Biomass Toolbox

Biomass Market Access Standards (BMAS) Group

Sustainability Certification: Intro to the U.S. Biomass Market Access Standard (BMAS)

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Principles of Sustainability

- Soils
- Water
- GHGs/Air
- Biodiversity
- Socio-economics
- Integrated planning
- Legality
- Continuous improvement and adaptive management

Drivers of Certification: Verification

- EU Renewable Energy Directive (2009)
  - Art. 17
    - No conversion of HCV or high-carbon stock lands
    - Requires cross-compliance with CAP agro-environmental measures
    - Member state reporting of the mandate's effects on air, water, soils, socio-economics
    - 15 certification systems have been recognized by EU Commission
      - ISCC (German-based)/commodities
      - RSB (Swiss-based)/eNGOs; FSC partner
      - Bonsucro (London/Brazil)/sugarcane

Drivers of Certification: Verification

- Aviation
  - MASBI/SAFN
  - ICAO negotiations
- Department of Defense Farm to Fleet
- Business-to-business (B2B)
    - The Sustainability Consortium
    - Field-to-Market
    - Bioplastic Feedstock Alliance
    - Sustainable Purchasing Leadership Council
      - No fuels

Water Quality Verification

- Efforts to reduce nitrogen pollution
  - Chesapeake (nitrogen trading)
    - *AFB v. US EPA*
  - Florida
    - *Florida Wildlife Federation v. US EPA*
    - Notice of Appeal filed in 11th Cir.
  - Mississippi
    - *Gulf Restoration Network v. US EPA*
    - Stoner memo
      - States implementing nutrient loss programs
      - Numerics and Verification of BMPs

Verification Costs/Opportunities

- Nascent bioenergy industry must reduce costs
  - Certification is expensive
  - Few certifications in U.S.; organic certification only model
  - NRCS does not offer certification, nor are its plans dynamic
- Verification as an opportunity
  - Greater efficiency saves costs
  - Ecosystem services markets
    - Water quality
    - Carbon (California LCFS? Aviation?)

Reducing Costs While Achieving Greater Sustainability Gains

- How?
  - Improving certification beyond social license to operate to verifiable outcomes
  - Transition from BMPs to outcomes where possible
    - Data and analytics allow us to aim more exactly for outcomes
    - Specialized knowledge being generated by U.S. research institutions in the for novel bioenergy supply chains
      - BMAS Collaboration seeks to incorporate federally-funded (e.g., AFRI, Sungrant, section 319), EBI, and private sector efforts into user-friendly tools for the U.S. producer and consumer to gauge "sustainability"
      - Blueprint for systems analysis

Ag-Forestry Standards Integration

- Motivations
  - In bioenergy, need for a united voice against pervasive skepticism
  - Trends in one may influence trends in another
    - BMPs transition to outcomes
    - Planning
  - Trend toward more multi-functional, diverse landscapes
    - Water quality
    - Biodiversity
    - Supply chain risks

Collaborators

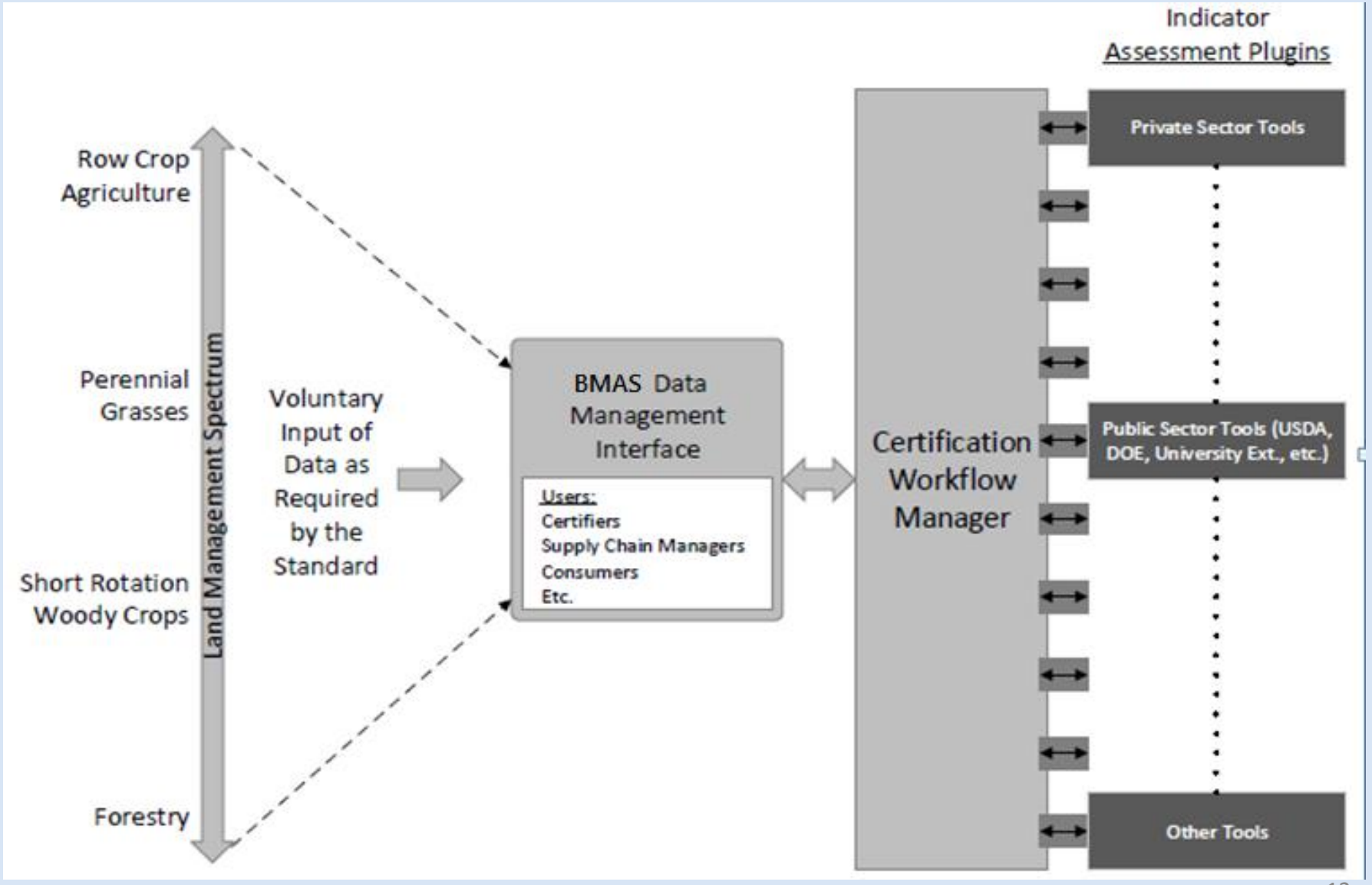
- Universities
  - Illinois, Tennessee, SUNY-ESF, NC State, Western Illinois
- Government
  - DOE, USDA (NRCS, ARS), CA ARB
- Industry
  - Genera, Poet, CERES, Antares, Ag Solver, Weyerhaueser, Plum Creek
- Civil Society
  - 25X25, AWI, SFI
- Seeking others

BMAS Standards Activities

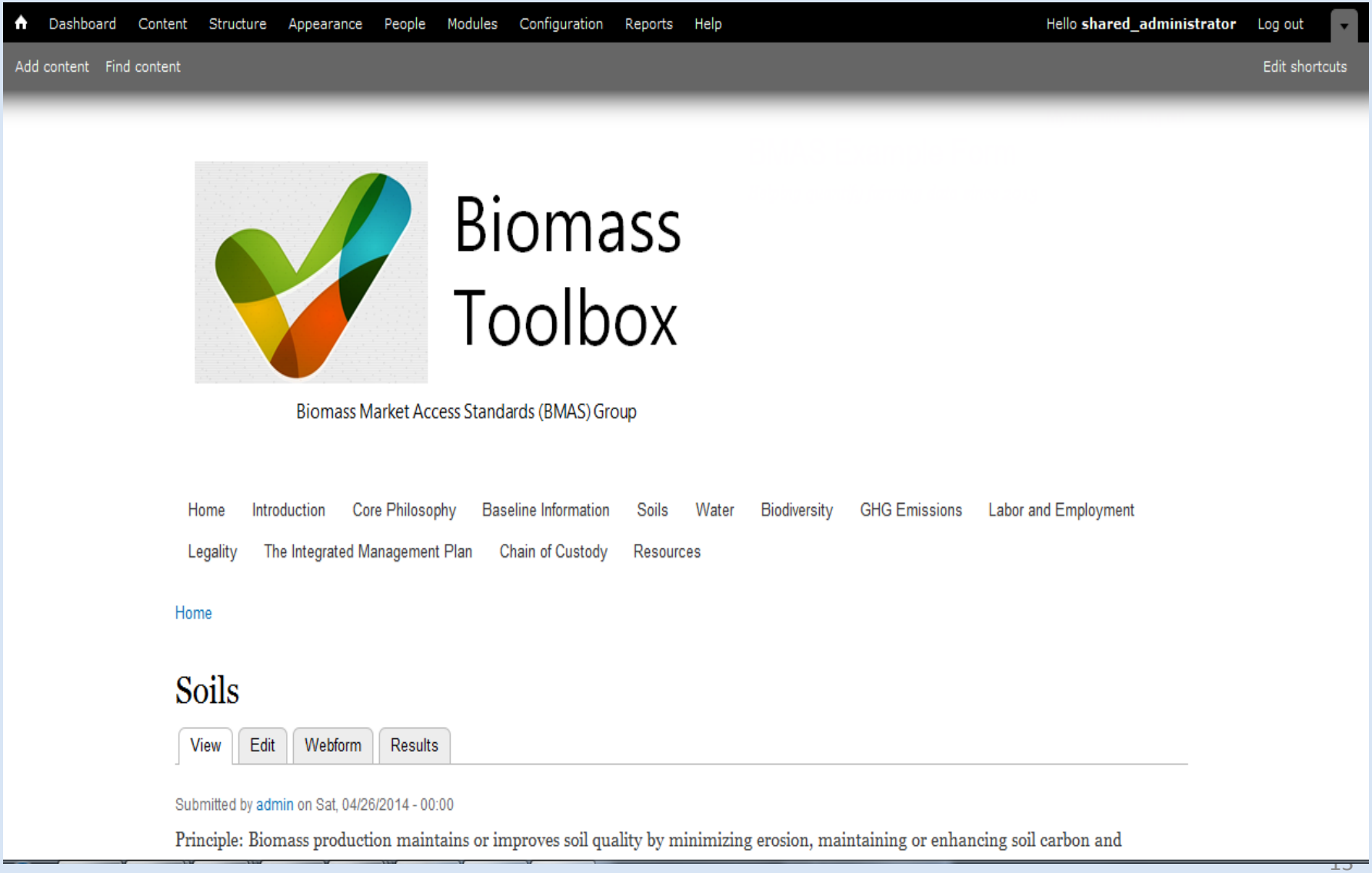
Ag and SRWB Standards & Tool Building

- Building on CSBP effort
- Producer level currently; parallel consumer level
- Process:
  - Translate standards into:
    - Outcome baselines
    - Series of questions for the producer to input data on "front end"
    - In parallel, survey universe of data and analytics on "back end" that can be used to "auto-populate," to the extent possible, producer front-end side
    - Middle interface built for certifiers and businesses to interact with producer

The BMAS Web-Tool



The BMAS Web-Tool



The BMAS Web-Tool

4.1 Maintain or Improve Soil Health

Minimize erosion and maintain soil carbon and nutrients at appropriate levels, as well as the overall physical, chemical, and biological properties of the soil.

▾ 4.1.1. Soil assessment and monitoring

Participants assess and monitor nutrient levels of the soil or plants, and soil capabilities to maintain and improve soil health, appropriate to the scale and intensity of the management unit.

4.1.1. Yes

Do you assess and monitor nutrient levels of the soil or plants and soil capabilities to guide management decisions?

4.1.1. Yes

Do you conserve soil and maintain its productivity through an integrated resource management plan?

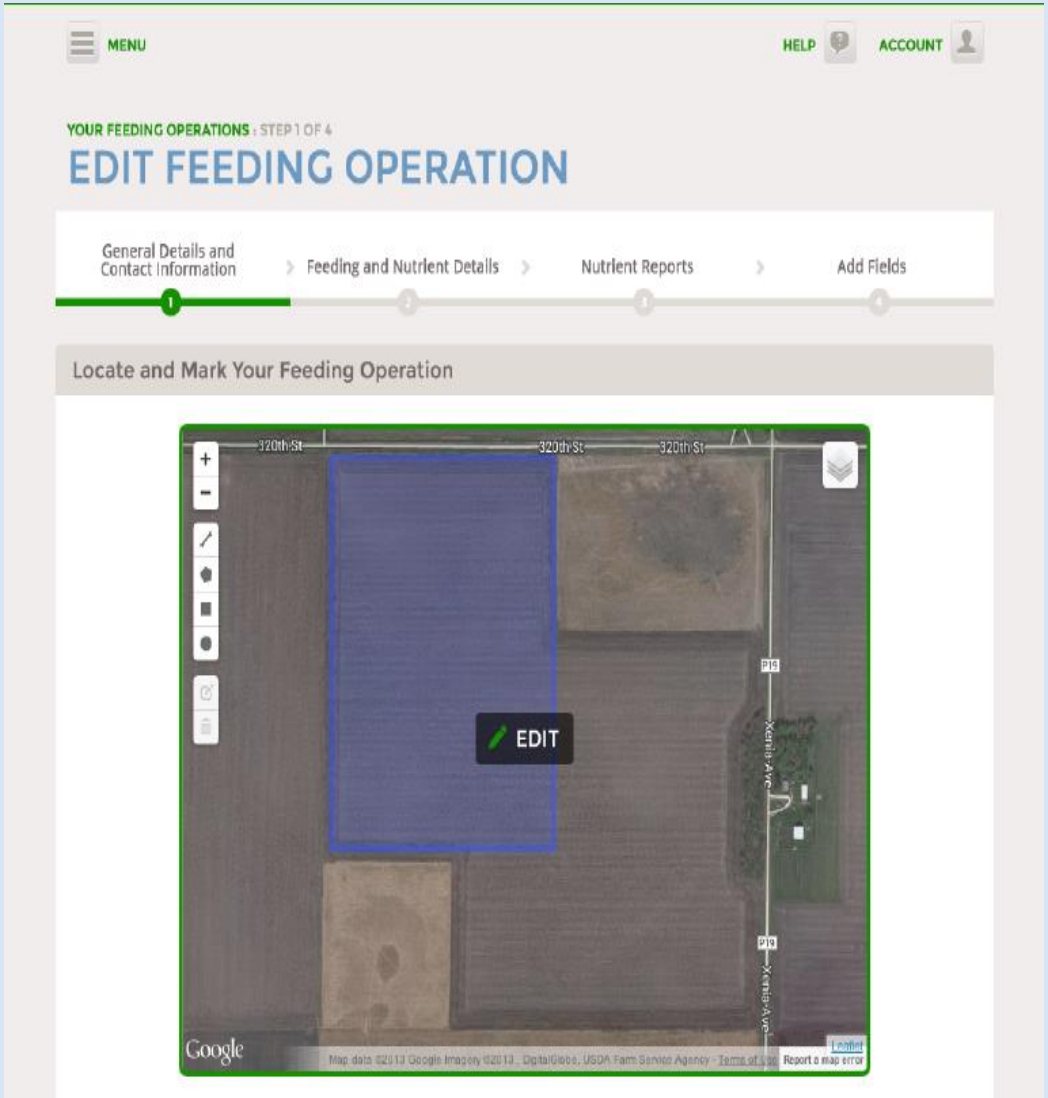
4.1.1. Yes

Are nutrients managed to reduce loss to air and water?

4.1.1 Comments

Additional details

Baseline Information



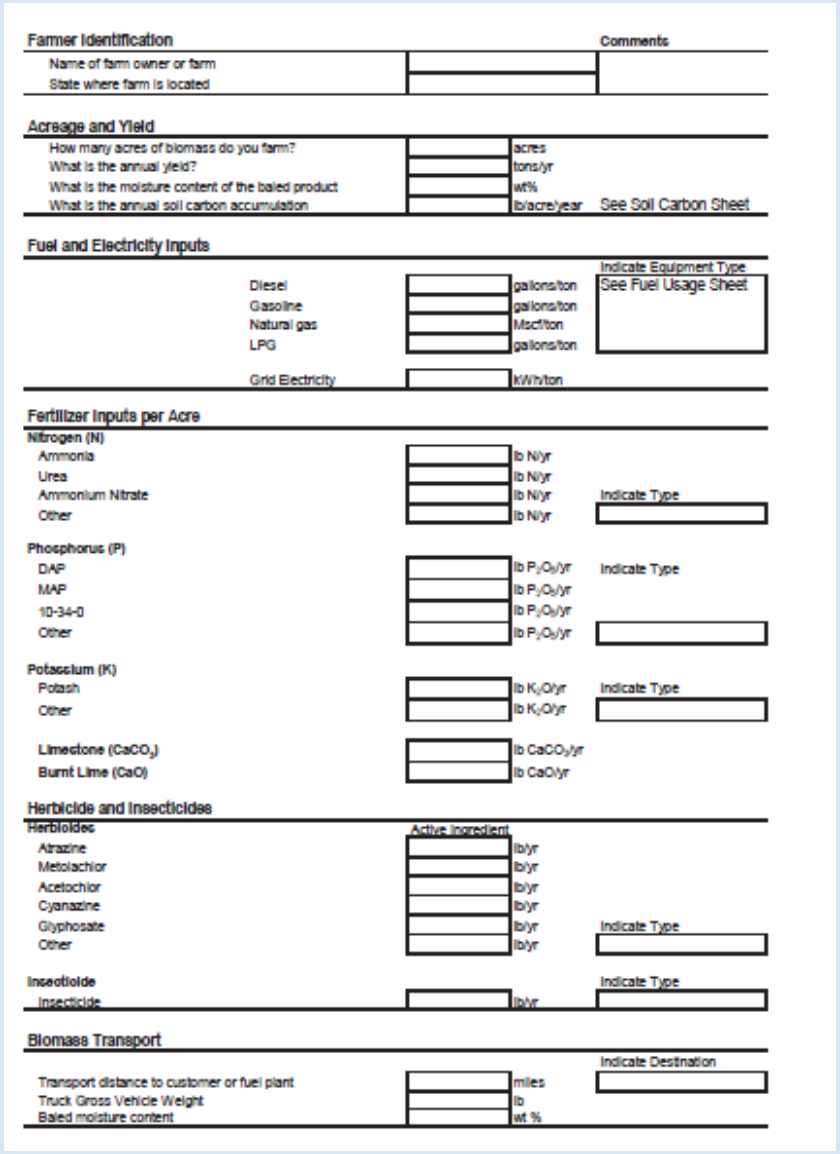
Fields:

- Google Map for each field name

Other:

- Under each field, the type of biomass system used, e.g., "Corn stover removal," "Switchgrass," etc.
- Producer's control of property, e.g., "own," or "rent"
- The history of production on the property to verify when conversion took place in relation to regulatory thresholds
- What is the operator's current system of determining what management decisions to deploy at the field level? Sub-field level?
- Does the operator currently maintain an NRCS conservation plan (option to attach)? If so, when was the plan created? What resource concerns were identified and what actions were taken?

Front-Back Matching: GHGs



Farmer Identification

		Comments
Name of farm owner or farm		
State where farm is located		

Acreage and Yield

How many acres of biomass do you farm?		acres	
What is the annual yield?		tons/yr	
What is the moisture content of the baled product		wt%	
What is the annual soil carbon accumulation		lb/acre/year	See Soil Carbon Sheet

Fuel and Electricity Inputs

			Indicate Equipment Type
Diesel		gallons/ton	See Fuel Usage Sheet
Gasoline		gallons/ton	
Natural gas		Mscf/ton	
LPG		gallons/ton	
Grid Electricity		kWh/ton	

Fertilizer Inputs per Acre

Nitrogen (N)			
Ammonia		lb N/yr	
Urea		lb N/yr	
Ammonium Nitrate		lb N/yr	Indicate Type
Other		lb N/yr	
Phosphorus (P)			
DAP		lb P_2O_5/yr	Indicate Type
MAP		lb P_2O_5/yr	
10-34-0		lb P_2O_5/yr	
Other		lb P_2O_5/yr	
Potassium (K)			
Potash		lb K_2O/yr	Indicate Type
Other		lb K_2O/yr	
Limestone ($CaCO_3$)		lb $CaCO_3$/yr	
Burnt Lime (CaO)		lb CaO/yr	

Herbicide and Insecticides

Herbicides	Active Ingredient		
Atrazine		lb/yr	
Metolachlor		lb/yr	
Acetochlor		lb/yr	
Cyanazine		lb/yr	
Glyphosate		lb/yr	Indicate Type
Other		lb/yr	
Insecticide			Indicate Type
Insecticide		lb/yr	

Biomass Transport

			Indicate Destination
Transport distance to customer or fuel plant		miles	
Truck Gross Vehicle Weight		lb	
Baled moisture content		wt %	

Front

Farming Inputs:

- Farm survey of energy and fertilizer inputs

Front-Back Matching: GHGs

Table 4.2. Example Fuel Monitoring Input Sheet

Activity	Tractor Passes/year	Hours/acre	Cycles, Crops	Equipment Type	Power (hp)	Load Factor	Fuel Use (gal/acre)
Seeding	1	0.5	1	Deere	120	0.3	1.1
Raking	1	1.2	9	Cat	120	0.4	31.1
Baling	1	0.8	9	Cat	120	0.7	36.3
Other	1	0.5	2	Cat	80	0.4	1.9
Tilling	1	1	1	Deere	120	0.5	3.6
Total							74.0
			Average crop cycle fuel usage (gal/acre)				8.2

Front

- Fuel data populated from GREET

Front-Back Matching: GHGs

Scenario Definitions

Feedstock	Switch Grass
Fuel	Ethanol
Functional Unit	mmBtu

Biomass Farming

Feedstock Region	US
Scenario	SG_LF
Feedstock	Switch Grass
Moisture Basis (wt%)	0%

Fuel Inputs (Feedstock Basis)	Parameter	Units
Diesel	164,386	Btu/tonne
Gasoline	0	Btu/tonne
Natural gas	0	Btu/tonne
LPG	0	Btu/tonne
Total	164,386	Btu/tonne

Electricity Input		Units	Value	Units
Electricity	9,818	Btu_e/tonne	2.877	kWh/tonne

Chemical Inputs		Units
N	11,443	g/tonne
Ammonia	0	g/tonne
Urea	11,443	g/tonne
Ammonium Nitrate	0	g/tonne
P_2O_5	110	g/tonne
K_2O	220	g/tonne
$CaCO_3$	0	g/tonne
Herbicide	0.0	g/tonne
Atrazine	0	g/tonne
Metolachlor	0	g/tonne
Acetochlor	0	g/tonne
Cyanazine	0	g/tonne
Glysophate	0	g/tonne
Insecticide	0.00	g/tonne

Land Emissions (g/tonne)	**Direct**	**Indirect**
N content of ag system	11,443	0
N in N_2O as % of N in fertilizer and biomass	1.509%	0.000%
Field Emissions	0	
CH_4	-514	0
N_2O	173	0
CO_2	-8,528	0

Back-End

Energy: GREET

Field emissions:

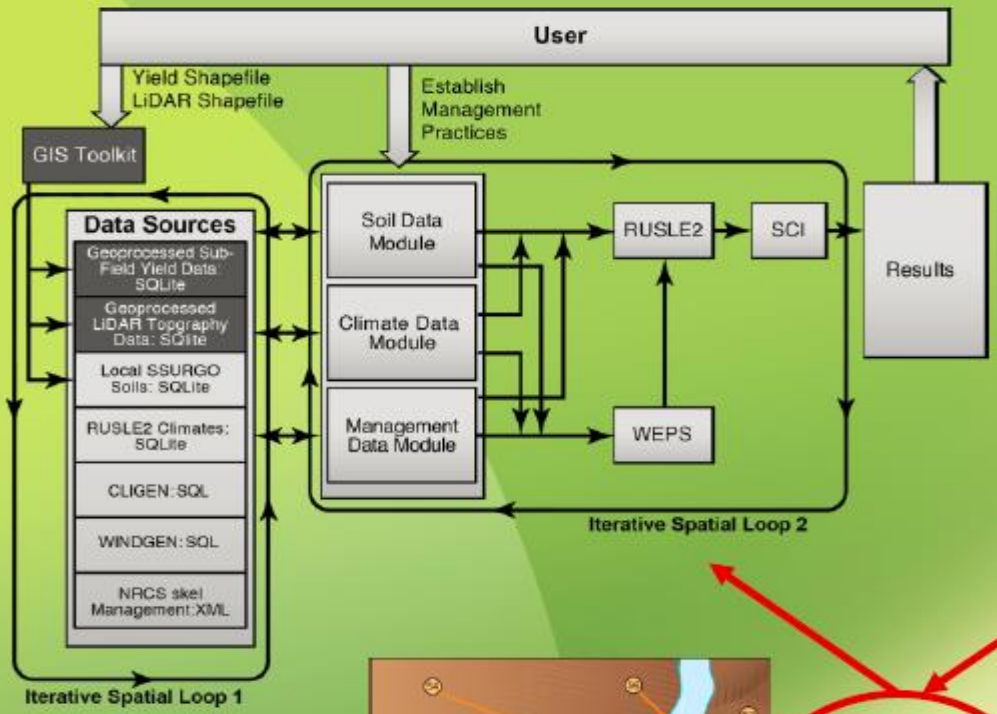
- GREET, DAYCENT, EPA RFS RIA
- Incorporate most recent soil carbon studies?

Front-Back Matching: Example of Private Sector Tool

Front-Back Matching: Soils/Water

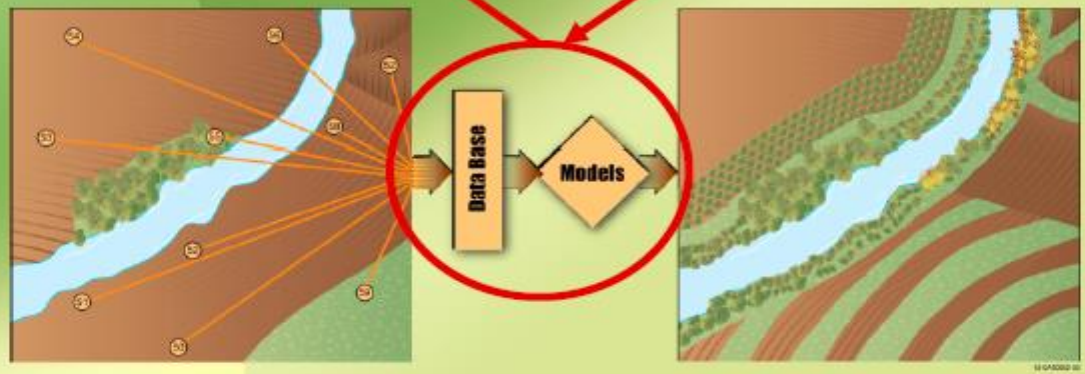
Agronomic Strategies

praxik™



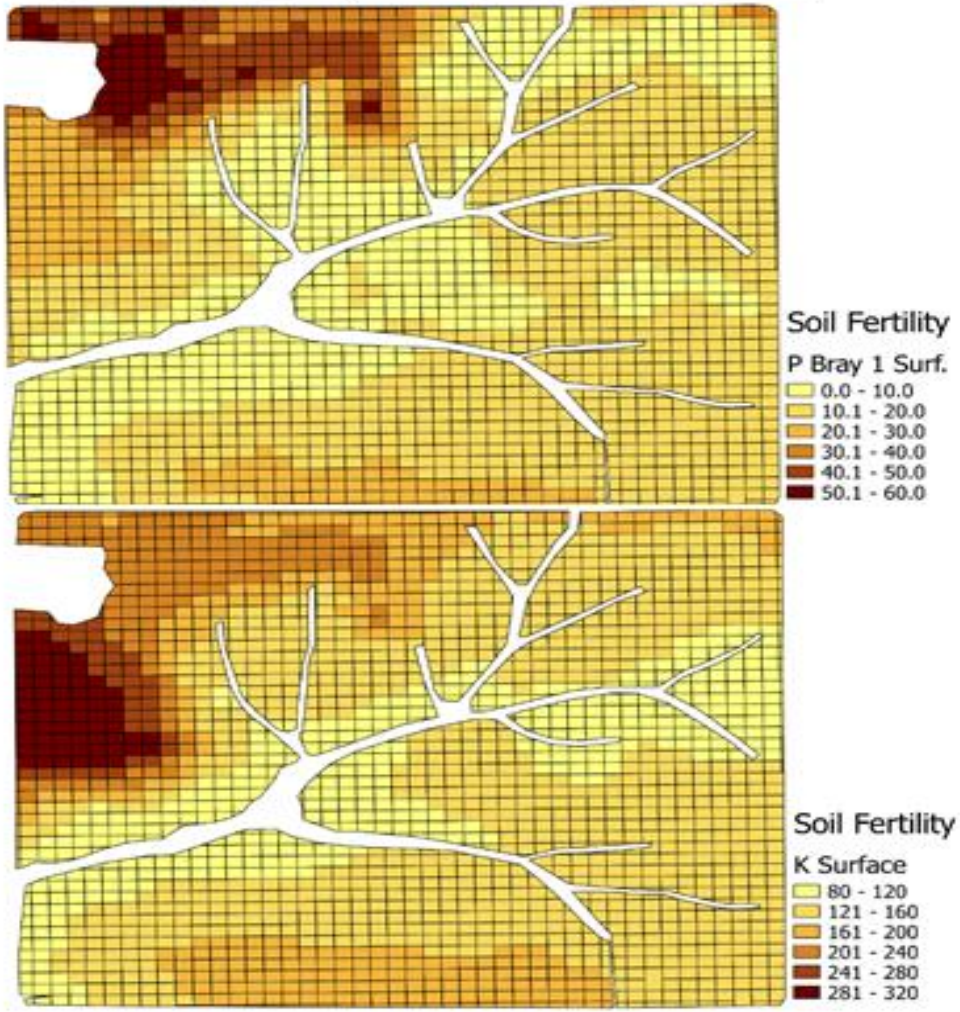
Agronomic Strategies

- **Cover Crops**
- **Integrated Cropping Systems**



Front-Back Matching: Soils/Water

Criterion / Indicator: Soil



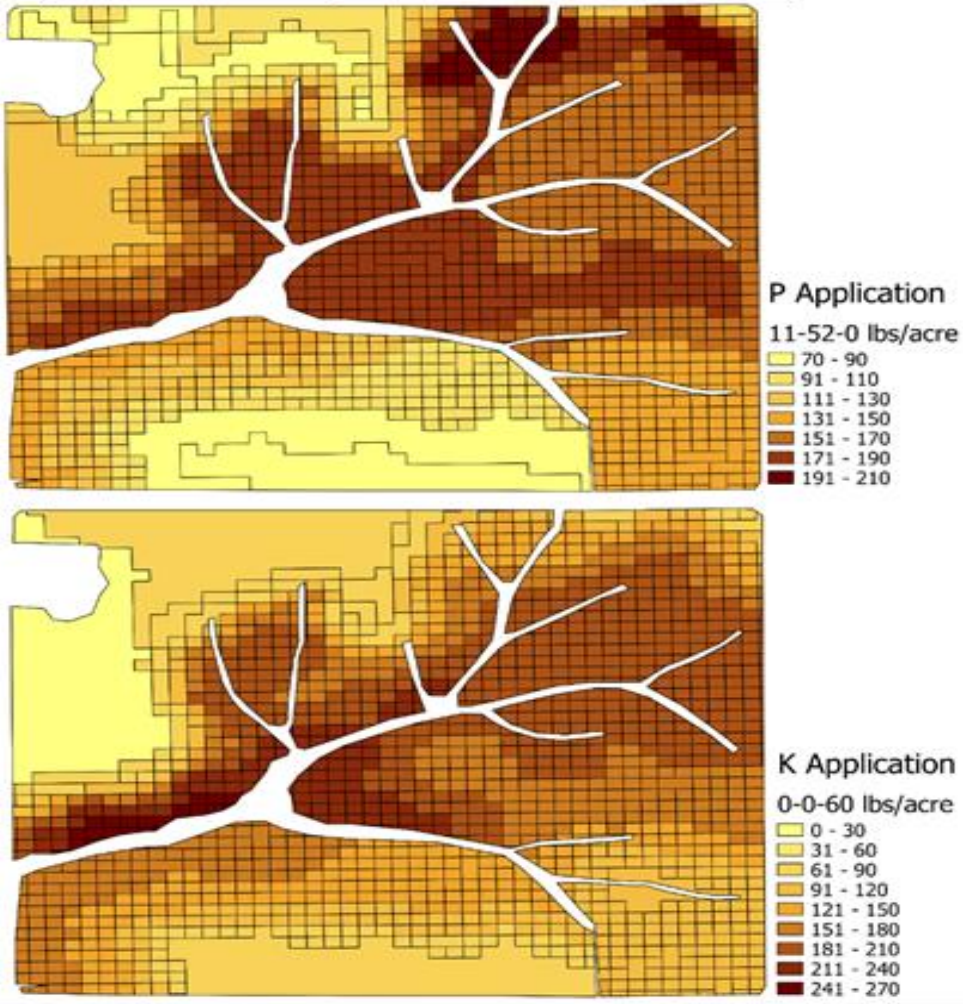
2.1	Maintain or Improve Soil Health
2.1.1	Soil Productivity and Conservation Planning
2.1.1.1	Soil assessment and monitoring
	Do you assess and monitor nutrient levels of the soil or plants and soil capabilities to guide management decisions?

Documentation of soil fertility monitoring:

- High resolution spatial data
- Static maps
- Static data tables

Front-Back Matching: Soils/Water

Criterion / Indicator: Soil



2.1	Maintain or Improve Soil Health
2.1.1	Soil Productivity and Conservation Planning
2.1.1.2	Soil nutrient and conservation planning
	Do you conserve soil and maintain its productivity through an integrated resource management plan?

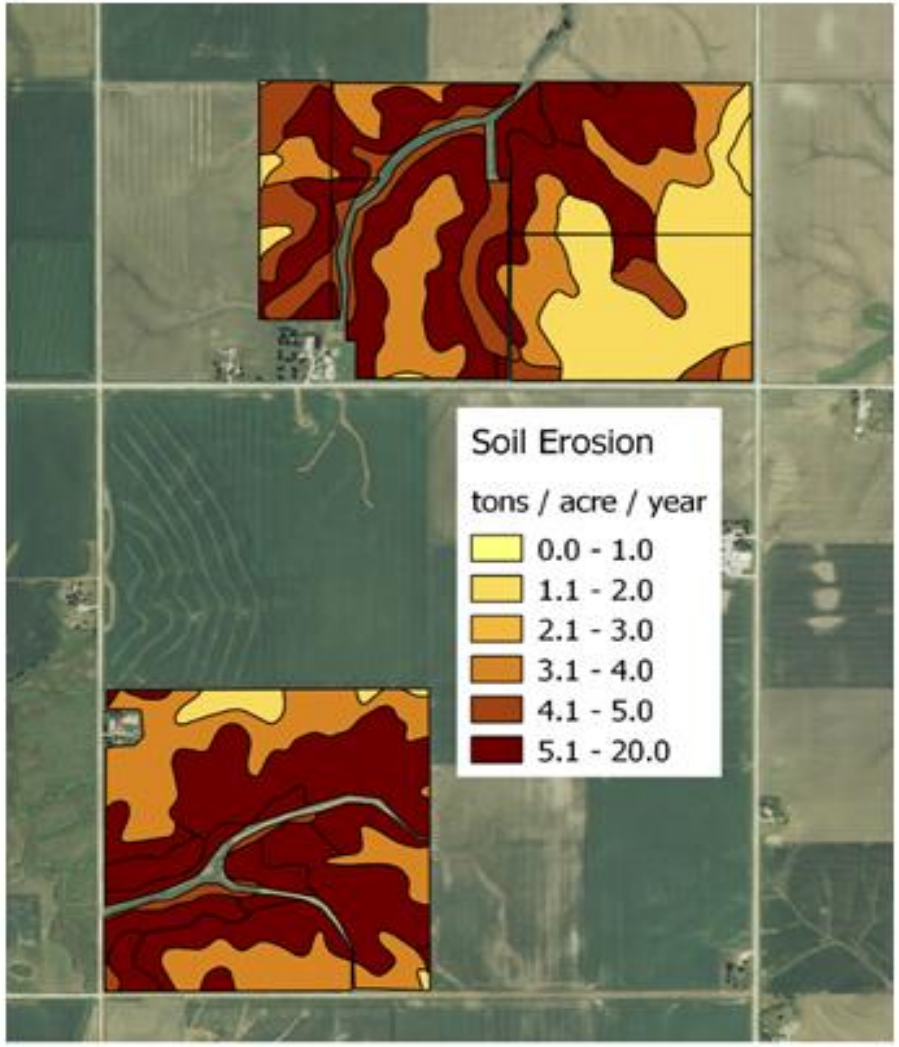
Documentation of fertilizer application:

- High resolution spatial data
- Static maps
- Static data tables

Key Question: do application rates account for risk factors and productive capacity

Front-Back Matching: Soils/Water

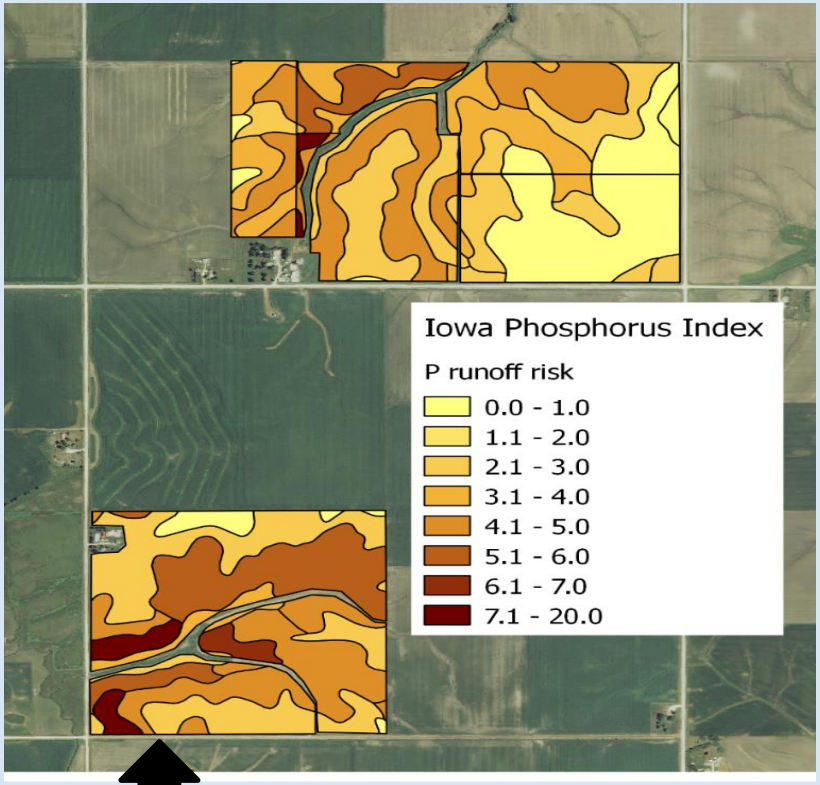
Criterion / Indicator: Soil

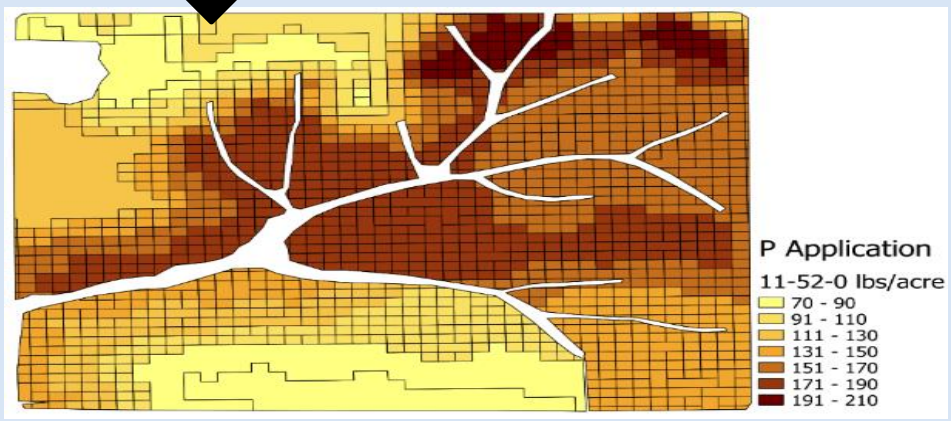


2.1	Maintain or Improve Soil Health
2.1.1	Soil Productivity and Conservation Planning
2.1.1.2	Soil nutrient and conservation planning
	Do you use planning protocols supported by the Natural Resource Conservation Service (NRCS) Conservation Planning process?

NRCS conservation planning report

Front-Back Matching: Soils/Water



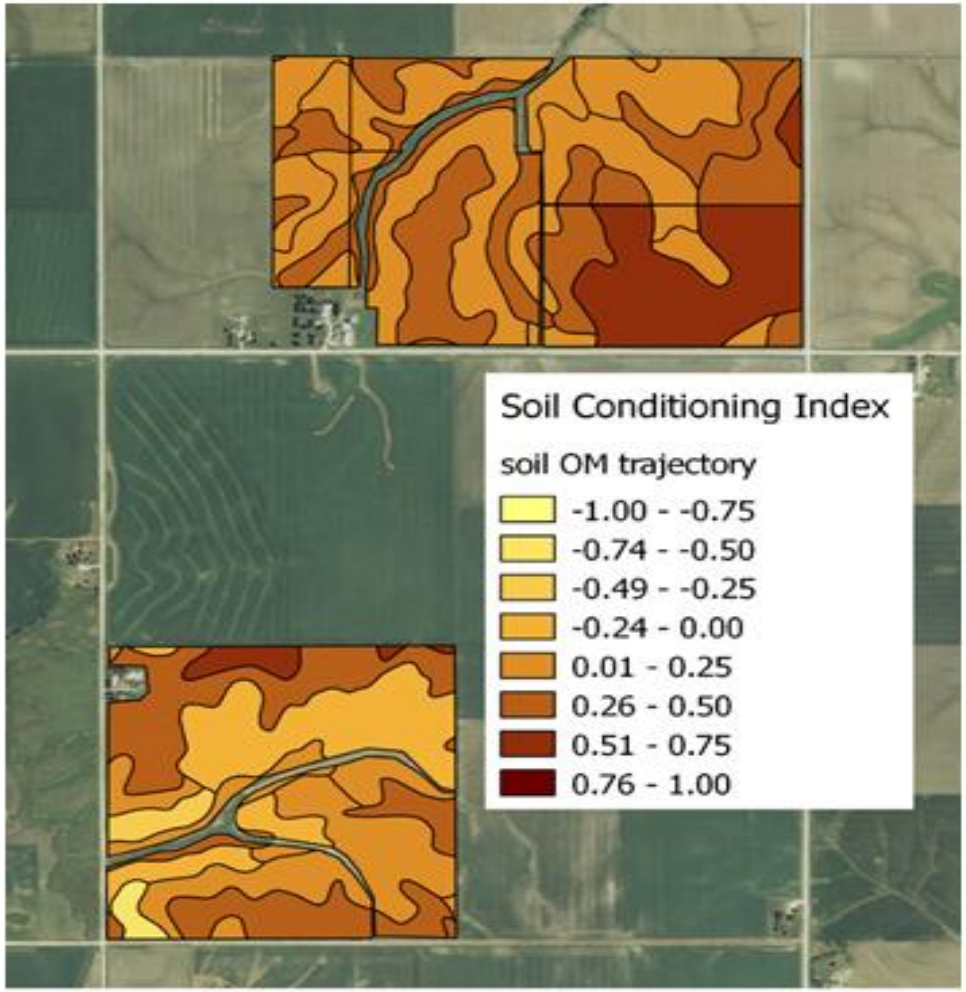


2.1	Maintain or Improve Soil Health
2.1.1	Soil Productivity and Conservation Planning
2.1.1.2	Soil nutrient and conservation planning
	Are nutrients managed to reduce loss to air and water?

Key Question: do application rates account for risk factors and productive capacity?

Front-Back Matching: Soils/Water

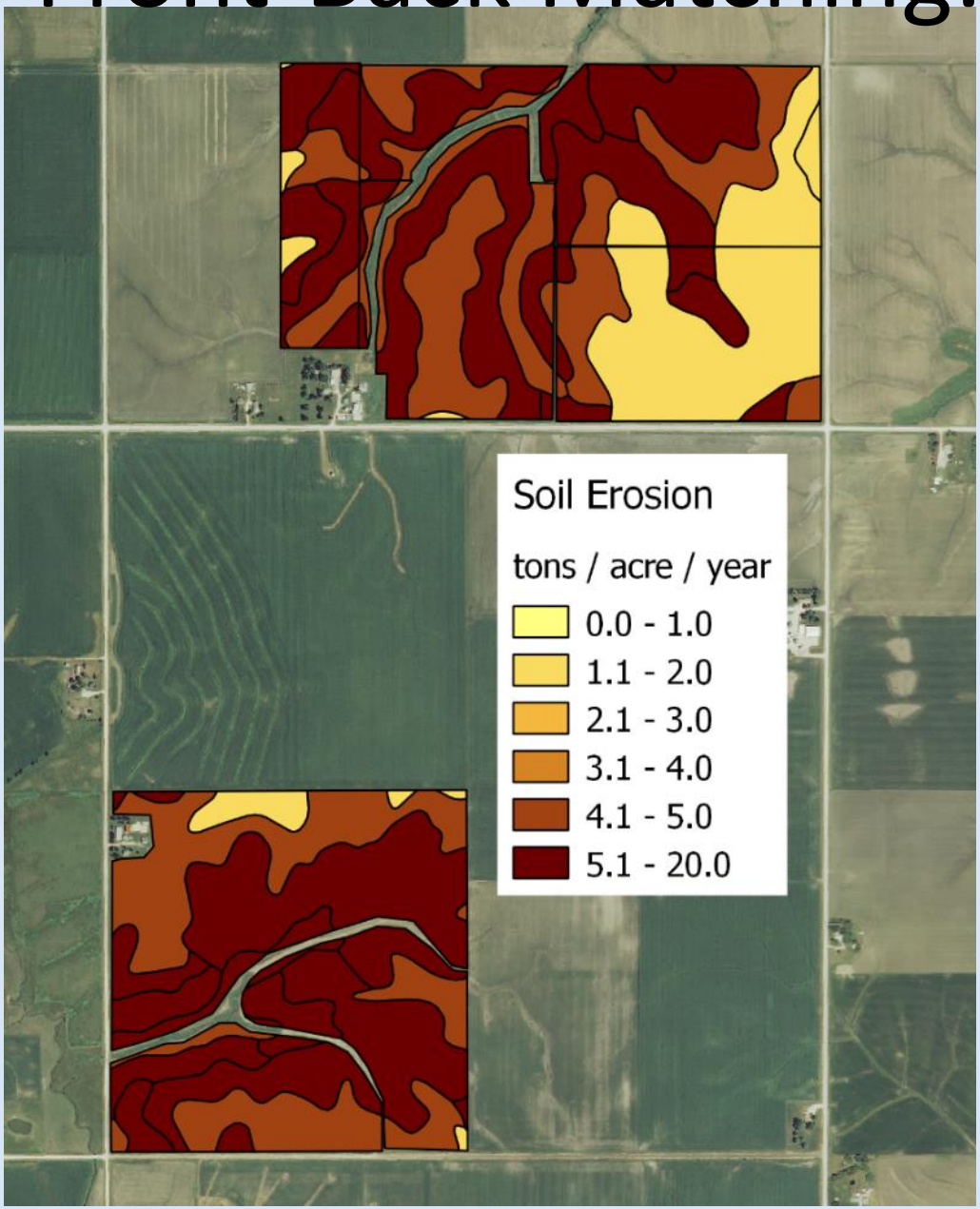
Criterion / Indicator: Soil



2.1	Maintain or Improve Soil Health
2.1.1	Soil Productivity and Conservation Planning
2.1.1.2	Soil nutrient and conservation planning
	Have you established comprehensive management planning and implementation of practices to improve soil function and productivity? (Include copy of management plan, if applicable.)

NRCS conservation planning report

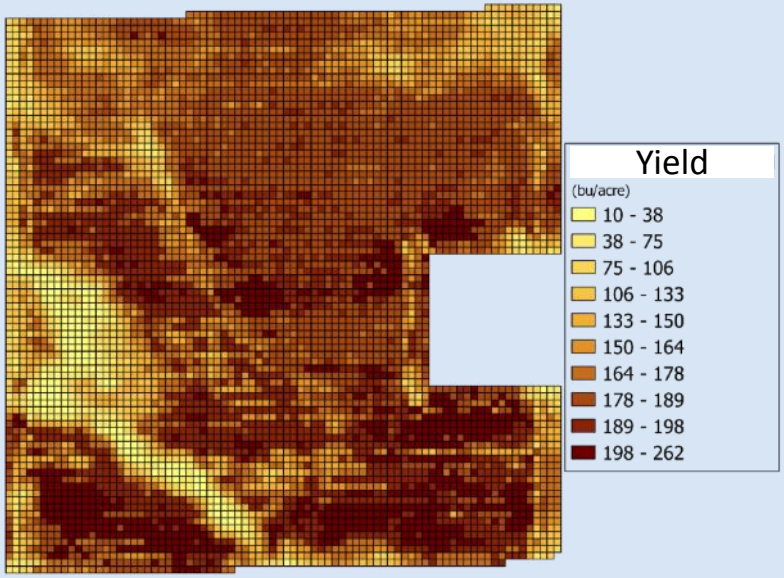
Front-Back Matching: Soils/Water



2.1	Maintain or Improve Soil Health
2.1.2	Residue Removal
	Do you retain biomass materials required for erosion control and soil fertility?

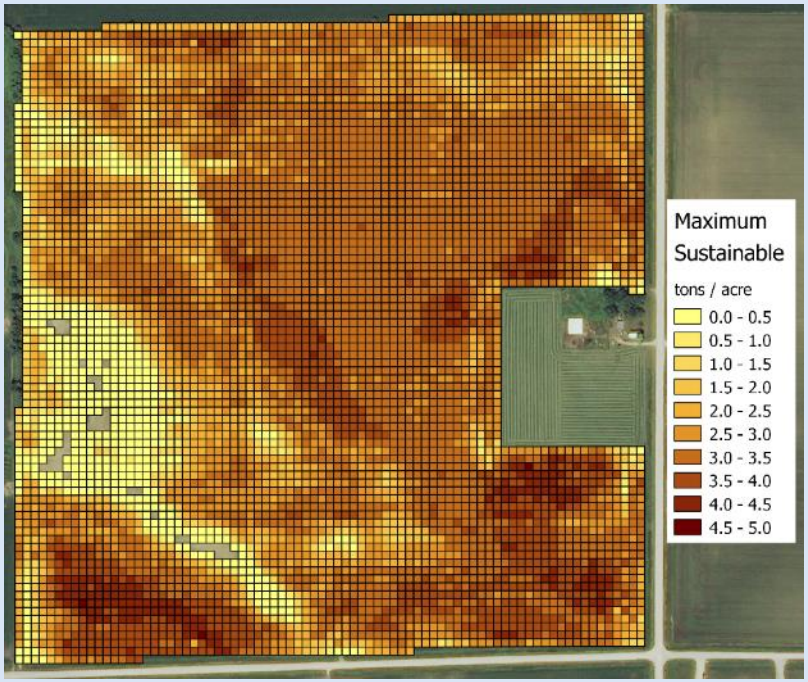
- 1.8 tons/acre average removal rate
- Apply CMP methodology
- Custom Report

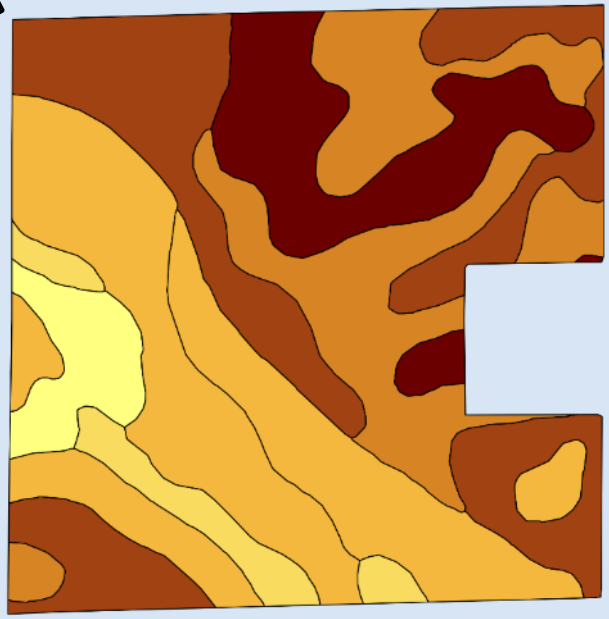
Front-Back Matching: Soils/Water



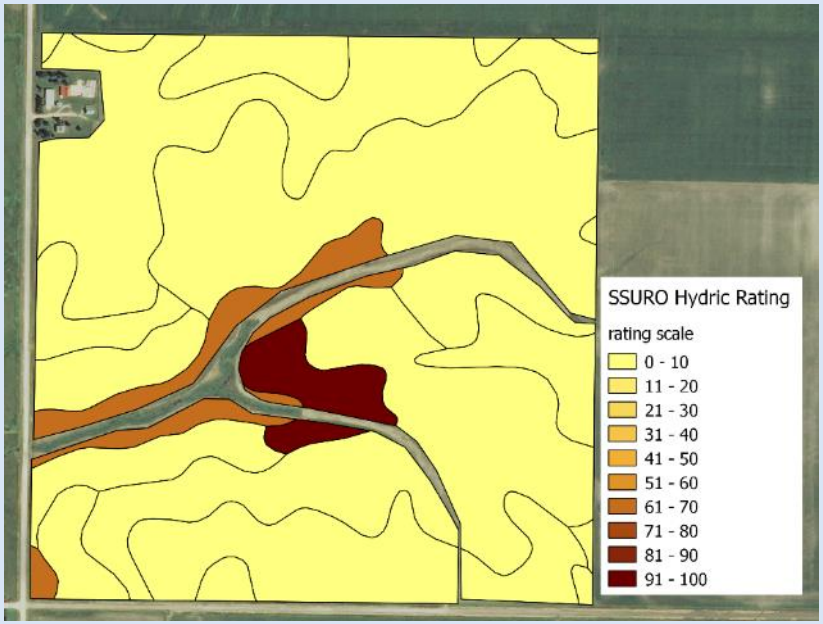
2.1	Maintain or Improve Soil Health
2.1.2	Residue Removal
	Do you retain biomass materials required for erosion control and soil fertility?

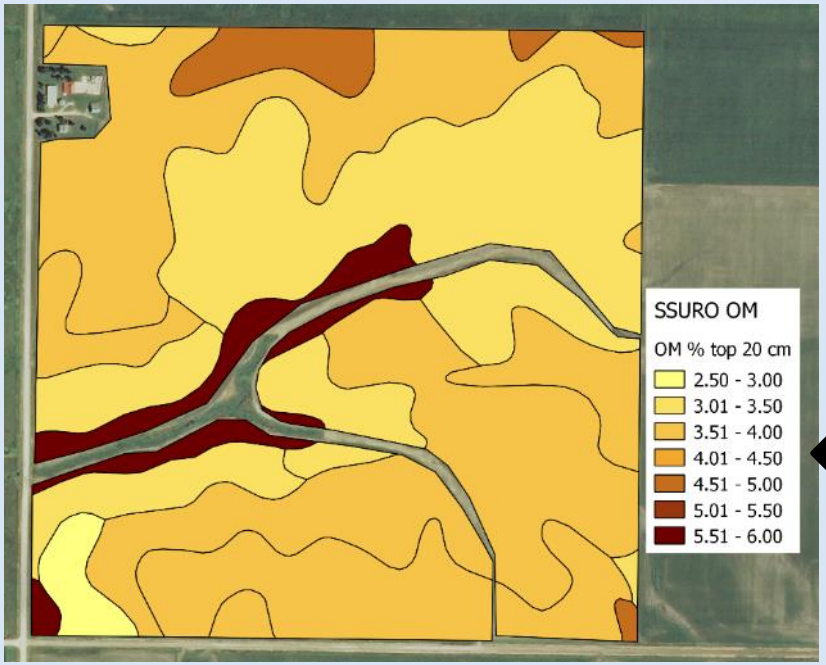
- Optimization: maximize sustainable residue removal rates





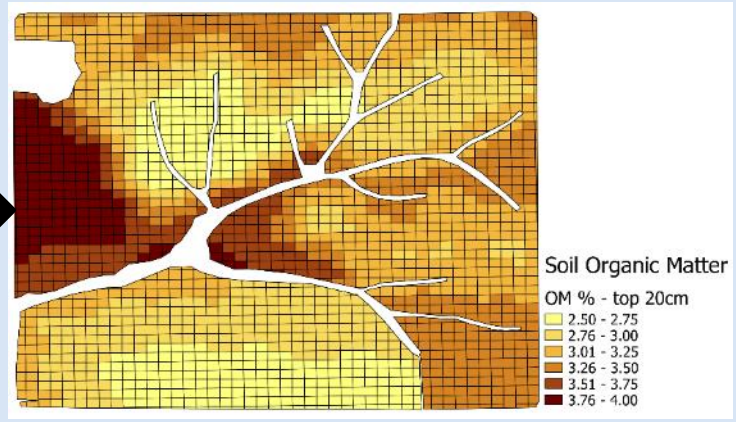
Front-Back Matching: Soils/Water



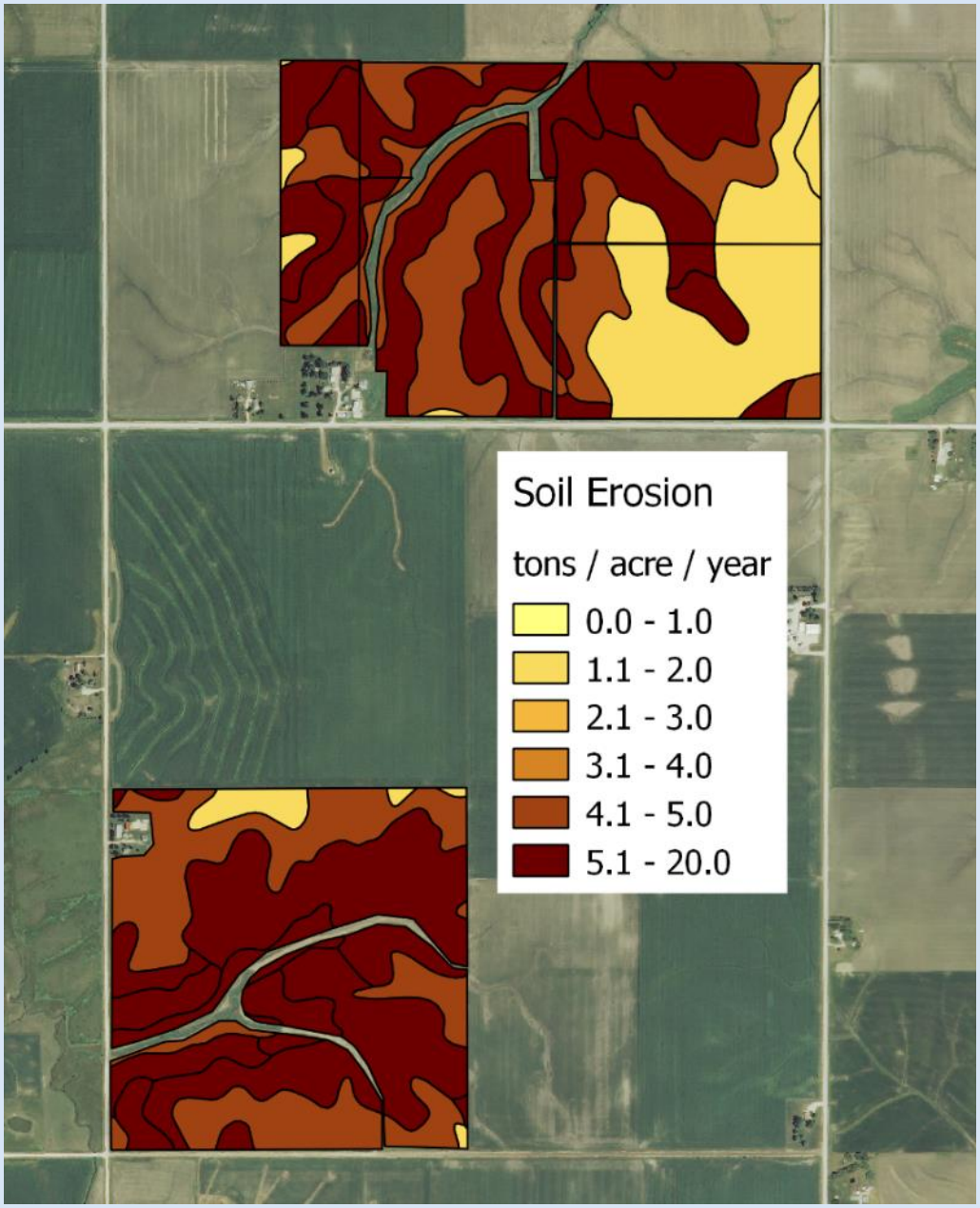


2.1	Maintain or Improve Soil Health
2.1.3	Compaction
2.1.4	Road construction
	Do you identify soils vulnerable to compaction?
	Do you use appropriate methods to reduce compaction if necessary and maintain site productivity?
	Do you identify techniques that might lead to compaction?

Document with public and private information



Front-Back Matching: Soils/Water

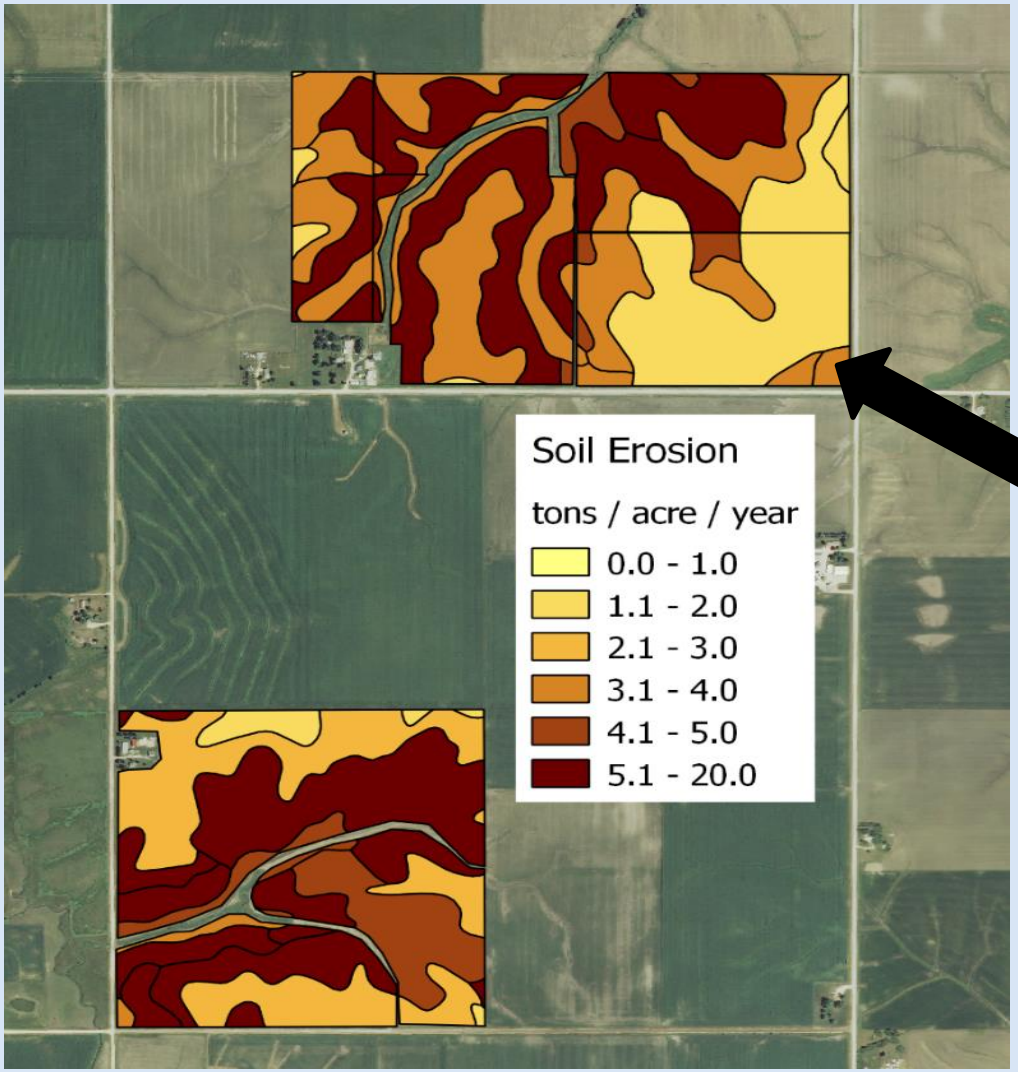


2.1	Maintain or Improve Soil Health
2.1.5	Erosion
	For agricultural operations, is your RUSLE-II score less than or equal to T? If not, please provide explanation in the 'comments' column. (Attach supporting documentation if applicable, and list document name)

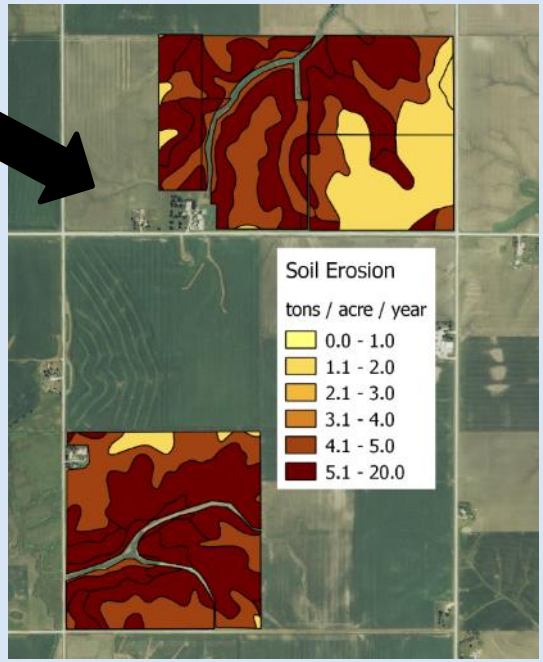
- T-value is 5 tons/acre/year for all soils in this farm

Front-Back Matching: Soils/Water

2.1	Maintain or Improve Soil Health
2.1.5	Erosion
	Do you apply USDA conservation practices and conservation systems?

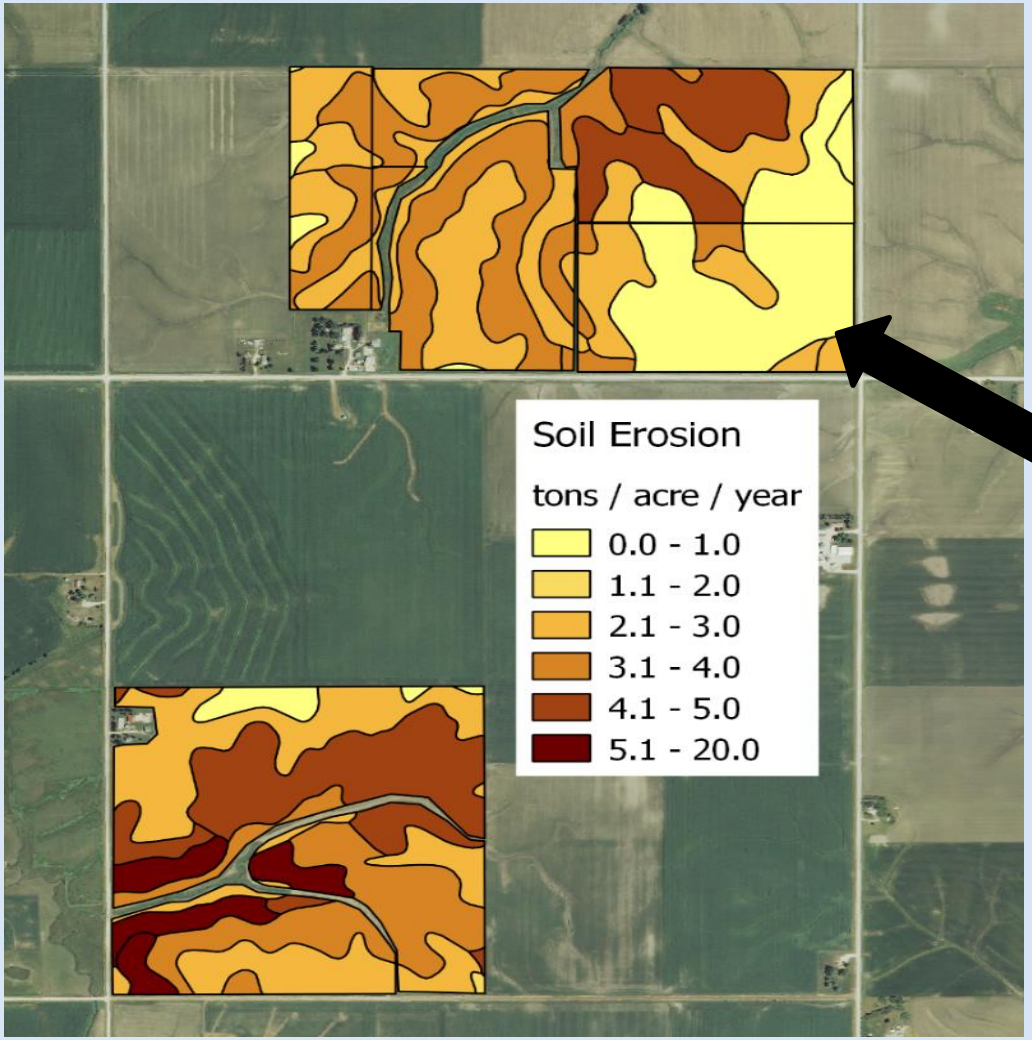


- T-value is 5 tons/acre/year for all soils in this farm
- Applying vegetative buffer conservation practices

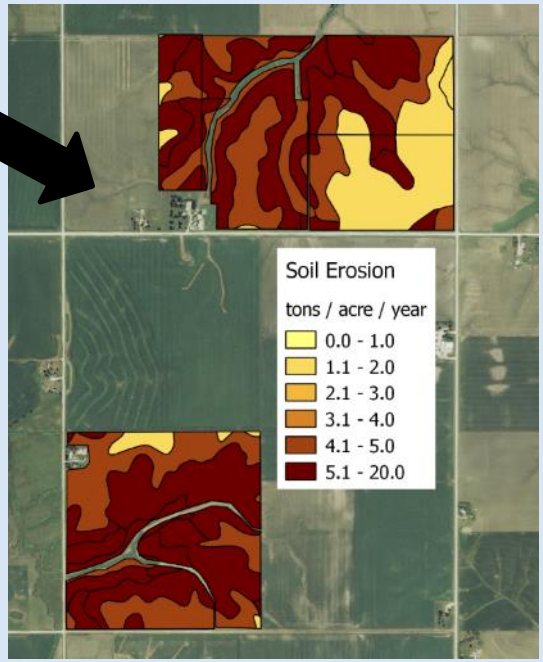


Front-Back Matching: Soils/Water

2.1	Maintain or Improve Soil Health
2.1.5	Erosion
	Do you apply USDA conservation practices and conservation systems?

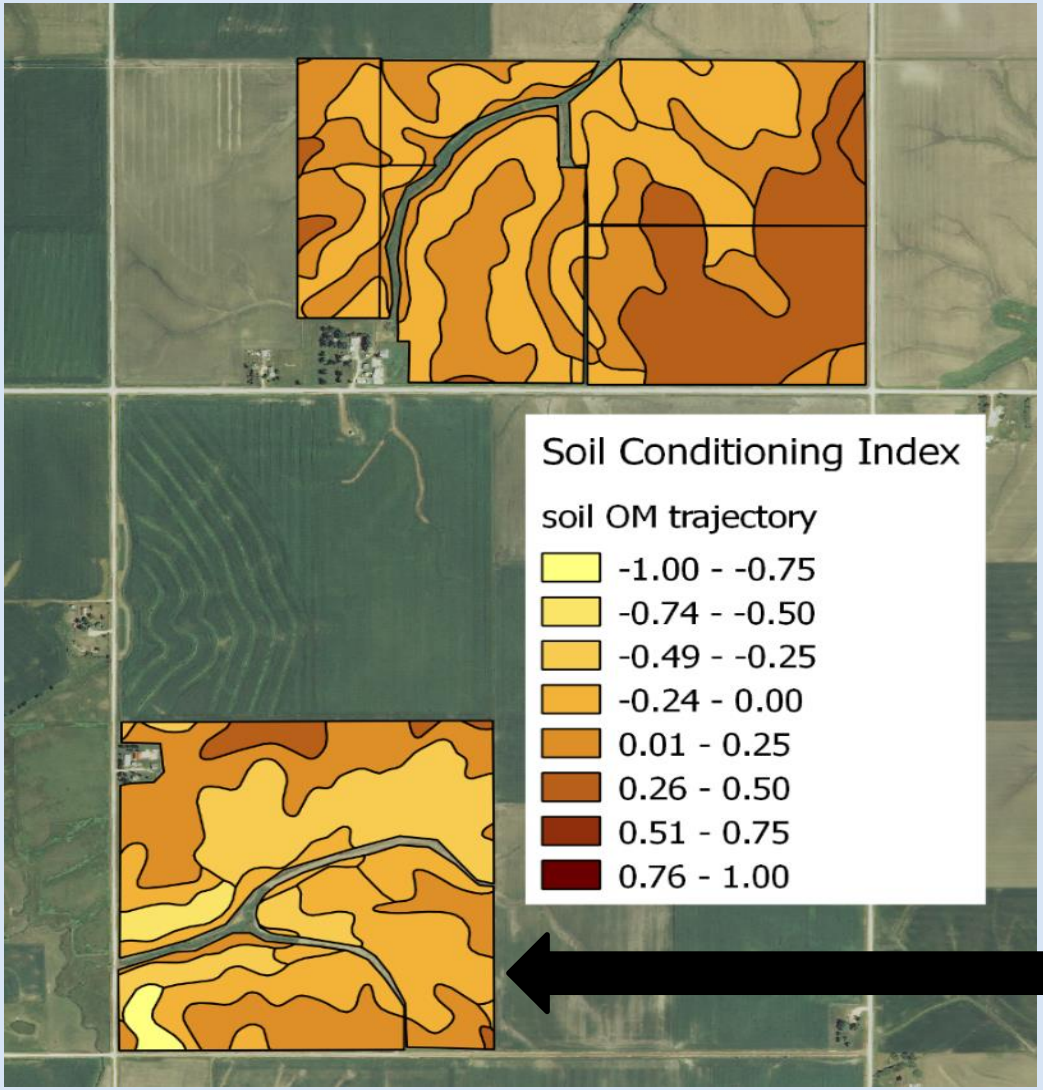


- T-value is 5 tons/acre/year for all soils in this farm
- Applying cover crop conservation practices

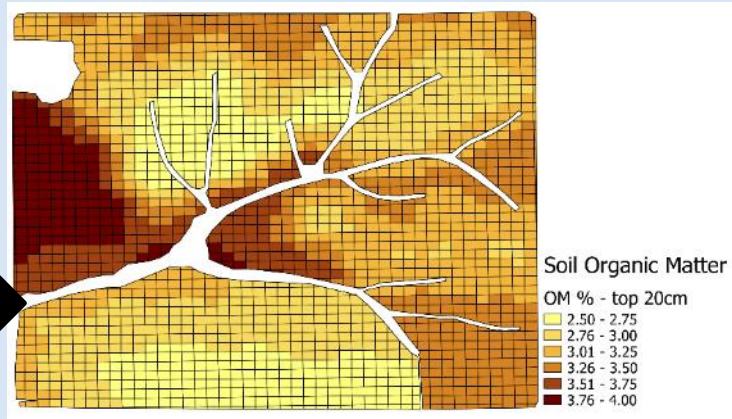


Front-Back Matching: Soils/Water

2.1	Maintain or Improve Soil Health
2.1.6	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?



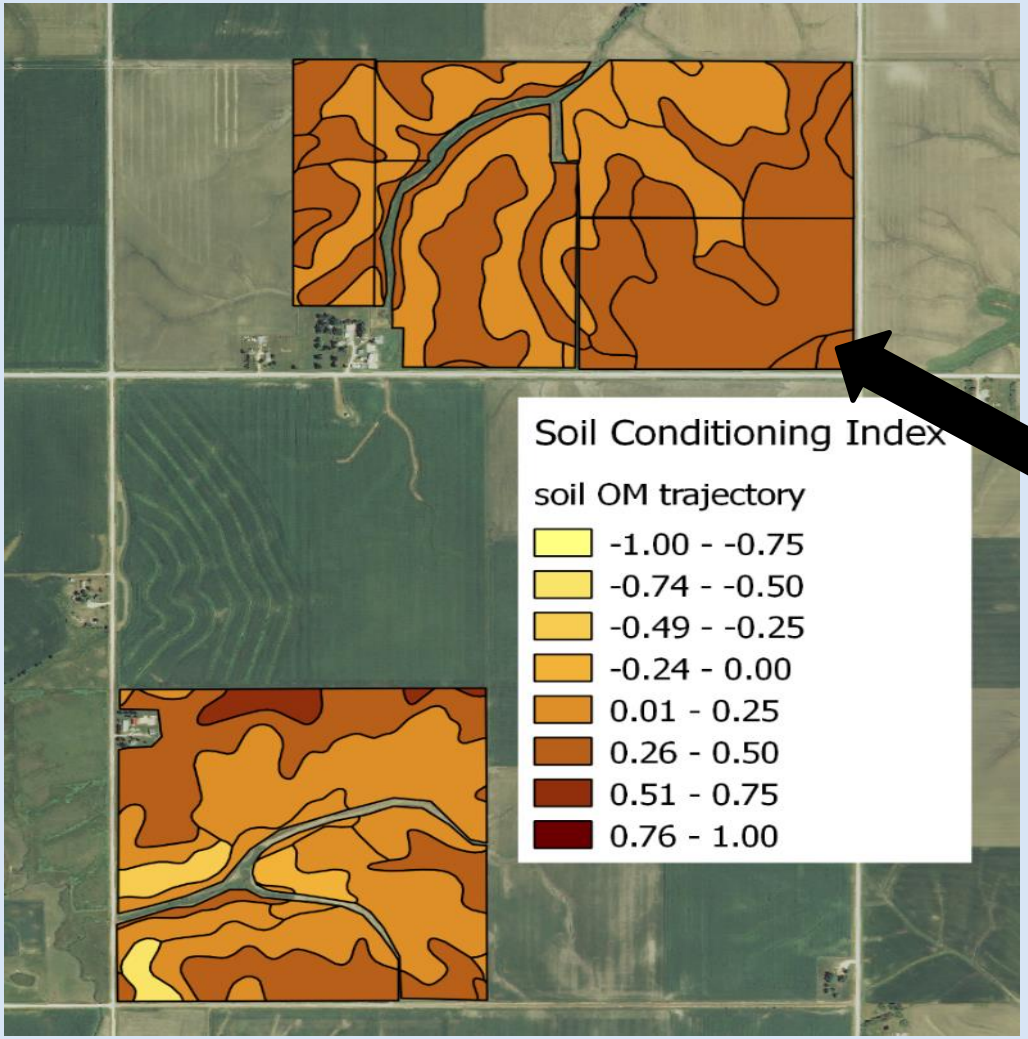
- Soil grid sampling
- SCI > 0 indicates maintaining or increasing soil organic carbon levels

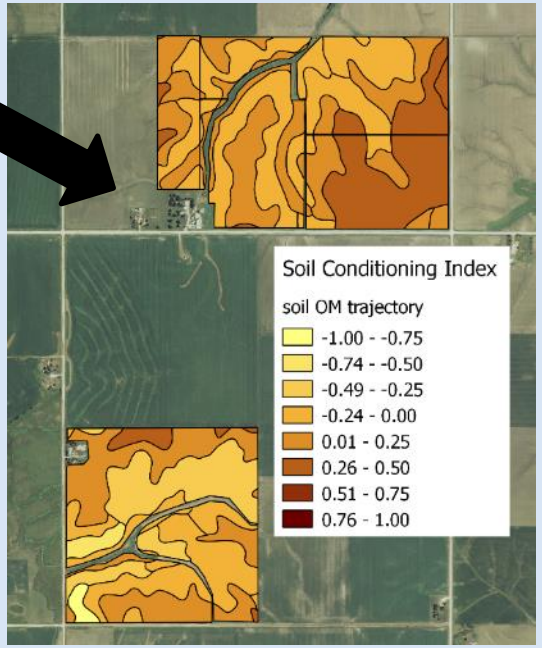


Front-Back Matching: Soils/Water

2.1	Maintain or Improve Soil Health
2.1.6	Soil carbon
	Can you demonstrate that you maintain or improve soil carbon levels?

- SCI > 0 indicates maintaining or increasing soil organic carbon levels
- Applying vegetative buffer conservation practices

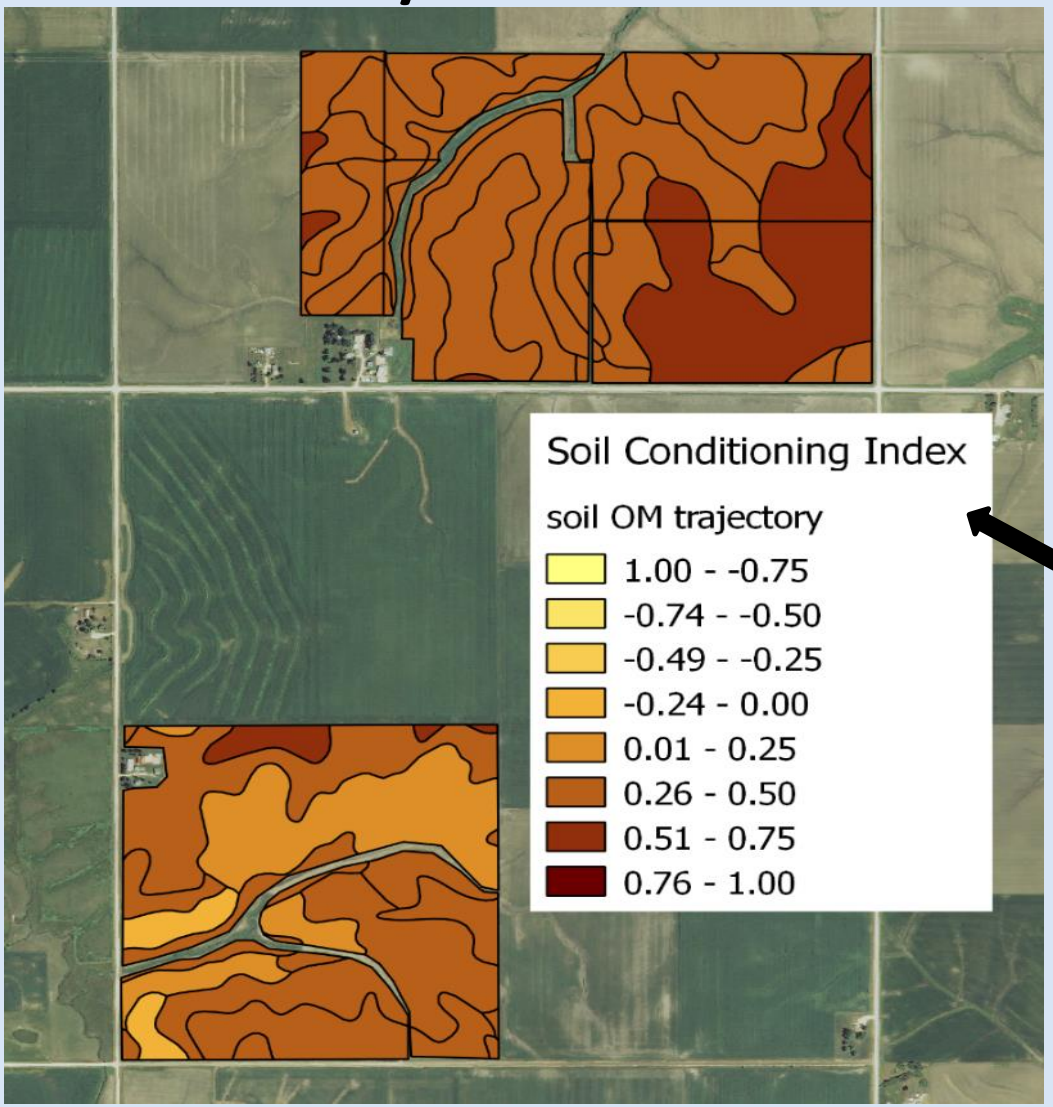


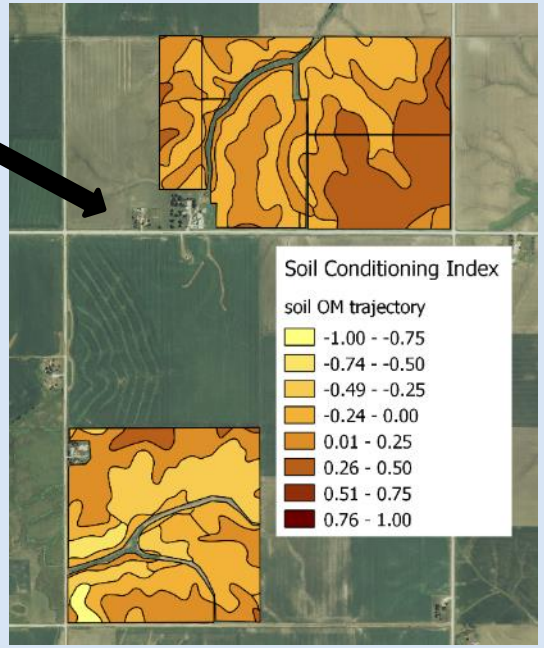


Front-Back Matching: Soils/Water

2.1	Maintain or Improve Soil Health
2.1.6	Soil carbon
	Can you demonstrate that you maintain or improve soil carbon levels?

- SCI > 0 indicates maintaining or increasing soil organic carbon levels
- Applying cover crop conservation practices





Front-Back Matching: Soils/Water

4.1	Water Quality
4.1.6	Phophorus
	Does your operation use the following to avoid ground or surface water contamination? Please document. -Periodic soil sampling -Accurate yield monitoring -Plant tissue testing or colormetric analysis -Conservation Plan modeling
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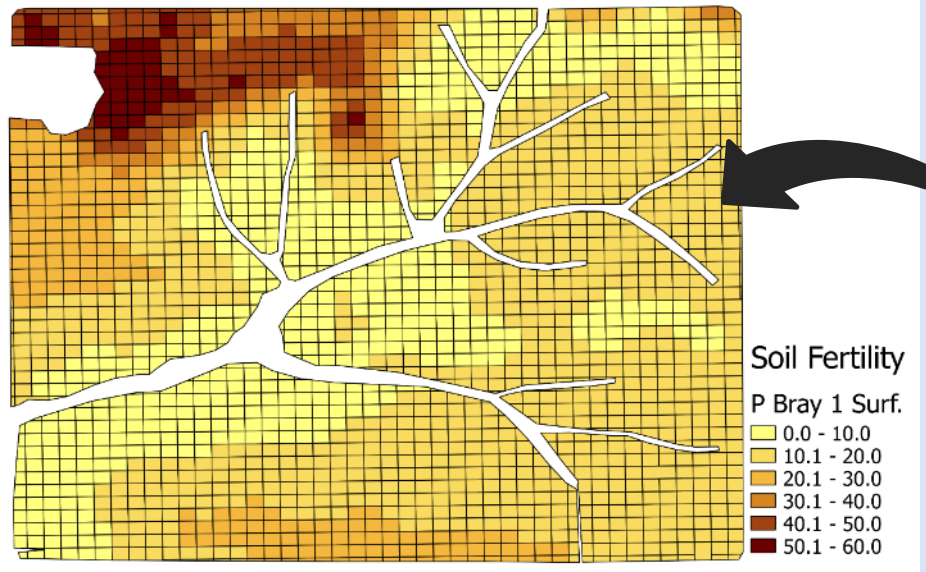
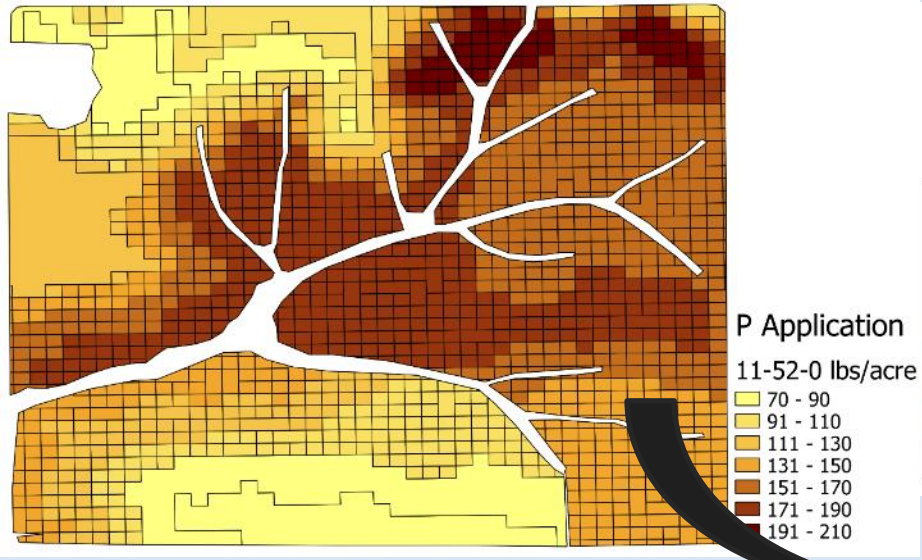
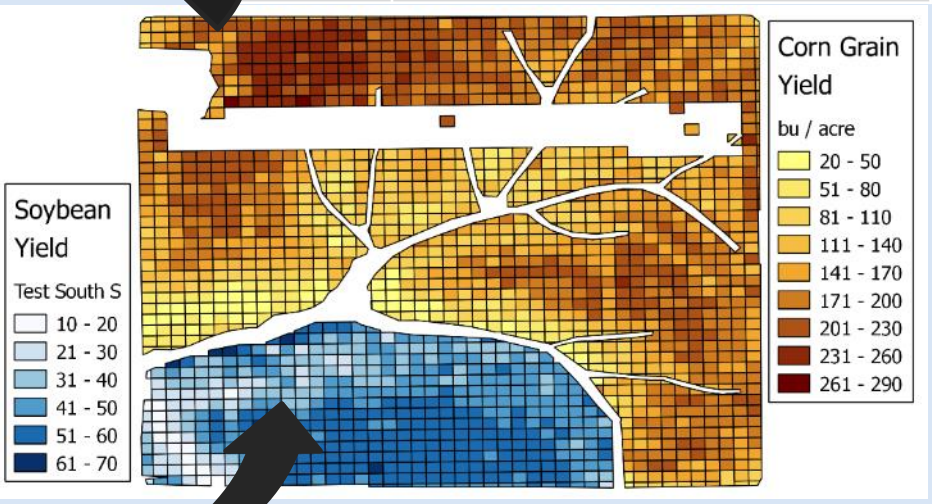
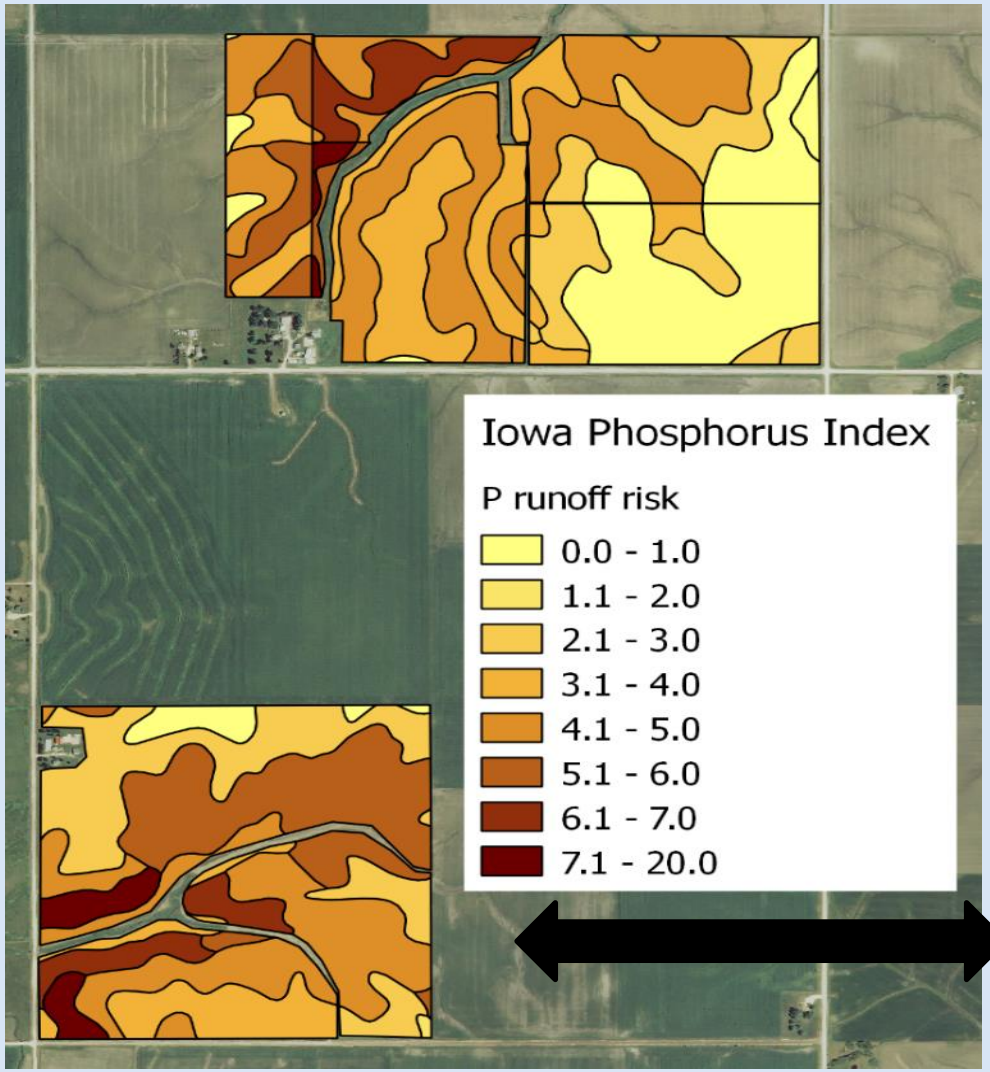






Front-Back Matching: Soils/Water



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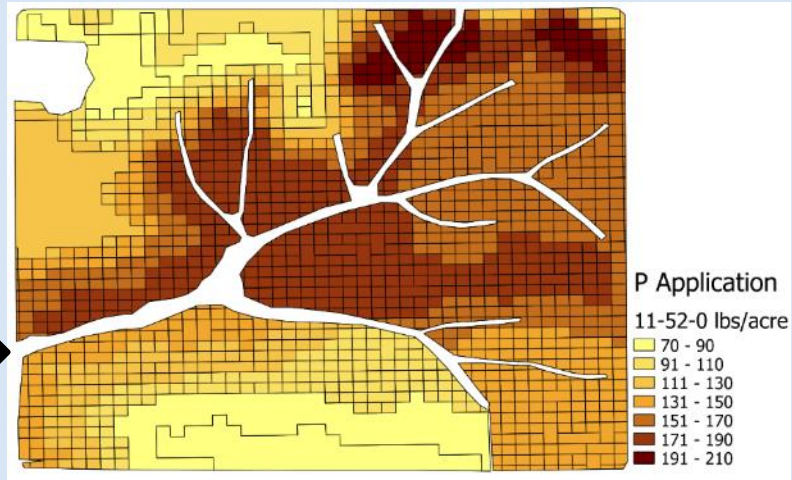
- Current Practices



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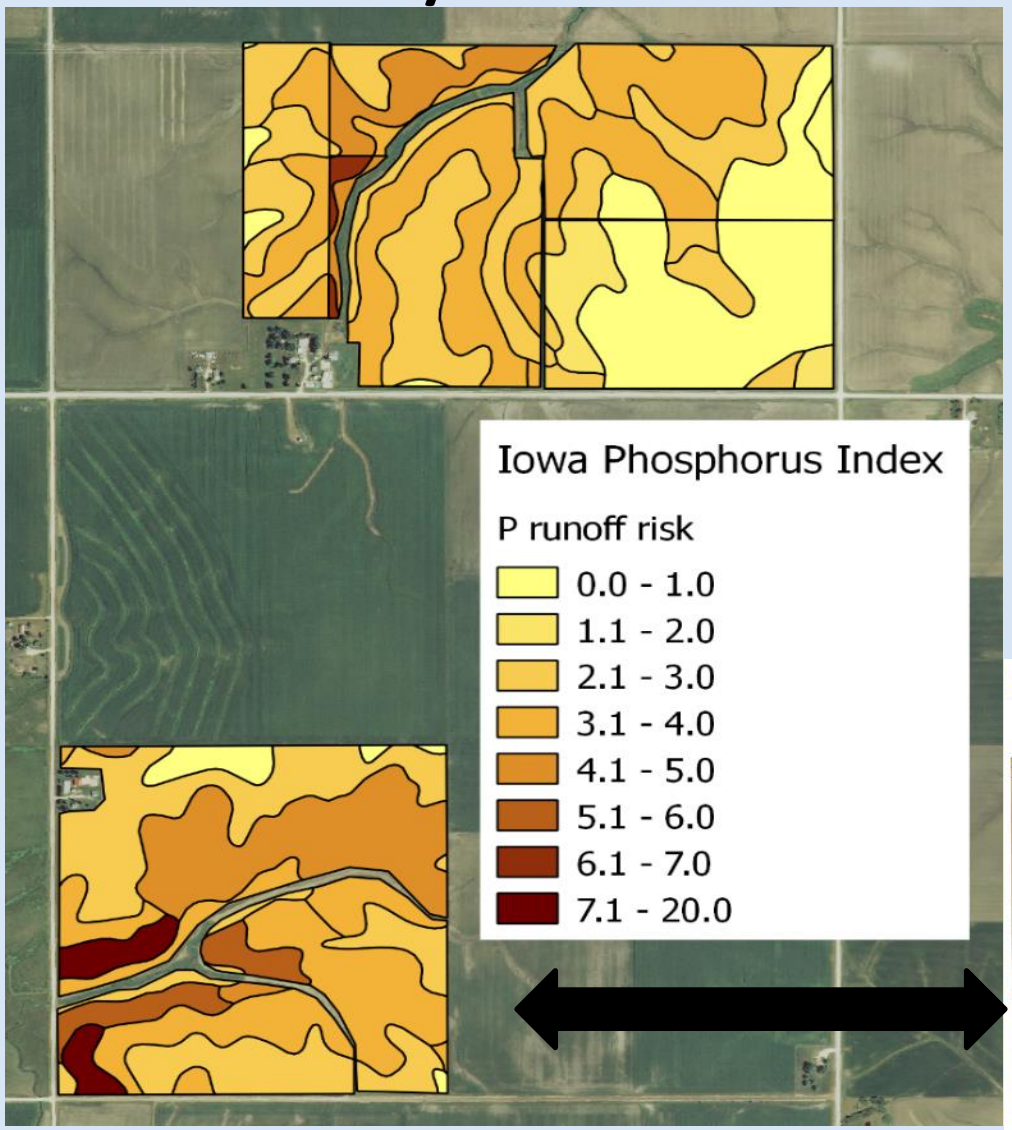

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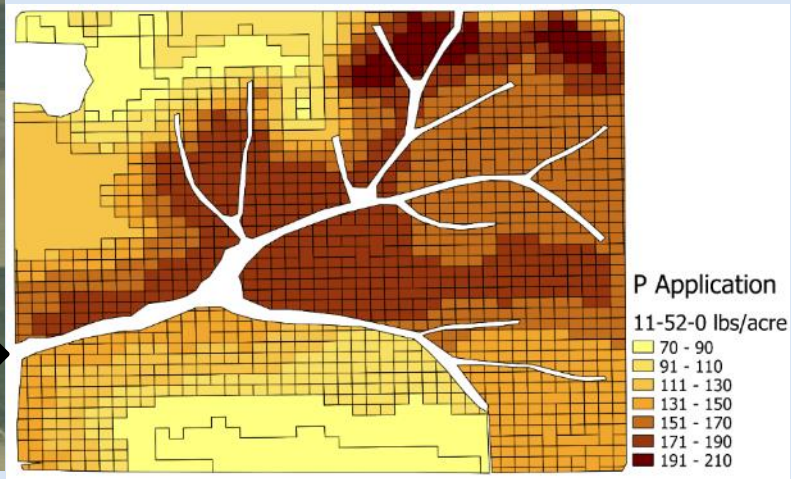
- Vegetative Buffers



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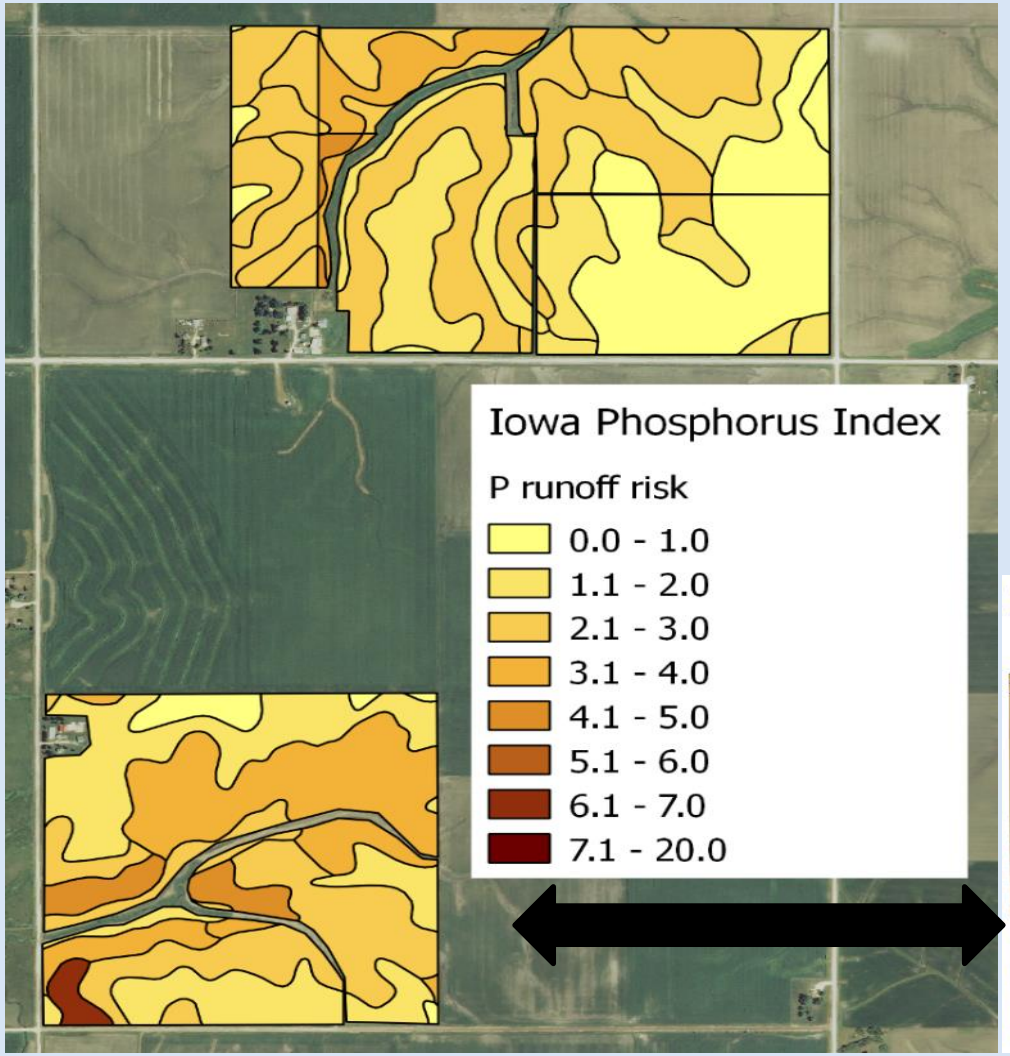
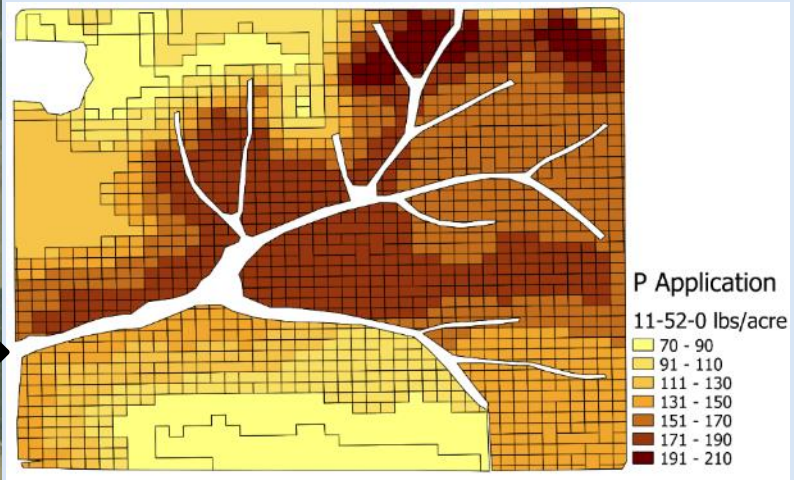


- Cover Crops



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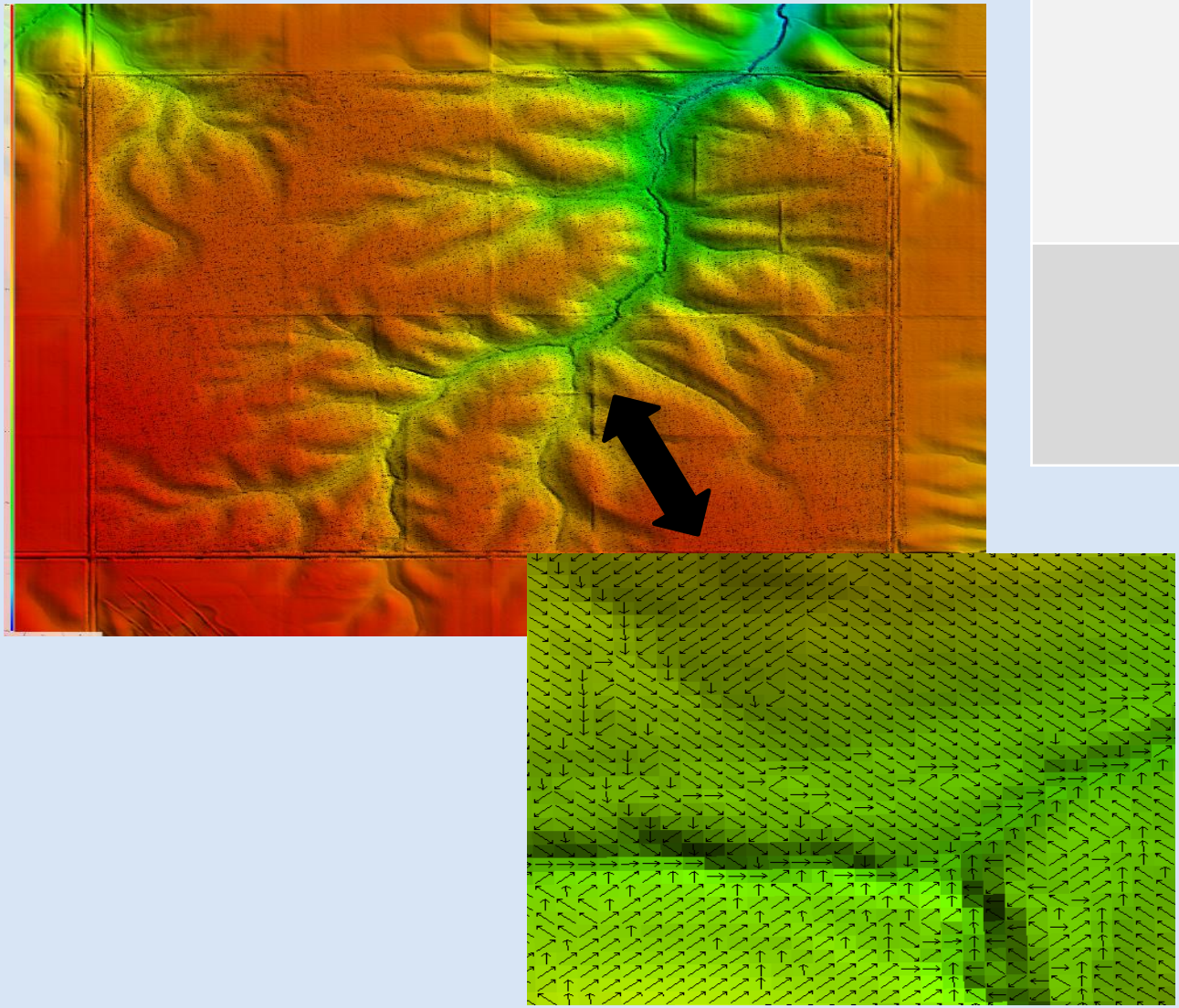

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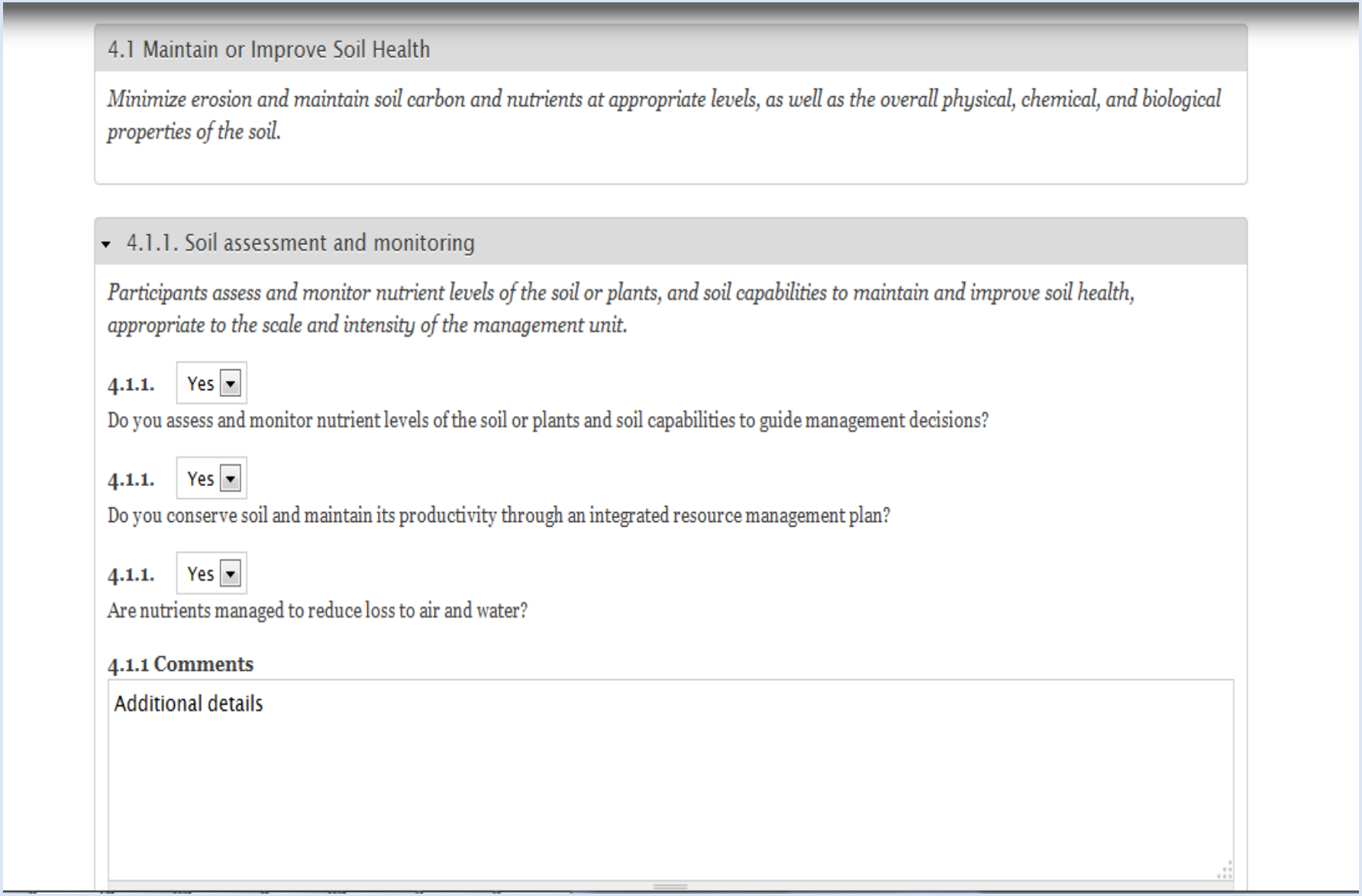
- Nutrient Reduction Strategy

Back-End Mapping: NRCS CPA-52, CPPE

	A	F	G	P	Q
1	?	BMAS Standard Nomenclature			
2		Criterion / Indicator	SOIL	CPA 52	Iowa
3		1.1	Maintain or Improve Soil Health		
4		1.1.1	Soil Productivity and Conservation Planning		
5			Do you assess and monitor nutrient levels of the soil or plants and soil capabilities to guide management decisions?	**Resource Concerns** F: Soil Erosion, Soil Quality Degradation Resource Concerns (Record results from planning steps 3 and 4.) Record the resource concerns that have been identified through the scoping and Resources Inventory and Analysis processes. Use the Resource Planning Criteria and Measurement and Assessment Tools in Section III of the FOTG to identify Resource Concerns present and compare the potential environmental effects of alternatives. Include all resource concerns that apply, adding additional sheets as necessary.	Identification through USDA NRCS, Web Soil Survey for soil capabilities for management decisions http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm?TARGET_APP=Web_Soil_Survey_application_nva0jmuvag5kmhipkp2t5lii Nutrient Assessments developed by Iowa State University Extenstion, available here to determine recommended sampling and assessments: https://store.extension.iastate.edu/Product/A-General-Guide-for-Crop-Nutrient-and-Limestone-Recommendations-in-Iowa - Targets pH between 6.0 and 7.0 for soil, and makes recommendations for lime application based upon reaching the desired level
6			Do you conserve soil and maintain its productivity through an integrated resource management plan?	See Above, see also Resource Considerations, Field Inventory Guide Sheet	See Above and application of conservation through consulting Iowa FOTG resources for specific soil management conservation planning

The BMAS Web-Tool: Education & Outreach



4.1 Maintain or Improve Soil Health

Minimize erosion and maintain soil carbon and nutrients at appropriate levels, as well as the overall physical, chemical, and biological properties of the soil.

4.1.1. Soil assessment and monitoring

Participants assess and monitor nutrient levels of the soil or plants, and soil capabilities to maintain and improve soil health, appropriate to the scale and intensity of the management unit.

4.1.1. Yes

Do you assess and monitor nutrient levels of the soil or plants and soil capabilities to guide management decisions?

4.1.1. Yes

Do you conserve soil and maintain its productivity through an integrated resource management plan?

4.1.1. Yes

Are nutrients managed to reduce loss to air and water?

4.1.1 Comments

Additional details

The BMAS Web-Tool: Forestry

State Best Management Practices (BMPs) for Forestry					
State	Soil or Water Focus	Description	Document Name	Citation/Reference	Other Notes
Alabama	BOTH	Document provides several strategies and approaches to implementing harvest methods, road access for logging, reforesting, wetland management and stabilization	Alabama's Best Management Practices for Forestry	http://www.forestry.state.al.us/publications/BMPs/2007_BMP_Manual.pdf	The 2007 is the most current update of this document
Alaska	BOTH	Alaska has a regulatory provision with suggested methods on implementation of the best management requirements found in the regulations	Implementing Best Management Practices for Timber Harvest Operations from the Alaska Forest Resources and Practices Regulations	http://forestry.alaska.gov/forestpractices.htm#acts	Other relevant documents are included on the site, particularly the regulations and BMP suggestions.
Arizona	???				The program in AZ has been discontinued and finding the documents on the state forestry website are not easily done, though legacy web pages are still present
Arkansas	BOTH	Focuses on reducing the amount of erosion and water pollution for the state, identifying specific practices for harvesting timber, including road creation, wetland protection, reforestation, etc.	Best Management Practices for Water Quality Protection	http://forestry.arkansas.gov/Services/ManageYourForests/Documents/bmpbookrevise.pdf	The 2002 BMP guide is the most recent document for BMP implementation
California	BOTH	California Code of Regulations that controls professional foresters law and water and soil matters	CALIFORNIA FOREST PRACTICE RULES 2014	http://calfire.ca.gov/resource_mgt/downloads/2014_FP_Rulebook_w_TRA_No.1.pdf	
Colorado	BOTH	Emphasizes water protection and quality, but is a condensed version of a bigger document. The BMPs focus on planning to minimizing the impact for the watershed	Forestry Best Management Practices to Protect Water Quality in Colorado	http://csfs.colostate.edu/pdfs/ForestryBMP-CO-2010.pdf	Other, more complete documents are available at http://csfs.colostate.edu/pages/forests-

Biomass Toolbox

Biomass Market Access Standards (BMAS) Group

www.biomasstoolbox.org

Thank you for your time and attention!

jendres2@illinois.edu

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Questions and Discussion

Moderated by Brent Bailey and Helene Cser

Thank You For Your Participation!

A recording of this webinar will be available at: http://www.forestrywebinars.net/previous-webinars

Keep watch for new webinars coming soon!

http://www.se-ibss.org/webinars-1/upcoming-webinars/index.html