549-0831.2003.tb00138.x

Cranfield, J., Henson, S., Holliday, J., 2010. The motives, benefits, and problems of conversion to organic production. Agric. Hum. Values 27, 291–306. https://doi.org/10.1007/s10460-009-9222-9

Crompton, T., Kasser, T., 2009. Meeting environmental challenges: The role of human identity. WWF-UK, Godalming, UK.

d'Adda, G., 2011. Motivation crowding in environmental protection: Evidence from an artefactual field experiment. Ecol. Econ., Special Section - Earth System Governance: Accountability and Legitimacy 70, 2083–2097. https://doi.org/10.1016/j.ecolecon.2011.06.006

Daloğlu, I., Nassauer, J.I., Riolo, R.L., Scavia, D., 2014. Development of a farmer typology of agricultural conservation behavior in the American Corn Belt. Agric. Syst. 129, 93–102. https://doi.org/10.1016/j.agsy.2014.05.007

Darnhofer, I., Schneeberger, W., Freyer, B., 2005. Converting or not converting to organic farming in Austria:Farmer types and their rationale. Agric. Hum. Values 22, 39–52. https://doi.org/10.1007/s10460-004-7229-9

Davies, B.B., Hodge, I.D., 2007. Exploring environmental perspectives in lowland agriculture: A Q methodology study in East Anglia, UK. Ecol. Econ. 61, 323–333. https://doi.org/10.1016/j.ecolecon.2006.03.002

de Groot, J.I.M., Steg, L., 2008. Value Orientations to Explain Beliefs Related to Environmental Significant Behavior: How to Measure Egoistic, Altruistic, and Biospheric Value Orientations. Environ. Behav. 40, 330–354. https://doi.org/10.1177/0013916506297831

de Groot, M., de Groot, W.T., 2009. "Room for river" measures and public visions in the Netherlands: A survey on river perceptions among riverside residents: RIVER PERCEPTIONS AMONG RIVERSIDE RESIDENTS. Water Resour. Res. 45. https://doi.org/10.1029/2008WR007339

de Groot, M., Drenthen, M., de Groot, W.T., Center for Environmental Philosophy, The University of North Texas, 2011. Public Visions of the Human/Nature Relationship and their Implications for Environmental Ethics: Environ. Ethics 33, 25–44. https://doi.org/10.5840/enviroethics20113314

De Groot, W.T., 1992. Environmental science theory: concepts and methods in a one-world, problem-oriented paradigm.

DEFRA, 2008. Understanding Behaviours in a Farming Context: Bringing Theoretical and Applied Evidence Together From Across Defra And HIghlighting Policy Relevance and Implications for Future Research.

Defrancesco, E., Gatto, P., Runge, F., Trestini, S., 2007. Factors Affecting Farmers? Participation in Agri-environmental Measures: A Northern Italian Perspective. J. Agric. Econ. 0, 071003055534001-??? https://doi.org/10.1111/j.1477-9552.2007.00134.x

DeFries, R.S., Foley, J.A., Asner, G.P., 2004. Land-use choices: balancing human needs and ecosystem function. Front. Ecol. Environ. 2, 249–257. https://doi.org/10.1890/1540-9295(2004)002[0249:LCBHNA]2.0.CO;2

Dumanski, J., Peiretti, R., 2013. Modern concepts of soil conservation. Int. Soil Water Conserv. Res. 1, 19–23. https://doi.org/10.1016/S2095-6339(15)30046-0

Dwyer, J., Mills, J., Ingram, J., Taylor, J., Burton, R., Blackstock, K., Slee, B., 2007. Understanding and influencing positive behaviour change in farmers and land managers - a project for Defra. CCRI, Macauly Institute, Gloucester.

Emtage, N., Herbohn, J., Harrison, S., 2007. Landholder Profiling and Typologies for Natural Resource–Management Policy and Program Support: Potential and Constraints. Environ. Manage. 40, 481–492. https://doi.org/10.1007/s00267-005-0359-z

Emtage, N., Herbohn, J., Harrison, S., 2006. Landholder Typologies Used in the Development of Natural Resource Management Programs in Australia—A Review. Australas. J. Environ. Manag. 13, 79–94. https://doi.org/10.1080/14486563.2006.10648675

Enters, T., 1999. Incentives as policy instruments: key concepts and definitions, in: Incentives in Soil Conservation: From Theory to Practice. Enfield, NH : Science Publishers, pp. 25–40.

Falconer, K., 2000. Farm-level constraints on agri-environmental scheme participation: a transactional perspective. J. Rural Stud. 16, 379–394. https://doi.org/10.1016/S0743-0167(99)00066-2

Fang, W.-T., Ng, E., Zhan, Y.-S., 2018. Determinants of Pro-Environmental Behavior among Young and Older Farmers in Taiwan. Sustainability 10, 2186. https://doi.org/10.3390/su10072186

FAO, 1995. Planning for sustainable use of land resources 68.

Farmer Behaviour, Agricultural Management and Climate Change | READ online [WWW Document], n.d. . OECD ILibrary. URL https://read.oecd-ilibrary.org/agriculture-and-food/farmer-behaviour-agricultural-management-and-climate-change_9789264167650-en (accessed 8.1.18).

Feola, G., Binder, C.R., 2010. Towards an improved understanding of farmers' behaviour: The integrative agent-centred (IAC) framework. Ecol. Econ. 69, 2323–2333. https://doi.org/10.1016/j.ecolecon.2010.07.023

Flint, C.G., Kunze, I., Muhar, A., Yoshida, Y., Penker, M., 2013. Exploring empirical typologies of human–nature relationships and linkages to the ecosystem services concept. Landsc. Urban Plan. 120, 208–217. https://doi.org/10.1016/j.landurbplan.2013.09.002

Foley, J.A., 2011. Can We Feed the World & Sustain the Planet? Sci. Am. 305, 60–65. https://doi.org/10.1038/scientificamerican1111-60

Fraser, E., 2004. Land tenure and agricultural management: Soil conservation on rented and owned fields in southwest British Columbia. Agric. Hum. Values 21, 73–79. https://doi.org/10.1023/B:AHUM.0000014020.96820.a1

Frey, B.S., Jegen, R., n.d. MOTIVATION CROWDING THEORY: A SURVEY OF EMPIRICAL EVIDENCE 29.

Gessese, B.H., 2018. Impact of Land Use/Land Cover Change on Rural Communities Livelihood of Ethiopia 6, 8.

Giddens, A., 1984. The Constitution of Society. Polity Press, Cambridge.

Gill, P., Stewart, K., Treasure, E., Chadwick, B., 2008. Methods of data collection in qualitative research: interviews and focus groups. Br. Dent. J. 204, 291–295. https://doi.org/10.1038/bdj.2008.192

Gneezy, U., Meier, S., Rey-Biel, P., 2011. When and Why Incentives (Don't) Work to Modify Behavior. J. Econ. Perspect. 25, 191–210. https://doi.org/10.1257/jep.25.4.191

Gorton, M., Douarin, E., Davidova, S., Latruffe, L., 2008. Attitudes to agricultural policy and farming futures in the context of the 2003 CAP reform: A comparison of farmers in selected established and new Member States. J. Rural Stud. 24, 322–336. https://doi.org/10.1016/j.jrurstud.2007.10.001

Gosling, E., Williams, K.J.H., 2010. Connectedness to nature, place attachment and conservation behaviour: Testing connectedness theory among farmers. J. Environ. Psychol. 30, 298–304. https://doi.org/10.1016/j.jenvp.2010.01.005

Gowdy, J.M., 2008. Behavioral economics and climate change policy. J. Econ. Behav. Organ. 68, 632–644. https://doi.org/10.1016/j.jebo.2008.06.011

Greiner, R., Gregg, D., 2011. Farmers' intrinsic motivations, barriers to the adoption of conservation practices and effectiveness of policy instruments: Empirical evidence from northern Australia. Land Use Policy 28, 257–265. https://doi.org/10.1016/j.landusepol.2010.06.006

Guillem, E.E., Barnes, A., 2013. Farmer perceptions of bird conservation and farming management at a catchment level. Land Use Policy 31, 565–575. https://doi.org/10.1016/j.landusepol.2012.09.002

Hamdy, A., Aly, A., 2014. Land degradation, agricultural productivity and food security. Presented at the Fifth International Scientific Agricultural Symposium „Agrosym 2014", p. 11.

Hammond, J., van Wijk, M.T., Smajgl, A., Ward, J., Pagella, T., Xu, J., Su, Y., Yi, Z., Harrison, R.D., 2017. Farm types and farmer motivations to adapt: Implications for design of sustainable agricultural interventions in the rubber plantations of South West China. Agric. Syst. 154, 1–12. https://doi.org/10.1016/j.agsy.2017.02.009

Hodge, I., 2001. Beyond agri-environmental policy: towards an alternative model of rural environmental governance. Land Use Policy 18, 99–111. https://doi.org/10.1016/S0264-8377(01)00002-3

Holzer, G., Jilch, M., Wilfinger, H., 2013. Pachten und Verpachten in Österreich, 4., überarb. Aufl. ed. NWV - Neuer wissenschaftlicher Verlag, Wien; Graz.

Howley, P., Buckley, C., O Donoghue, C., Ryan, M., 2015. Explaining the economic 'irrationality' of farmers' land use behaviour: The role of productivist attitudes and non-pecuniary benefits. Ecol. Econ. 109, 186–193. https://doi.org/10.1016/j.ecolecon.2014.11.015

Jangid, K., Williams, M.A., Franzluebbers, A.J., Sanderlin, J.S., Reeves, J.H., Jenkins, M.B., Endale, D.M., Coleman, D.C., Whitman, W.B., 2008. Relative impacts of land-use, management intensity and fertilization upon soil microbial community structure in agricultural systems. Soil Biol. Biochem. 40, 2843–2853. https://doi.org/10.1016/j.soilbio.2008.07.030

Johansson, M., Rahm, J., Gyllin, M., 2013. Landowners' Participation in Biodiversity Conservation Examined through the Value-Belief-Norm Theory. Landsc. Res. 38, 295–311. https://doi.org/10.1080/01426397.2012.673576

Johnson, D.G., 1950. Resource Allocation under Share Contracts. J. Polit. Econ. 58, 111–123. https://doi.org/10.1086/256919

Juritsch, G., 2014. Öffentliche Verwaltung und Bodenschutz - Die Richtlinien des Fachbeirates als eine (wertvolle) Hilfestellung.

Kabii, T., Horwitz, P., 2006. A review of landholder motivations and determinants for participation in conservation covenanting programmes. Environ. Conserv. 33, 11. https://doi.org/10.1017/S0376892906002761

Karali, E., Brunner, B., Doherty, R., Hersperger, A., Rounsevell, M., 2014. Identifying the Factors That Influence Farmer Participation in Environmental Management Practices in Switzerland. Hum. Ecol. 42, 951–963. https://doi.org/10.1007/s10745-014-9701-5

Kellert, S.R., 1993. The biophilia hypothesis, A Shearwater book. Island Press.

Kelley, H., Rensburg, T.M. van, Yadav, L., 2013. A micro-simulation evaluation of the effectiveness of an Irish grass roots agri-environmental scheme. Land Use Policy 31, 182–195. https://doi.org/10.1016/j.landusepol.2012.06.017

Knowler, D., Bradshaw, B., 2007. Farmers' adoption of conservation agriculture: A review and synthesis of recent research. Food Policy 32, 25–48. https://doi.org/10.1016/j.foodpol.2006.01.003

Kollmuss, A., Agyeman, J., 2002. Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to Pro-Environmental Behavior? Env. Educ Res 239–260.

Kotchen, M.J., Young, O.R., 2007. Meeting the challenges of the anthropocene: Towards a science of. Glob. Environ. Change 5, 149–151.

Kutter, T., Louwagie, G., Schuler, J., Zander, P., Helming, K., Hecker, J.-M., 2011. Policy measures for agricultural soil conservation in the European Union and its member states: Policy review and classification. Land Degrad. Dev. 22, 18–31. https://doi.org/10.1002/ldr.1015

Lahmar, R., 2010. Adoption of conservation agriculture in Europe: Lessons of the KASSA project. Land Use Policy, Soil and Water Conservation Measures in Europe 27, 4–10. https://doi.org/10.1016/j.landusepol.2008.02.001

Lalani, B., Dorward, P., Holloway, G., Wauters, E., 2016. Smallholder farmers' motivations for using Conservation Agriculture and the roles of yield, labour and soil fertility in decision making. Agric. Syst. 146, 80–90. https://doi.org/10.1016/j.agsy.2016.04.002

Landwirtschaftskammer Oberösterreich, 2016. Pachtvertrag über landwirtschaftliche Flächen oder Betriebe - Erstellung, Beendigung, gegenseitige Rechte und Pflichten.

Laschewski, L., Penker, M., 2009. Editorial[: Rural Change and the Revalorisation of Rural Property Objects]. Int. J. Agric. Resour. Gov. Ecol. 8, 1. https://doi.org/10.1504/IJARGE.2009.024172

Lee, L.K., Stewart, W.H., 1983. Landownership and the Adoption of Minimum Tillage. Am. J. Agric. Econ. 65, 256. https://doi.org/10.2307/1240871

Leonhardt, H., Penker, M., Salhofer, K., 2019. Do farmers care about rented land? A multi-method study on land tenure and soil conservation. Land Use Policy 82, 228–239. https://doi.org/10.1016/j.landusepol.2018.12.006

Liu, S.-C., Lin, H.-S., 2015. Exploring undergraduate students mental models of the environment: Are they related to environmental affect and behavior? J. Environ. Educ. 46, 23–40. https://doi.org/10.1080/00958964.2014.953021

Mason, D.C., Holmes, G., 2015. Are agri environmental schemes "greening" the environmental attitudes of participating farmers?, Sustainability Research Institute Briefing Note Series No. 4. University of Leeds, Leeds.

Mattison, E., Norris, K., 2005. Bridging the gaps between agricultural policy, land-use and biodiversity. Trends Ecol. Evol. 20, 610–616. https://doi.org/10.1016/j.tree.2005.08.011

Mayring, P., 2014. Qualitative Content Analysis. Klagenfurt.

Mbuthia, L.W., Acosta-Martínez, V., DeBruyn, J., Schaeffer, S., Tyler, D., Odoi, E., Mpheshea, M., Walker, F., Eash, N., 2015. Long term tillage, cover crop, and fertilization effects on microbial community structure, activity: Implications for soil quality. Soil Biol. Biochem. 89, 24–34. https://doi.org/10.1016/j.soilbio.2015.06.016

McElwee, G., 2004. A segmentation framework for the farm sector. Presented at the The 3rd Rural Entrepreneurship Conference, University of Paisley, Scotland, October 2004, Nottingham Trent University, Paisley.

McGuire, J.M., Morton, L.W., Arbuckle, J.G., Cast, A.D., 2015. Farmer identities and responses to the social–biophysical environment. J. Rural Stud. 39, 145–155. https://doi.org/10.1016/j.jrurstud.2015.03.011

Michel-Guillou, E., Moser, G., 2006. Commitment of farmers to environmental protection: From social pressure to environmental conscience. J. Environ. Psychol. 26, 227–235. https://doi.org/10.1016/j.jenvp.2006.07.004

Mills, J., Gaskell, P., Ingram, J., Dwyer, J., Reed, M., Short, C., 2017. Engaging farmers in environmental management through a better understanding of behaviour. Agric. Hum. Values 34, 283–299. https://doi.org/10.1007/s10460-016-9705-4

Morton, L.W., McGuire, J., 2011. Getting to Performance-Based Outcomes at the Watershed Level, in: Wright Morton, L., Brown, S.S. (Eds.), Pathways for Getting to Better Water Quality: The Citizen Effect. Springer New York, New York, NY, pp. 181–196. https://doi.org/10.1007/978-1-4419-7282-8_15

Mosler, H.-J., 2005. Modelling environmental behaviour, in: Alternatives for Environmental Evaluation. Routledge, London, pp. 69–95.

Myyrä, S., Pietola, K., Yli-Halla, M., 2007. Exploring long-term land improvements under land tenure insecurity. Agric. Syst. 92, 63–75. https://doi.org/10.1016/j.agsy.2006.02.009

Nigbur, D., Lyons, E., Uzzell, D., 2010. Attitudes, norms, identity and environmental behaviour: using an expanded theory of planned behaviour to predict participation in a kerbside recycling programme. Br. J. Soc. Psychol. 49, 259.

North, D.C., 1990. Institutions institutional change and economic performance. Camebridge University Press, Camebridge, MA, USA.

NWF (National Wildlife Federation), 2012. Roadmap to increased cover crop adoption. NWF (National Wildlife Federation), Washington, DC.

OECD, 2014. Green Growth Indicators for Agriculture, OECD Green Growth Studies. OECD Publishing. https://doi.org/10.1787/9789264223202-en

Onwezen, M.C., Antonides, G., Bartels, J., 2013. The Norm Activation Model: An exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. J. Econ. Psychol. 39, 141–153. https://doi.org/10.1016/j.joep.2013.07.005

O'Rourke, E., Kramm, N., Chisholm, N., 2012. The influence of farming styles on the management of the Iveragh uplands, southwest Ireland. Land Use Policy 29, 805–816. https://doi.org/10.1016/j.landusepol.2011.12.008

Panagos, P., Standardi, G., Borrelli, P., Lugato, E., Montanarella, L., Bosello, F., 2017. Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models. Land Degrad. Dev. 29, 471–484. https://doi.org/10.1002/ldr.2879

Pannell, D.J., Marshall, G.R., Barr, N., Curtis, A., Vanclay, F., Wilkinson, R., 2006. Understanding and promoting adoption of conservation practices by rural landholders. Aust. J. Exp. Agric. 46, 1407–1424. https://doi.org/10.1071/EA05037

Pavlis, E.S., Terkenli, T.S., Kristensen, S.B.P., Busck, A.G., Cosor, G.L., 2016. Patterns of agri-environmental scheme participation in Europe: Indicative trends from selected case studies. Land Use Policy 57, 800–812. https://doi.org/10.1016/j.landusepol.2015.09.024

Pedersen, A.B., Nielsen, H.Ø., Christensen, T., Hasler, B., 2012. Optimising the effect of policy instruments: a study of farmers' decision rationales and how they match the incentives in Danish pesticide policy. J. Environ. Plan. Manag. 55, 1094–1110. https://doi.org/10.1080/09640568.2011.636568

Pe'er, G., Dicks, L.V., Visconti, P., Arlettaz, R., Baldi, A., Benton, T.G., Collins, S., Dieterich, M., Gregory, R.D., Hartig, F., Henle, K., Hobson, P.R., Kleijn, D., Neumann, R.K., Robijns, T., Schmidt, J., Shwartz, A., Sutherland, W.J., Turbe, A., Wulf, F., Scott, A.V., 2014. EU agricultural reform fails on biodiversity. Science 344, 1090–1092. https://doi.org/10.1126/science.1253425

Pimentel, D., 2006. Soil Erosion: A Food and Environmental Threat. Environ. Dev. Sustain. 8, 119–137. https://doi.org/10.1007/s10668-005-1262-8

Pimentel, D., Harvey, C., Resosudarmo, P., Sinclair, K., Kurz, D., McNair, M., Crist, S., Shpritz, L., Fitton, L., Saffouri, R., Blair, R., 1995. Environmental and Economic Costs of Soil Erosion and Conservation Benefits. Science 267, 1117–1123.

Posthumus, H., Morris, J., 2010. Implications of CAP reform for land management and runoff control in England and Wales. Land Use Policy 27, 42–50. https://doi.org/10.1016/j.landusepol.2008.06.002

Prager, K., Posthumus, H., 2011. Socio-economic factors influencing farmers' adoption of soil conservation practices in Europe.

Prazan, J., Dumbrovsky, M., 2009. Case Study Czech Republic sustainable agriculture and soil conservation (SoCo Project). Publications Office, Luxembourg.

Prokopy, L.S., Floress, K., Klotthor-Weinkauf, D., Baumgart-Getz, A., 2008. Determinants of agricultural best management practice adoption: Evidence from the literature. J. Soil Water Conserv. 63, 300–311. https://doi.org/10.2489/jswc.63.5.300

Rajendran, N., Tey, Y.S., Brindal, M., Sidique, S.F.A., Shamsudin, M.N., 2016. Factors influencing the adoption of bundled sustainable agricultural practices: A systematic literature review - ProQuest. Int. Food Res. J. 23, 2271–2279.

Reimer, A., Thompson, A., Prokopy, L.S., Arbuckle, J.G., Genskow, K., Jackson-Smith, D., Lynne, G., McCann, L., Morton, L.W., Nowak, P., 2014. People, place, behavior, and context: A research agenda for expanding our understanding of what motivates farmers' conservation behaviors. J. Soil Water Conserv. 69, 57A-61A. https://doi.org/10.2489/jswc.69.2.57A

Robinson, D.A., 1999. Agricultural practice, climate change and the soil erosion hazard in parts of southeast England. Appl. Geogr. 19, 13–27. https://doi.org/10.1016/S0143-6228(98)00032-0

Rode, J., Gómez-Baggethun, E., Krause, T., 2015. Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. Ecol. Econ. 117, 270–282. https://doi.org/10.1016/j.ecolecon.2014.11.019

Ryan, R.L., Erickson, D.L., De Young, R., 2003. Farmers' Motivations for Adopting Conservation Practices along Riparian Zones in a Mid-western Agricultural Watershed. J. Environ. Plan. Manag. 46, 19–37. https://doi.org/10.1080/713676702

Sattler, C., Nagel, U.J., 2010. Factors affecting farmers' acceptance of conservation measures—A case study from north-eastern Germany. Land Use Policy, Soil and Water Conservation Measures in Europe 27, 70–77. https://doi.org/10.1016/j.landusepol.2008.02.002

Schmitzberger, I., Wrbka, T., Steurer, B., Aschenbrenner, G., Peterseil, J., Zechmeister, H.G., 2005. How farming styles influence biodiversity maintenance in Austrian agricultural landscapes. Agric. Ecosyst. Environ. 108, 274–290. https://doi.org/10.1016/j.agee.2005.02.009

Schmolck, P., 2002. PQMethod Manual [WWW Document]. URL http://schmolck.org/qmethod/pqmanual.htm (accessed 9.25.18).

Schneider, F., Ledermann, T., Fry, P., Rist, S., 2010. Soil conservation in Swiss agriculture—Approaching abstract and symbolic meanings in farmers' life-worlds. Land Use Policy 27, 332–339. https://doi.org/10.1016/j.landusepol.2009.04.007

Schultz, P.W., Gouveia, V.V., Cameron, L.D., Tankha, G., Schmuck, P., Franěk, M., 2005. Values and their Relationship to Environmental Concern and Conservation Behavior. J. Cross-Cult. Psychol. 36, 457–475. https://doi.org/10.1177/0022022105275962

SCHWARTZ, S., 1992. UNIVERSALS IN THE CONTENT AND STRUCTURE OF VALUES - THEORETICAL ADVANCES AND EMPIRICAL TESTS IN 20 COUNTRIES. Adv. Exp. Soc. Psychol. 25, 1–65.

Schwartz, S., 1977. NORMATIVE INFLUENCES ON ALTRUISM. pp. 221–279.

Schwartz, S.H., Cieciuch, J., Vecchione, M., Davidov, E., 2012. Refining the theory of basic individual values. J. Pers. Soc. Psychol. 103, 663–688. https://doi.org/10.1037/a0029393

Siebert, R., Toogood, M., Knierim, A., 2006. Factors Affecting European Farmers' Participation in Biodiversity Policies. Sociol. Rural. 46, 318. https://doi.org/10.1111/j.1467-9523.2006.00420.x

Sklenicka, P., Molnarova, K.J., Salek, M., Simova, P., Vlasak, J., Sekac, P., Janovska, V., 2015. Owner or tenant: Who adopts better soil conservation practices? Land Use Policy 47, 253–261. https://doi.org/10.1016/j.landusepol.2015.04.017

Soule, M.J., Tegene, A., Wiebe, K.D., 2000. Land tenure and the adoption of conservation practices. Am. J. Agric. Econ. 82, 993–1005.

Sparks, P., Shepherd, R., 1992. Self-Identity and the Theory of Planned Behavior: Assesing the Role of Identification with "Green Consumerism." Soc. Psychol. Q. 55, 388–399. https://doi.org/10.2307/2786955

Stainton Rogers, R., 1995. Q methodology, in: Rethinking Methods in Psychology. SAGE.

Statistik Austria, 2018. Agrarstrukturerhebung 2016 (No. Schnellbericht 1.17). Statistik Austria, Wien.

Steg, L., Bolderdijk, J.W., Keizer, K., Perlaviciute, G., 2014. An Integrated Framework for Encouraging Pro-environmental Behaviour: The role of values, situational factors and goals. J. Environ. Psychol. 38, 104–115. https://doi.org/10.1016/j.jenvp.2014.01.002

Stephenson, W., 1936. THE INVERTED FACTOR TECHNIQUE. Br. J. Psychol. Gen. Sect. 26, 344–361. https://doi.org/10.1111/j.2044-8295.1936.tb00803.x

Stephenson, W., 1935. The study of behavior; Q-technique and its methodology, The study of behavior; Q-technique and its methodology. University of Chicago Press, Chicago, IL, US.

Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., Kalof, L., 1999. A value-belief-norm theory of support for social movements: The case of environmentalism. Hum. Ecol. Rev. 81–97.

Stocking, M.A., Murnaghan, N., Murnaghan, N., 2013. A Handbook for the Field Assessment of Land Degradation. Routledge. https://doi.org/10.4324/9781849776219

Stryker, S., 1980. Symbolic interactionism: A social structural Version. Blackburn Press, Caldwell, Nj.

Sulemana, I., James, H.S., 2014. Farmer identity, ethical attitudes and environmental practices. Ecol. Econ. 98, 49–61. https://doi.org/10.1016/j.ecolecon.2013.12.011

Tanentzap, A.J., Lamb, A., Walker, S., Farmer, A., 2015. Resolving Conflicts between Agriculture and the Natural Environment. PLoS Biol. 13. https://doi.org/10.1371/journal.pbio.1002242

Teel, T.L., Manfredo, M.J., 2010. Understanding the Diversity of Public Interests in Wildlife Conservation. Conserv. Biol. 24, 128–139. https://doi.org/10.1111/j.1523-1739.2009.01374.x

Terry, D.J., Hogg, M.A., White, K.M., 1999. The theory of planned behaviour: self-identity, social identity and group norms. Br. J. Soc. Psychol. 38 (Pt 3), 225.

Thoits, P.A., Virshup, L.K., 1997. Me's and we's: Forms and functions of social identities, in: Self and Identity: Fundamental Issues, Rutgers Series on Self and Social Identity, Vol. 1. Oxford University Press, New York, NY, US, pp. 106–133.

Triandis, H.C., 1980. Values, attitudes, and interpersonal behavior. Neb. Symp. Motiv. Neb. Symp. Motiv. 27, 195–259.

umweltbundesamt.at, n.d. Bodenschutz in Österreich [WWW Document]. www.umweltbundesamt.at. URL http://www.umweltbundesamt.at/umweltsituation/boden/zustand/bodenschutz/ (accessed 9.2.18).

United Nations, 2017. Global Land Outlook, first edition. United Nations Convention to Combat Desertification, Bonn, Germany.

URBAN, M.A., 2005. Values and Ethical Beliefs Regarding Agricultural Drainage in Central Illinois, USA. Soc. Nat. Resour. 18, 173–189. https://doi.org/10.1080/08941929590894570

Uthes, S., Matzdorf, B., 2013. Studies on Agri-environmental Measures: A Survey of the Literature. Environ. Manage. 51, 251–266. https://doi.org/10.1007/s00267-012-9959-6

van den Born, R.J.G., 2008. Rethinking Nature: Public Visions in the Netherlands. Environ. Values 17, 83–109. https://doi.org/10.3197/096327108X271969

van den Born, R.J.G., 2007. Thinking nature: everyday philosophy of nature in The Netherlands (PhD dissertation). Radboud University Nijmegen.

van der Werff, E., Steg, L., Keizer, K., 2013. The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental

preferences, intentions and behaviour. J. Environ. Psychol. 34, 55–63. https://doi.org/10.1016/j.jenvp.2012.12.006

Van Herzele, A., Gobin, A., Van Gossum, P., Acosta, L., Waas, T., Dendoncker, N., Henry de Frahan, B., 2013. Effort for money? Farmers' rationale for participation in agri-environment measures with different implementation complexity. J. Environ. Manage. 131, 110–120. https://doi.org/10.1016/j.jenvman.2013.09.030

Van Huylenbroeck, G., Vandermeulen, V., Mettepenningen, E., Verspecht, A., 2007. Multifunctionality of Agriculture: A Review of Definitions, Evidence and Instruments. Living Rev. Landsc. Res. 1. https://doi.org/10.12942/lrlr-2007-3

Varble, S., Secchi, S., Druschke, C.G., 2016. An Examination of Growing Trends in Land Tenure and Conservation Practice Adoption: Results from a Farmer Survey in Iowa. Environ. Manage. 57, 318–330. https://doi.org/10.1007/s00267-015-0619-5

Vatn, A., 2010. An institutional analysis of payments for environmental services. Ecol. Econ. 69, 1245–1252. https://doi.org/10.1016/j.ecolecon.2009.11.018

Verheijen, F.G.A., Jones, R.J.A., Rickson, R.J., Smith, C.J., 2009. Tolerable versus actual soil erosion rates in Europe. Earth-Sci. Rev. 94, 23–38. https://doi.org/10.1016/j.earscirev.2009.02.003

Vesala, H.T., Vesala, K.M., 2010. Entrepreneurs and producers: Identities of Finnish farmers in 2001 and 2006. J. Rural Stud. 26, 21–30. https://doi.org/10.1016/j.jrurstud.2009.06.001

Walder, P., Kantelhardt, J., 2018. The Environmental Behaviour of Farmers – Capturing the Diversity of Perspectives with a Q Methodological Approach. Ecol. Econ. 143, 55–63. https://doi.org/10.1016/j.ecolecon.2017.06.018

Watts, S., Stenner, P., 2012. Doing Q Methodological Research: Theory, Method and Interpretation. SAGE Publications Ltd, 1 Oliver's Yard, 55 City Road, London EC1Y 1SP United Kingdom. https://doi.org/10.4135/9781446251911

Watts, S., Stenner, P., 2005. Doing Q ethodology: theory, method and interpretation. Qual. Res. Psychol. 2, 67–91. https://doi.org/10.1191/1478088705qp022oa

Wauters, E., Bielders, C., Poesen, J., Govers, G., Mathijs, E., 2010. Adoption of soil conservation practices in Belgium: An examination of the theory of planned behaviour in the agri-environmental domain. Land Use Policy, Soil and Water Conservation Measures in Europe 27, 86–94. https://doi.org/10.1016/j.landusepol.2009.02.009

Wauters, E., Mathijs, E., 2014. The adoption of farm level soil conservation practices in developed countries: a meta-analytic review. Int. J. Agric. Resour. Gov. Ecol. 10, 78–102. https://doi.org/10.13140/2.1.3770.1766

Wilson, G.A., 1997. Factors Influencing Farmer Participation in the Environmentally Sensitive Areas Scheme. J. Environ. Manage. 50, 67–93. https://doi.org/10.1006/jema.1996.0095

Wilson, G.A., Hart, K., 2001. Farmer Participation in Agri-Environmental Schemes: Towards Conservation-Oriented Thinking? Sociol. Rural. 41, 254–274. https://doi.org/10.1111/1467-9523.00181

Wilson, G.A., Hart, K., 2000. Financial Imperative or Conservation Concern? EU Farmers' Motivations for Participation in Voluntary Agri-Environmental Schemes. Environ. Plan. Econ. Space 32, 2161–2185. https://doi.org/10.1068/a3311

Wilson, P., Harper, N., Darling, R., 2013. Explaining variation in farm and farm business performance in respect to farmer behavioural segmentation analysis: Implications for land use policies. Land Use Policy 30, 147–156. https://doi.org/10.1016/j.landusepol.2012.03.006

Wynn, G., Crabtree, B., Potts, J., 2008. Modelling Farmer Entry into the Environmentally Sensitive Area Schemes in Scotland. J. Agric. Econ. 52, 65–82. https://doi.org/10.1111/j.1477-9552.2001.tb00910.x

Yoshida, Y., Flint, C.G., Dolan, M.K., 2018. Farming between love and money: US Midwestern farmers' human–nature relationships and impacts on watershed conservation. J. Environ. Plan. Manag. 61, 1033–1050. https://doi.org/10.1080/09640568.2017.1327423

Zawojska, A., 2010. Homo agricola considered as homo economicus and homo politicus, in: Institutions in Transition - Challenges for New Modes of Governance. Presented at the IAMO Forum 2010, Halle (Saale).

Zechmeister, H.., Schmitzberger, I., Steurer, B., Peterseil, J., Wrbka, T., 2003. The influence of land-use practices and economics on plant species richness in meadows. Biol. Conserv. 114, 165–177. https://doi.org/10.1016/S0006-3207(03)00020-X

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12 Appendix

Leitfaden für Interviews mit BäuerInnen in NÖ, OÖ, STM, BGL

Erste Überlegungen basierend auf Leitfaden Stakeholder, Leitfaden Illinois, Fragen aus Pias ÖPUL-Befragung – bitte ergänzen/adaptieren/verbessern!

Allgemeine Rahmenbedingungen aus dem Erstgespräch (der Kontaktaufnahme) wiederholen

Wie kam das Interview zustande, wer hat vermittelt...Dauer: ca. 30-60 min
Projekt als Teil einer größeren Forschungskooperation zu Landmärkten mit D und Tschechien. Konkret geht es um Besitzverhältnisse (Pacht vs Eigentum) und dem Umgang mit Boden.
Es geht um Ihre persönliche Meinung und Ihr Erfahrungswissen, die praktischen Zusammenhänge zwischen Besitzverhältnissen und Bodennutzung besser zu verstehen. Wir bereiten eine größere Befragung von Buchführungsbetrieben vor. Dafür brauchen wir Ihr Praxiswissen.

Begründung der Tonbandaufnahme – einholen des Einverständnisses

Hinweis auf Anonymität: Was passiert mit den Daten? Kontext des Interviews
Wie geht man im Interview vor, offene Fragen (keine richtigen/falschen Antworten, sondern praktisches Erfahrungswissen), Sortieraufgabe, anonymisierte Auswertung

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1. Gesprächseinstieg

1.1. Erzählen Sie uns kurz was über Ihren Betrieb.
1.2. Hat sich über die letzten zehn Jahre etwas geändert?
1.3. Stehen in Zukunft Änderungen an?
1.4. Hat sich in den Besitzverhältnissen über die Jahre was geändert?

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2. Besitzverhältnisse

2.1. Ändert Pacht/Eigentum/Rechtsform etwas daran, wie der Boden genutzt wird, was anbaut, welche Bodenschutzmaßnahmen gesetzt werden? Bei Ihnen oder anderen Betrieben in der Region...
2.2. Wie sind Ihre Pachtverträge ausgestaltet? Was sind gängige Formen in der Region (Dauer, Auflagen, Kündigung, schriftlich/mündlich, finanzielle/andere Abgeltung)?
2.3. Wie werden Bewirtschaftungsentscheidungen zwischen Eigentümer und Pächter aufgeteilt, in welchen Belangen redet der Eigentümer mit?

Q - Teil

Wir haben Aussagen mitgebracht, die sich auf den Umgang mit dem Boden beziehen. Wir bitten Sie die nach Ihrer Zustimmung zu sortieren (es gibt KEIN Richtig oder Falsch):

- Drei Stapel
- Mit dem „Stimme zu"-Stapel beginnen und am besten alle vor sich hinlegen. Dann von rechts nach links auflegen, je nachdem wie Sie das intuitiv empfingen – der Form entsprechend.
- Dann am besten mit dem „Stimme nicht zu"-Stapel weitermachen, diesmal von links nach rechts.
- Den dritten Stapel am Ende, und die Lücken dazwischen auffüllen.
- Wenn es liegt, nochmals bitte kontrollieren: ist das Bild so stimmig, ev. Änderungen vornehmen,

Reflexion über das Q:

- So – bitte erzählen Sie uns bitte, warum diese Aussagen ganz links oder rechts angeordnet wurden, und was Sie darunter verstehen.
- Hat Ihnen was gefehlt?
- Haben Sie sich bei bestimmten Aussagen schwer getan, weil welchen? Warum?
- An was haben Sie alles gedacht, wenn Sie an „Umgang mit dem Boden" denken?

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3. Bodenschutz

3.1. Was **machen Sie** am Betrieb zum Bodenschutz (inkl. ÖPUL-Bodenschutzmaßnahmen, würden Sie diese Maßnahmen auch ohne Förderungen machen)?
3.2. Wo haben Sie Bodenschutz **gelernt**? Wie informieren Sie sich über Bodenschutz?
3.3. Gibt es Umstände bei Pachtverhältnissen, die aus Sicht des Bodenschutzes problematisch sein könnten (*z.B. kurze Pachtdauer, Pächter/Verpächter kennen einander nicht, leben nicht im selben Dorf, Entfernung der Fläche vom Betrieb ...*)? Wo ist die kritische Grenze bei Pachtdauer/Entfernung der Fläche vom Betrieb, Neigung…
3.4. Wenn Sie etwas zu sagen hätten, wie würden Sie die Politik gestalten, so dass sie gut für die Bauern und gut für den Boden ist? Wo gibt es da Ihrer Meinung nach Anpassungsbedarf?

4. Gesprächsende – DANKE

4.1. Haben Sie noch etwas, das Sie bezüglich Besitzverhältnissen und Bodennutzung ergänzen möchten?
4.2. Eck-Daten (Tabelle mit LW ausfüllen)
4.3. Nächster Schritt: Ergebnisse (Foto des Q) würden wir Ihnen gerne zusenden, wenn Sie das möchten (Email). Eventuell könnten wir eine Woche später Rückruf.

Figure 5. The applied semi-structured interview guideline, page 1

ECKDATEN zum Inteview

Alter/Geschlecht der interviewten Person
Wie lange führen Sie den Betrieb schon?
Wer trifft die Entscheidungen der Bodennutzung? Falls das jemand anderes macht, haben Sie Einblick in dessen Entscheidung?
Vollerwerb oder NE
Zahl der Mitarbeitenden Personen
Was ist ihr Betriebsschwerpunkt
Wie viel ha haben Sie an Ackerflächen (ca.)?
Wie viel davon Pacht/Eigentum/Verpachtet
EMAIL

Figure 6. The applied semi-structured interview guideline, page 2

Table 9. List of statements (original wording)

	Topic	Statement	Evidence
Formal institutions	**Tenure security**	Wie viele Jahre ich eine Fläche in Zukunft noch bewirtschaften werde hat einen Einfluss auf meinen Umgang mit dem Boden.	(Carlisle, 2016; Daloğlu et al., 2014; Karali et al., 2014; Myyrä et al., 2007; Sklenicka et al., 2015; Soule et al., 2000)
	Agri-environmental schemes	Den Umgang mit meinem Boden mache ich von Förderprogrammen abhängig.	(Batáry et al., 2015; Boardman et al., 2003; Hodge, 2001; Uthes and Matzdorf, 2013; Zechmeister et al., 2003)
		Freiwillige Programme und Maßnahmen bieten mir Orientierung für den Umgang mit meinem Boden, egal ob ich daran teilnehme.	(Pavlis et al., 2016; Wilson and Hart, 2001)
	Legal regulations	Der Umgang mit meinem Boden ist bestimmt durch Gesetze und staatliche Sanktionen.	(Gorton et al., 2008; Karali et al., 2014; Posthumus and Morris, 2010; Prager and Posthumus, 2011)
Farmer and Farm Level	**Risks and time constraints**	Beim Umgang mit dem Boden achte ich auf meine Gesundheit.	(Cranfield et al., 2010; Karali et al., 2014; Knowler and Bradshaw, 2007)
		Ich würde mit meinem Boden anders umgehen, wenn ich mehr Zeit hätte.	(Dwyer et al., 2007)
		Beim Umgang mit meinem Boden will ich keine Risiken eingehen.	(Karali et al., 2014; Sattler and Nagel, 2010)
	Knowledge transfer	Im Umgang mit meinem Boden verlasse ich mich auf meine Ausbildung und eigene Erfahrung.	(Arbuckle, 2012; Carlisle, 2016)
		Um mehr über den Umgang mit dem Boden zu lernen besuche ich Beratungs- und Weiterbildungsveranstaltungen.	(Arbuckle, 2012; Carlisle, 2016)
		Wissen aus überlieferten Weisheiten und Traditionen beeinflusst meinen Umgang mit dem Boden.	(Karali et al., 2014)
		Ich probiere im Umgang mit meinem Boden oft Neues aus.	(Knowler and Bradshaw, 2007; Prager and Posthumus, 2011; Reimer et al., 2014)
		Im Umgang mit meinem Boden orientiere ich mich an Erfahrungen von Berufskollegen.	(Coughenour, 2003; Falconer, 2000; Karali et al., 2014)
	Bio-physical environment	Ich richte mich im Umgang mit meinem Boden nach den natürlichen Gegebenheiten des jeweiligen Feldes wie Bodenqualität, Hangneigung, etc.	(Bielders et al., 2003; Prager and Posthumus, 2011; Wilson and Hart, 2001)
		Das Wetter bestimmt meinen Umgang mit dem Boden.	(Karali et al., 2014)
		Durch meinen Umgang mit dem Boden vermeide ich Schäden durch Umwelteinflüsse (z.B. Klimawandel, Schädlinge).	(OECD, 2014)
	Economic considerations	Die Wirtschaftlichkeit meines Betriebs steht für mich im Umgang mit meinem Boden an erster Stelle.	(Barbayiannis et al., 2009; Boardman et al., 2003; Carlisle, 2016; Defrancesco et al., 2007; Dwyer et al., 2007; Lahmar, 2010; Robinson, 1999)
		Die Entfernung eines Feldes vom Hof beeinflusst meinen Umgang mit dem Boden.	(Barbayiannis et al., 2009; Lahmar, 2010)
		Im Umgang mit dem Boden vermeide ich teure Investitionen.	(Carlisle, 2016)
		Beim Umgang mit meinem Boden richte ich mich nach den Vorgaben und Erwartungen meiner Abnehmer.	(Karali et al., 2014)
	Socio-psychological aspects	Beim Umgang mit meinem Boden habe ich eine Verantwortung gegenüber mithelfenden Personen.	Pre-Test
		Beim Umgang mit meinem Boden denke ich an zukünftige Generationen.	(Ryan et al., 2003)
		Im Umgang mit meinem Boden achte ich darauf, dass meine Flächen schön und gepflegt aussehen.	(Ryan et al., 2003; Schneider et al., 2010; URBAN, 2005)
		Beim Umgang mit dem Boden steht meine Freiheit als Landwirt im Vordergrund.	(Karali et al., 2014)
		Der Umgang mit meinem Boden soll mir Freude machen.	Voruntersuchung
		Die Aufgabe, Lebensmittel für die Gesellschaft bereit zu stellen, prägt meinen Umgang mit dem Boden.	(Burton, 2004a; Mills et al., 2017); Voruntersuchung
		Erwartungen der Gesellschaft setze ich im Umgang mit meinem Boden um.	(Karali et al., 2014; Mills et al., 2017; Uthes and Matzdorf, 2013)
		Durch meinen Umgang mit dem Boden sollen keine negativen Folgen für meine Nachbarschaft entstehen.	(Ryan et al., 2003)
		Ich vermeide es im Umgang mit meinem Boden Dinge zu tun, die mich ins Gerede bringen würden.	(Karali et al., 2014)
	HNR	Beim Umgang mit dem Boden lenke ich die Natur zu meinem Nutzen.	(Braito et al., 2017a)
		Beim Umgang mit dem Boden habe ich eine Verantwortung gegenüber der Natur.	(Braito et al., 2017a)
		Beim Umgang mit dem Boden arbeite ich mit der Natur zusammen.	(Braito et al., 2017a)
		Beim Umgang mit dem Boden fühle ich mich als Teil der Natur und ihrer Kreisläufe.	(Braito et al., 2017a)
		Beim Umgang mit meinem Boden denke ich nicht an die Natur.	(Braito et al., 2017a)

Innovative Stewards

-4	-3	-2	-1	0	+1	+2	+3	+4
(2)	*(3)*	*(4)*	*(5)*	*(6)*	*(5)*	*(4)*	*(3)*	*(2)*
Most disagree								***Most agree***

8 When dealing with my soil I do not think about nature	4 When dealing with my soil I avoid expensive investments	3 My freedom as a farmer when working with my soil is important to me.	1 When dealing with my soil I pay attention to the tidiness and neatness of my plots.	9 When dealing with my soil I go by the requirements and expectations of my customers	6 My duty to provide food for society shapes how I deal with my soil	2 I attend training and extension services to learn more about soil tillage	26 When dealing with my soil I think about future generations	17 When dealing with my soil I feel as a part of nature and its cycles
21 When dealing with my soil I avoid doing things that would make me the subject of gossip	15 I coordinate with my neighbors when dealing with my soil	7 How I deal with my soil depends on agri-environmental schemes	5 Traditional and passed-down knowledge determines how I deal with my soil	10 When dealing with my soil I have a responsibility for employees and assisting persons	11 When dealing with my soil I steer nature for my own use	16 When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	32 When dealing with my soil I have a responsibility for nature	34 The weather determines how I deal with my soil
	25 I would deal with my soil differently if I had more time	23 How I deal with my soil is determined by laws and governmental sanction	12 When dealing with my soil I want to avoid risks	13 Experiences of colleagues give me guidance for dealing with my soil	14 When dealing with my soil I rely on my own education and experience	19 Dealing with my soil ought to give me pleasure	33 When dealing with my soil I work together with nature	
		29 The number of years that I will still farm a plot determines how I deal with my soil	22 The profitability of my farm is top priority for me when dealing with my soil	18 When dealing with my soil I pay attention to my health	20 I try new things when dealing with my soil	24 By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)		
			28 The distance between a plot and my farm determines how I deal with my soil	27 Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	30 ow I deal with my soil ought not to have any negative impact on my neighborhood			
				31 I implement expectations of society in how I deal with my soil				

Figure 7. Hypothetical item configuration for the *Innovative Stewards*

Neo-traditional Producers

-4	-3	-2	-1	0	+1	+2	+3	+4
(2)	*(3)*	*(4)*	*(5)*	*(6)*	*(5)*	*(4)*	*(3)*	*(2)*
Most disagree								***Most agree***
4 When dealing with my soil I avoid expensive investments	13 Experiences of colleagues give me guidance for dealing with my soil	7 How I deal with my soil depends on agri-environmental schemes	8 When dealing with my soil I do not think about nature	12 When dealing with my soil I want to avoid risks	16 When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	9 When dealing with my soil I go by the requirements and expectations of my customers	2 I attend training and extension services to learn more about soil tillage	1 When dealing with my soil I pay attention to the tidiness and neatness of my plots.
25 I would deal with my soil differently if I had more time	23 How I deal with my soil is determined by laws and governmental sanction	11 When dealing with my soil I steer nature for my own use	17 When dealing with my soil I feel as a part of nature and its cycles	14 When dealing with my soil I rely on my own education and experience	22 The profitability of my farm is top priority for me when dealing with my soil	10 When dealing with my soil I have a responsibility for employees and assisting persons	3 My freedom as a farmer when working with my soil is important to me.	
	29 The number of years that I will still farm a plot determines how I deal with my soil	15 I coordinate with my neighbors when dealing with my soil	27 Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	18 When dealing with my soil I pay attention to my health	26 When dealing with my soil I think about future generations	19 Dealing with my soil ought to give me pleasure	5 Traditional and passed-down knowledge determines how I deal with my soil	
		21 When dealing with my soil I avoid doing things that would make me the subject of gossip	28 The distance between a plot and my farm determines how I deal with my soil	20 I try new things when dealing with my soil	34 The weather determines how I deal with my soil	33 When dealing with my soil I work together with nature	6 My duty to provide food for society shapes how I deal with my soil	
		30 ow I deal with my soil ought not to have any negative impact on my neighborhood		24 By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)				
				31 I implement expectations of society in how I deal with my soil				
				32 When dealing with my soil I have a responsibility for nature				

Figure 8. Hypothetical item configuration for the *Neo-traditional Producers*

Profit Maximisers

-4	-3	-2	-1	0	+1	+2	+3	+4
(2)	*(3)*	*(4)*	*(5)*	*(6)*	*(5)*	*(4)*	*(3)*	*(2)*
Most disagree								***Most agree***
15 I coordinate with my neighbors when dealing with my soil	10 When dealing with my soil I have a responsibility for employees and assisting persons	8 When dealing with my soil I do not think about nature	3 My freedom as a farmer when working with my soil is important to me.	6 My duty to provide food for society shapes how I deal with my soil	11 When dealing with my soil I steer nature for my own use	1 When dealing with my soil I pay attention to the tidiness and neatness of my plots.	14 When dealing with my soil I rely on my own education and experience	22 The profitability of my farm is top priority for me when dealing with my soil
25 I would deal with my soil differently if I had more time	21 When dealing with my soil I avoid doing things that would make me the subject of gossip	9 When dealing with my soil I go by the requirements and expectations of my customers	4 When dealing with my soil I avoid expensive investments	7 How I deal with my soil depends on agri-environmental schemes	12 When dealing with my soil I want to avoid risks	2 I attend training and extension services to learn more about soil tillage	16 When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	34 The weather determines how I deal with my soil
	28 The distance between a plot and my farm determines how I deal with my soil	29 The number of years that I will still farm a plot determines how I deal with my soil	5 Traditional and passed-down knowledge determines how I deal with my soil	17 When dealing with my soil I feel as a part of nature and its cycles	19 Dealing with my soil ought to give me pleasure	26 When dealing with my soil I think about future generations	32 When dealing with my soil I have a responsibility for nature	
		31 I implement expectations of society in how I deal with my soil	13 Experiences of colleagues give me guidance for dealing with my soil	18 When dealing with my soil I pay attention to my health	24 By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	33 When dealing with my soil I work together with nature		
			27 Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	20 I try new things when dealing with my soil	30 ow I deal with my soil ought not to have any negative impact on my neighborhood			
				23 How I deal with my soil is determined by laws and governmental sanction				

Figure 9. Hypothetical item configuration for the *Profit Maximisers*

Self-reliant Environmentalists

-4	-3	-2	-1	0	+1	+2	+3	+4
(2)	*(3)*	*(4)*	*(5)*	*(6)*	*(5)*	*(4)*	*(3)*	*(2)*

Most disagree ***Most agree***

15 I coordinate with my neighbors when dealing with my soil	8 When dealing with my soil I do not think about nature	6 My duty to provide food for society shapes how I deal with my soil	2 I attend training and extension services to learn more about soil tillage	4 When dealing with my soil I avoid expensive investments	1 When dealing with my soil I pay attention to the tidiness and neatness of my plots.	3 My freedom as a farmer when working with my soil is important to me.	17 When dealing with my soil I feel as a part of nature and its cycles	19 Dealing with my soil ought to give me pleasure
23 How I deal with my soil is determined by laws and governmental sanction	21 When dealing with my soil I avoid doing things that would make me the subject of gossip	7 How I deal with my soil depends on agri-environmental schemes	9 When dealing with my soil I go by the requirements and expectations of my customers	5 Traditional and passed-down knowledge determines how I deal with my soil	11 When dealing with my soil I steer nature for my own use	14 When dealing with my soil I rely on my own education and experience	34 The weather determines how I deal with my soil	33 When dealing with my soil I work together with nature
	27 Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	28 The distance between a plot and my farm determines how I deal with my soil	10 When dealing with my soil I have a responsibility for employees and assisting persons	13 Experiences of colleagues give me guidance for dealing with my soil	18 When dealing with my soil I pay attention to my health	16 When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.		
		29 The number of years that I will still farm a plot determines how I deal with my soil	12 When dealing with my soil I want to avoid risks	20 I try new things when dealing with my soil	25 I would deal with my soil differently if I had more time	26 When dealing with my soil I think about future generations		
			31 I implement expectations of society in how I deal with my soil	22 The profitability of my farm is top priority for me when dealing with my soil	30 ow I deal with my soil ought not to have any negative impact on my neighborhood	32 When dealing with my soil I have a responsibility for nature		
				24 By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)				

Figure 10. Hypothetical item configuration for the *Self-reliant Environmentalists*

Table 10. Crib-sheet for factor 1, the *Innovative Stewards*.

Innovative Stewards	
Items ranked at +4	**Ranking**
When dealing with my soil I feel as a part of nature and its cycles	4
The weather determines how I deal with my soil	4[a]
Items ranked higher in Factor 1 array than in other factors	
Experiences of colleagues give me guidance for dealing with my soil	0
I try new things when dealing with my soil	1
By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	2
When dealing with my soil I think about future generations	3
Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	0
The distance between a plot and my farm determines how I deal with my soil	-1[a]
I implement expectations of society in how I deal with my soil	0[a]
When dealing with my soil I have a responsibility for nature	3[a]
Items ranked lower in Factor 1 array than in other factors	
When dealing with my soil I pay attention to the tidiness and neatness of my plots.	-1
My freedom as a farmer when working with my soil is important to me.	-2
Traditional and passed-down knowledge determines how I deal with my soil	-1[a]
When dealing with my soil I want to avoid risks	-1[a]
The profitability of my farm is top priority for me when dealing with my soil	-1
Items ranked at -4	
When dealing with my soil I do not think about nature	-4
When dealing with my soil I avoid doing things that would make me the subject of gossip	-4

a: Items shared with maximal one other viewpoint.

Table 11. Crib-sheet for factor 2, the *Neo-Traditional Producers*

Neo-Traditional Producers	
Items ranked at +4	**Ranking**
When dealing with my soil I pay attention to the tidiness and neatness of my plots.	4
Items ranked higher in factor 3 array than in other factors	
I attend training and extension services to learn more about soil tillage.	3
My freedom as a farmer when working with my soil is important to me.	3
Traditional and passed-down knowledge determines how I deal with my soil	3
My duty to provide food for society shapes how I deal with my soil	3
When dealing with my soil I do not think about nature	-1
When dealing with my soil I go by the requirements and expectations of my customers	2
When dealing with my soil I have a responsibility for employees and assisting persons	2
I coordinate with my neighbors when dealing with my soil	-2
When dealing with my soil I avoid doing things that would make me the subject of gossip	-2
The distance between a plot and my farm determines how I deal with my soil	-1[a]
I implement expectations of society in how I deal with my soil	0[a]
Items ranked lower in factor 3 array than in other factors	
When dealing with my soil I steer nature for my own use	-2
Experiences of colleagues give me guidance for dealing with my soil	-3
When dealing with my soil I rely on my own education and experience	0
When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	1
When dealing with my soil I feel as a part of nature and its cycles	-1
By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	0[a]
When dealing with my soil I think about future generations	1
The number of years that I will still farm a plot determines how I deal with my soil	-3
How I deal with my soil ought not to have any negative impact on my neighborhood	-2
When dealing with my soil I have a responsibility for nature	0
When dealing with my soil I work together with nature	2[a]
The weather determines how I deal with my soil	1
Items ranked at -4	
When dealing with my soil I avoid expensive investments	-4
I would deal with my soil differently if I had more time	-4

a: Items shared with maximal one other viewpoint.

Table 12. Crib-sheet for factor 3, the *Profit Maximisers*

Profit Maximisers	
Items ranked at +4	**Ranking**
The profitability of my farm is top priority for me when dealing with my soil	4
The weather determines how I deal with my soil	4[a]
Items ranked higher in factor array 2 than in other factors	
How I deal with my soil depends on agri-environmental schemes	0
When dealing with my soil I want to avoid risks	1
When dealing with my soil I rely on my own education and experience	3
When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	3
How I deal with my soil is determined by laws and governmental sanction	0
When dealing with my soil I have a responsibility for nature	3[a]
Items ranked lower in factor 2 array than in other factors	
Traditional and passed-down knowledge determines how I deal with my soil	-1[a]
When dealing with my soil I go by the requirements and expectations of my customers	-2
When dealing with my soil I have a responsibility for employees and assisting persons	-3
Dealing with my soil ought to give me pleasure	1
The distance between a plot and my farm determines how I deal with my soil	-3
I implement expectations of society in how I deal with my soil	-2
When dealing with my soil I work together with nature	2[a]
Items ranked at -4	
I coordinate with my neighbors when dealing with my soil	-4
I would deal with my soil differently if I had more time	-4

a: Items shared with maximal one other viewpoint.

Table 13. Crib-sheet for factor 4, the *Self-reliant Environmentalists*

Self-reliant Environmentalists	
Items ranked at +4	**Ranking**
Dealing with my soil ought to give me pleasure	4
When dealing with my soil I work together with nature	4
Items ranked higher in factor 4 array than in other factors	
When dealing with my soil I avoid expensive investments	0
Experiences of colleagues give me guidance for dealing with my soil	0[a]
When dealing with my soil I pay attention to my health	1
I would deal with my soil differently if I had more time	1
Items ranked lower in factor 4 array than in other factors	
I attend training and extension services to learn more about soil tillage.	-1
My duty to provide food for society shapes how I deal with my soil	-2
When dealing with my soil I want to avoid risks	-1
By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	0[a]
Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	-3
Items ranked at -4	
I coordinate with my neighbors when dealing with my soil	-4
How I deal with my soil is determined by laws and governmental sanction	-4

a: Items shared with maximal one other viewpoint.

13 Affirmation

I certify that the master thesis was written by me, not using sources and tools other than quoted and without use of any other illegitimate support.

Vienna, March 2019 ……

Georg Thaler