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Where Can I Build or Expand a Livestock Operation? A Case Study of Cuming County, Nebraska

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observed. Time-lapse video recordings will be analyzed to determine whether behavior differences can help explain the performance differences found between the mat types.

Conclusions

The electric heat lamps and gas-fired heaters functioned well and were readily managed during this trial. Analyses of temperature fluctuations revealed that temperatures were generally maintained within $\pm 3^\circ\text{F}$ of the mean temperature, and that there were no differences in temperature fluctuations between the two heating systems, the mat types, or combinations of the treatments. No significant differences in air temperatures were evident between treatments or treatment combinations. Black-globe temperatures within pens with gas-fired heaters and/or wood floor mats were warmer ($2\text{--}3^\circ\text{F}$) than in com-

parison pens having electric heat lamps and/or rubber floor mats. The higher black-globe temperatures with gas-fired heaters may imply that extra adjustments in heater height and gas pressure were needed to obtain equivalent heating effects. Since producers often struggle to find the right setting for their zone heaters, this issue may deserve additional study. Given the variety of farm situations and management practices that exist, information that would help producers calibrate their zone-heating equipment once it is installed would be helpful. Higher black-globe temperatures with wood floor mats most likely were due to wood being more reflective than rubber.

This study showed an advantage to using wood floor mats in terms of pig growth rate (end weight and ADG), at least for nursery-age, disease-challenged pigs. This advantage combined with the ready availability and low cost of wood

sheathing (relative to commercially distributed rubber mats) suggests that producers may have another option to cut costs while enhancing production. This study did not reveal any other significant treatment or interaction effects on performance. A subsequent economic assessment of the heaters and mat types should shed more light on which zone-heating systems should be considered most seriously by producers and under what circumstances.

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¹Rick Stowell is an assistant professor in biological systems engineering; Sherri Colgan is a research technologist; and Mike Brumm is a professor and Extension swine specialist at the Northeast Research and Extension Center.

Where Can I Build or Expand a Livestock Operation?

A Case Study of Cuming County, Nebraska

Chris Henry
Jeff Arnold¹

Summary and Implications

The impacts that setback distances of 1/4, 3/8, 1/2, 3/4, and 1 mile would have on the land area available to the livestock industry for expansion in Cuming County, Neb. were estimated using a geographic information system and the current county zoning requirements. These setbacks seem to be typical of distances cited in many county zoning regulations. Setback distances greater than 3/8 of a mile appear

to be very exclusive to expansion of the livestock industry in Cuming County. Reciprocal setbacks that apply to new housing construction do not appear to be restrictive. It is expected that other Nebraska counties that are similar in population density will have similar resulting land areas available for livestock facility expansion for similar distances. Setbacks of greater than 1/4 of a mile may substantially retard growth of the livestock industry in a county.

Introduction

The purpose of this work was to evaluate the land available to

livestock producers looking to construct new facilities and to people wishing to build new residences in rural Cuming County, Neb. Cuming County was chosen for several reasons. Records indicating locations of permitted livestock facilities for Cuming County are more up-to-date than those for many other counties, according to Nebraska Department of Environmental Quality (NDEQ). Second, Cuming County has high population densities of both animals and people. Finally, Cuming County has a sliding scale setback requirement: that

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is the larger the facility, the further the setback distance needed, which demonstrates the impact different distances have on land area. Many times setback distances are chosen arbitrarily. Through this analysis we intend to show the impact those decisions have on the actual land area available based on the setback requirements outlined in comprehensive plans.

Population and Density Characteristics of Cuming County

Cuming County has a large concentration of livestock production facilities. General information about population densities of people and housing units from National Agricultural Statistics Service and the U.S. Census Bureau for selected counties in Nebraska are shown in Table 1. These counties are traditionally strong in animal agriculture. The distribution of operations in Nebraska is generally very dense in the eastern one-third of the state.

Cuming County appears to have one of the highest concentrations of AFOs (animal feeding operations) in Nebraska. Also, Cuming County is in the top tier of populated counties in Nebraska, being 27th out of 92 counties, according to the 2000 U.S. Census. The county has a lower population density at 18 persons per square mile compared to neighboring counties, such as Madison (43 persons per square mile) and Colfax (25 persons per square mile). Another measure of person density is housing units. For the counties studied, Cuming County has a relatively low density (8 houses/sq mile) of housing units per unit area, suggesting a very sparsely populated rural community.

Cuming County has a very high concentration of animal units per square mile, perhaps the highest in Nebraska at 539 Animal Units (AU) per square mile. Another measure of density is the ratio of AU to persons. Of the selected counties studied, Cuming County has the highest ratio of AU to persons (30).

Table 1. Comparison of human and livestock populations or densities.

County	Rank (# out of 92)	Population density (persons/square mile)	Housing units/sq mile	Animal units ^a /sq mile	Ratio AU ^a :persons
Boone	51	9	4	189	21
Cuming	27	18	8	539	30
Colfax	26	25	10	323	13
Madison	8	62	25	167	3
Platte	10	47	19	236	5
Dawson	12	24	10	275	11

Source: 1999 NASS and US Census 2000 (results have been rounded to the nearest whole number)
^aAU: Animal Unit, a standard way of representing livestock. An animal unit is standard way of comparing different species and sizes of livestock.

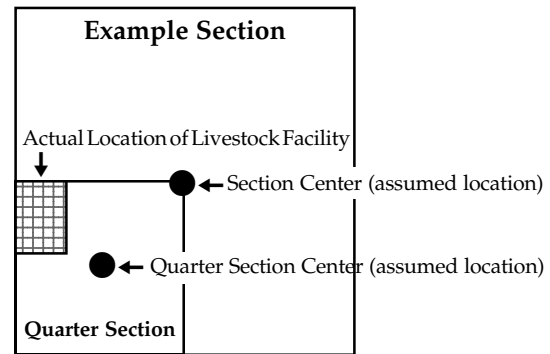


Figure 1. Assumed locations of livestock facilities from legal descriptions.

Method

To evaluate the land area available for livestock to locate in Cuming County, information on land features, such as streams, roads, residences, livestock facilities and groundwater wells was needed. This information was available geographically from state databases and was assembled using GIS (geographic information system) data. From this data, county zoning and NDEQ setback requirements were applied. The result yielded the land area available for locating or expanding a livestock facility and new rural residential construction.

To complete this analysis, information on livestock facility location, resident locations, streams, roads, cities, and setback locations was needed. Livestock facility locations were derived from legal descriptions, so locations of livestock facilities are not exact. The location of the livestock facilities

were placed either the center of the section center, quarter section or quarter-quarter section depending upon the legal description available. Figure 1 shows an example of the spatial precision with which livestock facilities were located.

Title 130, the rules and regulations governing the location of livestock waste control facilities, requires a 100-foot setback from any residential well not owned by the owner of the livestock facility, or for any well used for domestic purposes. To simplify the analysis, it was assumed that anyone locating a livestock facility would not be able to locate it within 100 feet of any registered groundwater well.

After all the data were compiled, a GIS software package (ARCGIS 8.2) was used to establish the setbacks around land features. The only required setback distance from land features was groundwater wells, as per Title 130 mentioned above. Roads were assumed



Table 2. Required setback distances from other land features.

Land feature	Setback distances for livestock facilities	Setback distances used for residential development
Roads (major and minor)	125 feet (all roads)	50 feet minor 100 feet for state or US Hwy.
Streams (major and minor)	100 feet	100 feet
Cities (West Point, Beemer, and Wisner)	1 mile	N/A
Registered groundwater wells	100 feet ^a	N/A

^aRequired by NDEQ to site a new livestock waste control facility.

Table 3. Animal feeding operation setbacks from residences.

Animal Units	Swine under 55 lbs, head	Swine over 55 lbs, head	Setback Distance, mile
Less than 300	< 7,500	< 750	None
301-1,000	<25,000	<2,500	1/4
1,001-5,000	<125,000	<12,500	3/8
5,001-10,000	<250,000	<25,000	1/2
10,001-25,000	<625,000	<62,500	3/4
>25,000	>625,000	>62,500	1

to have a constant setback of 125 feet from the centerline of the road, independent of the type of road. Most new livestock facilities would not locate within 100 feet of a stream, so this setback was applied. A 1-mile setback was applied to the four urban areas in Cuming County. While not required, this seemed a reasonable and common sense

voluntary setback that anyone would observe when locating a new livestock facility. The setback distances evaluated are shown in Table 2.

Similar setback distances from new residences were also evaluated assuming that setbacks would be reciprocal from existing livestock facilities (Table 3). It was assumed

that most homeowners would build closer to roads, yet would not locate with 100 feet of the four major roads in Cuming County. The same setback from streams was observed, based on the assumption that most home owners would stay at least 100 feet from a stream.

The setbacks from all features were applied along with the corresponding setback for each class of livestock facility. Cuming County assigns setbacks based on the size of facility (Table 3).

Results and Discussion

The resulting land excluded from livestock expansion is shown in Table 4. As can be seen, setback requirements greater than 3/4 mile almost completely exclude any new livestock facilities. Even a 1/2-mile setback leaves only about 4% of the county available to new livestock production facilities. A 1/4-mile setback leaves 39% of the county open to siting a new livestock operation, while a 3/8-mile setback

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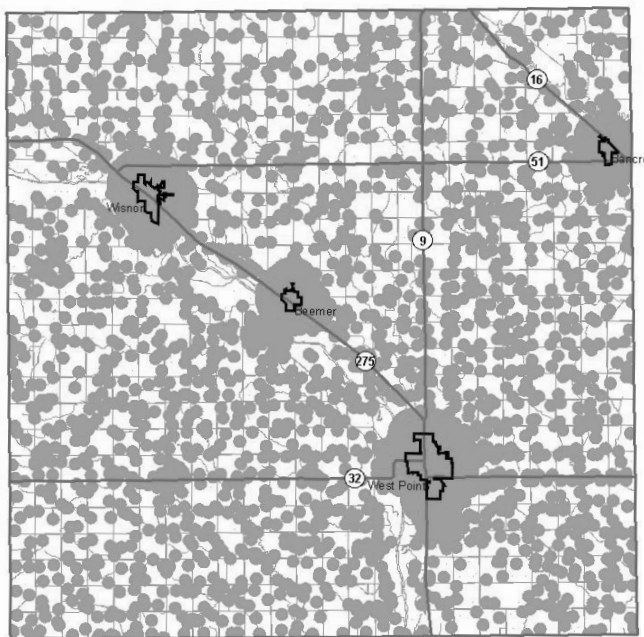


Figure 2. Land area available in Cuming County (shown in white) for expansion of livestock operations with between 301-1,000 animal units (1/4 - mile setback).

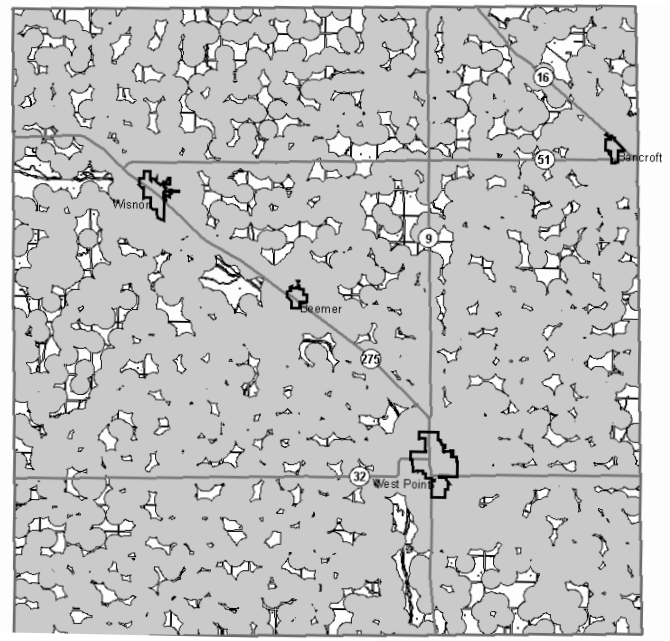


Figure 3. Land area available in Cuming County (shown in white) for expansion of livestock operations with between 1,001-5,000 animal units (3/8 - mile setback).

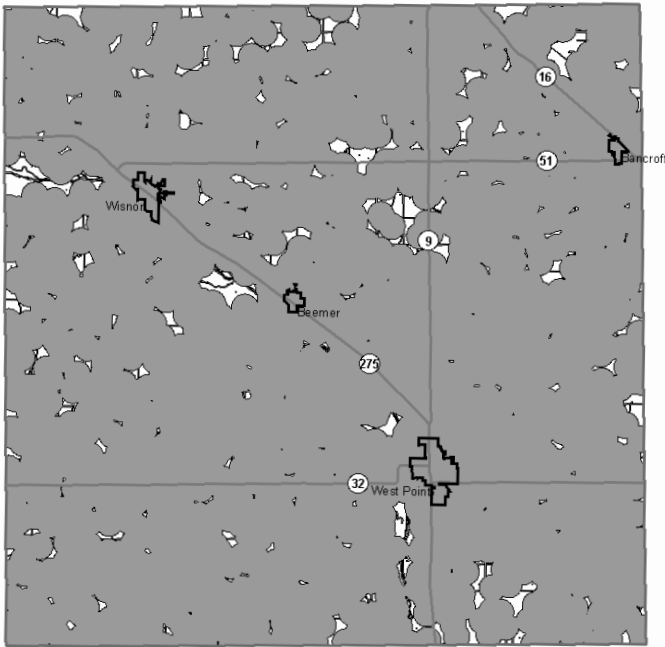


Figure 4. Land area available in Cuming County (shown in white) for expansion of livestock operations with between 5,001-10,000 animal units (1/2 - mile setback).

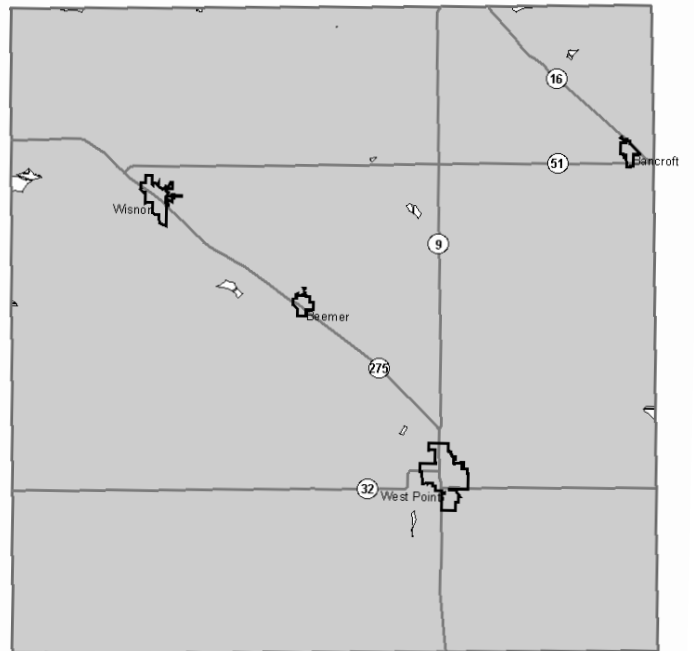


Figure 5. Land area available in Cuming County (shown in white) for expansion of livestock operations with between 10,001 - 25,000 animal units (3/4 - mile setback).

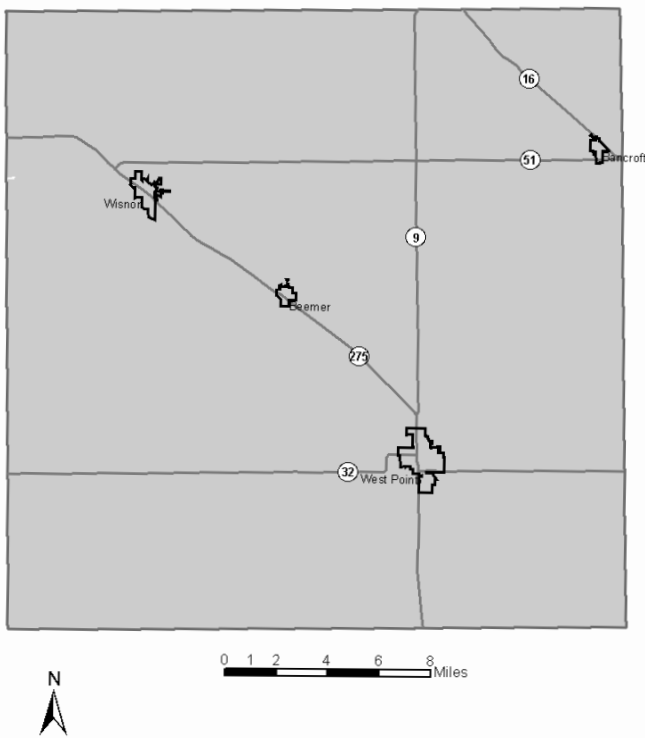


Figure 6. Land area available in Cuming County (shown in white) for expansion of livestock operations with greater than 25,000 animal units (1 - mile setback).

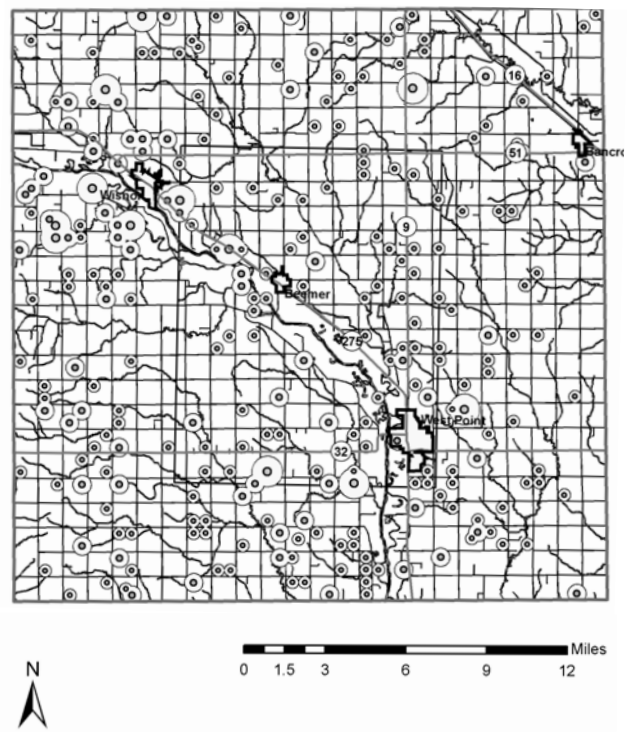


Figure 7. Land area available in Cuming County (shown in white) for rural residential development.



Table 4. Land areas excluded from livestock facility expansion or construction for given setback distances.

Setback distance from residences, mile	Acres excluded	Square miles excluded	Percent of county excluded
1/4	224,264	350	61
3/8	313,495	490	85
1/2	353,697	553	96
3/4	367,643	557	99.8
1	367,694	575	99.99

Table 5. Resulting land area excluded and available for residential development in rural areas based on a reciprocal setbacks.

All set backs from animal feeding operations	Land area excluded from new home construction (acres)	Land area excluded from new home construction (sq miles)	Percent of county new home construction	Percent of county available for new home construction
All current livestock facilities	74,810	117	20	80

leaves only 15% of the county available. An additional constraint for a potential livestock entrepreneur would be to find a location large enough for a new livestock operation at the larger class sizes. That constraint is not shown in Table 4, but it can be observed in Figures 2-6.

The expansion of existing livestock facilities would be restrained

by the required setbacks. This analysis assumes that the land available is not being used for another purpose, such as other agricultural uses, so the actual land available would be expected to be less than reported in Table 4.

In general terms, it is likely that operations with less than 5,000 AU's could locate in Cuming County, but larger operations would essentially

be excluded by the sliding scale setbacks. Facilities with less than 1,001 AU should be able to locate without much difficulty in satisfying setback requirements. It is not clear how many existing operations would be excluded from expanding, but they would have to be located in the white areas shown in Figures 2-6. The colored areas in Figures 2-6 show the land area that livestock facilities could not be located. Areas in white would be available to build or expand livestock facilities.

The results of implementing setbacks from livestock facilities reciprocally to new residential construction are shown in Figure 7 and Table 5. Even with these setbacks, over 80% of the county is still open to new housing construction, primarily in the rural areas of the county.

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Nebraska Supreme Court Rules City Can Regulate Animal Feeding Operation

J. David Aiken¹

municipal regulations may be vulnerable to future legal attacks.

Summary and Implications

Nebraska statutes authorize second class cities and villages to adopt regulations protecting municipal water supplies from pollution within 15 miles of their community borders. Livestock facility regulations implemented by the second class city of Alma that were stricter than those of the Nebraska Department of Environmental Quality were upheld by the Nebraska Supreme Court. However, similar

The construction of large swine facilities has been very controversial in Nebraska for the past several years. A major focus of the "hog wars" has been county livestock zoning regulations. In Nebraska livestock facilities are subject to state environmental regulation by the Nebraska Department of Environmental Quality (NDEQ) and also to local zoning regulations if the county is zoned (or if the livestock facility will be

located near a zoned community). The number of zoned counties has more than doubled in the last decade, from 36 to at least 80. Most of the newly zoned counties have adopted zoning in order to regulate the size and location of confined livestock facilities. The legal ability of counties to regulate livestock facilities through zoning regulations was confirmed by the Nebraska Supreme Court in 2002, when the court ruled that a Holt County zoning regulation could require a conditional use zoning

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