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Predictive Soil Health Economic Calculator (P-SHEC) Questionnaire
For "Soil Health Curious" Farmers

(Those who have yet to adopt soil health practices
but are interested in evaluating the potential costs and benefits of doing so)

Row Crop Version: Corn, Soybeans, Hay, and Wheat

August 10, 2021

I. Information Provided in the "Pre-Interview Form"

Thank you for completing the Pre-Interview Form in advance of this full P-SHEC Questionnaire. Your responses have been inserted below. At this point, you should have read and discussed the Predictive Soil Health Economic Assessment Project's "Introduction" document with your advisor and signed the Consent Form. Please do so if you have not. Please complete the rest of this full questionnaire with your advisor.

Name of farm: _____ **Name of farmer:** _____

Total farm acres: *(e.g., 1,100)*_____ **Acres owned:** _____ **Acres rented:** _____

Farm address: _____

Mailing address (if different from above): _____

County: _____ **Watershed:** _____

Phone number: _____ **Email**: _____

Date: _____ **Name of Advisor:** _____

DETERMINE STUDY AREA FOR PREDICTIVE ECONOMIC ANALYSIS:

1. **Is your farm sub-divided into enterprises (e.g., row crop, pasture, vegetables)? If so, please describe each enterprise and associated acreage (please make sure all acres add up to the total farm acres provided above)**:

2. **Please describe your farm's topography** (e.g., rolling hills, flat, flood plain, etc.)**:**

3. **Is your farm organic? (Y/N)** _____

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4. **Please tell us about all the row crop rotations (corn, soybean, wheat, and/or hay) on your farm and, if applicable, associated soil health practices by crop year (crop year generally begins in the fall – the first day after previous crop harvest – and ends the last day of crop harvest) in Table 1.** *(Note, acres of row crop rotations should add up to total acres of row crops provided in Question 1. See example gray rows for guidance.)*

Table 1: Farm Row Crop Rotations and Timeline of Soil Health Practices

Row Crop Rotations			Current Soil Health (SH) Practices	
Rotation Name	**Crop and Years in Rotation**	**Total Acreage**	**SH Practices and Current Acreage**	**Year Initiated Each SH Practice**
E.g., Corn-Soybean-Wheat	*Corn-1, Soy-1, Wheat-1*	*600*	*No-till Soy*	*2010*
E.g., Corn-Hay	*Corn-3, Hay-3*	*500*	*None*	*NA*

5. **Of the rotations, within which rotation have you implemented <u>no or the least amount of</u> soil health practices?**

   Rotation Name and Acreage: *(E.g., Corn-Hay, 500 acres)* _____. **<u>This will be your Study Area.</u>**

6. **Please check the soil health practices you would like your advisor to evaluate using the P-SHEC Tool.** Note, AFT's economic analysis assumes practice(s) are used <u>annually on all acres in the Study Area</u>.

   No-till, Strip-Till, or Reduced Till: ___ Nutrient Management: ___
   Cover Cropping: ___ Conservation Crop Rotation: ____

7. **Please complete the following table for the Study Area current and planned management activities <u>by crop</u>.** Indicate your **<u>current</u>** and **<u>planned</u>** management activities **<u>by crop</u> (split between columns) for that crop year** (crop year generally begins in the fall – the first day after previous crop harvest – and ends the last day of crop harvest). Include as much detail as possible. *(Note that the term planned refers simply to the soil health practices you are considering rather than a formal written conservation plan.)*

Table 2: Predictive Assessment Row Crop Study Area Current and Planned Management

Soil Health Practices		Crop 1: _____	Crop 2: _____	Crop 3: _____
Tillage	**Current**			
	Planned			
Cover Crops	**Current**			
	Planned			
Nutrient Management	**Current**			
	Planned			
Crop Rotation	**Current**			

	Planned	

8. **Fertilizer and Crop Prices (2020 currently):** To estimate the economic effects of adopting soil health practices, the P-SHEC Tool uses prices for fertilizer and crops grown. **If you would like to use your own prices, enter them below.** If any are left blank, we will use national average values for your predictive assessment (**Sources:** Fertilizer prices: https://www.extension.iastate.edu/agdm/crops/pdf/a1-20.pdf; Crop Prices: https://www.nass.usda.gov/Publications/Todays_Reports/reports/cpvl0220.pdf).
    a. Nitrogen ($/lb) _____ (National Ave. = $0.34/lb)
    a. Phosphorus ($/lb) _____ (National Ave. = $0.39/lb)
    b. Potassium ($/lb) _____ (National Ave. = $0.30/lb)
    c. Sulfur ($/lb): _____ (National Ave. = $0.40/lb)
    d. Corn ($/bu) _____ (National Ave. = $4.30/bu, $7.21/bu organic)
    e. Soybeans ($/bu) _____ (National Ave. = $11.15/bu, $20.80/bu organic)
    f. Wheat ($/bu) _____ (National Ave. = $5.00/bu, $8.50/bu organic)
    g. Hay ($/ton) _____ (National Ave. = $159.00/ton, $163.53/ton organic)

Commented [FS1]: Should ask for Potash and % potassium

9. **Learning activities:** The P-SHEC Tool includes an estimated $2.91/acre cost for learning activities associated with implementing new soil health practices. This value is based on an hourly rate of $26.16 (Bureau of Labor Statistics - 2020 Labor Rates, First-Line Supervisors of Farming, Fishing, and Forestry Workers, https://www.bls.gov/oes/current/oes_nat.htm#45-0000) combined with the average of hours per acre spent on learning activities as reported in AFT's seven row crop Retrospective Soil Health Case Studies (featuring already "soil health successful farmers"). If you would prefer to use your own estimates, please complete either or both of the following:
    1. **Hourly labor rate:** _____
    2. **Expected Hours/Year for Study Area Learning Activities:** _____

10. **Please provide a map of your Study Area location to your advisor, or a GPS location.** Your advisor will use this to determine your soil information, specificallythe clay content of your predominant soils in Question 11 (https://casoilresource.lawr.ucdavis.edu/gmap/).

    Study Area GPS location: _____

11. The table below will be completed by your advisor using online soil data to **determine the clay content of your Study Area predominant soils** (https://casoilresource.lawr.ucdavis.edu/gmap/) as described in AFT's guidance document titled "Determining Soil Type". (*Note, soils with less than 40% clay have greater potential to increase*

soil organic matter with soil health practice adoption. [1,2] *This information will be used in Section III of this Questionnaire to aid estimation of the long-term benefits of soil health practice use.*)

Table 3: Study Area Predominant Soil Type(s)

Soil Type(s)	% Dominance	% Clay Content	Soil Texture

12. **Soil Organic Matter (SOM)** - **Have you tested the soils in your Study Area for SOM**? If so, please list test results by location (i.e., lat/long in decimal degrees) or field name in table below.

Table 4: Percent Soil Organic Matter in the Study Area by Sampling Location and Year

Year of Test	Location and/or Field Name	SOM		Year of Test	Location and/or Field Name	SOM

DETERMINE FOCUS FIELD WITHIN STUDY AREA FOR PREDICTIVE ENVIRONMENTAL ANALYSIS (optional):

If you want your advisor to conduct a predictive environmental analysis, identify a Focus Field. Your advisor can conduct a water quality analysis, using USDA's Nutrient Tracking Tool (NTT), and a greenhouse gas emissions analysis, using USDA's COMET Tools to estimate the environmental benefits associated with soil health practice adoption. Questions about growing history needed by the NTT/COMET Tools will be restricted to a what we call a Focus Field.

Use the following criteria to select your Focus Field:

a. Your Focus Field is located within your Study Area and is consistent with the current production and management system of the Study Area described above in Table 2.

b. Ideally, your Focus Field has a long record of historic crop production information.

c. If your Focus Field contains a structural practice (Tile Drain, Filter Strip, Riparian Buffer, Grassed Waterway, Water and Sediment Control Basin, etc.), it must have been installed BEFORE you began implementing soil health practices on the field. That way, the NTT tool will not solely estimate the change in benefits of the structural practice, rather the tool will estimate the change in benefits due to the soil health practice(s).

1. **<u>Is your Focus Field different than your Study Area?</u>**

   i. If yes, proceed to answer the following questions.

   ii. If no, skip to Question 5.

[1] Libohova, Z., C.weybold, D. Wysoki, S. willis, P, Schoeneberger, C. Williams, D. Lindo, D. Stott, P.R. Owens. 2018. Reevaluating the effects of soil organic matter and other properties on available water holding capacity using the National Cooperative Soil Survey Characterization Database. Journal of Soil and Water. Vol 73. No. 4: 411-421.

[2] Hudson, B. 1994. Soil organic matter and available water capacity. J. Soil and Water Cons. Vol 49: 189-194.

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2. **Focus Field Location:**
   b. Qualitative description (optional):

   c. GPS Coordinates: _____
   d. Identify Focus Field Location on an online map with your advisor or provide a map (optional).
3. **Name and acreage of your Focus Field:** _____
4. **Focus Field Crop Rotation:** _____
5. **Choosing between COMET-Farm versus COMET-Planner Tool –** To estimate the greenhouse gas reduction benefits associated with the use of soil health practices, you can choose to use either COMET-Farm or COMET-Planner Tool. Discuss the pros and cons of each Tool with your advisor. **COMET-Farm** provides a **site-specific analysis** reflecting soils and weather data associated with your Focus Field. It also requires a longer, data-intensive interview to obtain historic crop production information for up to 20 years. If detailed crop history is not available, you and your advisor can make assumptions about what was grown in the Focus Field and when. **COMET-Planner** provides a **coarse county-level analysis**. It requires very little time and involves very few questions though results will be general in nature.

   Do you prefer one or the other tool?
   COMET-Farm: _____ COMET-Planner: _____ Not Sure: _____ No preference: _____

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II. Soil Health Practices and Potential Short-Term Economic Impacts

This part of the interview covers the short-term economic changes – both potential costs and benefits – that you anticipate with adoption of the soil health practices you are considering for your farm. We want you to provide responses for the Study Area selected in Section I. Information collected here will be used by the Excel-based P-SHEC Tool to run "what if scenarios" using partial budget analysis. An economic partial budget analysis is simply a cost-benefit analysis that isolates the anticipated costs and benefits associated with the planned soil health practice(s). Any changes that are not related to the soil health practices are not evaluated.

Section II is divided between the soil health practices and combined practices effects. You must provide details of the Study Area's current crop rotation in Question #1 of the Conservation Crop Rotation section, even if the conservation crop rotation is not a soil health practice being analyzed. Otherwise, complete only the parts that pertain to practices you are interested in adopting. For each practice, please tell us how the operation works now and then how it might change with adoption of the new practice. You'll notice that several questions are similar for each practice (e.g., anticipated reduction or increase in nutrients or pesticides, anticipated changes in machinery costs). If you find it difficult to provide an estimate for a change in nutrients, pesticides, or other items attributable to each soil health practice individually, you may instead use the "Combined Practices Effects" section to provide estimates for these changes attributable to the use of practices in combination together. It is alright to leave questions blank if you are unsure.

CONSERVATION CROP ROTATION

(REQUIRED: Complete Current Rotation information even if no change in rotation is planned.)

1. **Describe your Study Area Current Rotation in Table 5 even if you are not planning a change in rotation.** If no change in rotation is contemplated, leave Table 6 blank. (*Note, the information you provide in Table 5 should match information provided in Table 1. Also, make sure to adjust your acres by crop for annualized P-SHEC Tool calculations, so for a 100-acre Study Area with a corn-soybean rotation, you would enter 50 acres in corn and 50 acres in soybeans.)*

Table 5: Study Area Current Rotation

Current Rotation		
Crop	**# Years**	**Acres**
Confirm Sum of Acres Equals Study Area:		

Table 6: Study Area Planned Crop Rotation

Planned Conservation Crop Rotation		
Crop	**# Years**	**Acres**
Confirm Sum of Acres Equals Study Area:		

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2. Identify in Table 7 any **anticipated reductions or increases in primary nutrient inputs (N, P, K) by crop for that crop year** after adoption of the planned Conservation Crop Rotation. *(The example illustrates an anticipated reduction of 30 pounds per acre of N for the corn following hay when hay is introduced into the rotation.)*

Table 7: Anticipated Reductions or Increases in Primary Nutrient Inputs due to Planned Conservation Crop Rotation

Row Crop(s)	N Reduction or Increase (lb/ac)	P Reduction or Increase (lb/ac)	K Reduction or Increase (lb/ac)	Additional Notes
E.g., Corn	*-30 lb/ac for corn after planned hay*	*0*	*0*	

Commented [FS2]: Should ask for potash and % potassium

3. Identify in Table 8 any **anticipated reductions or increases in pesticides used by crop for that crop year** after adoption of the planned Conservation Crop Rotation. Provide current cost per acre (include chemical and application costs) for each pesticide category and the anticipated percent increase or decrease per acre **by crop**. (*The example illustrates an anticipated 30% reduction in insecticide cost from a current cost of $25/acre where use of a conservation crop rotation breaks the pest cycle.)*

Table 8: Anticipated Reductions or Increases in Pesticide Use due to Planned Conservation Crop Rotation

Cash Crop	Herbicides		Insecticides		Fungicides	
	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)
E.g., Soybean	*$25/ac*	*-30% due to potential pest cycle disruption*	*0*	*0*	*0*	*0*

4. Describe in Table 9 below **any other anticipated benefits, costs, or changes in activities** that may occur due to the planned Conservation Crop Rotation (*e.g., additional management costs*).

Table 9: Other Anticipated Benefits, Costs, or Changes in Activities due to Planned Conservation Crop Rotation

Description of Other Anticipated Benefit(s)	$/acre	# Acres Affected
Description of Other Anticipated Cost(s)	**$/acre**	**# Acres Affected**

5. If Conservation Crop Rotation is the only soil health practice you have selected for your predictive assessment, please skip to the **Combined Practices Effects section if you anticipate erosion benefits** due to adoption of the planned Conservation Crop Rotation, OR skip to the **Long-Term Benefits** section of the Questionnaire.

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NO-TILL or REDUCED TILLAGE

1. Please provide information in the tables below on the **machinery/implements** for **current** tillage crop establishment practices and **planned** no-till or reduced tillage soil health practices for the Study Area **by crop for that crop year (crop year generally starts in the fall – the first day after previous crop harvest – and ends the last day of crop harvest.)** We will use this information to calculate the **anticipated machinery cost changes** associated with field preparation and planting for each crop due to switching to No-Till or Reduced Tillage soil health practices.

CROP 1: _____

Table 10a: Crop 1 Current Tillage Machinery

Crop 1 Current Tillage Machinery	Size	Passes/Year*
E.g., Chisel plow	*23 feet*	*1*

Table 10b: Crop 1 Planned No-Till/Reduced Tillage Machinery

Crop 1 Planned No-Till/Reduced Tillage Machinery	Size	Passes/Year*
E.g., No-Till corn planter	*40 feet; 16-row*	*1*

**Note: Be sure to write down all the applicable crop establishment passes & activities (e.g., chisel plow, disking, field cultivator, planting, etc.) as only 1 pass and activity is provided in the example.*

CROP 2: _____

Table 11a: Crop 2 Current Tillage Machinery

Crop 2 Current Tillage Machinery	Size	Passes/Year*
E.g., Chisel plow	*23 feet*	*1*

Table 11b: Crop 2 Planned No-Till/Reduced Tillage Machinery

Crop 2 Planned No-Till/Reduced Tillage Machinery	Size	Passes/Year*
E.g., No-Till corn planter	*40 feet; 16-row*	*1*

**Note: Be sure to write down all the applicable crop establishment passes & activities (e.g., chisel plow, disking, field cultivator, planting, etc.) as only 1 pass and activity is provided in the example.*

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NOTE: IF THERE IS A THIRD CROP IN THE ROTATION, COPY AND PASTE NECESSARY TABLES FOR CROP 3, 4, etc.

2. Identify in Table 12 any **anticipated reductions or increases in primary nutrient inputs (N, P, K)** **by crop for that crop year** after adoption of the planned No-till or Reduced Tillage. *(The example illustrates an anticipated reduction of 30 pounds per acre of N for the corn crop after planned No-Till).*

Table 12: Anticipated Reductions or Increases in Primary Nutrient Inputs due to Planned No-till or Reduced Tillage

Cash Crop	N Reduction or Increase (lb/ac)	P Reduction or Increase (lb/ac)	K Reduction or Increase (lb/ac)	Additional Notes
E.g., Corn	*-30 lbs/ac*	*0*	*0*	

3. Identify in Table 13 any **anticipated reductions or increases in pesticides** **by crop for that crop year** after adoption of the planned No-till or Reduced Tillage. Provide current cost per acre (include chemical and application costs) for each pesticide category and the anticipated percent increase or decrease per acre by crop. (*The example illustrates an anticipated 30% increase in herbicide cost from a current cost of $15/acre due to No-Till.)*

Table 13: Anticipated Reductions or Increases in Pesticide Costs due to Planned No-till or Reduced Tillage

Cash Crop	Herbicides		Insecticides		Fungicides	
	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)
E.g., Soybean	*$15/ac*	*+30%*	*0*	*0*	*0*	*0*

4. Describe in Table 14 any **other anticipated benefits, costs, or changes in activities** that may occur with adoption of the planned No-Till or Reduced Tillage. *(For example, no longer need to pick rocks out of the field.)*

Table 14: Other Anticipated Benefits, Costs, or Changes in Activities due to Planned No-till or Reduced Tillage

Description of Other Anticipated Benefit(s)	$/acre	# Acres Affected
Description of Other Anticipated Cost(s)	**$/acre**	**# Acres Affected**

5. If No-Till or Reduced Tillage is the only soil health practice you have selected for your predictive assessment or you have completed all applicable soil health practice sections, please skip to the **Combined Practice Effects section if you anticipate erosion benefits** from adoption of planned No-Till or Reduced Tillage, OR skip to the **Long-Term Benefits** section of the Questionnaire.

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COVER CROPS

1. Please provide in Table 15 **information about planned use of Cover Crops in the Study Area**. For more information about Cover Crops visit http://mccc.msu.edu/covercroptool/covercroptool.php to use the Midwest Cover Crops Council's Cover Crop Decision Tool, or review AFT's "Sample Cover Crop Options" spreadsheet. *(Examples provided in Table 15 illustrate two different cover crops: non-legume and legume.)*

Table 15: Anticipated Cover Crop Type, Seeding Rate, Seed Costs, Establishment Cost, Termination Cost, and Other Cover Crop Costs

Cash Crop following Cover Crop	Cover Crop Type (include all species in a mix)	Cover Crop Seeding Rate (lb/ac)	Cover Crop Seed Cost ($/ac)	Establishment Cost ($/ac)	Termination Cost ($/ac)	Other Costs (description & $/ac)
E.g., Corn	*Annual ryegrass*	*15 lb/ac*	*$13*	*$12*	*$8*	*None*
E.g., Corn	*Red clover*	*11 lb/ac*	*$30*	*$12*	*$8*	*None*

2. Identify in Table 16 any **anticipated reductions or increases in primary nutrient inputs (N, P, K) by crop** after adoption of the planned Cover Crops. *(The example illustrates an anticipated reduction of 30 pounds per acre of N for the corn crop following a Cover Crop.)*

Table 16: Anticipated Reductions or Increases in Primary Nutrient Inputs due to Planned Cover Crops

Cash Crop following Cover Crop	N reduction or increase (lb/ac)	P reduction or increase (lb/ac)	K reduction or increase (lb/ac)	Additional Notes
E.g., Corn	*-30 lb/ac*	*0*	*0*	

3. Identify in Table 17 any anticipated **reductions or increases in pesticides** used for a cash crop after potentially adopting planned cover crops. Provide the current cost per acre (include chemical and application costs) for each pesticide category and the anticipated percent increase or decrease in your current cost per acre. (*The example illustrates an anticipated 30% increase in herbicide cost from a current cost of $15/acre due to cover crop.)*

Table 17: Anticipated Reductions or Increases in Pesticide Costs due to Planned Cover Crops

Cash Crop following Cover Crop	Herbicides		Insecticides			
	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)
E.g., Soybean	*$15/ac*	*+30%*	*0*	*0*	*0*	*0*

4. Describe in Table 18 any **other anticipated benefits, costs**, **other changes in activities** that may occur with adoption of planned Cover Crop (excluding forage-related benefits as that is covered in Question 6):

Table 18: Other Anticipated Benefits, Costs, or Changes in Activities due to Planned Cover Crops

Description of Other Anticipated Benefit(s)	$/acre	# Acres Affected
Description of Other Anticipated Cost(s)	**$/acre**	**# Acres Affected**

5. If Cover Cropping is the only soil health practice you have selected for your predictive assessment or you have completed all applicable soil health practice sections, please skip to the **Combined Practice Effects section if you anticipate erosion benefits**, OR skip to the **Long-Term Benefits** section of the Questionnaire.

GRAZING & HAYING OF COVER CROPS

Please answer the following questions to the best of your ability if you want to know the potential economic benefits and costs of grazing Cover Crops or harvesting Cover Crops for hay in your Study Area.

1. **Anticipated grazing infrastructure costs in $/acre:**
   - Fence: _____$/ac
   - Watering Facilities: _____$/ac
   - Additional Labor and Management: _____$/ac
   - Other Annual Grazing Cost: _____$/ac
2. Describe your **planned Cover Crop grazing system** in the applicable row(s) in Table 19:

Table 19: Anticipated Cover Crop Acres Grazed and Grazing Information

Type of Herd	Cover Crop Acres to be Grazed (Acres)	Anticipated Number Days of Grazing Cover	Anticipated Stocking Rate (AU/ac)	Anticipated Forage Demand (lb/AU/day)
Dairy Cows				
Cow/Calf				
Stockers				

3. **Anticipated cover crop harvesting costs**:
   - How many acres did you harvest? _____
   - What was your hay yield (ton/ac)? _____
   - What do you estimate are your harvesting costs ($/ac)? _____
   - What additional costs are incurred? _____
4. Provide any **other anticipated benefits or costs of grazing or harvesting Cover Crops** (e.*g., number days of fall grazing were extended or ability to start spring grazing earlier by a number of days):*

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NUTRIENT MANAGEMENT

1. If you have a **NRCS Practice Code 590 Nutrient Management Plan or a Nitrogen Plan for your Study Area**, enter the year it was prepared next to the person or organization who prepared your Plan in the following table:

Table 20: Study Area Nutrient Management Plan

Preparer	NRCS 590 or Nitrogen Nutrient Management Plan Year Prepared	Notes
Natural Resources Conservation Service		
Advisor via NRCS Cost-Share Program		
State Nutrient Management Planner		
Cooperative Extension Service		
Soil and Water Conservation District		
Ag Retailer		
Certified Crop Advisor		
Professional Agronomist		
Self-Certification		
Other:		

2. Please describe your **current and planned fertilization activities by crop for that crop year (crop year generally begins in the fall – the first day after previous crop harvest – and ends the last day of crop harvest)** in your Study Area:

   a. Describe **current** Nutrient Management activities by crop for that crop year (e.*g., fall application, soil testing)*:

   b. Describe **planned** Nutrient Management activities by crop for that crop year (e.*g., split application, Variable Rate Technology):*

3. If you anticipate your fertilizer application machinery will change due to adoption of the planned Nutrient Management activities, complete the following tables listing **your current and planned fertilizer application machinery/implements by crop for that crop year.** *(Note, be sure to include implements used to spread manure or compost if appropriate. For manure spreading, instead of passes per year, provide gallons per acre for liquid manure and hours per acre for solid manure applied with a spreader.)*

CROP 1: _____

Table 21: Crop 1 Current Machinery for Nutrient Management (NM) Activities

Crop 1 Current NM Machinery	Size	Passes/Year, Gallons/Acre, or Hours/Acre
E.g., NH3 Applicator	*40-feet*	*2 passes/yr*

Table 22: Crop 1 Planned Machinery for Nutrient Management (NM) Activities

Crop 1 Planned NM Machinery	Size	Passes/Year, Gallons/Acre, or Hours/Acre
E.g., No-Till corn planter	*40-feet; 16-row*	*1 pass/yr*

CROP 2: _____

Table 23: Crop 2 Current Machinery for Nutrient Management (NM) Activities

Crop 2 Current NM Machinery	Size	Passes/Year, Gallons/Acre, or Hours/Acre
E.g., Chisel plow	*23 feet*	*1*

Table 24: Crop 2 Planned Machinery for Nutrient Management (NM) Activities

Crop 2 Planned NM Machinery	Size	Passes/Year, Gallons/Acre, or Hours/Acre
E.g., No-Till corn planter	*40-feet; 16-row*	*1*

NOTE: IF THERE IS A THIRD CROP IN THE ROTATION, COPY AND PASTE NECESSARY TABLES FOR CROP 3, 4, etc.

4. Identify in Table 25 any **anticipated reductions or increases in primary nutrient inputs (N, P, K) by crop for that crop year** after adoption of the planned Nutrient Management activities. *(The example illustrates an anticipated reduction of 30 pounds per acre of N for the corn crop after adopting a nutrient management plan.)*

Table 25: Anticipated Reductions or Increases in Primary Nutrient Inputs due to Planned Nutrient Management Activities

Cash Crop	N Reduction or Increase (lb/ac)	P Reduction or Increase (lb/ac)	K Reduction or Increase (lb/ac)	Manure/Compost Reduction or Increase (ton/ac)	Additional Notes
E.g., Corn	*-30 lb/ac*	*0*	*0*	*0*	

5. **If planned NM activities involves applying manure or compost that is purchased off-farm:**
   a. How much do you pay per ton? _____
   b. What type of manure or compost do you purchase? _____

6. Identify in Table 26 any **anticipated reductions or increases in pesticides by crop for that crop year** after adoption of the planned Nutrient Management activities. Provide current cost per acre (include chemical and application costs) for each pesticide category and the anticipated percent increase or decrease per acre. (*The example illustrates an anticipated 30% increase in herbicide cost from a current cost of $15/acre.)*

Table 26: Anticipated Reductions or Increases in Pesticide Costs due to Planned Nutrient Management

Cash Crop	Herbicides		Insecticides		Fungicides	
	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)
E.g., Soybean	*$15/ac*	*+30%*	*0*	*0*	*0*	*0*

7. Describe in Table 27 any **other anticipated benefits, costs, or changes in activities** that may occur with adoption of the planned Nutrient Management activities *(e.g., increased frequency of soil testing):*

Table 27: Other Anticipated Benefits, Costs, or Changes in Nutrient Management Activities

Description of Other Anticipated Benefit(s)	$/acre	# Acres Affected
Description of Other Anticipated Cost(s)	**$/acre**	**# Acres Affected**

8. If Nutrient Management is the only soil health practice you have selected for your predictive assessment or you have completed all applicable soil health practice sections, please use the **Combined Practice Effects section if you anticipate erosion benefits**, OR skip to the **Long-Term Benefits** section of the Questionnaire.

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COMBINED PRACTICES EFFECT

1. Identify in Table 28 any **anticipated reduction or increase in primary nutrient inputs (N, P, K) by crop for that crop year** after adoption of the planned combination of soil health practices you are considering. *(The example illustrates a reduction of 30 lbs/ac of N for the corn based on a revised nutrient management plan and introduction of legume cover prior to planting corn.)*

Table 28: Anticipated Reductions or Increases in Primary Nutrient Inputs due to Planned Soil Health Practices

Cash Crop	N Reduction or Increase (lb/ac)	P Reduction or Increase (lb/ac)	K Reduction or Increase (lb/ac)	Additional Notes
E.g., Corn	*-30 lbs for corn due to*	*0*	*0*	

2. Identify in Table 29 any **anticipated reductions or increases in pesticides by crop for that crop year** after adoption of the planned combination of soil health practices. Provide current cost per acre (include chemical and application costs) for each pesticide category and the anticipated percent increase or decrease per acre. (*The example illustrates an anticipated 50% increase in herbicide cost from a current cost of $20/acre in the soybean crop where introducing a cover crop and switching to no-till adds to herbicide expense.)*

Table 29: Anticipated reductions or Increases in Pesticide Costs due to due to Planned Soil Health Practices

Cash Crop	Herbicides		Insecticides		Fungicides	
	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)	Current Cost ($/ac)	Anticipated % Change (+/-)
E.g., Soybean	*$20/ac*	*+50% due*	*0*	*0*	*0*	*0*

3. Identify **anticipated reduction in soil erosion** due to the adoption of the planned soil health practices in the Study Area:
    a. Provide an **anticipated reduction in sheet and rill erosion: _____ Tons/Acre/Year**
    *(Note: If you are uncertain, your advisor can calculate this for you using the Nutrient Tracking Tool, or you may use the average of **1.2 tons/ac/yr**, which is based on the NTT results from three AFT Retrospective Soil Health Case Studies featuring already "soil health successful" row crop farmers.)*

    b. **Is mechanical erosion repair a typical part of your Study Area operation?** (Y/N) _____
        i. If yes, please provide:
            1. An **anticipated total annual DECREASE in mechanical erosion repair cost** due to adoption of the planned soil health practices **in the Study Area**: - _____ **$/year**
            2. A **description** of the mechanical erosion repair activities **within your Study Area** that are currently carried out on an annual basis, and how/why the activities may change with adoption of the planned soil health practices:

4. Describe in Table 30 below any **anticipated other benefits, costs, or other changes in activities** that may occur with the combined adoption of the planned soil health practices *(e.g., additional management costs*):

Table 30: Other Benefits, Costs, or Changes in Activities due to Planned Soil Health Practices

Description of Other Benefit(s)	$/acre	# Acres Affected
Description of Other Cost(s)	**$/acre**	**# Acres Affected**

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III. POTENTIAL LONG-TERM ECONOMIC BENEFITS

This part of the Questionnaire collects information needed to estimate the potential long-term benefits that may accrue after consistent annual use of the planned soil health practices over time for the Study Area. The analysis focuses on three types of long-term benefits: crop yield, nutrient availability, and soil water holding capacity. Because emerging scientific research has identified relationships between soil organic matter (SOM) and all three of these benefit categories. We have tied these future, long-term benefits to the anticipated rate of change in SOM occurring over time with adoption of the planned soil health practices.

Research indicates increased SOM may increase:

- Crop yields due to improvements in soil tilth, better soil structure, less water logging, better crop stands
- Nutrient availability through improved nutrient cycling
- Soil water holding capacity providing:
  - Improved yield drought tolerance for dryland farming, or
  - Avoided irrigation costs through decreased water or diesel fuel use for irrigated cropland

Background about SOM: The annual change in SOM is estimated using COMET Planner (http://www.comet-planner.com/) which calculates the change in soil carbon at the county level for a range of soil health management changes. The annual increase in SOM is derived from the soil carbon output through a series of calculations made by AFT soil scientists. The various benefits categories rely on a combination of your input and default values for some variables. Although the questions for the analysis are focused on a 1% improvement in SOM, the actual benefit amounts are based on the P-SHEC Tool's estimated annual increase in SOM for your Study Area.

1. **General Study Area Information**: The following information will be used to calculate the discounted present value of soil health benefits that ***may accrue*** in the future within the Study Area. Please select:
   a. **A planning horizon (from 5 to 20 years):** _____
   Planning horizon is the length of time being analyzed. This assumes continued, **annual use** of soil health practices on all the acres in the Study Area. The longer the planning horizon, the more time available to accrue soil health benefits.

   b. **An interest rate or discount rate (between 1 and 15%):** _____
   Discount rate is a commonly published value used in amortizations. Three percent has been a common value in a low-interest rate environment. Other options could be to use the annual rate of your typical operating loan or the interest charged for new equipment purchases. At higher discount rates, money in the future has even less value than at lower discount rates.

   c. **Soil health management options** (based on COMET-Planner options)**:** Select up to **four** from the list (no more than one per category):

   Conservation crop rotations

   _____ Add Perennial Crops to Rotations *(Note: listed as Decrease Fallow Frequency or Add Perennial Crops to Rotations in the P-SHEC Tool)*

   Tillage options:
   _____ Intensive Till to No-Till or Strip-Till
   _____ Intensive Till to Reduced Till
   _____ Reduced Till to No-Till or Strip-Till

Cover crop options:
_____ Add Legume Seasonal Cover Crop
_____ Add Non-Legume Seasonal Cover Crop

Nutrient management options:
_____ Replace Synthetic N Fertilizer with Beef Feedlot Manure
_____ Replace Synthetic N Fertilizer with Chicken Broiler Manure
_____ Replace Synthetic N Fertilizer with Chicken Layer Manure
_____ Replace Synthetic N Fertilizer with Compost (CN ratio 10)
_____ Replace Synthetic N Fertilizer with Compost (CN ratio 15)
_____ Replace Synthetic N Fertilizer with Compost (CN ratio 20)
_____ Replace Synthetic N Fertilizer with Compost (CN ratio 25)
_____ Replace Synthetic N Fertilizer with Dairy Manure
_____ Replace Synthetic N Fertilizer with Other Manure
_____ Replace Synthetic N Fertilizer with Sheep Manure
_____ Replace Synthetic N Fertilizer with Swine Manure

2. **General Study Area Yield Increases due to Soil Health Practices**: There is a possibility that, by adopting a suite of soil health practices, your yields may increase due to improved soil structure which improves internal drainage, reducing waterlogging and saturated soil. These changes can result in improved germination and better crop stands. (Improved nutrient cycling and drought resiliency yield benefits are covered in the next two sections below and, therefore, should not be accounted for here.) Soils that have been seriously depleted are more likely to see a yield increase than soils that are already performing well. Information collected in this section will be used to calculate this optional benefit.

   Complete Table 31 for each crop included in the analysis. If you are not comfortable predicting a yield increase but nevertheless feel that yields may increase in the future due to improved soil health, you may elect to use the average of yield increases reported by four "soil health successful" corn-soybean farmers featured in AFT's Retrospective Soil Health Case Studies (average yield increases for corn and soybeans are 8% and 12% respectively). If you entered crop prices in Part I of this Questionnaire, we will use your prices for the calculation, otherwise, we will use national average crop prices.

Table 31: Anticipated Potential Increase in Yield due to Planned Soil Health Practices

Cash Crop	Corn (Bu)	Hay (Ton)	Soybeans (Bu)	Wheat (Bu)
Current Average Yield				
% Potential Increase from Current Average				

3. **Overall Study Area Soil Fertility Benefit:** This section captures the estimated quantity and value of the nitrogen, phosphorus, and sulfur available to the crop due to improved nutrient cycling as soil organic matter increases. This input accounts for the additional nutrient value beyond the anticipated nutrient input reductions captured in the short-term analysis. We will use your prices for nitrogen, phosphorus, and sulfur nutrient inputs if you entered them in Part I of this Questionnaire, otherwise, we will use national averages. Information collected in this section will be used to calculate this optional benefit.

a. Potential Plant Available Nutrient Amount due to a 1% Increase in SOM: As SOM improves, the rate of nutrient mineralization increases thereby increasing the availability of nitrogen, phosphorus, and sulfur in the soil for plant uptake. The P-SHEC Tool can estimate this for you* using suggested lbs/ac plant available nutrient amounts, but if you would prefer to use your own values, please enter them below:

i. Nitrogen (lb/ac): _____
ii. Phosphorus (lb/ac): _____
iii. Sulfur (lb/ac): _____

**Note: the P-SHEC Tool conducts a calculation based on your Study Area SOM, soil texture, an 8" sampling depth, and an annual mineralization factor, following the procedure outlined in the 2014 "Soil Organic Matter, Soil Health – Guides for Educators" by USDA, NRCS (https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053140.pdf). Below is a table of suggested annual plant available nutrient amounts:*

Suggested Lbs/Ac Plant Available Nutrient Amnt. due to 1% SOM Increase[1,2]			
State	Nitrogen	Phosphorus	Sulfur
California	24	2.4	2.5
Illinois	44	4.4	2.5
Ohio	45	4.5	2.5
New York	44	4.4	2.5

[1] Nitrogen: NT email correspondence with Alan Franzluebbers (ARS Ecologist, Raliegh NC), March 2020.
[2] Phosphorus & Sulfur: The Value of Soil Organic Matter, No-Till Farmer, July 8, 2012

4. Study Area Water Storage Benefits: In this portion of the analysis, we account for anticipated soil health practice benefits associated with improved water holding capacity making the soil more drought resistant. This benefit is calculated for **either dryland farming situations (a) or irrigated cropland (b).** Fill out section (a) or (b).

a. **Dryland Farming Drought Resistance:** For operations without irrigation, we are comparing current average yield losses due to drought (see Guidance Box below for estimates by location based on historical weather and crop yield data) with anticipated yield losses after a 1% increase in SOM. Note, if you have entered your own crop prices in Part I of this Questionnaire, we will use them for these calculations, otherwise, we will use national averages. Please provide the following information (**Question iii is required**):

i. The P-SHEC Tool uses historic drought data from the Palmer Drought Severity Index (https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/maps), to estimate the annual drought probability in your region. If you would prefer to use your own **drought probability** based on weather in your area, you may enter it here as a percent: _____

ii. The P-SHEC Tool also uses historic crop yield data from National Agricultural Statistics Service (https://www.nass.usda.gov/index.php) to estimate severe drought yield impact in your state for corn, hay, and soybeans. * If you would prefer to use your **historic percent yield loss during drought** based on crop insurance or other records for each of these crops, please enter the information below:

Corn (% yield loss during drought): _____

Soybeans (% yield loss during drought): _____

Hay (% yield loss during drought): _____

**Note, wheat is not included here since droughts typically occur later in the growing season after wheat has been harvested.*

iii. Assuming there will be improved drought resistance from a 1% increase in SOM, for each crop within the Study Area, in comparison to historic yield loss during drought (as indicated in the Guidance Box below), **estimate the potential yield loss with a 1% increase in SOM**:
Corn (%): _____
Soybeans (%): _____
Hay (%): _____

Guidance for Estimated % Yield Loss due to Drought after a 1% Increase in SOM: This value should be less than the *Historic % Yield Loss in Drought Years.* For example, according to the table below, the *Historic % Yield Loss due to Drought for Illinois* is 39%, thus, a reasonable value for the *Estimated Future % Yield Loss due to Drought after a 1 % Increase in SOM* could be 20%.

Historic % Yield Loss in Drought Years			
State	**Corn**	**Soybeans**	**Hay**
Illinois	39%	16%	20%
Ohio	14%	9%	17%
New York	16%	11%	18%

-OR-

b. **Avoided Irrigation Costs**: If you are irrigating your crops in the Study Area, we will estimate the soil water storage benefit of adoption of the planned soil health practices by calculating your **current annual costs of irrigating (either water use (i-ii) OR energy use (iii-iv)) and estimating the anticipated percent decrease in water use or diesel fuel use due to a 1% increase in SOM** (due to improved water holding capacity). Please provide the following information ideally for your Study Area, otherwise typical or average usage for the farm is ok (**Question v is required**):

Study Area Current Annual Water Use:

i. **Current pumping Cost: _____ $/acre-inch**
ii. **Current Water Use: _____ acre-inch/acre/year**
1. If you do not know your current water use on a per acre basis:
a. Total Water Use: _____ **acre-inches/year**
b. Total Acres (where irrigation occurs): _____ **acres**

-OR-

Study Area Current Annual Energy Use:

iii. **Current Price of Diesel Fuel or Electricity ($/Gal or $/KwH): _____**
iv. **Current Annual Diesel or Electricity Use (Gal or KwH): _____**
1. If you do not know your current diesel fuel use on a per acre basis:
a. Total Diesel Use: _____ **gal/year**
b. Total Acres (where diesel is used to irrigate): _____ **acres**

-AND-

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Study Area Anticipated Change in Irrigation Water or Energy Use:

v. **Assuming there will be improved soil water holding capacity from a 1% increase in SOM, estimate the percent decrease in water or energy use** (see Guidance Box below): _____ **%**

Guidance for Estimated % Decrease in Water/Diesel Fuel: Research has shown that soils with >40% clay content have a more limited potential for increasing available water holding capacity as SOM increases. Reference the list of your Study Area predominant soils detailed in **Section I** completed by your advisor based on online soil data. Knowing the clay content of the soil should guide in finding a reasonable value. For example, if a soil has >40% clay content, % decrease in water or diesel fuel use might be just 10% but if clay content is <40%, % decrease in water or diesel fuel use might be 20%.