



Quantifying SOC for Carbon & Ecosystem Services Markets: *Market Experiences & Challenges*

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Quantifying SOC for Market Applications

Scope of Need

- No standards, scientific agreement for quantifying SOC
- Markets require certainty of quantification: expensive
- Guidance, criteria, 'standards' needed to assure credibility
 - inform standards bodies
 - Assist market programs, buyers, investors
 - Assure civil society, consumers, investors
- More, granular, high quality SOC data needed now to ground-truth promising new technologies: RS, AI, etc.

Scale of Need

- Exponential global market growth occurring now
- Natural Climate Solutions and C removals in highest demand
- Carbon removals necessary to achieve global net zero (1.5C) by 2050
- Corporate actors, particularly in food & beverage sector & ag supply chain, investing millions in SOC removals
- w/o credible claims, investments in carbon removals at risk

Carbon Credit Instruments in Carbon Markets

Carbon Inset Credits: Guidance in Development

- New market instrument
- Absolute credits – no emissions allowed elsewhere
- Remain in ag supply/value chain
- Require soil sampling @ baseline & every 5 years, & modeling
- Monitoring in perpetuity?
 - When monitoring ends, all claims/credits reversed

Carbon Offset Credits: Rules in Effect

- ~25 years ago as temporary market mechanism
- Credits allow equivalent emissions elsewhere
- Can cross sectoral boundaries
- Require soil sampling @ baseline, sometimes resampling
- Variable monitoring requirements: 20-100 years

ESMC MISSION

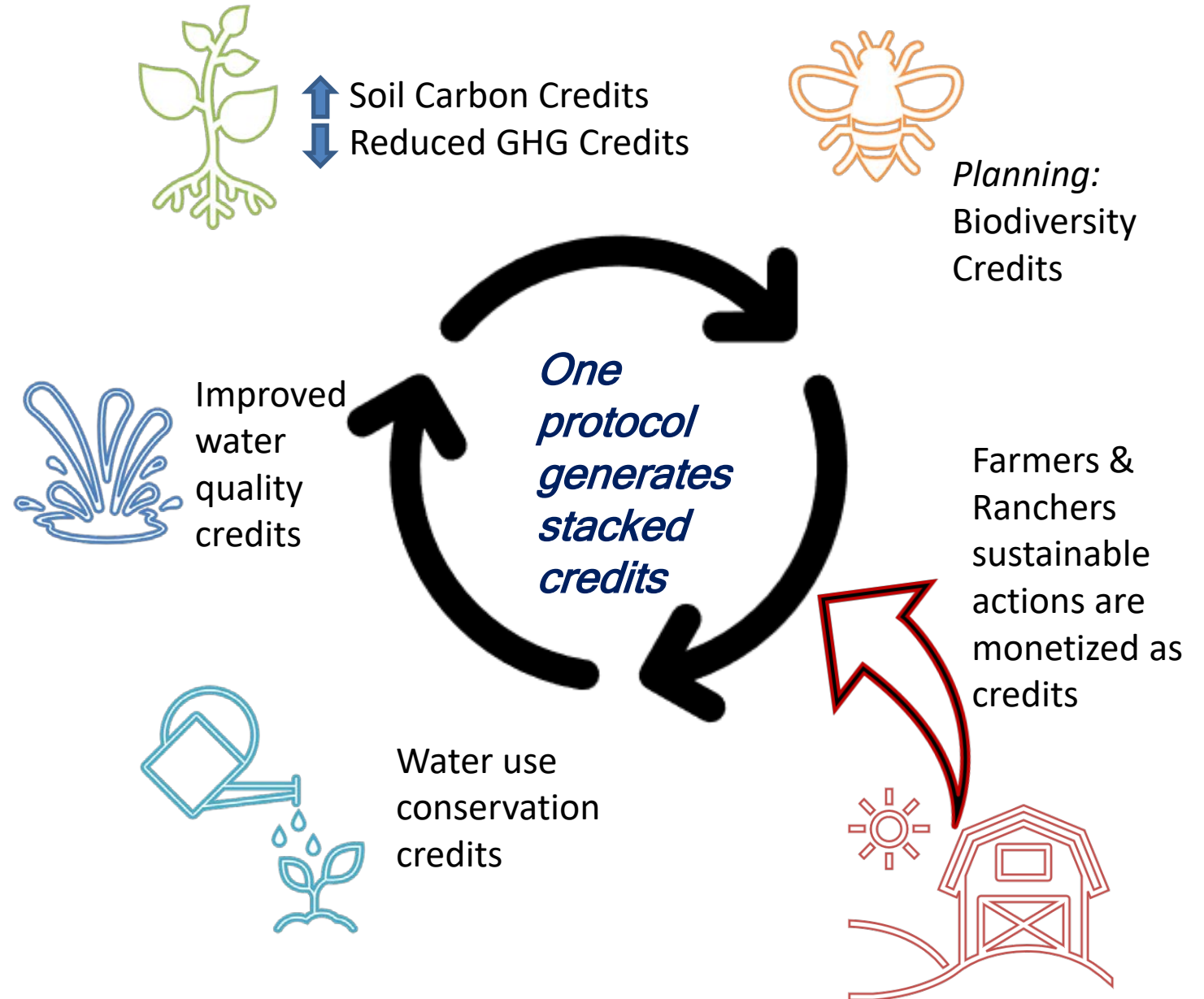
To advance ecosystem service markets that incentivize farmers and ranchers to improve soil health systems that benefit society

ESMC Market Program

ESMC modular, tiered protocols

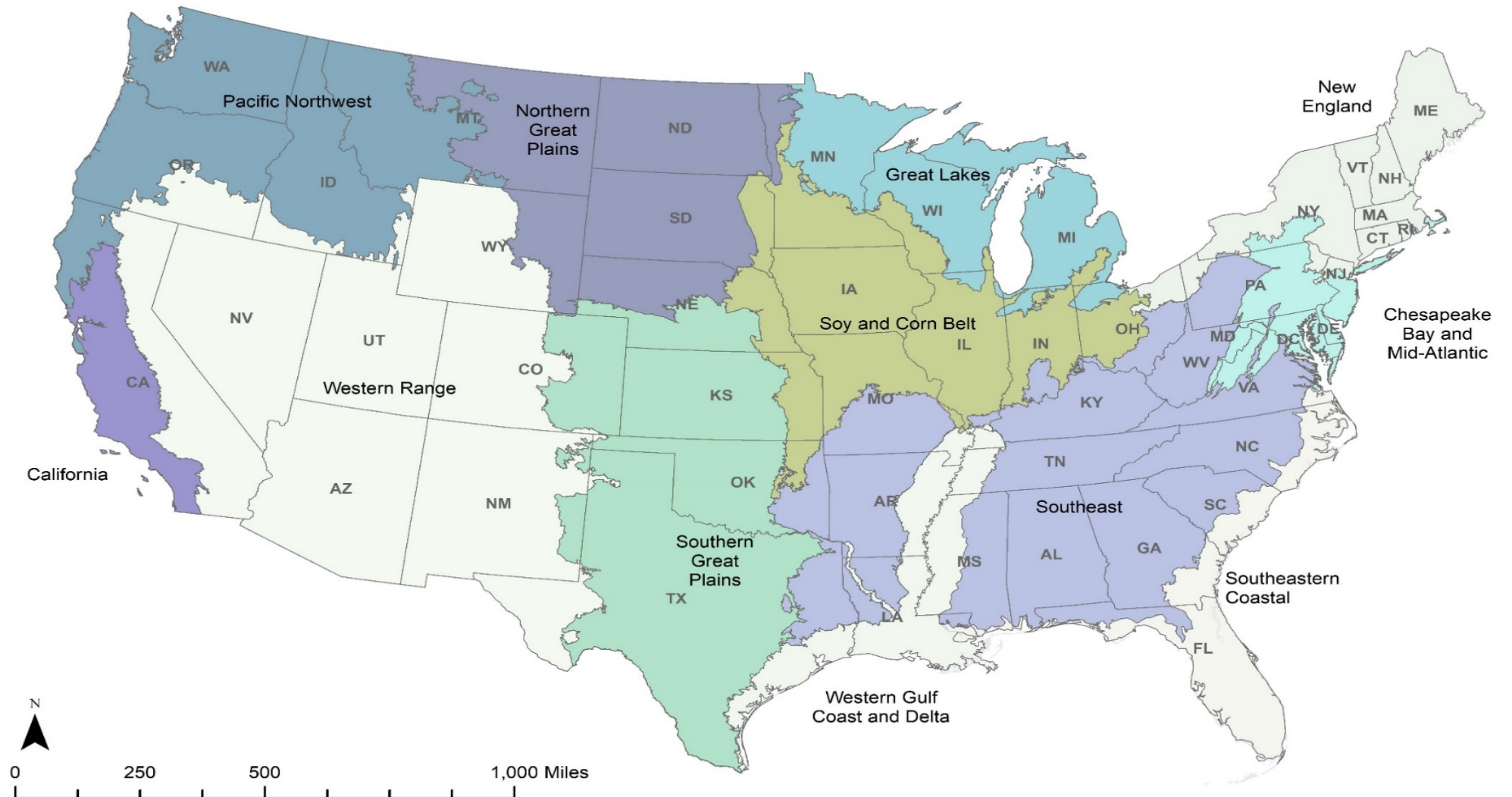
- Modular: generate & stack multiple credits
- Tiered: multiple market opportunities
- ESGC quantifies, verifies, certifies*, stacks, sells credits
- ESGC pays farmers

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



ESMC Program Coverage Currently

All Major Ag Production Systems





ESMC & ESMRC Funders



Founding Circle Members

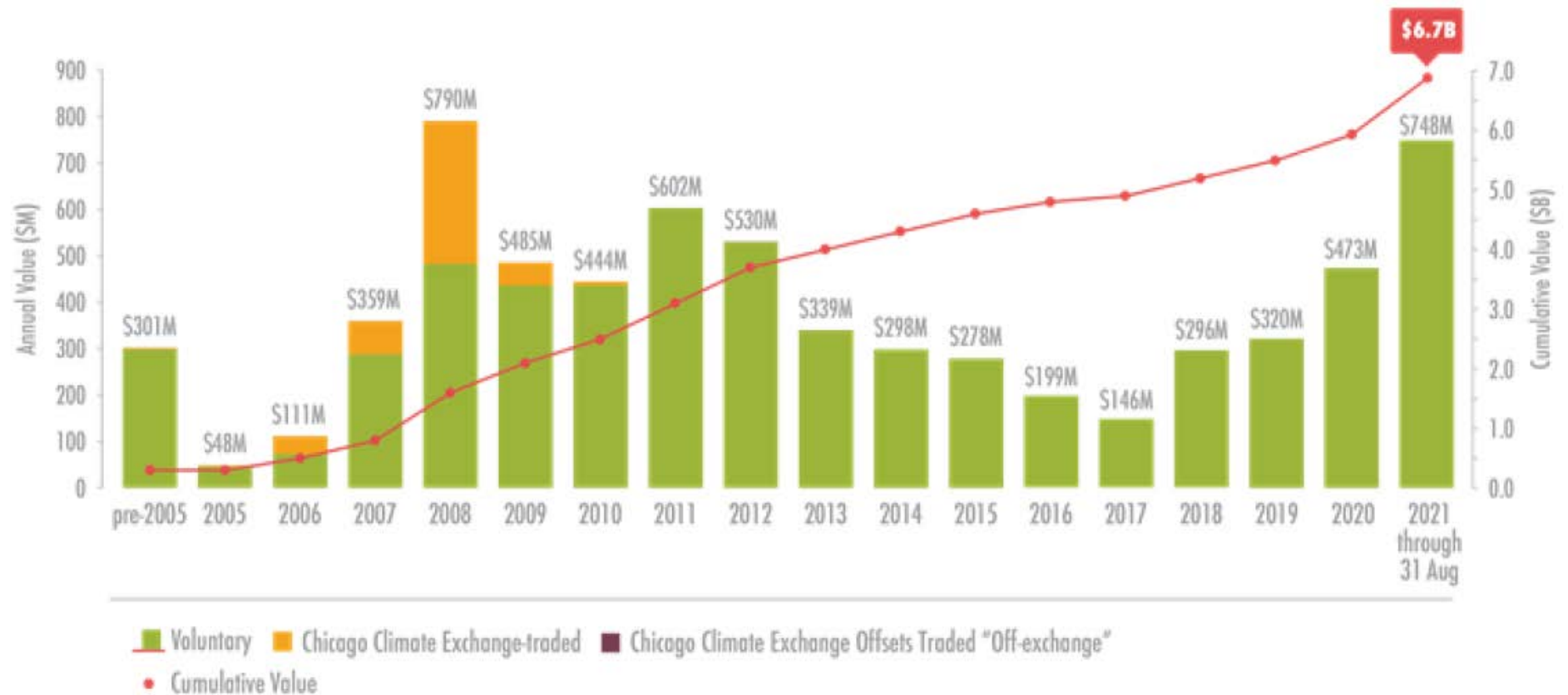


Legacy Partner Members



Scale of Need: Voluntary Carbon Markets 2021

Figure 1. Market Size by Traded Value of Voluntary Carbon Offsets, pre-2005 to 31 August 2021



Source: Ecosystem Marketplace, a Forest Trends Initiative.



Scale of Need:

Voluntary Carbon Markets 2021

Table 1: Annual Voluntary Carbon Market Overview, 2019 to 31 August 2021

	Volume (MtCO ₂ e)	Price per ton (USD)	Value (USD)
2021 (through August)	239.3	\$3.13	\$748M
2020	188.2	\$2.51	\$473M
2019	104.3	\$3.07	\$320M

Source: Ecosystem Marketplace, a Forest Trends Initiative.



Scale of Need:

C Removals Gaining Preference v Reductions

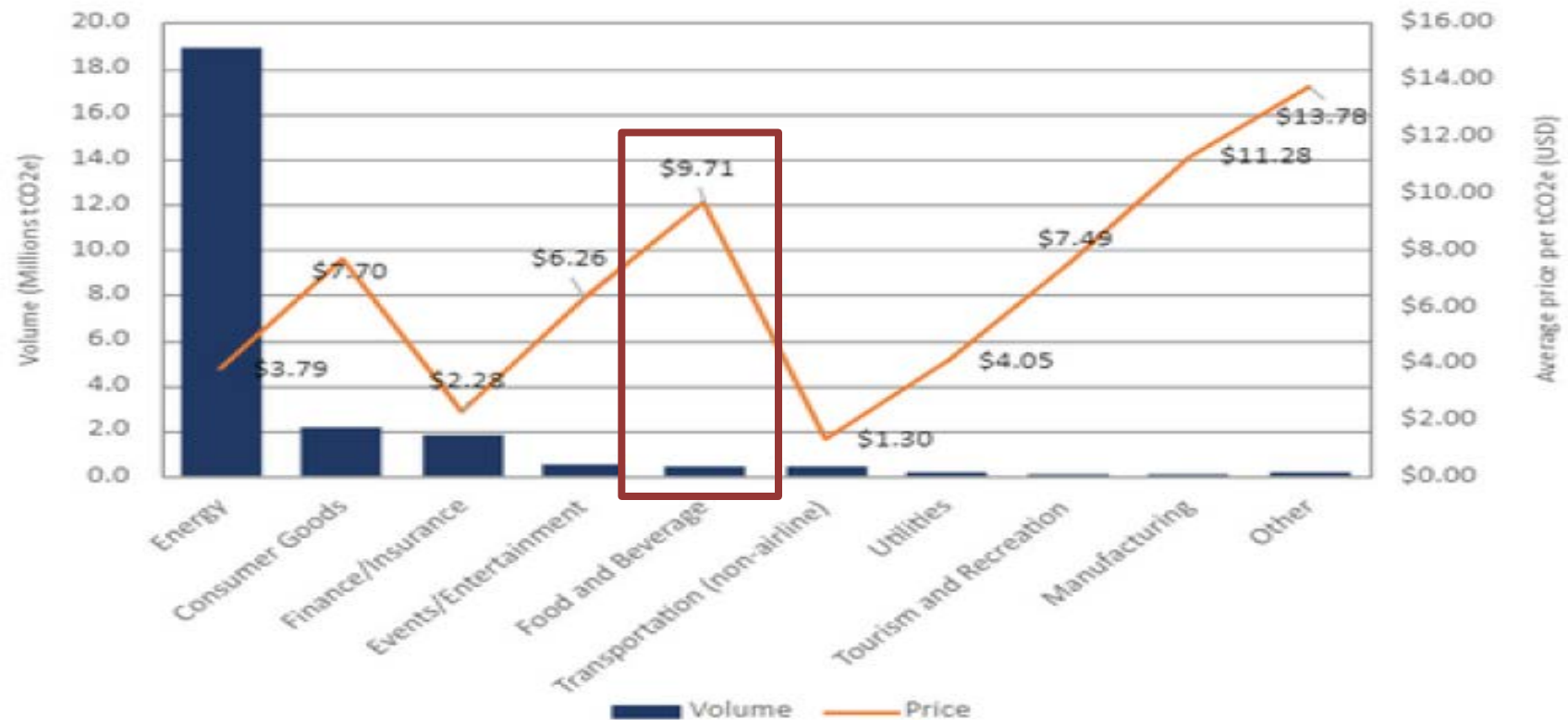
Table 6: Volume and Prices of Removals and Reductions Credits, 2020 and 2021 (through August)

	2020		2021 (through August)	
	Volume (MtCO ₂ e)	Price (USD)	Volume (MtCO ₂ e)	Price (USD)
Removals	9.0	\$7.93	5.6	\$7.98
Reductions	84.4	\$1.60	52.9	\$1.71

Source: Ecosystem Marketplace, a Forest Trends Initiative.

Scale of Need: Who is Buying Credits?

Figure 6: Volumes and Prices by Buyer Sector, 2021 through August



Source: Ecosystem Marketplace, a Forest Trends Initiative.

Scale of Need:

Why Sudden Growth in C Markets?

And interest in agriculture credits?

- **Increased *and* new** demand for carbon credits from both countries & private sector corporations
 - 2015 Paris Accord: Global Net Zero Commitments
 - Estimated \$100B in demand for carbon offset credits by 2030*
 - Food and beverage corporations GHG inventories of 90% or more from **agricultural supply chains**: has created significant focus on agricultural GHG emissions, and emissions reductions, and market opportunities for agriculture

*



Scale of Need:

Agriculture Credits in C Markets

- Forest Trends 2021 State Voluntary C Markets report:
 - Agriculture credits previously counted under Forestry and Land use category due to small volumes
 - *Ag credit volumes increased 876% from 2020 to 2021*
 - now being analyzed as standalone project category
 - Ag credits in high demand from buyers/investors
 - highly charismatic character and impacts of nature-based solutions
 - food & beverage sector focus on reduced supply chain impacts from agricultural production

Quantifying SOC for Market Applications:

What is the Scope of Need?

- Cost-effective, scalable, accurate quantification of SOC & changes in SOC stocks, at granular scales, are required to support the sale of SOC credits in markets
- C credits are intangible, but to be fungible in global markets, must be real, additional, verifiable and permanent
- *C Market quantification not same as GHG inventory quantification:*
 - more granular, project level accounting (v gross, national scale)
 - Discrete, distinct increases in SOC at specific sites, & only attributable to specific new activities
- Some market instruments (“carbon insets”) also require increased SOC to be allocated by crop, reported annually
- Pending accounting & accounting rules for these instruments also considering permanent monitoring - or - reversal of all claims when monitoring ends



Scope of Need:

Quantifying SOC for Market Applications

- No scientific agreement or standards on how to quantify SOC or changes in SOC
 - How to stratify sampling
 - How to pull samples
 - How to analyze samples in lab
 - How many samples to take, over what areas
 - What to measure? Bulk density issue
 - How to monitor over time?
- Guidance or criteria with 'grades' for methodologies such as 'good', 'better', and 'best' would be of benefit

Scope of Need:

Market Requirements & SOC removals

- Only 'new/additional' product
- Quantify and separate out BAU
- For SOC:
 - quantify changes in SOC attributable new practices only
 - Calculate baselines: BAU
 - Calculate SOC increase from new practices
 - Conservatively report delta
- Carbon offsets:
 - area carbon stock changes
 - Can report @ multi-year scales
- New instruments (supply chain emissions units, aka 'carbon insets'):
 - Unit-based quantification
 - Attribute SOC changes by commodity
 - Account & report annually
 - Complex!

Scope of Need:

Market Requirements & SOC Removals

- Permanence
 - Misnomer in biological systems
 - Duration more accurate than permanence
- Goal:
 - maximize SOC stocks
 - prevent & reverse losses to SOC stocks
 - Maintain duration of SOC stocks as long as possible
- Requires monitoring
 - C offsets:
 - Monitor 20-100 years
 - Supply chain emissions units, ala C insets:
 - Pending guidance for supply chain/insets indicates monitoring required in perpetuity for 'credits' to be claimed
 - reversal of all claims if monitoring ceases



Scope of Need:

ESMC/ESMRC Approaches

- Credibility of SOC removal credits of concern: high scrutiny
- Need to know what moves the needle with SOC, and how much, where, & need to track and monitor over time
- Start with measurement (direct sampling) to:
 - assure accuracy
 - Ground-truth new technologies
 - align with *and inform* developing standards for market-based accounting and reporting
- **Need scalable, credible cost-effective, low-touch solutions for markets!**



Scope of Need:

ESMC/ESMRC Experience

- Remote sensed SOC prediction tools promising, but accuracy depends on:
 - Characteristics of instrument used to gather data
 - Algorithms used for prediction
 - Quality & breadth of measurements used to ground-truth measurements
- Most tools immature, have variable *transparency* into above factors, and often limited set of ground-truth measurements to calibrate & validate tool
- *Tools must thus be vetted & assessed with caution*
- Need: automated evaluation approaches that minimize costs, reduce bias when comparing prediction accuracy of various technologies

Scope of Need:

ESMC/ESMRC Experience

- Need accurate quantification data to:
 - quantify baseline at appropriate level granularity
 - Quantify changes over time with ‘enough’ uncertainty
- Gold Standard requires $\leq 20\%$ uncertainty for quantifying SOC removals for C offset credits, $\leq 30\%$ uncertainty for supply chain emissions units/‘C inset’ credits
- Underlying standards considering requiring uncertainty levels be reported
 - uncertainty *thresholds* may be established in future

Conclusions

- Carbon market growth exponential
- High demand for SOC removal credits from agriculture
- SOC removals necessary to achieve global net zero 1.5C
- Standardized SOC quantification approaches essential, urgently needed for high quality/credible SOC removal credits
- Scientific agreement on SOC quantification approaches can support:
 - Appropriate, pragmatic market rules & requirements
 - continued buyer investments in SOC removals
 - Accepted credibility of removals

Conclusions

- If rules & standards for SOC quantification remain too onerous, too expensive & if uncertainty of ‘what is good enough’ continues, will likely mean:
 - Continued challenges to credibility of SOC removal credits
 - ‘Buyer’ demand for SOC removal credits may be hampered
 - Could reduce market mechanism pathways to increase SOC
 - Bad for climate, bad for agriculture:
 - SOC confers resilience and many additional benefits to farms, ranches, natural and working lands
 - Will hamper ability to achieve global net zero, 1.5C by 2050

Thank you
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