
# CAFO'S - WHAT DO THEY MEAN FOR MY COUNTY ?

South Dakota State University
College of Agriculture, Food and Environmental Sciences

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EXTENSION SWINE SPECIALIST

# OUTLINE

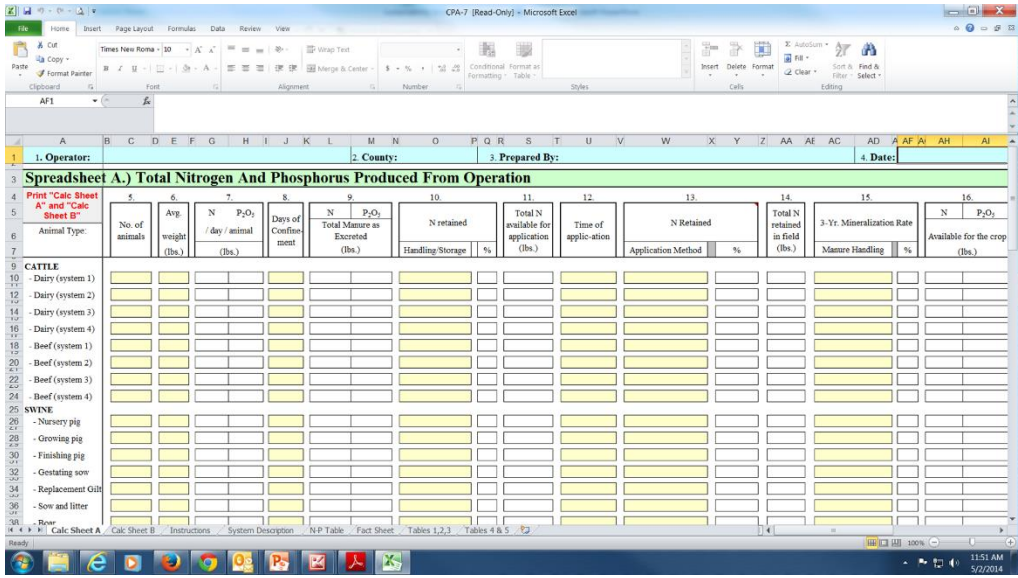
- Extension’s role
- Protecting water and the environment
- Odor
- Economics

# *WHY ISN'T SDSU EXTENSION AT HEARINGS???*

- As state employees, we are prohibited, by South Dakota Board of Regents policy, from providing expert testimony at public hearings. SDBOR policy 4-35 provides that ruling.
- SDSU Extension, based on land grant principles, provides un-biased, science based education and technical information. However, being summoned or requested to provide the information at a hearing now lends that information to be perceived as being requested/used on behalf of one side or the other, or is perceived as such.
- Therefore, the time to obtain information from Extension is at ***the public information gathering stage***. It needs to funnel into the process long before the hearing stage where decisions become legally binding.
- PLEASE utilize us

# PROTECTING WATER AND THE ENVIRONMENT

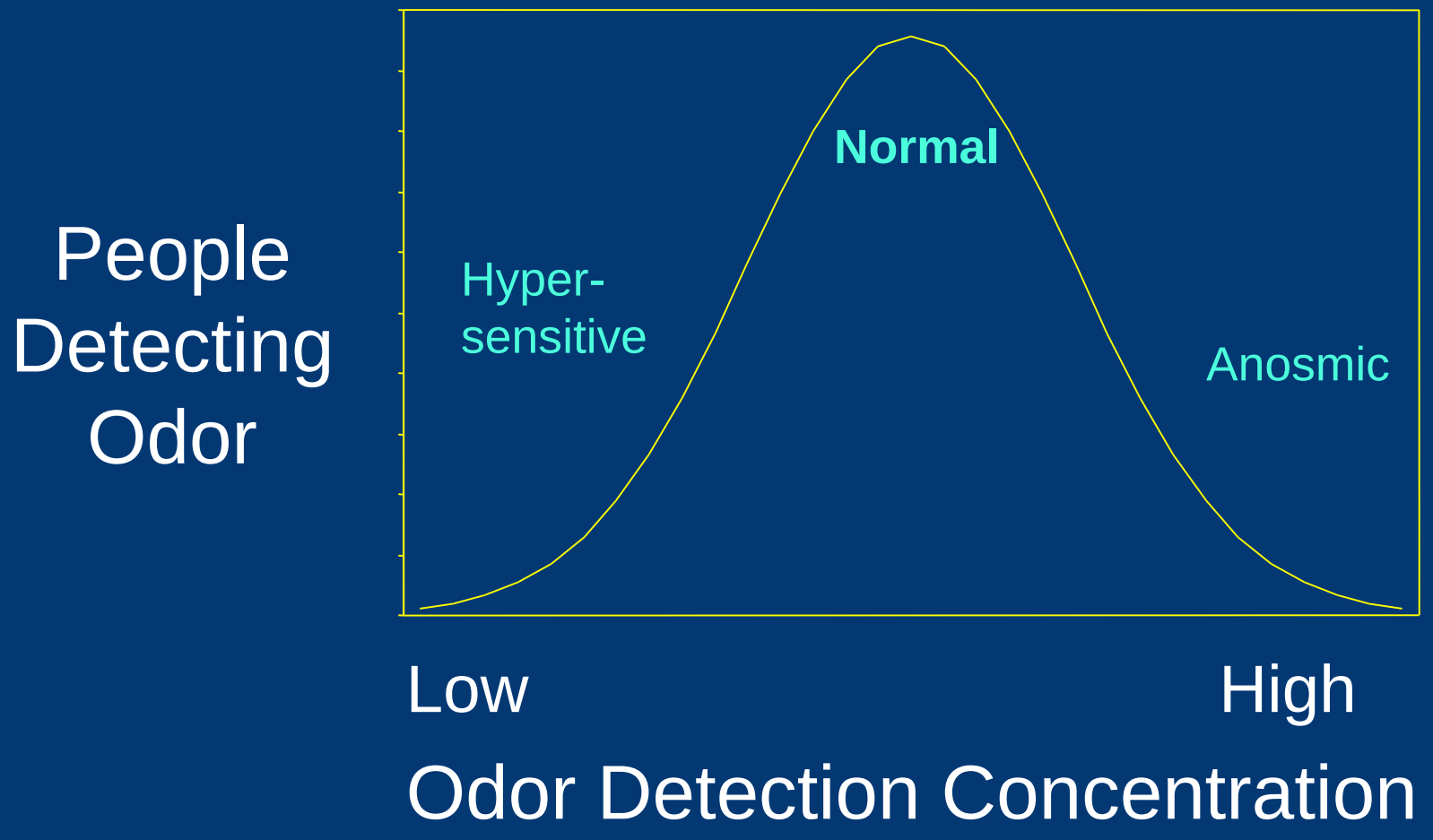
- SD Dept of Environment & Natural Resources
- All CAFOs must annually sample manure & soil, and only apply as much manure as the crop needs
- Operations < 1,000 AU are not regulated
- Application of commercial fertilizer is not regulated




# ODOR: HOW DO YOU REGULATE SOMETHING YOU CAN NOT MEASURE?

- Humans can detect over 10,000 different odors
- No direct correlation between individual gases & odor
- MN uses hydrogen sulfide as a surrogate for odor
- Human nose is still the best tool, but a great deal of variation

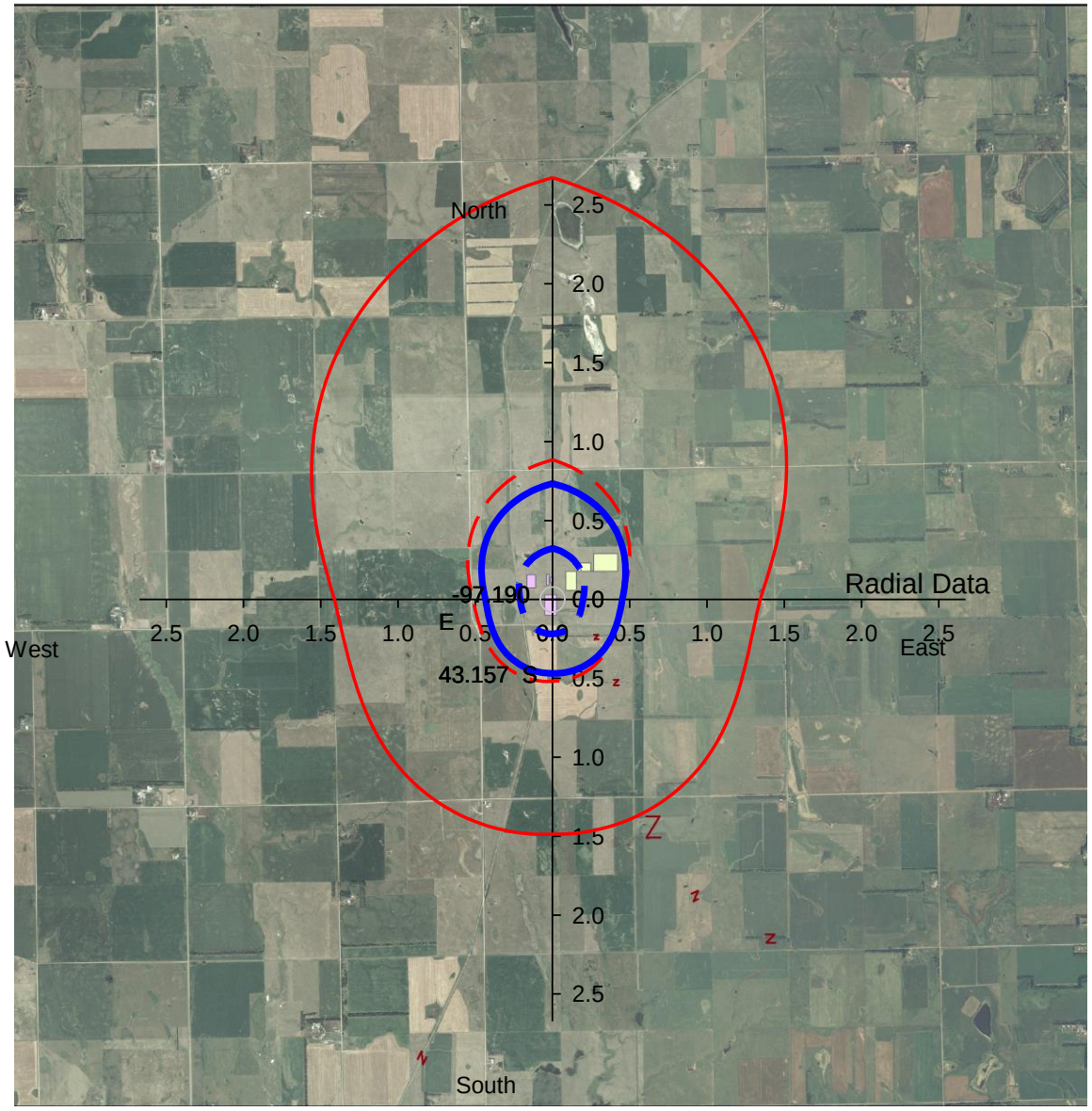
# Normal Olfactory Sensitivity



# SD Odor Footprint Tool: Starting Point for Discussion

*Gestation Barn 80 X 430*
*Farrowing Barn 100 X 175*
*Nursery Barn 80 X 243*
*Finishing Barn (2) 101 X 412*

98% No Odor Control
94% No Odor Control
98% with Biofilter and Deep Pit
94% with Biofilter and Deep Pit



# Development of the OFFSET Model for Determination of Odor-Annoyance-Free Setback Distances from Animal Production Sites: Part I. Review and Experiment

L. D. Jacobson, H. Guo, D. R. Schmidt, R. E. Nicolai, J. Zhu, K. A. Janni

**Abstract.** *The objective of the study was to develop a science-based model, OFFSET (Odor from Feedlot - Setback Estimation Tool), to establish setback distances from animal production sites based on the use of an air dispersion model (INPUFF-2) and the actual odor emission data from these sites. Extensive research was conducted to obtain representative odor emissions from various animal facilities and to evaluate the air dispersion model. Odor emissions were measured from 280 animal buildings and manure storage units on 85 farms in Minnesota during 1998 to 2001. The geometric means of the odor emission rates for each type of odor source were obtained to represent odor emissions of that source. The efficiencies of some odor control technologies were summarized. The air dispersion model was evaluated for short-distance (<0.5 km) odor dispersion prediction against the odor plumes measured by trained field assessors on 20 farms and also for long-distance (4.8 km) odor dispersion prediction against odor data recorded by trained resident observers living in the vicinity of livestock operations in a 4.8 × 4.8 km rural area. The relationship between odor detection threshold and intensity was obtained for swine and cattle odors in order to convert odor intensity to detection threshold. The results indicated that the INPUFF-2 model was capable of simulating odor dispersion downwind from animal production operations for low-intensity odors. Six stable or neutral weather conditions that favor odor transport were identified, and their historical occurrence frequencies in all 16 directions at six weather stations in Minnesota were obtained. The occurrence frequencies of these weather conditions were used to determine odor occurrence frequencies in the OFFSET model.*

***Keywords.*** *Animal, Dispersion, Distances, Emission, Modeling, Odor, Separation.*

Odors generated from animal production operations have become a major concern in Minnesota and other states and provinces in North America during the past decade. Increased pressure from the public regarding the potential human health impacts of livestock odors has prompted the need to find solutions to this growing problem. Determining appropriate setback distances between neighboring residents and livestock farms in order to ensure acceptable air quality could be one of the most feasible tools for solving the problem; therefore, it has become an urgent need for the livestock industry and regulatory agencies. Large setback distances tend to restrict the development and expansion of the livestock industry, whereas insufficient separation distances may result in odor complaints and lawsuits against the animal producers. Recognizing this need, the Livestock Odor Task Force (LOTF) of Minnesota recommended developing a tool to help predict offsite odor movement from livestock operations (LOTF, 1997). The OFFSET (Odor From Feedlots - Setback Estimation Tool) model was the result of this recommended research project. This article serves as Part I of the report and presents a relevant literature review and the research work that paved the way to the development of OFFSET. A second article will serve as Part II of the report and present the OFFSET model development and evaluation of the model (Guo et al., 2005).

Article was submitted for review in July 2004; approved for publication by the Structures & Environment Division of ASABE in November 2005. Presented at the 2000 ASAE Annual Meeting as Paper No. 004044.

The authors are **Larry D. Jacobson, ASABE Member Engineer,** Professor, Department of Biosystems and Agricultural Engineering, University of Minnesota, St. Paul, Minnesota; **Huiqing Guo, ASABE Member Engineer,** Assistant Professor, Department of Agricultural and Bioresource Engineering, University of Saskatchewan, Saskatoon, Saskatchewan, Canada; **David R. Schmidt, ASABE Member Engineer,** Extension Engineer, Department of Biosystems and Agricultural Engineering, University of Minnesota, St. Paul, Minnesota; **Richard E. Nicolai, ASABE Member Engineer,** Assistant Professor, Department of Agricultural and Biosystems Engineering, South Dakota State University, Brookings, South Dakota; **Jun Zhu, ASABE Member Engineer,** Associate Professor, and **Kevin A. Janni, ASABE Member Engineer,** Professor, Department of Biosystems and Agricultural Engineering, University of Minnesota, St. Paul, Minnesota. **Corresponding author:** Huiqing Guo, Department of Agricultural and Bioresource Engineering, 57 Campus Dr., Saskatoon, SK Canada S7N 5A9; phone: 306-966-5350; fax: 306-966-5334; e-mail: huiqing.guo@usask.ca.

## Literature Review

### Setback Distances Determination Guidelines or Models

Odor emissions from animal production facilities are a function of many variables including: species, housing type, feeding methods, manure storage and handling methods, size of odor sources, and weather conditions. The impact of the odor on the surrounding neighbors and communities depends on the amount and character of odor emitted from the source, the distance between the neighbor and the source, weather conditions, topography, and the odor sensitivity and toler-

# Development of the OFFSET Model for Determination of Odor-Annoyance-Free Setback Distances from Animal Production Sites: Part II. Model Development and Evaluations

H. Guo, L. D. Jacobson, D. R. Schmidt, R. E. Nicolai, J. Zhu, K. A. Janni

**Abstract.** *The OFFSET (Odor from Feedlots – Setback Estimation Tool) model was developed to estimate the setback distances from animal production sites in Minnesota. It is based on odor emissions taken from field measurements and an evaluated air dispersion model. The odor emissions of a site were estimated using odor emission rates that were the geometric means of odor emissions measured from 280 animal buildings and manure storage units on 85 farms in Minnesota. The odor-annoyance-free intensity level was set at 2 (faint odor) on a 0 (no odor) to 5 (very strong odor) intensity scale. An evaluated air dispersion model, INPUFF-2, was used to calculate setback distances from various animal farms for the set odor-annoyance-free level under six weather conditions that favor odor transport. Setback distances are presented in a graphic form as well as mathematically as a function of the total odor emission factor and the desired odor-annoyance-free frequency of the neighbors. Odor-annoyance-free frequencies between 91% and 99% are based on the average weather data for Minnesota from 1984 to 1992. Suggestions for odor-annoyance-free frequency selections are given. The OFFSET model also deals with residences located in different directions from a livestock site. Additionally, it can determine the odor occurrence frequency of a residence surrounded by several livestock sites. Comparing the setback distances obtained from the OFFSET model and the odor events reported by the resident observers, it was found that the OFFSET model does not overpredict odor transport distances under very stable weather conditions. By comparing the OFFSET predictions with the odor complainers' distances from swine farms, it was clear that their residences had high odor occurrence frequencies. The OFFSET model was also evaluated by comparing odor occurrences documented by the resident odor observers in the vicinity of eight livestock farms. It was found that although the model may describe the average neighborhood intensity correctly, a high variation in the observed odor intensities existed for all levels of predicted intensities calculated from the OFFSET. Further research is needed to improve the accuracy of OFFSET and also to improve the field odor measurement method by the resident observers to obtain reliable odor occurrence data. By comparing OFFSET with four other existing setback guidelines, it was found that the distances required by the other models fell in or below the 91% to 98% annoyance-free curves of the OFFSET.*

***Keywords.*** *Animal, Dispersion, Distances, Emission, Evaluation, Modeling, Odor, Separation.*

The objective of this study was to develop a science-based method to establish setback distances from animal production sites, based on the use of an air dispersion model that uses actual odor emission data, the selected odor-annoyance-free odor concentration, and historical weather data for Minnesota. The companion report, i.e., Part I of this study, described the separation distance determination approach and some experimental results (Jacobson et al., 2005). Typical odor emission rates for various livestock production facilities in Minnesota were measured from 280 animal buildings and manure storage units on 85 farms in Minnesota. The geometric means of the measured odor emissions were used to estimate emissions from other similar systems. The relationship between odor intensity and the odor detection threshold was determined in order to convert downwind odor intensity to odor threshold for the purpose of dispersion model evaluation. An air dispersion model, INPUFF-2 (Bee-Line Software Co., Asheville, N.C.), was evaluated by downwind odor plume measurement using trained field odor assessors and resident odor observers. It was proven reliable for prediction of odor dispersion from livestock operations. The frequencies of six different weather conditions that favor odor transport were calculated based on weather data from six weather stations in Minnesota from 1984 to 1992 (Jacobson et al., 2005).

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# Comparison of odor setback/odor footprint estimation tool

| Calculation Type | Factors | SDOFT | NOFT | OFFSET | POSM |
|---|---|---|---|---|---|
| **Odor emission** | Species | Beef, Dairy, Swine | Dairy, Swine, Poultry | Beef, Dairy, Swine, Poultry | Beef, Dairy, Swine, Poultry |
| | Emitting area options | Rectangular | Rectangular and circular | Rectangular | Rectangular and circular |
| **Odor dispersion** | Dispersion model | AERMOD | AERMOD | INPUFF 2 | Austrian and German model |
| | Terrain | Flat only | Flat and others | Flat only | Flat and others |
| | Meteorological data | Built-in historical data for three regions in South Dakota | Built-in historical data for eight regions in Nebraska | Built-in historical data for Minnesota | Wind frequency data can be manually entered |
| **Outcomes** | Setback | Setback distances from the operation at different odor annoyance-free level in four directions (NE, SE, SW,N W) | Setback distances from the operation at different odor annoyance-free level in four directions (NE, SE, SW, N W) for two different sets of odor management | Odor annoyance-free distance for various sources from the operation regardless of wind direction | Individual setback distance for various sources within an operation in eight wind directions (N, NE, E, SE, S, SW, W, NW) |

Akter, S. 2018. MSc Thesis, SDSU

# SD ODOR FOOTPRINT MODEL

- Is it perfect – NO
- It is a science-based estimate, and the best science available
- Topography (hills, valleys, trees, buildings, etc.) also affects odor dispersion
- During very stable meteorological conditions with cooling temperatures, odorous air may travel long distances along low lying areas
- Some counties are using 97% odor annoyance free (11 days/yr)

# HEALTH IMPACTS

- Physiological and psychological symptoms have been reported in various studies

- Systematic study of available literature by O'Connor et al. (2010)
  - A weak and inconsistent association between self-reported disease in people with allergies or familial history of allergies

  - No consistent dose-response relationship between exposure and disease

# ECONOMIC DEVELOPMENT FROM LIVESTOCK

- Labor in barns
  - 13-15 full-time people in a 5,400 sow barn
  - 2,400 hd wean-to-finish barn = 2 hrs/day

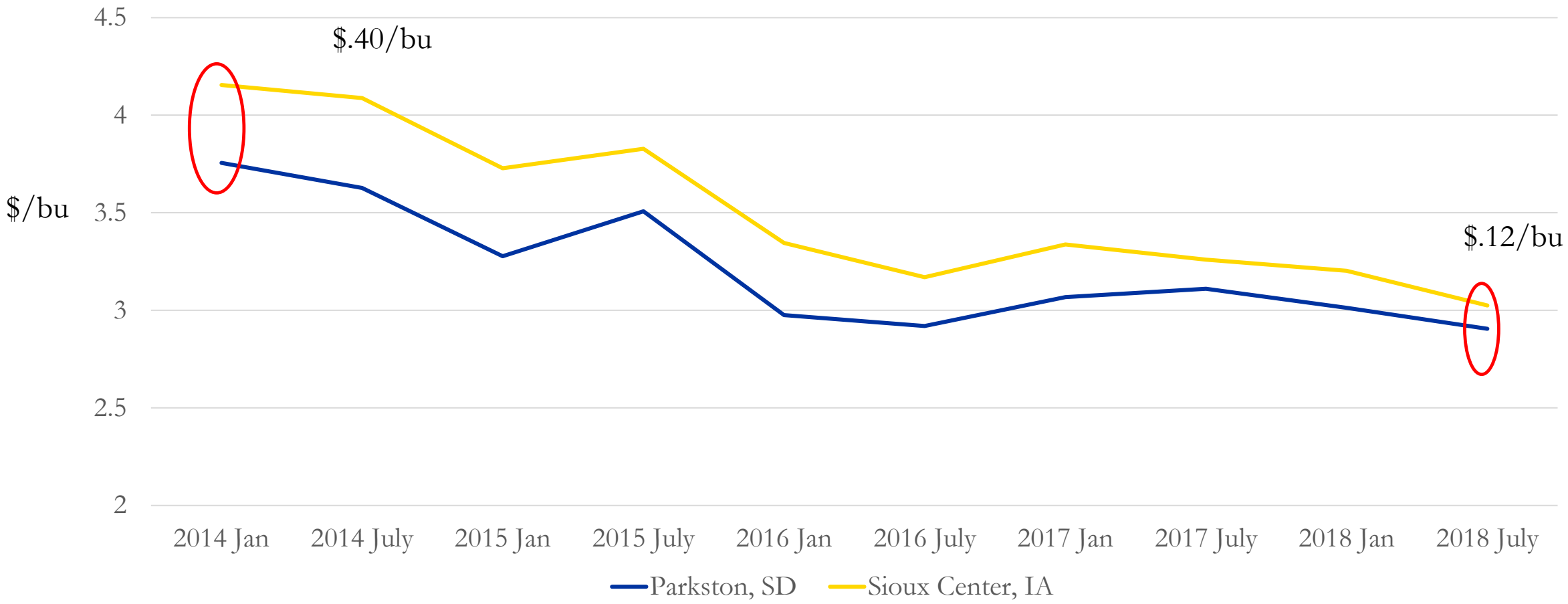
- Taxes
  - 5,400 sow barn = $13-15 million
  - 2,400 WF barn = $750,000

- Manure = $25,000/yr from 2,400 hd WF barn

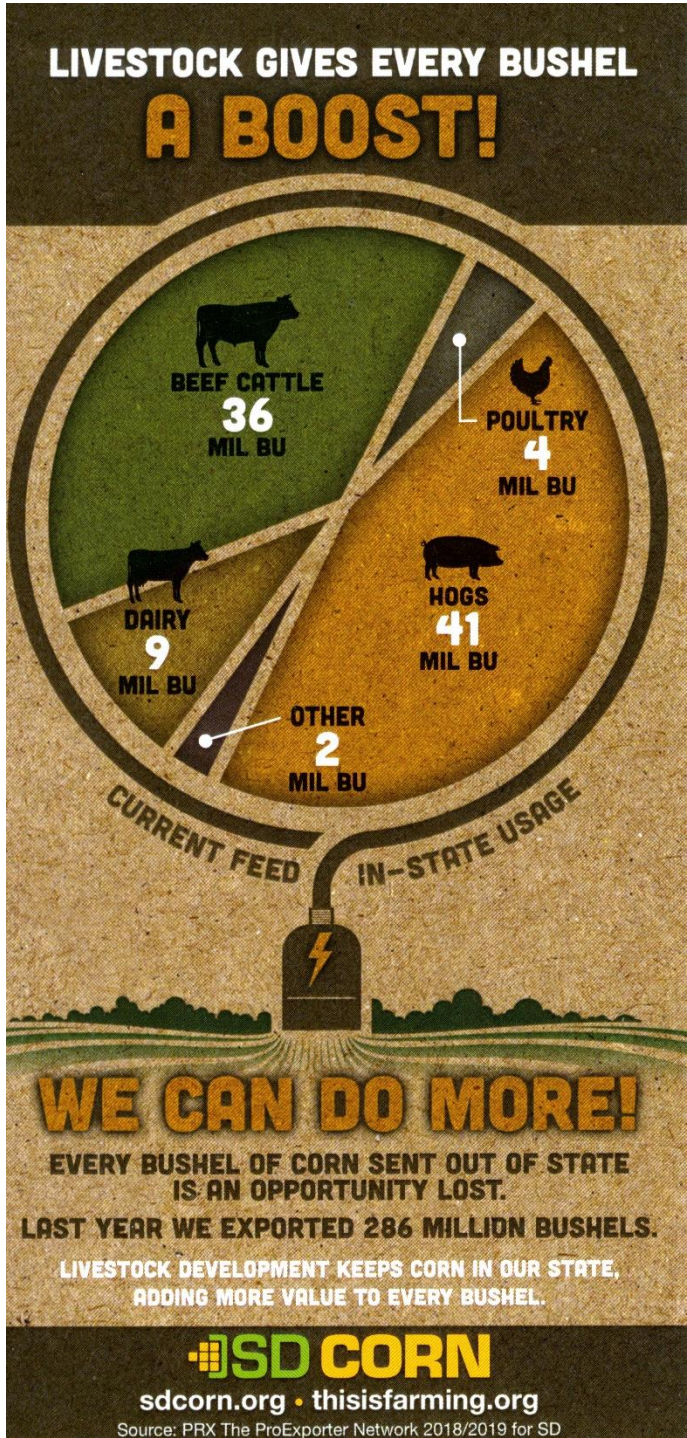
# ECONOMIC BOOST

| Company | Role | Town & Population | Jobs |
|---|---|---|---|
| MDS | Equipment | Parkston – 1,497 | 65 |
| SDI | Equipment | Alexandria – 635 | 73 |
| Hogslat | Equipment | Salem – 1,277 | 21 |
| Ethan Lumber | Barn Construction | Ethan – 321 | 56 |
| Subcontractors | Barn Construction | Ethan area | 27+ |
| Summit Contracting | Barn Construction | Platte – 1,272 | 16 |
| Subcontractors | Barn Construction | Platte area | 10 |
| Reaves Buildings and Subs | Barn Construction | Sioux Falls – 176,888 | 23 |
| D&D Construction | Barn Construction | Marion – 771 | 10 |
| Parkston Grain & Feed | Feed Suppliers | Parkston – 1,497 | 11 |
| Parkston Grain & Feed | Feed Suppliers | Kaylor – 47 | 19 |
| Stan's | Feed Suppliers | Alpena - 283 | 17 |
| Central Farmers Cooperative | Feed Suppliers | Montrose - 442 | 9-10 |

# IMPACT OF LIVESTOCK ON CORN PRICES ($/BU)




$56/acre increase


LIVESTOCK GIVES EVERY BUSHEL
A BOOST!
BEEF CATTLE
36
MIL BU
POULTRY
4
MIL BU
DAIRY
9
MIL BU
HOGS
41
MIL BU
OTHER
2
MIL BU
CURRENT FEED IN-STATE USAGE
WE CAN DO MORE!
EVERY BUSHEL OF CORN SENT OUT OF STATE IS AN OPPORTUNITY LOST.
LAST YEAR WE EXPORTED 286 MILLION BUSHELS.
LIVESTOCK DEVELOPMENT KEEPS CORN IN OUR STATE, ADDING MORE VALUE TO EVERY BUSHEL.
SD CORN
sdcorn.org • thisisfarming.org
Source: PRX The ProExporter Network 2018/2019 for SD

# ECONOMIC IMPACT

- 5,000 Sow Barn (annually)
  - 190,714 bu of corn (1,090 acres)
  - 53,854 bu of soybeans (1,077 acres)
  - 6,250 tons of feed- 156 loads of feed
  - 1 trailer of piglets out/wk & 4 semis of gilts in

- 2,400 hd W-F Barn (annually)
  - 45,737 bu of corn (261 acres)
  - 13,340 bu of soybeans (267 acres)
  - 1,584 tons of feed – 40 loads of feed
  - Two trailers of piglets in
  - Twenty-nine semis of pigs out

- 5,000 sow produce 135,000 piglets/year
  - 1,215,000 bu corn (6,943 acres)
  - 375,188 bu soybeans (7,504 acres)

- 1 sow: $2,478

- 1 market hog: $202.67

- 1 dairy cow: $13,594

# ECONOMIC IMPACT OF A 3,100 DAIRY

## ROGER SCHEIBE, MIDWEST DAIRY ASSOCIATION

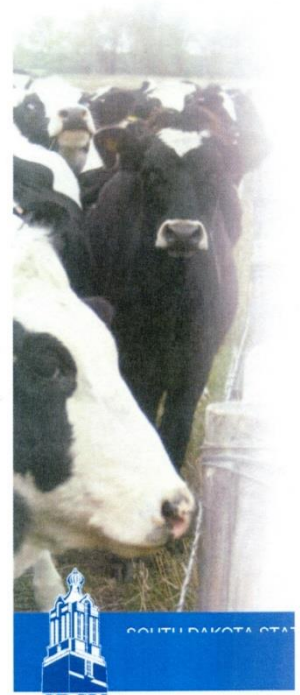
| Item | $ |
|---|---|
| Sales & Use Tax | 156,422 |
| Excise Tax | 9,566 |
| Property Taxes & Permits | 40,570 |
| Vehicle Licenses | 4,187 |
| **Total Taxes** | **210,745** |
| | |
| Payments Made to Local Vendors | 16,142,041 |
| | |
| Gross Payroll | 2,377,392 |
| | |
| Total Employee Count | 62 |

# Livestock Development in South Dakota

Frequently asked questions, with answers for you and your community

Q&A

The purpose of this publication is to answer — with science-based land-grant university research — questions frequently asked by the public about issues and needs that affect agricultural growth, urban expansion, and rural community development in this state.



SDSU

## It's not just about agriculture... It's a public policy debate to address the concerns of all state residents

In February 2006 Rodney and Dorothy Elliot and their three children moved from their home in Northern Ireland to Lake Norden, South Dakota. By the end of that year they were already milking 1,400 cows in their farm, "Drumgoon Dairy". In 2013 they built a new milking parlor and half of a new cross-ventilated barn to the North of their facilities. The second half, named "Norden Dairy", brought their total capacity to 4,500 cows. The farm currently has 45 full time employees which the family enjoys assisting to enhance their farming skills. The family also farms 1,000 acres of corn and alfalfa, and owns 200 acres of pasture. Their farmland and that of their neighbors is naturally fertilized with manure from the dairy. Drumgoon and neighbor crop farmers have prospered with this arrangement and at the same time they have reduced their carbon footprint. Their top priority is to buy local, purchasing 90 percent of their feeds from farms within their county.

Dairy farms are only one segment of animal agriculture. Family farm expansions and relocations have been the norm across species all over the state.

Livestock producers and processors who deal in beef cattle, hogs, sheep, and poultry are finding South Dakota to be an excellent location for processing plants and large-scale livestock operations. All this, makes for some general public concerns as residents in communities around the state try to chart a course that will allow for farm development while protecting the environment and dealing with nuisances such as odor.

Daniel Scholl, director of the South Dakota Agricultural Experiment Station, says that is why land-grant university research will be crucial to South Dakotans as producers, cooperatives, and local governments make decisions about how to proceed with safe, science-based agricultural development.

**"In the past 15 years we have seen a lot of livestock expansion in South Dakota. The most sustainable agricultural systems are diversified, environmentally friendly operations."**

— Barry Dunn

**"We need to find a way to integrate animal agriculture back into crop farming."**

— Evert Van der Sluis

### Go west, young man: the 'push' factors

Vikram Mistry, head of SDSU's Dairy Science Department, says producers that have come to South Dakota from other states and countries "would like to expand at home but they cannot in many cases because they are essentially landlocked. What's available here is open land, but it's also reasonably priced." Rural Sociologist Dave Olson of SDSU's Rural Life/Census Data Center says that, as Mistry suggests, the choice to relocate often has to do with decreasing opportunities elsewhere combined with numerous possibilities in South Dakota.

"Migration can be explained by the 'push/pull theory.' In other words, people migrate because there are factors that push them out of one place and pull them into another," Olson says.

"Push factors might include lack of employment, undesirable living conditions, personal interests, and limited opportunities for success. Pull factors might include the opposites—better jobs, safer or better living conditions, personal opportunities, and better or different recreational amenities."

Evert Van der Sluis, Professor of Economics, and a native of The Netherlands, agreed with Mistry that two major "push" factors that are making producers in his part of Europe look elsewhere are tough environmental laws and limited agricultural land that is costly and increasingly hard to find.

Van der Sluis noted that The Netherlands is one of the most densely populated countries in the world, and so much of the agricultural activity there takes place near cities and towns. It is therefore not surprising to find relatively strict environmental laws and a level of scrutiny over agricultural production methods by members of society who demand access to clean water, air, and other natural resources.

In the past, farmers who owned their land might have been able to use the proceeds from selling their capital assets in The Netherlands to invest in a South Dakota operation. These favorable differences shrunk somewhat over the past decade slowing-down the immigration of Dutch producers.

However, more recent weather and environmental-related concerns have remained relevant for agricultural producers in states along the West Coast of the United States. Ongoing drought concerns and issues associated with increased population pressures may provide opportunities for South Dakota to encourage agricultural producers in states along the West Coast to consider investing in our state.

### Coming to South Dakota: The 'pull' factors

Whether they're from other states or countries or whether they've lived here all their lives, producers agree on some inherent advantages for animal agriculture in the state. In a nutshell, the advantages are a climate suitable for livestock; abundant, affordable feedstuffs, including distillers grains produced as a co-product from ethanol plants; and a growing number of state or regional processing plants for dairy and livestock industries that are reducing the distance farmers must take their products for processing. One example is the 2014 opening of the Bel Brands USA in Brookings, a plant that produces 1.5 million individually wrapped, Mini Babybels cheeses per day. This plant, an investment of $140 million and a 170,000 square-foot facility which requires more than 500,000 pounds of milk daily to produce 22 million pounds of cheese, employs 250 people.

Joe Cassady, head of SDSU's Animal and Range Sciences Department affirmed: "Historically we've exported calves and corn from South Dakota. When you're doing both of those and they're going to neighboring states, someone else is taking advantage of the quality of livestock and the abundance of feed we have in South Dakota".

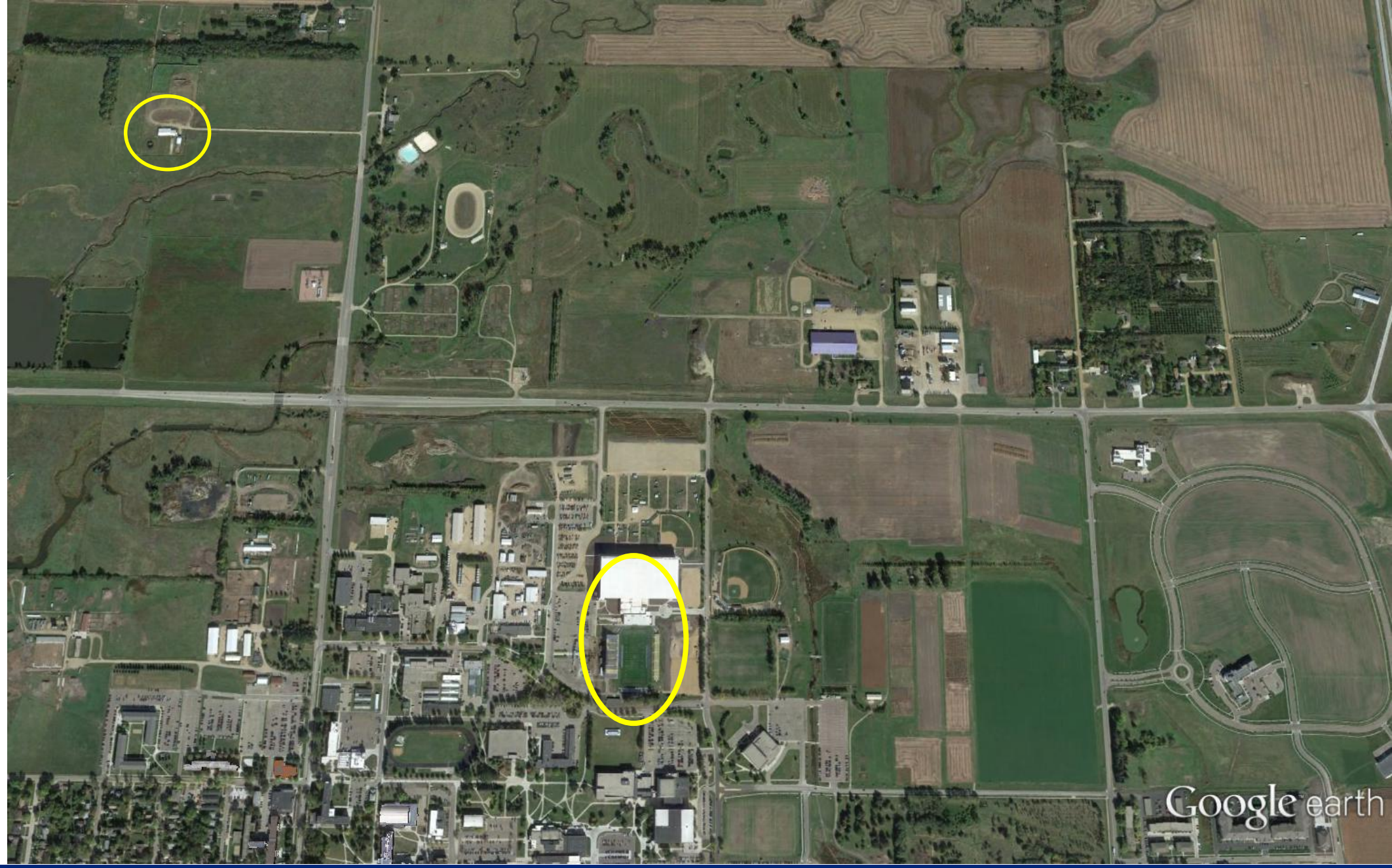
"If you want to have jobs, you have to have chores"

Bill Even, former SD Secretary of Ag & current CEO of the National Pork Board

# Evan Schoenfelder


# Brooke Heisinger

# If not responsibly sited livestock operations, then what?


Google earth

Please
stop by
for a visit

# “We’re all in this together”