



Forest Carbon Working Group

Learning Exchange Series

Ecosystem Services Markets Conceived and Designed for Agriculture: Scaling Impacts

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ESMC:
Mission-Driven.
Impact-Driven.
Non-profit.

POPULATED PLACES

- 1,000,000 and over
- 500,000 - 999,999
- 250,000 - 499,999
- 100,000 - 249,999
- 50,000 - 99,999
- Principal capital
- State or provincial capital
- Other cities
- Chicago
- Seattle
- Orlando
- Houston
- Washington
- Albany

TRANSPORTATION

- Interstate (numbered) and other highways
- Other principal highways
- Road
- Railroad

PHYSICAL FEATURES

- Boundary (national, international, state, provincial, administrative)
- Boundary (national)
- Physical features
- Higher elevation in color than lower elevation
- Sea level



ESMC MISSION

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

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



Founding Circle Members



Legacy Partner Members



ESMC Program: Value to Stakeholders

- National scale harmonized market program 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 Program Design

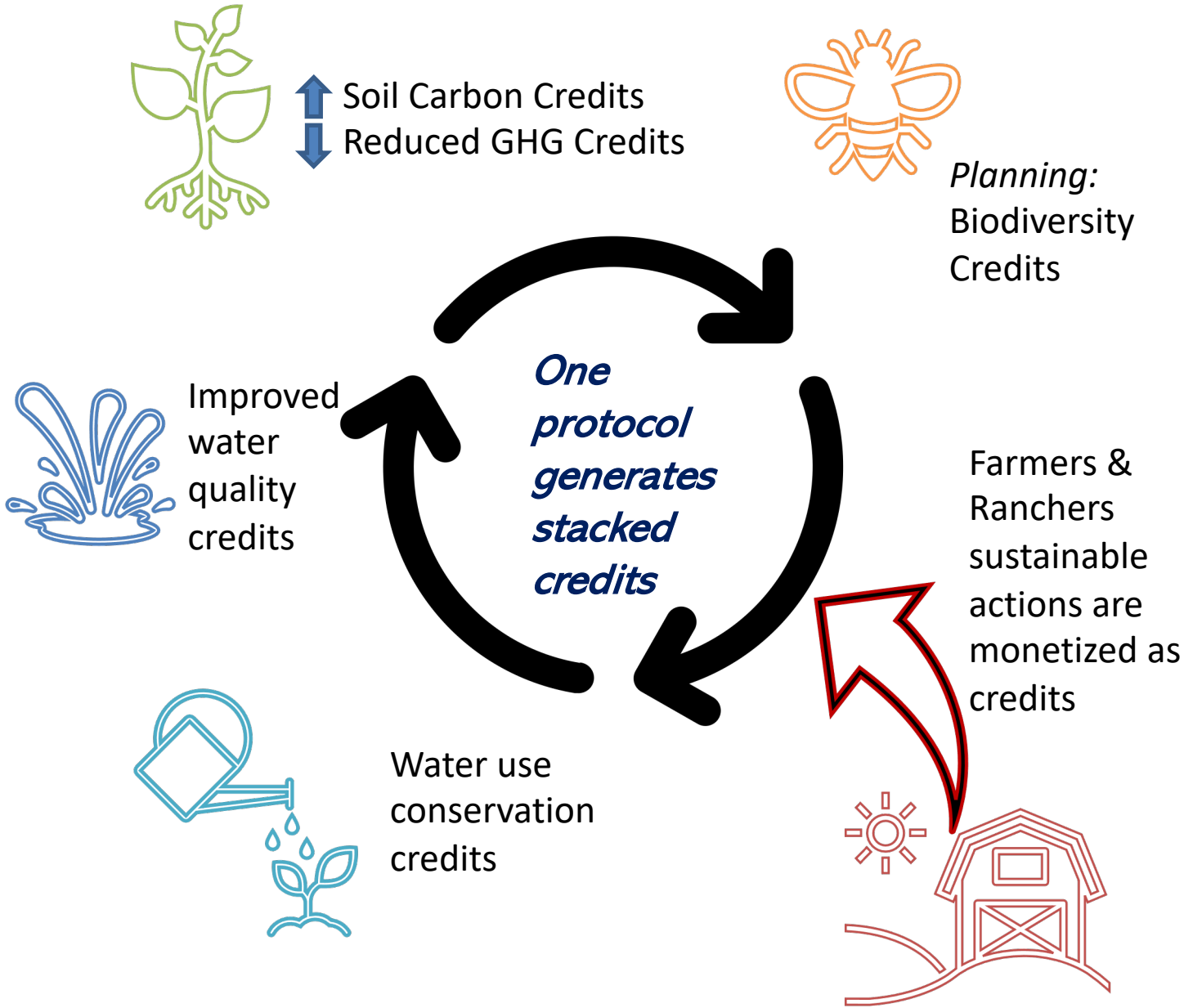


- Farm-level accounting
- Farmer data, credits are farmer owned
- Data privacy critical, extensive policies and procedures (HST)
- Pricing value to farmers: market analyses, pilots testing costs, returns
- Market program launch – price discovery, transparency will be key

ESMC Market Program Design:

- Modular tiered protocols
- Modular = stack multiple credits
 - ESGMC quantifies, verifies, certifies*, stacks, sells credits
 - ESGMC pays farmers

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





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

Integrated GHG Quantification

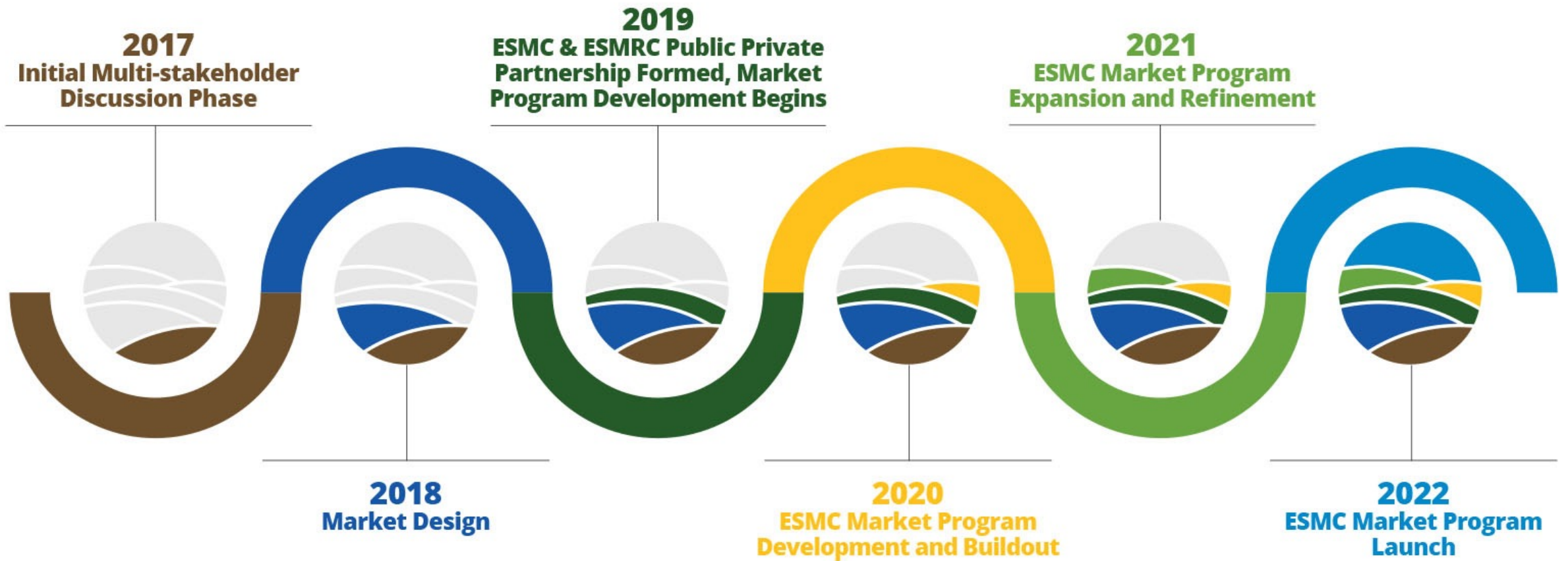
- Quantify GHG outcomes
- 1 GHG credit = 1 ton CO₂e sequestered and/or reduced
 - SOC removals
 - GHG reductions
- Model: GHG quantification using DNDC biogeochemical model (CO₂, N₂O, CH₄) *and*
- Sample: SOC sampling (0, 5, 10 yr) due to lack of accurate SOC baselines, data
- Calculate uncertainty



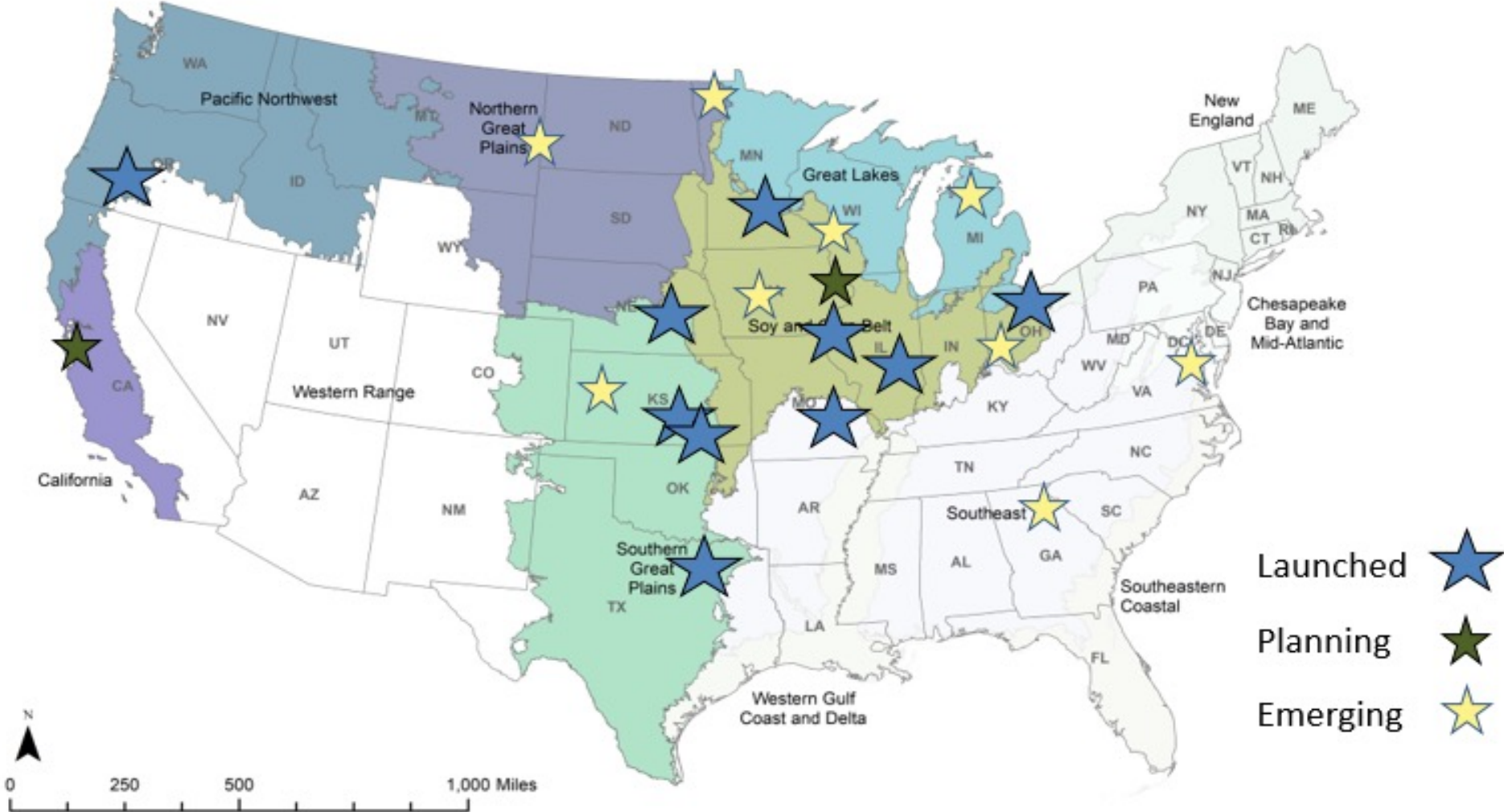
ESMC Program Efforts Underway

1. 10 research projects in progress
2. 10 Emerging Market projects for 2021
3. ESMC Producer Portal Improvements
4. Improving project training and materials
5. Producer recruitment process with partners
6. Refine Program process, materials, and training
7. Develop contracts, agreements, payment mechanisms
8. Buyer Recruitment





ESMC Program Coverage



Pilot Project Steps

1. Pre-enrollment interview/screening
2. ESMC account creation in the Producer Portal
3. Producer or Advisor identifies fields for enrollment
4. Field stratification and soil sampling
5. Enter field management data in the Producer Portal
6. Data self-certification and Producer Agreement
7. Data submission and auto-validation



2021 Pilot Schedule

Farmer activities
ESMC activities

Crop land

Stratification and soil sampling
within 1st 6 months

For 2021 Soil Sampling can be done in the Spring OR Fall

Crediting
period begins

Crediting
period ends

Self-certification of data,
sign Producer Agreement,
data submission by Dec 31

Previous
harvest
2020

Harvest
2021

2022

Payment
2022-Q2

Identify fields for
enrollment in ESMC

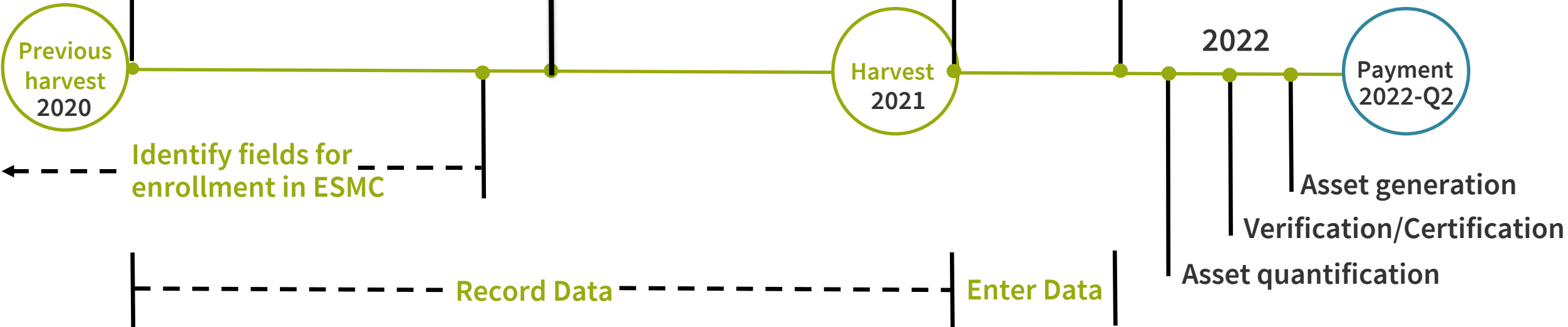
Asset generation

Verification/Certification

Asset quantification

Record Data

Enter Data



Producer Portal

ECOSYSTEM
SERVICES MARKET
CONSORTIUM

 Andrew McClintick



Start



Fields &
Crops



Herds



Submit

Welcome to the ESMC PilotProject Portal

Pilot Project Data Entry Process Summary

Enter the general information below and follow the additional steps below to enter data into ESMC's pilot project portal. Detailed instructions can be found at esmportal.org/knowledge-base.

Summarize the historic or baseline conditions of the project site

Specify significant management changes in the past 3 years such as total nutrient applications, cropping rotation, and average stocking rate.

Is a change in electricity utilization expected?

Yes No

Baseline Electricity Usage(MWh/yr)

Projected Electricity Usage(MWh/yr)

Is a change in fossil fuel consumption expected?

Yes No

Historical average yields across all acres (entire operation, not just ESMC enrolled fields)

Historical average stocking rates across all acres (entire operation, not just ESMC enrolled fields)

Next Steps

Producers

Step 1. Select the Crops tab. Step 2. Enter your field boundaries (see esmportal.org/knowledge-base/fields for more details).

Step 3. Add a crop for each field (see esmportal.org/knowledge-base/crops for more details).

Step 4. Add relevant management operations for each crop (see esmportal.org/knowledge-base/management for more details).

Step 5. After harvest, enter the yield information (see esmportal.org/knowledge-base/crop-expansion for more details).

Step 6. After validating your data, select the submit tab, agree to the terms and conditions, and click submit.

Ranchers

Step 1. Select the Crops tab. Step 2. Enter your field boundaries (see esmportal.org/knowledge-base/fields for more details).

Step 3. Select the Herds tab. Step 4. Add details regarding your herds (see esmportal.org/knowledge-base/herds for more details).

Step 5. After details regarding your rotation (see esmportal.org/knowledge-base/rotation for more details).

Step 6. After validating your data, select the submit tab, agree to the terms and conditions, and click submit.

Pilot Project Summary

Pilot Project Name:

Pilot Project Manager:

Contact Email:

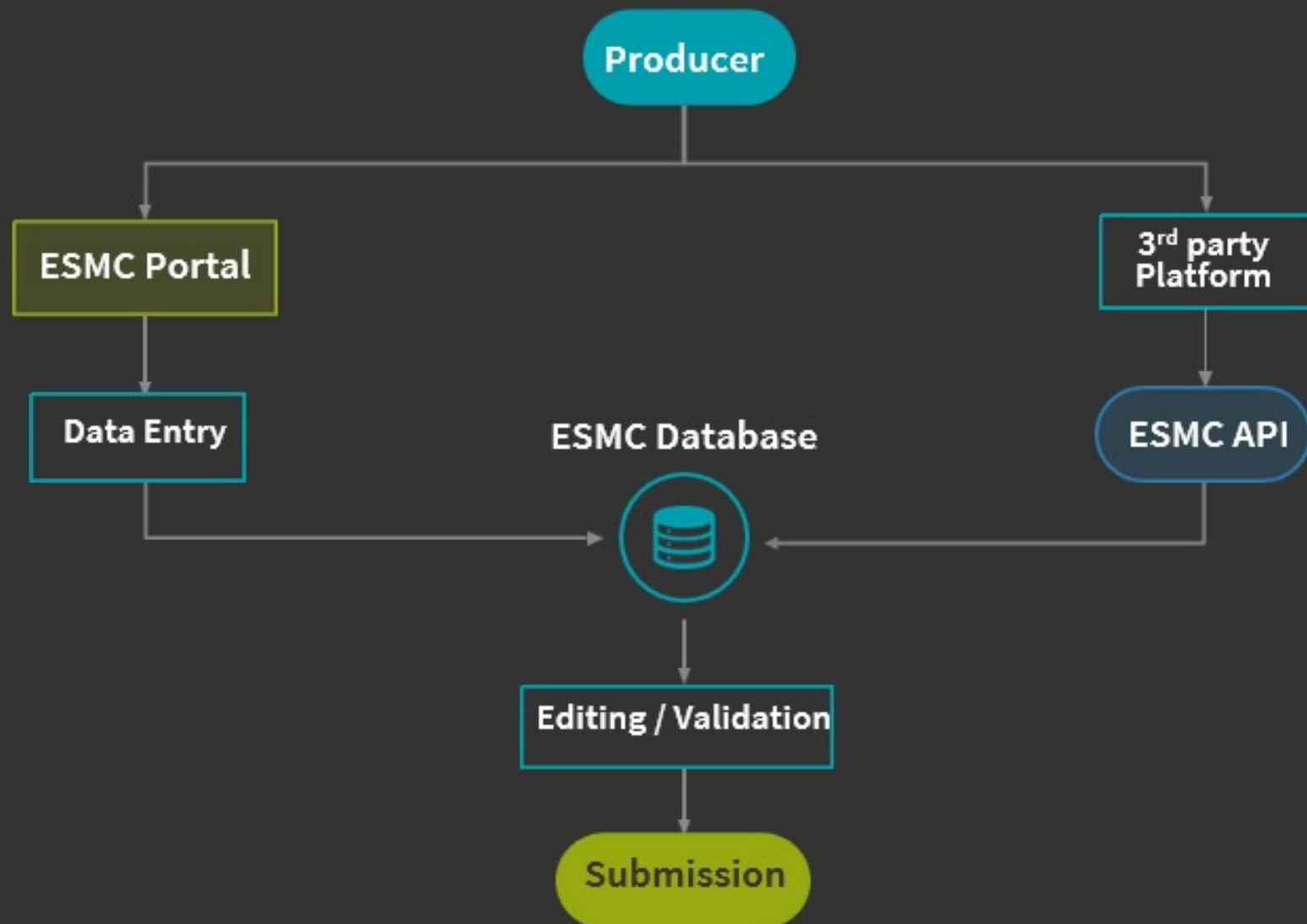
Environmental Asset:

Help Desk Email: info@esmportal.org

ESMC Website: ecosystems-services-market.org

Data Entry Status

Data Collection Option



Research to Simplify Scope 3 Asset Quantification

Proposed modifications of soil sampling approach

- Reevaluate sampling density and needed level of uncertainty
- Project or sub-project scale stratification

Reduction in data requirements from producers

- Use of remote sensing or other external data sources
- Sensitivity analysis to determine which variables have the greatest impact on outcomes

Automation and integration of process steps and tools

- 3rd party data import, stratification app, model automation, etc.



ESMC Program Coverage: 2021-2022



Questions & Answers



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