

2016 ASA, CSSA, and SSSA Annual Meeting (Nov. 6-9) | Phoenix, AZ

# The OSU Soil Organic Matter Calculator - a Decision Tool to Manage Soil Health

Vinayak Shedekar<sup>1</sup>, Khandakar Rafiq Islam<sup>1</sup>, Randall Reeder<sup>1</sup>, and Jerry Grigar Jr.<sup>2</sup>

(<sup>1</sup>)The Ohio State University, Columbus OH, (<sup>2</sup>)USDA-NRCS, East Lansing, MI



## Introduction

Soil health management is important to sustain crop production & enhance agroecosystem services. Soil organic matter (SOM) is a core indicator of soil health. Management practices like continuous no-till, cover crops, and manure can offset the SOM losses. However, there is a limited availability of tools & skillset to evaluate agricultural practices impact on SOM content and overall soil health.

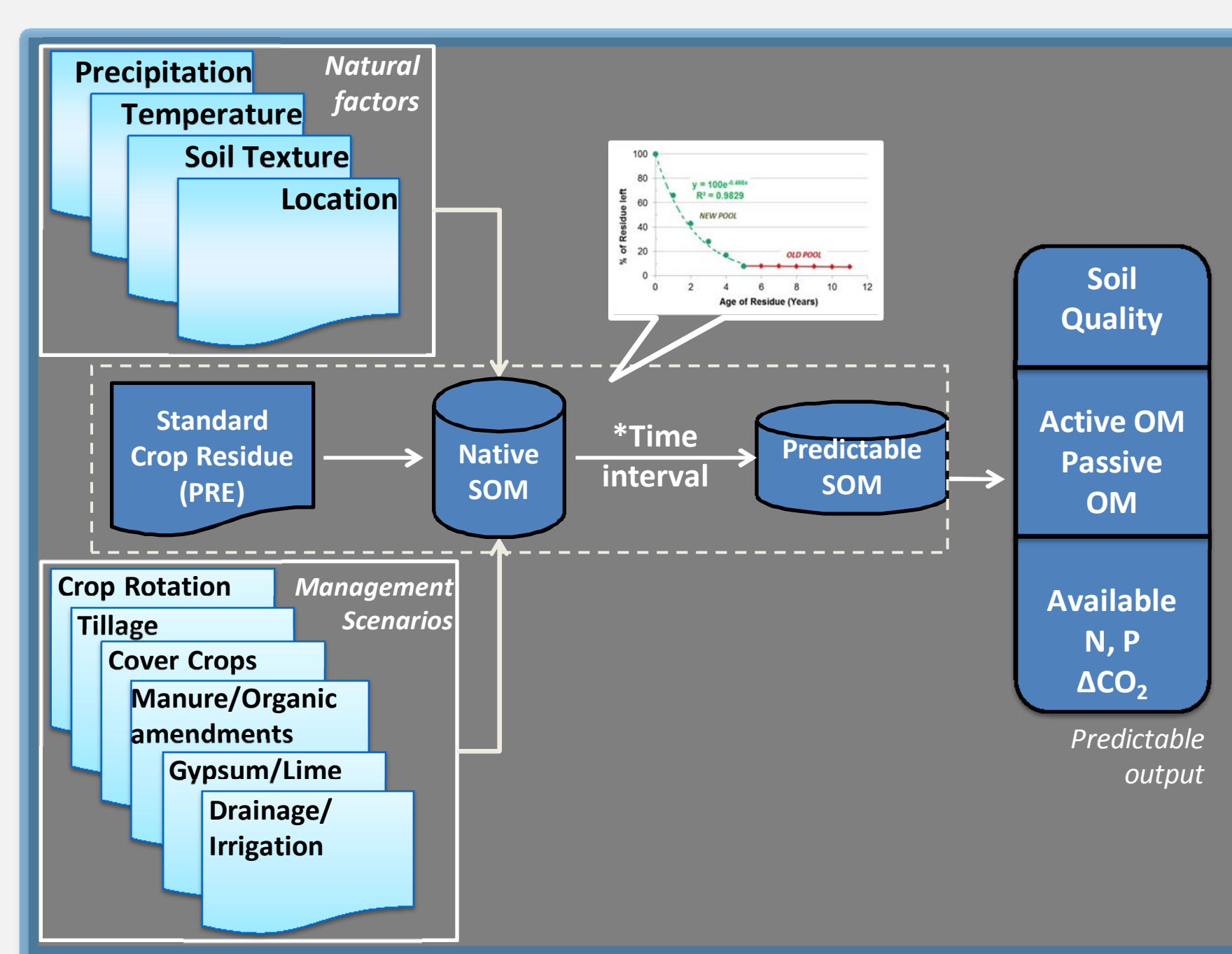
There is a growing interest among farmers, crop consultants, and bio-energy related industry for a tool that can help optimize their management practices and crop residue removal, while maintaining a good soil health in the long term. Some tools are available to quantify SOM changes, e.g. Soil conditioning index, CENTURY, DAISY, Comet VR, COMET-FARM™.

Some prediction tools are “User Friendly”...but none are “Farmer-friendly”

## Objective

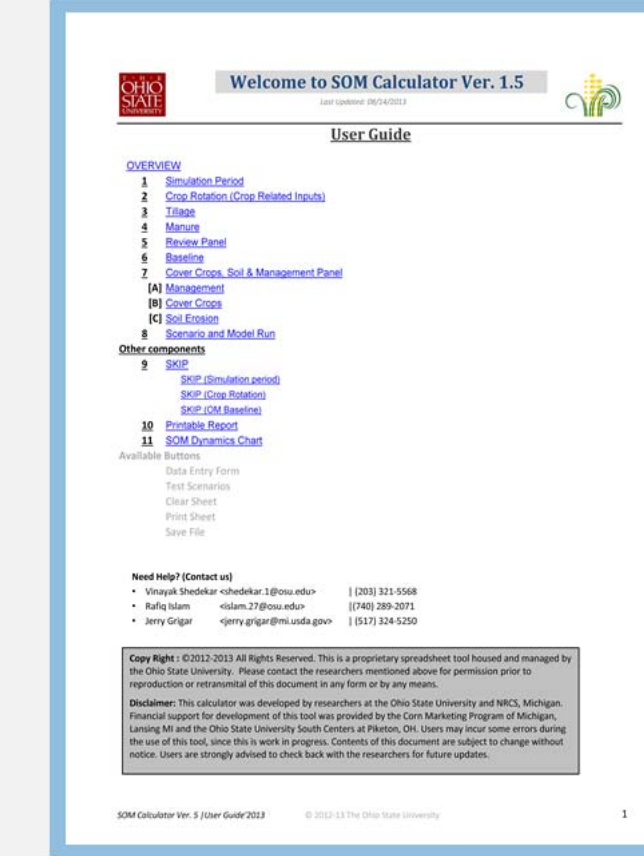
- To develop a farmer-friendly tool for predicting SOM, nutrients, and overall soil health.
- To disseminate the tool to various stakeholders

## Conceptual model

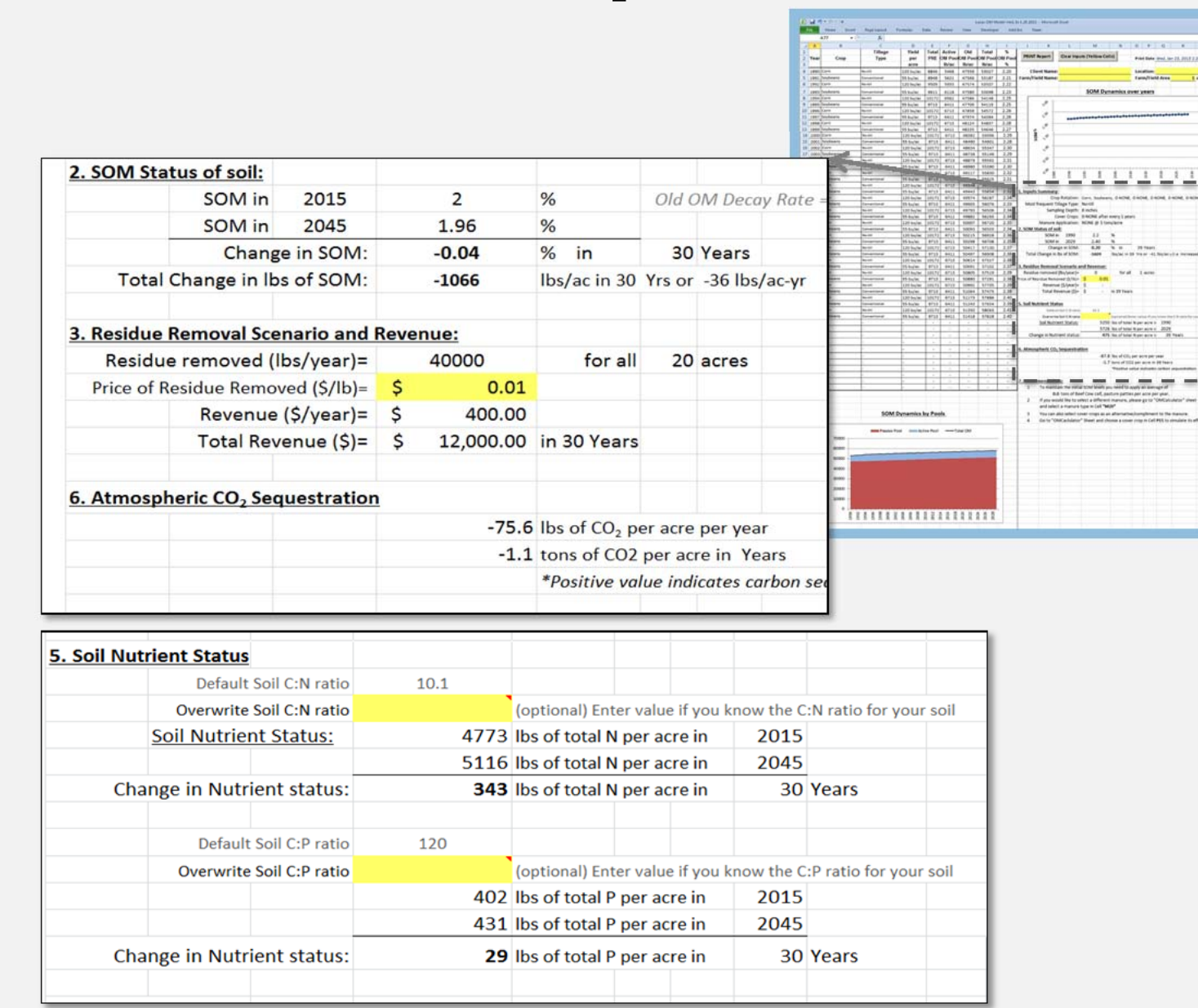


The SOM is divided into two pools: active- and passive (old) organic matter. The active pool is assumed to decompose at a faster rate, exponentially with time (years 1 to 5). The passive pool, is expected to have a very slow and constant decomposition rate (linear), which depends on local climate, native vegetation, soil type, and management practices.

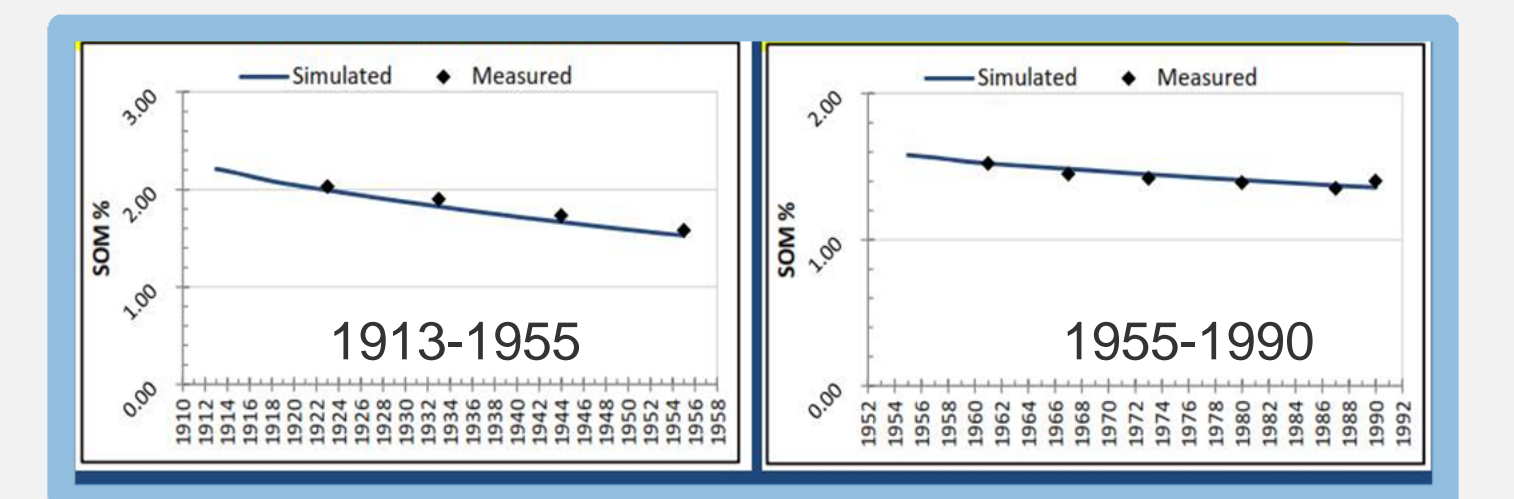
## User Guide



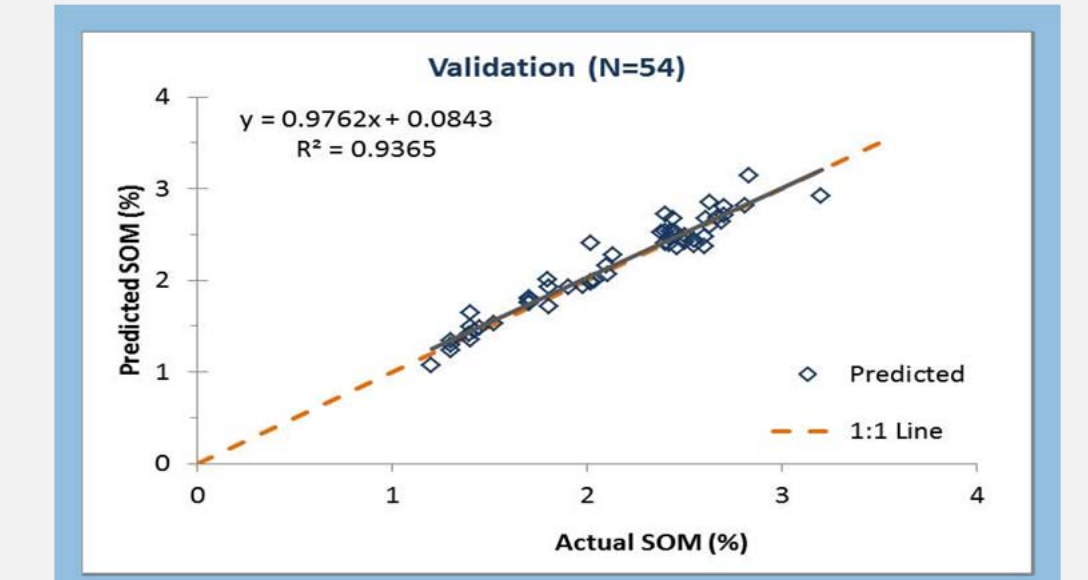
## Printable Report



## Performance Evaluation



Morrow plots (North C) – Continuous corn



Data from 12 different experiments in OH, MI, & IL

## Future work

- Regional validation using a GIS to extend the applicability of calculator over the Midwest
- A web-application and/or a stand-alone program that can make this calculator widely accessible
- Provide a capability to estimate carbon credits
- Further improve accuracy, expand the options and modules for biomass type and management

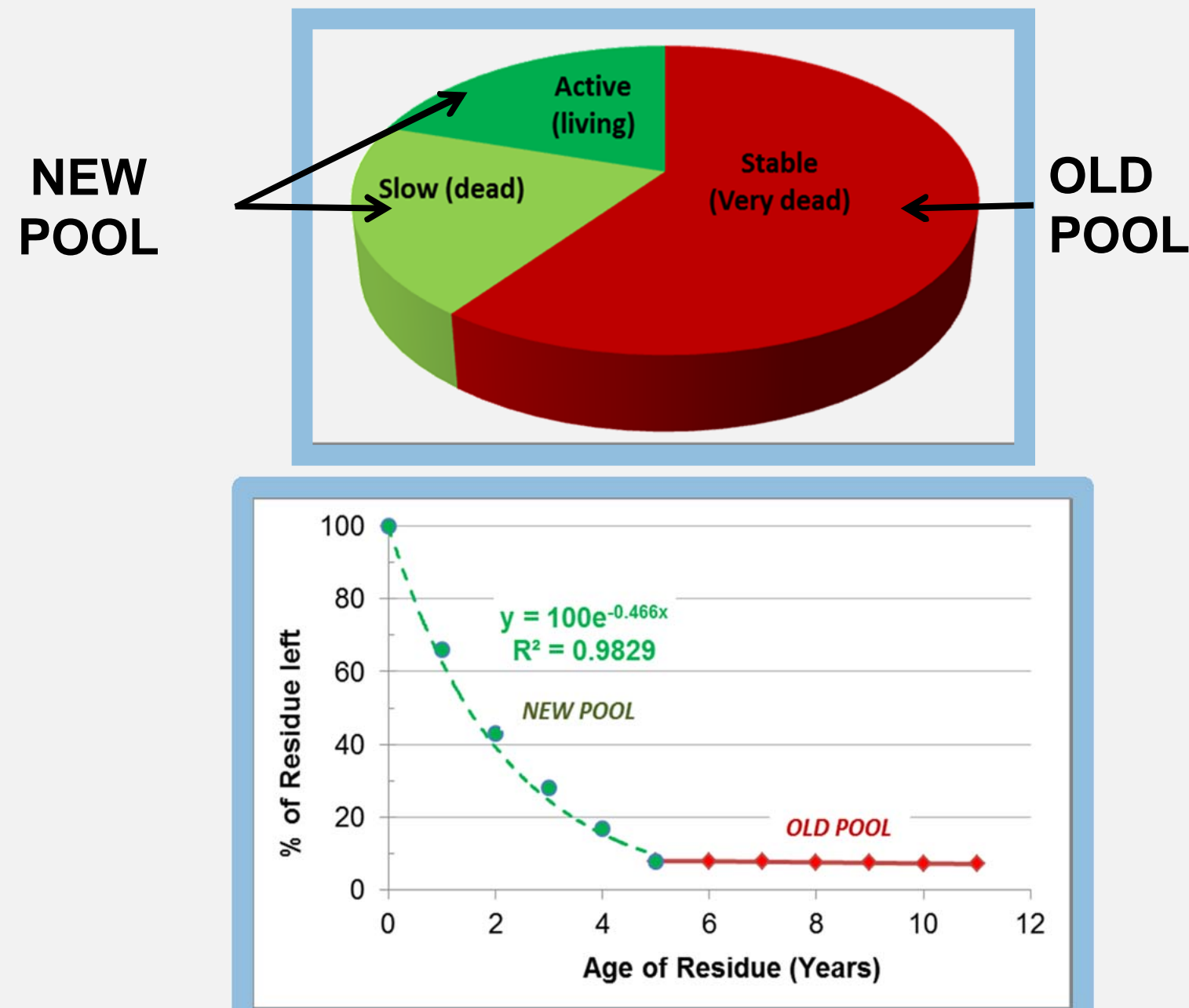
## Materials and methods

Characteristics of a “Farmer-Friendly” tool:

- ✓ Easy to install, use, maintain
- ✓ Clear and easy to interpret outputs
- ✓ Less data intensive
- ✓ Capable of scenario generation
- ✓ Simple and sequential inputs
- ✓ Capable of generating reports
- ✓ How to use? guide

## Theoretical Basis:

The calculator is based on a 2-pool exponential decay model initially suggested by Dr. Robert Lucas (Lucas et al., 1978).



## OSU SOM Calculator

The calculator is available as a “Macro Enabled Excel File”

The screenshot shows the 'Lucas OM Model Version 1.5x' interface. It includes a 'Data Entry Form' with fields for crop rotation, tillage, manure, and erosion. A 'Printable Report' is also visible, showing detailed SOM and nutrient status over time.

## Extension activities

Year	Location	Event
2013	Michigan	SWCD farmer meeting (Paw Paw, Allegan), Center for Excellence (Adiran) – Jan, Feb. Sustainable Agriculture and Soil Health Workshops (Clarksville, Gaylord, Owosso) – Oct.
	Illinois	Sustainable Agriculture and Soil Health Workshops (Mt. Vernon, Springfield, Sycamore) – May
	Tampa, FL	Farm Science Review, FARE Seminar – Sept.
2014	Ohio	Annual International ASA meeting – Nov
	Michigan	OEFA Conference (Granville), CTC Conference (Ada)
	Michigan	NRCS Soil Health Training (Marquette, Hickory Corners)
	Iowa	Extension Energy & Environment Summit (Ames)
2015	Ohio	Biofuels and Bioproducts workshop (Columbus)
2016	Ohio	OEFA Conf. (Granville), Soil Health Workshops (Wooster)
	Overseas	Ukraine (2013), Ghana & Canada (2014), Turkey (2015), China (2016)

## Summary & Conclusions

We developed a spreadsheet-based SOM calculator in MS-Excel using VBA. The calculator is capable of assessing soil health by simulating the dynamics of SOM in response to residue removal and various management scenarios. It can predict scenarios for up to 50 years with satisfactory accuracy. In addition to farmers, the calculator can also be used by private crop consultants, University Extension Educators, and USDA professionals to help guide farmers.

## Abstract

Farmers in the Midwest are recognizing the importance of soil health in crop production. However, they lack the skillset to effectively manage soil health while maintaining profitability. Our research shows that soil organic matter (SOM) is a core indicator of soil health. We developed the “OSU SOM Calculator” - a carbon-modeling tool primarily for use by farmers and educators. Unlike existing carbon models, this tool has minimal input requirements, provides step-by-step guidance and summarizes outputs in printable format. The calculator consists of a user-friendly interface, with options to specify crop rotation, management (tillage, cover crops, drainage, manure application etc.), soil erosion, and residue removal rates. It uses a two-pool exponential decay model to simulate decomposition of biomass and native soil organic matter at yearly time-steps. The model divides organic inputs into ‘active’ and ‘passive’ fractions; and applies decay rates as affected by management practices. The calculator outputs consist of annual changes in SOM over short- and long-term (5 to 50 years), revenue generated from residue removal, changes in SOM-bound nitrogen and phosphorus, CO<sub>2</sub> sequestration and overall soil health. The calculator also consists of a “test scenario” feature that helps compare different management scenarios and aids in future farm planning decisions. The tool has been successfully tested using data from long-term trials in Ohio, Illinois and Michigan. The OSU SOM Calculator has been made available for free at the OSU South Centers’ website and has gained popularity among farmers and extension educators.

## Acknowledgments

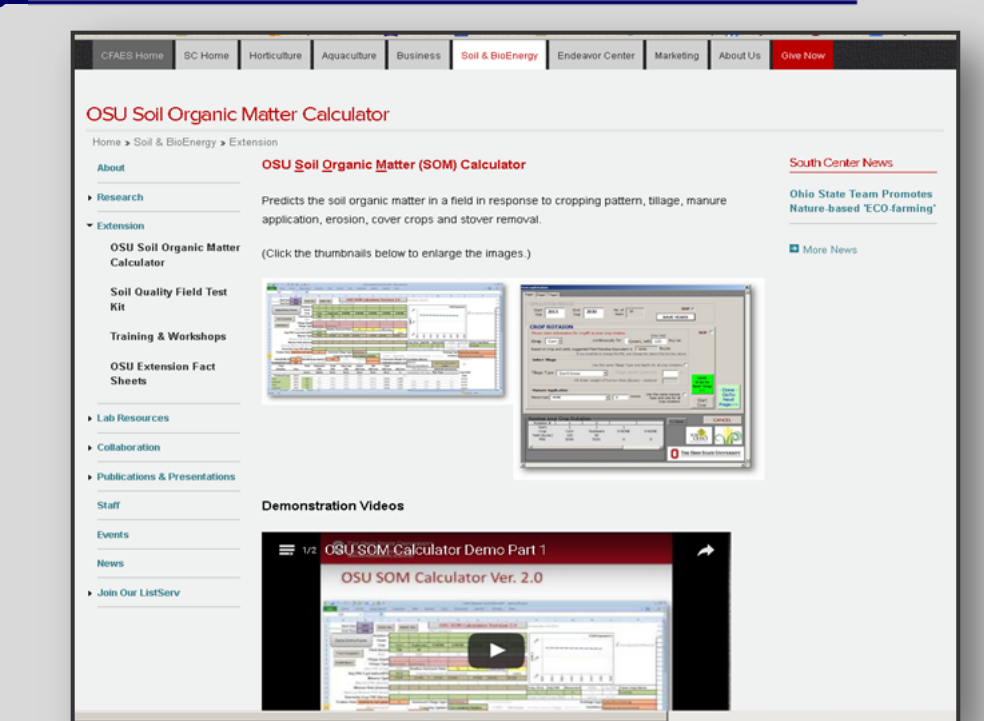
This work was the result of cooperation among Corn Marketing Program of Michigan, Ohio Soybean Council, and the Ohio State University. We thank the following individuals and units:

- The Corn Marketing Program of Michigan Ohio Soybean Council, and the OSU South Centers (financial support)
- Michigan USDA-NRCS (technical help)
- Prof. Delbert Mokma, MSU (field data)
- Sponsored Research Program of the Ohio State University

## Where to get it?

The SOM calculator is available for download free of cost after due request. Please visit the following link for more details:

[www.go.osu.edu/SOMCalculator](http://www.go.osu.edu/SOMCalculator)



Scan this QR code for download