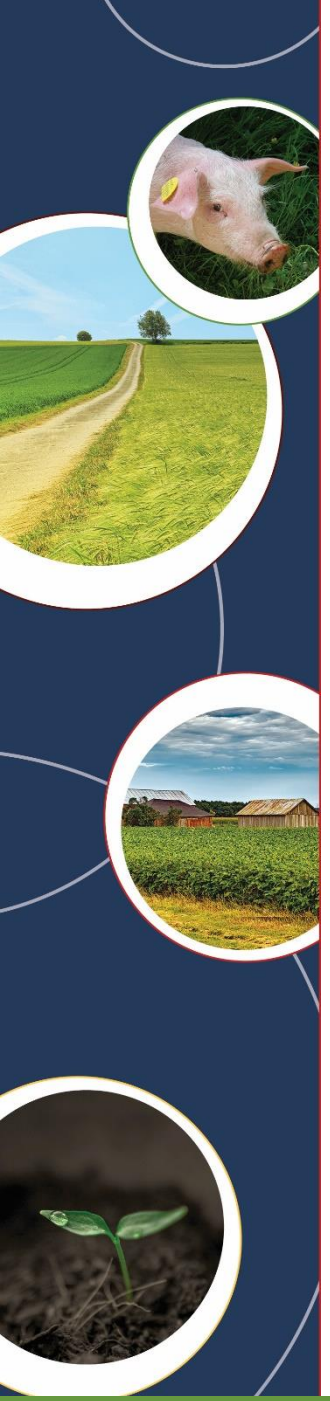


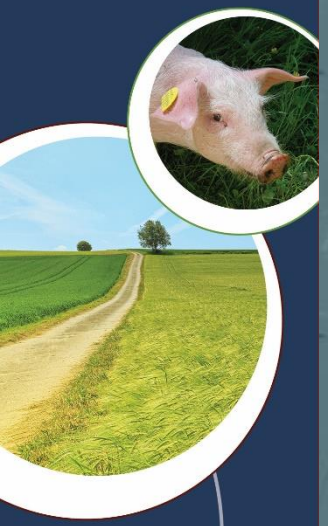
ECOSYSTEM SERVICES MARKET CONSORTIUM

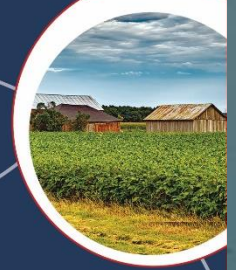
How ESMC Can Benefit the Chesapeake Bay Watershed

Chesapeake Bay Program Trading and Offsets Workgroup

Wednesday 21 April 2021

Debbie Reed, ESMC/ESMRC
Jennifer Olson, Tetra Tech
Michelle Schmidt, Tetra Tech





ECOSYSTEM SERVICES MARKET CONSORTIUM

ESMC:

Mission-Driven.

Impact-Driven.

Non-profit.

ESMC MISSION

To advance ecosystem service markets that incentivize farmers and ranchers to improve soil health systems that benefit society

ECOSYSTEM SERVICES MARKET CONSORTIUM

Ecosystem Services Markets for Agriculture

Ecosystem Services Markets Conceived & Designed…

- *…for Agriculture*
- *…to Overcome Past Market Challenges*
- *…to recognize and reward farmers & ranchers for their impacts*

ESMC/ESMRC Funders

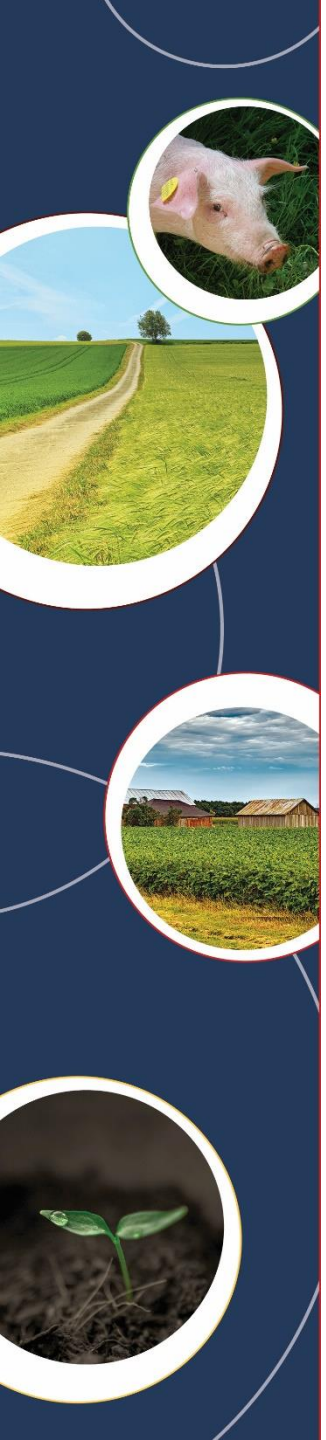
FFAR
McKnight Foundation
The Nature Conservancy — Protecting nature. Preserving life.
USDA NRCS — United States Department of Agriculture, Natural Resources Conservation Service
USDA
The Ida and Robert Gordon Family Foundation
General Mills
United Soybean Board
Walton Family Foundation
arpa·e — Changing What's Possible
Noble Research Institute

Founding Circle Members

Soil Health Institute
Nestlé
Corteva agriscience
Noble Research Institute
ADM
General Mills
Danone North America
Cargill — Helping the world thrive
TruTerra
National Fish and Wildlife Foundation
Nutrien Ag Solutions
syngenta
The Nature Conservancy — Protecting nature. Preserving life.

Legacy Partner Members

California Almonds — Almond Board of California
Farmers Business Network
Soil Health Partnership
Missouri Soybeans
MissouriCorn Merchandising Council
The Moonshot Factory
National Corn Growers Association
National Association of Conservation Districts
GROWMARK
The Campbell Foundation
National Association of Wheat Growers
P·O·R·T
CTIC
Trace Genomics
IL Corn — ilcorn.org
National Farmers Union
OpenTEAM
American Farmland Trust — Saving the Land that Sustains Us
MFA Incorporated
Sand County Foundation
K·COE Isom
Trust in Food — A Farm Journal Initiative
PepsiCo — Pepsi, Lay's, Tropicana, Quaker, Gatorade
Farm Foundation
NCBA — National Cattlemen's Beef Association
Low Carbon Prosperity Institute
Pivot Bio
Bushel
Field to Market
ASA — American Soybean Association
Cornell Atkinson Center for Sustainability
Sustainable Northwest
Tyson
Mars
FarmMobile
Vence
WWF
ARVA Intelligence
Silicon Ranch
Sorghum Checkoff
Anuvia — Planet Inspired Products
native energy — A Public Benefit Corporation
American Society of Agronomy
Crop Science Society of America
American Farm Bureau Federation
The Fertilizer Institute
Soil Science Society of America
Stewardship Index for Specialty Crops
Newtrient
Arizona State University
American Sugarbeet Growers Association
Pattern

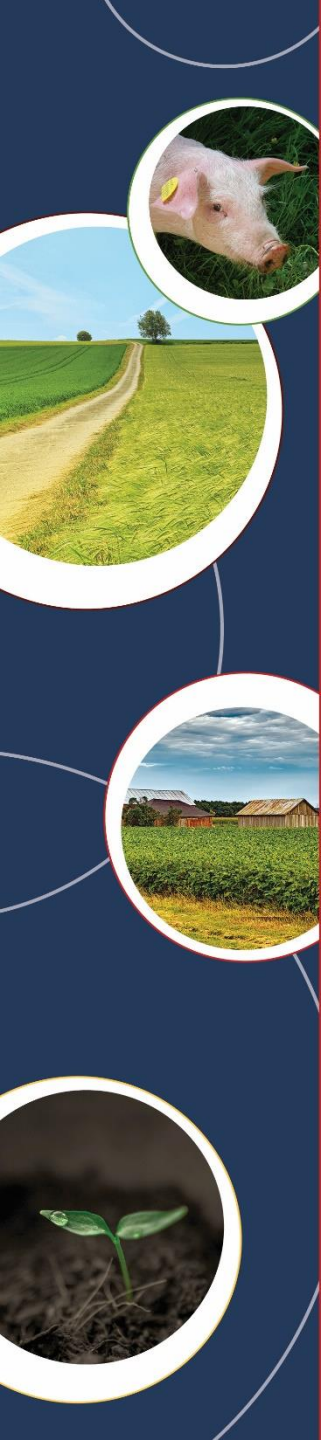


ESMC Program: Value to Stakeholders

- National scale harmonized market for US agriculture
- Transparent, certified program to meet corporate needs for scope 3 GHG reporting requirements and (developing) water risk reporting and tracking
  - Modular approach: biodiversity, additional assets added in future
  - ESMC first market to quantify multiple assets in integrated approach
- ***ESMC as agent of change*** to help meet CSR goals in ag supply chains while ensuring farmers & ranchers are paid
- ESMC programmatic investments will meet ***variable markets (e.g. C markets)*** & needs as they change, develop

ESMC Protocols & Market Design

- Farm-level accounting
- Farmer data, credits are farmer owned
- Data privacy critical, extensive policies and procedures (HST)
- Pricing value to farmers: market analyses, pilots testing costs, returns
- Market launch – price discovery, transparency will be key

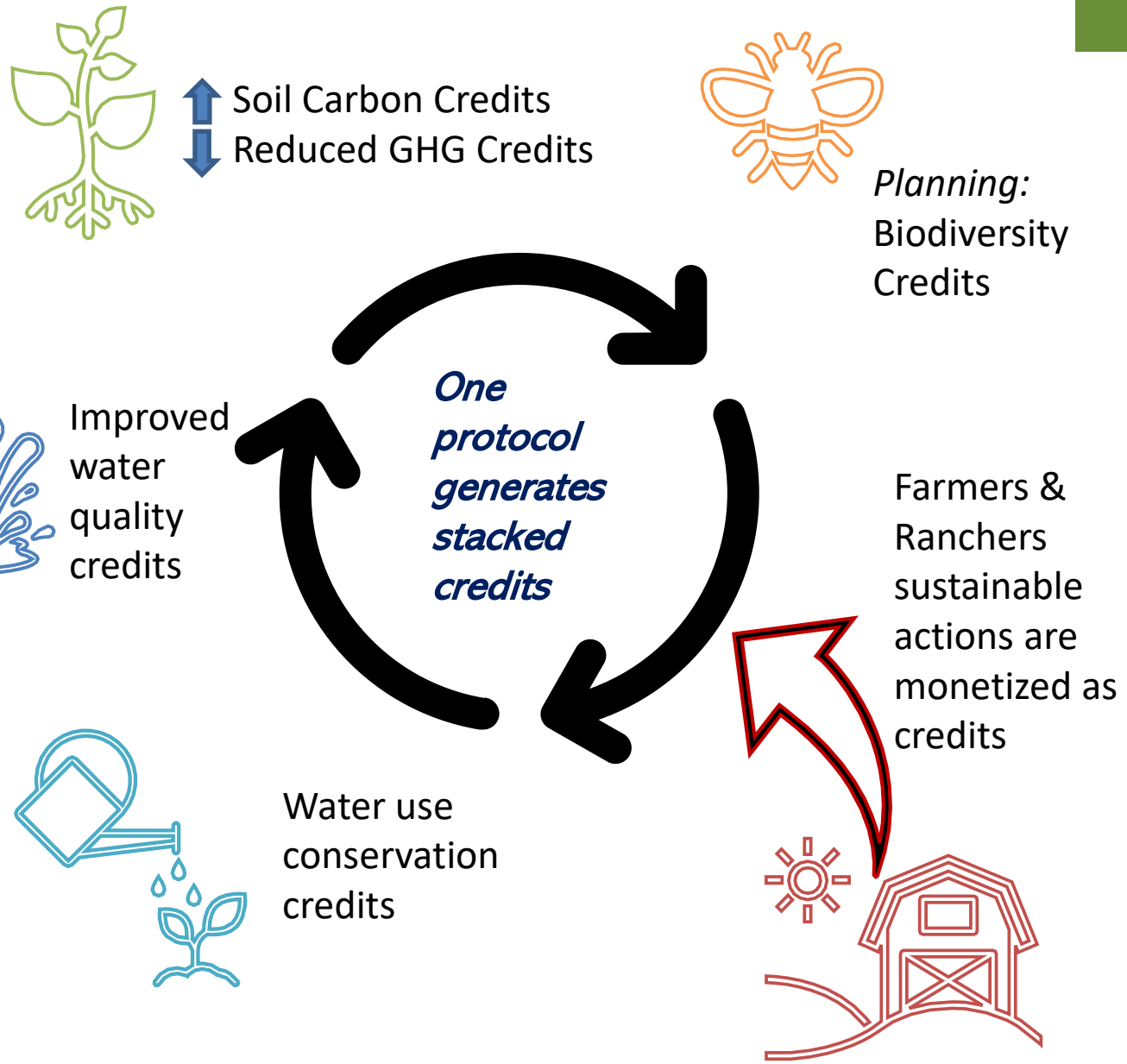


ESMC Market Design:

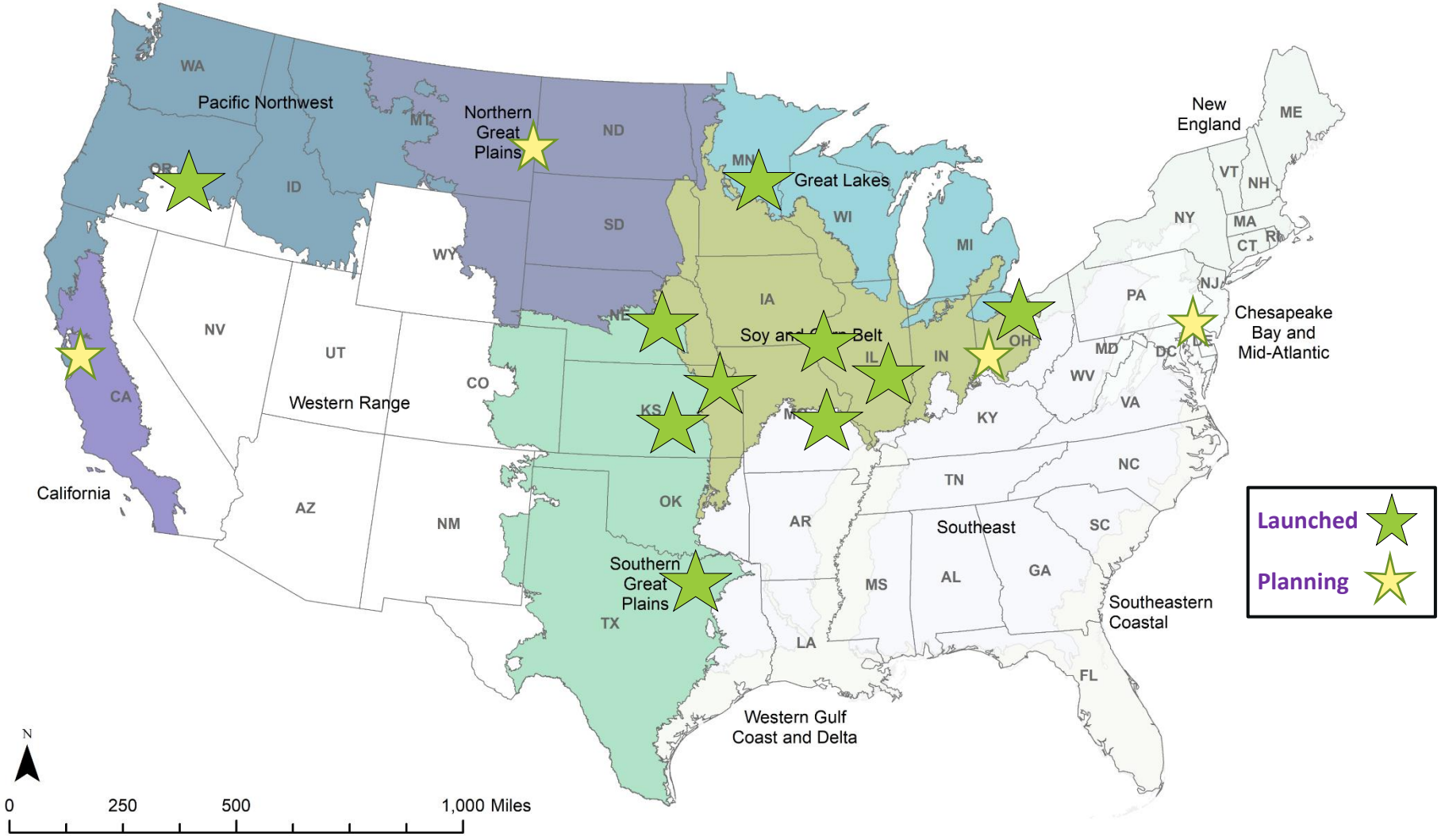
Modular tiered protocols

- Modular = stack multiple credits
- ESMC quantifies, verifies, certifies*, stacks, sells credits
- ESMC pays farmers

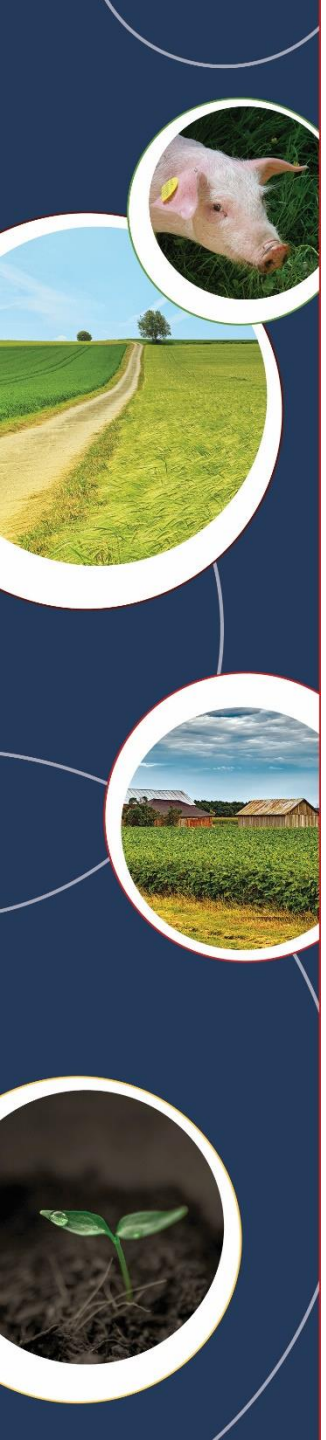
*Gold Standard & SustainCERT are global certification bodies we are using for certification



ESMC Pilot Project Locations

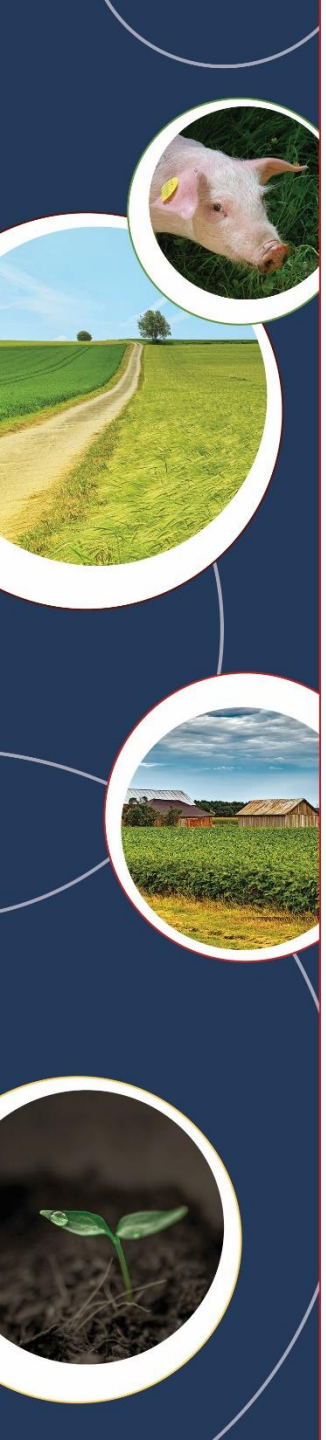


ECOSYSTEM SERVICES MARKET CONSORTIUM



Asset Quantification

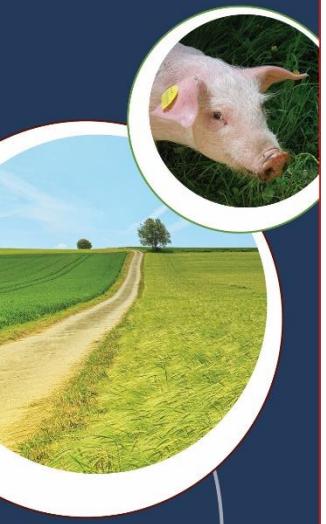
- Approach focuses on model rigor, scale (field), applicability across the U.S., multiple production systems and conservation practices, model documentation
- **Water quality assets**: sediment, total phosphorus, and total nitrogen
- **Greenhouse gas assets**: soil organic carbon, methane, nitrous oxide, carbon dioxide from fuels/electricity
- **Water quantity assets**: irrigation efficiency based on monitoring

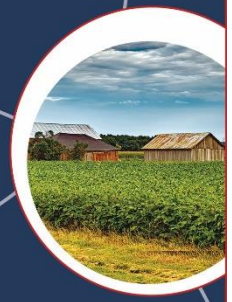


Current Production Systems and Practices

- **Grazing**
- **Corn**
- **Soybeans**
- Wheat
- Cotton
- Sorghum
- Oats
- Sugar beets
- Potatoes
- Hay/alfalfa
- Barley
- Almonds

Agricultural Management Practice	Applicable Environmental Attributes
Residue and tillage management, reduced tillage	GHG, Water Quality
Cover crop	GHG, Water Quality
Nutrient management	GHG, Water Quality
Prescribed grazing	GHG, Water Quality
Field buffer, filter strip, field border	Water Quality
Contour buffer strip, vegetative barrier within a field	GHG, Water Quality
Constructed ponds and wetlands	Water Quality
Grassed waterway	Water Quality
Conservation crop rotation	GHG, Water Quality
Prescribed burning	GHG
Irrigation water management	GHG, Water Quality

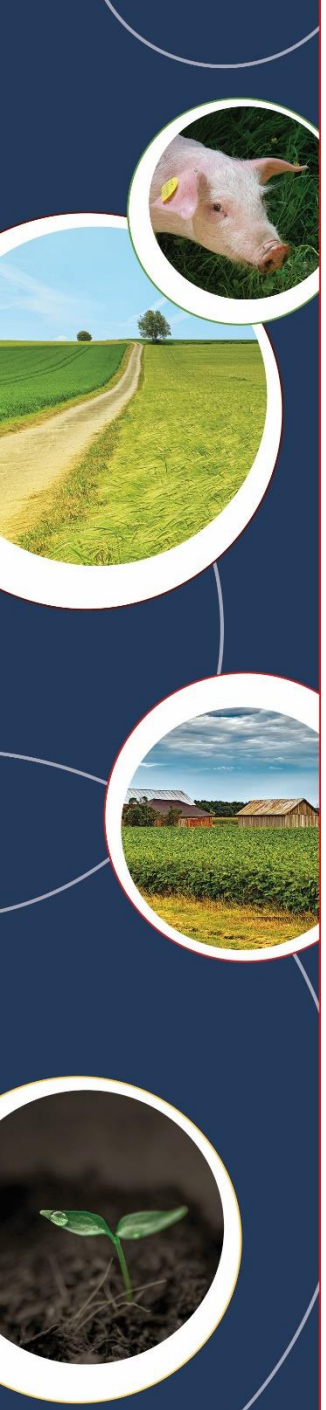





Water Quality

- Agricultural Policy Environmental eXtender (APEX)
  - Texas A&M AgriLife
  - NRCS Conservation Effects Assessment Project
- Agronomic and crop growth model
- Field scale, daily timestep

Water Quality Credit or Asset = (Baseline Scenario Load – Project Scenario Load) – Uncertainty Deduction



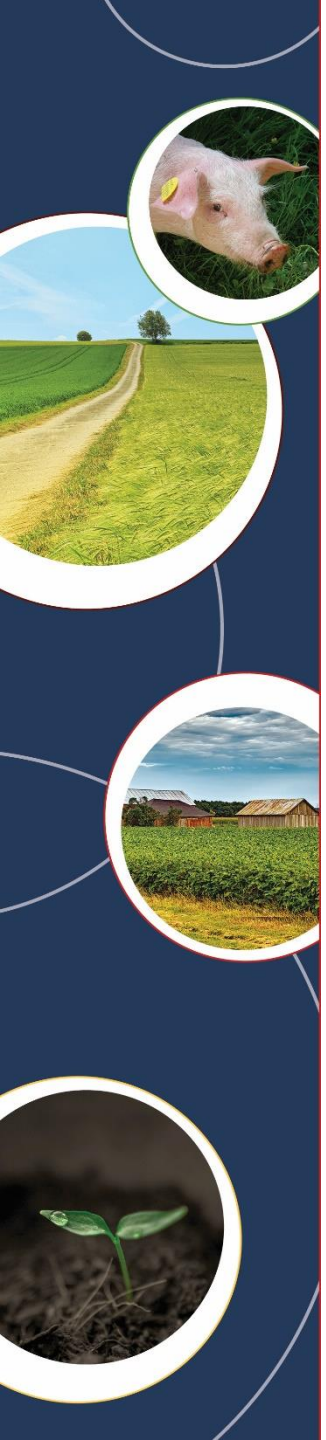
Greenhouse Gases

- DeNitrification-DeComposition (DNDC) model
  - daily time-step, process-based biogeochemical model that predicts carbon and nitrogen fluxes in agricultural ecosystems
- Emission factors for fuel, electricity, enteric
- SOC measurement via soil sampling

Net GHG Credits = GHG Emission Reductions + GHG Emission Removals – Uncertainty Deduction

GHG Emission Reductions = Baseline Emissions – Project Emissions

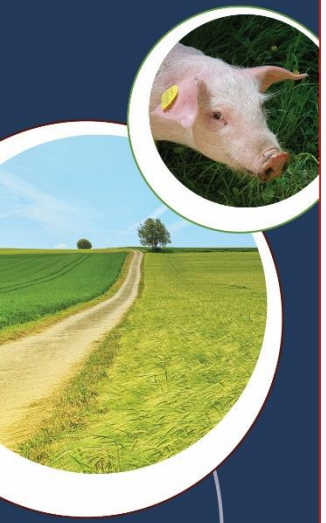
GHG Emission Removals = Project Removals – Baseline Removals

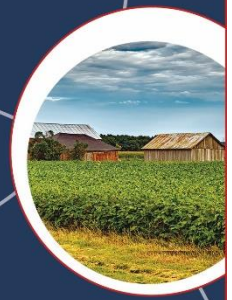


Producer Input – Per Field

- Cropland: species/rotation, yield
- Tillage: dates, type
- Irrigation: method, source, schedule/frequency, rate
- Drainage: percent tiled, tile depth
- Residue management: percent covered, OpTis satellite-derived datasets
- Cover crops: species, establishment success, dates
- Conservation practices: multiple inputs for each practice (date installed, size, etc.)
- Non-manure fertilizer: type, rate, nutrient content, method, dates
- Manure fertilizer: source, type, rate, nutrient content
- Operation: planting, harvesting, cutting/baling, burning
- Grazing: head, hours/days, additional feed

Questions & Answers





Integrated GHG quantification

- Quantify GHG outcomes
- 1 GHG credit = 1 ton CO_2e sequestered and/or reduced
  - SOC removals
  - GHG reductions
- Model: GHG quantification using DNDC biogeochemical model (CO_2, N_2O, CH_4) *and*
- Sample: SOC sampling (0, 5, 10 yr) due to lack of accurate SOC baselines, data
- Calculate uncertainty