Utilizing LEAF to Increase Biomass Feedstock Supplies from Agricultural Land

Soil's Role in Restoring Ecosystem Services
March 7, 2014

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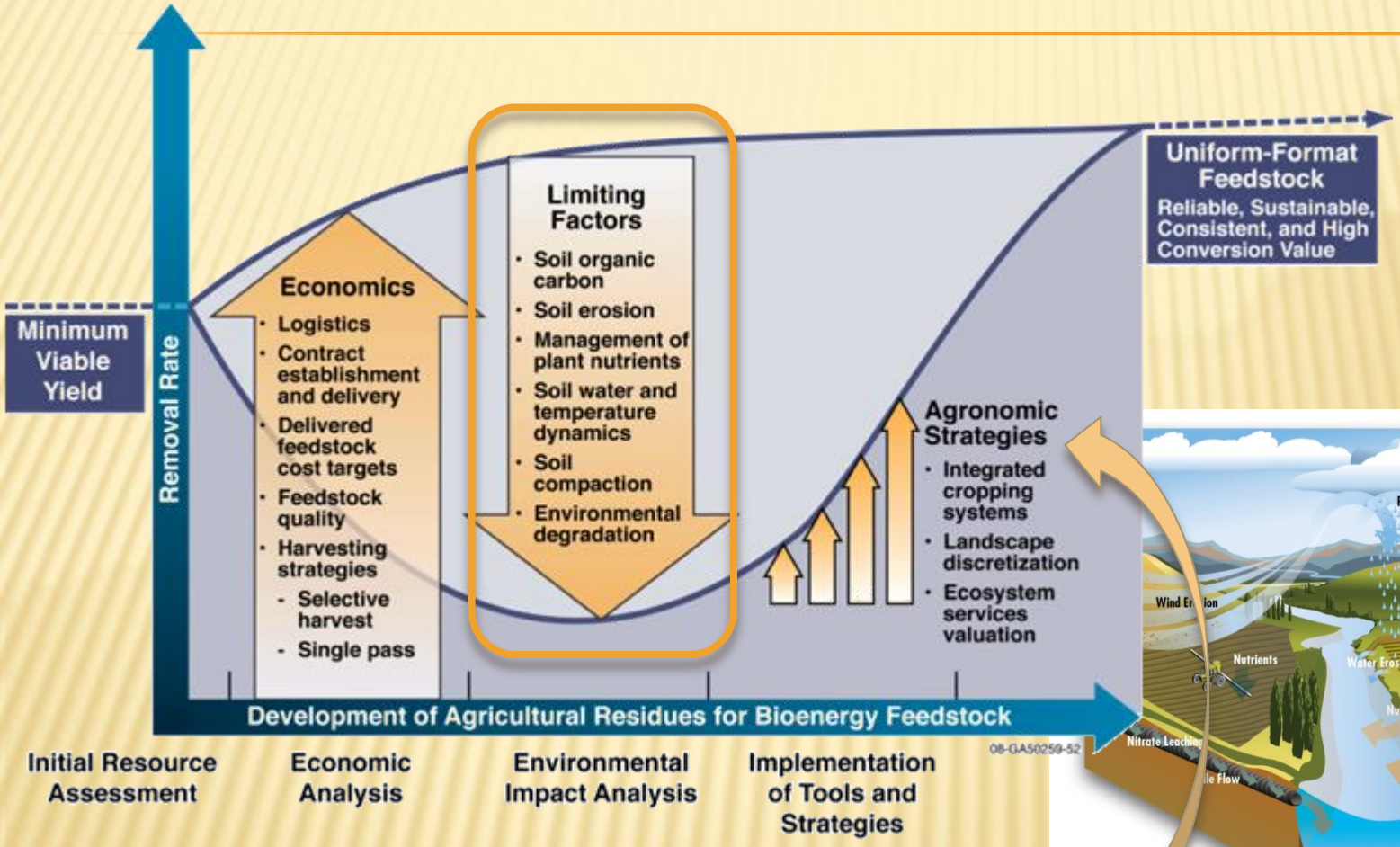
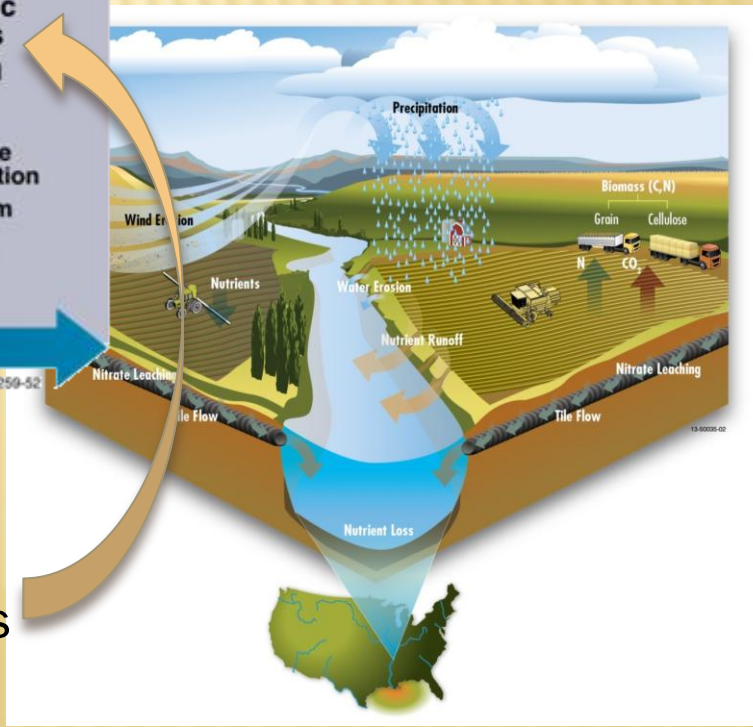
Presentation Overview

- A Grand Challenge – Striving for balance
- Evolution of the Landscape Environmental Assessment Framework (LEAF)
- The anatomy of LEAF
- How LEAF can be used to protect, sustain and restore ecosystem services

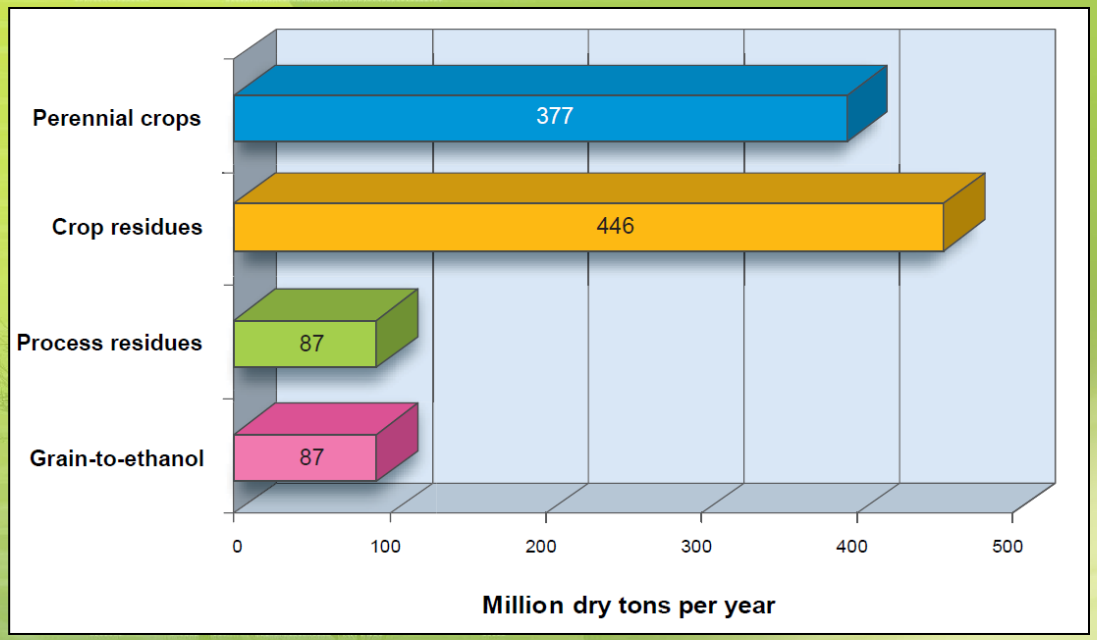
Achieving Balance: A Grand Challenge for Sustainable Biomass Feedstock Production

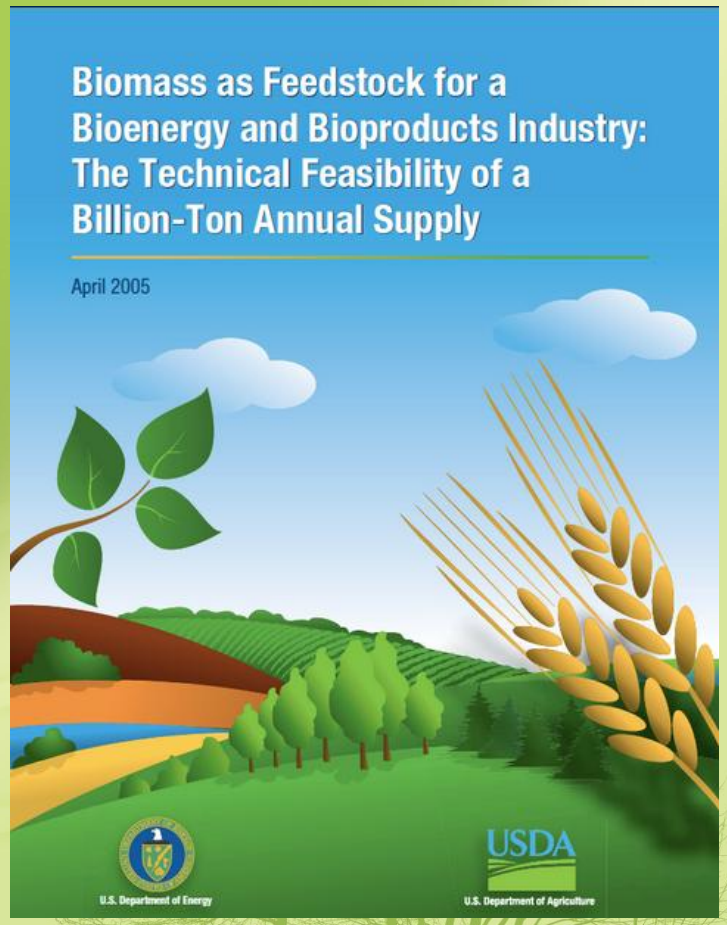




Research focused on quantifying limiting factors, so we can develop effective agronomic strategies for delivering sustainable feedstock supplies

LEAF began to evolve when crop residues were identified as a potential bioenergy feedstock

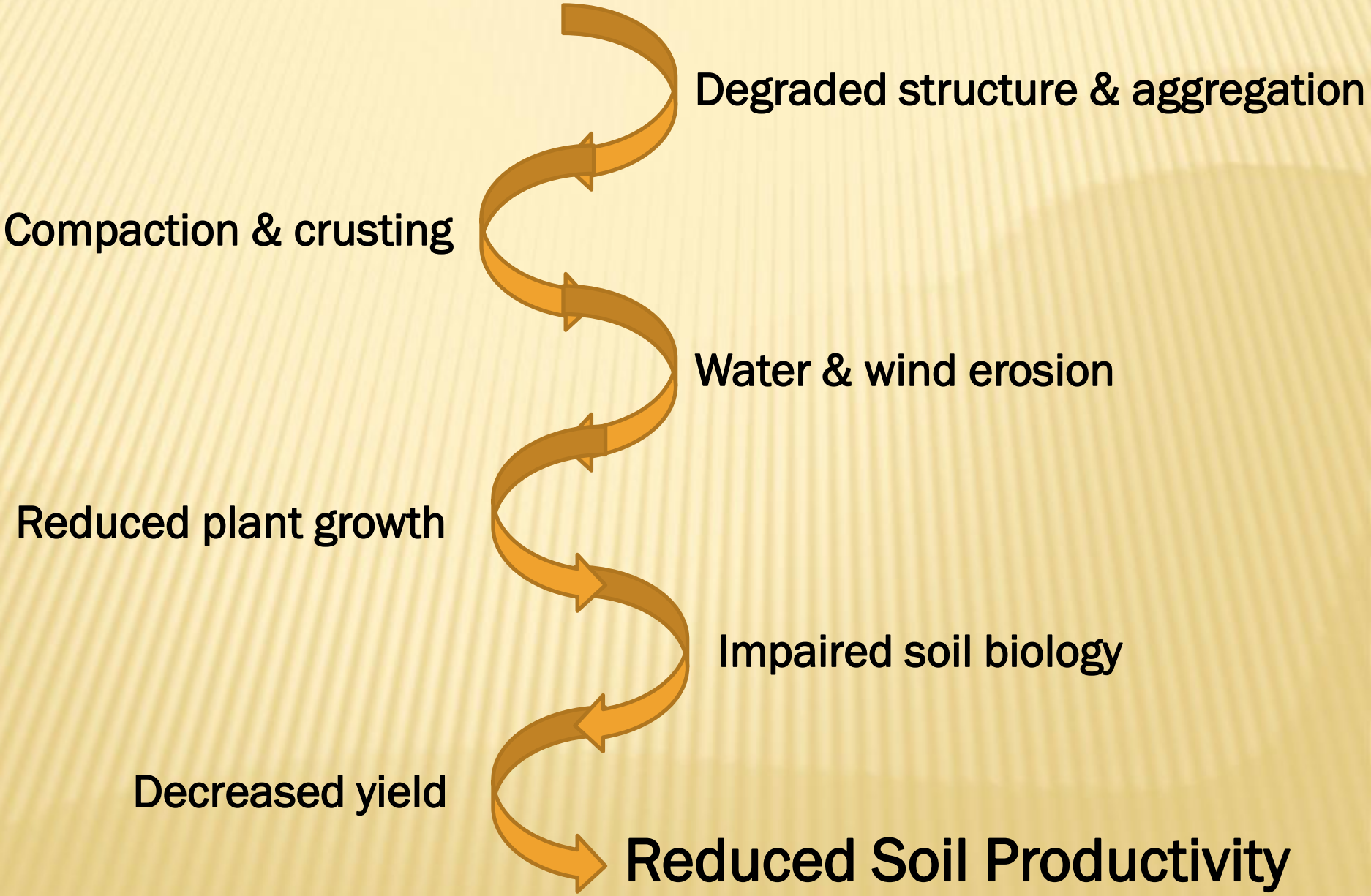




Why -- because crop residues are also needed to protect and sustain ecosystem services

As the late W.E. Larson often stated – soil is “the thin layer covering the planet that stands between us and starvation.”

LEAF's Purpose -- Prevent the Degradation Spiral



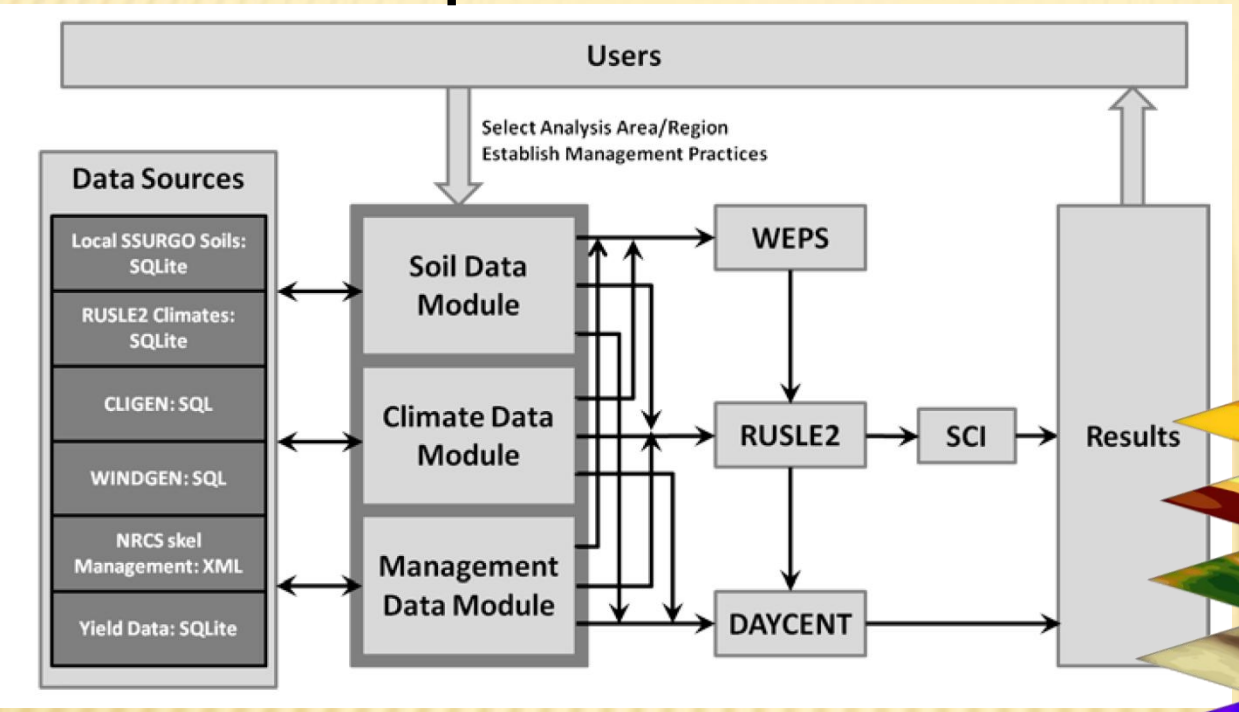
The Philosophy Behind LEAF

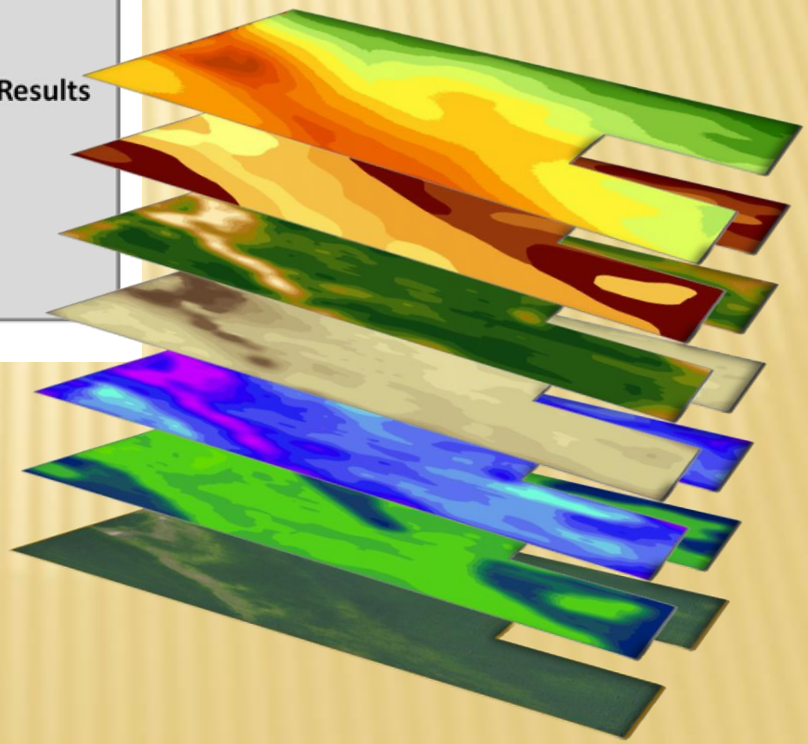
The models and databases exist

We need a framework where simulation models can plug together to answer our questions.

The Anatomy of LEAF

Landscape Environmental Assessment Framework





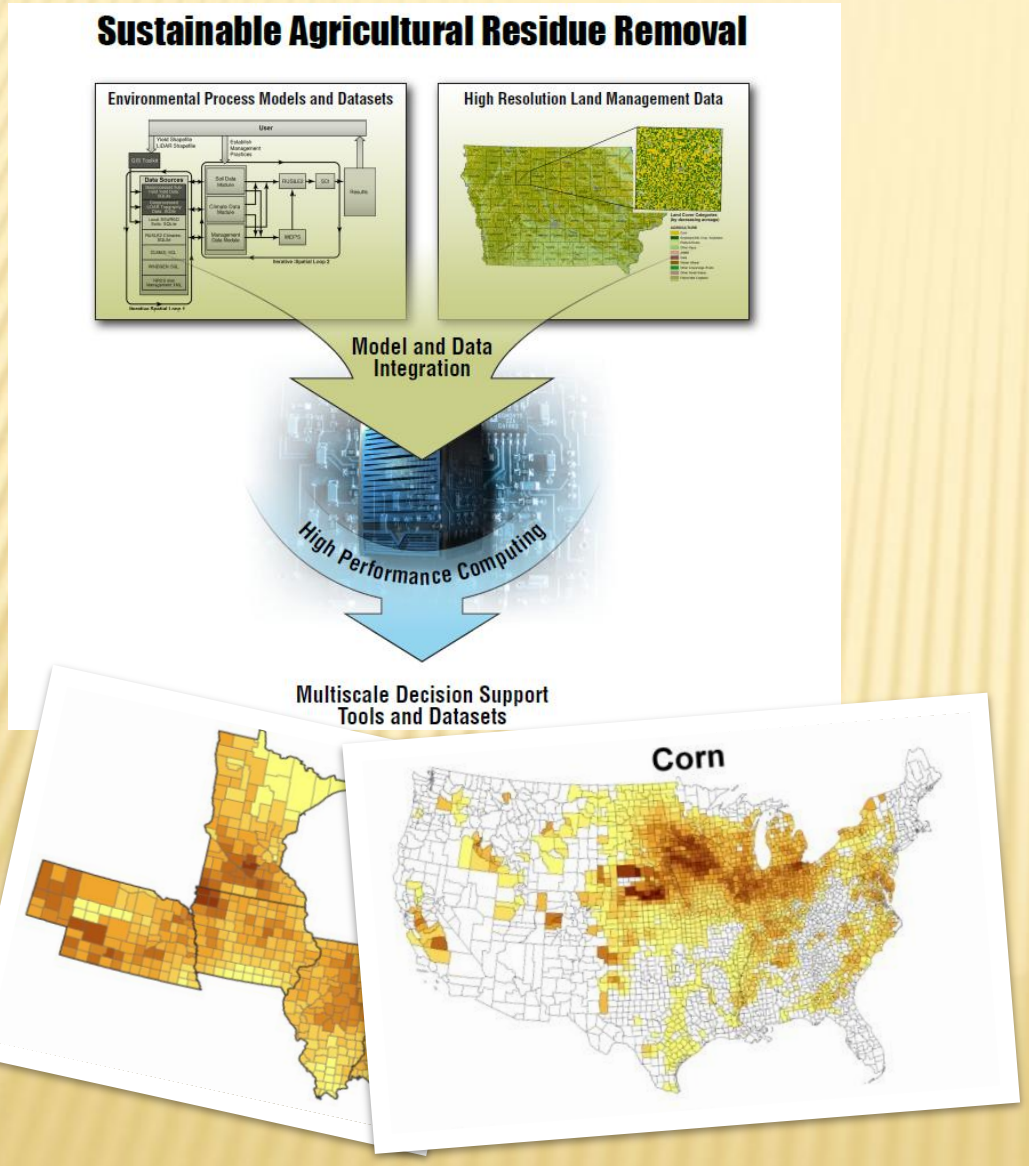
LEAF brings together diverse data sources and dynamic models into a single analysis tool

LEAF Goals

- Increased production of food, feed, fiber, and fuel from our land resources

- Improved environmental performance from our intensively managed landscapes
  - e.g., reduced GHG emissions
- Increased profitability for each of the business sectors associated with landscape production
  - e.g., greater crop production and potential fuel production

LEAF Applications – Large Spatial Scale Assessments



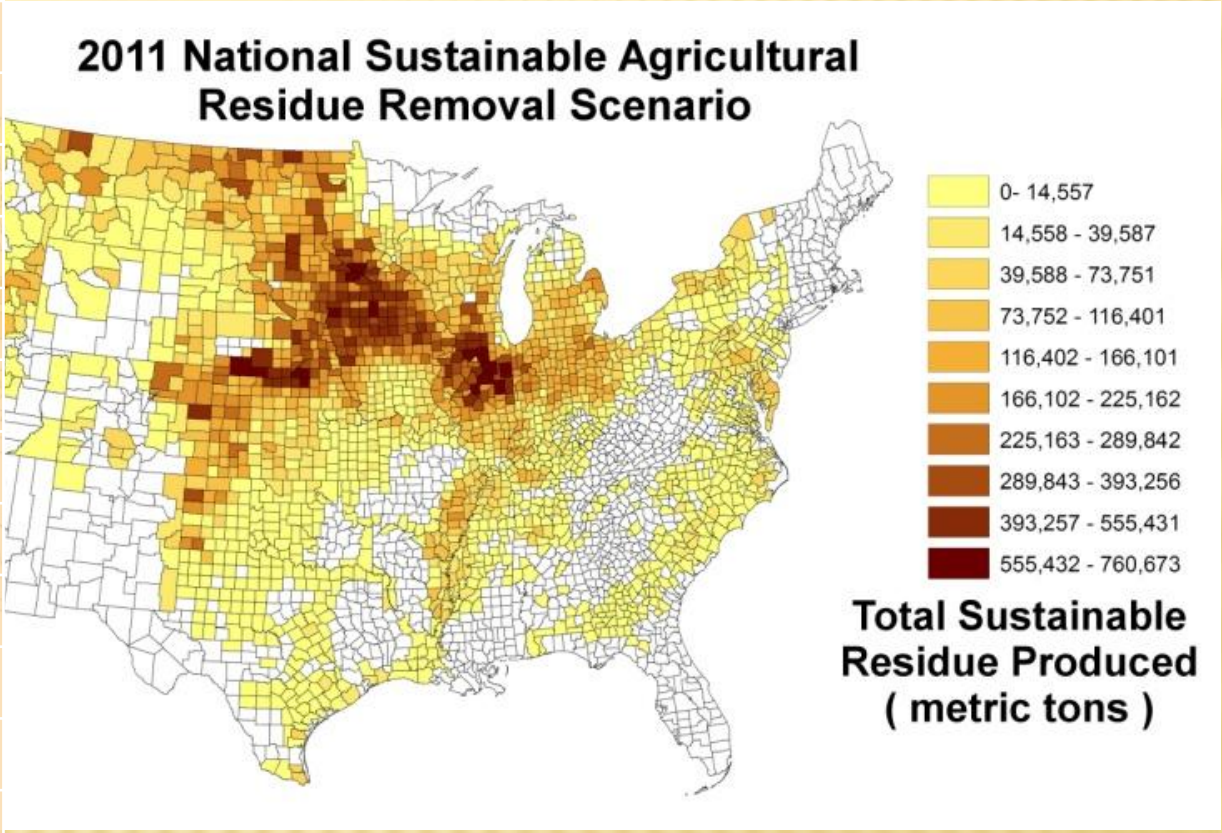
Large-scale assessments on the national and regional scale

Utilizes data inputs from:

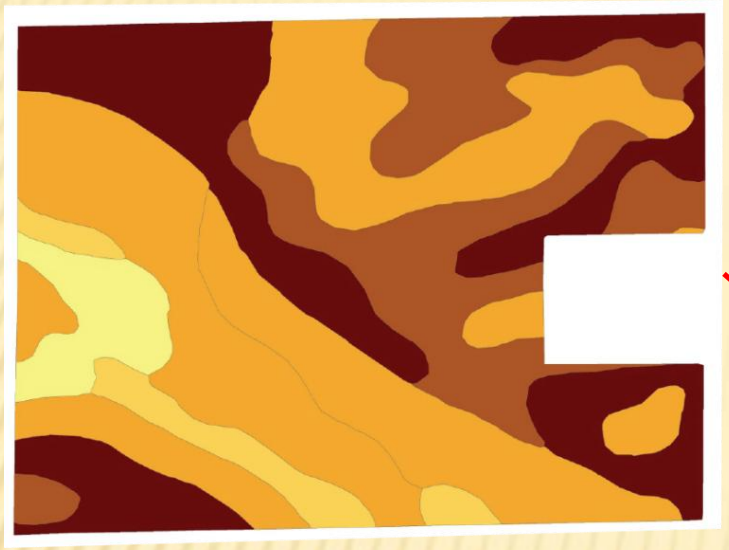
- SURGO Soil Layer
- Cropland Data Layer
- Land Management Scenarios (CMZs)
- County Level Grain Yields

LEAF was used for BT2 National Assessment

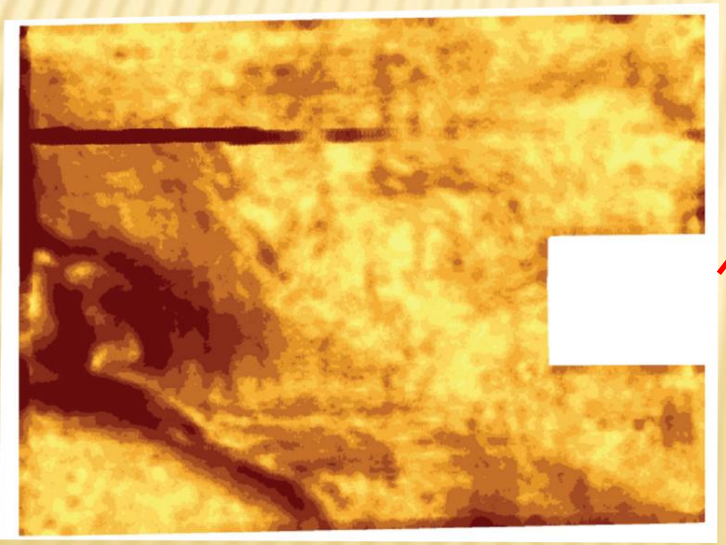
State	2011 Sustainable Residue (short tons)	2030 Sustainable Residue – All No Till Assumption (short tons)
IA	28,570,000	54,850,000
IL	23,080,000	48,580,000
NE	20,520,000	34,770,000
MN	17,650,000	30,780,000
IN	9,500,000	20,080,000
SD	10,160,000	14,210,000
ND	8,090,000	12,070,000
OH	6,270,000	11,710,000
KS	7,160,000	14,500,000
WI	4,700,000	12,780,000
MI	3,530,000	7,960,000
TX	2,520,000	8,040,000
MO	2,490,000	7,120,000
.....	...	...
US Total	166,340,000	327,940,000



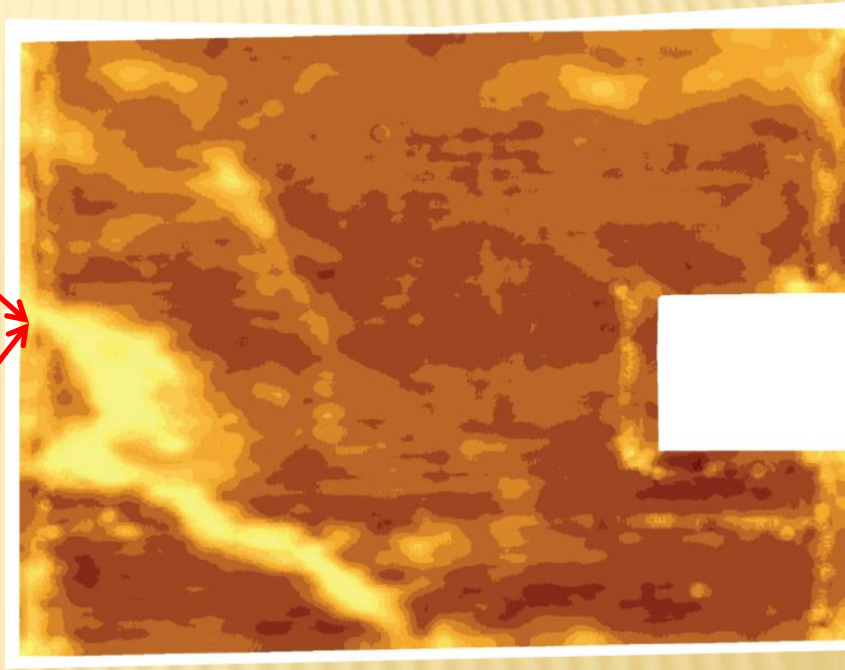
LEAF helps address sub-field scale variability



Soil Characteristics



Surface Topography

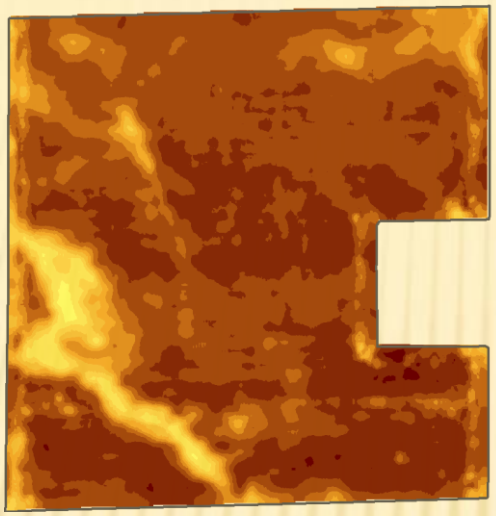


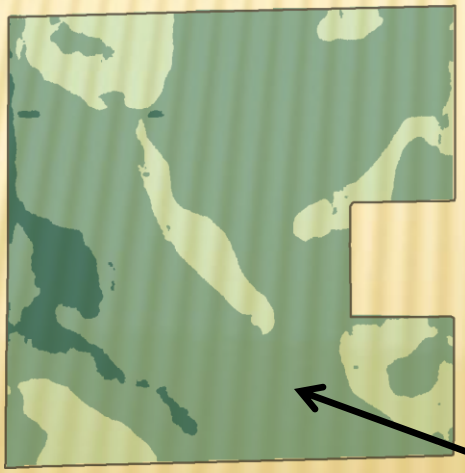
Grain Yield

LEAF Projection of Cover Crop Effects

Addition of Rye Cover	
Without	With
Annual Sustainable Residue (Mg)	
36	140
% Field Managed Sustainably	
21%	83%
Annual Soil Loss (Mg)	
316	182

Grain Yield





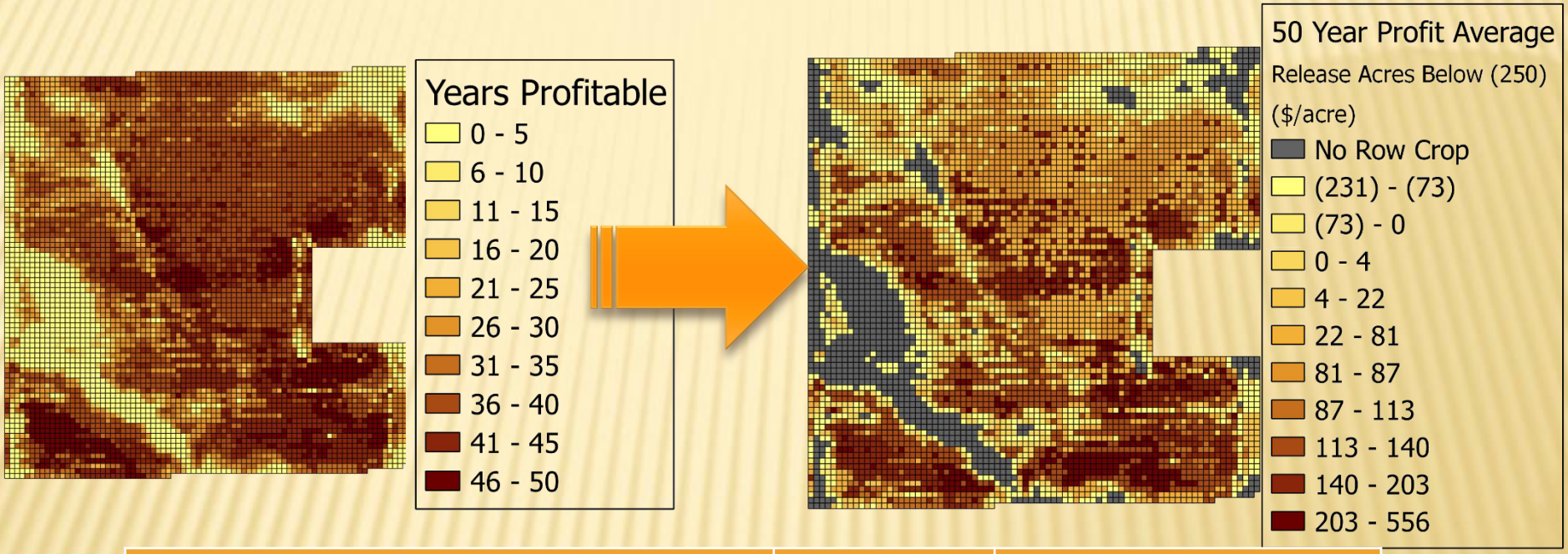
Sustainability Factors

- Sustainable
- SCI < 0
- SCI < 0 & Erosion > T
- Erosion > T

Darker areas have less available crop residue

Using LEAF to Design Integrated Landscapes

How would an energy crop affect long-term profitability?

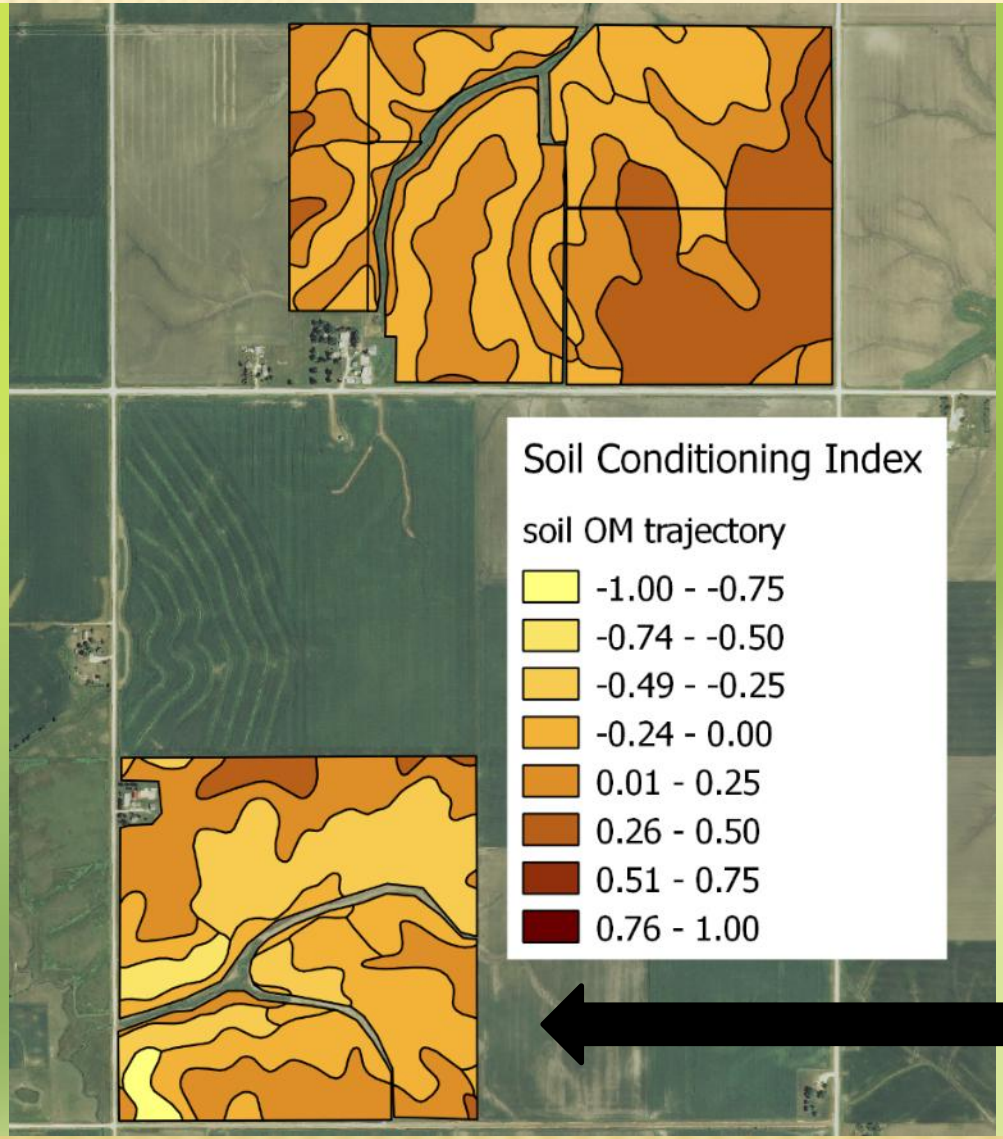


Management Scenario	Average Profit ($/ac)	Profit Standard Deviation ($/ac)
Complete Row Crop	47$	235$
Selective Removal Of Row Crops	57$	120$

Evolving Applications for LEAF

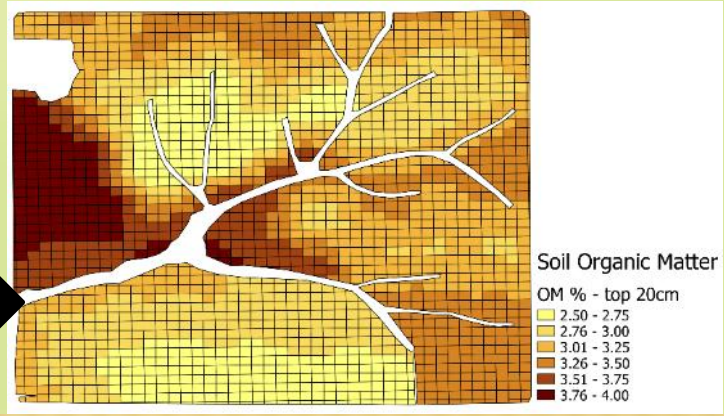
- Economic risk assessments
- Environmental risk assessments
- Automating certification for voluntary programs such as the Biomass Market Access Standard (BMAS)
- Controlling single-pass harvest & tillage systems

BMAS Criterion/Indicator: Soil Health



2.1	Maintain or Improve Soil Health
2.1.5	Soil carbon
	Can you demonstrate that you maintain or improve soil carbon levels?
	Have you earned a zero or positive score on the Soil Conditioning Index?

- Soil grid sampling
- SCI > 0 indicates maintaining or increasing



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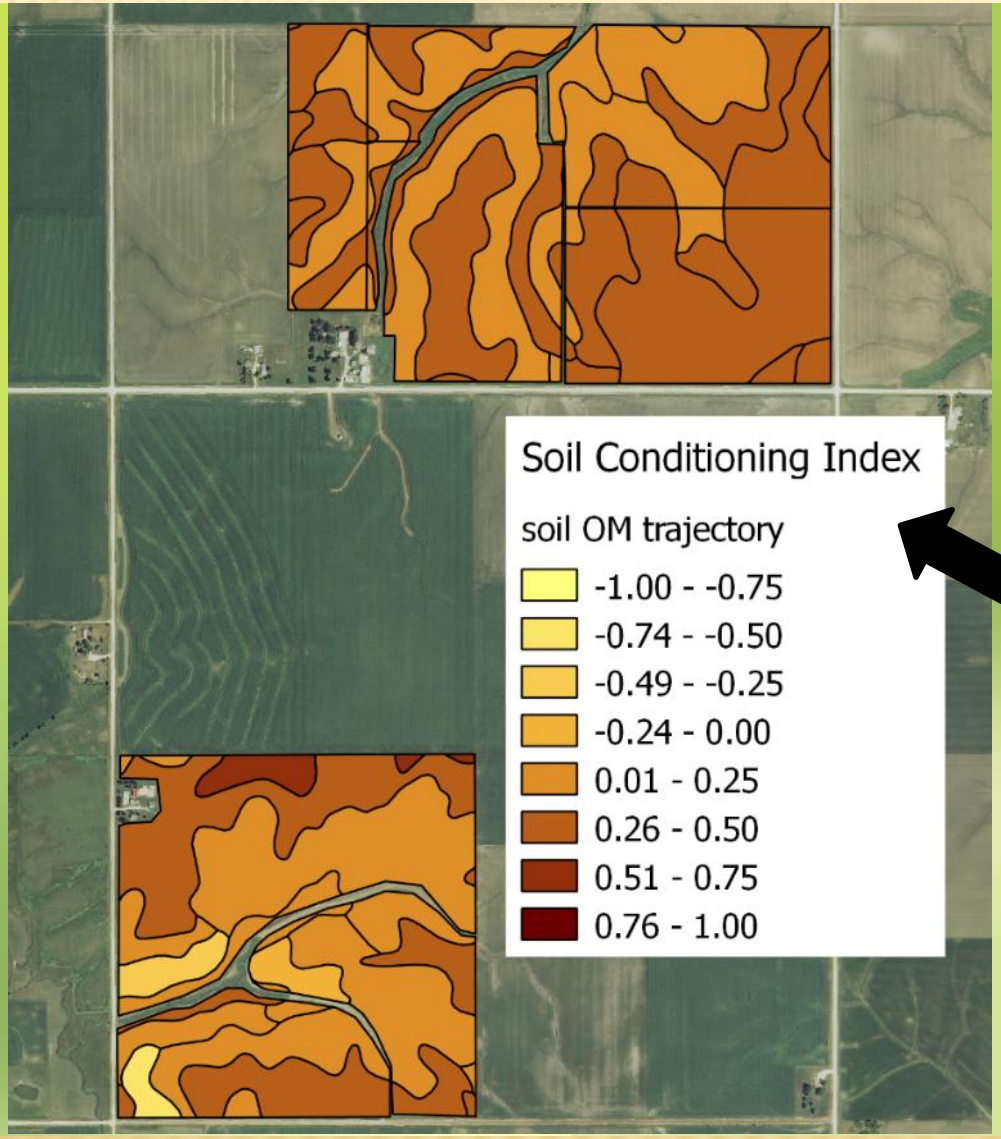

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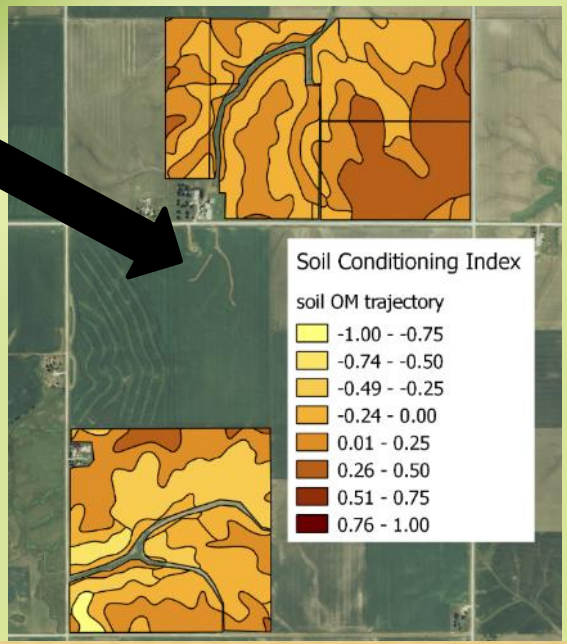
- Apply vegetative buffer conservation practices



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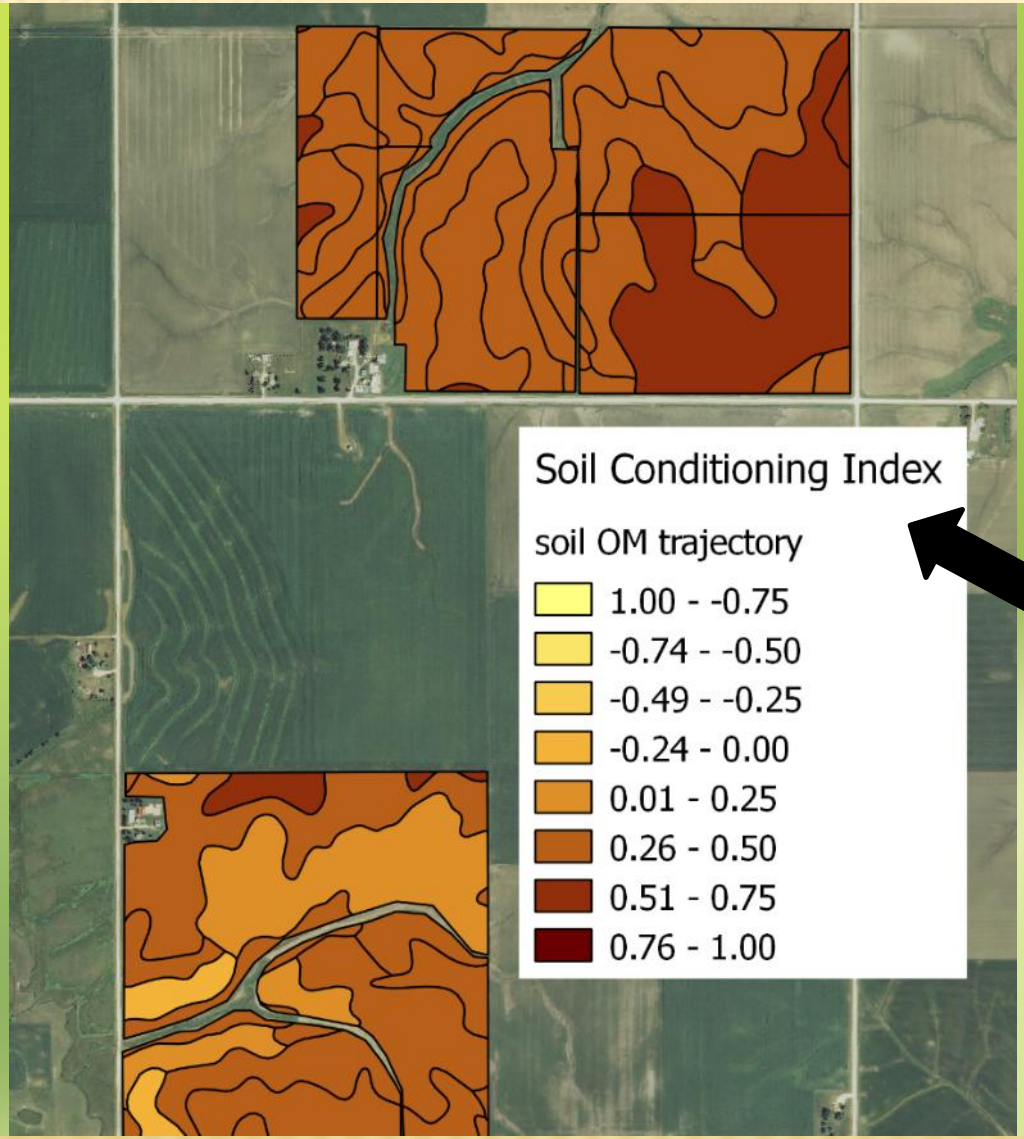
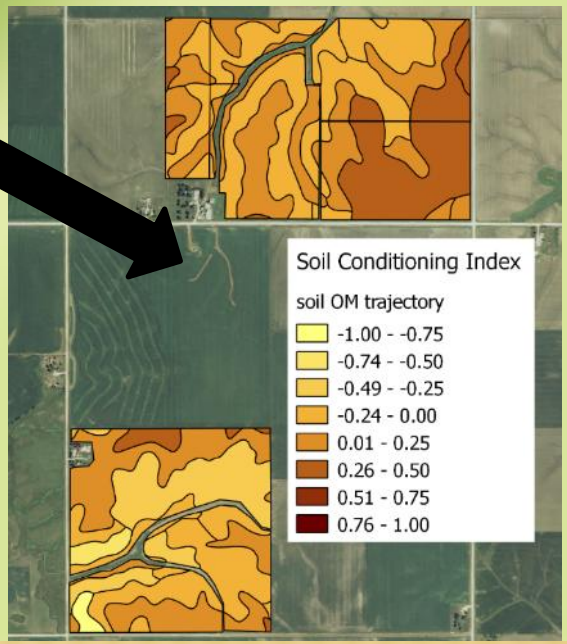


- Apply cover crop conservation practices




Any Questions?