Assessing cropland greenhouse gas emissions with **COMET**-Farm

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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 & Range
- Livestock
- Agroforestry
- Energy usage

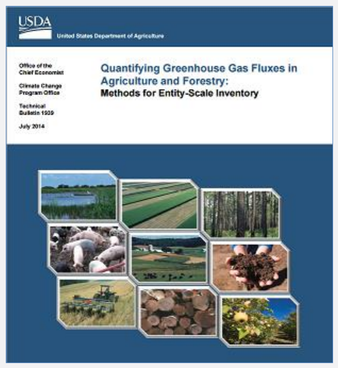
By generating reports from users' current and potential future management scenarios, COMET-Farm allows users to evaluate how conservation practices may reduce GHG emissions and sequester carbon.

Cropland, Pasture, Range

Photo courtesy of USDA Natural Resources Conservation Service

Agricultural soil management is the leading source of greenhouse gas emissions in the agricultural sector. Applying conservation practices can greatly reduce the amount of greenhouse gas released into the environment and aid in building and storing soil carbon. COMET-Farm allows rapid assessment of conservation scenarios to aid in conservation planning.

Scientific Basis



COMET-Farm utilizes peer-reviewed greenhouse gas (GHG) inventory methods published by the USDA. The USDA report provides methods for estimating changes in GHG emissions and carbon storage at the farm scale. COMET-Farm integrates these methods into a powerful and useful tool.

Using COMET-Farm

Croplands Demo

This poster showcases the capabilities of the COMET-Farm Cropland, Pasture, Range module utilizing a typical grain corn-soybean rotation on the Allee Demonstration Farm operated by Iowa State University.

Baseline Scenario

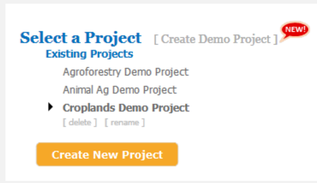
- Grain Corn-Soybean rotation
- Grain Corn intensively tilled with the addition of 160 lbs N/ac in the form of Anhydrous Ammonia.
- Soybeans reduced-till
- For both crops, no manure or compost was applied; there was no irrigation, liming, or burning.

Future Scenario:

- Conversion from conventional tillage to no-tillage for grain corn and soybeans
- All other management practices remain the same

Getting Started

Creating a cropland project in COMET-Farm is easy. Simply create and name your customized project and begin to define activities. Methods have been implemented to quantify emissions from a wide range of cropland categories. For the purpose of this poster we will be showcasing the demo project modeling a typical grain corn-soybean rotation.



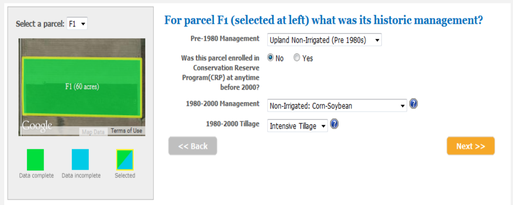
Parcel Location

COMET-Farm relies on site specific NARR climate and SSURGO soil data for the user-defined parcel.

Parcels can be defined by drawing a polygon around the field or selecting a point and entering the acreage of the field.

Historic Management

For the purpose of this demonstration we assumed the parcel was in a long-term non-irrigated, upland cropping system. Between 1980 and 2000, we assumed the system was intensively tilled, non-irrigated corn-soybean rotation.

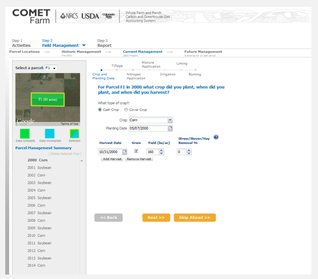


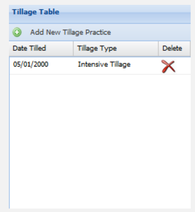
Historic management is necessary for the tool to accurately initiate carbon stocks.

Current Management

For the purpose of this demonstration we assumed the parcel was in a grain corn-soybean rotation:

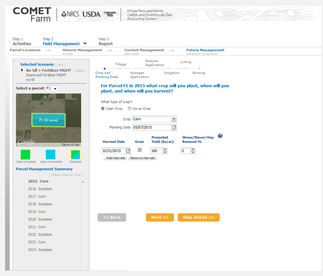
- Corn was intensively tilled with 160 lbs N/ac applied at planting as anhydrous ammonia.
- Soybeans were grown on a reduce-tillage system.
- No manure or compost was applied. The field was not irrigated, limed, or burned.

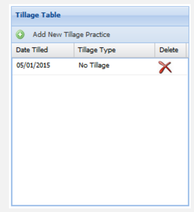




Future Management

The hypothetical future scenario developed for the demo depicts a conversion from conventional tillage to no-tillage. Both the grain corn and soybeans were converted to a no-tillage system. Everything else stayed the same.



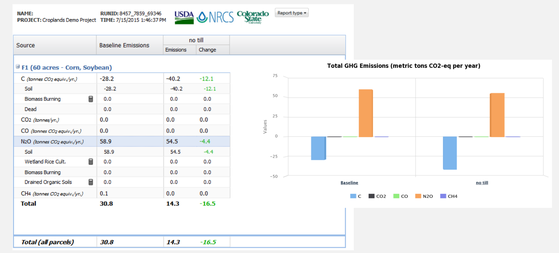


Scenarios

COMET-Farm allows users to automatically copy the crops and management from the Current Management (or any future management scenario) to a new future management scenario, to use as the basis for a management change (such as changing only tillage, or changing only fertilizer management, etc.). Any management practices that have been defined in current management can be changed in the future scenario. Scenarios provide users a "what if" option to see how adopting conservation practices can increase soil carbon and reduce greenhouse gas emissions on their farm or ranch.

Report

Using the DayCent simulation model in conjunction with 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 tabular and interactive graphical reports.



The detailed tabular 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.

In this example, conversion from conventional to no-tillage on a 60 acre field resulted in an estimated 40.2 metric tonnes CO_2-eq of carbon sequestration and reduced nitrous oxide emissions.

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 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

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