Assessing cropland greenhouse gas emissions with COMET-Farm USDAONRCS COLORED

M. Stermer¹, Easter M.¹, Swan A.¹, Paustian K.¹, Brown K.¹, Toureene C.¹, Ziegler J.¹, Marx E.¹, Huber A.¹, Velayudhan S.¹, Chambers A.², Eve M.³ ¹Natural Resource Ecology Laboratory—Colorado State University, ²USDA Natural Resources Conservation Service, ³USDA 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 & 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.



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.



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.

- Grain Corn-Soybean rotation
- Grain Corn intensively tilled with the addition of 160
- Ibs 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.
- Conversion from conventional tillage to no-tillage for grain corn and soybeans
- All other management practices remain the same

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.

Select a l Existing Cropla [delete

Creat

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

field.



Contact us at:

Croplands Demo

Baseline Scenario

Future Scenario:

Getting Started

NEW!	Selected Activities for the Current Project:
Project [Create Demo Project]	Croplands Demo Project
prestry Demo Project	All Categories - Full Accounting
Ag Demo Project	Cropland, Pasture, Range
ands Demo Project	Animal Agriculture
] [rename]	Agroforestry 🔞
New Project	Define Activities >>

Parcel Location

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

USDA Control Whole Farm and Panch Carbon and Greenhouse C Accounting System.	999		HOME UTOL	INFO HELP Demo	ome Matt Stermer ntProject: Croplands Project ut change password
Step 3 Report agement Current Management	Future Management Scenarios for 30 year benod				
dd Parcel' buttons to define each parcel <u>location</u> . Eac r <u>v</u> . When finished, dick the button to the right.					lefining parcels >>
	980	Soil Attributes		Soils Aerial Hybrid	
	55	Map Unit:	403308	600	
	930 930	Texture: Sand/Silt/Clay Fractions:	Silty day loam 19 / 50 / 31		507
	0000	Bulk Density: Hydric:	1.30 g/cm3 Yes		
	110.7	FT (60 acres)		1	
				Close	
		0 1000	5 9802	hf	50
1 11	908 07 909				Annte
	V) / (908		90063	507 533	•









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.



Funding provided by USDA NRCS and the USDA Climate Change Program Office. Technical assistance provided by John Wick, (Marin Carbon Project), Jeff Creque (Marin Carbon Project), and Ken Joussome (NREL—CSU).





Using COMET-Farm

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-

Pre-1980 Management	Upland Non-Irrigated (Pre 1980s) 🔻	
Was this parcel enrolled in Conservation Reserve Program(CRP) at anytime before 2000?	◉ No	
1980-2000 Management	Non-Irrigated: Corn-Soybean 👻 🔞	
1980-2000 Tillage	Intensive Tillage 🔻 🕡	
<< Back		Nex

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

if" option to see how adopting conservation

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.

NAME: PROJECT: Croplands Demo Projec	RUNID: 8457_7859_6934 t TIME: 7/15/2015 1:46:37	PM	O NRCS	
Source	Baseline Emissions	n	no till	
		Emissions	Change	
🖻 F1 (60 acres - Corn, Soy	bean)			
C (tonnes CO2 equiv./yr.)	-28.2	-40.2	-12.1	
Soil	-28.2	-40.2	-12.1	
Biomass Burning	0.0	0.0	0.0	
Dead	0.0	0.0	0.0	
CO2 (tonnes/yr.)	0.0	0.0	0.0	
CO (tonnes CO2 equiv./yr.)	0.0	0.0	0.0	
N2O (tonnes CO2 equiv./yr.)	58.9	54.5	-4.4	
Soil	58.9	54.5	-4.4	
Wetland Rice Cult.	0.0	0.0	0.0	
Biomass Burning	0.0	0.0	0.0	
Drained Organic Soils	0.0	0.0	0.0	
CH4 (tonnes CO2 equiv./yr.)	0.1	0.0	0.0	
Total	30.8	14.3	-16.5	

14.3

-16.5

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.

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



appnrel@colostate.edu



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 practices can increase soil carbon and reduce greenhouse gas emissions on their farm or ranch.

Report



Conclusion



