Evaluating Greenhouse Gas emissions from Swine production in Central Iowa using COMET-Farm™

C. Toureene[1], Easter M.[1], Swan A.[1], Paustian K.[1], Brown K.[1], Marx E.[1], Ziegler J.[1], Stermer M.[1], Velayudhan S.[1], Archibeque S.[2], Chambers A.[3], and Baranski M.[4]

[1]Natural Resource Ecology Laboratory-Colorado State University, [2]Colorado State University-Department of Animal Sciences, [3]USDA Natural Resources Conservation Service, [4]USDA Office of the Chief Scientist

Introduction to COMET-Farm

COMET-Farm is an integrated web-based decision support tool developed to aid farmers, agricultural producers, land managers and conservationists.

COMET-Farm provides total farm greenhouse gas (GHG) accounting and carbon sequestration occurring from these practices:

- Cropland, Pasture & Rangeland
- Livestock
- Agroforestry
- Energy usage
- Forestry

By generating reports from users' current and potential future management scenarios, COMET-Farm allows users to evaluate how conservation practices may reduce GHG emissions and sequester atmospheric CO_2.
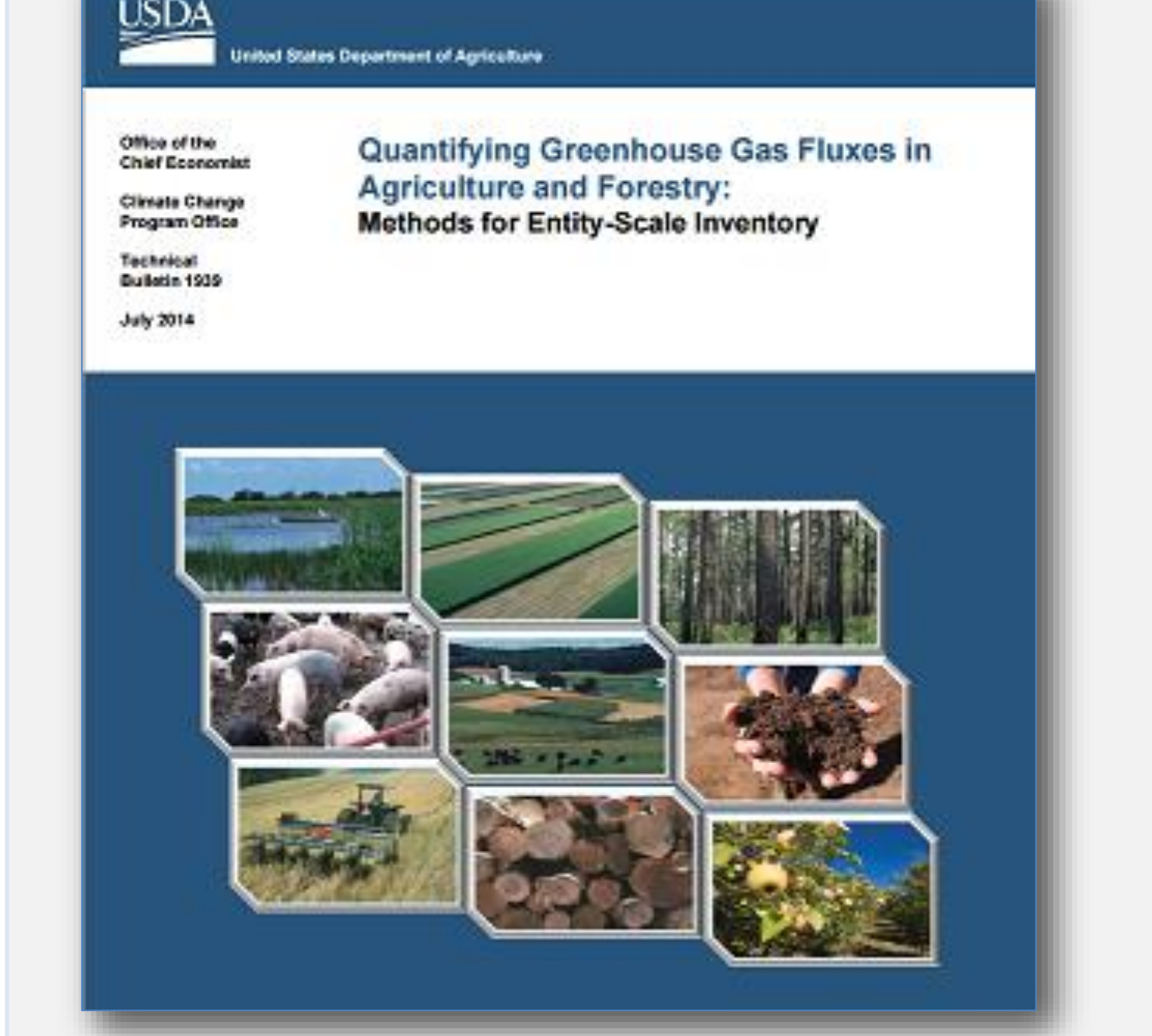
Animal Agriculture

Photo courtesy of USDA Natural Resources Conservation Service

Livestock management practices contribute a significant amount of GHG emissions in the agricultural sector. COMET-Farm reports estimate:

- Methane from enteric fermentation
- Methane from housing and manure management
- Nitrous oxide from housing and manure management

Scientific Basis

United States Department of Agriculture
Office of the Chief Economist
Climate Change Program Office
Technical Bulletin 1939
July 2014

Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory

COMET-Farm utilizes peer-reviewed greenhouse gas (GHG) inventory methods published by the USDA in *Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory* to assess the greenhouse gas balance of management at the field level.

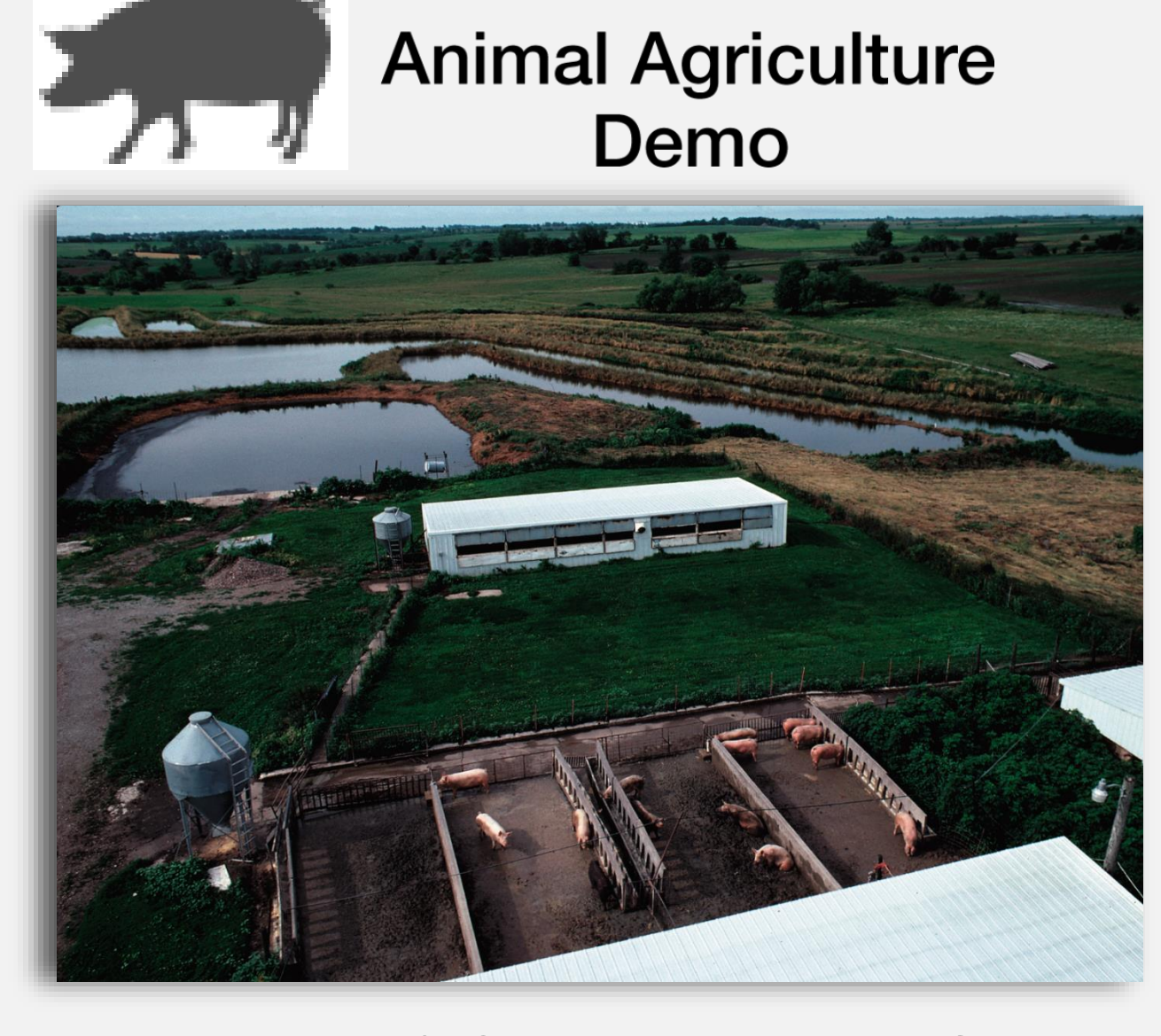## Using COMET-Farm

Animal Agriculture Demo

Photo courtesy of USDA Natural Resources Conservation Service

This poster showcases the capabilities of the Animal Agriculture module of COMET-Farm evaluating a hypothetical swine operation in Iowa.

Baseline Scenario

- Population of 500 Grow-Finish Pigs
- Housed in a roofed facility
- Manure flushed into a single-cell lagoon

Future Scenario: Digester Install

- A methane recovery system will be been constructed.
- The new anaerobic digester system is a lined concrete digester with a gas collection system attached (egg shaped digester).

Getting Started

Creating a livestock project in COMET-Farm is easy. Simply create and name your customized project and begin to define activities. COMET-Farm relies on accurate climate data so location information is collected. Methods have been implemented to quantify emissions from a wide range of livestock categories. For the purpose of this poster we will be showcasing the swine category, particularly a Grow-Finish operation.
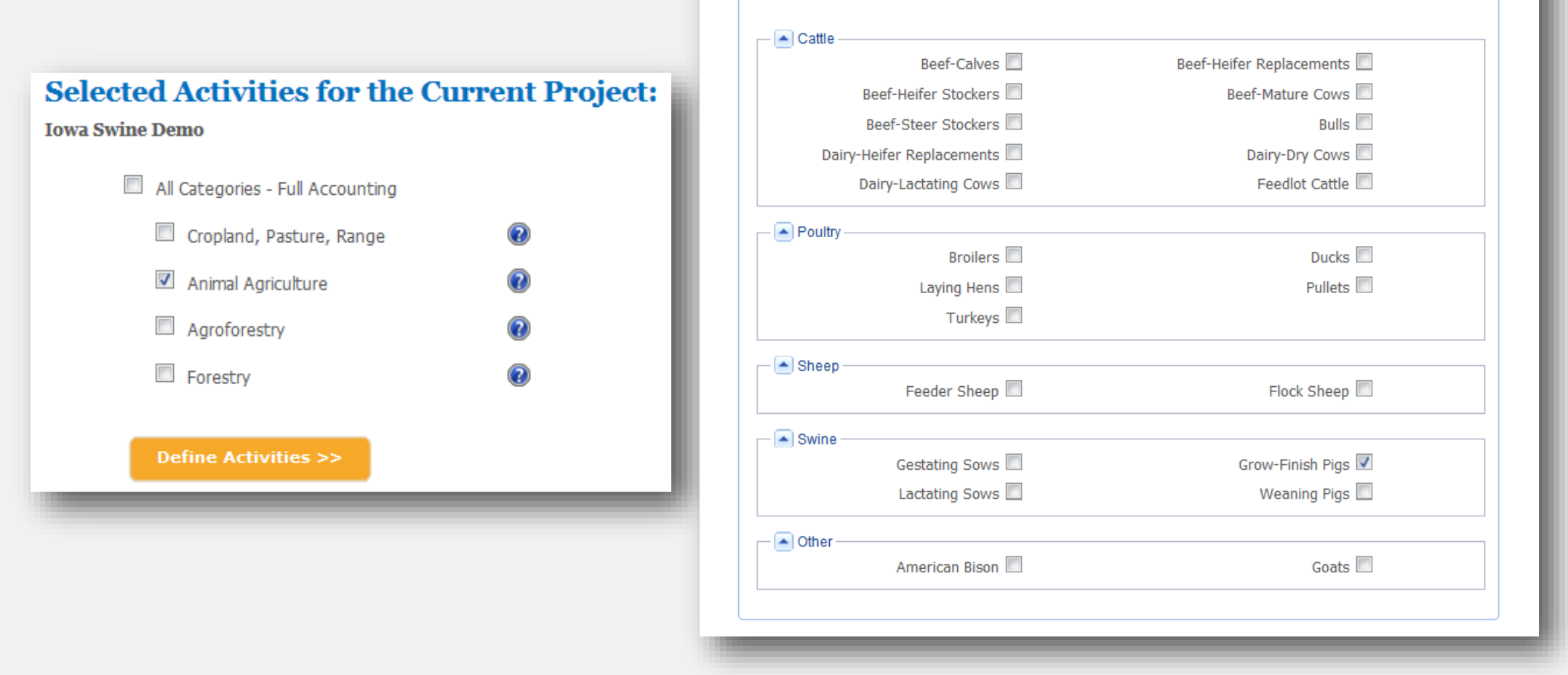
Animal Details

Specific management data is collected from the user, starting with Animal Details. Animal details such as monthly populations, feed intake, days on feed, and percentage of crude protein is needed. Default values are provided for dressing percentage, fat free lean percentage, initial body weight and final body weight. User may change the values to represent their operation more accurately.
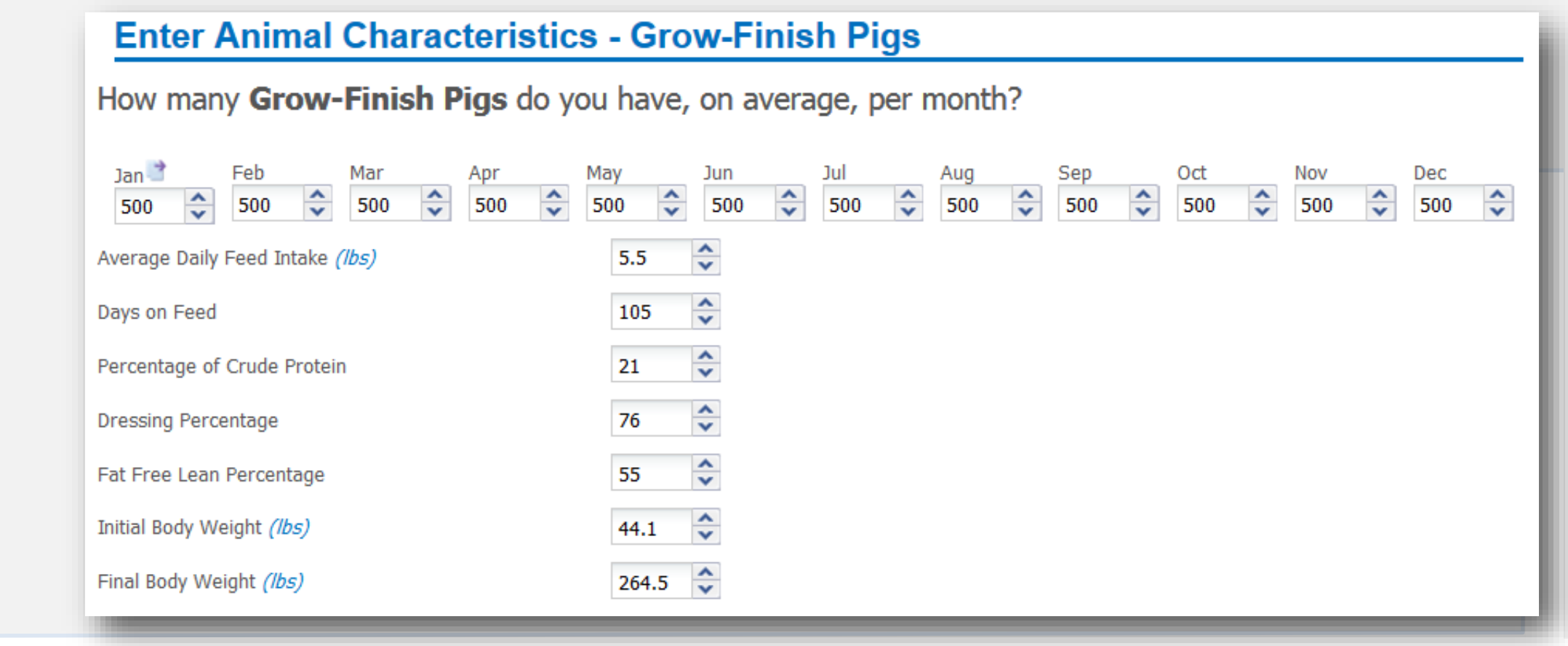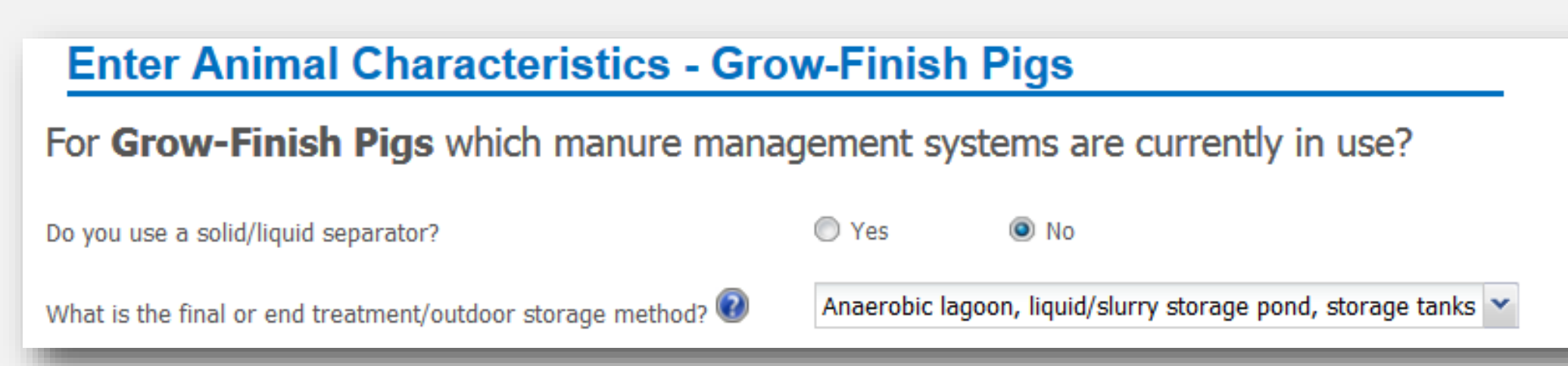
Housing Details

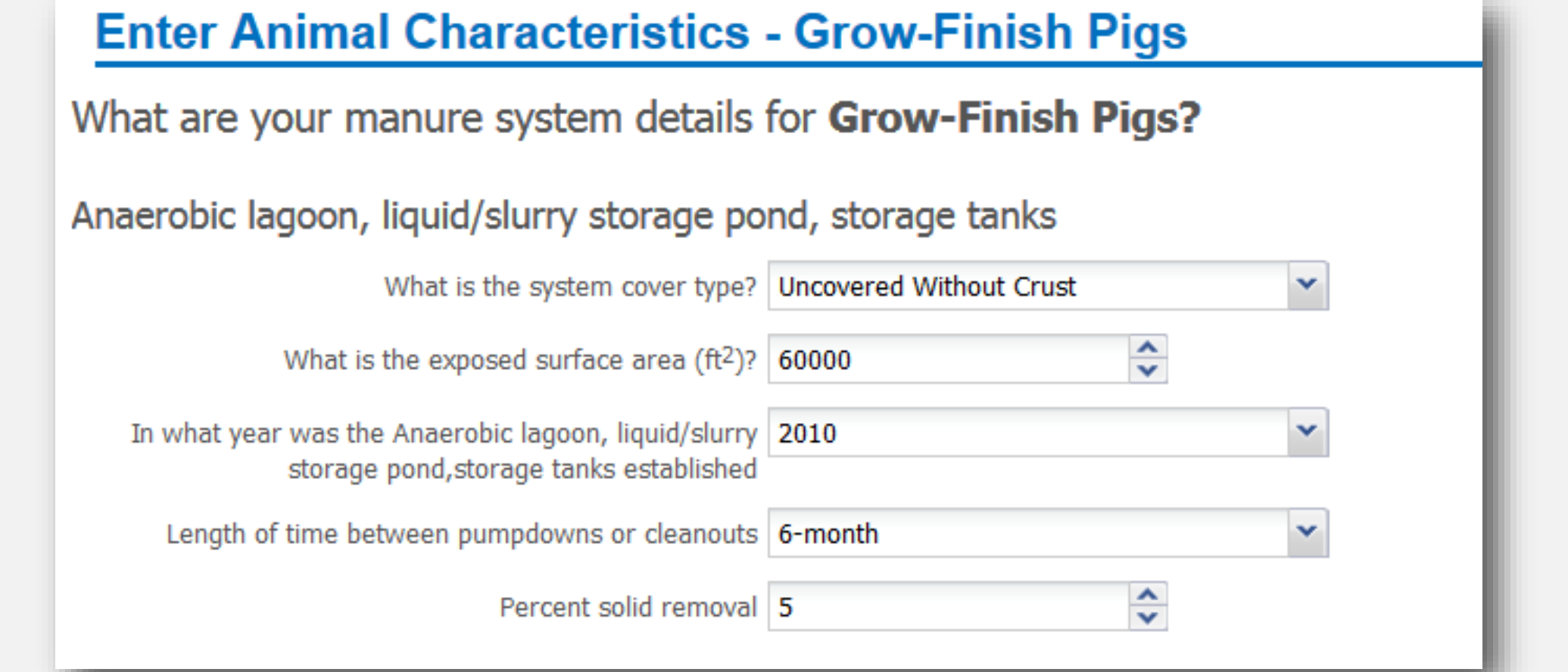Detailed housing information is selected to accurately measure housing emissions.
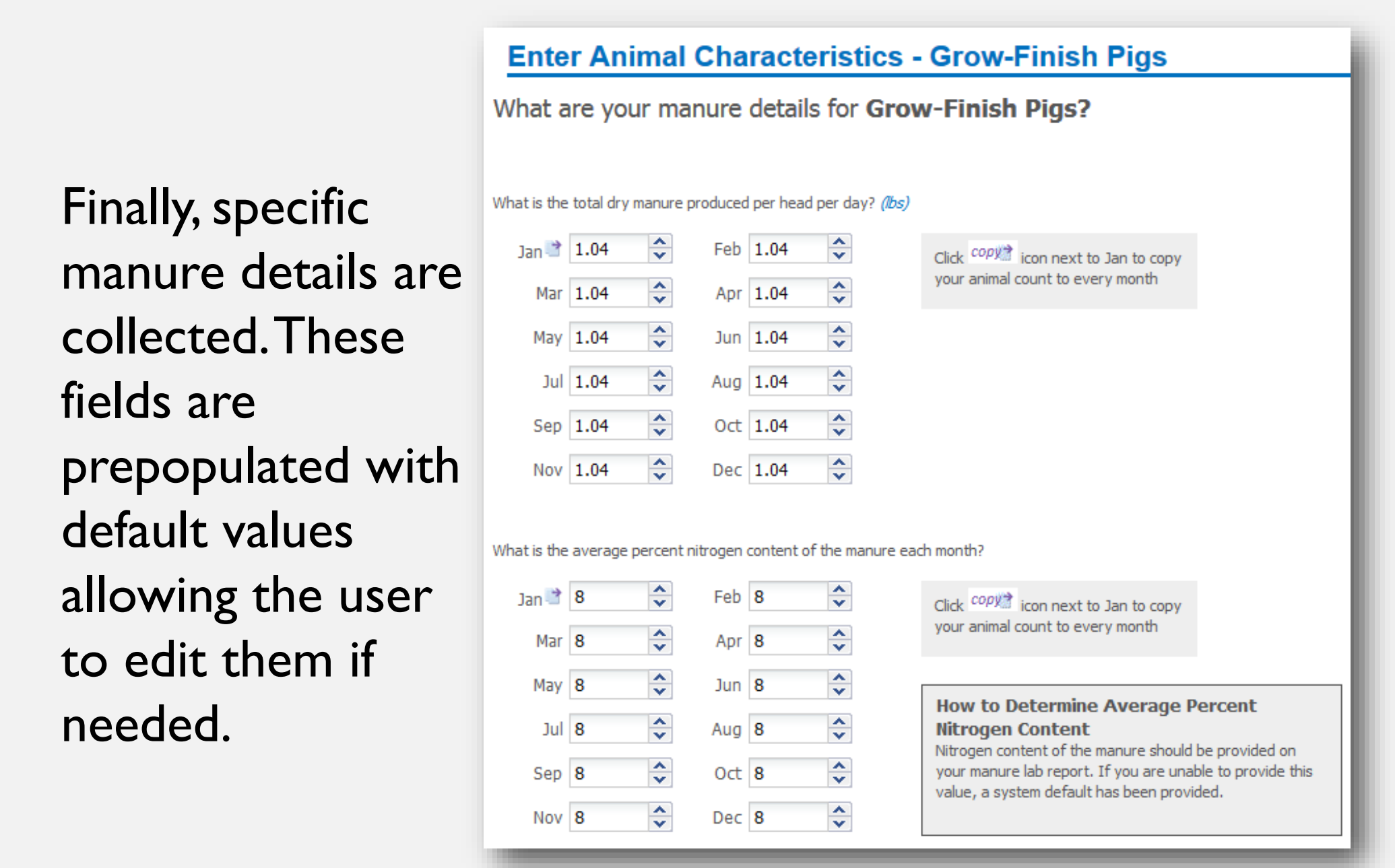
Manure System Types

Finally, manure details are collected, including detailed information on the manure system type as well as specific manure details. Below are examples from the manure management for the baseline scenario.

For this demonstration baseline scenario, the manure is managed in an anaerobic lagoon. Details about the anaerobic lagoon are user defined.

Manure System Types and Details

Finally, specific manure details are collected. These fields are prepopulated with default values allowing the user to edit them if needed.

Conservation Scenario Analysis

COMET-Farm allows users the ability to evaluate how changes in management can impact GHG emissions. Copying the baseline management information and changing the end treatment of the manure created a new scenario. The change in management for this example is the installation of an anaerobic digester. All other management options remained the same as in the baseline.

Report

Using the methods in the USDA document, *Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry,* COMET-Farm calculates potential changes in GHG emissions and carbon storage. Results are provided in easy to read detailed tables and interactive graphical reports.

NAME: Matthew Stermer   **TIME:** 7/7/2016 3:09:18 PM
PROJECT: Iowa Swine Demo

Source	Baseline Emissions	Digester Emissions	Digester Change
Grow-Finish Pigs			
Methane *(tonnes CO_2 equiv./yr.)*	1974.8	151.2	-1823.6
Enteric	15.7	15.7	0.0
Housing	135.0	135.0	0.0
Anaerobic Lagoon	1824.1	0.0	-1824.1
Anaerobic Digester	0.0	0.5	+0.5
Nitrous oxide *(tonnes CO_2 equiv./yr.)*	7.1	7.1	0.0
Housing	7.1	7.1	0.0
Anaerobic Lagoon	0.0	0.0	0.0
Anaerobic Digester	0.0	0.0	0.0
Total	**1981.9**	**158.4**	**-1823.6**

The detailed report allows users to explore each source category in more detail. The interactive graphical report allows users to click an emission category and see a detailed breakdown of each source category.
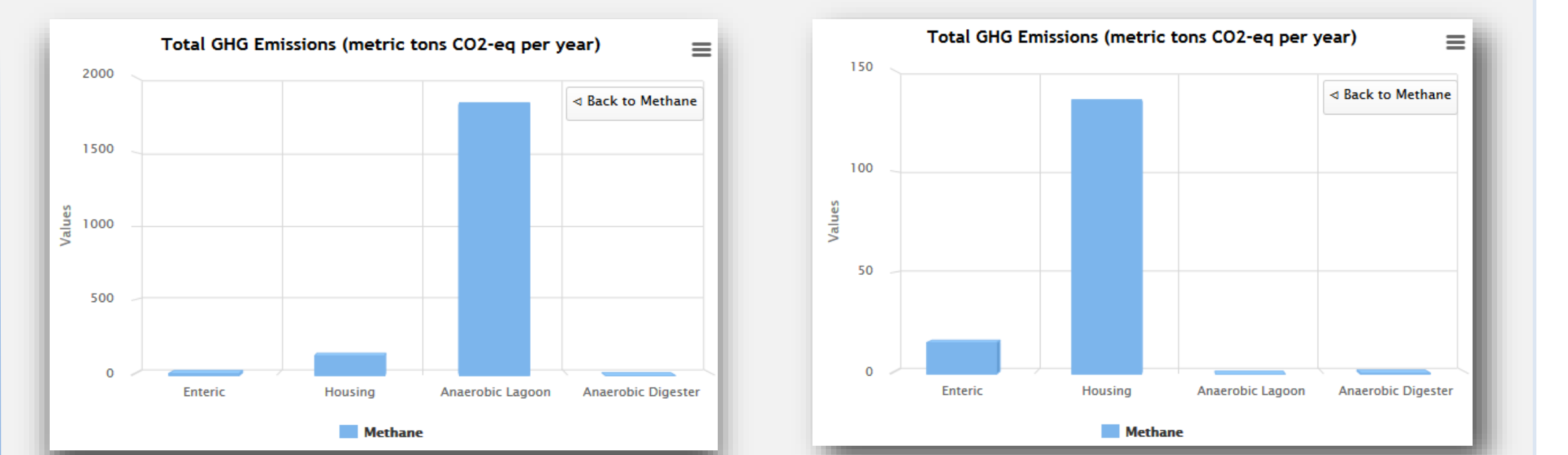
Baseline (Anaerobic Lagoon)   Future (Anaerobic Digester)

The example above shows the change in emissions when an anaerobic digester with methane recovery is installed in a future scenario. Sometimes we see an increase in overall methane emissions when a digester is installed due to digester leakage. The methane generated by anaerobic digesters is usually burned in a generator to produce on-farm electricity, is burned to heat water and buildings, or is piped to be used elsewhere to offset burning fossil methane (natural gas) in another location. These avoided fossil fuel emissions are a significant part of the overall life cycle benefit of installing anaerobic digesters, and that is the main GHG benefit to installing an anaerobic digester.

Conclusion

COMET-Farm estimates the 'carbon footprint' for all or part of the producers farm/ranch operation and allows users to evaluate options for reducing GHG emissions and maximizing carbon sequestration. Users are able to create up to ten future conservation scenarios with varying conservation practices to compare GHG mitigation strategies. COMET-Farm is a powerful tool designed to help agricultural producers make on-farm decisions to reduce energy costs, reduce GHG emissions and build soil health.

Acknowledgements

Contact us at: **www.comet-farm.com**   @CometFarm   facebook.com/COMETFarmTool   appnrel@colostate.edu