CLIMATE ACTION RESERVE

Nitrogen Management Project Protocol V2.0

Workgroup Meeting 4

June 20, 2018

This work supported in part through a grant from the USDA Natural Resources Conservation Service, Agreement Number 69-3A75-16-016.

Agenda

8:30 – 8:45	Welcome & Overview; Summary of Changes
8:45 – 10:00	Quantification Methodology (Mark Easter Consulting LLC)
10:00 – 10:15	Break
10:15 – 10:45	Project Definitions
10:45 – 11:45	Eligibility Rules
11:45 – 12:00	Break
12:00 – 12:30	GHG Assessment Boundary & Quantification Methodology (Reserve)
12:30 – 1:00	Monitoring, Reporting and Verification
1:00 – 1:30	Other Issues, Wrap Up, & Next Steps

Reserve Staff

- Trevor Anderson, *Policy Associate*
  - Protocol development lead
- Sami Osman, *Senior Policy Manager*
  - Assist with protocol development
- Beatrice Zavariz, *Policy Associate*
  - Assist with protocol development; Meeting coordinator

Workgroup (WG) Members

Name (alphabetical)	Organization
Tom Bruulsema; Tai McClellan Maaz	International Plant Nutrition Institute (IPNI)
Sally Flis	The Fertilizer Institute (TFI)
Ritwick Ghosh	Cornell University
Noel Gurwick	U.S. Agency for International Development (USAID)
Alastair Handley	Carbon Credit Solutions Inc.
Richard Kennedy & Alicia Klepfer	Climate Smart Group
Dave Lundberg & Jim Pollock	Veri6 Inc

Workgroup (WG) Members

Name (alphabetical)	Organization
Neville Millar	Michigan State University (MSU)
Meredith Niles	University of Vermont
Robert Parkhurst & Amy Hughes	Environmental Defense Fund (EDF)
Jessica Rudnick & Mark Lubell	UC Davis
Richard Scharf	Environmental Services, Inc.
Michael Wara	Stanford University
Hannah Waterhouse	UC Davis

Technical Contractors

- Colorado State University Team
  - Keith Paustian – Professor
  - Mark Easter – Senior Research Associate
  - Ernie Marx – Research Associate
  - Amy Swan – Research Associate
  - Stephen Williams – Research Associate

Process Timeline

Milestone/Task	Timeline
Technical Contractor begins work	Aug 1, 2017
Staff work with contractor	Aug 2017 – Jul 2018
1st WG meeting (webinar) – technical elements	Aug 29, 2017
Staff protocol drafting	Sep 2017 – Jul 2018
2nd WG meeting (webinar) – quantification methodology (QM)	Oct 10, 2017
3rd WG meeting (webinar) – QM	Dec 12, 2017
Draft protocol to Workgroup	Jun 14, 2018
4th WG meeting (webinar) - draft protocol sections	Jun 20, 2018
WG comment on draft protocol	Jun – Jul 2018
Revised protocol & start of 30-day public comment period	Jul – Aug 2018
“Board-ready” protocol	Sep 2018
Final protocol adoption by Reserve Board	Oct 17, 2018

Purpose

- Provide update on changes from V1.1 to V2.0
- Demonstration of new Quantification Tool
- Walk through V2.0 draft protocol in detail
  - Focus on sections and issue areas where Reserve is seeking comment or have undergone significant change
  - Discuss questions, options and identify directions for further improvement
- Next Steps

Summary of Changes from V1.1 to V2.0

Protocol Element	V1.1	V2.0
Practices	Synthetic N Rate Reductions	Synthetic N Rate Reductions; Nitrification inhibitor or Slow-release fertilizer; Long-Term No-Till (under consideration)
Crops	Corn (grain + silage)	Corn (grain + silage), Barley, Cotton, Oats, Sorghum (grain), Spring Wheat, Winter Wheat, Tomatoes
Regions	U.S. North Central Region	Contiguous U.S. 48 States (pending data availability for additionality tests and capabilities of quantification methodology)
Project Size	1 Field	1 or More Fields
Aggregation	More than 1 field; field size limits; aggregate size distinctions	Can aggregate multiple fields / farmers into single project AND / OR multiple projects can combine into cooperative for joint MRV
Ownership Structure	Single field – simple ownership	Can be multiple owners / managers – must nominate single project developer
Irrigation	Emergency-Only	Allowed; SSR 4 included in GHG Assessment Boundary
Start Date	6 months prior to submission	12 months prior to submission
Initial Reporting Period	1 cultivation year	1-2 cultivation years
Crediting Period	5 reporting periods	10 reporting periods

Summary of Changes from V1.1 to V2.0

Protocol Element	V1.1	V2.0
Performance Standard Test	Annual State Average Removed to Applied (RTA) Benchmark; Average Historical Yield	Multi-year County Average Partial Factor Productivity (PFP) Benchmark; Project Yield
Baseline	5-year lookback period; historical records only	3-year lookback period; hierarchical approaches: 1) historical records, 2) county average, 3) agronomic guidance
N_2O Emissions Quantification	MSU-EPRI Methodology	Nitrogen Management Quantification Tool (Emission factor-based Excel tool)
Leakage	Proportionate Increase in Emissions	Proportionate Increase in Project N Rates
Monitoring	Corn Stalk Nitrate Test (CSNT)	Removed CSNT – same annual Project Monitoring Plan & Report required
Reporting		12 or 24 month RPs
Verification	CSNT-informed	Risk – random sampling based verification scheduling

Section 5 (Mark Easter Consulting LLC)

QUANTIFICATION METHODOLOGY

Update #2 on Ecosystem Modeling to Support "Conservation Innovation Grant: Demonstration of a Scalable Nutrient Management Project to Reduce Nitrous Oxide Emissions and Generate Voluntary Compliance Carbon Credits"

Mark Easter, Amy Swan, Ernie Marx, Steve Williams and Keith Paustian

Natural Resource Ecology Lab and Dept of Soil and Crop Sciences

Colorado State University, Fort Collins, CO

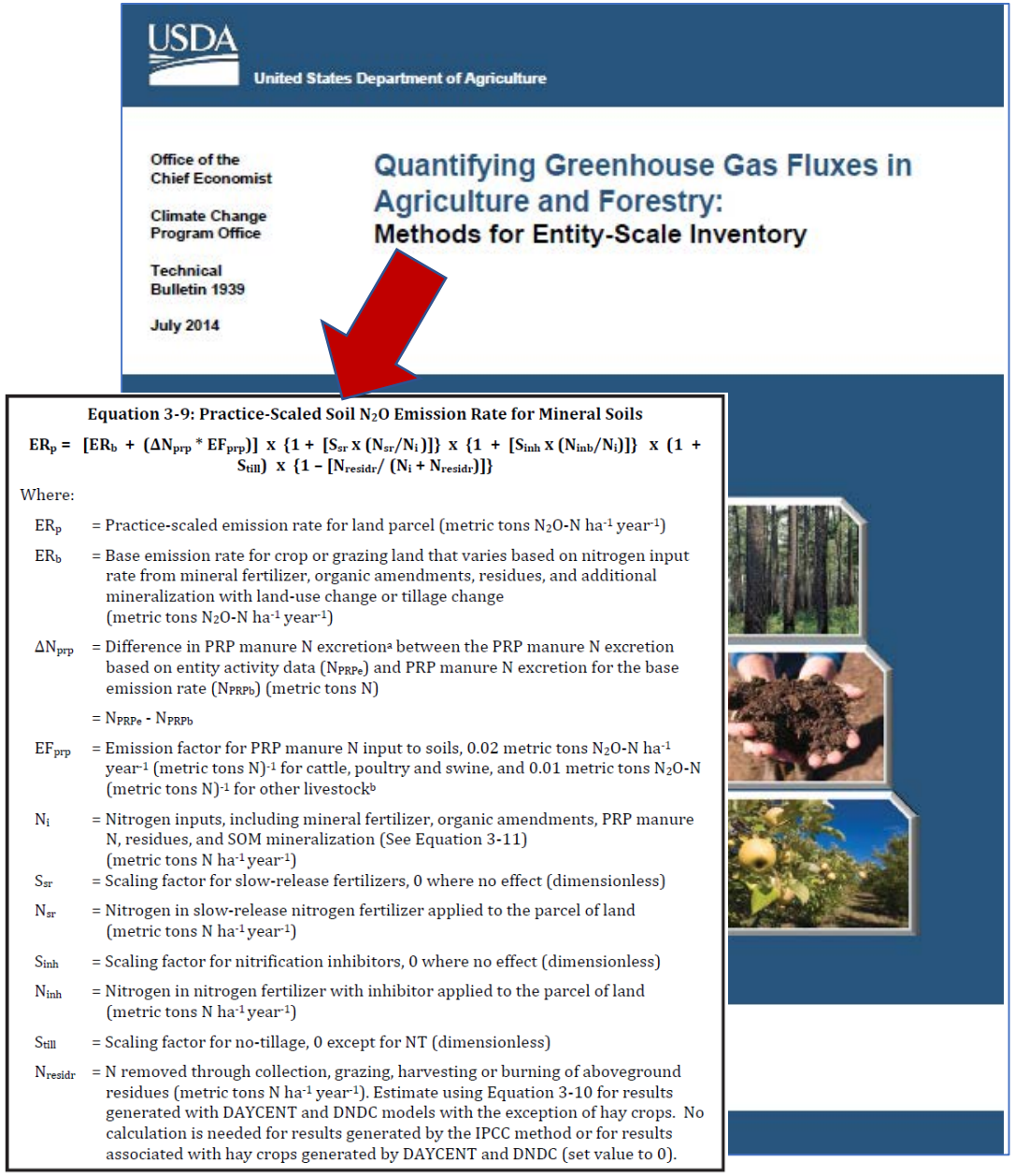
20 June 2018

Outline

- Brief Review of the Modeling Effort
- Brief Review of the Uncertainty Analysis Effort
- Review some examples from the modeling results
- Demonstrate the Excel Tool
- Final Steps

Model Description

- Direct and Indirect Soil Nitrous Oxide Emissions were based on the USDA Methods Document: “Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory”
- After extensive model comparison analysis and consultation with the Climate Action Reserve, we used direct soil N2O emissions predicted by the DayCent model for ***Direct Soil Nitrous Oxide emission predictions*** (see image to the right), rather than the base emission factor (Erb) described in the USDA methods document, as described in previous presentations.
  - Base emission factors that were consistently derived were not available for all crops of interest in the entire geographic region envisioned for this project. The DayCent-DNDC combined ERb was only available for some crops, whereas the IPCC-based ERb would have to be used for other crops.
  - Using DayCent for all crops offered a consistent approach for all crops, with better overall model performance.
  - All other practice-scaled emission factors (e.g. use of EEP, long-term conversion to no-tillage) were applied against the DayCent predictions.



USDA
United States Department of Agriculture

Office of the Chief Economist

Climate Change Program Office

Technical Bulletin 1939

July 2014

Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry:
Methods for Entity-Scale Inventory

Equation 3-9: Practice-Scaled Soil N_2O Emission Rate for Mineral Soils

$$ER_p = [ER_b + (\Delta N_{prp} * EF_{prp})] \times \{1 + [S_{sr} \times (N_{sr}/N_i)]\} \times \{1 + [S_{inh} \times (N_{inh}/N_i)]\} \times (1 + S_{till}) \times \{1 - [N_{residr}/(N_i + N_{residr})]\}$$

Where:

ER_p = Practice-scaled emission rate for land parcel (metric tons N_2O-N ha^{-1} $year^{-1}$)

ER_b = Base emission rate for crop or grazing land that varies based on nitrogen input rate from mineral fertilizer, organic amendments, residues, and additional mineralization with land-use change or tillage change (metric tons N_2O-N ha^{-1} $year^{-1}$)

ΔN_{prp} = Difference in PRP manure N excretion[a] between the PRP manure N excretion based on entity activity data (N_{PRPe}) and PRP manure N excretion for the base emission rate (N_{PRPb}) (metric tons N)

= $N_{PRPe} - N_{PRPb}$

EF_{prp} = Emission factor for PRP manure N input to soils, 0.02 metric tons N_2O-N ha^{-1} $year^{-1}$ (metric tons N)$^{-1}$ for cattle, poultry and swine, and 0.01 metric tons N_2O-N (metric tons N)$^{-1}$ for other livestock[b]

N_i = Nitrogen inputs, including mineral fertilizer, organic amendments, PRP manure N, residues, and SOM mineralization (See Equation 3-11) (metric tons N ha^{-1} $year^{-1}$)

S_{sr} = Scaling factor for slow-release fertilizers, 0 where no effect (dimensionless)

N_{sr} = Nitrogen in slow-release nitrogen fertilizer applied to the parcel of land (metric tons N ha^{-1} $year^{-1}$)

S_{inh} = Scaling factor for nitrification inhibitors, 0 where no effect (dimensionless)

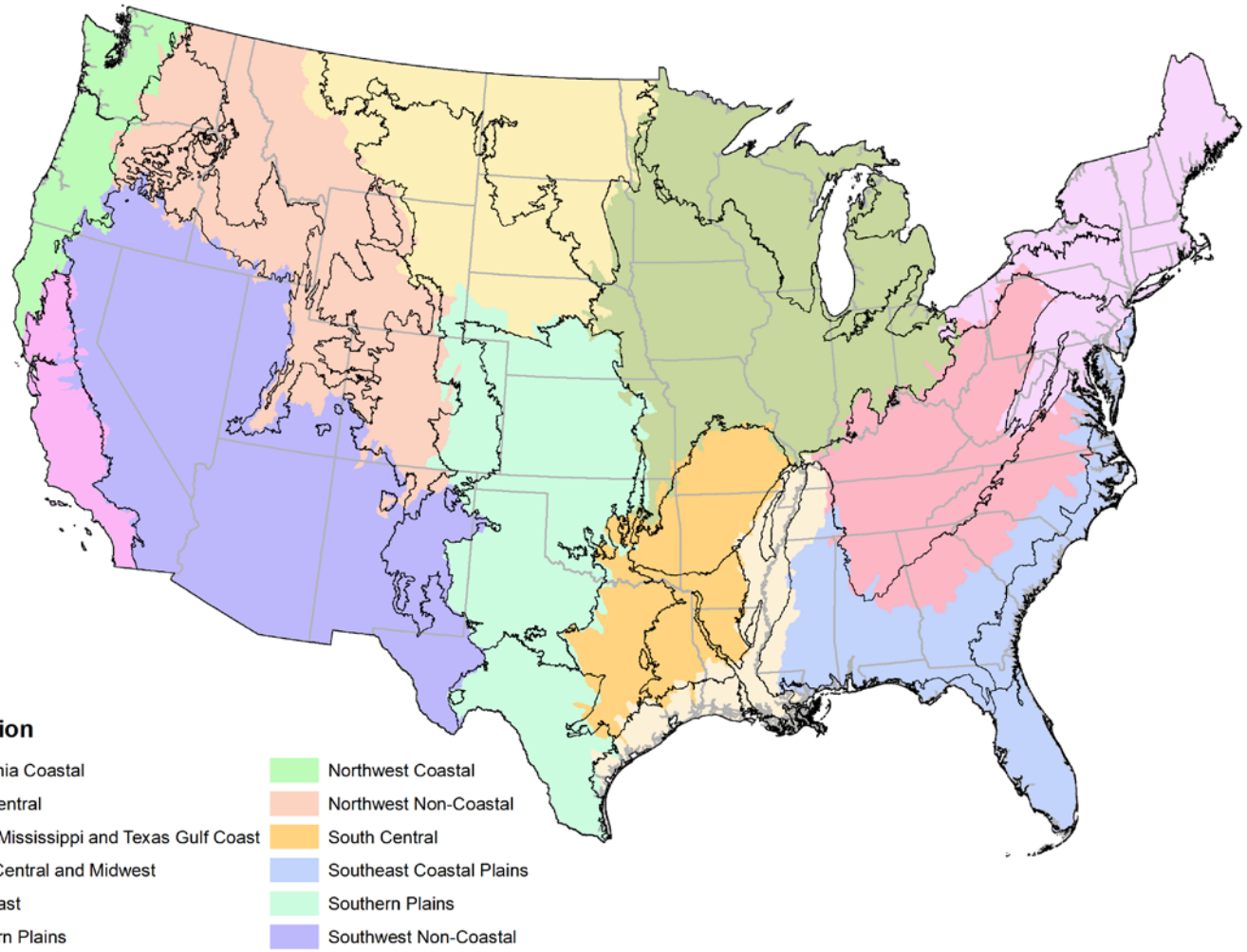
N_{inh} = Nitrogen in nitrogen fertilizer with inhibitor applied to the parcel of land (metric tons N ha^{-1} $year^{-1}$)

S_{till} = Scaling factor for no-tillage, 0 except for NT (dimensionless)

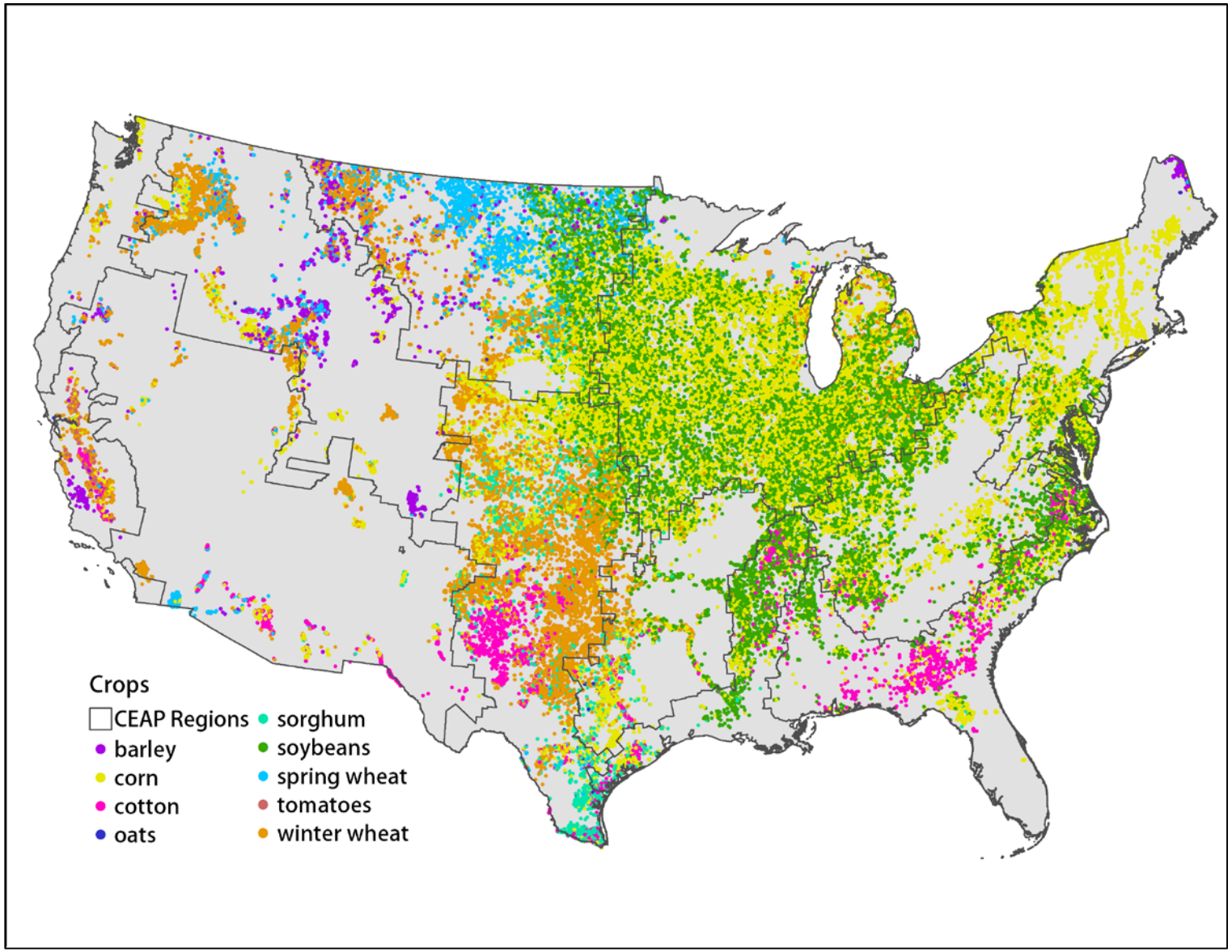
N_{residr} = N removed through collection, grazing, harvesting or burning of aboveground residues (metric tons N ha^{-1} $year^{-1}$). Estimate using Equation 3-10 for results generated with DAYCENT and DNDC models with the exception of hay crops. No calculation is needed for results generated by the IPCC method or for results associated with hay crops generated by DAYCENT and DNDC (set value to 0).

Sampling Design

- Modeling the following crops:
  - corn for grain & silage
  - sorghum for grain & silage
  - spring grains:
    - spring wheat
    - spring barley
    - oats
  - processing tomatoes
  - cotton
  - winter wheat
- Randomly sampled the Cropland Data Layer (CDL) to select cropland points containing the crops of interest
- Built crop rotations based on CDL-predicted cropping sequence at each point for the period 2010-2016
- Used that crop rotation to represent the crop rotation from 2000-2017 and then 2018-2027
- 13,900 randomly-sampled points modeled in 12 CEAP Regions, for > 480,000 point-year samples



Sampling Density:
13,900 randomly-sampled points modeled, >480,000 point-year samples



Baseline Scenario

- For Each Crop:
  - Planting date, by state, derived from USDA database of average planting dates
  - Harvest date, by state, derived from USDA database of average harvest dates
  - Fertilizer amounts based on state-level ARMS survey
  - Fertilizer applied at planting (early-mid April for winter wheat)
  - Intensive Tillage:
    - 1 pass with Moldboard plow
    - 1 pass with Tandem Disc
    - 1 pass with seed bedder/drill
  - No Tillage:
    - 1 pass with drill

Model Scenarios

- 12 CEAP Regions
- 9 Crops or Crop Classes
  - corn for grain & silage
  - sorghum for grain & silage
  - spring grains:
    - spring wheat
    - spring barley
    - oats
  - processing tomatoes
  - cotton
  - winter wheat
- Scenarios modeled for each point:
  - Baseline
  - Fertilizer Reductions (10% - 50%) (at 5% increments from 5% to 30%, then 10% increments afterwards)
  - Fertilizer Reductions (10% - 50%) + Conversion from Intensive Tillage to No Tillage
  - Fertilizer Reductions (10% - 50%) + Use of Slow-Release Fertilizer
  - Fertilizer Reductions (10% - 50%) + Use of Slow-Release Fertilizer + Conversion from Intensive Tillage to No Tillage
  - Fertilizer Reductions (10% - 50%) + Use of Nitrification Inhibitors
  - Fertilizer Reductions (10% - 50%) + Use of Nitrification Inhibitors + Conversion from Intensive Tillage to No Tillage

Monte Carlo Simulation

- 10,000 individual simulations at each of up to 750 randomly-selected point-year samples per crop, per CEAP Region
- Applied a Linear Mixed Effect (LME) Model used in the U.S. National GHG Inventory with DayCent:

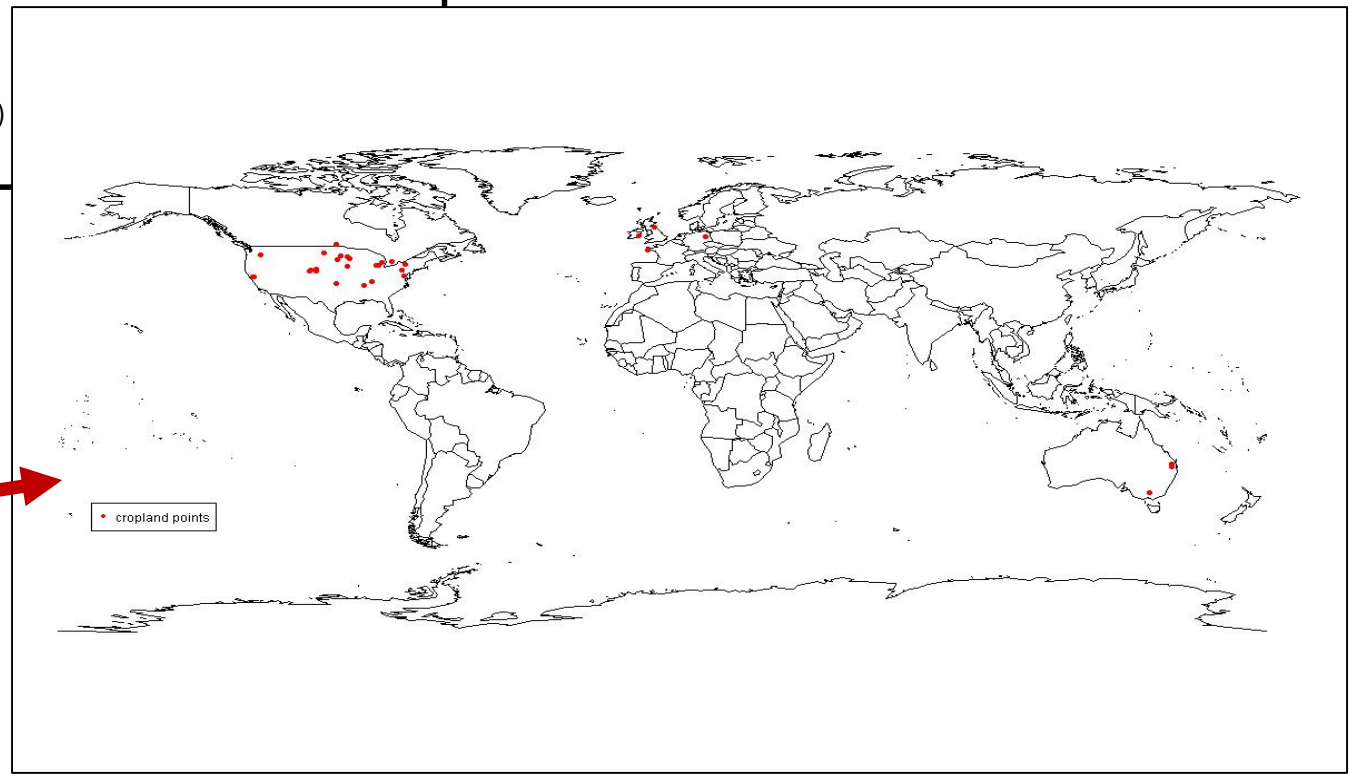
Equation-1: Adjusted N2O-flux

$$N2O_{pysm} = exp\left(\beta_{0m} + \beta_{1m} * \ln(N_2O\ Mod)_{pys} + \beta_{2m} * soy_{pys} + \beta_{3m} * smgr_{pys} + \gamma_{pm} + \delta_{pym}\right)$$

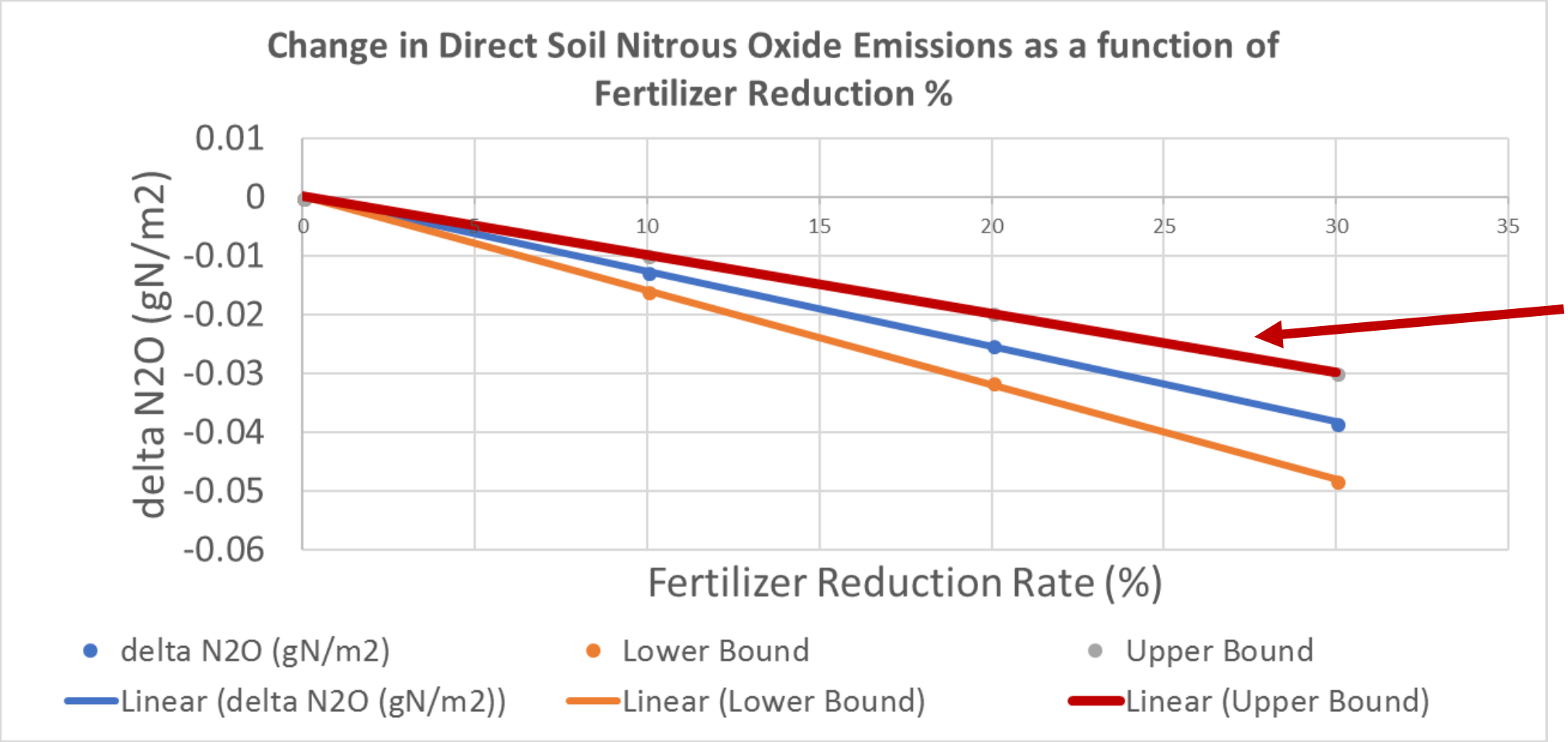
Where:

$N2O_{pysm}$	= Adjusted N_2O flux from parcel p, year y, scenario s, and Monte Carlo iteration *m* (g N/ha/day)
X_{pys}	= is the new design matrix created in bullet 1.
β_{im} (i=0,1,2,3)	= are fixed effect regression parameters of length 4, m^{th} Monte Carlo iteration. (see bullet 2)
$\ln(N_2O - Mod)_{pys}$	= natural log transformation of DayCent-modeled N2O-flux (g N/ha/day)
soy_{pys}	= set to 1 if crop is soybean for parcel *p*, year *y*, and scenario *s*, else 0
$smgr_{pys}$	= set to 1 if crop is small grain for parcel *p*, year *y*, and scenario *s*, else 0
γ_{pm}	= random site effect for parcel p, and Monte Carlo iteration m (see bullet3)
δ_{pym}	= random site effect for parcel p, year y, and Monte Carlo iteration m (see bullet4)

Direct Soil N_2O Measurement Dataset Used to Develop the Structural Uncertainty and Bias Correction

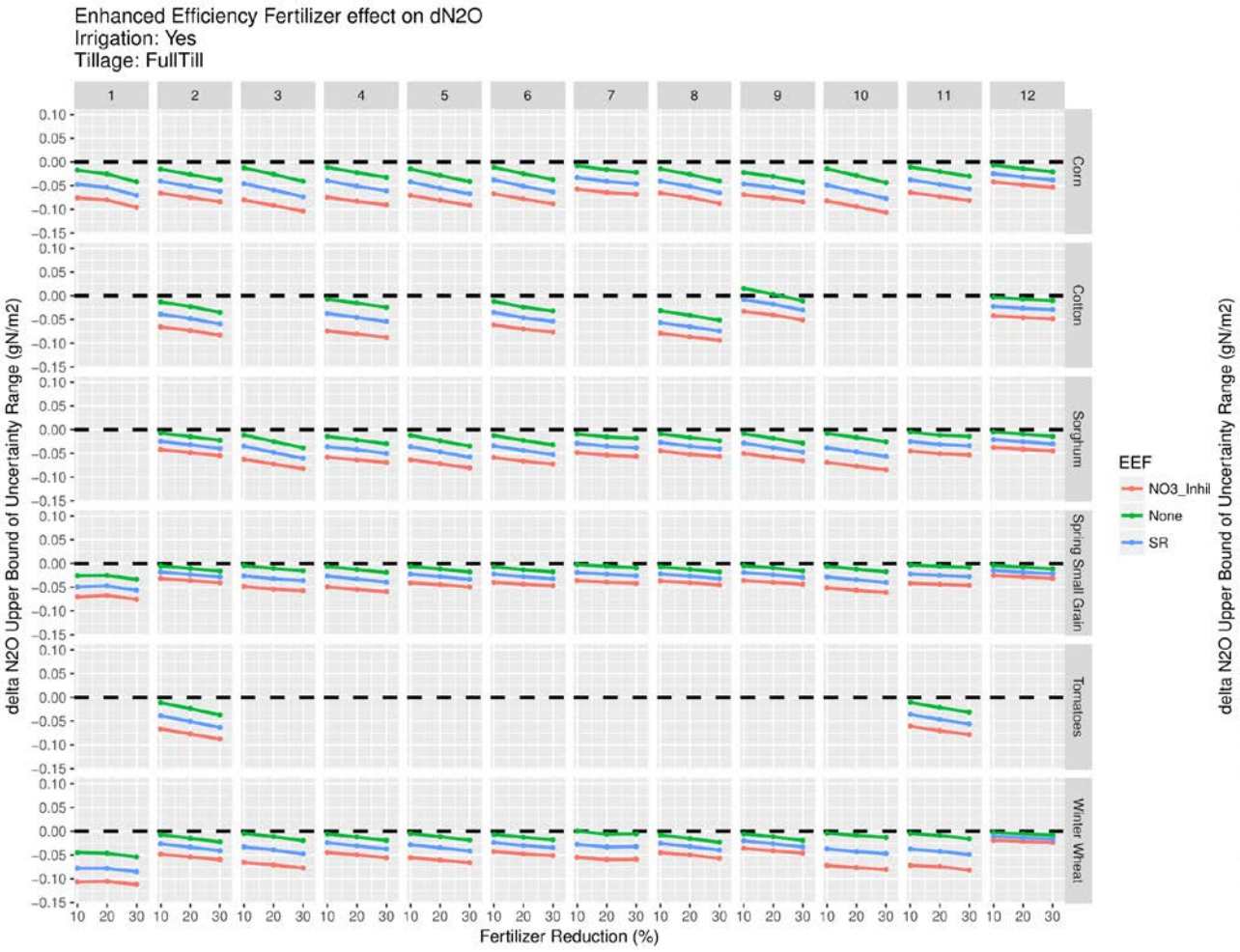


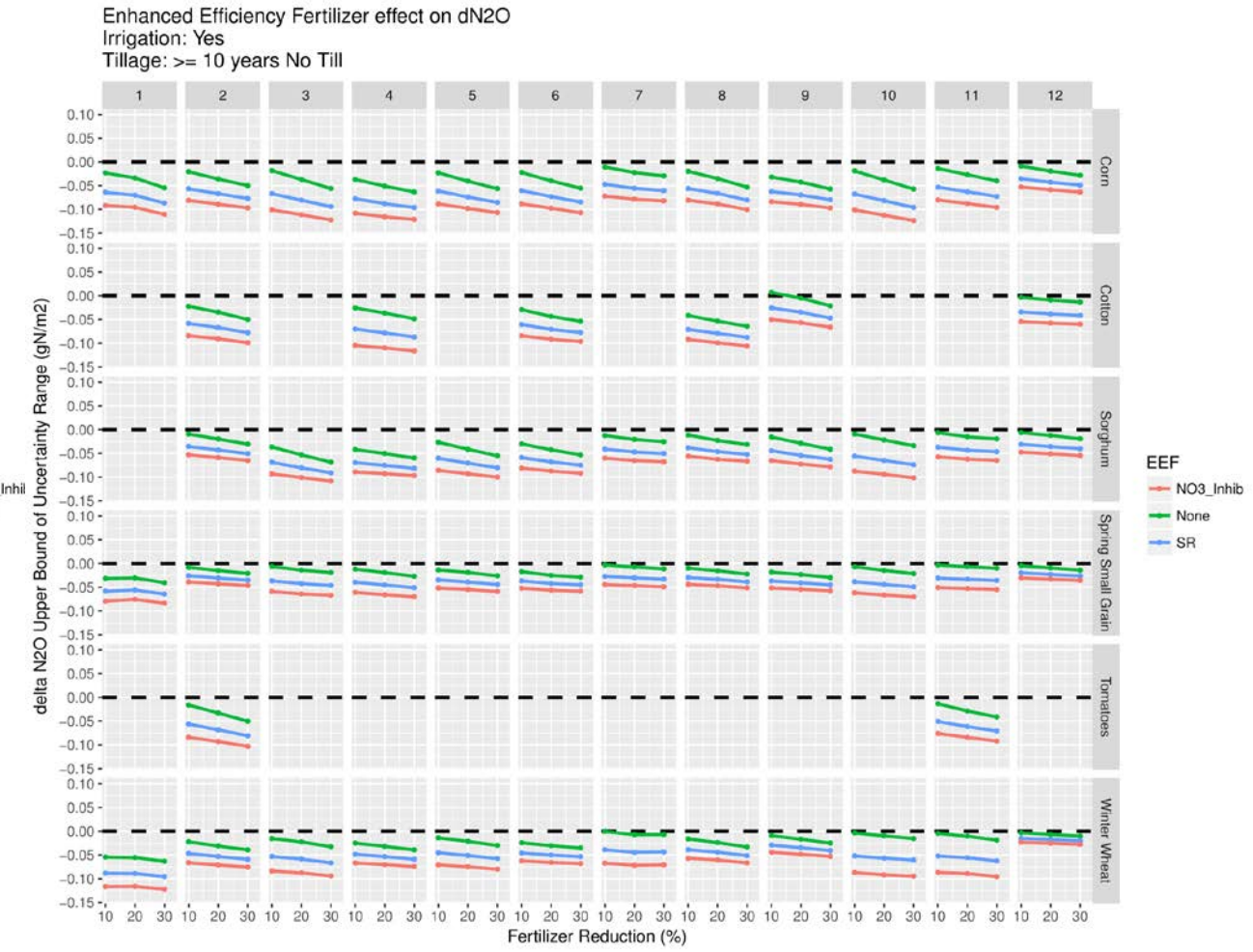
Modeling Results Used in the Draft Protocol & Tool



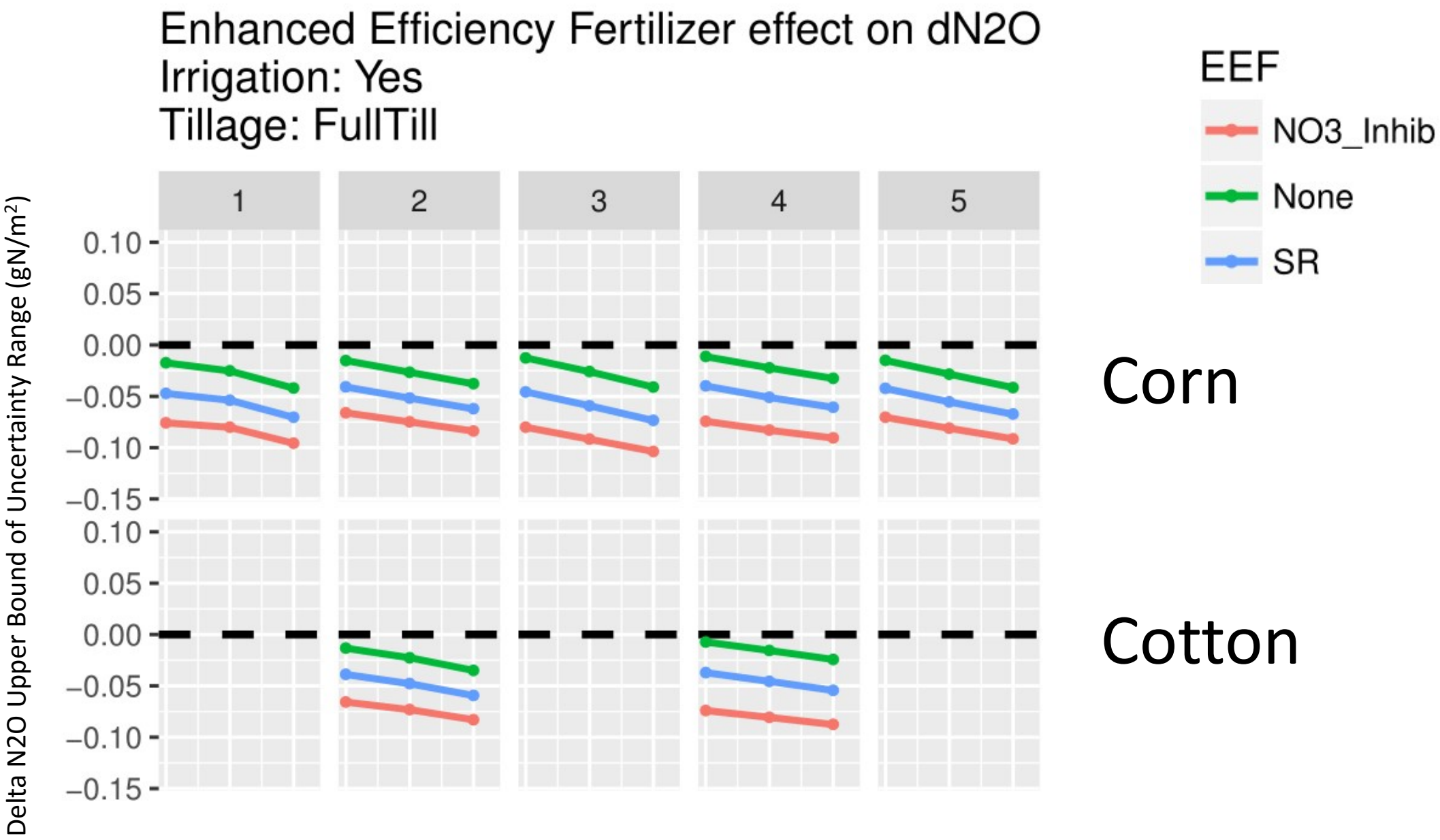
The Draft Protocol and Excel Tool use the modeled upper bound value

Examples from Results in Protocol Appendix F

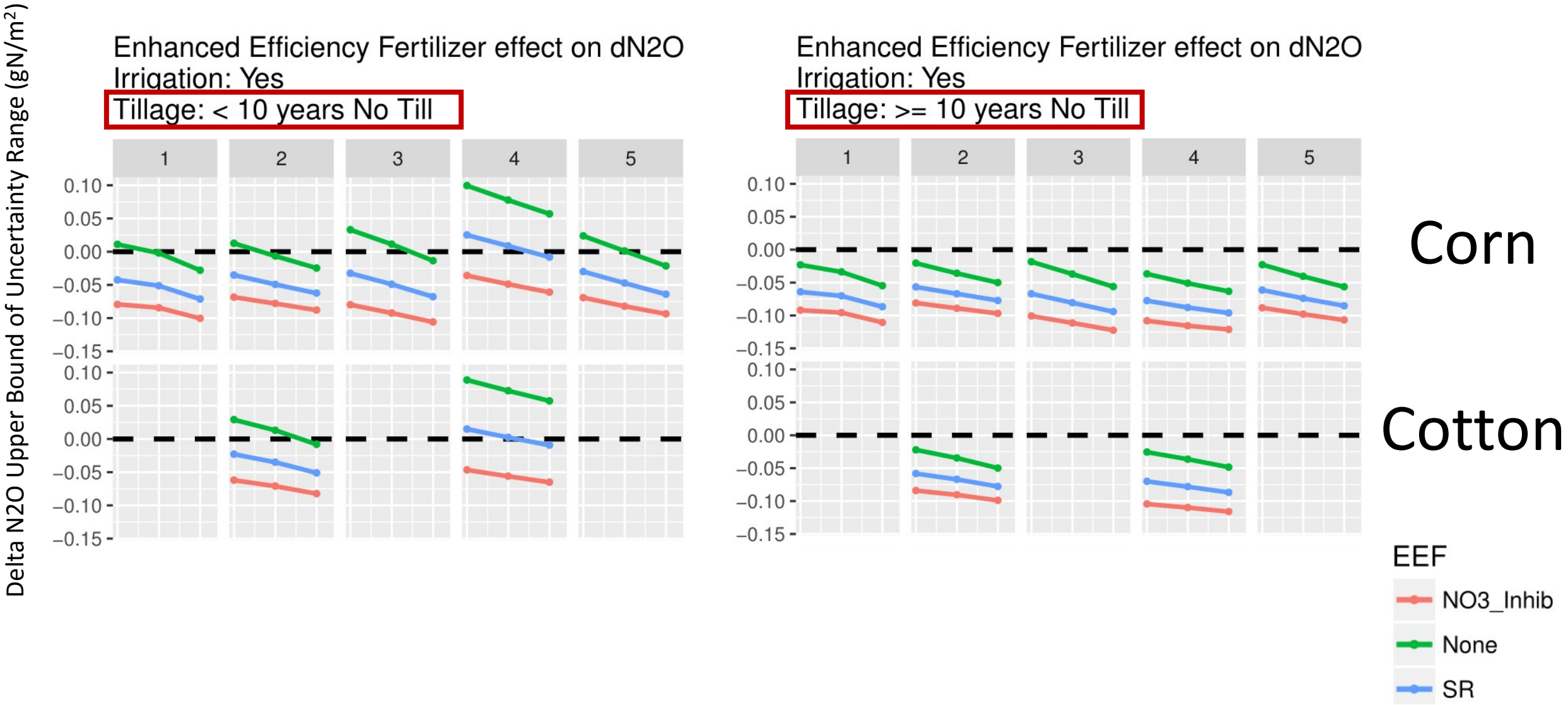




Examples from Results in Protocol Appendix F, cont'd



Examples from Results in Protocol Appendix F, cont'd



Excel Tool Demonstration

Final Steps

- Add corn for silage and sorghum for silage to tool
  - modeling complete
  - QC review and uncertainty analysis in process
- Add 5%, 15%, 25% fertilizer reductions to tool
  - Modeling underway, completion expected by June 25
  - QC and uncertainty analysis expected by July 8
- Final tool delivery expected July 11

Section 2

PROJECT DEFINITIONS

Project Objective and Definition (Section 2.2)

- Objective: to reduce N_2O emissions by adopting best management practices (BMPs) that further improve nitrogen use efficiency (NUE) and enhance crop N uptake, beyond what is projected to happen in the future, absent a carbon market
- Definition: the adoption and maintenance of one or more *eligible project activities* during the cultivation year of an *eligible crop,* on one or more fields in an *eligible project area*, that reduce N_2O emissions
- Multiple fields may be managed together under a single project, across multiple owners and multiple regions
- Multiple projects may also be managed together as a “project cooperative” or “cooperative”

Eligible Project Activities-Crops-Regions

- Project activities-crops-regions eligible in the protocol had:
  - Scientific literature supporting consistent reductions in N_2O emissions (Appendix A, Appendix B)
  - Sufficient data to develop a performance standard test for additionality (Section 3.5.1, Appendix C)
  - *And* a quantification methodology meeting Reserve criteria (Appendix E, Appendix K)

Eligible Project Activities (Section 2.2.1)

Eligible Project Activity	Description
N Rate Reduction	Reduction in the annual synthetic nitrogen application rate compared to 1) recent historic application rates at the site, 2) the applicable county average, as found in Nitrogen Management Project County Benchmark Lookup Tool, or 3) agronomic guidance, without going below N demand.
- AND -	
Use of Nitrification Inhibitor	Application of enhanced efficiency fertilizer product(s) as defined by AAPFCO and accepted for use by the State fertilizer control, or similar authority, alongside the use of ammonia or ammonium fertilizers, to delay the nitrification process (i.e., the conversion of NH_4^+ to NO_3^-), by eliminating the bacteria *Nitrosomonas* in the area where ammonium is to be present.
- OR -	
Switch to Slow Release Fertilizer	Conversion from conventional fertilizer(s) to enhanced efficiency fertilizer product(s) as defined by AAPFCO and accepted for use by the State fertilizer control, or similar authority, to discharge soluble nitrogen (NH_4 and NO_3) over longer timeframes (either slowing or controlling the release), increasing the amount of fertilizer recovered by the plant and improving the synchronization between plant uptake and nitrogen availability.
- AND/OR -	
Switch to Long-Term No-Till [UNDER CONSIDERATION]	Conversion from conventional tillage practices to no-till and maintaining no-till for at least 10 years in a row and more.

Allowed Activities: Organic N rate amendments, crop rotations, irrigation, NM BMPs

Eligible Project Activities-Crops-Regions

- Tillage
  - PD must input data on tillage in NMQuanTool GUI
  - Short term no-till
    - Where no-till adopted on field 0-10 years prior to cultivation year – such fields ineligible
      - Uncertainty very high
      - Expect flux in N2O in some regions
  - Long term no-till
    - Where no-till adopted 10+ years prior to cultivation year – associated increased emission reductions not included in modelling
      - USDA Methods adopt EF moving from intensive tillage to LTNT, perhaps over generous and not as suitable for project-level accounting
      - Additionality concerns

Eligible Crops x Eligible Region (Section 2.2.2, 2.2.3)

Crop	State*
Barley	AZ, CA, CO, ID, MN, MT, ND, OR, PA, VA, WA, WY
Corn (Grain)	CO, GA, IL, IN, IA, KS, KY, MI, MN, MS, NE, NY, NC, ND, OH, PA, SD, TX, WI
Corn (Silage)	TO BE UPDATED ONCE MODELING IS COMPLETE
Cotton (Upland)**	AR, GA, MS, MO, NC, TN, TX
Oats	IL, IA, KS, MI, MN, NE, NY, ND, OH, PA, SD, TX, WI
Sorghum (Grain)	CO, KS, NE, OK, SD, TX
Spring Wheat (Durum)	MT, ND
Spring Wheat (excluding Durum)	MN, MT, ND, SD
Tomatoes (Processing)	CA
Winter Wheat	CO, ID, IL, KS, MO, MT, NE, OH, OK, OR, SD, TX, WA

*Eligible Counties found in NM Project County Benchmark Lookup Tool; **County data only available for Upland Cotton

Cultivation Year (Section 2.3)

Period between the 1st day after harvest of the last primary crop on a field and the last day of harvest of the current primary crop on a field

- NMPP is currently only applicable to annual primary crops, the cultivation year is ~12 months
- Cover crops established between the successive production of primary crops, shall be included as part of the cultivation year of the subsequent primary crop

Project Ownership Structures (Section 2.5)

Project Structures

- **Project**:
  - Can be one or more fields
  - Can be owned / controlled by one or more entities
  - Can span multiple crops / regions
  - Will have single *project developer*

- **Cooperative**
  - Administrative grouping of two or more projects that report and verify together

Project Ownership Structures (Section 2.5)

Project Ownership & Management

- **Field Managers**
  - Any entity that has ability to control decision making on project fields – can be farmer / employees / landlords / state agencies
  - May or may not be involved in management of project
  - Set very broadly to recognize types of entities that may affect NMPP project – think carefully about how to manage such risks

- **Project Owner**
  - Any party that wants to be issued CRTs and/or hold CRTs in a Reserve account will need to open Project Owner account with Reserve
  - Must demonstrate hold legal title to CRTs – via clear transfer of title from parties holding legal title to project fields

Project Ownership Structures (Section 2.5)

Project developers

- **Project**
  - Single entity must be designated as responsible entity to manage all aspects of project development (submittal, reporting and verification)
  - Will need to open Project Developer account with Reserve
- **Cooperative**
  - Single entity must be designated as responsible entity to manage all aspects of project development (submittal, reporting and verification)
  - Will need to open Cooperative Developer account with Reserve

Project Ownership Structures (Section 2.5)

Project developers – Key agreements

- **GHG reduction rights agreement**
  - Each project developer will need to enter into GHG reduction rights agreement with Reserve prior to start date setting out:
    - Project developers authority and responsibility to manage project
    - Identify of all Field Managers and Field Owners known at time;
    - Indemnity for Reserve against any claims brought by any party (named or otherwise) against the Reserve
    - OPTIONAL – project developer encouraged to consider seeking similar indemnification from Field Managers and Project Owners against any actions they may take which may undermine integrity of the NMPP project or CRTs issued to project

Section 3

ELIGIBILITY RULES

Start Date (Section 3.2)

1st day of the cultivation year for the eligible crop field during which 1 or more approved project activities are implemented

- Cultivation year day 1 = 1st day after the field's previous harvest of a primary crop was completed for that field
- Fields within the same project may have different start dates, but the "*project start date"* will always be the earliest start date of a field in the project, i.e., the "*first field"*
- Projects must be submitted for listing within 12 months of the project start date (before the end of the first field's cultivation year)

Reporting Period & Crediting Period (Section 3.3, 3.4)

- Reporting Period = 1 complete cultivation year of an eligible crop (i.e., eligible crop year), when CRTs are being sought
  - For projects with multiple eligible crop fields, the reporting period starts on the project start date and ends on the last day of a cultivation year of a field in the project (i.e., the "*last field*")
  - Initial reporting period may constitute 1 or 2 eligible crop years, for a maximum of 3 years (e.g., if in rotation with ineligible crop)
- Crediting Period = 10 Reporting Periods
  - May be renewed one time; maintain same baseline

Reporting Period (continued) (Section 3.3)

- Fields that will *not* count as part of a project's reporting period include:
  - Fields left fallow;
  - Fields cultivating an ineligible crop; and
  - Fields cultivating an eligible crop, but either do not meet project requirements or are voluntarily withdrawn for that eligible crop year
- Fields must continue to meet monitoring and continuous reporting requirements, even if not eligible to generate CRTs in a given cultivation year

Performance Standard Test (Section 3.5.1)

- N Rate Reductions (Sec. 3.5.1.1)
  - Based on NUE metric termed the partial factor productivity (PFP)
  - PFP = Annual Crop Yield / Total Annual N Rate (synthetic + organic)
  - A field passes when its annual PFP exceeds the 3-year, county- and crop-specific average PFP benchmark (Appendix C)
    - $PFP_{P,f} > PFP_{avg,Co,c}$
  - Each field must pass this test each reporting period to be eligible for CRTs

Developing the PFP Benchmarks (Appendix C)

- USDA NASS – crop-specific N rates (State); planted acres and yield (county)
- IPNI NuGIS – N rates (county) per *cropland acre*
- Estimated annual State- & crop-specific N rates for non-survey years
  - Reference years – 2010, 2011, and 2012
  - Assumption: % of Planted Acres Treated with N remains constant
  - Created weights based on changes in planted acres and applied to survey year N rates
- Comparison ratio of NuGIS:NASS data for estimated total N applied to *eligible cropland acres per county*
- County- & Crop-Specific N Rate (NR) = Ratio x State- and Crop-Specific N Rate
- County- & Crop-Specific Yield (Y) – converted to pounds / acre
- PFP Benchmark = (3-year average Y / 3-year average NR)

PFP Benchmarks

Demonstration: Nitrogen Management Project County Benchmark Lookup Tool

Performance Standard Test

- Use of Nitrification Inhibitors or the switch to Slow-Release Fertilizers (Sec. 3.5.1.2)
  - Determined not common practice (Appendix C)
    - Low rates of adoption, where data is available
    - Financial barriers to implementation
  - Considered additional when applied in combination with N rate reduction
    - Each field must pass the test for N rate reductions
  - If project used NI or SRF in baseline lookback period, cannot be included in NM QuanTool – therefore field will be ineligible

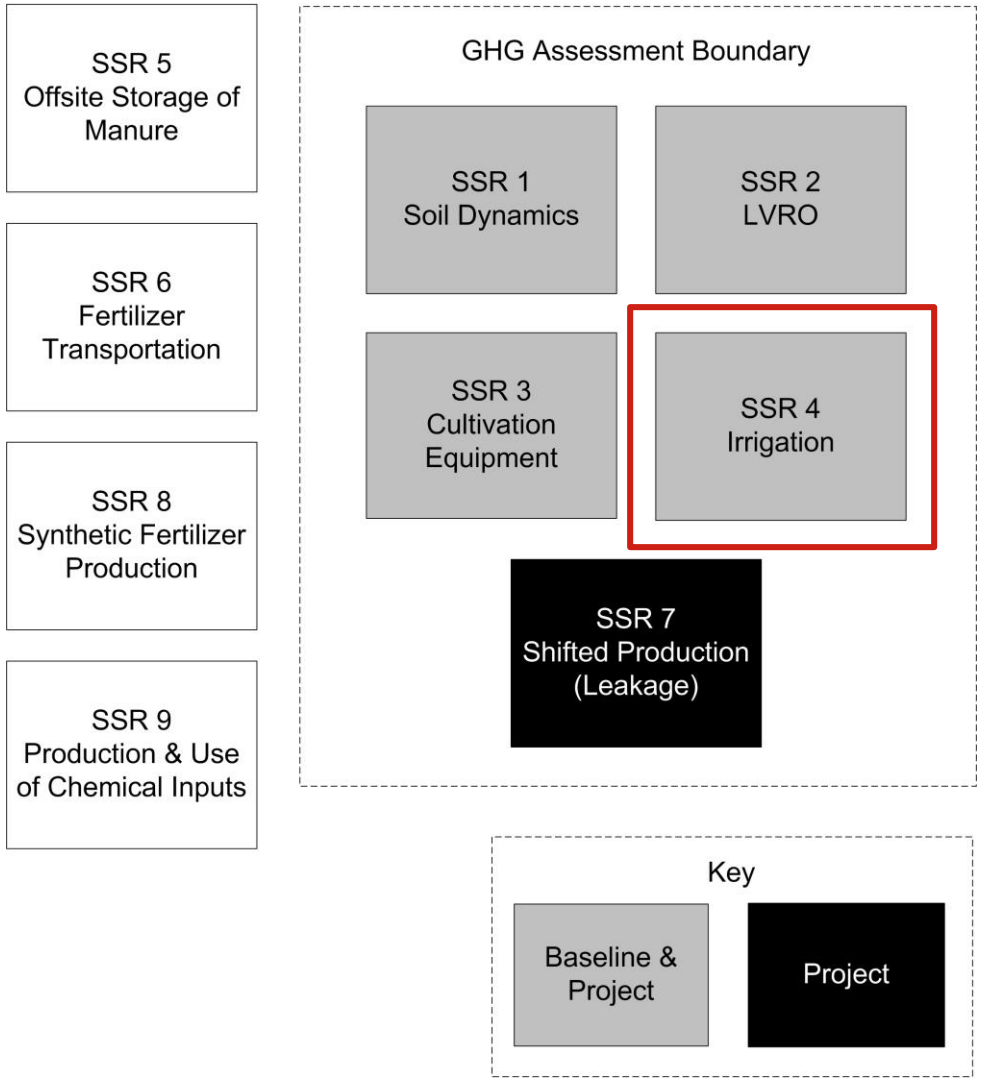
Legal Requirement Test

- A field passes the legal requirement test when there are no legally required mandates that require adoption or continued use of eligible project activities on the field
  - If any such legally binding mandate exists, only emission reductions resulting from activities in excess of what is required to comply are eligible
- California Dairy General Order (Appendix D)
  - For fields receiving manure applications in the CA Central Valley, total N rates must not exceed 1.4x the N taken up by the crop
  - Any field subject to the Order will only be eligible for emission reductions associated with reductions in N rates below this 40% residual N threshold

Section 4

GHG ASSESSMENT BOUNDARY

GHG Assessment Boundary



- SSR 1 & SSR 2 – NM QuanTool for Eligible Project Activities
- SSR 1 & SSR 2 – modified and new equations for increases in organic N rates
- SSR 3 & SSR 4 – modified equations for increases in fossil fuel and electricity use
- SSR 7 – modified equation to increase project synthetic N rate

Section 5 (Reserve)

QUANTIFICATION METHODOLOGY

Quantifying GHG Emission Reductions

$$ER = (PERsyn - PEorg) - SE$$

- **ER** = total emission reductions from the project area for the reporting period (tCo2e)
- **PER_{syn}** = total primary effect GHG emission reductions (i.e., N_2O emission reductions) from implementation of eligible activities
  - calculated using NM QuanTool
- **PE_{org}** = total primary effect GHG emissions from organic N rate increases
- **SE** = secondary effect GHG emissions from changes in cultivation equipment and irrigation (i.e., increased fossil fuel use)

Baseline (Section 5.3.1)

- N rate during the baseline and project reporting period must be compared using the same crop(s) grown on the same field
- Baseline look-back period: the 3 most recent cultivation years of the given crop on the given field, prior to the field's start date
  - E.g., previous 3 years (monoculture), 6 years (2-crop rotation), or 9 years (3-crop rotation) prior to the field's start date
- Reduction in Synthetic N Rate (%) for use in NM QuanTool is calculated as difference between average synthetic N rate over the baseline look-back period and the project synthetic N rate

Baseline (continued) (Section 5.3.1.1)

- Hierarchy of options for setting average baseline N rates:
  1. N management records
  2. If insufficient or no records:
     a) Estimated historical county average N found in Nitrogen Management Project County Benchmark Lookup Tool
     b) Records of N rate recommendations from agronomic experts
  – The lower N rate of 2a or 2b must be used
- Options 2a and 2b are only permissible for synthetic N rate

Increases in Organic N

- Organic N rate may increase from baseline to project, but Total N rate must still decline
- Change in organic N rate from baseline to project calculated the same way as the reduction in synthetic N rate
- Only emissions from increases in organic N rate are quantified
  - 2 ways for SSR 1 – Direct N2O Emissions:
    1. MSU-EPRI – for corn cultivated in the North Central Region
    2. IPCC 1% Default Emission Factor – for all other scenarios

Increases in Fossil Fuel / Electricity Use (Section 5.5.1)

- If project activities include the increased use of mobile or stationary equipment or vehicles that consume fossil fuels or electricity associated with cultivation (SSR 3) and/or irrigation (SSR 4), these emissions must be subtracted from the total calculated primary effect GHG reductions
  - E.g., increases in number of fertilizer applications, irrigation frequency
- If the total value is reasonably expected to be *de minimis* (i.e., less than the relevant materiality threshold), these emissions may be estimated through a conservative method proposed by the project developer and deemed acceptable by the verifier

Leakage (Section 5.5.2)

- If yield decreases in a statistically significant manner compared to historical average yields, there's an assumed increase of production outside of the project area
  - To determine, the annual yield from the project area must be compared to the historical average yield over the baseline look-back period
  - Yields are normalized to historical average annual county yields using USDA NASS data
  - This normalization procedure must be followed for each cultivation year
- The project synthetic N rate will be increased proportionate to the shift in production, which results in a smaller % N rate reduction

Section 6

MONITORING

Monitoring (Section 6)

- **Monitoring Plans & Reports**
  - Similar to v1.1 – each project will need project level monitoring plan (PMP)
- **PMP must include:**
    - Number of fields – how they will be delineated
    - Names / roles of entities involved in management of project
    - Methods / frequency of data acquisition + QA/QC for same
    - Procedures for tracking quantification, reporting, verification requirements – for each field
    - Procedures for demonstrating each field meets eligibility requirements
- **Cooperative monitoring plan:**
  - Pd has discretion as to whether use single spreadsheet or multiple
  - Will still need to carefully identify quantification for each field and each project
  - Could distill common info for all projects, and then delineate unique aspects for each project

Monitoring (Section 6)

- **Field Monitoring Parameters & Management Data**
  - **Table 6A Field Monitoring Parameters**
    - All field level monitoring parameters – including parameters needed for equations and for NMQuanTool
  - **Table 6.B Field Management Data**
    - GIS shapefile data
    - Key dates
    - Regulatory compliance records
    - Certain baseline practices
    - Agronomic records

Section 7

REPORTING

Reporting (Section 7)

- **Section 7.1 Project submittal**:
  - Same form for projects / cooperatives – identify entities / fields – update when verifying
- **Section 7.2 Annual reports**
    - Attestations
    - Verification report / statement
    - Project / Cooperative Monitoring Report
  - Record keeping: keep all relevant records for 15 years

Reporting (Section 7)

- **Section 7.4 Reporting periods & verification cycles**
  - No gaps in reporting once start project – report even if not claiming CRTs
  - Any one/more field claiming CRTs = reporting period towards crediting period
  - Flexible verification options
    - First RP – can be 1-2 cultivation years
    - Subsequent RPs
      - 12 month RP/VP – *with site visit*
      - 24 month RP / VP – site visit every 2 cultivation years
        - » No CRTs in interim desktop only verification cultivation year

Section 8

VERIFICATION

Verification (Section 8)

- **Section 8.2 Sampling & scheduling**
  - Same approach regardless of number of fields / projects grouped together
  - Verification schedule developed by VB based on combination of risk-based and random sampling
  - 3 step sampling process
    - 1) Risk based site visit selection
      - e.g. if a field fails site visit verification in given year, will need site visit following year to be eligible
    - 2) Additional field site visits selected at random
    - 3) Random sampling for desktop data verification
  - Every field included in pool subject to site visit sampling = eligible to generate CRTs for that given RP

Verification – Table 8.A Summary of eligibility

Eligibility rule	Eligibility criteria	Frequency
Start Date	1st day of cultivation year, after previous harvest ends	Once during 1st RP
Location & crop type	Field in eligible project area, growing eligible crop	Every verification
PST	Check if eligible county-crop combination	Every verification
LRT	No laws mandating project	Every verification
Legal title to CRTs	Clear contractual ownership	Every verification
Regulatory compliance	No breaking any laws	Every verification
HEL classification	Meets HEL conservation req's	Once during 1st RP
Wetland classification	Meets wetlands conservation req's	Once during 1st RP

Verification – Table 8.B Eligibility verification items

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
2.2	Verify that all verified fields meet the definition of a nitrogen management project	No
2.2	Verify that all fields are comprised of eligible crop-region combinations	No
2.2.3	Verify that all verified fields meet the eligible project area definition	Yes
2.2.1.1	Verify that the total annual N rate decreased below baseline levels	No
2.3	Verify that all verified fields meet the definition of cultivation year	No
2.5	Verify that an appropriate indemnification and GHG reductions rights agreement or agreements have been executed.	No
2.5	Verify the project and/or cooperative structure is appropriate	No
2.5	Verify ownership of the reductions by reviewing Attestation of Title, and contracts between Field Managers, and Project Owners	No
2.5	Verify that no fields within the project are simultaneously enrolled in another project	No
2.5	Verify that any fields previously enrolled in another project have followed the proper procedures to enter the new project and leave the old project	Yes
3.2	Verify accuracy of project start date for all verified fields based on operational records	Yes
3.4	Verify that each field is within the 10-year crediting period	No
3.5.1	Verify that each field meets the performance standard test	No
3.5.1.1	Verify that each field previously in a year for which CRTs are not being sought applied no more than the permissible N rate range over the growing season	Yes
3.5.2	Confirm execution of the Attestation of Voluntary Implementation form to support demonstration of eligibility under the legal requirement test	No
3.5.3	Verify that any ecosystem service payment or credit received for activities on a project field has been disclosed and is allowed to be stacked	No
3.6	Verify that the project activities at all verified fields comply with applicable laws, particularly water quality laws, by reviewing any instances of non-compliance provided by the project developer and performing a risk-based assessment to confirm the statements made by the project developer in the Attestation of Regulatory Compliance form	Yes
3.6	Verify whether the project is located on fields that are classified as Highly Erodible Land or wetlands. If HEL or wetlands are included, verify that the required conservation compliance standards are being met	No
5.2	Verify increases in N rates during cultivation years where CRTs are not being sought are appropriately accounted for	No
6.1, 6.2	Verify that the project Monitoring Plan contains a mechanism for ascertaining and demonstrating that all fields pass the legal requirement test at all times	No
6.3	**Verify that field-level and project-level monitoring meets the requirements of the protocol. If it does not, verify that a variance has been approved for monitoring variations**	No

Verification – Table 8.C Quantification verification items

Protocol Section	Quantification Item	Apply Professional Judgment?
4	Verify that all SSRs in the GHG Assessment Boundary are accounted for	No
5.1	For each field, and the project as a whole, ensure that the emission reductions associated with reductions in synthetic N rates have been calculated correctly, using the NMQuanTool.	No
5.2	For each cultivation year for which CRTs are not being sought, ensure any increases in N rate are properly accounted for	No
5.3	For each field, verify that the synthetic and organic N rate changes have been properly quantified.	No
5.3, 5.4, 5.5	For each field, verify that input parameters for both the baseline and the project are represented by the appropriate data and the calculations are accurate.	Yes
5.5	For the project, verify that emissions from any increased consumption of fossil fuel and electricity are calculated correctly.	Yes
5.5	**For the project, verify that the emissions from crop production leakage are properly accounted for.**	No

Verification – Table 8.D Risk assessment verification items

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
6, 7	Verify that all contractors and employees are qualified to perform the duties expected. Verify that there is internal oversight to assure the quality of the contractor's work	Yes
6.1, 6.2	Verify that the project has documented and implemented the Project Monitoring Plan and, where appropriate, the Cooperative Monitoring Plan	No
6.1, 6.2	Verify that the project monitoring plans are sufficiently rigorous to support the requirements of the protocol and proper operation of the project	Yes
6.3	Verify that appropriate monitoring data is measured or referenced accurately	No
6, 7, 8	Verify properly informed risk-based sampling for site visit selection	Yes
7.2	Verify that the Project Monitoring Report and any Cooperative Monitoring Report was uploaded to the Reserve software	No
7.2, 7.3	Verify that field data has been gathered and made available to project developers	No
7.3	**Verify that all required records have been retained by the project developer**	No

CLIMATE ACTION RESERVE

QUESTIONS?

Next Steps

- Workgroup comments - submit to Reserve by COB Monday, July 2
- Reserve to consolidate feedback into revised Draft for Public Comment
- Start 30-Day Public Comment Period – end of July - end of August
- “Board-Ready” Protocol completed – mid-September
- Final protocol submitted to Reserve Board – October 17, 2018

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