Analyzing swine movement patterns using zonal neighborhood effect.

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Key points:

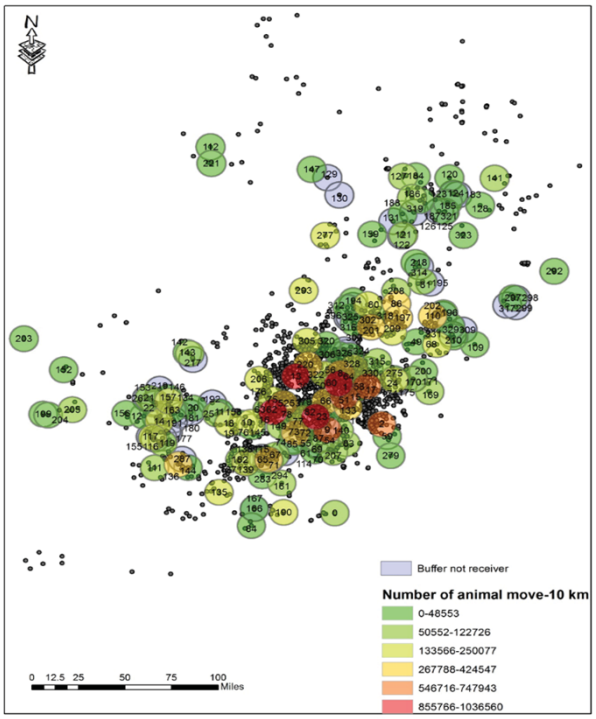
- **Pig movements into farms located near a sow farm may serve as a proxy for the probability of local introduction of a pathogen and the risk of airborne spread**
- **Movements into sow herd "neighborhoods" was correlated with PRRS seasonality suggesting a possible contributory role.**

Objectives: Describe patterns of pig movement into buffer zones surrounding sow farms as a measure of PRRS risk

Methods and findings:

We analyzed weekly pig movement data from three spatially-overlapping systems located within a high swine density state. These systems represented ~90% of all commercial swine farms within the study area. We were informed of locations and all corresponding production types. For these systems, pig movement data was available for a period of one year (2014), including the origin, destination, date and number of live pigs moved into sow farm neighborhoods (n=60,961 movements). We defined the "neighborhood" of each sow farm by drawing a 10-km buffer around each sow farm in the region, a radius that is potentially relevant for airborne transmission for PRRS and other transboundary diseases (Dee, S, et al, 2009). The median weekly number of pigs coming into a neighborhood was 1,970 pigs (min 3-max 30,850). The median weekly number of shipments (batches) received into a neighborhood was 5 (min 1-max 106). Patterns of movement into neighborhoods showed a high degree of heterogeneity (Figure 1).

Preliminary results (Figure 2) show a clear seasonal increase in both the number of shipments and the total number of pigs moved into sow farm neighborhoods. The influx of pigs into sow farm neighborhoods in 2014 increased around week 23 (June) and through the autumn months. This correlates with an increased number of outbreaks in June 2014 and seasonal breaks in the autumn. Thus, PRRSV seasonality could be a result of both changes in movement patterns at the neighborhood level as well as with the fact that the virus is more stable at low temperature and humidity [Hermann, J., et al. 2007][SHMP-12/23/2016]. These observations suggest that movements into a sow farm's neighborhood may play an important role in exposure. While initial results are promising, further analysis is necessary to gain a more complete picture on neighborhood effects on PRRS risk and to generate predictive risk scores that can be used in near



Above Figure 1- Characterization of buffer zones. Black points represent farms, and colored circles represent the buffer zone around each sow farm. Shading represents the total number of incoming movements (batches) into each buffer in 2014.

Figure 2: Bottom Left- total pigs movement into neighborhoods (buffer zone - 10 km) per week of 2014. Bottom Right: Mean (SD) of the shipments into neighborhoods.