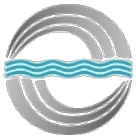

The State of Carbon Insetting

Overview and Best Practices

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1.0 Introduction

Insetting is a term used to describe greenhouse gas emission (GHG) reductions that result from projects and interventions within the supply chain of an organization. These reductions can be used to reduce Scope 3 emissions for the organization. Insetting is distinct from carbon offsetting because the inset credits are generated within (or near to) the supply chain, while offset credits are generated by external projects that may have no direct connection to the organization and its supply chain.

Insetting is particularly attractive for food and beverage producers because Scope 3 emissions represent the majority of GHG emissions for these companies. Ceres' 2019 analysis of GHG reporting from the top 50 food and beverage companies identified that, on average, 89% of reported GHG emissions were Scope 3 (Ceres, 2019). Ceres published the data as part of its content, "An Investor Guide on Agricultural Supply Chain Risk." Yet, companies often lack direct control over activities in their supply chains. Insetting programs offer one path to incentivize suppliers to reduce emissions.

For food and agriculture companies, using insetting to address Scope 3 emissions reductions can be a powerful lever to mitigate climate change. Carbon policy analysts tout insetting policies as a more "virtuous cycle" than offsets as insetting programs not only reduce emissions, but they may also reduce supply chain risk.

This document is based on a literature review, with references from current media regarding market trends and integrity. The document explains why insetting is gaining traction and what entities should consider before launching or participating in an insetting program. It will also provide an overview of the current insetting program structures and market types.

1.1 The growing interest in insetting

The world's largest food companies have made Science Based Targets Initiative (SBTi) commitments, including Scope 3 emissions reductions. SBTi is one of the most recognized standards for GHG emissions reporting, including the Forest, Land, and Agriculture (FLAG) guidance for the food and agriculture sector. SBTi adheres primarily to the internationally recognized GHG Protocol accounting standard (SBTi, 2023).

As of April 2023, FLAG guidance requires companies with a target to report on land use change and land management emissions within their value chains. The guidance also requires Scope 3 emissions reductions as part of the target. SBTi updated its FLAG guidance in December 2023, making it mandatory for companies to meet targets

separately for FLAG scopes 1 and 3 of their GHG inventory (SBTi, 2023). The updated standard also requires accounting for land-based emissions.

FLAG guidance prohibits companies' use of carbon offsets to meet their near-term FLAG targets. SBTi guidance permits only removals on land owned or operated by a company or within a company's supply chain to reach SBTi goals (Anderson, 2022; SBTi, 2023).

Prior to March 2024, the list of SBTi commitments included both meat industry giants and the world's largest food manufacturers. The current list still includes some of these entities, however companies like Smithfield and JBS have removed their commitments. Tables 1 and 2 present examples of SBTi commitments for the meat and dairy industries, as well as for several food industries.

Table 1. Examples of Meat and Dairy SBTi Commitments (Current)

Company	Global Rank	SBTi Scope 3 commitment
Tyson	2	Reduce Scope 3 GHG emissions from production of poultry, pork, and beef (covering 80% of their scope 3 inventory) 30% per ton of finished meat by 2030 from a 2016 base-year. Tyson Foods and partners were awarded $60 million in USDA Climate Smart Commodities funds to incentivize producers to adopt regenerative growing practices for animal feed production.
Pilgrim's Pride (UK)	14	Reduce scope 3 GHG emissions 30% per tonne of product sold by 2030.
Dairy Farmers of America	29	Reduce absolute scope 1, 2 and 3 GHG emissions 30% by 2030 from a 2018 base year.

Sources: Food Processing (2023), SBTi (2023)

Table 2. Examples of Food Manufacturing SBTi commitments

Company	Global Rank	SBTi Scope 3 commitment
PepsiCo	1	Reduce Scope 3 GHG emissions 40% by 2030 from a 2015 base year.
Nestle	4	Reduce absolute scope 1, 2 and 3 GHG emissions 20% by 2025 and 50% by 2030 from a 2018 base year.
AB InBev	6	Reduce emissions across the value chain (Scopes 1, 2 and 3) by 25% per beverage by 2025, from a 2017 base year.
ConAgra		Reduce scope 3 GHG emissions from purchased goods and services 20% per metric tonne of material sourced by 2030.
Coors	17	Reduce absolute GHG emissions from across the value chain 20% by 2025 from a 2016 base year
Mondelez	20	Reduce absolute scope 1, 2, and 3 (purchased goods and services and waste generated in operations) GHG emissions 10% by 2025 from a 2018 base year.
Kellogg Co.	22	Reduce absolute Scope 3 emissions 20% by 2030 from a 2015 base year.

Sources: Sources: Food Processing (2023), SBTi (2023)

2.0 Insetting Best Practices

Both insetting and offsetting projects face barriers including integrity concerns and consumer perception, i.e. greenwashing[1]. Recently, when media outlets identified issues with the credibility of avoided deforestation and renewable energy carbon offset projects, the entire voluntary carbon market was subject to intense scrutiny and a drop in carbon pricing across all types of carbon project credits (Silverstein, 2023).

[1] Greenwashing is the act of making false or misleading statements about the environmental benefits of a product or practice.

Inset program developers can benefit from lessons learned from the implementation of offset markets, helping build a more accepted path to GHG emissions reduction. Building a credible and accepted insetting market will require applying best practices and rigorous standards during program development. Transparency and communication with stakeholders and consumers are essential. There are also complexities with evolving standards, regulations, and accounting practices to consider. This section provides information on key issues, integrity concerns, and standards development.

2.1 Key Issues

An effective insetting program should address the following issues to reduce the risk of greenwashing claims and generate valid, defensible, and real GHG emissions reductions for Scope 3 reporting. The following sections identify some of the key challenges with a summary recommendation in bold.

2.1.1 Integrity

Integrity is a primary concern, as insetting projects currently do not have to adhere to accepted standards or regulatory requirements. Examples of integrity issues include programs that do not include verification or cannot accurately quantify emissions reductions.

Insetting projects can also occur as a direct transaction between a company and its suppliers. The projects do not require validation and verification, rigorous protocols, or standards such as those governing voluntary and regulatory carbon credits. Buyers, insetting platforms, and project developers have the responsibility to determine standards for their programs or if the program will adhere to existing guidance (See Section 2.2.3 Accounting Standards and Insetting).

As a result, the integrity of insetting claims will vary across the food and agriculture industry. This represents a greenwashing risk for any insetting program not backed by defensible standards and methodologies.

Two entities have released carbon credit integrity standards for the offset markets, the Integrity Council for the Voluntary Carbon Market (ICVCM) and the Voluntary Carbon Markets Initiative (VCMI). ICVCM established Core Carbon Principles (CCPs) (ICVCM, 2023). The Carbon Credit Quality Initiative (CCQI) established rating systems for carbon project types. The standards and ratings apply based on carbon credit type and the inherent risks associated with each project. For example, due to the high risk for permanence with soil carbon sequestration, the ICVCM recommends establishing buffer pools and long-term monitoring for these projects. Buffer pools set aside a reserve of carbon credits in the event of a reversal, such as a wildfire for forest projects or tillage

for soil-based projects. However, integrity initiatives rate other agriculture-based projects such as livestock projects, without reversal risks, more favorably (Hughes, 2023).

Entities that want to ensure integrity in an insetting program should develop scientifically valid protocols, have the protocols validated by an accredited third-party, develop programs based on accepted guidance and integrity standards, and require third-party verification.

2.1.2 Double-counting

Double-counting refers to situations when more than one entity claims credit for the same GHG emission reduction. The following describes the types of double-counting or double-claiming scenarios that are applicable to insetting.

Co-crediting

Supply chains are complex and entangled. If a buyer funds an intervention, for example, that entity may want to ensure ownership or prevent competitors sourcing within the same supply region from also claiming the benefit, an activity known as double-claiming. Where multiple buyers fund supply shed interventions, there needs to be clear standards for how insets are co-claimed without double-counting (Value Chain Initiative, 2023).

GHG Emissions Accounting Overlap

GHG accounting rules are confusing regarding Scope 3 emissions simply because a buyer's Scope 3 emissions are the same as their suppliers' Scope 1 and 2 emissions. The GHG Protocol identifies that counting of the same emissions occurs across a value chain and accounted in different scopes by different entities (GHG Protocol, 2011). Because of this, Scope 3 emissions reports cannot be aggregated across companies or regions to determine total emissions. However, the payment for emissions, or credit, exchanged in an insetting program may have specific accounting rules such as prohibiting the farm or producer from also claiming the reduction (credit) sold.

Double-counting or double-crediting

With multiple voluntary, regulatory, and insetting programs, as well as payments and incentives for practice options, there is a significant risk of double counting the same credit. This could occur if a farm participated in a voluntary or compliance offset project and sold credits for the same reduction to an insetting program. Payments and incentives for practice adoption related to the GHG reduction activity and outside of the insetting program may also impact additionality and eligibility for crediting, depending on the insetting protocol and program standards.

Programs should include eligibility requirements and steps to prevent the sale of insetting credits across multiple markets or registries and ensure that reductions are additional to business as usual. Programs should also consider how to allocate co-crediting among buyers in the same supply chain.

2.1.3 Avoidance of addressing Scope 1 and 2 emissions

Given the backlash over corporate claims of "Net Zero" through the use of offsets, such as the lawsuit filed against Delta Airlines (Berrin vs Delta Airlines Inc., 2023), insetting programs will need to provide consumer education and transparency to prevent issues.

Without public education, the concept of Scope 3 emissions reductions can be confusing for consumers. Negative perceptions of Scope 3 insets commonly present the credits as external reductions by a company to avoid addressing its Scope 1 and 2 emissions (Civillini, 2023).

Develop supporting consumer education on the insetting and Scope 3 emissions as part of the insetting program initiative to clarify the role of insetting.

2.1.4 Traceability and Transparency

For complex supply chains, such as feed, fiber, and food, connecting field- and farm-level interventions with Scope 3 reductions at the buyer stage is challenging. Technology platforms seek to address traceability issues, including Monitoring, Reporting, and Verification (MRV) tools. Tools that also include measurement functionality are referenced as MMRV platforms. The capabilities of these tools vary (See Section 3.0 Insetting Program Structure).

Methods to address traceability in insetting programs also vary, depending on the accounting standards applied (See Section 2.2.3 Accounting Standards and Insetting).

Determine upfront how traceability and data availability will apply to your insetting program for the short term, and how this may improve in the future.

Voluntary and regulatory carbon markets and offsetting require transparency. Credit transactions are publicly accessible for these programs. Given the confidential nature of supply chain data, insetting standards may differ in terms of requirements for public reporting. Buyers and program developers, however, should be transparent regarding the rigor of the program's standards, methodologies, and verification that back inset credits.

Determine how your program will document and certify inset credits for GHG accounting and reporting.

2.2 Developing Standards

Many of the issues described above are best addressed in the early stages of program development to avoid having to make major changes after the program is already operating. The following information can inform the design of program structure and governance.

2.2.1 Pre-regulatory Reporting

Currently, companies in the U.S. are not required by regulations to report Scope 3 emissions. Insetting programs should establish a foundation for required GHG emissions reporting to SBTi or GHG reporting platforms and to the Securities and Exchange Commission (SEC) in the future. However, the SEC rules were delayed for over two years, primarily due to concerns over Scope 3 reporting requirements, which would impact privately-held companies in value chains, and result in perceived regulatory overreach of the SEC (Renshaw et al. 2023; Prentice, 2024). The final, adopted SEC rules do not include Scope 3 requirements (SEC, 2024). Both the European Union (EU) and the state of California have implemented GHG reporting requirements that do include Scope 3 emissions (Jones, 2023). The EU requirements begin in 2024 and those for California begin in 2026. The California legislation is applicable to both public and private companies that conduct over $500 million of business in the state (SB-253 Climate Corporate Data Accountability Act, 2023). Eligible companies must report on Scope 3 emissions, but companies are not legally liable for inaccurate Scope 3 emissions reporting until 2030, given the complexity of Scope 3 accounting.

The California law faces challenges from the business and agriculture sectors. On January 30, 2024, the U.S. Chamber of Commerce, along with the American Farm Bureau Federation, California Chamber of Commerce, Central Valley Business Federation, Los Angeles County Business Federation, and Western Growers Association, filed a lawsuit against the state of California in the U.S. District Court for the Central District, citing a violation of the First Amendment (U.S. Chamber, 2024).

Entities developing an insetting program should monitor future regulatory requirements for GHG reporting on Scope 3 emissions and how insets apply under the rules.

2.2.2 Scope 3 Requirements Pose a Barrier to NetZero

On March 7, 2024, SBTi removed 239 company commitments from its roster, in addition to the entities that voluntarily withdrew. The purging, which included entities like Microsoft, Unilever, and Proctor & Gamble, occurred mainly because the corporations failed to submit science-based targets for validation by a January 2024 deadline. SBTi

conducted a 2021 survey of 1045 of the companies that had made an SBTi commitment. Twenty-nine percent of the companies surveyed had had their SBTi commitment removed. According to the companies, addressing Scope 3 emissions was the number one barrier to meeting a net zero goal (SBTi, 2024a).

Historically, SBTi standards have disallowed the use of carbon offsets to meet net zero targets. The organization also did not have guidance to allow for insetting with Scope 3.

One month after SBTi removed the 239 commitments, the organization issued a near-180-degree policy reversal. On April 9, 2024, the SBTi Board of Trustees released a statement indicating it would allow the use of environmental attribute certificates (EACs), including carbon offsets, against Scope 3 emissions reduction targets. SBTi's board made the announcement without consulting the SBTi Technical Council. Within days, SBTi staff publicly protested the announcement. On April 12, SBTi clarified its announcement, stating its current standards would not change and the organization would review Scope 3 and the use of offsets for proposed recommendations. SBTi provided a July 2024 deadline for the draft proposal. On July 30, 2024, SBTi signaled it would review the role of offsets and its standards, stating they were "responding to the experiences of the thousands of businesses that have had their targets validated by the SBTi to explore options to develop a more effective approach to addressing scope 3 emissions and enhance the impact of its Corporate Net-Zero Standard." SBTi postponed release of a new standard until Q4 of 2024 (SBTi, 2024b)

The upheaval at SBTi underscores the complexities of reporting and addressing Scope 3 emissions that have created delays in both developing clear policy guidance and meeting net zero emissions goals.

Other organizations besides SBTi have taken stronger stances to close the Scope 3 gap. The Voluntary Carbon Markets Integrity Initiative (VCMI) launched the beta version of its Scope 3 Flexibility Claim in November 2023 (VCMI, 2023). The Scope 3 Flexibility Claim allows companies who have taken other steps to reduce current emissions to leverage carbon credits to address 50 percent of their scope 3 emissions gap, up until 2035. VCMI defines this gap as the difference between a company's most recently reported scope 3 emissions and their target scope 3 emissions for the same year, under the SBTi guidance. VCMI stated it would work with other standards organizations on acceptance of the Scope 3 Flexibility Claim. The program is under "road testing" this year. VCMI hopes to finalize the guidance in September 2024.

2.2.3 Accounting Standards and Insetting

Ideally, an insetting program will align with widely accepted GHG accounting standards given the potential regulatory requirements for reporting. The most accepted GHG accounting standard currently is the GHG Protocol. The California and EU regulations and the SBTi guidance are based on the GHG Protocol. VCMI guidance aligns to the GHG Protocol and SBTi's 1.5°C-aligned pathway for reductions but provides allowances for use of carbon credits. The GHG Protocol is undergoing updates, primarily to address Scope 3 requirements.

According to the World Business Council for Sustainable Development (WBCSD)[2], insetting is currently treated differently by four of the leading initiatives, GHG Protocol, International Carbon Reduction and Offset Alliance (ICROA), International Platform for Insetting (IPI) and Race to Zero (RtZ) (WBCSD, 2023).

One key difference is if the allowable insets occur both near to and within the supply chain, also called the "supply shed" methodology, or if the standard allows only reductions within the value chain (Figure 1). The SustainCert program, for example, is based on the supply shed approach and guidance from the Value Change Initiative (VCI), a collaborative initiative between SustainCert and Gold Standard (SustainCert, n.d.). GHG Protocol stakeholders are participating in VCI workgroups. The GHG Protocol draft Scope 3 guidance currently limits insetting to within the value chain with an exception: if primary source data is not available, companies may consider broader sourcing regions as part of their value chain.

Traceability is a significant barrier to adhering to the GHG Protocol standard. Traceability of ingredients back to the field or farm level is often not feasible for aggregated ingredients and commodities or in complex, multi-layered supply lines. The "supply shed" methodology reduces the barrier of traceability to allow Scope 3 emissions reduction programs to move forward.

The other difference is if the inset activities are credited. The GHG Protocol defines "credited" as verified to a voluntary carbon standard, equivalent to registries such as Climate Action Reserve (CAR) or American Carbon Registry (now ACR).

[2] WBCSD and World Resources Institute (WRI) are stakeholders in the development of the GHG Protocol.

Figure 1. Differences accounting standards for insetting

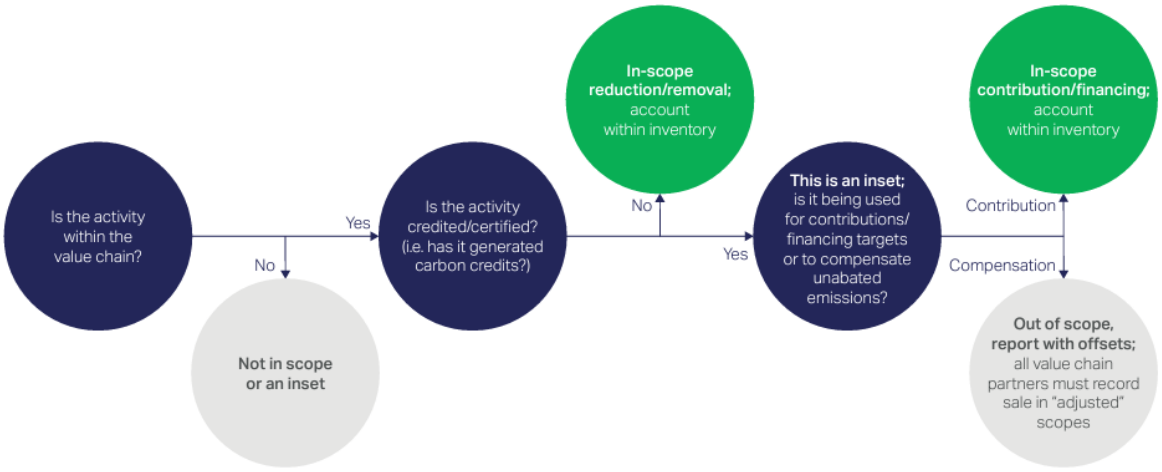
Source: World Business Council for Sustainable Development

As much as feasible, align an insetting program with the accounting standards for buyers and suppliers in your value chain and their potential GHG reporting requirements.

2.2.4 Accounting for Insetting Credits

The GHG Protocol Draft guidance separates accounting for insetting credits from offsetting credits through the intended use of the GHG reduction. The guidance sets the dividing line at Contribution versus Compensation. For example, a corporation's accounting may only include activities in the green circles (Figure 2). For uncredited accounting, interventions that occur at supplier locations can be a Scope 3 reduction in the corporate's accounting. This could also be a voluntary supplier-led reduction. However, if a corporation funds and credits the activity as an inset (not used for unabated Scope 1 and 2 emissions), the corporation can account for the reduction within its inventory.

Figure 2. GHG Protocol proposed accounting rules for insetting



Source: World Business Council for Sustainable Development

The GHG Protocol draft guidance has a proposed publication date of early 2024. The final guidance will have repercussions on most accounting standards and programs.

Monitor publication of GHG Protocol standards for guidance on accounting for insets to inform the program's structure.

2.3 Other Considerations

Insetting offers a viable option to address, measure, and report on Scope 3 emissions reductions. However, when it comes to agricultural supply chains, there are alternatives. These could include non-credited interventions or supplier initiatives that reduce supplier emissions (and thus, Scope 3 emissions for their buyers) or assessing carbon intensity scores for products, especially commodities for feed or feedstock for low carbon fuel or tax credits under the Inflation Reduction Act's 45Z program (California Air Resources Board, n.d.). It may also be possible to establish premium pricing for verified low-carbon products, like the premiums for organic products.

Finally, a market-based model provides a foundation for other types of environmental service credits, including conservation, biodiversity, habitat restoration, and water rights and water quality trading. The right solution or mix of solutions will depend on the dynamics of a given value chain, the product types, and buyer goals.

3.0 Structure of Insetting Programs

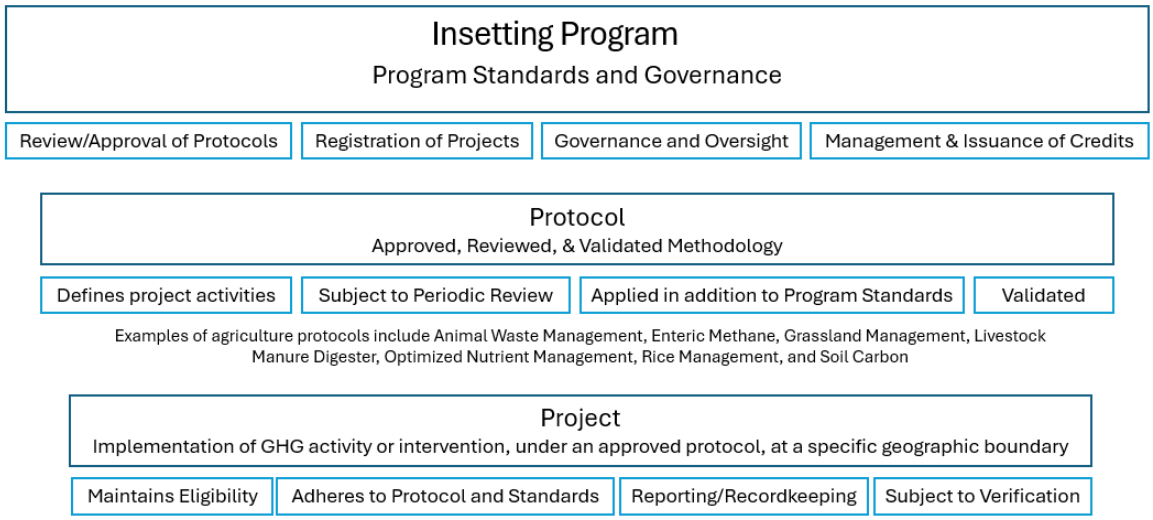
The structure of an insetting program will be determined by the standards, purpose, and governance established by the program owner. The following overview covers structure,

processes, and roles that are typical for a standards-backed program, such as the voluntary and compliance offset markets.

The Three P's

Terminology for carbon credit programs can be confusing. In general, the program refers to the overarching structure, including the management system and program standards. A program can include different GHG reduction activities as defined by project protocols, the approved methodologies, and other requirements for projects that receive credits. Projects are the implementation of a carbon intervention, following an approved protocol and applicable standards, at a specific geographic location or boundary.

Figure 3. Program, Protocol, and Project Levels for Insetting



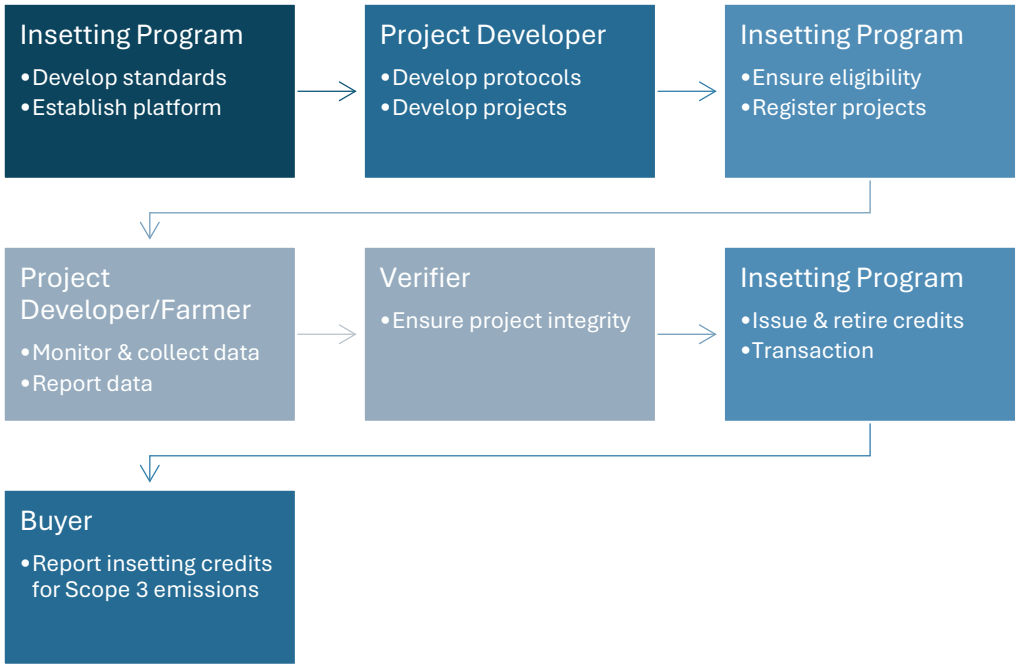
Graphic: SES, Inc.

Process Flow for Insetting

The structure of an insetting program can vary. For example, the program may facilitate development of protocols with project developers or interested stakeholders, or a program may be limited to a pre-selected protocol. The program also may or may not manage transactions of registered insets. Depending on the standards in place (or lack of standards), an inset transaction may be more direct between a buyer and a supplier.

The following process flow represents how insetting can occur when it follows standards that require verification, crediting, and approved protocols.

Figure 4. Process flow for insetting



Graphic: SES, Inc.

Roles

Insetting Program

Generally, the program is an external entity from the buyer. The program establishes overall standards including requirements for accreditation, verification, project eligibility, integrity, and approved protocols. The program issues credits and can facilitate and record transactions and transfers of credits. At end of the credit life cycle, the program retires credits to prevent resale.

Project Developer

This stakeholder develops protocols and supports project implementation. If a project developer is different from the project owner, such as a farm, the project developer or a technical consultant may support the project owner in implementing the protocol.

Validation and Verification Body (VVB)

The VVB or verifier is responsible for ensuring the integrity of the credits generated. There are two facets involved: validation, which occurs before a project implementation and validates the methodology or protocol, and verification, which occurs after implementation, and is based on historical data.

Validation reviews a protocol for the reasonableness of the assumptions, limitations and methods that support a statement about the outcome of future projects. Validation also includes a review of eligibility criteria to ensure the project can earn inset credits.

Verification is the review of a GHG reduction statement including the historical data and underlying documentation to determine if the statement is materially correct and conforms to the protocol. Depending on the program and protocol, verification can include desk audits, automated quality assurance on digital MRV platforms, site visits, and recalculation of the data, or a combination of these activities.

4.0 Technology

One concern with verification is the cost and time required to ensure integrity. Similarly, the burden of record keeping and gathering data along with the complexity of carbon projects creates a barrier for producers. A growing set of technology solutions is addressing these barriers, including the following solutions.

MRV Platforms

World Resources Institute (WRI) defines the M in MRV as monitoring and/or measuring (WRI 2020). MMRV, or Measurement Monitoring Reporting and Verification, is another common acronym (Singh et al. 2017). The M, R, and V are the activities that underlie GHG reduction or emission avoidance projects. Digital MRV platforms (D-MRV) simply digitize the activities of monitoring, measuring, reporting, and verification.

There are advantages and disadvantages to both approaches, manual or digital (Table 3). In practice, many projects will employ a mix of manual and digital activities as part of MRV.

Table 3. Comparison of Manual MRV and Digital MRV Activities

Activity	*Manual MRV*	*D-MRV*
Monitoring	Manually recorded data is subject to human error. Documentation gathered from multiple sources requires time and effort.	Data uploaded and aggregated across sources in real time or at significantly less human effort. However, audits and verifying data accuracy still require original documentation.
Reporting	Data and information from the project compiled into a report with a calculated total for GHG emissions impact. The process can be time-consuming and subject to human error.	Automated reporting saves time. The system can conduct quality checks on uploaded data to flag errors, missing data, or deviations from expected values. However, some data may still require manual entry. Human effort is still required to identify root cause and to address data errors.
Verification	Manual review of data and supporting documents is a lengthy process, especially if the program is large-scale, or has data from multiple projects, acres, or operations. Back and forth to get all project data and documentation is time-consuming.	Automated quality control can help identify some data issues, risks, and areas that most require audits or site visits for ground truthing. Source documentation still required for transparency.

While D-MRV platforms are promising to support the scaling of insetting programs, there are barriers for adoption. Building an MRV system can be expensive and requires time. Existing solutions offer speed-to-launch but may need to be adjusted to fit the requirements of an insetting program.

With multiple D-MRV platforms entering the market, there is a risk of fragmentation, with wide variance in monitoring and measuring technologies. In addition, D-MRV must address data ownership and security concerns (World Bank, 2022). Given the requirements for carbon market transparency, D-MRV platforms and insetting programs will also have to address data privacy.

The key takeaway is that MRV platforms can reduce the level of effort, but not eliminate the need for manual review and ground-truthing (World Bank, 2022).

Remote Sensing

The biggest changes are occurring in the "M" of D-MRV platforms with technology such as remote sensing, satellite imagery, Light Detection and Ranging (Lidar), and on-farm data from equipment and sensors at the field or tractor level.

Some of the most powerful MRV platforms for agriculture credits have remote sensing capabilities to monitor cover crop use and tillage practices. These systems use multiple data sources like satellite and drone imagery, USDA databases, farmer-provided practice data, climate data, and machine learning to apply all the data layers in analysis (Kavoosi et al., 2020; Beeson, 2020). Robust D-MRV systems allow for data capture and remote sensing. However, the systems vary in their accuracy and still require additional data sources for quality control.

Stakeholders will need to consider use of technology for remote sensing, as well as MRV platform capabilities at the program, protocol, and project levels for developing inset markets.

Registry Platforms and Blockchain

Carbon credits, whether offsets or insets, must have a unique identifier to help avoid double-counting. Currently, credits are issued through registry platforms, such as offsets on ACR or CAR. Both registries issue a unique serial number to each carbon credit to prevent double counting and to preserve information about the origin of the carbon credit. The registry platforms are publicly accessible and provide a tool to search for a specific serial number and the credit associated with that number.

Blockchain is a decentralized, secure record of data and transactions. Another term for blockchain is "distributed ledger." Key benefits of the technology include security and traceability (Pan et al., 2018). For example, if a satellite feed uploads images and data to an MRV platform, the associated blockchain records the upload. The blockchain data record includes a timestamp and a unique cryptographic signature. This ensures no one can alter the data and allows full transparency back to the data source. Blockchain technology can also assign unique IDs for inset credits, ensure data security and transparency, and support secure financial transactions.

Whether or not the program leverages blockchain technology, programs must register and track inset credits with full traceability to provide assurance against double counting.

5.0 Insetting Programs in Market

The American Farmland Trust (AFT) published a timeline of the current offset, compliance, and insetting markets in its farmer-focused white paper, *Top 10 Things You Want to Know About Carbon Markets* (AFT, 2023). AFT released the report at the end of 2023. Soon after, a new agriculture insetting market from Organic Valley's co-op launched in December, with its first farmer agreement announcement in January 2024.

For context, in the 18 years between 1995 and 2013, only 7 compliance and voluntary offset markets launched in the U.S. (AFT, 2023), a 38% growth rate per year. In the past ten years, the registries have issued 326 million carbon credits, under both compliance and offset markets. Agricultural and land use projects generated only 3 percent of these credits (USDA, 2023).

The minimal issuance of agriculture-based projects is due in part to additionality requirements that make early adopters of soil health practices ineligible for participation and permanence requirements that need a 100-year commitment for soil carbon sequestration (USDA, 2023). Barriers to adoption also include a lack of trust and understanding by farmers, in addition to burdensome MRV requirements for projects involving large land areas. (Barbado & Strong, 2023).

In 2023, two new compliance markets launched, Washington Ecology and Colorado Recovered Methane. Both markets include livestock methane digester protocols.

Between 2016 to present, more than 20 agriculture-focused inset and offset markets have launched, a >300% annual growth rate for non-regulatory, agriculture-based inset and offset markets, primarily driven by the food and agriculture sector. About half of these new agriculture-focused markets include insetting. Two future markets are focused on ag-based insets, with funding from the USDA Climate Smart Commodities (USDA-CSC) grant program (Table 4).

Table 4. Overview of Carbon Markets

Launch	Market	Type	Ag Credit Types or Program Description
1995	American Carbon Registry (now ACR)	Voluntary Offset[3]	Avoided grassland conversion, Climate Smart Rice and Beef Production (USDA-CSC program)
2003	Chicago Climate Exchange	Voluntary Offset,	Discontinued market. Projects included livestock methane, agricultural soil carbon

[3] ACR is a partner in a USDA-funded inset and offset program though a Climate Smart Commodities Grant.

Launch	Market	Type	Ag Credit Types or Program Description
		discontinued 2010	management, and improved rangeland soil management.
2003	Gold Standard	Voluntary Offset and Inset	Soil organic carbon framework, water quality, and biodiversity projects. Includes value chain initiative credits for Scope 3 emissions reductions.
2006	Verra	Voluntary Offset (and inset partnership with CIBO)	Nitrogen fertilizer reduction, livestock enteric emissions reductions, biochar, improved agricultural land management (VM0042), reduction for food loss and waste, manure management
2007	Climate Action Reserve (CAR)	Voluntary Offset	Avoided grassland conversion, nitrogen fertilizer reduction, rice cultivation, livestock methane (digester)
2009	Regional Greenhouse Gas Initiative	Compliance Offset	Livestock methane (digester)
2013	California Air Resources Board	Compliance Offset	Livestock methane (digester), Rice cultivation
2016	CIBO	Voluntary Ag, Offset, Inset, and Low Carbon Feedstock	CIBO Initiative for Scaling Regenerative Agriculture (with Verra, cover crop, reduced tillage, and nitrogen fertilizer reduction for grain under VM0042), practice-based Scope 3 emissions reductions, low carbon intensity feedstock. Offers insetting program development. Also partners with Gold Standard and Field to Market. MRV platform.
2016	Truterra	Voluntary Ag, Offset and Inset	Soil carbon, water quality, and payments for practice adoption such as reduced tillage and cover crops. Provides technical support.
2017	Puro.earth	Voluntary Ag, Offset	Biochar, terrestrial storage of biomass
2018	Corteva	Voluntary Ag, Offset	Practice-based credits for cover crops, reduced tillage, and reduced nitrogen fertilizer use. Provides technical support.
2018	Nori	Voluntary Ag, Offset, discontinued 2024	Practice-based, 10-year soil carbon removals, sale of future CO2 removals (to occur by 2027) from non-agricultural projects
2018	Field to Market Fieldprint	Voluntary, Ecosystem services market	Various supply chain interventions including soil health and water quality. Outcomes-based platform. Provides technical support.
2018	Regen Network	Voluntary, Ecosystem	Open-source registry built on blockchain technology. Aims to combine MRV platform, marketing, and marketplace for credits.

Launch	Market	Type	Ag Credit Types or Program Description
		services market	Projects can choose which “pieces” of the registry are needed. Includes practice adoption and water quality credits including “green infrastructure” credits like swales. No evidence of issued credits.
2019	Carbon by Indigo Ag	Voluntary Ag, Offset	Practice-based credits for reduced tillage, or planting/improving cover crops. Includes technical support.
2019	Indigo Ag: Market + Source	Voluntary Ag, Inset	Premium payments for suppliers in ag supply chains for cover crop and reduced tillage practices, fertilizer management, and rice production. Includes technical support.
2020	Soil & Water Outcomes Fund	Voluntary Ag, Inset	Payments based on new conservation practice adoption (cover crops, reduced tillage, other) and water quality outcomes. Includes technical support.
2020	BCarbon	Voluntary, Offset	Soil carbon
2021	Agoro Carbon	Voluntary Ag, Offset	Practice-based payments annually or on outcomes, including reduced tillage, cover crop, nitrogen reduction, improved grazing, and rangeland management. Includes technical support.
2021	Cargill RegenConnect	Voluntary Ag, Inset	Open only to suppliers of Cargill and its partners. Three-year commitment for cover crop and reduced-tillage practice adoption. Includes technical support. Backed by the Regrow MRV platform using remote sensing and soil carbon modeling. Allows payment stacking with government incentives. Includes technical support.
2021	Locus Ag CarbonNOW	Voluntary Ag, Offset	Payments based on adoption of biological products. Requires soil sampling and five years data. Pays performance bonuses based on soil sampling. Uses Anew (project developer) and finance partner.
2021	Farmers Edge	Voluntary Ag, Offset, Inset, and Low Carbon Feedstock	Nitrogen fertilizer reduction and soil carbon. MRV platform with soil testing and satellite data. Includes technical support. Traceability from field to buyer.
2021	Grassroots Carbon	Voluntary Ag, Offset	Managed grazing. Solution includes soil testing and remote sensing. Payments based on soil carbon sequestration.
2021	Rabobank	Voluntary Ag, Offset	Soil carbon and practice-based (cover crops and reduced tillage). U.S. and Netherlands pilot projects currently. Has a smallholder

Launch	Market	Type	Ag Credit Types or Program Description
			farm soil carbon and agroforestry credit (Acorn). Partnering with Verra on afforestation/revegetation and improved agricultural land management projects.
2022	ADM: re:generations	Voluntary Ag, Inset	Payments for climate smart practices (cover crops, reduced tillage, reduced nitrogen). Survey-based with Farm Business Network (FBN) as a partner that registers farms, consults, and audits. FBN owns the MRV platform Gradable. Soil sampling for limited farms with remote sensing. Funded by USDA-CSC Grant.
2022	Bayer Carbon Program	Voluntary Ag, Offset	Payments for practice adoption (cover crops, reduced tillage). Includes MRV platform and technical support. Part of Bayer's GHG emissions offsetting portfolio.
2022	Ecosystems Services Marketplace EcoHarvest	Voluntary Ag, Inset	Payments for practice adoption and soil carbon with soil testing and quantified outcomes (reduced nutrient loss, irrigation reduction, water quality). Managed grazing for livestock operations. Works with SustainCert and VCI supply shed methodology for mass balance/co-claiming of Scope 3 reductions across multiple buyers. Has technical support and MRV platform.
2022	Nutrien	Voluntary Ag, Offset	Nitrogen reduction and payments for practice adoption. Pilot projects currently, with plan to scale for 2030. Agrible MRV platform.
2022	PepsiCo-PCM	Voluntary Ag, Inset	Partnership with PepsiCo and Precision Conservation Management (PCM), the conservation program of IL Corn and IL Soybean Board. Payments for cover crop use, reduced tillage, and nitrogen management. Affiliated with Field to Market and the FieldPrint MRV platform.
2023	Athian	Voluntary Ag, Inset	Livestock enteric emissions, manure management
2023	Washington Ecology	Compliance Offset	Livestock methane (digester)
2023	Colorado Methane Recovery	Compliance Offset	Livestock methane (digester)
2023	Organic Valley	Voluntary Ag, Inset	Livestock enteric emissions, manure management, renewable energy. Funded by USDA-CSC Grant.
2024	ICAO Carbon Offsetting and	Compliance Offset	Works with multiple registries/protocols including ACR, CAR, and Verra and their

Launch	Market	Type	Ag Credit Types or Program Description
	Reduction Scheme for Aviation (CORSIA)		associated agricultural project types (exceptions apply).
Not yet launched	Growing Value for Producers (ACR)	Voluntary Ag, Offset and Inset	Future market. Funded by USDA-CSC Grant.
Not launched yet	Field to Market Climate-Smart Agriculture Innovative Finance Initiative	Voluntary Ag, Practice-based payments to farmers	Future market. Funded by USDA-CSC Grant.

In part, the USDA Climate Smart Commodities program grants drive the current and future market growth. Grant funding from this program supported development of several inset markets, including Organic Valley's insetting program (Organic Valley 2023) (Table 4).

The USDA-CSC grant funds provided $20 million for the Growing Value for Producers Through Increased Access to Markets for Climate-Smart Commodities project. Project partners include the ACR carbon registry, the Arva Intelligence MRV platform, the Intertribal Agriculture Council, Arkansas-based Riceland Foods, and Virginia-based Blue Raster (ACR 2023).

Under this program, producers will own agricultural GHG Certificates. ACR will issue and track the credits. Producers can then sell the credits through commodity markets for corporate buyers with Scope 3 GHG emission reduction goals. The program offers financial support ($25-$40 per acre per year) and technical support to producers to adopt practices and participate in the market.

The USDA-CSC program also awarded grant funding to Truterra to offer financial assistance for adoption of reduced tillage and cover crops. And USDA-CSC funds supported the ADM re:generations program, under a separate grant.

Exponential growth in carbon programs includes insetting, which is eligible under accounting standards for Scope 3 emissions reductions and focuses on agriculture projects. Such markets have strong buyer demand from the food and agriculture sector where supply chains comprise the majority of GHG impact. However, with multiple programs and markets launching, tracking, and preventing double counting of credits will be more complex.

6.0 Conclusion

Multiple drivers fuel growth for insetting programs. These forces range from policies requiring GHG emissions reporting to voluntary corporate commitments under standards that do not allow use of offsets. In addition, programs like the USDA's Climate Smart Commodities grants provide strong financial incentives to develop insetting programs. Historical voluntary and regulatory markets were based on offset credits, with minimal credits issued for agriculture and land use projects. Insetting markets offer a path to reduce barriers for agriculture-based projects that exist with offset markets and their associated protocols. Policy shifts from GHG Protocol and other standards organizations signal increasing acceptance of carbon credits, including insets, that can meet integrity standards.

There has been exponential growth for agriculture-based inset programs in the past five years, with expected future growth. Even so, carbon credit programs are facing intense scrutiny over greenwashing claims and integrity concerns including potential for double counting. Such concerns and rapid market expansion require any new program to establish standards, verifiable emissions reductions claims, and traceability. New programs can leverage technology solutions to reduce monitoring, reporting, and verification effort, and increase the quality and integrity of market data.

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