INTEGRATING A LIFE CYCLE COSTING MODEL INTO A GHG EMISSIONS MODEL FOR SWINE PRODUCTION

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ABSTRACT

This poster describes the integration of life cycle costing capabilities into a life cycle assessment model of greenhouse gas emissions for US swine production. Combining both tools allows for a sustainable analysis of a process to identify potential production practices which are environmentally friendly and economically feasible.

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BACKGROUND

Agriculture is a driving force of the U.S. economy and like all economic sectors, agriculture is also a source of greenhouse gas (GHG) emissions. The Supreme Court recently upheld the right of the Environmental Protection Agency (EPA) to regulate GHG emissions. So even economically important agricultural sectors such as the swine industry, whose contributions to total US emissions are small (only 0.3%) (NPB, 2009), may not be exempt from regulation. Decision support tools are needed to ensure that producers can meet expected regulatory goals and maintain profits.

Certain tools can calculate GHG emissions and costs associated with a production process. Life Cycle Assessments (LCAs) determine environmental impacts of a product. Life Cycle Costings (LCCs) identify costs and financial risks in a product's life cycle (Swarr et. al, 2010). Combining both allows for an exploration of potential production practices which are environmentally friendly and economically feasible.

In 2011, the National Pork Board released the Live Swine Carbon Footprint Calculator. This tool, developed at the University of Arkansas, calculates emissions of GHGs as kg CO_2e/yr for 12 activities including feed production, manure handling, and barn climate control. Users can modify production activities to determine how those changes may impact emissions. However, the tool does not estimate the associated economic costs. By comparing and adjusting different production processes, a producer may be able to determine cost-effective methods to reduce farm-level GHG emissions. Here we describe the integration of economic considerations into the Live Swine Carbon Footprint Calculator.

METHODS

The integration of economic considerations will take place in five steps:

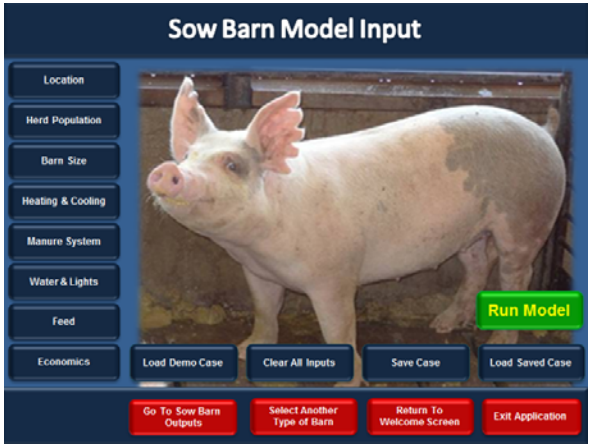
- Geographically and time specific price data for the production activities will be collected from several sources including: USDA, the Energy Information Administration, the Farm and Ranch Irrigation and ARMS Surveys, swine producers and the swine industry.
- Economic algorithms will be developed to calculate farm production costs over a full year.
- Economic components will be integrated into the GHG model to estimate both sources and amounts of GHG emissions generated and their associated costs.
- Differential cost analyses will be conducted by estimating the cost of reducing GHG emissions associated with production activity modifications.
- Cost-benefit, risk assessment and optimization analyses will be conducted by the inclusion of mathematical processes that simulate scenarios hundreds of times and provide ranges of outputs that fall within 95% confidence intervals.

RUNNING THE MODEL

Users can run the model in just a few easy steps:

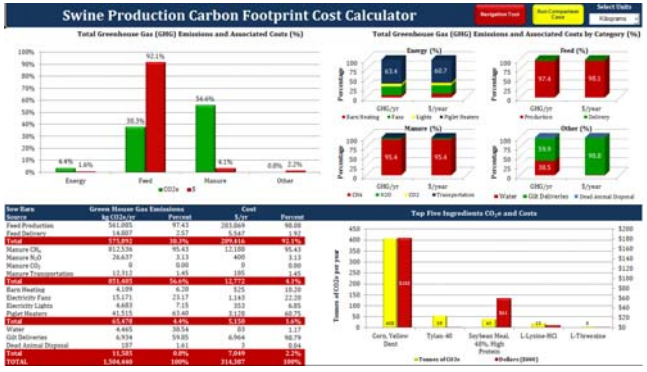
- Select among four types of barns: gestation, lactation, sow and grow barn. Users will then be taken to an input screen for their barn choice, such as the sow screen input shown in Figure 1.
- Populate the eight input fields related to their barn by entering information into userforms (like the economic input user farms in Figures 2 and 3) OR load a demonstration case as an example.
- Hit the "run model" button. The model will run in about 10 seconds, depending on computer speed.
- Review GHG and economic results presented on a summary screen (as shown in Figure 4) as well as detailed results related to sources, amount and cost of all GHG emissions associated with the operation.

Figure 1: Example Input Screen, Sow Barn



Figures 2 and 3: Example of Economic Input Screens

Figure 4: Example Output Screen, GHG and Cost Estimates



DISCUSSION

The model will be a powerful tool usable for swine producers, industry leaders, policy makers, academic instructors and outreach educators. Once integrated, this latest version of the model will allow the user to:

- Estimate GHG emissions and costs of an operation simultaneously
- Answer "what if" questions concerning GHG and cost impacts related to changes in various production activities including:

  a) Herd Size
  b) Barn Heat
  c) Feeding Strategies
  d) Barn Size
  e) Animal Rendering
  f) Manure Management

- Evaluate expected impacts of proposed production activity changes to GHG and costs resulting from modifications BEFORE undergoing expensive changes
- Estimate the economic efficiency of system modifications in reducing GHG emissions ($ spent /emissions avoided)

The overall model will help to better determine the economic and environmental impacts of swine production activities. It will also serve as the foundation for a more detailed LCA and costing being conducted through a grant from the USDA National Institute of Food and Agriculture. This model presents great potential for assisting researchers, policy makers, and especially farm managers in making informed decisions regarding GHG emissions while maintaining production and profitability.

An updated version of the GHG model will be released by the National Pork Board in early 2013. The integrated GHG /Cost model is expected to be released in late 2013.

LITERATURE CITED

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