Describing the cull sow and cull hog market networks in the US: A pilot project

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Key Points

- Little is known about the cull market, how culls are transported, and how they play a role in disease spread
- While most sows travel directly to slaughter, an important percentage most likely move through multiple collection points
- Cull sow movement are important for understanding disease transport related epidemiology

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Project Summary

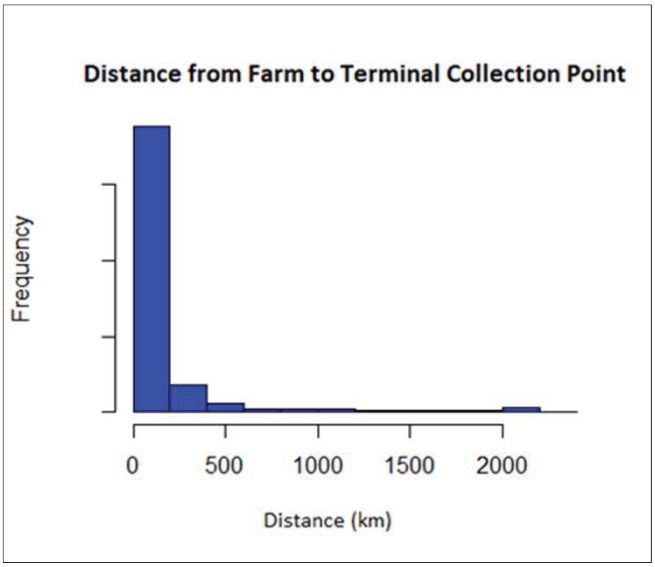
This project was designed to help answer the questions, "what is the range of locations of sows that enter a slaughter plant?", "how many stops along the way do they make?" and "how long do they remain the slaughter channel?" Currently there is little data to investigate such questions allowing the industry and regulators to make informed decisions about how to respond to an animal disease outbreak. This project set out to collect data from a harvest plant to see if such information could help answer these questions allowing the industry and animal health officials to better make decisions to prevent and control animal health emergencies.

Methods

In this study, data was captured from a single cull harvest plant over a period of one week during the spring of 2017. We collected Premise ID tags of the culls as they moved through the plant and grouped them by shipping lot. This allowed for the final point of collection to be identified for the purposes of this study. The premise IDs were then cross referenced against a database containing origin information for each unique premise ID to identify the cull's proposed farm of origin.

In total, we collected premise data on 90.4% of the culls that moved through the harvest plant that week. The animals originated from a total of 297 unique source farms. Sows originated from farms in 21 states and Canada. To determine whether movements to plants derive locally or nationally the distances between origin farms and plant were calculated. We defined the local region for this plant as the radius needed to meet the plant's capacity at an industry standard 50% cull rate per year. USDA census surveys were used to calculate the breeding inventory of this area at a county level, and determined a 250km radius sufficient to provide the culls needed to meet capacity. With this in mind, 23.5% of culls originate from farms in the described local region and 43% of final collection points also reside within 250km of the plant. This depicts nature of the cull movements in the market network as national.

The data above presents information on how the cull network begins and ends. Little is known about how culls move through collection points. To learn more about how these culls move after leaving the farm and before arriving at the plant, a simple distribution of the distance between the farm of origin and the final collection point was graphed. We also screened the data for statistical outliers and found that culls originating from distances greater that 240km from the terminal collection point were classified as outliers in the network.



The majority of culls (86%) originate less than 240km from the final collection point. This interaction is deemed to be a primary interaction, meaning that it is very likely the culls moved direct from the farm of origin to the final collection point. 14% of the culls travel a distance greater than 240km to the terminal collection point. Of these 14%, 17.7 % or 2.5% of all culls, traveled 5 times as far to the last point of collection from the farm than they did from collection point to plant. We hypothesize that 2.5%-14% of culls moved between multiple collection points prior to arrival at the

Discussion and conclusion

We believe to be the first data set collected that allows for this level of detail in describing cull movement from farm until harvest. Although or study has limitations in both the size of dataset and limited timeframe, we believe it provides a unique insight into animal movements and serves as a platform for further work such as this, using larger sets of data to be completed. A better understanding of how culls move throughout the network may provide more detail about disease transmission in the cull market in the US.

Identifying 90.4% of culls over a short time period demonstrates that tracking culls through harvest plants is a realistic method to capture the complexity of the cull network. Although only 2.5%-14% of culls are believed to have moved between multiple collection points prior to harvest. We believe that this is significant and suggest, as was suspected for PEDV, that culls could be an efficient means of transferring diseases across large geographical regions. Being able to understand the way not only sows but diseases move through the slaughter chain holds great value in making the correct decisions to effectively control and prevent disease outbreaks, and why further work must be completed to effectively and efficiently track culls sows through harvest plans to prepare for such an event.