5.3 Paper 3:

Structural development in Danish agriculture and its implications for farmland nature

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Abstract

During the last decades, development of Danish agriculture was characterised by concentration of land on fewer and larger farms and consequently increasing farm sizes. On basis of three case studies supplemented by national data we explore relationships between farm size change and farmland nature in terms of field sizes and hedgerow densities. Data point to a significant relationship between farm enlargement and increases in mean field sizes. Furthermore, mean field size is negatively related to densities of hedgerows. For the coming decades, scenarios for Danish agriculture point to a continued increase in farm sizes. We argue for an increased focus on the effects of a continued scale enlargement on farmland nature in terms of changes in field size structure. In order to reduce harmful influences of scale enlargement, we suggest that in relation to changes in field structure, agricultural policies should focus on restrictions on removal of old hedgerows and on subsidies for planting of new hedgerows.

Keywords

Structural development in agriculture, farm size, farmland nature, field size, field size structure, hedgerow density

Background

In Denmark, from 1960 until 2000 mean farm size has more than tripled (Hansen 2001). Scenarios of the agricultural development estimate that the number of farms will decrease by 52 % from 79,300 in 1990 to 38,500 in 2010 (Landboforeningerne 2002). Scenarios also estimate that the number of farms in all size categories up to 100 ha will decrease, while number of farms larger than 100 ha will increase, leading to a dramatic concentration of farmland on fewer farms.

During the last century, farmland nature has suffered as a consequence of the structural development, due to homogenisation of the cultivated area, adjusting it to new technology (Ministry of Environment and Energy 1995). However, in the mid-1980s the environmental discourse was introduced in agricultural policy and particularly since the early 1990ies, focus on the conservation and restoration of farmland nature increased. However, it remains an important question, whether the continued scale enlargement in agriculture still implies continued homogenisation and impoverishment of the farmland nature.

Over the last 50 years new technology necessitated the enlargement of agricultural fields through the merging of field plots, resulting in increasing field sizes (Benton et al. 2003). In both Denmark (Clausen and Larsen 1997) and England (Barr et al. 1993, Westmacott and Worthington 1997), during the last 50 years mean field sizes increased considerably and negative impacts on farmland nature and on hedgerow densities have been documented (Smith et al. 2005, Benton et al. 2003, Robinson and Sutherland 2002).

Hedgerows have been planted in Denmark with public subsidies since 1880 (Fritzbøger 2002). The Nature protection Agency however estimates a 40% decrease in dikes and hedgerows during the last 100 years (Prip 1995). Decreases in hedgerow densities have also been documented for other intensively farmed landscapes in Western Europe (Deckers et al. 2005; Barr and Gillespie, 2000; Haines-Young et al., 2003; Burel and Baudry, 1990). Hedgerows in field divides are sensitive to the merging of fields and it can be hypothesised that merging of fields does influence hedgerow density.

Due to the varying functions of hedgerows, the development has not been continuous in time and space. In addition to agricultural production also other factors like e.g. farmers' age (Ackerman 2003) or aesthetic and environmental functions (Kristensen 2003, Busck 2002, Kristensen 2001) are important for hedgerow dynamics. Moreover during the last century subsidy schemes for hedgerow planting have particularly focused on protection against soil erosion in western Denmark, where sandy soils dominate (Fritzbøger 2002).

In this paper we focus on scale enlargement in agriculture as driver for field size- and hedgerow dynamics. Combining results from different Danish studies we discuss the effect of a continued scale enlargement on field size- and hedgerow development. Our aim is to draw up a picture of future landscape development for use in policy making on nature conservation in the general farmland outside protected areas.

Data and methods

The paper draws on partial results from 3 case studies and a national analysis. Focus is on the period from 1995 to 2004, and the main analytical variables used are farm size, field size (the area covered by a single plot of agricultural land use) and density of hedgerows (measured as m/ha).

The first study is based on quantitative interviews with app. 10% (N=340) of Danish organic farmers, exploring land use and field- and farm size in 2001 and landscape activities from 1996 to 2001 (Frederiksen

and Langer 2005). The second study analyses landscape changes on 72 conventional and 40 organic farms in the period 1995 to 2004 using aerial photos (Levin in prep.). Hedgerow and field size development were followed, while changes in farm size were not investigated. This study has also been used to confirm that hedgerow data for organic farms are representative for Danish farms in general. The third study analyses changes in field and farm sizes from 1997 to 2002 on 234 organic farms, which converted to organic farming in 1997 and were still organic in 2004 (Langer et al. 2005). The 3 studies are supplemented by national data on changes in field- and farm sizes from 1998 to 2004. Furthermore, national data on hedgerow density in 2001 were derived from a national map of hedgerows. Finally, as data on hedgerow change are only available from study 2, we explore field size as an indicator of hedgerow density through this study.

For studies 1, 3 and national data, field sizes are derived from agricultural registers and reflect field units, for which farmers have applied for EU subsidies. Here, fields are administrative units, which however also constitute units of agricultural land use. For study 2, field sizes were registered on basis of aerial photos. Fields registered on aerial photos highly conform to fields recorded in agricultural registers. In this paper we estimate mean field size as the mean size of all fields within one farm unit.

Relationships between hedgerow density, farm size and field size in 2001/2002 are analysed on basis of studies 1, 2 and national data. How these variables change over time, is explored for the period from 1995 to 2004 in three steps. 1) On basis of study 1 we first establish the relationship between farm size, field size and hedgerow density in 2001 for a sample of farms, which are distributed over all major Danish landscape types and have a similar distribution over farm types as at national scale. 2) Based on study 2, we analyse the link between development in field size and in hedgerow densities. 3) Based on study 3 and national data, we explore the link between development in farm size and field size. Finally, based on study 1, we analyse how hedgerow activities are related to farm size.

Results

From 1998 to 2004, the average farm size in Denmark increased from 44 to 57 ha, while the total number of farms decreased from over 60,000 to about 47,000. In the same period mean field size for the whole country increased from 3.7 to 4.0 ha. As large fields (>8 ha) increased by number, and the total agricultural area has been decreasing, change in mean field size must be linked to the merging of fields.

Relationship between hedgerow density, farm size and field size.

Data collected in study 1 show a hedgerow density of 59m/ha in 2001 and a weak but significant negative relationship between density of hedgerows and farm size (r^2= 0.12 for log of farm size). There is also a weak, but significant negative relationship between hedgerow density and mean field size (r^2= 0.07). Analysing the relationship between mean field size and farm size in 2001 shows a clear and significant negative relationship (r^2= 0.39 for log of farm size).

In study 2 the mean density of hedgerows was 39m/ha and a weak but significant negative relationship is found between hedgerow density and

farm size (r^2= 0.08 for log of farm size) and between hedgerow density and mean field size (r^2= 0.04). Also a strong and positive relationship between farm and mean field sizes was found (r^2= 0.38 for log of farm size).

National registry data for 2001, including all 53,750 Danish farms, show a significant positive relation between farm size and mean field size (r^2= 0.22 for log of farm size)(Figure 1) and significant negative relations between farm size and hedgerow density (r^2= 0.03 for log of farm size) and between mean field size and hedgerow density (r^2= 0.03).

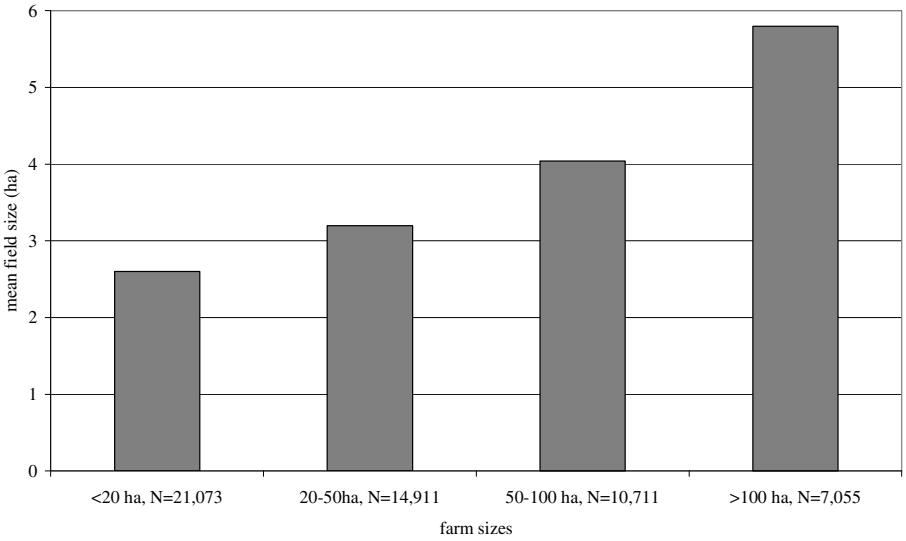

Figure 1: Mean field size over farm size, Denmark 2001
Sources: Agricultural register 2001

Changes in hedgerow density, field size and farm size

On the 112 farms in study 2, mean field sizes increased at average from 2,2 ha in 1995 to 3.2 ha in 2002, while hedgerow density increased on average by 12%. 25% of all farms removed hedgerows and 50% planted new hedgerows. While no relationship between change in mean field size and total change in hedgerow density was found in this study, a clear positive relationship between change in mean field size and both density of removed and density of planted hedgerows was found, indicating that farms with larger fields are most active in adjusting their field structure.

Among the 234 farms in study 3 significant increases in mean field size (>20%) were seen on 20% of all farms, and on 35-50% of the farms with considerable or major growth in farm size. There is a significant relationship between change in farm size and change in mean field size from 1997 to 2004, indicating that enlargement in farm area is linked to field enlargement. National data on farm size and field size development from 1998 to 2004 support this: on the 40.385 farms, which could be traced in both the 1998 and 2004 agricultural register there is a strong and significant relationship between change in farm area and change in mean field size (r^2= 0.32) (Figure 2).

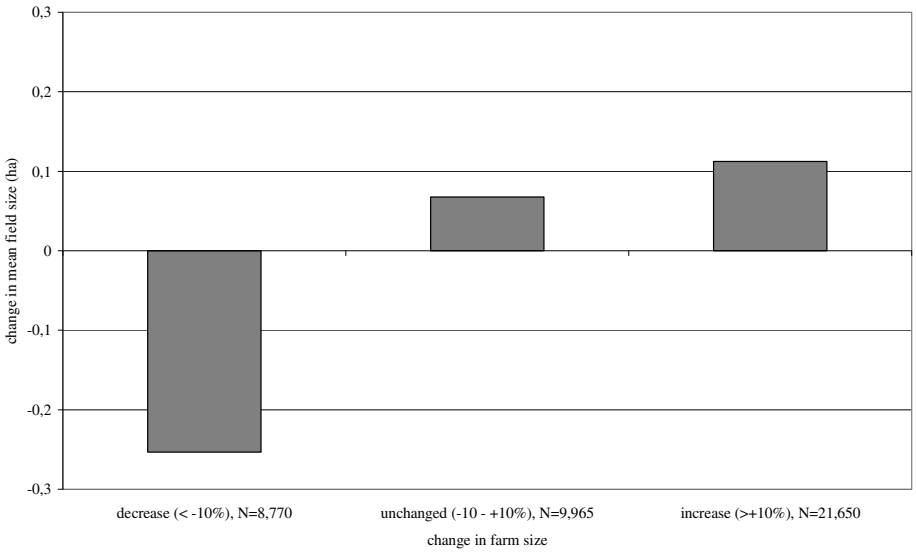

Figure 2: Change in mean field size over change in farm size, Denmark 1998 – 2004
Sources: Agricultural registers 1998 and 2004

Planting and removal of hedgerows on different farm sizes

From 1996 to 2002 11% of the 340 farmers in study 2 removed hedgerows, but very few of these did not establish hedgerows during the same period. 37% of the farms established hedgerows. On small farms (<20 ha) the net increase in hedgerow length was app. 10 m pr ha of farmed area, while for the other 3 farm size groups net increases were only 2-3 m/ha. Thus, although there is a higher planting activity on large farms (Figure 3), the resulting densities are higher on the area managed by small farms.

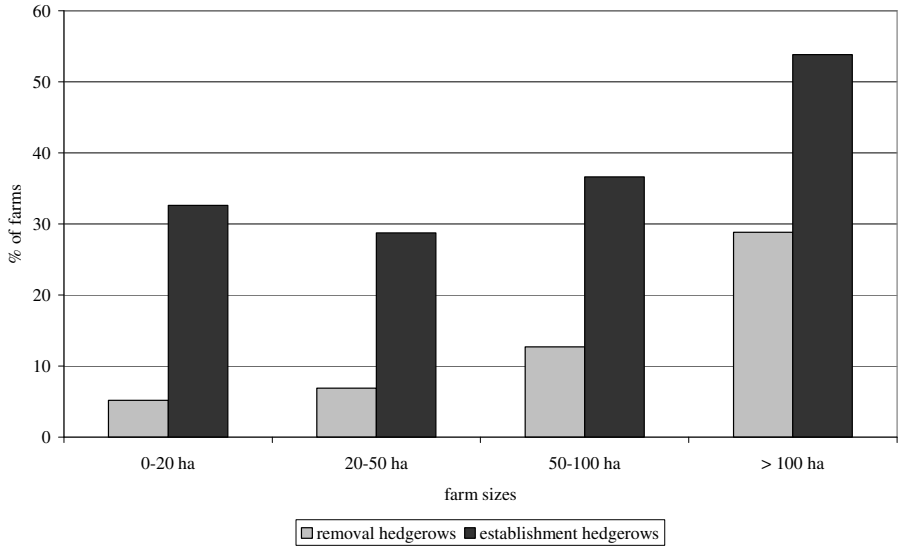

Figure 3: Farm hedgerow activities 1996 – 2002
Source: Questionnaires with 340 organic farms in Denmark

Discussion

Our data show that during the last decade increasing proportions of large farms were accompanied by increasing mean field sizes. Enlargement of farms and fields does not necessarily lead to a decrease in over-

all hedgerow density but very large farms seem to be most active in both establishment and removal, which could be due to a rationalisation of farm layout. While hedgerow densities increased among all farm sizes, small farms show the relatively highest increases. As farm enlargement is widely expected to continue in the next decade, this development will probably lead to a continued merging and thus enlargement of fields. This may affect farmland nature by removal and replacement of old hedgerows, as hedgerow removal and establishment is extensive on large farms. Small farms seem to have higher hedgerow densities in general and density of plantings is relatively high. Consequently, worries of farmland nature in relation to hedgerows should be primarily directed towards large farms and the possible removal of old and valuable hedgerows, and policies of advice on farm nature supplemented by continued subsidies for planting new hedgerows and protection of existing hedgerows would appear to be beneficial. However, other landscape elements such as field divides and remnant biotopes cannot be expected to follow the same development. Particularly densities of field divides can be expected to be largely affected by the scale enlargement within agriculture.

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