

Spatial Trends in Barn Building Permits

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This paper presents an overview of the trends in building permits issued for livestock facilities between 1996 and 2001 for 42 municipalities in the livestock intensive region of southwestern Ontario. Most of the permits were issued for barns less than 100 livestock units. Most of the permits for large facilities (larger than 500 livestock units) were exclusively for hog farms. There was no spatial concentration of large facilities away from townships with requirements for a nutrient management plan before building permit approval. Instead, new and expanding barn facilities are being built largely in the traditional livestock production regions. Ontario is currently undergoing a transition from local regulation of livestock facilities to a provincial system. The new regulatory framework will not change the continued concentration of production.

Keywords: building permits, spatial distribution, Ontario, livestock barns

Ontario's livestock sector has undergone extensive structural changes over the last generation and the changes have been met with some resistance from both within and outside the agricultural community. The total number of census farms has fallen dramatically but total livestock numbers have remained relatively constant for most sectors and even increased significantly in the hog and poultry sectors. Average farm size has subsequently increased and so has the distribution around the average. The livestock sector is moving away from predominantly homogeneous units of smaller, mixed farms to a sector dominated by large, specialized operations producing the majority of the output and a large number of small, life-style farms. The intensity of livestock production in the province coincides with a change in the composition of rural Ontario. The number of non-farm residents in rural areas exceeds the farm population in all Ontario municipalities and the difference continues to grow as more people spill out from growing urban areas

and farm numbers decline. Changes in intensity of livestock production and in demographics of rural areas combined with a growing concern over environmental health in the general population have led to greater regulatory requirements for livestock farming. The direct and indirect pressures facing livestock farmers could affect their investment decisions including the location and size of new barns.

Relatively few studies document the trends in spatial distribution of livestock operations and these tend to be focused on the situation in the United States. Herath, Weersink and Line-Carpentier (2004) describe the trends in the geographical concentration of U.S. hog, dairy and fed cattle production. Kellogg *et al.* (2000) and Gollehon *et al.* (2001) estimate the number of livestock units at the county level in the US, and the associated manure production, and compare this to the capacity of nearby land to assimilate the nutrients. These studies have used aggregate regional production values to examine changes

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in the spatial distribution of livestock production. However, inventory numbers hide the underlying trends in farm structure. For example, the increase in Ontario hog numbers could be due to an increase in new barns and/or from an expansion of existing operations. It is the large, intensive hog operation that tends to generate the most vocal opposition from the surrounding community and give the impression that it is only the largest operations that are growing. Knowledge on the extent of building by smaller farms is a signal on the viability of such operations. The use of micro-level data, such as barn building permit information, reveals the extent of new livestock operations and the relative differences by size and livestock type over time and space.

Changes in the spatial distribution of livestock production can have consequences on regional employment opportunities and development, the quality of rural community services, and environmental quality (Ikerd 1998). The changes could be due to factors such as agglomeration economies, population density or comparative advantages in production (Roe *et al.* 2002). Variations in environmental stringency among regions may also induce a migration of livestock operations to 'pollution havens' in which the cost of compliance with regulation is lower (Metcalf 2001; Park *et al.* 2002). Ontario provides a natural experimental setting to evaluate the impact of environmental regulations on the siting of livestock operations. Ontario is currently undergoing a transition from local regulation of livestock facilities to a provincial system through the Nutrient Management Act, which asserts Provincial authority over a number of key issues related to the approval of new facilities. Prior to this Act, some municipalities had established by-laws and regulations on the construction of livestock barns, while others had not. In addition, the specific rules varied from one jurisdiction to another.

The purpose of this paper is to examine the inter-regional shifts in Ontario's traditional livestock producing areas. Municipal building permit data for 1996 to 2001 was collected and summarized. The generated database allows not only for within township analysis of construction activity by livestock type and size of operation but also an inter-temporal analysis of construction activity. This regional variation in the intensification of livestock production is often accompanied by perceived environmental risk. Whether this risk is real or perceived it frequently leads to public opposition to proposals to build new barns and often

influences local municipal decision making. This study describes the regional variation in livestock production, and suggests possible explanations for the changes.

Review of Structural Changes in Ontario Agriculture

The total number of census farms in Ontario has dropped by 50% between 1976 and 2001 with the largest decline occurring in swine (-153%) and dairy (-109%). While the number of livestock enterprises has fallen dramatically, total livestock numbers have remained relatively constant for most sectors over these last 25 years and even increased significantly in the hog sector (81%). Average farm size has subsequently increased. In addition, the distribution is becoming increasing bi-modal with a larger portion of inventory held by a few, very large operations. For example, less than 25% (5%) of Ontario farmers in 2001 generated 90% (50%) of total sales. The increase in concentration is especially evident in the hog sector. Only 11 farms in Ontario stocked more than 5,000 pigs and these accounted for 2.3% of provincial production in 1976 but this had increased to 86 operations which represented 22% of the provincial total in the 2001 census (Keddie and Wandel 2002).

The increasing intensity of livestock production evident in most regions of North America is occurring at the same time as the non-farm component of the rural population in Ontario continues to increase. During the 1990's, for example more than 12,000 new residential lots were created in the midst of prime farmlands on lands designated agriculture (Caldwell, Weir and Thomson 2003). These new lots are in addition to tens of thousands of lots created during previous decades. The opportunity for conflict with the larger, more intensive livestock operations has increased coincidentally with this residential development.

The inevitable conflicts between intensive livestock operations and their neighbours resulted in local municipalities imposing restrictions on the potential location and management practices of new farms. Local zoning laws have traditionally prevented barns being built close to waterways and residential units but many municipalities increasingly required the submission of a nutrient management plan (NMP) before a building permit would be issued. In some cases, the NMP imposed limits on the stocking density restriction, while in other cases an

outright moratorium was issued on the construction of new hog facilities. The requirement associated with the stocking density restriction of having sufficient land to apply total manure levels increased the price of land in some livestock intensive regions of the province (Weersink, deVos and Stonehouse 2004). The variation in rules across jurisdictions resulted in the province introducing the Nutrient Management Act (NMA) in 2002 to enforce consistent standards for nutrient management across Ontario. The NMA will become effective in 2005 for larger farms and there will be significant compliance costs that will vary between livestock type and farm size. However, the costs will not vary regionally as has been the case with the differences in municipal by-laws.

Potential investment decisions by livestock farmers have been affected by output price fluctuations in addition to environmental regulations. Hogs and beef are sold in an open market with much of the product exported to the United States. Thus, both red meat sectors in Ontario are price takers and subject to significant price variability depending upon supply and demand conditions. For example, the Ontario hog price dropped from approximately \$175 per hog in July of 1998 to \$45 in December of the same year. Despite the price uncertainty, there was a relatively small drop in the number of Ontario hog farms between the 1996 and 2001 census (2,677 to 2,454) and an increase in overall pig numbers from 2.8 million to 3.5 million. In contrast, the Ontario beef sector continues to shrink as much of its finishing capacity has shifted to the Prairies due to the elimination of the Crow's Nest Rate that increased the relative profitability of livestock versus crop farming in the western provinces.

In contrast to the red meat sectors, there is no output price variability for Ontario's dairy and poultry sectors. Production is controlled under a supply management system that guarantees farmers a price based on a cost of production formula. However, the profitability of these sectors has become capitalized into the price of the quota that provides the farmers the right to produce. For example, the value of quota is greater than the value of other assets on most Ontario dairy farms. The level of investment required to purchase additional quota has curtailed the expansion decisions of some producers and prompted the exit of others cashing in on their asset. The latter decision is particularly evident for dairy farmers whose numbers dropped by approximately 2,000 between the last two censuses to 6,400 in 2001. The aging demographics of farmers in general combined with the

high labour demands of dairy farming and the high values of quota resulted in many older, dairy farmers moving out of the business completely or shifting to poultry production (Lane 2005). The exodus of dairy farmers has been offset to a degree by the influx of Europeans (Wolleswinkel and Weersink 2001).

Building Permit Data

In order to better understand the structural changes in Ontario's livestock sector, we collected data on building permits issued to individual farmers by local municipalities. Building permits contain a wealth of information related to the type of construction, value of construction, and size of facility used to house livestock. A survey of building permit documents for approximately 200 municipalities was carried out for the counties falling within the traditional livestock production region of southwestern Ontario. The counties included in the study are Huron, Perth, Lambton, Middlesex, Elgin, Oxford, Wellington, Waterloo, and Grey. Information contained within municipal building permits is not held within one central location in each county and was therefore accessed through visits to local township offices. Where the permit data was not readily available at the township office, the information was requested via personal contact with the Chief Building Official or Building Department staff. The format and completeness of building permit application files varied significantly across municipalities. The result was that the effort in collecting, assembling and ensuring a consistent data set varied significantly by jurisdiction.

The first step in assessing the permit data was to determine whether or not the structure in question actually housed livestock and what type of livestock. When blueprints of the structure were not available or when building official were unsure as to whether the structure housed livestock, the building permit was excluded from the survey. Facilities for which the type of livestock was not known were also excluded to avoid the improper inclusion of non-livestock storage barns or facilities housing animals not of interest to the study.

The next step was to determine whether the construction was new or an expansion as well as the size of the facility. When the specific type of livestock was known, square footage values of the structure were used in conjunction with Ontario Ministry of Agriculture and Food (OMAF) minimum square footage requirements to

determine the maximum number of animals that could be housed within the structure. This value was then converted to Livestock Units (LU) using standard conversion charts. In those cases where the type of livestock was known but not the specific sub-type of livestock, for example weaner pigs, an average square footage requirement for all types of swine operations was used to generate estimates of operation size. The procedure of dividing size of building by minimum square footage requirements generates LU values that are comparable to those calculated by municipal building officials using the Minimum Distance Separation (MDS) calculations. Since nutrient management bylaws mandating MDS calculations were not enacted until 1998 for most municipalities, our approach to calculating size of the facility appears appropriate for years prior to 1998.

Results

Although over 200 municipalities were contacted, usable results were obtained for 42 municipalities located in 8 counties (see Figure 1). All or most municipalities are included for some counties, such as Huron and Perth, but many are missing for counties such as Middlesex and Oxford. Therefore, when referring to a county, we are referring only to the area within a county for which we have the data. This implies that comparisons between counties are difficult but observed trends within the observed localities can be compared across regions and sectors.

Over 1,400 building permits were issued in the 42 municipalities between 1996 and 2001 (Table 1). Over 40% of these permits were for swine facilities with

Type of permit	Type of Livestock					Total
	Beef	Dairy	Poultry	Swine	Other	
New Barn	97 (62%)	213 (58%)	221 (81%)	428 (74%)	37 (82%)	996 (70%)
Addition	60 (32%)	156 (42%)	53 (19%)	151 (26%)	8 (18%)	428 (30%)
Total	157	369	274	579	45	1424

Table 1. Number of Permits for New Barns and Additions by Livestock Sector, 1996-2001

approximately 26% for dairy barns and 19% for poultry

Size of Barn	Beef	Dairy	Poultry	Swine	Other	Total
< 100 LU	129 (82%)	252 (68%)	152 (55%)	220 (38%)	37 (82%)	790 (55%)
100-500 LU	25 (16%)	116 (31%)	116 (42%)	300 (52%)	8 (18%)	575 (40%)
> 500 LU	3 (2%)	1 (0%)	6 (2%)	59 (10%)	0	69 (5%)
Total	157	369	274	579	45	1424

Table 2 Number of Building Permits by Barn Size and Livestock Type, 1996-2001

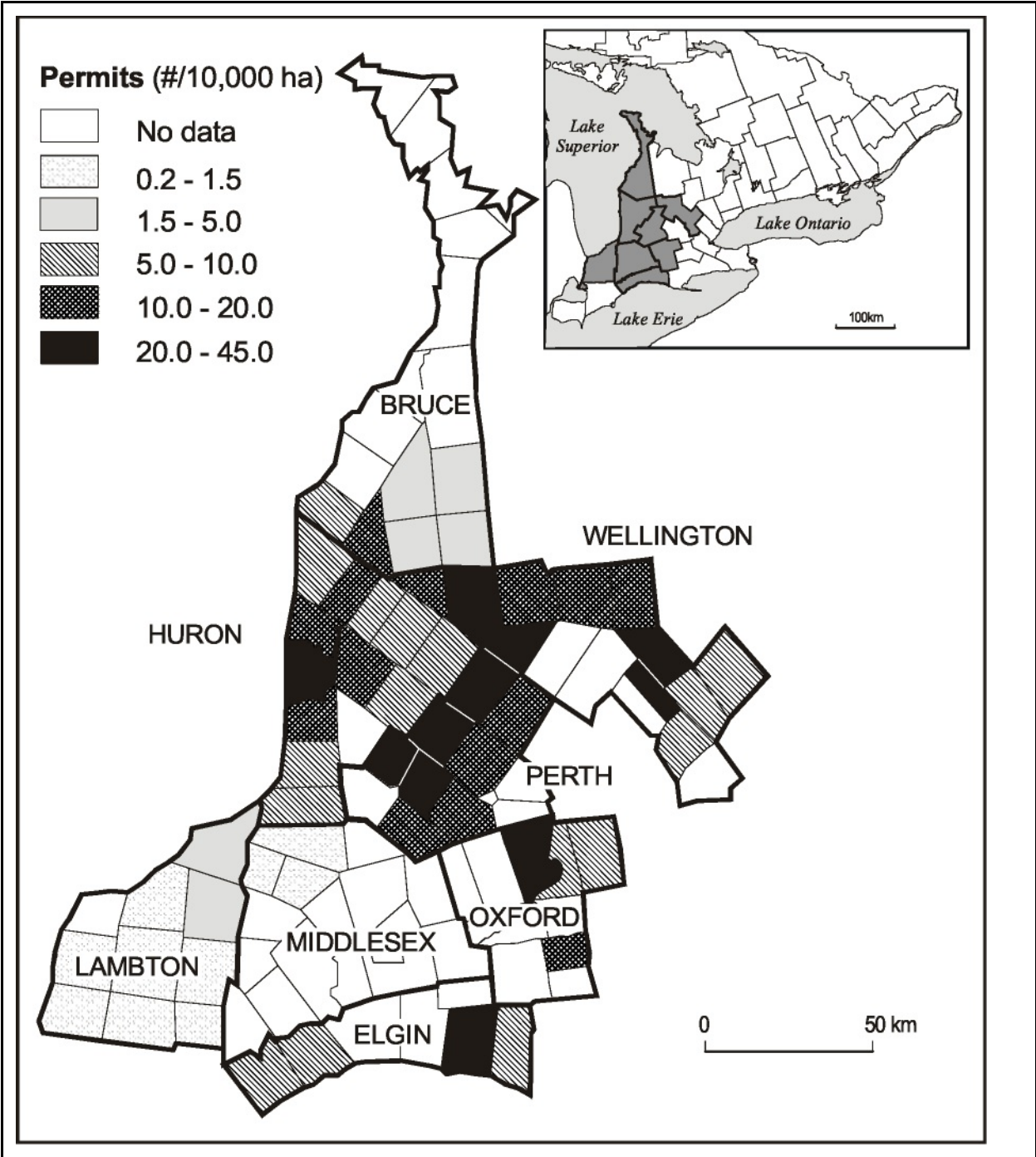


Figure 1 Density of Barn Building Permits by Location in Ontario, 1995-2000

Year	Type of Livestock					Total
	Beef	Dairy	Poultry	Swine	Other	
1996	18	59	15	94	3	189
1997	22	61	24	153	4	264
1998	19	40	58	81	15	213
1999	34	74	49	56	8	221
2000	32	171	75	108	8	294
2001	32	64	53	87	7	243
Total	157	369	274	579	45	1424

Table 3 Temporal Changes in the Number of Barn Building Permits by Livestock Type, 1996-2001

operations. Operations involving more than one kind of animal are referred to as 'various' in the tables. Only 45 multi-purpose barns were built between 1996 and 2001, which is consistent with the increasingly specialized nature of the livestock sector.

The majority of the building permits (996) were for new barns while only 30% represented additions (Table 1). The number of new barns in the swine sector (428) is almost double that of new barns built for any other livestock. These new facilities represent nearly three-quarters of all permits issued for the swine sector. Similarly, most of the permits issued for the poultry sector

Year	Size of facility		Total
	< 100 LU	> 100 LU	
1996	108	81	189
1997	164	100	264
1998	121	92	213
1999	129	92	221
2000	144	150	294
2001	24	119	243
Total	790	634	1424 (100)

Table 4 Temporal Changes in Type of Livestock Facility, 1996-2001

were for new barns (81%). The number of new barns is still greater than barn additions for the two cattle sectors, but the relative importance of additions is much greater than for hogs and poultry. More than one-third of the beef barn permits were for additions. The result is consistent with the number of beef farmers who have off-farm employment and operate their farm on a part-time basis in Ontario. The relatively high number of additions for dairy barns is likely due to the high cost of expansion associated with the supply management regime for dairy farming in Ontario. The cost

of additional quota permitting production is equal to all other costs associated with the expansion including barn and cows.

Over half of all permits (55%) are for facilities less than 100 LU (Table 2). Of the 790 permits issued for smaller barns, 450 were for new facilities. Thus, not all new barns are necessarily large. The number of investments in farm buildings by smaller operations suggests that smaller livestock operations are viable, and it is not just large operators that are investing in their farms. However, if a barn larger than 100 LU was built, 86% of them were new operations rather than additions. Most of the permits issued for the swine sector were for facilities larger than 100 LU. In contrast, the barns for other sectors were generally smaller than 100 LU, especially in the beef sector. Almost all of the 63 permits granted for barns larger than 500 LU were for swine facilities which may explain why the opposition to industrialized farming tends to focus on hog operations.

The temporal changes in permits issued by sector and by size of operation are listed in Tables 3 and 4 respectively. The maximum number of permits issued was in 2000 (294) and the fewest in 1996 (189). The annual fluctuations over all livestock sectors are less than the cyclical variations within some individual sectors. For example, over 26% of all swine permits were issued in 1997 and close to 20% in 2000. These peak building periods coincided with high hog prices. The minimum number of permits issued for dairy barns was in 1998

Permits per 10,000 ha of Farmland	Percentage of Permits Issued by Municipality for Swine Operations			Total
	< 25%	25%-50%	> 50%	
< 10	5	5	13	23
10-20	5	6	0	11
> 20	1	5	2	8
Total	11	16	15	42

Table 5 Percentage of Permits for Swine Operations by Regional Intensity of Barn Construction for 42 Ontario Municipalities

Permits per 10,000 ha of Farmland	Percentage of Permits Issued by Municipality for Barns > 100 LU			Total
	< 30%	30%-60%	> 60%	
< 10	5	8	10	23
10-20	4	5	2	11
> 20	2	6	0	8
Total	16	15	11	42

Table 6 Percentage of Permits for Operations Greater than 100 LU by Regional Intensity of Barn Construction for 42 Ontario Municipalities

Permits per 10,000 ha of Farmland	Requirement of a NMP		
	No	Yes	Total
< 10	14	9	23
10-20	8	3	11
> 20	4	4	8
Total	26	16	42
Average Density	10.8	12.7	

Table 7 Requirement of a Nutrient Management Plan (NMP) by Regional Intensity of Barn Construction for 42 Ontario Municipalities

of stable and high returns associated with supply management. The number of poultry barn permits has generally increased over time. This is due partially to the profitability of the sector and to the shift of dairy farmers to poultry.

The perceived trend toward larger farms over time is supported to some degree by the results in Table 4. Prior to 2000, the number of facilities larger than 100 LU was consistently around 42% of all permits issued. This percentage has increased to 50% in the last two years of the survey. However, a significant investment is still being made in small operations implying that these farm types are viable and that not all growth in the sector is coming from large farms.

The number of buildings permits issued in a municipality was divided by the area of farmland to indicate the relative intensity of new livestock production. The number of permits issued per unit of farmland in a municipality is related to the percentage of permits issued for swine facilities in Table 5. Hog barns are more likely to be the dominant form of new construction in regions issuing relatively few permits in total. The result suggests there is some evidence of a potential pollution haven effect although it could also be related to land availability. In contrast, there does not appear to be a concentration of large barns in just the livestock intensive regions (Table 6). Smaller facilities are just as likely in regions with few permits issued per unit of farmland as those with a large number.

Building intensity does not appear to be related to environmental stringency within the province. Until recently, individual townships had the option of placing environmental process standards on farmers wishing to obtain a building permit in addition to safety and engineering quality restrictions on barn design. For example, some municipalities required producers to complete a nutrient

management plan (NMP) before a building permit would

management plan (NMP) before a building permit would

be issued. A NMP documents the sources, uses, and application testing/methods of organic and inorganic fertilizer and thus represents a cost to applicants. The results in Table 7 suggest that differences in the requirement of a NMP across townships did not significantly affect building decisions. The 16 municipalities with a NMP requirement had more permits issued per unit of farmland on average (12.7) than those 26 townships without such a requirement (10.8). The result suggests that differences in environmental stringency across the region did not affect the spatial distribution of new and expanding livestock operations.

Summary

This paper has presented an overview of the trends in building permits issued for livestock facilities between 1996 and 2001 for 42 municipalities in the livestock intensive region of southwestern Ontario. Very few of the 1,424 permits issued were for multi-purpose barns which is consistent with the trend toward increasing specialization within the livestock sector. However, the perception that all new and expanding barns are large is not supported by the evidence. Over half of the building permits were granted for operations less than 100 livestock units, and such investment signals the viability of smaller operations. The few permits issued for facilities larger than 500 livestock units were almost exclusively for swine operations which may explain the perception that all building investment is associated with large farms since these farms tend to generate the greatest local protest. These large farms are not concentrating in regions with lax environmental regulations. Instead, the spatial distribution of mix and size of operations tends to be consistent with historical trends. The majority of new barns and barn expansions (both small and large) in Ontario are occurring in the livestock intensive regions of Huron and Perth counties. The results suggest that there are agglomeration economies enjoyed by farmers in those regions where the production is sufficient to provide a network of services. However, future research is necessary to explain the exact determinants of the spatial distribution.

Ontario is currently undergoing a transition from local regulation of livestock facilities to a provincial system. The Nutrient Management Act asserts Provincial authority over a number of key issues related to the approval of new facilities. The completion of a Nutrient Management Plan

and the superseding of local by-laws are components of the new Provincial system. The results of this study provide insight into the local variability that has led the province to establish a new regulatory framework. Provincial action was driven by a number of factors including concern for the environment, but it was also driven by the regional variation of different concentrations of livestock facilities across Ontario. Quite simply, Ontario was no longer a level playing field for livestock production. Some municipalities had established by-laws and regulations, while others had not. In addition the specific rules varied from one jurisdiction to another. This study helps to explain the regional variation in livestock production, and related issues of conflict and governance.

References

- Abdalla, C.W., L.E. Lanyon and M.C. Hallberg. 1995. What we know about historical trends in firm location decisions and regional shifts: Policy issues for an industrializing animal agriculture sector. *American Journal of Agricultural Economics*. 77(5): 37–52.
- Gollehon, N., M. Caswell, M. Ribaud, R. Kellogg, C. Lander, and D. Letson. 2001. *Confined Animal Production and Manure Nutrients*. Washington, DC: US Department of Agriculture, Economic Research Service, Agr. Econ. Rep. 717, June.
- Hubbell, B.J., and R. Welsh. 1998. An examination of trends in geographic concentration in US hog production, 1974-96. *Journal of Applied and Agricultural Economics*. 30(2):285–99.
- Ikerd, J. E. 1998. Sustainable agriculture, rural economic development, and large-scale swine production. *Pigs, Profits, and Rural Communities* Kendall M. and E. P. Durrenberger (eds), pp. 157-169. Albany, State University of New York Press.
- Kellogg, R.L., C.H. Lander, D.C. Moffitt, N. Gollehon. 2000. *Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States*. Washington, DC: US Department of Agriculture, Natural Resources

- Conservation Service, Economic Research Service, Publication No. nps00-0579, December.
- Keddie, P. and J. Wandel. 2002. Animal Agriculture in Ontario, 1996: A Profile of its Sectors and Patterns of Distribution, An Atlas Resource. Dept of Geography, University of Guelph.
- McBride, W.D. and N. Key. 2003. Economic and Structural Relationships in US Hog Production. Washington, DC: US Department of Agriculture, Economic Research Service, Agr. Econ. Rep. 818, February.
- Metcalf, M. 2001. US hog production and the influence of state water quality regulation. *Canadian Journal of Agricultural Economics* 49(1): 37–52.
- Perry, J., D. Banker, and R. Green. 1999. Broiler Farms' Organization, Management, and Performance. Washington, DC: US Department of Agriculture, Economic Research Service, Agr. Econ. Rep. 748, March.
- Park, D., A. Seidl, and S. Davies. 2002. Environmental policy and industry location: The case of US livestock industry. *The Review of Regional Studies* 32(2): 293-307.
- Roe, B., E.G. Irwin and J.S. Sharp. 2002. Pigs in space: Modeling the spatial structure of hog production in traditional and nontraditional production regions. *American Journal of Agricultural Economics* 84(2): 259-278.
- Statistics Canada. 2004. Farm and off-farm income statistics, 2001. Catalogue no 21-019-X1E, Agriculture Division, Whole Farm Data Projects Section. <http://www.statcan.ca/english/freepub/21-019-X1E/2004004/families.htm>
- Weersink, A., G. deVos, and P. Stonehouse. 2004. Farm returns and land price effects from environmental standards and stocking density restrictions. *Agricultural and Resource Economic Review*. 33(2):272-281.
- Wolleswinkel, A, and A. Weersink. 2001. Farmer emigration: The case of Dutch dairy farmers moving to Ontario. *Livestock Production Science*. 69:197-205.