CLIMATE ACTION RESERVE

Public Scoping Meeting: Soil Enrichment Project Protocol v1.0

January 15, 2020

Housekeeping

- All attendees are in listen-only mode
- We will take questions at the end, time permitting
- Please submit your questions in the GoToWebinar question box
- We will follow up via email to answer any questions not addressed during the meeting
- The slides and a recording of the presentation will be posted online

Introduce speakers

1 MAIN PRESENTER

Sami Osman, Senior Policy Manager, Climate Action Reserve

2 INTRODUCING RESERVE

Craig Ebert, President, Climate Action Reserve

3 INTRODUCING INDIGO AG'S PROTOCOL APPROACH

Ed Smith, Vice President, Terraton & Carbon, Indigo Ag
Dan Harburg, Senior Director Systems Innovation, IndigoAg

AGENDA

- Climate Action Reserve
- Background on soil enrichment projects
- Development process/timeline
  - **REMINDER: Statements of Interest for joining workgroup due Jan 17th**
- Overview of Indigo Ag's proposed approach
- Key considerations for protocol development
  - Project definition
  - Aggregation
  - Eligibility considerations
  - Quantification approach
  - Monitoring and data needs
- Next steps

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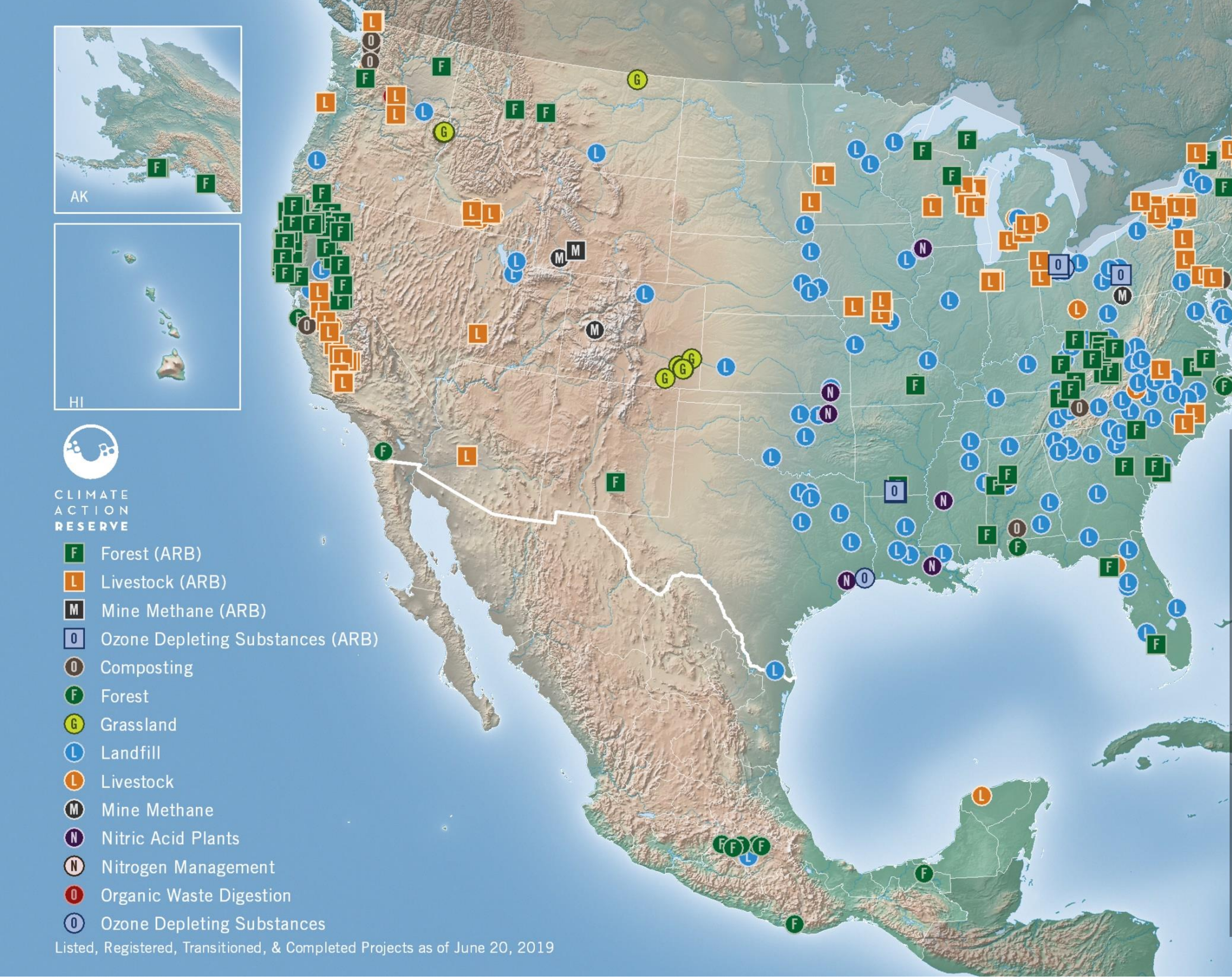
Climate Action Reserve

- Mission: to develop, promote and support innovative, credible market-based climate change solutions that benefit economies, ecosystems and society
- Develop high-quality, stakeholder-driven, standardized carbon offset project protocols across North America
- Accredited Offset Project Registry under the California cap-and-trade program
- Serve compliance and voluntary carbon markets
- Reputation for integrity and experience in providing best-in-class registry services for offset markets
- Based in Los Angeles, CA



CLIMATE ACTION RESERVE

Nonprofit, founded 2001

Voluntary & compliance

>550 Projects

140M+ Credits Issued

Agricultural protocols

Livestock manure

Grassland conservation

Rice cultivation

Nitrogen management

BACKGROUND

Background: Why soil enrichment?

- Growing attention as most widely available and least costly GHG emission reduction tool, with many co-benefits
- IPCC: increasing Soil Organic Carbon (SOC) can reduce GHGs by 3 Gt CO_2e per year
- Various challenges still prevent large-scale uptake of means to increase SOC
- Incentives may be necessary to support farmers to overcome such barriers
- Can offsets support large scale SOC increases?

Background: What types of activities promote soil enrichment?

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US Dept of Agriculture's Natural Resource Conservation Service (NRCS) practice standards

- Crop rotations
- Cover crops
- Forage and biomass planting
- Hedgerow planting
- Irrigation management
- Nutrient management
- Mulching
- Prescribed grazing
- Tillage management
- Riparian buffers

Can offsets support large scale soil enrichment?

DEVELOPMENT PROCESS & TIMELINE

Protocol Development Timeline

Internal research and scoping

1. Scoping meeting
2. Work-group formation
3. Draft develop-ment
4. Work-group process
5. Public comment (30-day)
6. Board adoption

~6 months

Workgroup Formation

Stakeholder participation & feedback is critical to protocol development

The Reserve assembles an intensive multi-stakeholder workgroup to advise protocol development and produce rigorous, well-vetted, and credible protocols

- Strive for balanced representation from industry, project developers, farmers, environmental NGOs, verification bodies, independent consultants, academia, and government bodies
- Interested stakeholders invited to submit Statement of Interest (SOI) forms
  - **Deadline for submitting SOI is Jan 17th**
  - **SOIs can be downloaded here:** http://www.climateactionreserve.org/how/protocols/soil-enrichment/

Requires commitment to ~three workgroup meetings plus additional protocol reviews, familiarity with the practices, technologies, and/or activities for which the protocol is being developed and solid understanding of project-based GHG accounting

Workgroup Process and Expectations for Workgroup members

Process

- Reserve staff identify and solicit feedback on specific protocol criteria
- Reserve staff schedule and hold meetings (~2-3)
- Reserve staff produce draft protocol for review
- Reserve staff revise protocol based on feedback

Expectations

- Review, comment on and provide recommendations on specific protocol criteria
- Participate in meetings via webinar
- Provide written comments on draft protocol

OVERVIEW OF INDIGO AG’S PROPOSED APPROACH

Intro: Key steps for generating agricultural carbon credits

1. Growers enroll in carbon offset program
2. Baseline is established
3. Farmers are supported in transitioning to regenerative practices
4. Data is collected manually and automatically
5. GHG abatement and soil carbon sequestration quantified through model
6. Offsets are verified and validated
7. Offsets are sold
8. Value of offset is transferred to grower

Indigo's program builds upon previous agricultural methodologies

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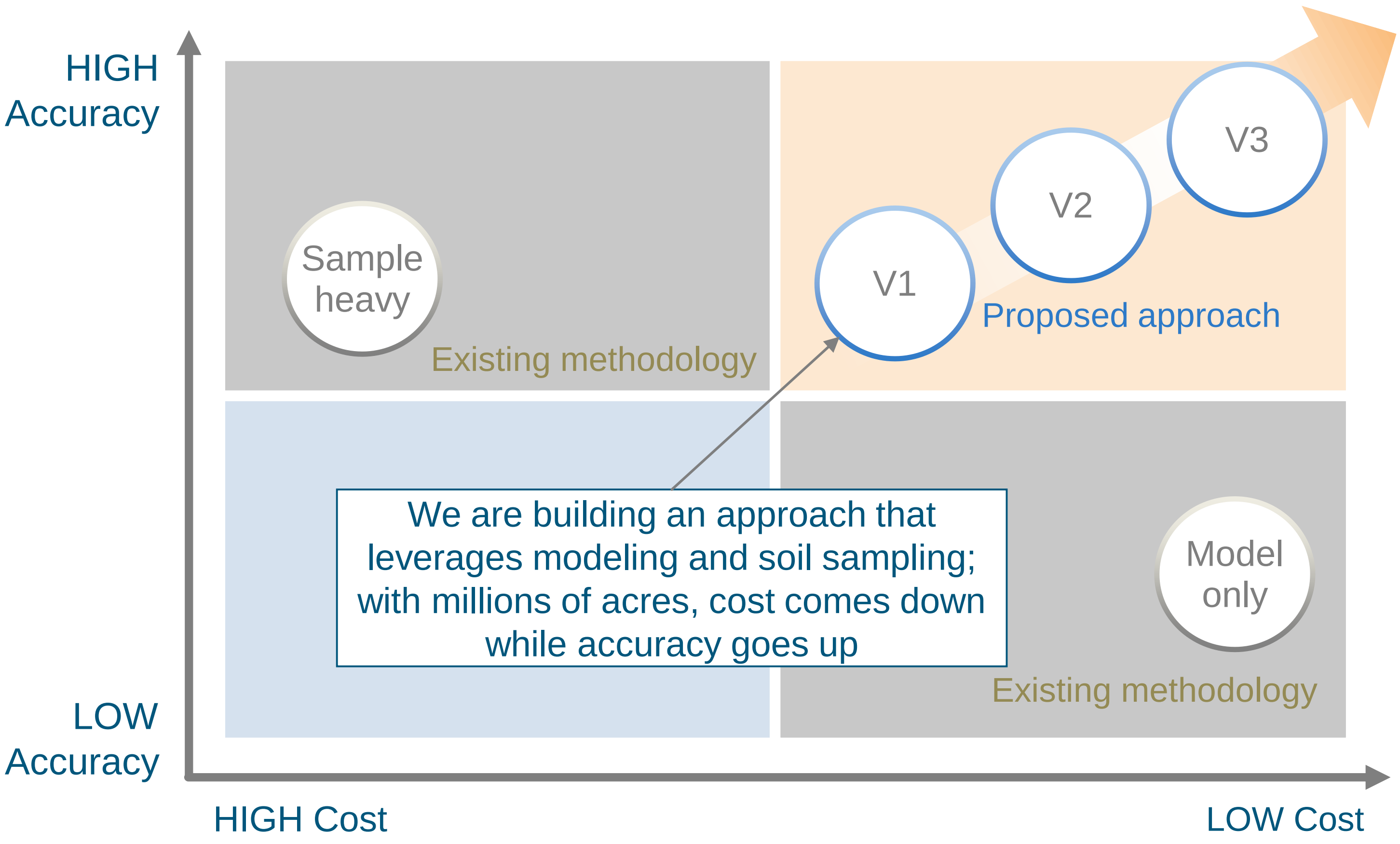
	Methodology	Limitations
CLIMATE ACTION RESERVE	Rice Cultivation Project Protocol, v1.1	Only applicable to the California Sacramento Valley rice growing region
	Nitrogen Management Project Protocol Version 2.0	Only covers nitrogen fertilizer applications
VERRA	VM0017: Adoption of Sustainable Agricultural Land Management, v1.0	Methodology that encompasses many agricultural practices, but mainly geared for developing countries
	VM0021: Soil Carbon Quantification Methodology, v1.0	Requires direct measurements to quantify soil carbon
	VM0022: Quantifying N_2O Emissions Reductions in Agricultural Crops through Nitrogen Fertilizer Rate Reduction, v1.0	Only covers nitrogen fertilizer applications
	VM0026: Methodology for Sustainable Grassland Management, v1.0	Limited to IGM activities and only applicable under specific climatic conditions.
	VM0032: Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing, v1.0	Limited to a narrow set of IGM activities
Carbon farming initiative	Carbon Credits (Carbon Farming Initiative — Measurement of Soil Carbon Sequestration in Agricultural Systems) Methodology Determination 2018	Requires direct measurements to quantify soil carbon
	Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015	Low uptake due to use of very conservative soil carbon models
	Carbon Credits (Carbon Farming Initiative – Sequestering Carbon in Soils in Grazing Systems) Methodology Determination 2014	Superseded by 2015 and 2018 soil carbon methodologies

None of these methodologies combine soil sampling + modeling to enable impact at scale

Current methodologies are designed in a way that necessitates a tradeoff between cost and accuracy



Current systems are unable to scale and adapt

- Methodologies do not allow for soil carbon models that dynamically improve over time
- Tedious approval processes for new methodologies prevent climate science from using the newest tech
- Once farmers join a project, they cannot switch to a new project with better technology

Proposed program has differentiators that will enable to impact at scale

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Advanced technology

- **Sampling + modelling** provides accurate estimates at lower cost
- **Grouped strata** allows sampling only for representative growers

Universal accounting

- Methodology will cover all GHG emission **sources and sinks**

Simplified additionality

- Establishing additionality simply on basis of **practice change**

Scalable to developing nations

- **Remote monitoring** allows us to collect detailed practice data
- Potential to expand to **small-holder communities** in developing nations

Advanced technologies | Proposed approach seeks to combine best of modeling and sampling methods

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Biogeochemical soil carbon model

Sophisticated **biogeochemical model** will provide an accurate estimation of GHG impacts

High-quality practice data

Management practice data will be collected through our proprietary tool, and confirmed through in-person visits and **remote monitoring**

In-field soil sampling

Direct soil carbon measurements will be used to **improve the soil carbon model** and give a measured view of carbon stock changes

What Indigo's program solves:

Soil carbon model is run on high-quality practice data to ensure an **unbiased view** of carbon sequestration

Large-scale soil sampling and model calibration ensures soil carbon model **predicts actual sequestration**

Advanced technologies | Proposing a grouped project approach to realize scale benefits of quantification

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Proposed path forward

	Individual project	Grouped project
Description	• Each participant records project activities as part of discrete projects	• Multiple participants and project activities are combined into a single project
Adding new participants	• Each participant is documented separately as a stand alone project	• New participants can be added to existing projects
Quantification	• Quantification of carbon benefits is done for each participant	• Quantification done through a sampling approach for the whole group
Credit issuances	• Credits are issued to each individual participant • Multiple monitoring reports / verifications needed	• Credits issued as a batch to the grouped project • Only one monitoring report / verification needed

Advanced technologies | Propose selecting and quantifying a representative sample of growers to estimate for the full project

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Step 1: Selection of a representative set

- **Percentage of participants** (preliminarily, 6%) in the sample optimized for cost and uncertainty
- Sampled participants are selected through a **randomized sampling approach**
- **Stratification of participants** may be used to group 'like' participants to improve accuracy and reduce sampling percentage

Step 2: Quantification of the representative set

Data collected on the representative set of participants in the project

Carbon benefits quantified on the representative set using the appropriate protocol

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Propose collecting practice data on all participants outside of sampled acres and verify with remote sensing

Step 3: Quantification of full project from representative set

1. Project carbon benefits are **scaled up** from the sampled set

Strata A:	Sampled offsets	✖	$\frac{1}{\text{Sampled \%}}$	=	Strata A offsets
Strata B:	Sampled offsets	✖	$\frac{1}{\text{Sampled \%}}$	=	Strata B offsets
⋮		⋮		⋮	
Strata Z:	Sampled offsets	✖	$\frac{1}{\text{Sampled \%}}$	=	Strata Z offsets
			Sum total:		**Project offsets**

2. **Offset deductions** taken if uncertainty in quantification is larger than registry requirements
3. **Post-stratification** may occur to improve sample selection in future verifications

Advanced technologies | We are leveraging three types of fields in our program, each with distinct data requirements

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Sampled Fields

% Total portfolio: 6%[1]

Sampling:
Medium density (1 per 8 ac.)
Single depth (30cm)
5-year frequency

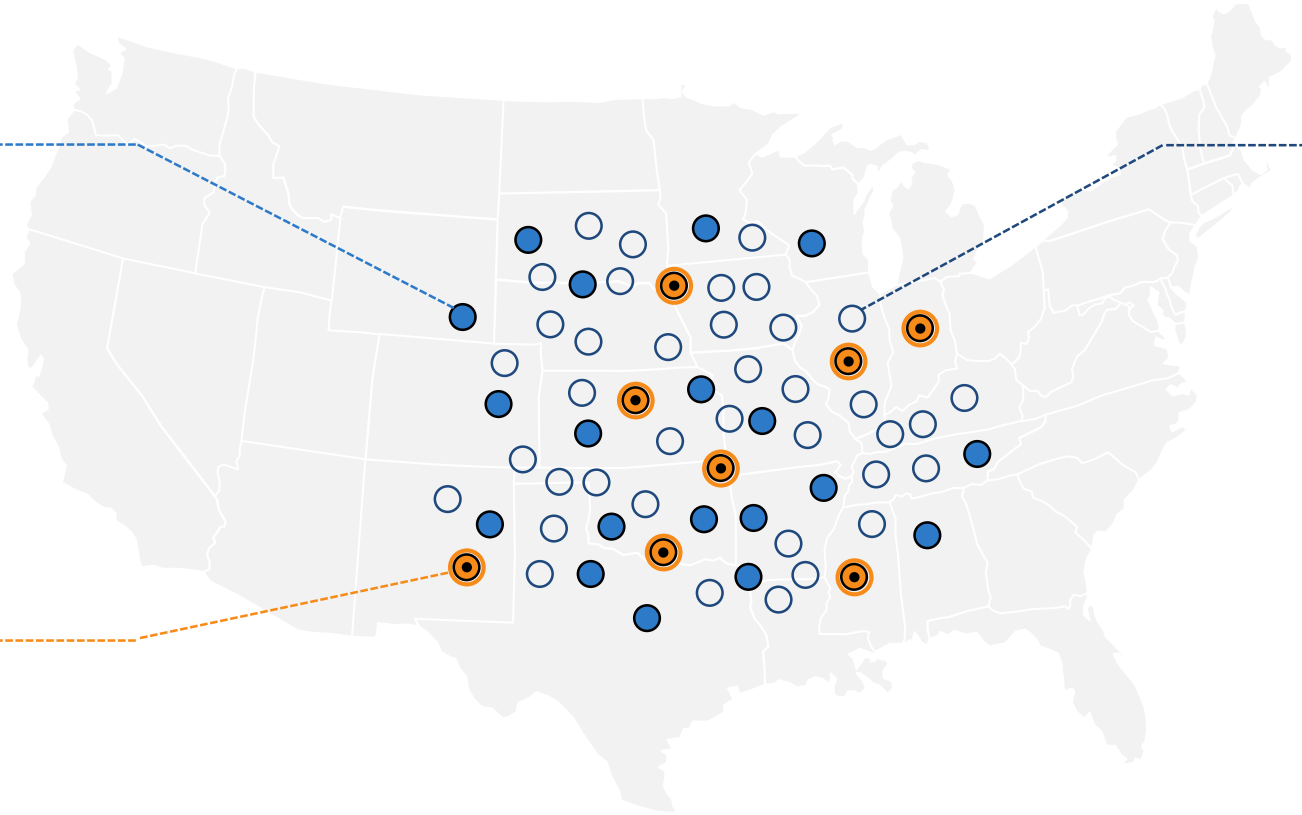
Data collected:
Management practices
Remote sensing

Experiment Fields

% Total portfolio: 0.1%[1]

Sampling:
High density (1 per 5 ac.)
Multiple depths (30cm, 1m)
1-year frequency
Soil health (e.g. microbial, Haney)

Data collected:
Deep management practices
Remote sensing



Grouped Fields

% Total portfolio: 93.5%[1]

Sampling:
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Data collected:
Light mgmt. practices
Remote sensing

1. 2019 enrollment assumed at 9.5M acres

Universal accounting | Our methodology includes all GHG emission sources and sinks

Greenhouse gas	Source	Quantification approach
CO_2	Soil organic carbon	Soil measurements + soil carbon model
	Fossil fuel use	Default emission factors
CH_4	Soil respiration	Soil carbon model
	Enteric fermentation	Default emission factors
	Manure deposition	Soil carbon model
	Biomass burning	Default emission factors
N_2O	Soil respiration	Soil carbon model
	Nitrogen inputs to soil	Soil carbon model/default emission factors
	Biomass burning	Default emission factors

Proposal is to incentivize and credit the adoption of all regenerative farm activities

Simplified additionality | Establishing additionality by simple practice change maximizes impact while minimizing subjectivity

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Under previous approaches to additionality

- Subjective **argumentation** over barriers to implementation
- **Limited verifiability** of justifications for additionality
- Debate over **common practice** thresholds and definitions

Proposed approach

A **simplified approach** to additionality: all growers who adopt a new *eligible* regen ag practice are additional

Proposed program features

1. **Practice verification**
   Practice change verified by self-attestation, remote monitoring, and on-the-ground indicators

Simplified additionality | A small portion of U.S. growers implement more than one regenerative practice on their farm today

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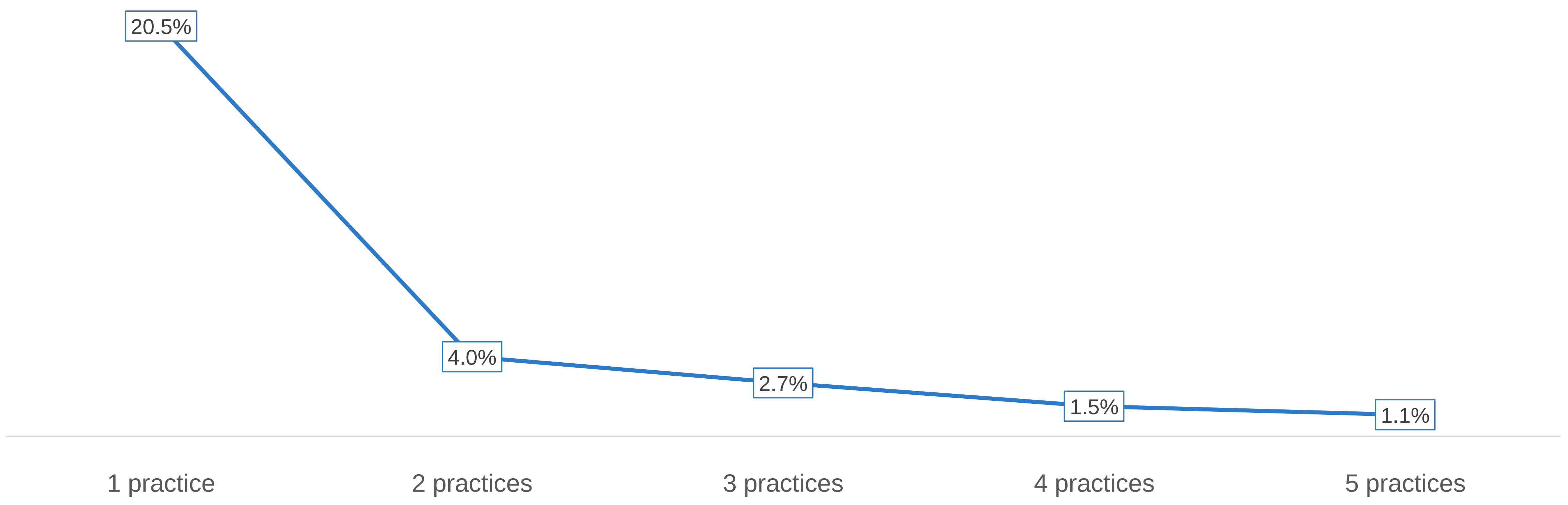
Adoption rate of multiple regenerative practices (weighted average of U.S. corn, cotton, soybeans & wheat)



Note: Assumes 100% adoption of additional regenerative practice
Source: Analysis based on cross-tabulated regenerative practices adoption rate data from USDA report "Tillage Intensity and Conservation Cropping in the United States," September 2018.

Simplified additionality | We propose incentivizing adoption of all variations of regen practices

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Cash crop planting

- Continuous Cash Crop (Monoculture)
- Rotational Cash Crop
- Continuous Cash Crop with Cover Crop
- Rotational Cash Crop with Cover Crop
- Continuous Cash Crop planting into living cover crop
- Rotational Cash Crop planting into living cover crop
- Relay Cropping
- Companion or Intercropping of cover crop with cash crop during the same growing season

Cover crop planting

- Plant cover crops, annual
- Plant cover crops, perennial
- Plant leguminous cover crops, annual
- Plant leguminous cover crops, perennial
- Plant multi-species blend cover crops, annual
- Plant multi-species blend cover crops, perennial
- Interseeding cover crops, annual/perennial
- Interseeding leguminous cover crops, annual/ perennial
- Interseeding multi-species blend cover crops, annual/perennial

Tillage

- Moldboard (2-10”)
- Disk/chisel (2-10”), <50% residue remaining (soil armor)
- Disk/chisel (2-10”), >50% residue remaining
- Vertical tillage (1-2”), <50% residue remaining
- Vertical tillage (1-2”), >50% residue remaining
- Strip till, <50% residue remaining
- Strip till, >50% residue remaining
- No-till
- Continuous no-till (no tillage in last full year)

Incorporate livestock

- Stock pasture
- Rotational pasture
- Multi-species rotational pasture

Fertilizer

- Synthetic fertilizer without optimization
  Synthetic fertilizer: Optimize application or practice split application, surface-applied or broadcast
- Synthetic fertilizer: Optimize application or practice split application, and apply subsurface or with controlled-release (nitrogen stabilizer)
- Use non-synthetic fertilizers

Irrigation

- Flood irrigation
- Standard irrigation (defined as >X gallons/acre)
- Precision irrigation (defined as <X gallons/acre)
- No irrigation
- RICE ONLY: Minimize annual flood days (<X days/year)

This list will adapt and change as we learn and identify new practices that sequester carbon

Scalability | Remote monitoring tools can be applied to track crop health and practice adoption across the globe

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Satellite monitoring enables Indigo to analyze crop health at the **field level** by assessing plant vigor, water availability, and yield potential

Remote sensing technology will allow for **monitoring of smallholder farms**

Scalability | Our in-field data collection app synthesizes diverse data sources

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"TurboTax of Agriculture" makes it easy for farmers and agronomists to enter data and understand return from IndigoCarbon

- Enroll their own fields
- Record tillage, fertilizer deployment, and other events
- Flag pests and weeds

Data used as an input to big data models to calculate carbon sequestered on each field

Video demo

indigo

Indigo's direct interaction with growers reveals **practical considerations** to take into account in agricultural programs

Agricultural carbon programs always face tradeoffs between rigor and feasibility

Agricultural programs **must often decide** between collecting as much data as possible and placing undue burden on a grower

Finding the correct balance is essential to maximizing grower participation and maintaining program rigor

We believe we are well-positioned to support difficult data collection

1. **Heavy investment in grower relations** to understand landscape of easily accessible vs. difficult to obtain data points
2. **Willingness to flex and be creative** in gap-filling data points that are either incomplete or difficult to obtain
3. **Expertise in remote monitoring tools** (e.g., satellites, data collection apps) to collect and verify management practices at a large scale

KEY CONSIDERATIONS FOR PROTOCOL DEVELOPMENT

Key considerations for protocol development

- On this webinar we'll outline key considerations including:
  - *Project definition*
  - *Eligibility*
  - *Permanence*
  - *Aggregation*
  - *Quantification*
  - *Monitoring / Reporting / Verification*
- Identify key challenges – available options

Project definition

- This section of protocol will define the eligible:
  - ***Activities / practices:*** At outset will focus primarily on various regenerative practices relating to cropping:
    - » Cover crops
    - » Tillage practices
    - » Incorporating livestock
    - » Fertilizer use efficiency
    - » Irrigation practices
  - ***Location(s):*** geographical areas that are eligible - At outset will focus on the US
  - ***Crops:*** positive list of specific crops
- Eligibility may depend on combination of above factors – eligible combinations expanding over time

Eligibility considerations

- ***Additionality*** – ensuring only crediting for actions that go beyond what would occur in the absence of the project
- Proposing practice-based approach
  - What practices was farm implementing in the ***baseline*** – prior to the project?
  - Farms must start new eligible practice(s)
- ***Questions:***
  - How many years before start date do we need to evaluate baseline?
  - How do we cost-effectively verify baseline information is accurate?
  - How many new practices shall we require for the combination of practices to be eligible?
  - What impact should any new legal mandates have on crediting?
  - How shall we handle regulatory compliance?

Permanence

- ***Permanence:*** each tCO_2e of sequestered carbon must remain secured for 100 years
  - Releases of sequestered carbon are called ‘reversals’ – losses must be replaced
  - ***Various approaches:***
    - Buffer pool contributions: each time credits are issued, place % in central pool – pool used to replace (unintentional) reversals
    - Legal agreements – often with restrictions registered on title to land (eg conservation easements)
    - Issue less offsets in return for shorter commitment (‘tonne-year’ accounting) – e.g. a 20-year commitment gets 1/5 of credits
  - We will likely seek to use a combination of each of these

Aggregation

- ***Aggregation:*** bringing together multiple farms for improved efficiency
  - ***Why consider aggregation?*** Transaction costs associated with developing offset projects typically make small projects cost-prohibitive – thus ***aggregation*** facilitates grouping multiple farms into more cost-effective projects
  - Spectrum of approaches available:
    - ***Limited aggregation approach:*** allow for multiple eligible fields / farms to come together as a group of projects undergoing MRV together
    - ***Unlimited aggregation approach:*** no limits on how many eligible fields / farms – different eligible crops or practices – different eligible locations – can come together in single project

Quantification approaches

- ***Quantification:*** multiple approaches to quantifying SOC increases
  - ***Biogeochemical models:*** Several process-based models are used to estimate GHG impacts of wide variety of actions
  - ***Direct measurement:*** of SOC changes – through extraction of samples that are then measured
  - ***Emission factors:*** Use existing (typically conservative) emission factors – or develop new ones
  - ***Or combination***

Quantification approaches

- ***Quantification:*** multiple approaches to quantifying SOC increases
  - ***Biogeochemical models:*** Several process-based models are used to estimate GHG impacts of wide variety of actions
    - Pros: analyze complex relationships within living systems – forgo need for direct measurement – verifier can replicate
    - Cons: complex – time consuming to learn and to operate - uncertainty can be high – extensive data required to validate

Quantification approaches

- ***Quantification:*** multiple approaches to quantifying SOC increases
  - ***Direct measurement:*** of SOC changes – through extraction of samples that are then measured
    - Pros: no need for complex models or large datasets
    - Cons: need scientific precision management of sample plots, sampling method, samples once taken – can be costly to take/ship/lab analyze samples
  - Robust sampling plan needed to ensure sufficient data to accurately model emission reductions across project

Quantification approaches

- ***Quantification:*** multiple approaches to quantifying SOC increases
  - ***Emission factors (EFs):*** can use existing conservative default EFs for key parameters or develop new EFs during protocol development process
    - Pros: greatly simplifies quantification / verification – reducing transaction costs
    - Cons: limited available defaults – typically very conservative – new EFs are costly / difficult to develop & data often lacking

Quantification approaches

- ***Quantification:*** multiple approaches to quantifying SOC increases
  - ***Combination of biogeochemical models / direct measurement / emission factors:***
    - look to employ models to be used by project developers directly, and/or to generate EFs - bolstered by direct sampling – relying on default EFs where appropriate
  - ***Other ways to reduce transaction costs***
    - rapidly scale up area of fields being modelled - utilize MRV data to continually validate / improve modelling – further reducing uncertainty and sampling requirements
    - employ machine learning to improve modelling (reducing uncertainty & sampling requirements)
    - possibly use remote sensing to improve modelling and/or corroborate soil health assessments

Monitoring / Reporting / Verification (MRV)

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- ***Monitoring:*** requirements can vary greatly re: volume / complexity / frequency of data required to be monitored
  - associated transaction costs can vary greatly
  - historically many farms lack rigorous data collection systems
- Requirements dictated by quantification, additionality & baseline setting approaches
- We will look to reduce transaction costs by:
  - standardizing / streamlining / simplifying - limiting requirements - using detailed & standardized guidance - using templates
  - making use of any existing data gathering and reporting efforts
  - making use of new technologies such as remote sensing
  - facilitating consolidated reporting for aggregates

Monitoring / Reporting / Verification (MRV)

- ***Reporting:*** requirements & associated costs vary
  - We will require a comprehensive monitoring report summarizing monitoring results, raw data, quantification results, qualitative descriptions etc
- We will look to reduce transaction costs by:
  - standardizing / streamlining / simplifying - limiting requirements - using detailed & standardized guidance - using templates, automating data systems
  - making use of any existing data gathering and reporting efforts
  - facilitating consolidated reporting for aggregates

Monitoring / Reporting / Verification (MRV)

- ***Verification:*** requirements & associated costs vary
  - Site visits are typically largest contributor to cost
  - Large volumes of raw data will need to be sampled
  - Use of models / tools should be replicated by verifier
- We will look to reduce transaction costs by:
  - standardizing / streamlining / simplifying - limiting requirements - using detailed & standardized guidance - using templates
  - making use of any existing data gathering and reporting efforts
  - facilitating consolidated verification for aggregates

NEXT STEPS

Protocol development process & timeline

Milestone	Date
Public scoping meeting	January 15th
Statements of Interest for workgroup due	**January 17th**
Formation of workgroup	January
Staff conducts internal research and drafts protocol	January
First workgroup meeting	February 5th
Second workgroup meeting	Late February
Third workgroup meeting at NACW	April 2nd (tentative)
Public comment period	April – May
Protocol presented to Reserve Board for approval	*Expected June 10*

Next steps

- ***For interested stakeholders:***
  - **submit a Statement of Interest to become a workgroup member (by Jan 17th)**
  - email interest to sign up for updates as an observer
  - email us feedback anytime
- ***For Reserve:***
  - Form workgroup
  - Start drafting!!
  - First Workgroup meeting Feb 5th (likely remote via webinar)

Key contacts

- ***Climate Action Reserve:***
  - Email: Policy@climateactionreserve.org
  - Protocol development lead:
    - Sami Osman, Senior Policy Manager, Climate Action Reserve
    - Email: sosman@climateactionreserve.org