

Title: Environmental Footprints for Regional Swine Production Systems Now and in the Future – A Demonstration Pilot Project (**NPB #18-042**)

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Scientific Abstract:

Environmental sustainability is a goal that increasingly influences decisions and actions at all levels of the pork industry, from individual producers to meat packers and retailers. Many analyses and tools can assess current production practices, and have the power to help identify and assess strategies for changing sustainability metrics in the future. This project explored if, and how, Extension and/or existing outreach networks can increase the adoption of the Pig Production Environmental Footprint Calculator (PPEFC) through engagement, data gathering and strategizing. At the same time, aggregated footprints from cooperating producers provide a baseline for carbon and water footprints in the Midwest region, reflecting regional manure management and housing systems. Our footprint dataset included 4 breed-to-wean facilities, 11 wean-to-finish and 12 grow-finish facilities. For all farms, first we generated a set of footprints using a common set of corn-soybean based diet formulations for each stage of production. We created additional footprints for farms that supplied their farm diet formulations and/or production parameters like average daily gain (ADG) and feed conversion ratio (FCR).

We engaged over 20 producers, and we generated footprints for 26 farms spanning Minnesota, Iowa, Nebraska and South Dakota. Based on survey responses by 10 producers, we found the producers we engaged with are aware of and engaged in protecting the environment, but the interest and specific knowledge about environmental footprints is highly variable. The producers' prior experience with environment footprints ranged from no experience to instances of producers who have looked into their operation's footprint in the past. We personally asked the majority of producers to participate, but the majority indicated 'a desire to be able to address questions about pork production' was a major driver for participation.

Amongst the wean-finish barns using the common diet, the average (\pm standard deviation) carbon and water footprints were 2.40 ± 0.09 lb CO₂e per pound of pig and 26.0 ± 0.9 gal H₂O per pound of pig at the

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farmgate. The footprints both increased and decreased up to 5% with the producer-supplied production metrics. The average carbon footprint was 2.15 ± 0.24 lb CO₂e per pound of pig and the average water footprint was 23.5 ± 2.7 gal H₂O per pound of pig at the farmgate in the grow-finish phase. Producer supplied feed formulations and production metrics tended to increase carbon footprints up to 10%, but decrease water footprints by 20%. For four breed-wean sites, the footprints were more variable, and comparison between sites depends greatly on the base unit. When the footprints are expressed per weaned pig produced, the carbon and water footprints ranged from 29 to 41 lb CO₂e per weaned pig and 475 to 739 gal H₂O per weaned pig for a common diet. The carbon footprints (per piglet) increased 33 to 64% when the farm-specific diet formulations replaced the common diet, but the water footprints decreased 19 to 31%.

The PPEFC footprints for the cooperating farms in the Midwest region that predominantly use deep pit manure storage show that feed production and manure storage represent over 95% of greenhouse gas emissions for wean-finish and grow-finish phases, and over 80% of emissions for breed-wean farms. Feed production is generally 90% of the water usage in a water footprint. However, building design and herd management contribute to efficient use of land, energy and water resources. We explored and discussed four strategies for changing environmental footprints via altering feed formulations, changes to manure storage design or frequency of manure removal, animal environment and husbandry, and record keeping.