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A farm typology for North Rhine-Westphalia to assess agri-environmental policies

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Abstract

The use of farm models to analyze agri-environmental policies requires selecting farms which can be hypothetical, typical or observed ones. Farm typologies, understood as a grouping of farms according to relevant farm characteristics, allow selecting most prevailing farm types for a modelling exercise. Thereby, a farm type represents a share of the real-word farm population. We develop a farm typology for the German Federal State of North Rhine-Westphalia based on the Farm Structure Survey 2016. It is designed to assess the revision of the German fertilization regulations in 2017 by applying a combination of a bio-physical crop model and a bio-economic farm model. The derived typology covers 77% of farms in North Rhine-Westphalia and comprises 210 farm types. Farms are grouped according to specialization, size in relation to area, and stocking density. In addition, a typical crop rotation is defined for every specialization in the nine soil-climate regions of North Rhine-Westphalia. We show that the proposed typology provides the necessary information for the selection of farm types as well as for the model initialization and parameterization in the described modelling exercise. Furthermore, we provide the information to adapt and extent the typology to similar research questions and upcoming Farm Structure Surveys. The incorporation of expert knowledge to identify farm structures which are not captured by the official statistic could improve the typology.

Keywords: farm typology, farm type, typical farm, farm modelling, North Rhine-Westphalia, Germany

JEL classification: Q12, Q19

1 Introduction

A vast number of farm (level) models emerged in the last years and is frequently used in policy analysis with various foci (Reidsma et al. 2018, p. 113f.). Their strength is, amongst others, the ability to capture heterogeneity across farms and the interaction between different farming activities, the environmental impact and the economic performance (Blanco 2016, p. 2). However, a crucial decision is the selection of the modelled farms. Based on the research focus and data availability, different approaches exist. First, studies dealing with more general research questions tend to assess hypothetical farms, typically derived from a thin data base and expert knowledge, and not from a known farm population (e.g. Lengers et al. 2013, p. 460). Second, application of farm models to case studies typically cover exemplary farms (e.g. van Calker et al. 2004, p. 149f.). Third, farm models can be applied to farms selected from a typology (e.g. Belhouchette et al. 2011, p. 138) or, forth, for a representative sample of a farm population (e.g. Mack & Huber 2017, p. 35).

A farm typology is understood as a grouping of farms according to farm characteristics which are of importance for the addressed research question. Thereby, every derived group of farms within the typology forms a so-called farm type. Hence, a modelled farm related to such a farm type is thought to represent a number of real-world farms of the underlying data.

There are two basic methodological approaches in literature with regard to farm typologies: the expert approach and the analytical approach (Mądry et al. 2013, p. 320). In some cases, both approaches are combined (e.g. Caballero et al. 2008, p. 191f.). The expert method relies both on official statistics and expert knowledge. When comparing studies using that approach, two partly overlapping groups can be found. The first one uses expert knowledge to arrange farms into groups and relies on official statistics for farm characteristics (e.g. Gocht & Britz 2011, p. 149f.; Andersen et al. 2007, p. 355ff.). The second group uses expert knowledge in addition as a relevant data source for farm characteristics (e.g. Zimmer & Deblitz 2005, p. 2; Budde 2013, p. 87). In studies following the analytical approach,

statistical methods such as combinations of factor and cluster analysis are used for grouping farms (e.g. Köbrich et al. 2002, p. 143f.; Sierra et al. 2017, p. 174).

This paper provides an expert-based farm typology for the German Federal State of North Rhine-Westphalia (NRW). The typology is used to assess the revision of the German Fertilization Ordinance in 2017 (BMEL 2017) with the bio-economic farm-scale optimization model Farmdyn (Britz et al. 2018). For this purpose, Farmdyn is connected to the bio-physical crop modelling framework Simplace (Gaiser et al. 2013, p. 7) which requires the regional location of farm types to define soil and climate conditions. The derived farm typology firstly allows selecting the most frequent farm types for the modelling exercise. Secondly, it enables assessing the relative importance of selected farm types in the farm population when modelling the most affected instead of the most frequent farms. Thirdly, it provides necessary variables and parameters for the modelling exercise.

The presented farm typology is largely based on the German Farm Structure Survey (FSS) from 2016 which provides single farm data for all farms in Germany above a minimum threshold size. However, the use of single farm data is subject to strict data protection standards (Statistische Ämter des Bundes und der Länder 2017, p. 16 ff.) to which the developed typology adheres. The study at hand provides all necessary information to easily renew the typology for upcoming FSS or extend the typology to address different research questions. Hence, it can serve as a guideline for the future use of the FSS.

The paper is structured as follows: Chapter 2 introduces the developed farm typology and the used data sources. In chapter 3, the results of the farm typology are exemplarily presented for specialized cereal and pig fattening farms. Chapter 5 briefly discusses the typology and concludes. The appendix contains extended results of the typology as well as the syntax for reproducing the analysis.

2 Concept of farm typology

To derive a farm typology for NRW, we adapt the methodology applied by Andersen et al. (2007). Farm types are created by grouping farms from official

agricultural statistics with regard to relevant farm characteristics. The definitions of the groups are based on expert knowledge, whereas the farm characteristics are derived from official statistics.

2.1 *Data Source*

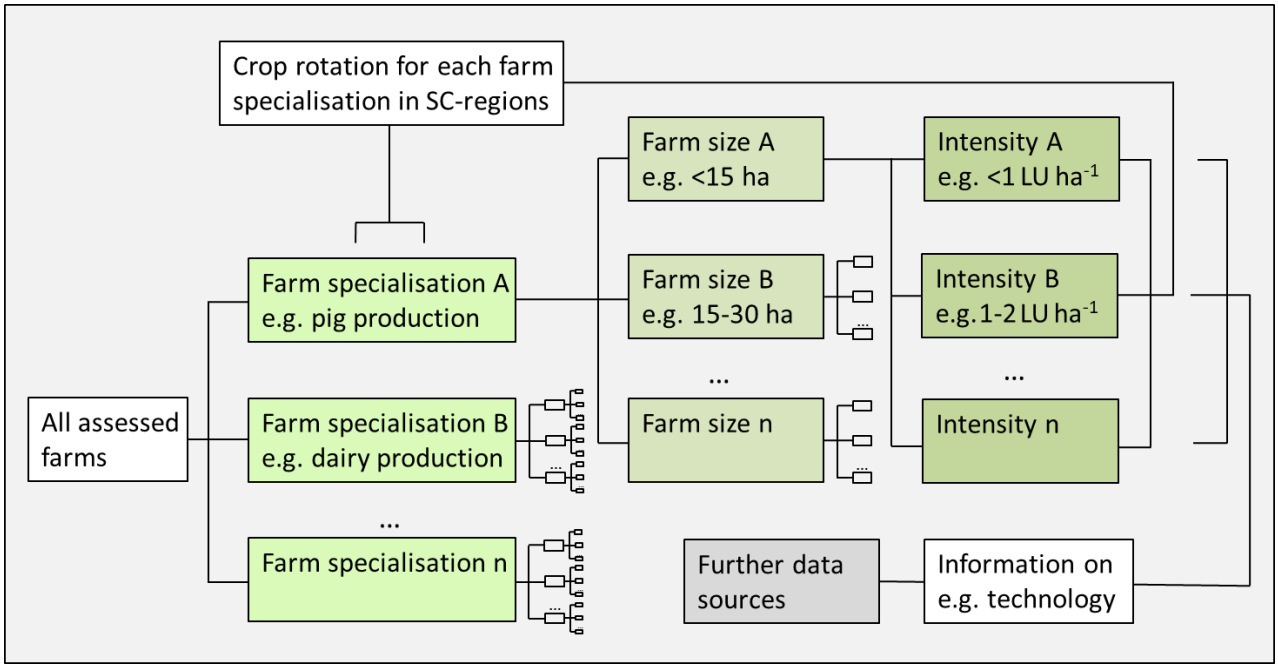
The typology is based on the FSS which is conducted every three to four years (Hauschild et al. 2017, p. 75). The FSS is carried out in the whole EU by member states using a harmonized approach and reported to Eurostat (Eurostat 2018). We rely on the FSS of 2016. It covers all farms of NRW registered as legal entities above a defined size and provides numerous farm characteristics, such as cropping shares, animal stock or work force, as well as the farm location at community level (Destatis n.d.). The use of FSS is governed by strict data protection standards which prevent direct data access. Instead, researchers have to provide their statistical scripts to the Research Data Centers of the Federal Statistical Office and the statistical offices of the states. The institutions review the script, run it themselves and carefully check its output, mainly to prevent the later identification of single farms. If data protection requirements are met, the output is handed to the researcher. However, it might still be partly blanked if for instance selected data refer to three or less real farms.

2.2 *Farm grouping*

All farms in NRW are grouped according to (1) specialization (2) farm area, and (3) stocking density (Figure 1). Thus, following Andersen et al. (2007, p. 355), an existing typology on specialization of farms from official agricultural statistics is extended. The FSS groups farms according to their main farming activities which are defined based on the relative contribution of standard output coming from certain farming activities following the EU typology of 2008 (European Commission 2008). Standard output is defined as “the standard value of gross production” (European Commission 2008, p. 4). A specialist pig fattening farm, for instance, realizes more than 2/3 of its standard output with fatteners (Appendix 1).

The EU typology distinguishes a total of 61 specializations. However, we exclude 44 specializations from the typology as they are neither relevant for the study area nor of interest for the assessed research question.

Figure 1: Concept of the farm typology



Source: Own figure; SC-regions – soil-climate regions, LU – livestock units

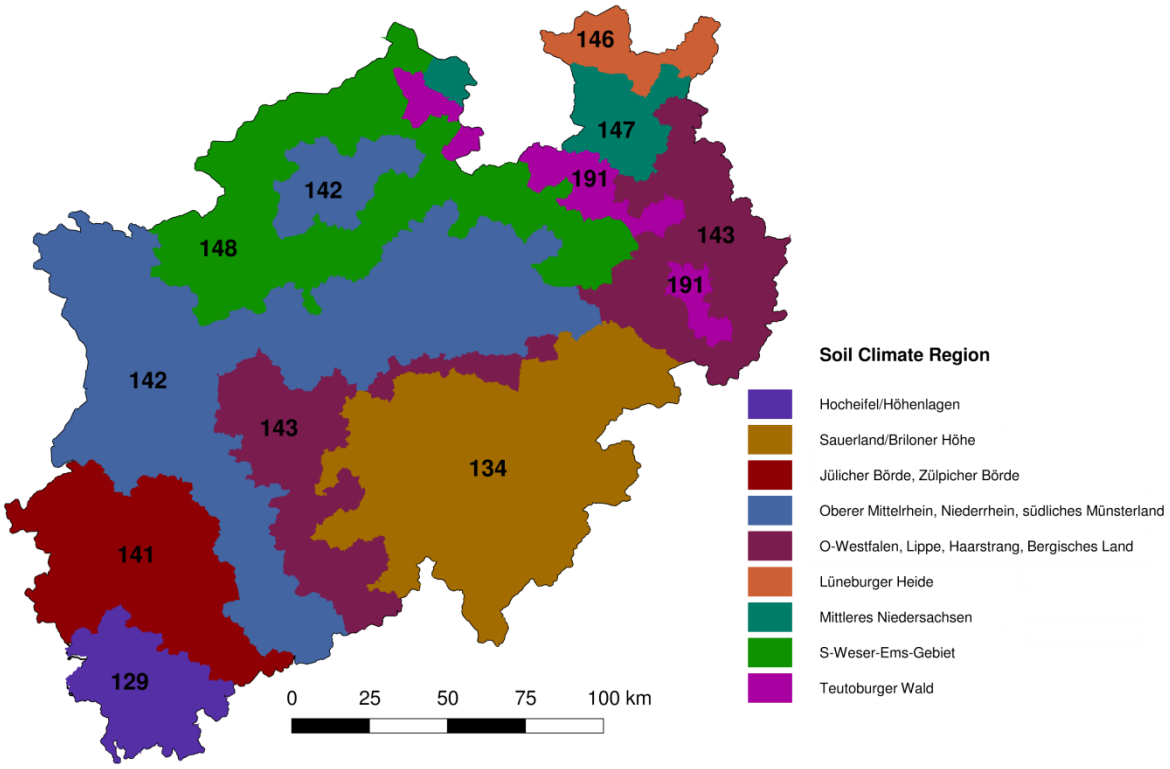
Farms of a certain specialization are further grouped according to their farm area in hectare as farm size influences profits and is potentially related to economies of scale. Regarding the assessment of the Fertilization Ordinance, this can be relevant for the costs of introducing low-emission manure application techniques or additional manure storage. Breaks between groups are defined with the help of descriptive statistics, aiming at homogeneity within groups and heterogeneity between groups. Four groups of different farm sizes are selected whereby group limits differ between specializations. In the next step, farms are further grouped according to their stocking density in livestock units (LU) per hectare. Stocking density is a relevant farm characteristic when assessing the impact of agri-environmental policies such as the German Fertilization Ordinance. Farms with

higher stocking density face higher efforts and costs to fulfil measures like nutrient application thresholds (Menghi et al. 2015, p. 139ff.) or requirements concerning the manure storage capacity which are directly linked to the stocking density (BMEL 2017, p. 12). Depending on the specialization, two to four categories of stocking density are defined.

2.3 *Farm location and crop rotation*

The farm typology is developed for a modelling setup which combines a bio-economic farm model and a biophysical crop model. The latter simulates crop rotations under different management and soil-climate conditions. It captures relevant bio-physical flows of crops and corresponding environmental parameters (Gaiser et al. 2013, p. 7f.). Inter alia, information on the crop rotation of farm types is needed to run the modelling setup. The prevalent crop rotations depend on climatic and soil conditions. Accordingly, farms in the sample are grouped into predefined soil-climate regions (SCRs). The concept of SCRs has been developed by Roßberg et al. (2007) with the goal of harmonizing typologies used in different agricultural institutions for field variety trials and pesticide monitoring. Every of the around 400 communities in NRW is assessed with regard to soil quality and climate. Based on a cluster analysis and expert judgement, homogenous communities form a SCR (Roßberg et al. 2007, 156ff.). Hence, SCRs are consistent to the community level which allows a precise interlinkage to the FSS. NRW consists of nine SCRs as shown in Figure 2 whereas five SCRs cover the bigger part of the land area.

Figure 2: Overview on soil-climate regions in North Rhine-Westphalia



Sources: Own figure based on the typology from Roßberg et al. (2007) and data provided by GeoPortal.JKI (n.d.)

In a next step, crop shares are derived for all specializations and each SCR from the FSS 2016 and from the Census of Agriculture 2010. For some combinations of specialization and SCR, the crop shares derived from the FSS 2016 are blocked due to data protection standards. Partly, data from the Census of Agriculture 2010 are accessible for these combinations and used instead (see Appendix 7 for details). Depending on the crop shares and based on expert judgement, one dominant crop rotation is defined for each specialization in each SCR (Gaiser 2018). Unlike farm area or stocking density, crop rotations are not included in the typology as a further farm characteristic for two reasons. First, we could not find a relevant variation of crop shares between farms of different size and stocking density within a specialization. Second, a further differentiation increases the number of farm types

in the typology tremendously and leads to the blocking of a higher share of the data output due to the data protection standards.

3 A farm typology for NRW

The derived farm typology covers 25,914 farms and thus around 77% of all farms in NRW. Horticulture, specialist permanent crops, grazing livestock other than cows and poultry are the specializations of farms not captured by the typology. In the following sections, the results of the typology are exemplary presented for ten specialized pig fattening farm types and farm types specialized in cereals (other than rice), oilseeds and protein crops (in the following called specialized cereal farms). The selected farm types are the most prevalent ones with regard to farm numbers. In the appendix, 100 farm types of the typology are presented. Each of the remaining 110 farm types represents less than 40 farms and numerous farm characteristics are blocked in the data output due to the low number of observations for those farm types.

3.1 *Farm importance*

The developed farm typology allows assessing the relative importance of farm types in the population. Importance can be defined as (1) share of total farms covered by a farm type, (2) share of total agricultural land covered by a farm type and, (3) share of livestock covered by a farm type. Table 1 exemplary presents the results on farm importance for specialized cereal and pig fattening farm types (see Appendix 4 for full results).

Specialized cereal farms with less than 50 ha and a livestock density between 0 and 0.2 LU ha^{-1}, for instance, are highly frequent in the farm population with a share of 8.09% of all farms in NRW. However, due to their small size, they cover only 3.80% of the agricultural land. In opposite, specialized cereal farms between 50 and 100 ha with 0 to 0.2 LU ha^{-1}, only cover 1.78% of farms but account for 2.90% of the agricultural land.

Table 1. Most frequent specialized cereal and pig fattening farm types in NRW

Farm type	Share of farm area	Share of farm numbers	Share of livestock units	Share of dairy cows	Share of fattening pigs
Specialized cereal farm[a] <50 ha, >0.2 LU ha^{-1}	0.36%	0.76%	0.11%	0.00%	0.01%
Specialized cereal farm[a] <50 ha, 0-0.2 LU ha^{-1}	3.80%	8.09%	0.04%	0.00%	0.01%
Specialized cereal farm[a] >200 ha, 0-0.2 LU ha^{-1}	-	0.20%	-	-	-
Specialized cereal farm[a] 100-200 ha, 0-0.2 LU ha^{-1}	2.35%	0.76%	0.03%	-	-
Specialized cereal farm[a] 50-100 ha, 0-0.2 LU ha^{-1}	2.90%	1.78%	0.04%	-	0.02%
Pig fattening farm[b] <20 ha, >3 LU ha^{-1}	0.08%	3.85%	8.52%	-	26.15%
Pig fattening farm[b] 20-50 ha, 1-2 LU ha^{-1}	0.63%	0.75%	0.80%	-	2.49%
Pig fattening farm[b] 20-50 ha, 2-3 LU ha^{-1}	0.92%	1.07%	1.80%	-	5.79%
Pig fattening farm[b] 50-100 ha, 1-2 LU ha^{-1}	-	1.26%	-	0.00%	8.99%
Pig fattening farm[b] 50-100 ha, 2-3 LU ha^{-1}	-	0.96%	-	-	8.63%

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation. , "-" indicates values which are blocked due to data privacy requirements; [a] Specialist cereals (other than rice) oilseeds and protein crops (151), [b] Specialist pig fattening (512); LU – livestock units

For livestock farms, the share of animals covered by a farm type is an additional indication for farm importance. 26.15% of the assessed pig stock is found in pig fattening farms with less than 20 ha and more than 3 LU ha^{-1}. However, these farms are to some extent part of a bigger farm unit which is separated amongst other for tax optimization. That limits the validity of the developed farm typology especially in case of pig farms (section 4). Pig fattening farms with 50 to 100 ha cover a relevant share of farm numbers and pig stock. 8.99% of the pig stock in NRW can be found in this size class for a livestock density between 1 and 2 LU ha^{-1} and 8.63% of the pig stock for a livestock density between 2 and 3 LU ha^{-1}.

3.2 *Farm characteristics*

For the developed farm types, farm characteristics are extracted from the FSS. For all farms summarized as a farm type, we calculate the median of the selected farm characteristics. Characteristics are chosen in accordance to the assessment of the Fertilization Ordinance being livestock numbers (total livestock, dairy cows, pigs, sows), arable land area, grassland area, and livestock density. Table 2 exemplary shows the farm characteristics for the most frequent specialized arable and pig fattening farm types (see Appendix 5 for full results).

Table 2. Median of farm characteristics of the most frequent specialized cereal and pig fattening farm types in NRW

Farm type	Total livestock units [LU]	Pig [LU]	Arable land [ha]	Grassland [ha]	Livestock density [LU ha^{-1}]
Specialized cereal farm[a] <50 ha, >0.2 LU ha^{-1}	7.00	0.00	14.00	3.00	0.36
Specialized cereal farm[a] <50 ha, 0-0.2 LU ha^{-1}	0.00	0.00	14.96	0.50	0.00
Specialized cereal farm[a] >200 ha, 0-0.2 LU ha^{-1}	0.00	0.00	233.50	4.89	0.00
Specialized cereal farm[a] 100-200 ha, 0-0.2 LU ha^{-1}	0.00	0.00	119.11	3.00	0.00
Specialized cereal farm[a] 50-100 ha, 0-0.2 LU ha^{-1}	0.00	0.00	62.40	1.96	0.00
Pig fattening farm[b] <20 ha, >3 LU ha^{-1}	106.54	103.26	0.00	0.00	4.60
Pig fattening farm[b] 20-50 ha, 1-2 LU ha^{-1}	56.40	54.00	33.58	0.68	1.64
Pig fattening farm[b] 20-50 ha, 2-3 LU ha^{-1}	93.60	92.40	36.00	0.00	2.46
Pig fattening farm[b] 50-100 ha, 1-2 LU ha^{-1}	118.44	117.60	71.00	1.00	1.68
Pig fattening farm[b] 50-100 ha, 2-3 LU ha^{-1}	149.82	148.32	61.67	0.35	2.30

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation. ; [a] Specialist cereals (other than rice) oilseeds and protein crops (151), [b] Specialist pig fattening (512); LU – livestock units

Specialized cereal farms with less than 50 ha and more than 0.2 LU ha^{-1}, for instance, have a size of 14 ha and livestock density of 0.36 LU ha^{-1} as median. Pig

fattening farms are characterized by higher stocking densities. Pig farms with less than 20 ha and more than 3 LU ha^{-1} do not hold any land in the median and have a median of 4.60 LU ha^{-1} as stocking density. The second most present pig farm type, 20 to 50 ha and 1 to 2 LU ha^{-1}, has a median of 33.58 ha and 1.64 LU ha^{-1}. The median of pig and total LU is almost equal which indicates that other livestock than pigs is rarely present. The grassland area is, as for all pig fattening farm types in Table 2, very low. None of the most frequent pig farm types, except the farms which to some extent are part of a bigger farming unit, exceeds 2.5 LU ha^{-1}.

3.3 *Farm location*

As explained, all farms present in the FSS can be located in a SCR. This allows deriving the distribution of farm types in the nine SCRs of NRW. Table 3 exemplary shows the distribution of the most frequent specialized cereal and pig fattening farm types in the SCRs (see Appendix 6 for full results).

Specialized cereal farms with less than 50 ha and more than 0.2 LU ha^{-1}, for instance, are found mainly in SCR 142 with 30.42%, SCR 143 with 23.44%, and SCR 148 with 22.27%. Pig fattening farms with 20 to 50 ha and 1 to 2 LU ha^{-1} are also most frequent in SCR 142 with 41.34% and SCR 148 with 37.01%. The distribution of the farm types in the SCRs is on the one hand caused by the size of the SCR and on the other hand by the comparative advantage of certain agricultural activities under certain climate and soil conditions.

Table 3. Farm location of the most frequent specialized cereal and pig fattening farm types in NRW

Farm type	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191
Specialized cereal farm[a] <50 ha, >0.2 LU ha^{-1}	1.56%	5.86%	2.34%	30.47%	23.44%	2.34%	6.64%	22.27%	5.08%
Specialized cereal farm[a] <50 ha, 0-0.2 LU ha^{-1}	1.72%	5.06%	5.47%	25.61%	18.83%	6.72%	10.02%	22.68%	3.89%
Specialized cereal farm[a] >200 ha, 0-0.2 LU ha^{-1}	2.99%	8.96%	14.93%	31.34%	32.84%	2.99%	1.49%	0.00%	4.48%
Specialized cereal farm[a] 100-200 ha, 0-0.2 LU ha^{-1}	9.02%	5.88%	16.08%	24.71%	26.67%	0.78%	4.31%	7.84%	4.71%
Specialized cereal farm[a] 50-100 ha, 0-0.2 LU ha^{-1}	2.67%	6.83%	9.00%	32.83%	21.67%	3.33%	6.83%	12.50%	4.33%
Pig fattening farm[b] <20 ha, >3 LU ha^{-1}	0.00%	3.86%	1.00%	37.50%	6.79%	2.55%	2.62%	43.90%	1.77%
Pig fattening farm[b] 20-50 ha, 1-2 LU ha^{-1}	0.00%	3.15%	0.00%	41.34%	6.30%	5.51%	3.94%	37.01%	2.76%
Pig fattening farm[b] 20-50 ha, 2-3 LU ha^{-1}	0.00%	2.22%	0.00%	39.89%	4.16%	2.22%	2.77%	46.81%	1.94%
Pig fattening farm[b] 50-100 ha, 1-2 LU ha^{-1}	0.24%	6.86%	0.47%	33.10%	15.37%	4.26%	4.96%	32.15%	2.60%
Pig fattening farm[b] 50-100 ha, 2-3 LU ha^{-1}	0.62%	2.80%	0.00%	39.44%	5.28%	3.42%	1.55%	44.41%	2.48%

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation.; [a] Specialist cereals (other than rice) oilseeds and protein crops (151), [b] Specialist pig fattening (512); SCR – soil-climate region

As described above, the farm typology defines the most present soil and climate conditions for the developed farm types. In addition, it allows extracting the most present farm types in the nine SCRs which is exemplarily shown in Table 4 for SCR 129. For a total of 674 farms, 11.78% are specialized in growing a combination of various field crops and have less than 50 ha and no animal stock. The second most present farm type are small cattle farms (less than 20 ha and 0 to 1 LU ha^{-1}) with 9.35%. The most present farm types can be derived for all SCRs based on the data provided in Appendix 6.

Table 4. Most frequent farm types in soil-climate region 129

Farm type	Size and livestock density	SCR 129
Total farm numbers		674
Various field crops combined (166)	<50 ha, 0-0.2 LU ha^{-1}	11.87%
Specialist cattle - rearing and fattening (460)	<20 ha, 0-1 LU ha^{-1}	9.35%
Specialist dairying (450)	>100 ha, 1-2 LU ha^{-1}	8.90%
Specialist dairying (450)	50-100 ha, 1-2 LU ha^{-1}	8.01%
Specialist cereals (other than rice) oilseeds and protein crops (151)	<50 ha, 0-0.2 LU ha^{-1}	6.97%
Specialist cattle — rearing and fattening (460)	<20 ha, 1-2 LU ha^{-1}	6.53%
Specialist cattle — rearing and fattening (460)	20-50 ha, 0-1 LU ha^{-1}	5.79%
Specialist dairying (450)	50-100 ha, 0-1 LU ha^{-1}	4.45%
Specialist cereals (other than rice) oilseeds and protein crops (151)	100-200 ha, 0-0.2 LU ha^{-1}	3.41%
Specialist dairying (450)	20-50 ha , 1-2 LU ha^{-1}	2.97%

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation; SCR – soil-climate region

3.4 *Crop rotations*

For all farming specializations and SCRs, crop rotations are defined based on the crop shares derived from the FSS. Table 5 exemplary illustrates the derived crop rotations for the most present specialized cereal and pig fattening farms (see Appendix 7 for full results).

Table 5. Crop rotations of specialized cereal and pig fattening farm types in the different soil-climate regions of NRW

Specialization	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191
Specialized cereal farm[a]	WW	WW	WW	WW	WW	-	WW	WW	WW
	WB	WB	WB	WB	WB		WB	KM	WB
	WR[d]	WR[c]	WR[c]	WR[c]	WR[c]		WR[c]	KM[c]	WR[c]
Pig fattening farm[b]	-	-	WW	WW	WW	-	-	WW	-
			WB	WB	WB			WB	
			ZR[d]	CCM[c]	WTr			CCM	
					WR[d]			CCM[c]	

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender, Farm Structure Survey, 2016, own calculation (crop rotations marked with [c]), RDC of the Federal Statistical Office and Statistical Offices of the Laender, Census of Agriculture, 2010, own calculation (crop rotations marked with [d]), Gaiser (2018) ; [a] Specialist cereals (other than rice) oilseeds and protein crops (151), [b] Specialist pig fattening (512); WW - Winter wheat; WB - Winter barley; SB - Sugar beet; CCM - Corn-Cob-Mix; WR - Winter rapeseed; WTr - Winter triticale; SM - Silage maize; KM – Grain maize; SCR – soil-climate region.

Specialized cereal farms, for instance, grow crop rotations dominated by winter wheat and winter barley. Only in SCR 148, grain maize dominates the crop rotation. Pig fattening farms grow more diverse rotations in the different SCRs, for instance winter wheat, winter barley and sugar beet in SCR 141 and winter wheat, winter barley and corn-cob-mix in SCR 148.

4 Discussion and Conclusion

We provide a farm typology for NRW based on single farm data from the FSS. Farms are grouped according to specialization, size in hectare and livestock density. Furthermore, a dominant crop rotation is defined for the combination of all assessed farm specializations and the nine SCRs in NRW. The typology provides important variables to the initialization (e.g. stocking density) and parameterization (e.g. specialization, farm size) of farm models to assess the revision of the German Fertilization Ordinance.

We adopt the methodology developed by Andersen et al. (2007) within the SEAMLESS project (van Ittersum et al. 2008). Following Mądry et al. (2013, p. 320), the methodology can be characterized as an expert approach with a strong use of agricultural statistics. In contrast to Andersen et al. (2007, p. 354), we use the FSS instead of the Farm Accountancy Data Network (FADN) as the main data source. This has the advantage of a higher coverage of farms and more detailed information on farm location. The latter is of importance for a consistent linkage of the location of farms to SCRs. However, FADN covers more economic parameters than the FSS. The typology defines in total 210 farm types for NRW. This is in the same range as the typology developed by Andersen et al. (2006, p. 6) which results in 189 farm types. Generally, there is a trade-off between segregation and generalization in farm typologies. More segregated typologies reflect better heterogeneity and result in farm types closer to real-world farms. However, that leads to a lower number of real-world farms represented by a farm type and, hence, more blocked data output due to data protection standards. A more general farm typology facilitates the selection of the most relevant farm types for further analysis and the communication of results to stakeholders.

The FSS accounts legal units as one farm. However, farms frequently consist of numerous legal units or numerous farms are combined to one legal unit for tax optimization and other reasons. Such complex structures primarily are motivated by the avoidance of the status as a commercial farm which impacts the tax burden

(Forstner & Zavyalova 2017, p. 13). Complex holding structures of farms are hardly recognizable from official agricultural statistics (Forstner & Zavyalova 2017, p. 33ff.) and are not reflected in the derived typology. This can result in misleading outcomes when selecting such farm types for the modelling exercise. For the most present specialized pig farm type with high stocking density, for instance, a farm level model will return high compliance costs to fulfil environmental regulations such as the German Fertilization Ordinance because of high costs to export excess manure. If such farms are part of a bigger farming unit, excess manure is, at least partly, only transported within the bigger unit which results in lower costs.

Compared to a farm typology which relies on expert knowledge for the judgement of farm characteristics (e.g. Budde 2013, p. 87), the typology in the paper at hand is transparent with regard to data sources and covers all farms with the specializations of interest. However, complex farm structures beyond legal units may be better captured by expert judgement. Furthermore, a typology based on the FSS or FADN does not provide all farm characteristics needed to parameterize farm models for detailed analysis of environmental policies. Therefore, such typologies are also complemented by expert knowledge. For the modelling exercise, we need additional expert judgement for current farm management which is not covered in detail in the FSS. Furthermore, we strongly rely on expert knowledge to derive the crop rotations from the observed crop shares for the developed farm types. However, this process can be improved by using optimization models to detect the crop rotations with the highest coverage of cropped land (Schönhart et al. 2011).

We conclude that the developed farm typology provides the necessary information to select relevant farms, understood as most frequent or affected, to assess the revision of the Fertilization Ordinance in Germany with farm models. Furthermore, it contains important input variables for the initialization and parameterization of such models. The paper at hand allows to select farms and corresponding farm characteristics for similar research questions as well as to easily extent and update the typology with future FSS. The typology can be improved by the inclusion of

expert knowledge to detect farm structures beyond legal units which are not covered in agricultural statistics.

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Appendix 1: Farm specialization according to standard output

Particular type of farming		Farm type explanations	Definition
1		Special field crops	General cropping i.e. cereals, dried pulses and protein crops for the production of grain, oilseeds, potatoes, sugar beet, industrial plants, fresh vegetables, melons, strawberries open field, arable land seed and seedlings, other arable land, fallow land and forage for sale > 2/3
	151	Specialist cereals (other than rice) oilseeds and protein crops	Cereals, excluding rice, oilseeds, dried pulses and protein crops > 2/3
	161	Specialist root crops	Potatoes, sugar beet and fodder roots and brassicas > 2/3
	162	Cereals, oilseeds, protein crops and root crops combined	Cereals, oilseeds, dried pulses protein crops > 1/3; roots > 1/3
	166	Various field crops combined	Holdings in class 16, excluding those in 161, 162, 163, 164 and 165 (Fresh vegetables, melons and strawberries open field, Tobacco and Cotton)
4		Specialist grazing livestock	Forage for grazing livestock (i.e. fodder roots and brassicas, plants harvested green, pasture and meadows, rough grazings) and grazing livestock (i.e. equidae, all types of cattle, sheep and goats) > 2/3
	450	Specialist dairying	Dairy cows > 3/4 of total grazing livestock; grazing livestock > 1/3 of grazing livestock and forage
	460	Specialist cattle — rearing and fattening	All cattle (i.e. bovine animals under one year, bovine animals over one but under two and bovine animals two years old and over (male, heifers, dairy cows and other cows)) > 2/3 of grazing livestock; dairy cows ≤ 1/10 of grazing livestock; grazing livestock > 1/3 of grazing livestock and forage
	470	Cattle — dairying, rearing and fattening combined	All cattle > 2/3 of grazing livestock; dairy cows > 1/10 of grazing livestock; grazing livestock > 1/3 of grazing livestock and forage; excluding those holdings in class 45
5		Specialist granivores	Granivores i.e.: Pigs (i.e. piglets, breeding sows, other pigs), poultry (i.e. broilers, laying hens, other poultry) and rabbits breeding females > 2/3
	511	Specialist pig rearing	Breeding sows > 2/3
	512	Specialist pig fattening	Piglets and other pigs > 2/3
	513	Pig rearing and fattening combined	Holdings in class 51, excluding those in classes 511 and 512
7		Mixed livestock holdings	Grazing livestock and forage and granivores > 2/3; grazing livestock and forage ≤ 2/3; granivores ≤ 2/3
	731	Mixed livestock, mainly dairying	Cattle, dairying > 1/3 of grazing livestock; dairy cows > 1/2 of dairying cattle
	732	Mixed livestock, mainly non-dairying grazing livestock	Holdings in class 73, excluding those in class 731
	741	Mixed livestock: granivores and	Cattle, dairying > 1/3 of grazing livestock; granivores > 1/3,

Particular type of farming	Farm type explanations	Definition
	dairying	dairy cows > 1/2 of cattle, dairying
742	Mixed livestock: granivores and non-dairying grazing livestock	Holdings in class 74, excluding those in class 741
8	Mixed crops — livestock	Holdings excluded from classes 1 to 7
831	Field crops combined with dairying	Cattle, dairying > 1/3 of grazing livestock; dairy cows > 1/2 of cattle, dairying; cattle, dairying < general cropping
832	Dairying combined with field crops	Cattle, dairying > 1/3 of grazing livestock; dairy cows > 1/2 of cattle, dairying; cattle, dairying ≥ general cropping
842	Permanent crops and grazing livestock combined	Permanent crops > 1/3; grazing livestock and forage > 1/3

Source: European Commission (2008, p. 14–19)

Appendix 2: Stata code for farm typology

```
*clear all
***  Version festlegen
*version <14>

*** Bildschirmausgabe steuern
set more off
set logtype text
set linesize 255

*** Ado-Pfad festlegen
*sysdir set PERSONAL ....
*mata mata mlib index

*** Makros für Pfade
*global datenpfadd ""
*global outputfad ""

*** Makros für Datei- und Outputnamen
*global dateiname <dateiname.dta> /*Dateiname einfügen*/
*global outputname <outputname> /*Outputname einfügen*/

*use "Z:\fdz-gast10\heckelei_3287_2017_schaefer\daten\na3287-2017_lz2010_gwap_ContingencyTables.dta", clear

***********
*** Aufzeichnung in Protokoll starten
*capture log close log using "$outputpfad\$outputname.log", replace

*******************************************************************************
*******************************************************************************
*** Titel des Projekts:        Skalenübergreifende Modellierung von Änderungen von Änderungen der Agrarstruktur *** und landwirtschaftlichen Stoffflüssen in Regionen von Nordrhein-Westfalen

*** Datengrundlange:                    Agrarstrukturerhebung 2016
*** Dateiname des Programm codes:  20180608_farmtypocharac_New.do
*** erstellt:                           09.06.2018
*** von:                                Till Kuhn, David Schäfer
*** Dateiname des Output-Files:         1_farmTypoCharac.csv
*** Grundriss des Programms:            Program zur Analyse und Definition von Typologien
*** landwirtschaftlicher Betriebe in NRW. Explorative Analyse mit deskriptiven Ergebnissen.
***
*** Verwendete Variablen:
***       Originalvariablen:
***   AGS                         Allgemeiner Gemeindeschlüssel
***       C0060           Einzel - BWA
***       C0060UG2                Allgemeine BW
***       C002                    Hauptproduktionsrichtung des Betriebs
***       C3316                   GVE Michkühe
***       C3337                   GVE andere Schweine
***       C3332                   GVE Zuchtsauen
***       C3391                   GVE insgesamt
***       C0210                   Ackerland gesamt
***       C0231                   Wiesen
***       C0232                   Weiden
***       C0233                   ertragsarmes Dauergrünland
***       C0240                   Landwirtschaftlich genutzte Fläche

*** Neuangelegte Variablen:
***        Aggreg_SCR             Boden-Klima-Region (Variable aus externener Datenquelle)
***        x                      Variable zum Zählen der Beobachtungen
```

```
***        areaNRW:                  Fläche von NRW
***        farmNrNRW:                Anzahl Betriebe in NRW
***        LUNrNRW:                  Anzahl GVE in NRW

***  areaTypicalFarm                 Summe der Fläche eines bestimmten Betriebstyps
***  shareAreaTypicalFarm  Anteil der Fläche eines bestimmten Betriebstyps an der Gesamtfläche
***  farmNrTypicalFarm               Anzahl der Betriebe eines bestimmten Betriebstyps
*** sharefarmNrTypicalFarm           Anteil der Betriebe enes bestimten Betriebstyps an der gesamten Anzahl der ***
                                     Betriebe
***  LUNrTypicalFarm                 Summe der GVE eines bestimmten Betriebstyps
***  shareLUNrTypicalFarm Anteil der GVE eines bestimmten Betriebstyps an der Gesamtfläche
***  LuDens                          GVE pro Fläche eines Betriebes Grasland Gesamtes Grünland eines
***                                   Betriebes, fasst C0231, C0232 und C0233 zusammen
***  shareDairy                      Summe der Milchkühe eines bestimmten Betriebstyps
***  shareFattening                  Summe der Mastschweine eines bestimmten Betriebstyps
*** shareSow                         Summe der Sauen eines bestimmten Betriebstyps
***  shareDairyTypicalFarm           Anteil der Milchkühe eines bestimmten Betriebstyps an allen Milchkühen
***  shareFatteningTypicalFarm       Anteil der Mastschweine eines bestimmten Betriebstyps an allen
***  Mastschweinen
***  shareSowTypicalFarm             Anteil der Sauen eines bestimmten Betriebstyps an allen Sauen
***  dairyGV                         Alle Milchkühe in NRW
***  fatteningGV                     Alle Mastschweine in NRW
*** sowGV                            Alle Sauen in NRW
*** allBWA_Size_Lu                   Anzahl der Betriebe, die einem Betriebytpy angehören
***  SCR_129      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 129
***  SCR_134      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 134
***  SCR_141      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 141
***  SCR_142      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 142
***  SCR_143      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 143
***  SCR_146      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 146
***  SCR_147      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 147
***  SCR_148      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 148
***  SCR_191      Anteil des jeweiligen Betriebstyps in der Boden-Klima-Region 149
***  farmType                        Eigene Variable für BWA, irrelevante BWA erhaltenden Wert 0
***  sizeClassHectare                Größenklassen für die Einteilung der Betriebe
***  sizeClassLuDens                 Viehbesatzdichte-Klassen für die Einteilung der Betriebe
***  BWA_Size_LU                     Variable zur Charakterisierung der typischen Betrieben Einzel-BWA,
***                                   Größenklasse, Viehbesatzdichte-Klasse

***MERKMALSCHARAKTERISIERUNG:        Variablen für Charakterisierung der Merkmale typischer Betriebe
***  Durchschnitt, Median, Minimal- und Maximal Werte und Standardabweichung Variablen sind unter G.1
*** aufgelistet>

*************************************************************************
*** I. Datenaufarbeitung
*************************************************************************

* --- A.1 Einlesen externer Daten
use "E:\fdz-gast10\heckelei_3287_2017_schaefer\externe_daten\18_01_22 daten für Destatis.DTA", clear

* --- A.2 Verknüpfung mit ASE 2016 anhand des allgemeinen Gemeindeschlüssels. Durch externe Daten wird
* jeder Betrieb einer Boden-Klima-Region zugeordnet

destring ags, replace
rename ags AGS
joinby AGS using "E:\fdz-gast10\heckelei_3287_2017_schaefer\daten\na3287-2017_ase2016_gwap.dta"

keep Aggreg_SCR C0010U2 C0010U3 C0027 C0060 C0060UG2 C3316 C3391 C3337 C3332 C0210 C0231 C0232 C0233
C0240
drop if C0027 == 20
```

```
* --- A.2 Erstellen von Makros basierend auf allen Variablen die im Syntax verwendet werden

local variableNumber1  x areaNRW farmNrNRW LUNrNRW areaTypicalFarm shareAreaTypicalFarm farmNrTypicalFarm sharefarmNrTypicalFarm LUNrTypicalFarm shareLUNrTypicalFarm LuDens Grasland shareDairy shareFattening shareSow shareDairyTypicalFarm shareFatteningTypicalFarm shareSowTypicalFarm dairyGV  fatteningGV  sowGV allBWA_Size_Lu

local variableNumber2  SCR_129 SCR_134 SCR_141 SCR_142 SCR_143 SCR_146 SCR_147 SCR_148 SCR_191

local variableString1 farmType sizeClassHectare sizeClassLuDens BWA_Size_LU

* --- A.3 Überprüft ob Variablen der eben definierten Makros schon existieren. Falls Ja, hat der Loop keine * Auswirkung, falls nein kreiert die Loop die Variable mit einem default Wert von 0 für Zahlen und "" für Strings

foreach variables in `variableNumber1'{
                        capture confirm  variable `variables'
                        if !_rc {
                        }
                        else{
                                gen `variables' = 0
                        }
}

foreach variables in `variableNumber2'{
                        capture confirm  variable `variables'
                        if !_rc {
                        }
                        else{
                                gen `variables' = 0
                        }
}

foreach variable in `variableString1'{
                        capture confirm  variable `variable'
                        if !_rc {
                        }
                        else{
                                gen `variable' = ""
                        }
}

* --- A.4 Berechnung des GV-Besatzes und des gesamten Grünlands

replace LuDens = C3391/C0240

replace Grasland = C0231 + C0232 + C0233

* --- A.4 Makro zum erstellen von Variablen für Characteristika der typischen Betrieben, z.B. die durschnittlie * Ackerflächen
local charac C3316 C3391 C3337 C3332 C0210 Grasland C0240 LuDens
local range mean min max median stdDev

foreach y in `charac'{
                        foreach x in `range'{
                                capture confirm  variable `y'`x'
                                if !_rc {
                                }
                                else{
                                        gen `y'`x'   = 0
                                }
                        }
}
```

```
* --- A.5 Definieren einer Variable zum Zählen

replace x = 1

* --- B.1 Berechnung der Betriebsanzahl, GVE und Gesamtfläche aller Betrieben in NRW

sum C0240
replace areaNRW = r(sum)
replace farmNrNRW = r(N)

sum C3391
replace LUNrNRW = r(sum)

* --- C.1 Aggregierung der Betriebe nach BWA. Aggregierung basierend auf Allgemeine und Einzel BWA. Nicht * betrachtete BWAs (z.B. Gemüsebau) bleiben 0.

local farmTypes "0" "151" "161" "162" "166" "450" "460" "470" "511" "512" "513" "731" "732" "741" "742" "831" "832" "841"

replace farmType = "0" if farmType == ""

  foreach y in "`farmTypes'" {
                        replace farmType = string(C0060) if string(C0060) == "`y'"
}

* --- D.1 Einführung von Größenklassen nach Hektaranzahl für typische Betriebe

* ---      Für Ackerbaubetriebe (Allgemeine BWA == 1}
replace sizeClassHectare = "<50" if C0240 <= 50 & C0060UG2 == 1 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060UG2 == 1 & farmType != "0"
replace sizeClassHectare = "100-200" if C0240 > 100 & C0240 <= 200 & C0060UG2 == 1 & farmType != "0"
replace sizeClassHectare = ">200"  if C0240 > 200 & C0060UG2 == 1 & farmType != "0"

* ---      Für Spezialisierte Weideviehbetriebe (Allgemeine BWA == 4}
replace sizeClassHectare = "<20" if C0240 <= 20 & C0060UG2 == 4 & farmType != "0"
replace sizeClassHectare = "20-50" if C0240 > 20 & C0240 <= 50 & C0060UG2 == 4 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060UG2 == 4 & farmType != "0"
replace sizeClassHectare = ">100"  if C0240 > 100 & C0060UG2 == 4 & farmType != "0"

* ---      Für Spezialisierte Veredelungsbetriebe (Allgemeine BWA == 5}
replace sizeClassHectare = "<20" if C0240 <= 20 & C0060UG2 == 5 & farmType != "0"
replace sizeClassHectare = "20-50" if C0240 > 20 & C0240 <= 50 & C0060UG2 == 5 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060UG2 == 5 & farmType != "0"
replace sizeClassHectare = ">100"  if C0240 > 100 & C0060UG2 == 5 & farmType != "0"

* ---     Für Viehaltungsverbundbetriebe (Einteilung nach ABWA == 7 (831))
replace sizeClassHectare = "<50" if C0240 <= 50 & C0060UG2 == 7 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060UG2 == 7 & farmType != "0"
replace sizeClassHectare = "100-200" if C0240 > 100 & C0240 <= 200 & C0060UG2 == 7 & farmType != "0"
replace sizeClassHectare = ">200"  if C0240 > 200 & C0060UG2 == 7 & farmType != "0"

* ---      Für Ackerbau-Milchviehverbundbetriebe (Allgemeine BWA == 831; Einteilung nach ABWA == 1)
replace sizeClassHectare = "<50" if C0240 <= 50 & C0060 == 831 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060 == 831 & farmType != "0"
replace sizeClassHectare = "100-200" if C0240 > 100 & C0240 <= 200 & C0060 == 831 & farmType != "0"
replace sizeClassHectare = ">200"  if C0240 > 200 & C0060 == 831 & farmType != "0"

* ---      Für Milchvieh-Ackerbauverbundbetriebe (Allgemeine BWA == 832 ; Einteilung nach ABWA == 1}
replace sizeClassHectare = "<20" if C0240 <= 20 & C0060 == 832 & farmType != "0"
replace sizeClassHectare = "20-50" if C0240 > 20 & C0240 <= 50 & C0060 == 832 & farmType != "0"
```

```
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060 == 832 & farmType != "0"
replace sizeClassHectare = ">100"  if C0240 > 100 & C0060 == 832 & farmType != "0"

* ---      Für Ackerbauveredelungsbetriebe (Allgemeine BWA == 841}
replace sizeClassHectare = "<50" if C0240 <= 50 & C0060 == 841 & farmType != "0"
replace sizeClassHectare = "50-100" if C0240 > 50 & C0240 <= 100 & C0060 == 841 & farmType != "0"
replace sizeClassHectare = "100-150" if C0240 > 100 & C0240 <= 150 & C0060 == 841 & farmType != "0"
replace sizeClassHectare = ">150"  if C0240 > 150 & C0060 == 841 & farmType != "0"

* --- D.2 Einführung von Klassen nach Tierbesatzdichte für typische Betriebe

* ---          Für Ackerbaubetriebe (Allgemeine BWA == 1; In LUdensity bis 0.1 wird die Tierhaltung als Hobby angesehen)
replace sizeClassLuDens = "0" if  LuDens <= 0.2 & C0060UG2 == 1 & farmType != "0"
replace sizeClassLuDens = ">0.2" if  LuDens > 0.2 & C0060UG2 == 1 & farmType != "0"

* ---      Für Spezialisierte Weideviehbetriebe (Allgemeine BWA == 4}
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060UG2 == 4 & farmType != "0"
replace sizeClassLuDens = "1-2" if  LuDens > 1 & LuDens <= 2 & C0060UG2 == 4 & farmType != "0"
replace sizeClassLuDens = "2-3" if  LuDens > 2 & LuDens <= 3 & C0060UG2 == 4 & farmType != "0"
replace sizeClassLuDens = ">3" if   LuDens > 3  & C0060UG2 == 4 & farmType != "0"

* ---      Für Spezialisierte Veredelungsbetriebe (Allgemeine BWA == 5}
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060UG2 == 5 & farmType != "0"
replace sizeClassLuDens = "1-2" if  LuDens > 1 & LuDens <= 2 & C0060UG2 == 5 & farmType != "0"
replace sizeClassLuDens = "2-3" if  LuDens > 2 & LuDens <= 3 & C0060UG2 == 5 & farmType != "0"
replace sizeClassLuDens = ">3" if   LuDens > 3 &  C0060UG2 == 5 & farmType != "0"

* ---      Für Vielhaltungsverbundbetriebe (Allgemeine BWA == 7}
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060UG2 == 7 & farmType != "0"
replace sizeClassLuDens = "1-2" if  LuDens > 1 & LuDens <= 2 & C0060UG2 == 7 & farmType != "0"
replace sizeClassLuDens = "2-3" if  LuDens > 2 & LuDens <= 3 & C0060UG2 == 7 & farmType != "0"
replace sizeClassLuDens = ">3" if   LuDens > 3 &  C0060UG2 == 7                    & farmType != "0"

* ---      Für Ackerbau-Milchviehverbundbetriebe (Allgemeine BWA == 831)
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060 == 831 & farmType != "0"
replace sizeClassLuDens = ">1" if   LuDens > 1 &  C0060 == 831 & farmType != "0"

* ---      Für Milchvieh-Ackerbauverbundbetriebe (Allgemeine BWA == 832}
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060 == 832 & farmType != "0"
replace sizeClassLuDens = "1-2" if  LuDens > 1 & LuDens <= 2 & C0060 == 832 & farmType != "0"
eplace sizeClassLuDens = ">2" if   LuDens > 2 &  C0060 == 832 & farmType != "0"

* ---      Für Ackerbauveredelungsbetriebe (Allgemeine BWA == 841}
replace sizeClassLuDens = "0-1" if  LuDens <= 1 & C0060 == 841 & farmType != "0"
replace sizeClassLuDens = "1-2" if  LuDens > 1 & LuDens <= 2 & C0060 == 841 & farmType != "0"
replace sizeClassLuDens = ">2"  if   LuDens > 2 &  C0060 == 841 & farmType != "0"

* ---  E.1 Generiere Variable welche die Kombination wiedergibt von BWA, Größenklasse in Hektar und Größenklasse in Viehbesatzdichte. Darüber hinaus würd ein Makro über alle Elemente der Variable erstellt.

replace BWA_Size_LU = farmType + "_" +  sizeClassHectare + "_" + sizeClassLuDens

levelsof BWA_Size_LU, local(typicalFarms) clean

* ---  E.2 Anteil der Betriebstypen in den verschiedenen Boden-Klima-Regionen (Boden-Klima-Region ist extern
* zugefügtes Merkmal)

levelsof Aggreg_SCR, local(SCR) clean

foreach z in `typicalFarms'{
```

```
		sum x if BWA_Size_LU == "`z'"
		replace allBWA_Size_Lu = r(sum) if BWA_Size_LU == "`z'"

			foreach y in `SCR'{

				sum x if BWA_Size_LU == "`z'" & `y' == Aggreg_SCR
				replace SCR_129 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 129
	replace SCR_134 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 134
	replace SCR_141 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 141
	replace SCR_142 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 142
	replace SCR_143 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 143
	replace SCR_146 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 146
				replace SCR_147 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 147
	replace SCR_148 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 148
	replace SCR_191 = r(sum) / allBWA_Size_Lu if BWA_Size_LU == "`z'" & `y' == 191
			}
}

* --- F.1 Berechnung der Merkmale der typischen Betrieben

foreach y in `typicalFarms'{
		foreach z in `charac' {
		sum `z' if BWA_Size_LU == "`y'" , detail
		replace `z'mean    = r(mean) if BWA_Size_LU == "`y'"
		replace `z'min     = r(min)  if BWA_Size_LU == "`y'"
		replace `z'max     = r(max) if BWA_Size_LU == "`y'"
		replace `z'stdDev  = r(sd)  if BWA_Size_LU == "`y'"
		replace `z'median  = r(p50) if BWA_Size_LU == "`y'"
		}

}

* --- G.1 Berechnung der Anteile der typischen Betriebe an der gesamten untersuchten Region bezüglich
* Betriebszahl, Fläche und GVE

foreach y in `typicalFarms' {
			sum C0240 if "`y'" == BWA_Size_LU
   replace areaTypicalFarm = r(sum)  if "`y'" == BWA_Size_LU
			replace shareAreaTypicalFarm = areaTypicalFarm / areaNRW if "`y'" == BWA_Size_LU

			replace farmNrTypicalFarm = r(N) if "`y'" == BWA_Size_LU
		replace sharefarmNrTypicalFarm = farmNrTypicalFarm / farmNrNRW if "`y'" == BWA_Size_LU

			sum C3391 if "`y'" == BWA_Size_LU
			replace LUNrTypicalFarm = r(sum) if "`y'" == BWA_Size_LU
			replace shareLUNrTypicalFarm = LUNrTypicalFarm / LUNrNRW if "`y'" == BWA_Size_LU
}

* --- G.2 Berechnung der Anteile der typischen Betriebe an der gesamten untersuchten Region bezüglich GVE
* Milchkühe, GVE Mastschweine und GVE Sauen

sum C3316
replace dairyGV = r(sum)

sum C3337
replace fatteningGV = r(sum)

sum C3332
replace sowGV = r(sum)
```

```
foreach y in `typicalFarms' {
                        sum C3316 if "`y'" == BWA_Size_LU
                        replace shareDairy = r(sum) if "`y'" == BWA_Size_LU
                        replace shareDairyTypicalFarm = shareDairy / dairyGV if "`y'" == BWA_Size_LU

                        sum C3337 if "`y'" == BWA_Size_LU
                        replace shareFattening = r(sum) if "`y'" == BWA_Size_LU
                        replace shareFatteningTypicalFarm = shareFattening / fatteningGV if "`y'" == BWA_Size_LU

                        sum C3332 if "`y'" == BWA_Size_LU
                        replace shareSow = r(sum) if "`y'" == BWA_Size_LU
                        replace shareSowTypicalFarm = shareSow / sowGV if "`y'" == BWA_Size_LU


}

* --- H.1 Generiere Tabelle mit dem Anteil der typischen Betriebe an Fläche, Betriebszahl und GVE im
* Untersuchungsgebiet sowie den merkmalen der typischen Betriebe

collapse (count) x, by(BWA_Size_LU farmType shareAreaTypicalFarm sharefarmNrTypicalFarm
shareLUNrTypicalFarm ///
 shareDairyTypicalFarm shareFatteningTypicalFarm shareSowTypicalFarm ///                                C3316mean
C3316min    C3316max     C3316median     C3316stdDev ///
C3391mean      C3391min    C3391max     C3391median     C3391stdDev ///
C3337mean      C3337min    C3337max     C3337median     C3337stdDev ///
C3332mean      C3332min    C3332max     C3332median     C3332stdDev ///
C0210mean      C0210min    C0210max     C0210median     C0210stdDev ///
C0240mean      C0240min    C0240max     C0240median     C0240stdDev ///
Graslandmean Graslandmin Graslandmax Graslandmedian GraslandstdDev ///
LuDensmean LuDensmin LuDensmax LuDensmedian LuDensstdDev             ///
SCR_129 SCR_134 SCR_141 SCR_142 SCR_143 SCR_146 SCR_147 SCR_148 SCR_191)

* --- H.1 Anpassung an Datenschutzrichtliche Vorgaben um zu verhindern, dass kein Betriebstyp weniger als 3 *
Beobachtungen aufweist

drop if x < 3

*************************************************************************
*** II. Datenoutput
*************************************************************************

* --- Output: Exportiere die generierte .dta als .csv file

export delim  x BWA_Size_LU farmType shareAreaTypicalFarm sharefarmNrTypicalFarm
shareLUNrTypicalFarm ///
shareDairyTypicalFarm shareFatteningTypicalFarm shareSowTypicalFarm ///
C3316mean      C3316min    C3316max     C3316median     C3316stdDev ///
C3391mean      C3391min    C3391max     C3391median     C3391stdDev ///
C3337mean      C3337min    C3337max     C3337median     C3337stdDev ///
C3332mean      C3332min    C3332max     C3332median     C3332stdDev ///
C0210mean      C0210min    C0210max     C0210median     C0210stdDev ///
C0240mean      C0240min    C0240max     C0240median     C0240stdDev ///
Graslandmean Graslandmin Graslandmax Graslandmedian GraslandstdDev ///
LuDensmean LuDensmin LuDensmax LuDensmedian LuDensstdDev             ///
SCR_129 SCR_134 SCR_141 SCR_142 SCR_143 SCR_146 SCR_147 SCR_148 SCR_191 ///
 using "E:\fdz-gast10\heckelei_3287_2017_schaefer\output/output_20180611/1_farmTypoCharac.csv", replace
```

Appendix 3: Stata code for crop rotations

```
clear all
***  Version festlegen
*version <14>

*** Bildschirmausgabe steuern
set more off
set logtype text
set linesize 255

*** Ado-Pfad festlegen
*sysdir set PERSONAL ....
*mata mata mlib index

*** Makros für Pfade
*global datenpfadd ""
*global outputfad ""

*** Makros für Datei- und Outputnamen
*global dateiname <dateiname.dta> /*Dateiname einfügen*/
*global outputname <outputname> /*Outputname einfügen*/

*** Aufzeichnung in Protokoll starten
*capture log close log using "$outputpfad\$outputname.log", replace

*************************************************************************
Titel des Projekts:  Skalenübergreifende Modellierung von Änderungen von Änderungen der Agrarstruktur und landwirtschaftlichen Stoffflüssen in Regionen von Nordrhein-Westfalen

*** Datengrundlange:                  Landwirtschaftszählung 2010
*** Dateiname des Programm codes:  20171204_td_cropshares.do
*** erstellt:                  24.01.2018
*** von:                                                                  Till Kuhn, David Schäfer
*** Dateiname des Output-Files:          1_cropShares.csv/dta
*** Grundriss des Programms:              Program zur Analyse von BWA und Kreisspezifischen Cropshares
*** Originalvariablen
***         C0010U2         Regierungsbezirk
***         C0010U3         Kreis
***         C0060           Einzel - BWA
***         C0060UG1        Haupt-BWA
***         C0060UG2        Allgemeine BWA
***         C0027           Hauptproduktionsrichtung der Betriebe
***         C0330           Schweine insgesamt
***         C3330           GVE Schweine insgesamt
***         C3391           GVE insgesamt
***         C3310           GVE Rinder insgesamt
***         C0101           Winterweizen einschl. Dinkelkorn
***         C0102           Sommerweizen (ohne Durum)
***         C0104           Roggen und Wintermengengetreide
***         C0105           Triticale
***         C0106           Wintergerste
***         C0110           Körnermais/Mais zum Ausreifen
***         C0122           Silomais/Grünmais
***         C0124           Feldgras/Grasanbau
***         C0142           frühe, mittelfrühe und späte Speisekartoffeln
***         C0143           andere Kartoffeln
***         C0145           Zuckerrüben
***         C0161           Winterraps
***         C0231           Wiesen
***         C0232           Weiden
```

```
***         C0233              Ertragsarmes Dauergrünland
***         C0234              aus der Erzeugung genommenes Dauergrünland
***         Total<crops>   Totale Fläche einer Pflanzenkultur für einen bestimmten
***                        Betrieb in einer Region. (<crops>)
***         Max1<crops>    Maximal Wert für einen Betrieb in einer TotalCrop Gruppe

***    Neuangelegte Variablen
***
***         x                  Variable zum Zählen der Betriebe
***         regBez             Kreis mit Regierungsbezirksspezifikation
***         SCR                Boden-Klima Regionen
***         farmType           Eigene Klassifikation von landwirtschaftl. Betrieben
***         BWA_SCR            Boden-Klima Region landwirtschaftl. Betriebe.
***         Total<crops>       Totale Fläche einer Pflanzenkultur für einen bestimmten
***                            Betrieb in einer Region. (<crops>)
***         Max1<crops>        Maximal Wert für einen Betrieb in einer TotalCrop Gruppe

***         Variablen aus Verknüpfung mit externen Daten
***         Aggreg_SCR         Boden-Klima Region

*******************************************************************************
*** I. Datenaufarbeitung
*******************************************************************************
* --- A.1 Einlesen externer Daten
use "E:\fdz-gast10\heckelei_3287_2017_schaefer\externe_daten\18_01_22 daten für Destatis.DTA", clear

* --- A.2 Verknüpfung mit ASE 2016
destring ags, replace
rename ags AGS
joinby AGS using "E:\fdz-gast10\heckelei_3287_2017_schaefer\daten\na3287-2017_ase2016_gwap.dta"

keep Aggreg_SCR C0010U2 C0010U3 C0027 C0060 C0060UG2 C0330 C3330 C3391 C3310 C0101 C0102 C0104 C0105
C0106 C0107 C0110 C0122 C0124 C0142 C0143 C0145 C0161 C0231 C0232 C0233 C0240 C0210
drop if C0027 == 20

* --- A.3 Erstellen von Makros basierend auf allen Variablen die im Modell verwendet werden
local variableNumber1  x
local variableString1  farmType BWA_SCR

* --- A.4 Checkt ob Variablen der eben definierten Makros schon existieren. Falls Ja, macht die Loop nichts, falls * *     nein
kreiert die Loop die Variable mit einem default Wert von 0 für Zahlen und "" für Strings

foreach variables in `variableNumber1'{
                        capture confirm  variable `variables'
                        if !_rc {
                        }
                        else{
                                gen `variables' = 0
                        }
}

foreach variable in `variableString1'{
                        capture confirm  variable `variable'
                        if !_rc {
                        }
                        else{
                                gen `variable' = ""
                        }
}

* --- A.5 Macro für alle Kulturen
```

```
local crops C0101 C0102 C0104 C0105 C0106 C0107 C0110 C0122 C0124 C0142 C0143 C0145 C0161 C0231 C0232 C0233 C0210
foreach variables in `crops'{
		capture confirm  variables `variables'
		if !_rc {
		}
		else{
			gen Total`variables' = 0
			gen double Max1`variables' = 0
		}
}

* --- A.6 Variable zum Zählen
replace x = 1

* --- B.1 Aggregierung der Betriebe nach BWA. Aggregierung basierend auf Allgemeine und Einzel BWA. Nicht betrachtete BWAs (z.B. Gemüsebau) bleiben 0.

local farmTypes "0" "151" "161" "162" "166" "450" "460" "470" "511" "512" "513" "731" "732" "741" "742" "831" "832" "833" "834" "841" "844"
replace farmType = "0" if farmType == ""
foreach y in "`farmTypes'" {
		replace farmType = string(C0060) if string(C0060) == "`y'"
}

* --- B.2 Betriebe, die keine Gemischtbetriebe sind, aber meherer Tierarten oberhalb eines Schwellenwertes haben, werden seperat erfasst, um eine Verschiebung in der Fruchtfolge aufgrund von BWA nicht-spezifischer Charakteristika zu verhindern

* ---	Ackerbauveredelungsverbundbetriebe die keine Schweine haben werden rausgeschmissen (Kein Geflügel in typischen Betrieben)

replace farmType = "0" if farmType == "841" & C0330 == 0

* ---  Weideviehbetriebe mit einem Anteil an Schweinen an Gesamt GVE größer als 5 Prozent werden gesondert betrachtet

replace farmType = "450_mix" if (farmType == "450" ) & (C3330 / C3391) > 0.05
replace farmType = "460_mix" if (farmType == "460" ) & (C3330 / C3391) > 0.05
replace farmType = "470_mix" if (farmType == "470" ) & (C3330 / C3391) > 0.05

* ---	Spezialisierte Schweinebetriebe mit einem Anteil an Rindern an Gesamt GVE größer als 5 Prozent werden nicht betrachtet

replace farmType = "511_mix" if (farmType == "511")& (C3310 / C3391) > 0.05
replace farmType = "512_mix" if (farmType == "512")& (C3310 / C3391) > 0.05
replace farmType = "513_mix" if (farmType == "513")& (C3310 / C3391) > 0.05

* --- B.3 Betriebe die zu Betriebstyp 450,460,470,511,512,513 gehören und nicht vom in B2 beschriebenen Ausschluss kriterium erfasst werden.

replace farmType = "450" if (farmType == "450" ) & (C3330 / C3391) <= 0.05
replace farmType = "460" if (farmType == "460" ) & (C3330 / C3391) <= 0.05
replace farmType = "470" if (farmType == "470" ) & (C3330 / C3391) <= 0.05

replace farmType = "511" if (farmType == "511")& (C3310 / C3391) <= 0.05
replace farmType = "512" if (farmType == "512")& (C3310 / C3391) <= 0.05
replace farmType = "513" if (farmType == "513")& (C3310 / C3391) <= 0.05

* --- B.4 Lösche alle Beobachtungen für Betriebe mit farmTyp 0
*
drop if farmType == "0"
```

```
* --- C.1 Generieren einer Variable die eine kombinierte BWA und SCR wiedergibt
tostring Aggreg_SCR, replace
replace BWA_SCR  = farmType + "_" + Aggreg_SCR
levelsof BWA_SCR, local (BWABKR)

* --- C.2 Addiere die Hektar pro Ackerfrucht für alle Betriebstypen in einer bestimmten SCR und nehme den höchsten Wert den ein Betrieb hat und weise ihn aus
foreach x in `BWABKR'{
        foreach z in `crops'{
                sum `z' if "`x'" == BWA_SCR
                replace Total`z' = r(sum) if "`x'" == BWA_SCR
    replace Max1`z' = r(max) if "`x'" == BWA_SCR
        }
}

* --- C.3 Zusammenfassung der Ausgabe Variablen. Betriebe in BWAs sowie die gesamte Hektarzahl pro Ackerfrucht in den BWAs
collapse (count) x, by(BWA_SCR TotalC0101 TotalC0102 TotalC0104 TotalC0105 TotalC0106 TotalC0107 TotalC0110  ///
TotalC0122  TotalC0124  TotalC0142  TotalC0143  TotalC0145   ///  TotalC0161  TotalC0231  TotalC0232  TotalC0233  TotalC0210 ///
Max1C0101  Max1C0102  Max1C0104  Max1C0105  Max1C0106  Max1C0107  Max1C0110   ///  Max1C0122  Max1C0124  Max1C0142 Max1C0143 Max1C0145  /// Max1C0161 Max1C0231 Max1C0232 Max1C0233  Max1C0210 )
save "E:\fdz-gast10\heckelei_3287_2017_schaefer\output\output_20180124/1_cropShares_RAW.dta", replace

*************************************************************************
*** II. Datenoutput
*************************************************************************

* --- Output2: Exportiere Fruchtanteile je BWA und SCR außer Differenzgruppe
export delim BWA_SCR TotalC0101 TotalC0102 TotalC0104 TotalC0105 TotalC0106 TotalC0107 TotalC0110///
      TotalC0122 TotalC0124 TotalC0142 TotalC0143 TotalC0145  ///
              TotalC0161 TotalC0231 TotalC0232 TotalC0233  TotalC0210 ///
              Max1C0101 Max1C0102 Max1C0104 Max1C0105 Max1C0106 Max1C0107 Max1C0110  ///
              Max1C0122 Max1C0124 Max1C0142 Max1C0143 Max1C0145  ///
              Max1C0161 Max1C0231 Max1C0232 Max1C0233   Max1C0210 ///  ///
Using "E:\fdz-gast10\heckelei_3287_2017_schaefer\output/output_20180124/1_cropShares.csv", replace
```

Appendix 4: Results on farm importance

Farm types[a]	Share of farm area	Share of farm numbers	Share of livestock units	Share of dairy cows	Share of fattening pigs	Number of farms
151_<50_>0.2	0.36%	0.76%	0.11%	0.00%	0.01%	256
151_<50_0	3.80%	8.09%	0.04%	0.00%	0.01%	2725
151_>200_0	-	0.20%	-	-	-	67
151_100-200_0	2.35%	0.76%	0.03%	-	-	255
151_50-100_>0.2	0.24%	0.15%	0.07%	-	0.01%	49
151_50-100_0	2.90%	1.78%	0.04%	-	0.02%	600
161_<50_0	0.41%	0.71%	0.00%	-	-	240
161_100-200_0	0.75%	0.24%	-	-	-	82
161_50-100_0	0.41%	0.25%	0.00%	-	0.00%	85
162_<50_0	0.92%	1.37%	0.01%	-	-	461
162_>200_0	-	0.14%	-	0.00%	-	46
162_100-200_0	1.21%	0.38%	0.01%	0.00%	0.00%	127
162_50-100_0	1.38%	0.83%	0.01%	-	-	280
166_<50_>0.2	0.20%	0.28%	0.08%	-	0.06%	93
166_<50_0	2.70%	6.88%	0.01%	0.00%	0.01%	2317
166_>200_0	1.69%	0.21%	0.01%	0.00%	-	71
166_100-200_>0.2	0.50%	0.16%	0.24%	0.08%	-	54
166_100-200_0	2.02%	0.63%	0.03%	0.01%	-	211
166_50-100_>0.2	0.60%	0.34%	0.24%	-	0.17%	116
166_50-100_0	1.58%	0.97%	0.02%	-	0.01%	326
450_<20_>3	0.05%	0.23%	0.39%	1.18%	-	76
450_<20_0-1	0.07%	0.23%	0.04%	0.11%	-	79
450_<20_1-2	0.18%	0.54%	0.21%	0.58%	-	182
450_<20_2-3	0.11%	0.32%	0.21%	0.57%	-	109
450_>100_>3	0.48%	0.15%	1.37%	4.10%	-	50
450_>100_0-1	0.84%	0.25%	0.56%	1.52%	-	84
450_>100_1-2	4.71%	1.45%	5.50%	15.47%	-	487
450_>100_2-3	1.90%	0.57%	3.52%	10.16%	-	192
450_20-50_>3	0.44%	0.51%	1.35%	3.68%	-	171
450_20-50_0-1	0.33%	0.39%	0.19%	0.52%	-	133
450_20-50_1-2	1.37%	1.62%	1.61%	4.37%	-	547
450_20-50_2-3	0.82%	0.94%	1.55%	4.22%	-	316
450_50-100_>3	0.91%	0.57%	2.71%	7.54%	0.14%	192
450_50-100_0-1	0.80%	0.46%	0.52%	1.45%	0.00%	156
450_50-100_1-2	5.10%	3.03%	6.06%	17.04%	0.04%	1022
450_50-100_2-3	2.62%	1.59%	4.94%	13.85%	0.06%	535
460_<20_>3	0.16%	1.30%	1.19%	-	-	438
460_<20_0-1	0.65%	2.18%	0.35%	0.00%	-	734
460_<20_1-2	0.78%	2.78%	0.85%	-	-	936

Farm types[a]	Share of farm area	Share of farm numbers	Share of livestock units	Share of dairy cows	Share of fattening pigs	Number of farms
460_<20_2-3	0.21%	0.96%	0.40%	-	-	324
460_>100_1-2	0.53%	0.16%	-	-	-	53
460_20-50_>3	0.20%	0.26%	0.72%	-	0.03%	88
460_20-50_0-1	1.06%	1.44%	0.58%	-	0.00%	486
460_20-50_1-2	1.30%	1.69%	1.44%	-	0.01%	570
460_20-50_2-3	0.37%	0.46%	0.69%	-	0.02%	155
460_50-100_>3	0.22%	0.15%	0.67%	-	-	49
460_50-100_0-1	0.65%	0.42%	0.36%	-	-	141
460_50-100_1-2	0.91%	0.58%	1.01%	-	-	196
460_50-100_2-3	0.46%	0.28%	0.88%	-	-	94
470_<20_>3	0.02%	0.16%	0.17%	0.15%	0.00%	54
470_<20_1-2	0.08%	0.24%	0.09%	0.09%	-	81
470_<20_2-3	0.05%	0.17%	0.10%	0.12%	-	57
470_20-50_0-1	0.11%	0.14%	0.06%	0.06%	0.00%	48
470_20-50_1-2	0.34%	0.43%	0.39%	0.54%	0.01%	145
470_20-50_2-3	0.13%	0.16%	0.25%	0.34%	0.02%	55
470_50-100_1-2	0.55%	0.33%	0.64%	0.91%	-	110
470_50-100_2-3	0.28%	0.18%	0.53%	0.72%	-	59
511_<20_>3	-	0.53%	-	0.00%	-	179
511_20-50_>3	-	0.34%	-	-	0.07%	113
511_20-50_1-2	-	0.33%	-	0.00%	0.03%	111
511_20-50_2-3	-	0.48%	-	0.00%	0.06%	162
511_50-100_1-2	-	0.34%	-	-	-	113
511_50-100_2-3	-	0.25%	-	-	-	83
512_<20_>3	0.08%	3.85%	8.52%	-	26.15%	1296
512_<20_1-2	0.09%	0.28%	0.11%	0.00%	0.33%	93
512_<20_2-3	0.08%	0.25%	0.16%	0.00%	0.49%	85
512_>100_1-2	-	0.51%	-	-	-	173
512_20-50_>3	0.37%	0.47%	1.10%	-	3.50%	158
512_20-50_1-2	0.63%	0.75%	0.80%	-	2.49%	254
512_20-50_2-3	0.92%	1.07%	1.80%	-	5.79%	361
512_50-100_1-2	-	1.26%	-	0.00%	8.99%	423
512_50-100_2-3	-	0.96%	-	-	8.63%	322
513_>100_1-2	-	0.13%	-	0.00%	-	45
513_20-50_>3	0.11%	0.13%	0.35%	-	0.63%	44
513_20-50_1-2	0.19%	0.23%	0.23%	-	0.41%	76
513_20-50_2-3	0.25%	0.29%	0.49%	-	0.89%	98
513_50-100_1-2	-	0.44%	-	-	-	148
513_50-100_2-3	-	0.38%	-	0.00%	-	129
731_<50_1-2	0.13%	0.18%	0.15%	0.24%	0.09%	62

Farm types[a]	Share of farm area	Share of farm numbers	Share of livestock units	Share of dairy cows	Share of fattening pigs	Number of farms
731_<50_2-3	0.11%	0.14%	0.21%	0.32%	0.20%	48
732_<50_0-1	0.10%	0.21%	0.05%	0.00%	0.03%	72
732_<50_1-2	0.13%	0.25%	0.16%	-	0.10%	84
732_<50_2-3	0.12%	0.18%	0.22%	-	0.21%	61
741_50-100_2-3	-	0.13%	-	-	-	45
742_<50_>3	0.08%	0.14%	0.25%	-	0.36%	48
742_<50_1-2	0.22%	0.36%	0.26%	-	0.36%	122
742_<50_2-3	0.18%	0.25%	0.34%	-	0.58%	83
742_100-200_1-2	0.39%	0.13%	0.44%	-	-	45
742_50-100_1-2	0.48%	0.28%	0.57%	0.00%	1.06%	95
742_50-100_2-3	0.37%	0.23%	0.68%	-	1.26%	79
831_<50_0-1	0.13%	0.20%	0.05%	0.10%	-	66
831_50-100_0-1	0.31%	0.19%	0.14%	0.33%	-	65
832_50-100_0-1	0.25%	0.15%	0.15%	0.40%	0.00%	50
841_<50_0-1	0.64%	1.07%	0.33%	-	0.74%	362
841_<50_1-2	0.30%	0.42%	0.29%	0.00%	0.73%	141
841_>150_0-1	1.35%	0.28%	0.68%	-	1.76%	93
841_100-150_0-1	1.08%	0.38%	0.55%	-	1.34%	128
841_100-150_1-2	0.67%	0.23%	0.64%	-	1.80%	78
841_50-100_0-1	1.37%	0.81%	0.75%	-	1.74%	272
841_50-100_1-2	0.90%	0.52%	0.94%	0.00%	2.51%	176

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation.; [a] *Code refers to Specialization (see Appendix 1)_size in ha_stocking density in LU ha*$^{-1}$

Appendix 5: Results on farm characteristics

Farm type[a]	LU total	Dairy cows [LU]	Pig [LU]	Sows [LU]	Arable land [ha]	Grassland [ha]	Livestock density [LU ha^{-1}]
151_<50_>0.2	7.00	0.00	0.00	0.00	14.00	3.00	0.36
151_<50_0	0.00	0.00	0.00	0.00	14.96	0.50	0.00
151_>200_0	0.00	0.00	0.00	0.00	233.50	4.89	0.00
151_100-200_0	0.00	0.00	0.00	0.00	119.11	3.00	0.00
151_50-100_>0.2	23.75	0.00	0.00	0.00	55.20	13.86	0.32
151_50-100_0	0.00	0.00	0.00	0.00	62.40	1.96	0.00
161_<50_0	0.00	-	0.00	0.00	19.90	0.00	0.00
161_100-200_0	0.00	-	0.00	0.00	120.28	1.19	0.00
161_50-100_0	0.00	-	0.00	0.00	65.07	0.00	0.00
162_<50_0	0.00	0.00	0.00	-	27.95	0.13	0.00

Farm type[a]	LU total	Dairy cows [LU]	Pig [LU]	Sows [LU]	Arable land [ha]	Grassland [ha]	Livestock density [LU ha^{-1}]
162_>200_0	0.00	0.00	0.00	-	231.63	1.12	0.00
162_100-200_0	0.00	0.00	0.00	-	128.20	0.95	0.00
162_50-100_0	0.00	0.00	0.00	-	67.30	0.36	0.00
166_<50_>0.2	11.30	0.00	0.00	0.00	24.50	3.29	0.38
166_<50_0	0.00	0.00	0.00	0.00	6.00	5.01	0.00
166_>200_0	0.00	0.00	0.00	0.00	261.29	3.80	0.00
166_100-200_>0.2	57.57	0.00	0.00	0.00	116.95	10.36	0.43
166_100-200_0	0.00	0.00	0.00	0.00	123.02	3.00	0.00
166_50-100_>0.2	29.49	0.00	0.00	0.00	60.13	8.92	0.42
166_50-100_0	0.00	0.00	0.00	0.00	60.53	2.28	0.00
450_<20_>3	51.98	30.00	0.00	0.00	1.89	3.22	4.80
450_<20_0-1	9.30	6.00	0.00	0.00	3.30	8.38	0.69
450_<20_1-2	21.13	13.00	0.00	0.00	3.92	8.50	1.52
450_<20_2-3	37.70	22.00	0.00	0.00	6.82	6.25	2.44
450_>100_>3	476.85	315.00	0.00	0.00	80.74	47.14	3.42
450_>100_0-1	109.00	65.00	0.00	0.00	63.10	71.49	0.88
450_>100_1-2	196.30	125.00	0.00	0.00	53.81	79.19	1.49
450_>100_2-3	300.50	193.00	0.00	0.00	74.04	54.52	2.31
450_20-50_>3	143.98	84.00	0.00	0.00	26.50	9.94	3.72
450_20-50_0-1	27.90	16.00	0.00	0.00	8.25	23.89	0.80
450_20-50_1-2	51.20	31.00	0.00	0.00	13.59	20.80	1.47
450_20-50_2-3	91.33	56.00	0.00	0.00	22.08	13.99	2.36
450_50-100_>3	244.35	147.50	0.00	0.00	48.10	17.87	3.55
450_50-100_0-1	60.35	36.00	0.00	0.00	27.98	42.76	0.87
450_50-100_1-2	104.60	67.00	0.00	0.00	24.24	44.07	1.51
450_50-100_2-3	165.30	106.00	0.00	0.00	41.76	26.00	2.36
460_<20_>3	30.92	0.00	0.00	0.00	0.00	1.51	4.50
460_<20_0-1	8.20	0.00	0.00	0.00	0.00	10.43	0.72
460_<20_1-2	16.20	0.00	0.00	0.00	0.87	7.05	1.38
460_<20_2-3	19.20	0.00	0.00	0.00	2.67	4.27	2.39
460_>100_1-2	183.80	0.00	0.00	0.00	97.30	28.24	1.40
460_20-50_>3	131.85	0.00	0.00	0.00	26.08	3.90	3.90
460_20-50_0-1	21.40	0.00	0.00	0.00	0.28	24.24	0.74

Farm type[a]	LU total	Dairy cows [LU]	Pig [LU]	Sows [LU]	Arable land [ha]	Grassland [ha]	Livestock density [LU ha^{-1}]
460_20-50_1-2	43.80	0.00	0.00	0.00	15.89	15.09	1.37
460_20-50_2-3	80.10	0.00	0.00	0.00	24.90	5.50	2.34
460_50-100_>3	231.22	0.00	0.00	0.00	58.19	2.01	3.40
460_50-100_0-1	48.80	0.00	0.00	0.00	10.29	51.80	0.74
460_50-100_1-2	89.18	0.00	0.00	0.00	37.99	25.98	1.36
460_50-100_2-3	165.63	0.00	0.00	0.00	58.85	7.91	2.44
470_<20_>3	32.68	6.00	0.00	0.00	0.00	2.43	4.15
470_<20_1-2	20.40	4.00	0.00	0.00	3.88	8.02	1.50
470_<20_2-3	33.90	8.00	0.00	0.00	6.67	5.63	2.38
470_20-50_0-1	22.15	3.50	0.00	0.00	5.39	23.68	0.72
470_20-50_1-2	48.90	15.00	0.00	0.00	17.46	14.13	1.45
470_20-50_2-3	79.20	24.00	0.00	0.00	24.26	9.75	2.34
470_50-100_1-2	107.65	31.00	0.00	0.00	37.15	28.25	1.54
470_50-100_2-3	157.40	55.00	0.00	0.00	47.33	14.52	2.37
511_<20_>3	106.00	0.00	0.12	86.70	0.00	0.00	4.63
511_20-50_>3	134.10	0.00	0.24	114.00	30.00	0.50	4.10
511_20-50_1-2	62.22	0.00	0.24	45.00	36.10	0.70	1.69
511_20-50_2-3	86.29	0.00	0.24	64.35	33.65	0.76	2.44
511_50-100_1-2	108.18	0.00	0.24	81.60	63.00	1.22	1.60
511_50-100_2-3	148.72	0.00	0.36	115.50	57.05	1.71	2.35
512_<20_>3	106.54	0.00	103.26	0.00	0.00	0.00	4.60
512_<20_1-2	22.47	0.00	21.48	0.00	12.67	0.30	1.61
512_<20_2-3	33.90	0.00	31.20	0.00	12.74	0.00	2.49
512_>100_1-2	179.76	0.00	177.84	0.00	116.49	2.31	1.47
512_20-50_>3	117.80	0.00	114.00	0.00	31.04	0.00	3.40
512_20-50_1-2	56.40	0.00	54.00	0.00	33.58	0.68	1.64
512_20-50_2-3	93.60	0.00	92.40	0.00	36.00	0.00	2.46
512_50-100_1-2	118.44	0.00	117.60	0.00	71.00	1.00	1.68
512_50-100_2-3	149.82	0.00	148.32	0.00	61.67	0.35	2.30
513_>100_1-2	180.24	0.00	106.08	64.50	118.74	1.50	1.50
513_20-50_>3	140.62	0.00	78.00	43.35	32.83	0.60	3.87
513_20-50_1-2	53.57	0.00	28.20	17.55	33.42	0.96	1.63
513_20-50_2-3	92.91	0.00	51.00	25.05	37.21	1.05	2.44

Farm type[a]	LU total	Dairy cows [LU]	Pig [LU]	Sows [LU]	Arable land [ha]	Grassland [ha]	Livestock density [LU ha^{-1}]
513_50-100_1-2	116.53	0.00	64.02	37.35	71.90	1.12	1.66
513_50-100_2-3	144.52	0.00	87.84	45.00	60.23	0.90	2.27
731_<50_1-2	43.18	15.00	7.44	0.00	20.44	7.91	1.46
731_<50_2-3	79.18	24.00	22.14	0.00	24.31	8.22	2.54
732_<50_0-1	9.38	0.00	0.00	0.00	8.53	5.92	0.71
732_<50_1-2	29.86	0.00	2.22	0.00	13.97	4.95	1.41
732_<50_2-3	73.60	0.00	18.48	0.00	23.40	2.00	2.44
741_50-100_2-3	177.44	36.00	98.76	0.00	58.24	12.50	2.47
742_<50_>3	107.50	0.00	43.86	0.00	22.61	1.05	3.62
742_<50_1-2	33.05	0.00	11.76	0.00	18.03	3.51	1.43
742_<50_2-3	78.60	0.00	40.80	0.00	27.85	2.00	2.48
742_100-200_1-2	178.16	0.00	132.00	0.00	109.32	11.00	1.42
742_50-100_1-2	105.92	0.00	71.04	0.00	62.72	6.00	1.53
742_50-100_2-3	159.30	0.00	89.88	0.00	61.70	3.88	2.27
831_<50_0-1	13.40	5.00	0.00	0.00	18.98	6.00	0.51
831_50-100_0-1	38.60	21.00	0.00	0.00	53.48	12.19	0.55
832_50-100_0-1	52.05	32.00	0.00	0.00	52.31	18.42	0.73
841_<50_0-1	14.02	0.00	7.20	0.00	21.28	0.68	0.64
841_<50_1-2	37.78	0.00	27.72	0.00	30.00	0.16	1.19
841_>150_0-1	132.33	0.00	118.56	0.00	185.88	3.91	0.69
841_100-150_0-1	82.32	0.00	64.02	0.00	115.00	2.45	0.69
841_100-150_1-2	144.00	0.00	135.90	0.00	120.51	0.82	1.19
841_50-100_0-1	48.78	0.00	38.40	0.00	69.33	0.88	0.73
841_50-100_1-2	93.45	0.00	82.20	0.00	70.57	1.00	1.27

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation.; [a] *Code refers to Specialization (see Appendix 1)_size in ha_stocking density in LU* ha^{-1}

Appendix 6: Results on farm location

Farm type[a]	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191	Number of farms
151_<50_>0.2	1.56%	5.86%	2.34%	30.47%	23.44%	2.34%	6.64%	22.27%	5.08%	256
151_<50_0	1.72%	5.06%	5.47%	25.61%	18.83%	6.72%	10.02%	22.68%	3.89%	2725
151_>200_0	2.99%	8.96%	14.93%	31.34%	32.84%	2.99%	1.49%	0.00%	4.48%	67

Farm type[a]	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191	Number of farms
151_100-200_0	9.02%	5.88%	16.08%	24.71%	26.67%	0.78%	4.31%	7.84%	4.71%	255
151_50-100_>0.2	10.20%	8.16%	4.08%	30.61%	26.53%	6.12%	6.12%	4.08%	4.08%	49
151_50-100_0	2.67%	6.83%	9.00%	32.83%	21.67%	3.33%	6.83%	12.50%	4.33%	600
161_<50_0	0.00%	0.42%	33.33%	49.58%	0.83%	2.92%	2.92%	9.58%	0.42%	240
161_100-200_0	0.00%	0.00%	64.63%	31.71%	0.00%	1.22%	1.22%	1.22%	0.00%	82
161_50-100_0	0.00%	1.18%	63.53%	31.76%	0.00%	0.00%	1.18%	1.18%	1.18%	85
162_<50_0	0.00%	0.65%	60.30%	24.51%	6.29%	0.43%	3.47%	3.47%	0.87%	461
162_>200_0	0.00%	0.00%	52.17%	30.43%	13.04%	0.00%	2.17%	0.00%	2.17%	46
162_100-200_0	0.00%	0.00%	67.72%	20.47%	7.87%	0.00%	3.15%	0.00%	0.79%	127
162_50-100_0	0.00%	0.71%	67.86%	19.29%	5.36%	0.36%	3.21%	1.07%	2.14%	280
166_<50_>0.2	0.00%	3.23%	30.11%	37.63%	13.98%	0.00%	5.38%	6.45%	3.23%	93
166_<50_0	3.45%	14.29%	6.60%	25.33%	14.11%	3.50%	3.88%	24.56%	4.27%	2317
166_>200_0	1.41%	0.00%	43.66%	22.54%	12.68%	1.41%	11.27%	4.23%	2.82%	71
166_100-200_>0.2	1.85%	3.70%	25.93%	50.00%	9.26%	0.00%	1.85%	3.70%	3.70%	54
166_100-200_0	1.42%	2.37%	34.12%	29.38%	15.17%	2.37%	3.79%	9.00%	2.37%	211
166_50-100_>0.2	1.72%	1.72%	35.34%	39.66%	10.34%	1.72%	0.86%	6.03%	2.59%	116
166_50-100_0	2.76%	4.91%	23.62%	34.05%	12.88%	2.76%	4.60%	11.04%	3.37%	326
450_<20_>3	0.00%	5.26%	10.53%	21.05%	7.89%	3.95%	2.63%	44.74%	3.95%	76
450_<20_0-1	8.86%	32.91%	1.27%	11.39%	12.66%	8.86%	6.33%	12.66%	5.06%	79
450_<20_1-2	4.40%	24.18%	4.95%	17.03%	10.44%	4.40%	1.65%	26.92%	6.04%	182
450_<20_2-3	0.92%	7.34%	2.75%	18.35%	7.34%	6.42%	1.83%	54.13%	0.92%	109
450_>100_>3	0.00%	0.00%	6.00%	62.00%	0.00%	0.00%	0.00%	32.00%	0.00%	50
450_>100_0-1	17.86%	28.57%	4.76%	11.90%	20.24%	3.57%	3.57%	4.76%	4.76%	84
450_>100_1-2	12.32%	23.82%	8.01%	19.30%	19.51%	4.11%	2.05%	7.60%	3.29%	487
450_>100_2-3	3.65%	13.54%	3.65%	43.75%	8.85%	1.04%	2.60%	21.88%	1.04%	192
450_20-50_>3	1.17%	0.58%	4.68%	29.24%	1.75%	0.58%	1.17%	60.23%	0.58%	171
450_20-50_0-1	11.28%	37.59%	3.76%	15.04%	9.77%	4.51%	3.76%	4.51%	9.77%	133
450_20-50_1-2	3.66%	30.35%	6.58%	20.11%	14.26%	2.01%	0.37%	19.38%	3.29%	547
450_20-50_2-3	0.95%	8.54%	8.23%	28.48%	6.33%	1.90%	0.63%	43.67%	1.27%	316
450_50-100_>3	0.00%	1.04%	7.29%	44.79%	0.52%	0.52%	0.52%	44.79%	0.52%	192
450_50-100_0-1	19.23%	28.85%	3.85%	7.69%	23.72%	2.56%	1.28%	5.13%	7.69%	156
450_50-100_1-2	5.28%	34.93%	5.38%	19.86%	18.69%	1.57%	0.98%	9.88%	3.42%	1022
450_50-100_2-3	0.56%	10.84%	7.29%	37.38%	5.98%	0.75%	0.37%	36.26%	0.56%	535

Farm type[a]	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191	Number of farms
460_<20_>3	1.83%	5.25%	4.79%	23.29%	8.22%	0.68%	2.05%	51.14%	2.74%	438
460_<20_0-1	8.58%	46.73%	0.95%	6.95%	16.21%	1.77%	0.95%	15.94%	1.91%	734
460_<20_1-2	4.70%	26.60%	0.96%	13.35%	15.60%	2.56%	1.60%	30.98%	3.63%	936
460_<20_2-3	3.09%	4.94%	2.78%	20.06%	10.80%	3.70%	1.85%	51.54%	1.23%	324
460_>100_1-2	0.00%	7.55%	5.66%	24.53%	13.21%	5.66%	9.43%	32.08%	1.89%	53
460_20-50_>3	0.00%	0.00%	3.41%	21.59%	2.27%	3.41%	2.27%	64.77%	2.27%	88
460_20-50_0-1	8.02%	41.15%	2.67%	11.32%	14.40%	1.44%	0.82%	17.08%	3.09%	486
460_20-50_1-2	1.58%	23.51%	1.58%	19.65%	11.75%	2.46%	3.16%	32.81%	3.51%	570
460_20-50_2-3	0.65%	7.74%	1.29%	24.52%	5.16%	1.94%	3.87%	52.90%	1.94%	155
460_50-100_>3	0.00%	0.00%	0.00%	22.45%	2.04%	0.00%	2.04%	73.47%	0.00%	49
460_50-100_0-1	12.77%	29.79%	2.84%	14.89%	18.44%	0.71%	1.42%	16.31%	2.84%	141
460_50-100_1-2	3.57%	23.47%	0.51%	27.04%	10.71%	2.55%	3.57%	23.47%	5.10%	196
460_50-100_2-3	0.00%	4.26%	2.13%	28.72%	4.26%	3.19%	1.06%	52.13%	4.26%	94
470_<20_>3	0.00%	14.81%	5.56%	18.52%	1.85%	1.85%	0.00%	53.70%	3.70%	54
470_<20_1-2	4.94%	13.58%	2.47%	14.81%	16.05%	6.17%	0.00%	38.27%	3.70%	81
470_<20_2-3	1.75%	5.26%	1.75%	17.54%	5.26%	1.75%	1.75%	59.65%	5.26%	57
470_20-50_0-1	8.33%	43.75%	0.00%	10.42%	12.50%	8.33%	0.00%	12.50%	4.17%	48
470_20-50_1-2	0.69%	14.48%	1.38%	22.07%	13.10%	3.45%	4.83%	35.86%	4.14%	145
470_20-50_2-3	0.00%	9.09%	1.82%	16.36%	1.82%	1.82%	0.00%	69.09%	0.00%	55
470_50-100_1-2	3.64%	15.45%	5.45%	21.82%	18.18%	4.55%	2.73%	25.45%	2.73%	110
470_50-100_2-3	0.00%	1.69%	1.69%	25.42%	1.69%	0.00%	3.39%	62.71%	3.39%	59
511_<20_>3	0.56%	5.03%	0.00%	29.05%	6.70%	2.79%	3.91%	49.72%	2.23%	179
511_20-50_>3	0.00%	0.88%	0.88%	30.97%	1.77%	6.19%	2.65%	54.87%	1.77%	113
511_20-50_1-2	0.00%	2.70%	2.70%	36.94%	4.50%	1.80%	0.00%	47.75%	3.60%	111
511_20-50_2-3	0.00%	1.23%	1.23%	31.48%	5.56%	1.85%	0.62%	55.56%	2.47%	162
511_50-100_1-2	0.00%	4.42%	0.00%	27.43%	7.96%	5.31%	7.08%	46.90%	0.88%	113
511_50-100_2-3	0.00%	7.23%	0.00%	30.12%	7.23%	6.02%	2.41%	45.78%	1.20%	83
512_<20_>3	0.00%	3.86%	1.00%	37.50%	6.79%	2.55%	2.62%	43.90%	1.77%	1296
512_<20_1-2	1.08%	1.08%	0.00%	27.96%	1.08%	3.23%	3.23%	61.29%	1.08%	93
512_<20_2-3	0.00%	2.35%	0.00%	41.18%	2.35%	1.18%	1.18%	51.76%	0.00%	85
512_>100_1-2	0.00%	8.09%	0.58%	35.26%	24.28%	2.89%	2.31%	21.97%	4.62%	173
512_20-50_>3	0.00%	1.90%	0.63%	38.61%	1.27%	2.53%	1.27%	52.53%	1.27%	158
512_20-50_1-2	0.00%	3.15%	0.00%	41.34%	6.30%	5.51%	3.94%	37.01%	2.76%	254

Farm type[a]	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191	Number of farms
512_20-50_2-3	0.00%	2.22%	0.00%	39.89%	4.16%	2.22%	2.77%	46.81%	1.94%	361
512_50-100_1-2	0.24%	6.86%	0.47%	33.10%	15.37%	4.26%	4.96%	32.15%	2.60%	423
512_50-100_2-3	0.62%	2.80%	0.00%	39.44%	5.28%	3.42%	1.55%	44.41%	2.48%	322
513_>100_1-2	0.00%	13.33%	2.22%	17.78%	26.67%	11.11%	4.44%	20.00%	4.44%	45
513_20-50_>3	0.00%	2.27%	0.00%	38.64%	2.27%	2.27%	2.27%	52.27%	0.00%	44
513_20-50_1-2	0.00%	6.58%	0.00%	43.42%	6.58%	9.21%	3.95%	30.26%	0.00%	76
513_20-50_2-3	0.00%	4.08%	0.00%	37.76%	2.04%	3.06%	1.02%	52.04%	0.00%	98
513_50-100_1-2	0.00%	4.73%	1.35%	35.14%	10.14%	13.51%	4.73%	27.70%	2.70%	148
513_50-100_2-3	0.00%	0.00%	1.55%	36.43%	6.20%	5.43%	0.78%	44.96%	4.65%	129
731_<50_1-2	0.00%	9.68%	0.00%	29.03%	14.52%	6.45%	6.45%	30.65%	3.23%	62
731_<50_2-3	0.00%	0.00%	0.00%	31.25%	0.00%	0.00%	0.00%	68.75%	0.00%	48
732_<50_0-1	1.39%	13.89%	5.56%	26.39%	19.44%	2.78%	4.17%	23.61%	2.78%	72
732_<50_1-2	1.19%	9.52%	0.00%	22.62%	11.90%	0.00%	2.38%	46.43%	5.95%	84
732_<50_2-3	0.00%	3.28%	0.00%	19.67%	4.92%	1.64%	1.64%	63.93%	4.92%	61
741_50-100_2-3	0.00%	0.00%	0.00%	40.00%	2.22%	0.00%	0.00%	55.56%	2.22%	45
742_<50_>3	2.08%	2.08%	0.00%	18.75%	4.17%	0.00%	2.08%	64.58%	6.25%	48
742_<50_1-2	0.00%	7.38%	1.64%	30.33%	8.20%	3.28%	1.64%	44.26%	3.28%	122
742_<50_2-3	0.00%	2.41%	1.20%	33.73%	1.20%	0.00%	0.00%	59.04%	2.41%	83
742_100-200_1-2	0.00%	2.22%	0.00%	33.33%	8.89%	13.33%	2.22%	33.33%	6.67%	45
742_50-100_1-2	0.00%	6.32%	1.05%	34.74%	2.11%	4.21%	8.42%	37.89%	5.26%	95
742_50-100_2-3	0.00%	0.00%	1.27%	27.85%	1.27%	1.27%	0.00%	67.09%	1.27%	79
831_<50_0-1	3.03%	9.09%	18.18%	18.18%	19.70%	3.03%	3.03%	19.70%	6.06%	66
831_50-100_0-1	6.15%	3.08%	41.54%	21.54%	16.92%	1.54%	3.08%	3.08%	3.08%	65
832_50-100_0-1	6.00%	4.00%	32.00%	18.00%	30.00%	2.00%	2.00%	4.00%	2.00%	50
841_<50_0-1	0.00%	5.25%	1.66%	27.90%	15.19%	9.12%	8.01%	29.83%	3.04%	362
841_<50_1-2	0.00%	0.71%	2.84%	43.26%	5.67%	4.26%	3.55%	39.01%	0.71%	141
841_>150_0-1	0.00%	7.53%	1.08%	22.58%	36.56%	5.38%	11.83%	10.75%	4.30%	93
841_100-150_0-1	0.78%	3.13%	4.69%	33.59%	28.91%	4.69%	4.69%	16.41%	3.13%	128
841_100-150_1-2	0.00%	6.41%	1.28%	46.15%	6.41%	6.41%	6.41%	21.79%	5.13%	78
841_50-100_0-1	0.00%	6.25%	4.41%	30.88%	21.69%	8.46%	9.93%	15.81%	2.57%	272
841_50-100_1-2	0.00%	5.68%	2.84%	36.93%	6.82%	4.55%	2.27%	39.77%	1.14%	176

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation.; [a] Code refers to specialization (see Appendix 1)_size in ha_stocking density in LU ha^{-1}, SCR – soil-climate region

Farm type[a]	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191	Number of farms

Appendix 7: Results on crop rotations

Specialization	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191
151	WW WB WR[b]	WW WB WR[a]	WW WB WR[a]	WW WB WR[a]	WW WB WR[a]	-	WW WB WR[a]	WW KM KM[a]	WW WB WR[a]
161	-	--	WW WW SB[b]	WW WB SB[b]	-	-	-	-	-
162	WW WW SB[a]	-	WW WW SB[a]	WW WW SB[a]	-	-	-	-	-
166	WW WB SB[b]	-	WW WB SM[a]	WW WB SM[a]	WW WB SM[a]	WTr WB SM SM[a]	WW WB SM[a]	WW SM SM[a]	-
450	WW SG SM[a]	WW SM SM[a]	WW SM SB[b]	WW SM SM[a]	WW WB SM[b]	-	WW WB SM[a]	-	-
460	WW SG WTr[b]	-	WW SM SM[b]	WW WB SM SM[a]	WW WB SM SM[b]	WTr WB SM SM[a]	-	WTr SM SM[a]	-
470	WW SM WW WTr[b]	-	WW SM[b]	WW SM SM[a]	WW WB SM SM[b]	-	-	WTr WB SM SM[a]	WW WTr SM SM[a]
511	-	-	WW B SB[b]	WW WB CCM[b]	WW WB WR[b]	WTr WB CCM[a]	-	WTr WB CCM SM[a]	-
512	-	-	WW WB SB[b]	WW WB CCM[a]	WW WB WTr WR[b]	-	-	WW WB CCM CCM[a]	-
513	-	-	WW WB SB[a]	WW WB CCM[a]	WW WB WR[b]	-	-	WTr WB CCM CCM[a]	-
731	-	WW WB SM[a]	-	-	-		-	WW WB CCM SM[a]	-
732	-	-	-	-	WW WB SM[a]	-	-	WTr WB SM SM[a]	-
741	-	-	-	-	-		-	WW WB CCM SM[a]	-
742	-	-	-	WW WB CCM SM[a]	-	WW WTr CCM SM[a]	-	WTr WB CCM SM[a]	-
831	WW WB WW WR[b]	-	WW SM WW SB[a]	WW WB SM SB[b]	WG WB SM[b]	-	-	WW WB SM SM[b]	-
832	WW WB WW WR[a]	-	WW SM WW SB[b]	WW WB SM SB[b]	WW WB WW WR[b]	-	-	WB CCM CCM SM[b]	-
833	WW SG WR[a]	-	WW WB SM SB[a]	WW WB SM[a]	-	-	-	WTr WB CCM SM[a]	WW WB SM[a]

Specialization	SCR 129	SCR 134	SCR 141	SCR 142	SCR 143	SCR 146	SCR 147	SCR 148	SCR 191
834	-	WWTr WR SM[a]	WW WB SB[b]	WW WB SM[a]	-	-	-	WTr WB CCM SM[a]	WW WB SM[a]
841	-	-	-	WW WB WW CCM[a]	WW WB WR[a]	-	WW WB WR[a]	WTr WB CCM SM[a]	-

Source: RDC of the Federal Statistical Office and Statistical Offices of the Laender. Farm Structure Survey, 2016, own calculation (crop rotations marked with [a]), RDC of the Federal Statistical Office and Statistical Offices of the Laender, Census of Agriculture, 2010, own calculation (crop rotations marked with [b]), Gaiser (2018); [c] Code refers to specialization (see Appendix 1); WW - Winter wheat; WB - Winter barley; SB - Sugar beet; CCM - Corn-Cob-Mix; Tr - Triticale; WR - Winter rapeseed; WTr - Winter triticale; SM - Silage maize; WRa - Winter rapeseed; KM – Grain maize; SCR – soil-climate region.

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