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The plurality of farmers' views on soil management calls for a policy mix

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ABSTRACT

While soil degradation is continuing to threaten the global agricultural production system, a common understanding of how to encourage sustainable soil management is missing. With this study, we aim to provide new insights on targeted policies that address the heterogeneity of farmers. We scrutinized the plurality of views on soil management among arable farmers in the Austrian (and European) policy context. To do so, we applied Q methodology, a method that identifies different perspectives on a topic present in a population and analyzes this subjectivity statistically. We interviewed 34 arable land farmers who varied in their farming backgrounds. The results yielded four different viewpoints on soil management held by the interviewed farmers: two rather ecocentric perspectives (*Nature Participants*, *Pleasure Seekers*) and two rather anthropocentric perspectives (*Traditional Food Providers*, *Profit Maximizers*). Our study shows that farmers' soil management is influenced by more than economic considerations and suggests that a mix of policy approaches is needed to reach all farmers and avoid adverse effects of excluding farmers. We provide several suggestions for policymakers on how to complement agri-environmental policies: appealing to human-nature relationships, offering training and experimentation services, fostering social networks, and raising the social reputation of farmers.

1. Introduction

Soil erosion and the loss of soil biodiversity and fertility threaten the global agricultural production systems (Lal, 2015). Apart from natural processes that continually shape the state of soils, agricultural activities trigger soil degradation (Panagos et al., 2014). As soil management can not only degrade, but also restore soils (Lal, 2015), it is addressed in the 2030 Agenda for Sustainable Development by the United Nations (Tóth et al., 2018). However, a common strategy to encourage sustainable soil management is missing so far (Panagos et al., 2016), and the effectiveness of soil conservation policies is questionable (Kutter et al., 2011). A comparative analysis by Kutter et al. (2011) of hundreds of mandatory, voluntary incentive-based and awareness-increasing soil conservation policies across 24 EU countries revealed that most policies did not sustainably achieve their targeted environmental goals, but also that different policy mechanisms addressed similar soil conservation issues.

A small but growing body of literature (Frey and Jegen, 2001; Kieninger et al., 2018; Rode et al., 2015; Vatn, 2010) indicates that monetary incentives (the most common soil conservation policy) may not be enough to promote sustainable soil management practices substantially. Monetary incentives such as agri-environmental schemes (AES) do have the intended and primary effect of motivating behavioral change by offering financial rewards. However, they also have an often underestimated secondary effect of undermining intrinsic motivations for conservation or excluding individuals who, due to their mindset, do not feel addressed by the policy's framing (Baum and Gross, 2017; Dessart et al., 2019; Pannell et al., 2006). Therefore, long-term changes in soil management might be better promoted by adding other or supplementary measures, such as facilitating group learning (Prager and Creaney, 2017). This calls for behavioral insights into policy-making. Policymakers need to understand how farmers themselves perceive (their) soil management and how their mental models link with their management practices (Bartkowski and Bartke, 2018; Davies and Hodge, 2007). Dessart et al. (2019) identified several knowledge gaps regarding the interactions between soil management policies and

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how they can be orchestrated to meet the plurality of farmers' cognitive and normative mental models. According to them, these knowledge gaps might explain why secondary policy effects, such as crowding-out or rebound effects, are not yet fully understood, particularly in the context of farming practices.

Baum and Gross (2017) address these secondary effects and show that policies for behavior change are effective only if they understand and consider both (1) individual behavioral determinants and (2) the context that frames those determinants, and ultimately the expression of a particular behavior. The authors suggest a governance approach that considers the complexity of farmers' daily soil management decisions and rightly appreciates the context of those whom the policy addresses (Knowler and Bradshaw, 2007; Prager and Posthumus, 2011).

Regarding individual behavioral determinants, many studies have collected and examined variables that might explain diverging soil management practices (for an overview, see Dessart et al., 2019). For example, a review of 23 publications on farmers' adoption of conservation measures identified more than 150 explanatory variables (Prager and Posthumus, 2011). However, studies often underscore that farming has many facets and is not just about running a business and optimizing income (McElwee, 2004). Farming decisions are, like any other human behavior, guided by a multiplicity of thoughts, which emerge from their beliefs, attitudes, norms, and values (Hamdy and Aly, 2014; Karali et al., 2014; Knowler and Bradshaw, 2007; Mattison and Norris, 2005; Prager and Posthumus, 2011; Rajendran et al., 2016), as well as individual and collective understandings of the human-nature relationship (HNR) (Muhar et al., 2018). Thus, farmers are anything but a homogenous group (Darnhofer et al., 2005), and better understanding their soil management is a difficult endeavor.

Regarding the context that frames behavioral determinants and ultimately the expression of farmers' behavior, we need to acknowledge that farmers are embedded in their unique contexts, such as families, the society they live and work in, changing policies and legislations, developments of global markets or changing customer demands. However, the context not only shapes the local reality of farmers, it also influences their social-cultural concepts of nature (e.g., HNR). In this regard, Muhar et al. (2018) present a conceptual model that integrates socio-cultural concepts of nature into existing concepts of governance of social-ecological systems. Empirically, only a few studies investigate the adoption of soil conservation across contexts (Knowler and Bradshaw, 2007). As one of those few, Prager and Posthumus (2011) relate environmental, economic, institutional, and local variables to the adoption of soil conservation. More recently, Bartkowski and Bartke (2018) reviewed 87 European studies to identify leverage points for soil conservation policies and distinguish between farm and farmer characteristics, the social-institutional environment, economic constraints, and decision characteristics (e.g., how well a practice fits with existing farm management).

With our study, we aim to provide new ideas for targeted policies for sustainable soil management. As discussed above, such policies should be geared to the heterogeneity of farmers but should also take the farmers' context into account. We thus first scrutinize farmers' views on soil management, to understand the plurality of these viewpoints. More specifically, we are interested to see which different views on soil management we can distinguish among Austrian crop farmers. Based on these insights, we then develop suggestions of how policies can take this plurality into account. Thus, with this study we aim to support policies that strive to address and crowd-in farmers holding different views.

Empirically, *Farming Styles* identification and using *Q Methodology* to assess farmer perspectives are promising research approaches to deduce and distinguish farmers' viewpoints. Both methods allow being integrative in the sense of discerning the individual embedded in a broader context. *Farming Styles* differentiate groups of farmers that share a particular mindset (van der Ploeg, 1994; Schmitzberger et al., 2005). This approach has, among other things, helped to better understand variability in farmers' conservation practices (Schmitzberger et al., 2005). While farming style research is criticized for overly relying on the researchers' assessment, *Q Methodology* allows focusing on what people (in our case farmers) themselves select to be their approach to farm management (Fairweather and Klonsky, 2009). Therefore, *Q Methodology* has proven helpful in differentiating farmers' environmental perspectives (Davies and Hodge, 2007) and viewpoints on environmental behavior (Walder and Kantelhardt, 2018). As we aim to unravel farmers' soil management perspectives, we consider *Q Methodology* as well-suited to our research aim. The method combines qualitative and quantitative elements, which allows us to be comprehensive while still being able to reduce complexity. After identifying farmers' views on soil management, we discuss how soil conservation policies align with the identified viewpoints, and which types of policy may be promising options in the future.

In the remainder of the paper, we first explain *Q Methodology*. We summarize the existing research on soil conservation and variables influencing farmers' soil management, as such a thorough literature review constitutes the variable set of our Q study. We then describe our sample and process of data collection. Afterward, we describe the results regarding the viewpoints we have found to exist among farmers. The discussion chapter then links our findings to policy. We close with a brief conclusion.

2. Material and methods

Q Methodology is a method that identifies different perspectives on a topic present in a population, and that quantifies this subjectivity through statistical calculations (Watts and Stenner, 2012). In *Q Methodology*, respondents rank statements (the *Q set*) relating to a main question by placing them in a quasi-normal distribution (the *Q sort*) according to their level of (dis)agreement. Statistical analysis of the resulting *Q sorts* works like a 'flipped around' factor analysis: the statements themselves become the sample of the study, while the participants are the variables of interest (Watts and Stenner, 2005). The factors (i.e., patterns of similarity) are extracted from a correlation matrix between participants' *Q sorts*, rotated, and characterized by the *Q sorts* that define ('load on') each factor. This *Q pattern analysis* results in a set of statement rankings that each depict a distinct viewpoint or group perspective. The final results are descriptive narratives of these rankings that additionally draw on post-sorting interviews with respondents. While in *Q Methodology* the *Q set* needs to be representative of the field of enquiry, participants do not need to be representative of the underlying population in the usual sense, but rather cover all potentially existing viewpoints, i.e., ensure diversity of opinions (Watts and Stenner, 2012). The next sections describe the *Q set*, the *Q sorting* procedure and participant selection, and the *Q pattern analysis* specification we used for our study in detail.

2.1. Q set

The *Q set* reflects the broader discourse on a given topic in society and literature, providing a holistic or complete picture of the issue at hand (Watts and Stenner, 2005; Webler and Tuler, 2001), in our case farmers' soil management. Developed by the researcher, the *Q set* comprises a carefully selected subsample of the discourse in the form of heterogeneous statements (theory-based and empirically assessed), each making a different assertion about the subject of research (Watts and Stenner, 2005). In its final form, the *Q set* is a set of cards with these statements printed on them that study participants sort according to their (dis)agreement.

To compile our Q set, we first conducted a literature review on farmers' soil management and its determinants. Applying a semi-structured interview guideline, we then interviewed six expert stakeholders from public authorities (ministry of agriculture, agricultural county administration), extension services (chamber of agriculture), and an environmental NGO concerned with soil conservation. As a

result of this first phase, we derived more than 100 statements that reflect the broader discourse of soil management internationally, and in Austria in particular.

In order to manage the large scale and complexity of the subject, we categorized the statements systematically (Brown, 1993; Watts and Stenner, 2005). We reviewed existing categorizations and frameworks that proved to be helpful in previous studies. We found multiple variations in how to categorize influential variables of farmers' decision-making. Among them, Bartkowski and Bartke (2018) grouped variables influential for farming in six groups in a review of 87 European studies: characteristics of the farm, characteristics of the farmer, behavioral characteristics of the farmer (e.g., attitudes), social-institutional environment, economic constraints, and decision characteristics (e.g., goodness of fit). In their individual-centered framework, Baum and Gross (2017, p. 55) distinguished between internal behavioral determinants and split contextual variables into three distinct levels: individual-level context, socio-institutional context, and techno-economic context. Dessart et al. (2019) organized behavioral determinants based on their 'distance' from the decision-making and distinguish between dispositional variables (e.g., personality, farming objectives, moral concerns), social variables (e.g., norms), and cognitive variables (e.g., knowledge).

Drawing from all these studies, we categorized our statements into the following four categories: farmer, farm, socio-institutional context, and natural context. Sorting across these categories ensured that our final Q set was comprehensive enough to portrait the real world as relates to farmers (Brown, 1993).

The first category, ***farmer***, includes statements related to the farmers' personal disposition and experience. This category acknowledges that farmers' behavior is ultimately the result of a complex and often subconscious decision-making process influenced by mental models and intrinsic motivations (Greiner and Gregg, 2011; Prager and Posthumus, 2011; Ryan et al., 2003). The second category, ***farm***, acknowledges that each farmer is influenced by characteristics of his/her farm, household characteristics (including economic considerations, potential farm successions, etc.), and nearby reference groups. The third category, ***socio-institutional context***, consists of influences that are exogenous to the farm and the farmer, and thus, not directly influenceable by the farmers themselves. These influences are designed and managed through public authorities or institutions, or they evolve from market dynamics and the socio-economic environment at large. The fourth category, ***natural context***, acknowledges that each farmer is embedded in a unique natural, non-human setting that forces them to tailor their farming practices accordingly. However, the natural context not only frames the thematic focus of a decision process, it also affects farmers' situational HNR (Muhar et al., 2018). Thus, farmers may build a particular relationship with nature, which translates into behavioral patterns (Braito et al., 2017; Stupak et al., 2019) and which has been found to be a valuable concept for understanding farmers' behavior by Yoshida et al. (2018). We thus included several such types of human-nature relationships (HNR) in the Q set.

In the next step, we merged related statements and discarded duplicates, resulting in a robust set of 34 statements. We standardized the style and wording of the statements to reduce misinterpretation and ease the sorting for the respondents (Watts and Stenner, 2012). Table 1 shows all 34 statements, including the categorization, the labels that we use henceforth to facilitate the text, and the sources from where we distilled the statements. Finally, we pre-tested the *Q set* with people familiar with farming in Austria. As a result of the pre-test, we reformulated statements that our test candidates found confusing, incohesive, imprecise, or merely ambiguous. Moreover, we became aware of the importance of the guiding question's simplicity to support the cognitively challenging exercise of sorting 34 statements accordingly. Thus, the pre-test resulted in a rephrasing of the guiding question as well as slight rewordings of some statements.

In Table 1, we translated the original German statements into English. Two expressions turned out to be ambiguous in English and need further explanation. The German word "Wirtschaftlichkeit" translates roughly to profitability, economic efficiency, economic viability. For practical reasons, we use *profitability* when referring to farmers' economic considerations in the remainder of the text. Likewise, the German word "Freude" translates roughly to joy, pleasure, delight, or happiness. We use the word *pleasure* when referring to farmers' positive feelings when managing their soils.

2.2. Q sort

The expression of the *Q sorts* reveals the participants' subjective viewpoints towards the research focus (Brown, 1993). Respondents rank each statement of the *Q set* in the specific shape of the *Q sort*, placing every statement in relation to all other statements, i.e., the broader *Q set* (Webler and Tuler, 2001).

Q Methodology does not require a large number of participants to conduct this sorting (Watts and Stenner, 2005), but heterogeneous viewpoints need to be represented (Brown, 1980). For our research, we selected 34 arable land farmers in Austria, who varied in their farming backgrounds and thus potentially held different perspectives on soil conservation. Farmers were contacted by different means, including contact established via extension agents and other stakeholders, an open call in a newsletter, and a call among students of agricultural economics. The participants (primary decision-makers of the farm) were interviewed by one of the co-authors during winter 2017/18, in most cases on their farms. In addition to approaching the participants on their farms, we tried to avoid a potentially intimidating appearance and language, and avoided our academic titles, in order to reduce social desirability bias. The sorting procedures, including post-sorting interviews, lasted between 45 min and 2 h.

Respondents were first asked to read all statements and create three piles (generally agree – indifferent/ do not know – generally disagree) concerning the central question "What influences your soil management?". This helped them to get a first impression of the range of available opinions (statements) and to ease the subsequent sorting procedure (Brown, 1993). Next, respondents rank-ordered the statements into a predefined sorting grid (Fig. 1), representing a quasi-normal distribution and thus symmetrical about the middle (Brown, 1993; Watts and Stenner, 2005). The sorting along the scale from -4 (*fully disagree*) to +4 (*fully agree*) dictates the number of statements the respondent can assign to each rank. During the sorting procedure, respondents were encouraged to ask questions or discuss thoughts (Watts and Stenner, 2012). Once respondents were finished and satisfied with their ranking, we conducted brief post-sorting interviews as recommended by Watts and Stenner (2005). This provided us with further insights regarding a) the respondents' interpretation of the statements, b) the respondents' motivations for ranking statements at the extremes (-4, +4), c) the comprehensiveness of the *Q set*, and d) general comments from the respondents. This sorting procedure and the post-sorting interviews were audio-recorded and transcribed for later analysis.

2.3. Q pattern analysis

The *Q pattern analysis* reveals viewpoints that are shared by groups of participants. By-person factor analysis and correlations between participants identify groups of participants who sorted the statements in similar ways and thus hold characteristic viewpoints (Stephenson, 1936; Watts and Stenner, 2005).

To prepare this analysis, the final *Q sorts* were photographed and then digitalized using the free software package PQMethod[1] . We excluded one participant from our analysis as he did not properly

[1] http://schmolck.org/qmethod/.

Table 1
The *Q set* – list of statements related to farmers' soil management allocated along the categories.

categories	#	Q statements	labels	Source/Literature
Farmer	1	Dealing with my soil ought to give me pleasure	***pleasure***	Stakeholder interviews
	2	When dealing with my soil my freedom as a farmer is my main concern	***freedom***	(Karali et al., 2014)
	3	I would deal with my soil differently if I had more time	***time availability***	(Dwyer et al., 2007)
	4	I attend training and extension services to learn more about soil use	***training***	(Arbuckle, 2012; Carlisle, 2016)
	5	Traditional, passed-down knowledge determines how I deal with my soil	***traditional knowledge***	(Karali et al., 2014)
	6	When dealing with my soil I rely on my own education and experience	***education***	(Arbuckle, 2012; Carlisle, 2016)
	7	When dealing with my soil I pay attention to my health	***health***	(Cranfield et al., 2010; Karali et al., 2014; Knowler and Bradshaw, 2007)
	8	I try new things when dealing with my soil	***openness to change***	(Knowler and Bradshaw, 2007; Prager and Posthumus, 2011; Reimer et al., 2014)
Farm	9	The economic viability of my farm is top priority for me when dealing with my soil	***profitability****	(Barbayiannis et al., 2009; Boardman et al., 2003; Carlisle, 2016; Defrancesco et al., 2007; Dwyer et al., 2007; Lahmar, 2010; Robinson, 1999)
	10	The distance between a plot and my farm influences how I deal with my soil	***distance***	(Barbayiannis et al., 2009; Lahmar, 2010)
	11	The number of years that I will still farm a plot determines how I deal with my soil	***tenure security***	(Carlisle, 2016; Daloğlu et al., 2014; Karali et al., 2014; Leonhardt et al., 2019; Sklenicka et al., 2015)
	12	When dealing with my soil I avoid expensive investments	***avoid expensive investments***	(Carlisle, 2016)
	13	When dealing with my soil I want to avoid risks	***risk***	(Karali et al., 2014; Sattler and Nagel, 2010)
	14	When dealing with my soil I have a responsibility for employees and helping people	***responsibility for workers***	Stakeholder interviews
	15	When dealing with my soil I pay attention to the tidiness and neatness of my plots	***tidy plots***	(Ryan et al., 2003; Schneider et al., 2010; URBAN, 2005)
Socio-institutional context	16	When dealing with my soil I think about future generations	***future generations***	(Ryan et al., 2003)
	17	I coordinate with my neighbors when dealing with my soil	***coordinate with neighbors***	Stakeholder interviews
	18	How I deal with my soil ought not to have any negative impact on my neighborhood	***care for neighbors***	(Ryan et al., 2003)
	19	When dealing with my soil I go by the requirements and expectations of my customers	***customers' expectations***	(Karali et al., 2014)
	20	I implement expectations of society in how I deal with my soil	***society's expectations***	(Karali et al., 2014; Mills et al., 2017; Uthes and Matzdorf, 2013)
	21	My duty to provide food for society shapes how I deal with my soil	***food provision***	(Burton, 2004; Burton and Wilson, 2006)
	22	When dealing with my soil I avoid doing things that would make me the subject of gossip	***gossip***	(Karali et al., 2014)
	23	How I deal with my soil depends on agri-environmental schemes	***depend on AES***	(Batáry et al., 2015; Boardman et al., 2003; Hodge, 2001; Uthes and Matzdorf, 2013; Zechmeister et al., 2003)
	24	Voluntary programs and schemes are a useful guidance for how I deal with my soil, no matter whether I formally participate	***guided by AES***	(Pavlis et al., 2016; Wilson and Hart, 2001)
	25	Experiences of colleagues give me guidance for dealing with my soil	***others' knowledge***	(Coughenour, 2003; Falconer, 2000; Karali et al., 2014)
	26	How I deal with my soil is determined by laws and governmental regulations and sanctions	***laws & sanctions***	(Gorton et al., 2008; Karali et al., 2014; Posthumus and Morris, 2010; Prager and Posthumus, 2011)
Natural context	27	When dealing with my soil I take account of the natural conditions of the plot, such as soil quality, slope, etc.	***natural conditions***	(Bielders et al., 2003; Prager and Posthumus, 2011; Wilson and Hart, 2001)
	28	By dealing with my soil I avoid damages by natural influences (e.g., climate change, pests)	***natural influences***	(Mitter et al., 2018; OECD, 2014)
	29	The weather determines how I deal with my soil	***weather***	(Karali et al., 2014)
	30	When dealing with my soil I steer nature for my own use	***master***	(Braito et al., 2017)
	31	When dealing with my soil I work together with nature	***partner***	(Braito et al., 2017)
	32	When dealing with my soil I feel as a part of nature and its cycles	***participant***	(Braito et al., 2017)
	33	When dealing with my soil I have a responsibility for nature	***steward***	(Braito et al., 2017)
	34	When dealing with my soil I do not think about nature	***apathy***	(Braito et al., 2017)

	Most disagree								Most agree
Ranking value	-4	-3	-2	-1	0	+1	+2	+3	+4
Number of statements	(2)	(3)	(4)	(5)	(6)	(5)	(4)	(3)	(2)

Fig. 1. Forced choice distribution.

understand the sorting instructions (despite efforts to resolve the misunderstanding) and we could thus not trust his ranking. In a first step, we correlated all *Q sorts* to reflect the relationship of each *Q sort* to every other *Q sort* (Watts and Stenner, 2005) and to identify the degree of similarity between any two *Q sorts* (ranging from -1 to +1) (Brown, 1993). Next, we factor-analyzed the correlation matrix applying a Principal Component Analysis (PCA) with a Varimax Rotation, in order to detect patterns among the *Q sorts* and to extract different viewpoints (Schmolck, 2002; Walder and Kantelhardt, 2018). In contrast to regular PCA, *Q Methodology* correlates respondents instead of variables in order to detect relationships between them. This results in a small number of combinations of sorted statements, so-called factors. A factor is "the weighted average *Q sort* of a group of respondents that responded similarly" (Zabala and Pascual, 2016). The loadings of the initial *Q sorts* on these factors describe to which extent a participant corresponds – positively or negatively – with each viewpoint (Schmolck, 2002).

We only extracted factors if (a) their Eigenvalue was larger than one, (b) they were defined by at least two Q sorts, and (c) if they reasonably reflected the real world (Watts and Stenner, 2005). While (a) and (b) helped us to identify the minimum number of factors, we used (c) to narrow the number of factors down to a quantity that still allowed us meaningful interpretations; a process that we did in a small workshop setting with all co-authors of this article. As a result, we extracted four factors representing different viewpoints on soil management. In order to obtain the best result, we first 'flagged' associated factors and *Q sorts*. Second, we raised the suggested significance threshold value for a *Q sort* from ± .50 (Brown, 1993) to ± .55 to assure a higher resemblance of the loading *Q sorts* to the respective factor array. And third, we excluded *Q sorts* from defining a factor if their factor loadings for a second factor was higher than the calculated significance level of the study[2] (at $p < .01$). We only excluded the *Q sorts* from defining the factors, not the post-sorting interviews of the farmers. The software-defined Varimax rotation accounted for a total explained variance of 67 %, with 18 uniquely and significantly loading *Q sorts*. To increase the amount of loading *Q sorts*, we rotated the results modestly by hand and were able to increase the loading *Q sorts* to 23 by keeping the total explained variance constant at 67 %.

The final result of a Q Methodological study is a set of narrative descriptions of the viewpoints that exist among the participants. These descriptions are based on a qualitative interpretation of the quantitative results (e.g., the factors) and of the transcribed post-sorting interviews.

3. Results

Table 2 shows the factor loadings of all Q sorts (farmers) for the four extracted factors. The correlation scores indicate that factors were less distinct than expected. We considered alternative solutions with fewer factors, but settled for the four-factor solution, as it provides valuable insights into the nuances that separate viewpoints, which might at first glance appear similar. Moreover, we attribute the high correlations to our narrow subject of investigation as well as the by-hand rotation. However, we also make use of the commonalities and analyze the statements that all factors view similarly.

Table 3 describes the characteristics of the whole sample and each factor. Respondents were, on average, 46.6 years old and had an average of 16 years of farming experience. The average farm in our sample covered 101 ha. Thirty respondents (91 %) were male farmers; three were women. The majority of the respondents completed

Table 2
Q sorts (farmers) factor loadings (bold scores indicate that the Q sort defines the factor).

Q sort	Factor 1	Factor 2	Factor 3	Factor 4
1	0.41	0.38	**0.55**	0.08
2	0.37	0.34	**0.68**	−0.09
3	0.20	0.13	**0.68**	−0.01
4	0.42	−0.02	0.23	**0.59**
5	**0.64**	0.35	0.24	0.38
6	0.29	0.31	**0.59**	0.35
7	**0.73**	−0.23	0.26	0.20
8	**0.72**	0.21	0.43	−0.05
9	**0.71**	0.33	0.27	0.21
10	0.39	0.11	0.54	0.55
11	0.44	**0.63**	0.25	0.22
12	0.51	0.03	0.61	0.21
13	0.24	−0.01	0.38	**0.75**
14	0.11	0.09	**0.76**	0.24
15	0.63	0.46	0.41	0.27
16	**0.72**	0.15	0.22	0.18
17	0.26	0.54	0.21	0.54
18	0.01	**0.87**	0.17	0.06
19	0.42	0.31	0.40	0.54
20	**0.58**	0.29	0.22	0.43
21	**0.75**	0.17	0.24	0.22
22	0.55	0.07	0.48	0.00
23	0.25	0.57	0.26	0.54
24	0.58	0.47	0.22	0.30
25	**0.61**	0.14	0.17	0.18
26	0.50	0.31	0.25	0.48
27	0.31	0.45	0.47	0.35
28	**0.71**	0.07	0.13	0.29
29	**0.66**	0.44	0.11	0.29
30	**0.62**	0.42	0.15	0.32
31	0.34	0.39	0.06	**0.73**
32	**0.67**	0.14	0.32	0.34
33	0.06	−0.01	**0.66**	0.27
Number of defining *Q sorts*	12	2	6	3
Explained variance in %	26	12	16	13
Eigenvalue	8.91	3.96	5.28	4.29
Correlation between factor scores				
Factor 1		0.42	0.64	0.68
Factor 2			0.46	0.35
Factor 3				0.54

vocational education (55 %). Twenty-seven respondents (82 %) were full-time farmers, fourteen grew field crops (42 %) exclusively, while the other nineteen (58 %) ran mixed farming systems, and nine (27 %) were organic farmers.

As Table 3 shows, we were quite successful in selecting demographically diverse respondents who supposedly hold diverse viewpoints. Although different databases do not allow a direct comparison to the overall population of Austrian (arable) farmers, we provide, for the curious reader, the following information that can be found in BMLFUW (2019). According to the farm accountancy data network (which excludes very large and small farms), the median Austrian farmer is between 45 and 49 years old and the average crop farmer in this network manages approximately 50 ha of cropland. According to agricultural beneficiaries data, women operate about 25 % of crop farms (which may be biased upwards due to retirement insurance reasons). Around 50 % of the Austrian farms are run full-time (although this share is likely to be higher for crop farms) and 21 % are organic farms. No comparable data are available for farmers' educational level, years of farming experience, and share of direct marketing.

Table 4 describes each factor as a hypothetical Q sort and lists each statement with its respective rank it would have on the Q distribution.

[2] For $p < .01$: 2.58* (1/√number of items in the Q set) = .44 for our study.

Table 3
Respondents' characteristics.

	full sample	F1	F2	F3	F4
Number of farmers	33	12	2	6	3
Age [mean] (min-max)	46.6 (24 – 69)	46.4	30.5	47.5	53
Experience as a farmer [mean years] (min-max)	16.3 (0 – 43)	17	3.5	18.5	23
Farm size arable land [mean ha] (min-max)	100.8 (6 – 800)	88	122.5	96.3	15
Gender (male)	30 (91 %)	11	2	6	2
Level of education					
Vocational	15 (45 %)	5	2	3	2
Secondary	11 (33 %)	4		3	
University	3 (9%)				1
Other/unknown	4 (12 %)	3			
Full-time farmers	27 (82 %)	10	2	5	3
Type of farming					
Field crops only	14 (42 %)	5	1	2	1
Mixed farms	19 (58 %)	7	1	4	2
Of which:					
Cow (dairy)	6 (18 %)	4	–	1	–
Cow (fattening)	2 (6%)	–	–	–	1
Pig	10 (30 %)	3	1	3	1
Poultry	1 (3%)	–	–	–	–
Organic farming	9 (27 %)	3	1	–	2
Direct Marketing	11 (33 %)	4	–	2	3

Table 4
List of statements and factor scores.

		Statements[b]	Factor scores[a]			
			F_1	F_2	F_3	F_4
Farmer	1	pleasure	2	2	1	4
	2	freedom	−2	3	−1	2
	3	time availability	−3	−4	−4	**1**
	4	training	2	3	2	**−1**
	5	traditional knowledge	−1	**3**	−1	0
	6	education	1	0	3	2
	7	*health*	*0*	*0*	*0*	*1*
	8	openness to change	1	0	0	0
Farm	9	profitability	−1	1	**4**	0
	10	distance	−1	−1	−3	−2
	11	*tenure security*	*−2*	*−3*	*−2*	*−2*
	12	avoid expensive investments	−3	−4	−1	0
	13	risk	−1	0	1	−1
	14	responsibility for workers	0	**2**	−3	−1
	15	tidy plots	**−1**	4	2	1
Socio-institutional context	16	future generations	3	1	2	2
	17	coordinate with neighbors	−3	−2	−4	−4
	18	care for neighbors	1	−2	1	1
	19	customers' expectations	0	2	−2	−1
	20	society's expectations	0	0	−2	−1
	21	food provision	1	**3**	0	**−2**
	22	gossip	−4	−2	−3	−3
	23	depend on AES	−2	−2	0	−2
	24	guided by AES	0	−1	−1	−3
	25	others' knowledge	0	**−3**	−1	0
	26	laws & sanctions	−2	−3	**0**	−4
Natural context	*27*	*natural conditions*	*2*	*1*	*3*	*2*
	28	natural influences	2	0	1	0
	29	weather	4	1	4	3
	30	master	1	**−2**	1	1
	31	partner	3	2	2	4
	32	participant	4	−1	0	3
	33	steward	3	0	3	2
	34	apathy	−4	−1	−2	−3

[a] Distinguishing statements ($p < 01$) are marked in bold.
[b] Consensus statements ($p > .01$) are given in italics.

Particularly interesting are statements ranked at the two extremes (± 4 and ± 3), but also those that are ranked higher or lower than by any other factor. Additionally, Table 4 shows distinguishing statements that are differentiating the respective factor from the other factors statistically, and consensus statements, which are statements that are similar across all factors.

Next, we characterize each viewpoint shared by farmers in each factor. The numbers in parentheses refer to the statements that potentially influence farmers' soil management (Table 1) and their respective position in the hypothetical *Q sorts* (Table 4). Interviewees are quoted using their internal ID (P 1–33).

3.1. Nature Participants (F1)

In the first factor, we see farmers who emphasize their closeness to nature and their keenness to improve their soil management. We thus label them *'Nature Participants'*.

In terms of HNR, these farmers see themselves as part of nature (32: +4), work together with nature (31: +3), feel responsibility for nature (33: +3), and they firmly reject willful ignorance of nature (34: -4). Consequently, this is reflected in their stewardship for future generations (16: +3), as illustrated by one farmer who explains that *"[soil and] farm are only borrowed from future generations"* (P 16). In contrast, profitability is comparatively unimportant for this viewpoint (9: -1), as *"profitability results automatically anyway [from proper soil management]"* (P 29). The focus on nature of *Nature Participants* is underlined by the fact that weather is one of the most critical determinants of their soil management (29: +4), as are the natural conditions of a plot (27: +2). Therefore, proper soil management can even help to mitigate damages by natural influences such as climate change or pests (28: +2).

Compared to the other viewpoints, *Nature Participants* care least about their freedom as farmers when managing their soils (2: -2). Instead, they care more than others about societal expectations of how soil should be managed (20: 0), and less about their reputation, such as gossip (22: -4) or the appearance of their plots (15: -1). Farmers sharing this viewpoint are slightly more positive about trying new things than others (8: +1) and do not shy away from making investments (12: -3; 13: -1). Consequently, these farmers value experts' knowledge (4: +2) and are neutral about colleagues' experiences (25: 0). To improve their soil management, *Nature Participants* rely less on traditional knowledge than others (5: -1). They are indifferent about AES being useful guidance (24: 0), which they do not see as something that determines their soil management (23: -2).

3.2. Traditional Food Providers (F2)

In the second factor, we see farmers whose view on soil management is influenced by productivism together with a concern for socio-institutional expectations. We thus label them *'Traditional Food Providers'*. Literally all nature-related statements are ranked lower by this group than by any other, indicating that these farmers' HNR are of minor importance for their soil management (30: -2; 31: +2; 32: -1; 33: 0; 34: -1). Correspondingly, the natural conditions of a plot (27: +1), as well as the weather (29: +1), are of little importance to their soil management practices. What matters is to provide food for society (21: +3), as *"the provision of food is something beautiful for every farmer"* (P 11). To do so, *Traditional Food Providers* do not shy away from expensive investments (12: -4) and do not see themselves as time-constrained in their optimal soil management (3: -4).

Social norms and values, however, are more influential to this perspective than to any other: customers' expectations (19: +2) and a responsibility towards employees (14: +2) are important, but not the coordination with neighbors (17: -2). This translates to farmers' care of having tidy and neat plots (15: +4), so that *"[a plot] is also attractive for the eye"* (P 18), and they disagree less than others that they avoid doing things that would cause gossip (22: -2). Thus, gossip is slightly more

relevant for them than for others. Moreover, this viewpoint is least influenced by tenure security (11: -3). One interviewee underlines the strong personal norms that characterize this viewpoint, stating that treating all land equally, irrespective of its tenure status, is "*somewhat a little code of honor*" (P 11).

Compared to other viewpoints, *Traditional Food Providers* rely strongly on traditional and passed-on knowledge (5: +3) as well as training by professionals (4: +3). In comparison, their education (6: 0) and experiences of colleagues (25: -3) play minor roles. For this viewpoint, their freedom as farmers is of great importance (2: +3). Correspondingly, AES (23: -2) or laws (26: -3) are not of much concern.

3.3. Profit Maximizers (F3)

In the third factor, we see farmers whose view on soil management is influenced by economic considerations. We thus label them *'Profit Maximizers'*. Indeed, economic viability as a driver for soil management is ranked highest by this viewpoint (9: +4). One interviewee brought this to the point: *"the soil is important for profitability […] [and] without profitability, you are gone"* (P 33). Like *Nature Participants*, farmers with this mindset also regard the biophysical conditions of a plot and the weather as significant determinants for their soil management (27: +3; 29: +4;). Concerning farmers' relationship with nature (i.e., their HNR), *Profit Maximizers* agree most with having responsibility for nature (33: +3), but they do, to a lesser degree than farmers of the other groups, understand themselves as collaborating with nature (31: +2) and they feel least as part of nature (32: 0).

Profit Maximizers are not much influenced by others, such as customers' (19: -2) or societies' (20: -2) expectations, and values such as responsibility for employees (14: -3). One interviewee even commented on the statement of societal expectations (20) that *"they all have no idea – unfortunately"* (P 14). Likewise, coordination with neighbors is not considered necessary at all (17: -4), and passed-on knowledge (5: -1) is less important than their education about or experience with soil management (6: +3). *Profit Maximizers* are, like others, relatively risk-neutral (13: +1) and place less value on the pleasure derived from soil management than others (1: +1).

In contrast to the other groups, *Profit Maximizers* do not disagree that laws and sanctions (26: 0) or agri-environmental schemes (23: 0) influence their soil management. They do not see why time (3: -4) or the distance between a plot and the farmhouse (10: -3) should influence their soil management.

3.4. Pleasure Seekers (F4)

In the fourth factor, we see farmers whose view on soil management is similarly driven by environmental aspects as *Nature Participants*, but who are distinctive in their self-reliance and focus on freedom and pleasure. We thus label them *'Pleasure Seekers'*. Farmers sharing this viewpoint agree strongly that their HNRs are influential for their soil management, such as working together with nature (31: +4) and feeling like a part of nature (32: +3). A second prominent determinant of their soil management is the search for pleasure or joy (1: +4).

In addition, *Pleasure Seekers* value their freedom (2: +2) and do not see their soil management as influenced by laws and governmental sanctions (26: -4) or dependent on AES (23: -2). Coordination with neighbors is also a non-issue (17: -4), as is potential gossip (22: -3). Consequently, this viewpoint sees their own education and experiences (6: +2) as essential for soil management and seeks less training and education by professionals than others (4: -1). This might be related to the fact that that these farmers appear the only ones that feel slightly time-constrained (3: +1).

Moreover, in comparison to the others, this viewpoint is more cautious about making expensive investments (12: 0). According to one interviewee, *"they [other farmers] have to invest over and over again […] the investment is not even repaid, and they have to do the next one. They are stuck in a rat race"* (P 4). This again emphasizes striving for freedom, here from a financial perspective. *Pleasure Seekers* disagree that the provision of food gives meaning to farming and soil management (21: -2).

4. Discussion

The aims of this study were twofold: (a) to gain a deeper understanding of farmers' viewpoints on their soil management in order to (b) support policies that strive to address and crowd-in farmers holding different views. By applying *Q Methodology* with Austrian arable farmers, we identified four different viewpoints related to their soil management.

Before discussing the four viewpoints and our suggested policy implications, we acknowledge the specific context of this study. First, it is essential to remember that while most studies focused on farmers in general, we focused on farmers with cropland only, and thus, excluded livestock farmers. The latter may hold specific viewpoints, given that – at least in Austria – they usually farm in alpine, marginal areas. Whatsoever viewpoint they hold, their soil management differs substantially from that of arable land farmers, not least as pastures and grassland require entirely different measures to prevent erosion or degradation. Second, the socio-ecological and institutional context of farming in Austria differs substantially from countries with other climatic and geographic conditions or countries with other institutional settings and histories (e.g., countries with formerly collectivized agriculture). Consequently, this may not only influence farmers' mindsets but also their approach to farming in general. Nevertheless, and as our comparison will show, parallels exist, allowing us to draw conclusions about the relationships of farmers' mindset and their soil management.

Although the four viewpoints are distinct and differ in fundamental aspects, we found some considerable parallels. The most apparent similarity across all viewpoints is that farmers align their soil management to the biophysical environment of their plots and – all except the *Traditional Food Providers* – place great importance on weather conditions. This is hardly surprising, as farmers are, after all, working closely in and with their natural and biophysical environment (Bielders et al., 2003; Prager and Posthumus, 2011; Tanentzap et al., 2015). Moreover, and confirming Leonhardt et al. (2019), farmers across all viewpoints do not care how long they will continue to farm a plot. Accordingly, farmers do not consider plots that they may have to give up or cease to farm in the future as any different in their soil management. Less obvious, our results reveal that farmers state to be quite resistant to social pressures such as gossip across different viewpoints, except the *Traditional Food Providers*. Also, less anticipated, our study shows that monetary policy instruments such as AES have, according to the interviewees, little influence on farmers' soil management. Although partly discussed in the literature (Gowdy, 2008; Howley et al., 2015), it raises questions about the effectiveness of such monetary policy instruments.

4.1. Ecocentric versus anthropocentric viewpoints on soil management

Apart from the similarities mentioned above, the analysis of the Q sets identified four different mindsets regarding soil management. Some farmers have a close connection with nature and align their soil management with nature's needs and thus can be considered to share an **ecocentric viewpoint** (*Nature Participants*, *Pleasure Seekers*). Others have a more distant relationship with nature and rather align their soil management with their own needs and goals of producing food or being economically efficient, and therefore share an **anthropocentric viewpoint** (*Traditional Food Providers*, *Profit Maximizers*).

The mindset of ***Nature Participants*** resembles the *Environmental Stewards* described by Brodt et al. (2006) and is comparable to the *Environmentalists* (Davies and Hodge, 2007), or the *Diversity-Maintaining* viewpoint (Walder and Kantelhardt, 2018). We found that the

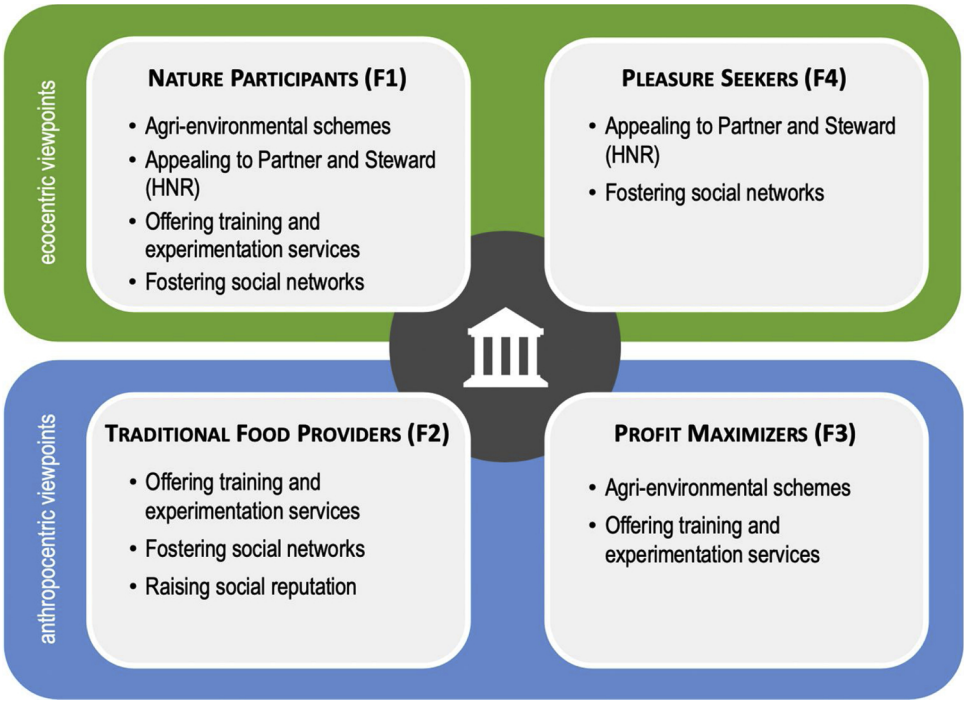

Fig. 2. Policy categories aligned with the four mindsets.

respective farmers are keen to improve their soil management, even if investments are expensive. They have a close relationship with nature, care for it, and acknowledge it as a resource that needs to be conserved for future generations (Ryan et al., 2003). Most of our respondents rather disagreed with a guidance effect of AES, i.e., knowledge-provision by AES independently of participation (Wilson and Hart, 2001) – the *Nature Participants* neither agreed nor disagreed.

Pleasure Seekers share a combination of environmental and self-centered attributes. Quite distinctly, farmers with this mindset manage their soil with a view to personal enjoyment and pleasure. They value their freedom as farmers and consequently do not adapt their soil management to laws or governmental sanctions. This viewpoint is not commonly described in the literature. However, it shares some aspects of the *Idealist* farming type (Schmitzberger et al., 2005). *Pleasure Seekers* rely strongly on their own experiences. It is, therefore, perhaps not surprising that they not only reject training and extension services as a source of soil management knowledge but are also resistant to external influences such as AES, apart from customers' expectations. Moreover, farmers with this mindset care little about societal expectations, do not coordinate much with neighbors and do not care about gossip. According to previous studies, these observations might be related to these farmers' age (Atari et al., 2009; Burton, 2014; Siebert et al., 2006). Regarding farmers' disregard of society, Mills et al. (2017) suggest that this might be related to public discussions, which often tend to accuse agriculture of unsustainable practices, painting a negative picture of farmers. *Pleasure Seekers* are the only ones that would manage their soil differently if they had extra time. While we cannot draw any conclusions with regard to demographic information due to the qualitative nature of the data collection process, it would be interesting to see whether *Pleasure Seekers* tend to have a particular business approach that is time-consuming (such as direct marketing), or whether they tend to be part-time farmers.

In contrast to the two ecocentric viewpoints, the ***Traditional Food Providers*** appear to be least connected to nature. Farmers with this mindset share strong traits of tradition, a focus on food production, and consider their relationship with nature less important than any other viewpoint. Other studies discuss similar viewpoints, such as *Production Maximizers* (O'Rourke et al., 2012) or *Yield Optimizers* (Schmitzberger et al., 2005), all of which put production or agribusiness ideals (Burton and Wilson, 2006) above nature conservation or environmental ideals. They understand themselves as important actors who provide food for society and in the interviews often referred to the need for providing nutrition for an ever-growing world population. In addition, these farmers strive to live up to what is traditionally perceived by many as a 'good' farmer in terms of aesthetics: they aim to have aesthetically well-maintained plots, which is believed to communicate land-use skills (Burton, 2004). As a result, *Traditional Food Providers* might be attracted by practices they consider as aesthetically pleasing or relevant for 'agricultural productivism' (Burton, 2004; Carlisle, 2016). Moreover, *Traditional Food Providers* are open to acquiring new soil management practices. They take passed on knowledge as a starting point or rely on their own first-hand experience (Carlisle, 2016) but are willing to learn more through training and extension services.

Among all four viewpoints, the ***Profit Maximizers*** have the most definite focus on their farms' efficiency and economic viability. This viewpoint resembles the *Commodity Conservationists*, identified among arable farmers in the UK (Davies and Hodge, 2007). Farmers with this mindset do consider their relationship with nature important but act on this relationship by focusing on economic considerations in their soil management. They appear to be the only ones in our sample who do not reject policies and regulations as being irrelevant for their soil management. This supports the argument of Pavlis et al. (2016) that economic motivations and income benefits are the primary motive for (some) farmers to participate in AES. However, it could also mean that these business-oriented farmers come closer to conflict with legal minimum requirements, which is why they consider the legal standards more critical than other farmers. Since Profit Maximizers consider nature's impact on farm's profit and soil's functionality, farmers with this mindset are most straightforward to access by policies that address both these attributes: focus on economic considerations, but stressing a practice's benefits for soil conservation.

4.2. A suggested policy mix to reflect the plurality of farmers

In the following and based on our results, we suggest considering a bundle of policy instruments to reflect an inclusive governance

perspective. As farmers' viewpoints are not directly observable and policymakers need to treat all farmers equally, only a mix of policies can address and crowd-in all mindsets. Moreover, due to the nature of our research design, we do not know the actual soil management of our interviewees and if and to what degree it is socially suboptimal. Therefore, our recommendations point to the need for a policy mix but do not indicate if the policies implemented in Austria are adequate to address soil conservation on the farms analyzed.

In line with Dessart et al. (2019), who recommend a mix of policies based on voluntary and mandatory adoption of soil conservation, we suggest a combination of the five policy categories, as shown in Fig. 2. Albeit not an outcome of systematic policy analysis, the five suggested policy categories integrate the knowledge and insights that we gathered during the whole research process: literature review, interviews with stakeholders from public authorities (ministry of agriculture, agricultural county administration), extension services (chamber of agriculture), and an environmental NGO, as well as the post-sorting interviews with respondents of the *Q Methodology*.

4.2.1. Agri-environmental schemes

We examined two potential effects of AES, and find evidence that both apply to a limited extent. First, AES can have a direct behavioral effect for *Profit Maximizers* and an indirect behavioral effect through knowledge transfer for *Nature Participants*. However, farmers of the two other groups do not see AES as an essential factor for their soil management. We see two potential explanations for this. First, Austria has chosen an AES strategy that is "broad and shallow", i.e., attractive to many farmers, but with less targeted environmental impact than "narrow and deep" schemes (Zimmermann and Britz, 2016). As a result, farmers' production systems may, especially in marginal areas, comply with AES requirements a priori. This may encourage farmers to sign up for the scheme without requiring them to change their soil management. Consequently, such farmers do not consider AES schemes as influencing their behavior. Second, AES have a long history in Austria, and farmers may thus have changed their soil management long ago. Thus, this AES supported soil management is already internalized and habitual, and thus farmers may not consider it to be influenced by AES. The literature is, however, ambiguous – while some question the long-term effect of AES in shifting farmers' attitudes towards more "green thinking" (Karali et al., 2014), others have found evidence that AES can induce attitudinal changes across participating farmers (Mason and Holmes, 2015; Riley, 2016). Whatever the effect might be, some farmers mentioned in the interviews that they started to recognize the value of policy-induced soil management practices after implementing it. Thus, the participation in AES induced a shift towards more environmentally friendly attitudes for some. Nevertheless, we suggest complementing AES with the following policy instruments, in order to reduce their dominance in agricultural policy strategies and potentially induce more profound behavioral changes.

4.2.2. Appealing to Partner and Steward (HNR)

Our study confirms that individuals (in our case farmers) hold multiple HNR (Fig. 3), as suggested by Flint et al. (2013). Similar to Yoshida et al. (2018), we find that the majority of farmers agree with the rather ecocentric HNR concepts such as the *Partner*, the *Steward*, and, although more ambiguous, the *Participant*. In contrast to previous studies, we find that our interviewed farmers can relate to the HNR concept of the *Master*, as set-out in its theoretical foundation (Muhar and Böck, 2017). So far, however, in most empirical HNR studies, the *Master* mostly got rejected by study participants (Braito et al., 2017; de Groot et al., 2011); or was identified to a lesser, weaker extent (Yoshida et al., 2018). We assume that farmers are more aware than the overall population of their potential to "master" nature – simply because their job is shaping nature.

Our study further confirms that individuals' (in our case farmers') relationship with nature is an essential behavioral determinant (in our case of soil management), as suggested by Braito et al. (2017). Therefore, we recommend policymakers to be sensitive to the HNR concepts in their policy framing, in order to avoid secondary effects of attracting or deterring certain individuals. For instance, a purely business-oriented policy framing would correspond to the HNR concept of *Apathy*, which implies that farmers do not relate to nature and which was rejected by all viewpoints in our study (Fig. 3).

However, we are aware that framing policies in terms of HNR is not an easy endeavor, and policies with unidirectional framings, such as addressing only one HNR type, run the risk of excluding other HNR orientations. Therefore, and based on our results (Fig. 3), we recommend the following strategy. First, policymakers should consider the diverse array of HNR in framing the policy's message to reflect that farmers hold multiple HNR. Second, we suggest appealing to the benefits particular practices have for nature and farmers' more ecocentric HNR concepts of the *Steward* or *Partner*, which, according to our results, would crowd-in all farmers.

4.2.3. Offering training and experimentation services

Another insight from this study is that training services are likely a promising way of encouraging farmers' soil conservation behavior. Our groups of farmers are, in general, willing to expand their knowledge and adopt different information channels. Passed-on knowledge about soil management serves in some cases as a starting point, while for others it is their previous education and experience. Almost all farmers are keen to expand their knowledge on soil management through training, whether for the sake of nature or for improving their economic efficiency. Thus, extension services are natural instruments to spread innovative and sustainable soil management practices, and could, for instance, be complemented by voluntary on farm-experiments, where farmers share hands-on knowledge. Given that many AES require applicants to attend training courses anyway (BMLFUW, 2017), training services for those farmers not participating in AES appear beneficial. Making training services attractive to all farmers may be challenging (Knierim et al., 2017), but good-practice examples exist (Ingram and Mills, 2019). In this regard, it could be wise to complement traditional approaches with internet-based services, smartphone-apps, or social media platforms to attract farmers that may be less inclined by traditional communication or training channels. According to Mills et al. (2019), Twitter could be used, for instance, to support on-farm experiential learning and adaptation.

4.2.4. Fostering social networks

Previous research has stressed the importance of social networks for the adoption of soil conservation practices (Coughenour, 2003) and has highlighted the importance of early adopters for the diffusion of practices in a region (Morton and McGuire, 2011; NWF (National Wildlife Federation), 2012. Targetti et al. (2019), for instance, acknowledge social networks among farmers as a catalyst for efficient adoption of environmentally-friendly practices.

However, in our study, all viewpoints share a rejection of coordination with neighbors, except when it comes to avoiding adverse impacts. And while the appearance of plots to others matters somewhat to some groups of farmers, judgment in the form of gossip is considered irrelevant by most viewpoints. Regarding farming communities, the experiences of colleagues are considered somewhat irrelevant by two viewpoints, and the *Nature Participants* and *Pleasure Seekers* are indifferent. However, to address these two groups, it may still be helpful to use social networks, as they may be difficult to reach otherwise. Moreover, *Nature Participants* may play a unique role as early adopters of new technologies and soil management practices who can share their knowledge. Relevant policies worth mentioning include organized settings for group learning such as regular meetings on soil erosion as currently organized by Austrian extension services, or study groups of interested farmers, supervised and supported by local extension agents. Collaborative AES as suggested by Prager et al. (2012); Prager (2015)

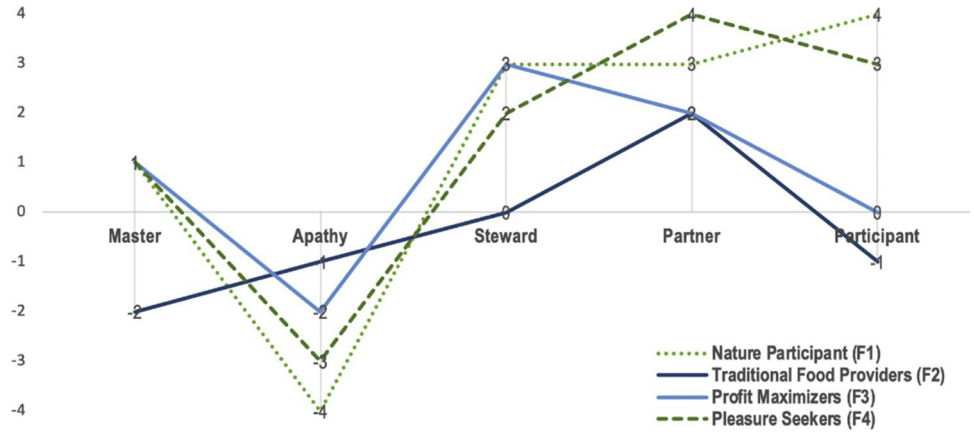

Fig. 3. (Dis-)agreement with HNRs among the four viewpoints on soil management.

and McKenzie et al. (2013) may be another option.

In this regard, it could be beneficial to make use of farmers' social contacts and their already existing networks. In our study, for instance, *Traditional Food Providers* take their customers and employees into account when managing their soils. Thus, appealing to the positive effects, e.g., in communication with these stakeholders, that soil management practices may have, could resonate with some farmers. This links with the following point, addressing farmers' reputation in society.

4.2.5. Raising social reputation

With regards to meeting expectations of society in their soil management, the farmers of our study largely responded as unwilling or indifferent. Several farmers commented on this statement that they feel like "*society often has absolutely no idea what we farmers do*" (P 7), or that "*society expects so much and has no idea*" (P 14). Others shared that they feel like farming has a wrongly negative reputation. Both are reasons for not caring about society's expectations. Thus, there appears to be a divide and lack of understanding between farmers and society that prevents farmers from taking society's interests into account. However, previous research has shown that norms have the potential to actively inform farmers' pro-environmental behavior (Fang et al., 2018; Mills et al., 2017). Raising farmers' social reputation, enabling communication between both sides, and thus closing the observed cleavage between some farmers and broad society might then help to make such society-averse farmers again reachable through social norms – at least those who are not primarily driven by their strive for freedom and independence. Thus, as some farmers were found to undertake pro-environmental land-use practices because they felt obligated to do so, and as it contributes positively to their societal image (Mills et al., 2017), this approach might also appeal to farmers with pro-societal norms.

Feasible ways to strengthen farmers' reputation are advertisement campaigns. In Austria, this is, for example, done by an agency that is also responsible for agricultural market research, quality control, and AES payment administration. Farmer-led approaches include offering farm visits to the general public or for schools, farmers visiting schools to talk about their approach to farming, and extension agencies providing online information and teaching materials to teachers and the interested public.

5. Conclusions

With this study, we aimed to identify farmers' viewpoints on their soil management. Ultimately, this helped us to derive applicable policy recommendations that consider the plurality of farmers' motivations across contexts. We unraveled the pluralism of farmers' viewpoints on soil management among Austrian arable farmers in the Austrian (and European) policy context by applying *Q Methodology*. We adapted existing and helpful categorizations and frameworks and derived our own operationalization of the vast number of behavioral determinants that influence farmers' soil management.

Our study shows that farmers are a very diverse group. They consider nature and society next to – and sometimes over – outputs and income, and they differ in their preferences and priorities. We have identified some of these preferences that are shared by groups of farmers, such as stewardship for nature, or personal pleasure and freedom.

We identified four distinct viewpoints on soil management among Austrian farmers, two of which can be considered ecocentric, while the other two tend to be anthropocentric. Using these different viewpoints or mindsets as a starting point, we then related five different policy strategies to these groups. We suggest that only a mix of policy approaches might achieve the target of addressing all farmers' mindsets, and by doing so, avoid adverse effects of excluding or crowding out farmers. As for future studies, we suggest acknowledging viewpoints such as that of *Traditional Food Providers* and *Pleasure Seekers*. Both viewpoints are distinct from the other viewpoints, but less commonly described in the literature and, thus, might merit more attention.

Due to the nature of *Q Methodology*, we cannot draw any conclusions concerning the prevalence of these viewpoints in the general farmer population, and neither can we provide suggestions on how to identify these groups based on demographics. Since these are questions of interest, a follow-up quantitative study would be of great use. Nevertheless, we have made a first step in characterizing Austrian crop farmers and identifying the range of viewpoints among them, such that future research and soil conservation policies can build upon our foundation.

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CRediT authorship contribution statement

Michael Braito: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Heidi Leonhardt:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Project administration. **Marianne Penker:** Conceptualization,

Methodology, Resources, Writing - original draft, Supervision, Funding acquisition. **Elisabeth Schauppenlehner-Kloyber:** Methodology, Formal analysis, Investigation, Writing - original draft. **Georg Thaler:** Formal analysis, Investigation, Writing - original draft, Visualization. **Courtney G. Flint:** Methodology, Writing - original draft.

Declaration of Competing Interest

We declare no conflicts of interest associated with this work.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.landusepol.2020.104876.

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