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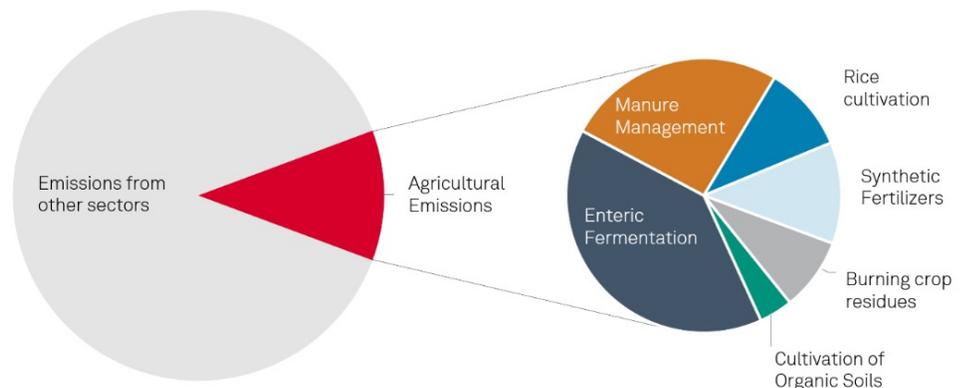
# Carbon Farming

## Opportunities for agriculture and farmers to gain from decarbonization

### Key Insights

- Growing global population has increased food demand resulting in carbon footprint from agricultural activities that continue to impact the environment negatively.
- While agriculture is part of the problem, it can also become a part of the solution. CO<sub>2</sub> emissions from agricultural production currently account for 11% of global greenhouse gas emissions, with largest contribution from the livestock sector.
- In response, carbon markets tailored to farming and agricultural activities are emerging with increasing interest from farmers, private sector and governments. Farmers and ranchers, as stewards of land and agricultural resources, are sequestering carbon through sustainable soil, crops, livestock and agroforestry management practices.

Figure 1: Global Agricultural Emissions, 1990-2017



Source: FAOSTAT; S&P Global  
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## Notes

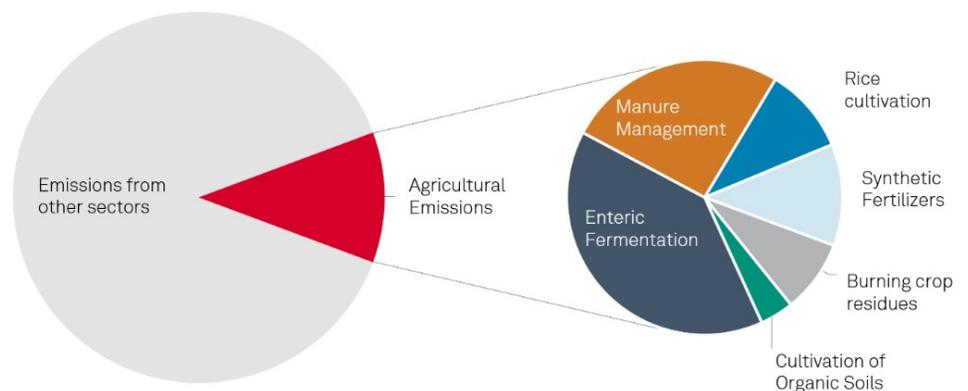
[World Resources Institute \(WRI\), 2019](#)

# Carbon Markets in Agriculture

Growing global population has increased food demand resulting in carbon footprint from agricultural activities that continue to impact the environment negatively. While agriculture is part of the problem, it can also become a part of the solution. CO2 emissions from agricultural production currently account for 11% of global greenhouse gas emissions<sup>1</sup>, with largest contribution from the livestock sector. In response, carbon markets tailored to farming and agricultural activities are emerging with increasing interest from farmers, private sector and governments. Farmers and ranchers, as stewards of land and agricultural resources, are sequestering carbon through sustainable soil, crops, livestock and agroforestry management practices. On the other hand, investments in carbon markets by the private sector is gaining share and are principally driven by:

1. Legal obligations
2. Voluntary goals (e.g. corporations, industrial or municipal operations interested in meeting publicly stated goals on environmental impacts), and/or
3. Shareholder or consumer expectations. Government has a role to play in establishing protocols and certifying mechanisms to accurately verify carbon offsetting efforts

**Figure 1: Global Agricultural Emissions, 1990-2017**



Source: FAOSTAT; S&P Global  
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## Notes

<sup>2</sup> [World Bank States and Trends Report, 2019](#)

<sup>3</sup> [International Carbon Action Partnership \(ICAP\) Status Report, 2019](#)

<sup>4</sup> [CDP Disclosure, 2019](#)

## Driving Forces of Carbon Demand

### **Effective public sector environmental policies that strengthen climate change adaptation and mitigation across economies will further drive demand for carbon credits in agriculture.**

Public Policy: Global market for carbon trading systems has grown rapidly in the past 20 years with largest and most liquid markets in Europe and California. What's common in these markets? Carbon market enabling public policy. In recent years, China has also introduced a cap-and-trade program in 2020 that will be double the size of emission reduction by Europe Emissions Trading System (ETS)<sup>2</sup>.

Recently, the U.S. Department of Agriculture (USDA) Secretary announced their goal to reduce the US agriculture carbon footprint by 40% by 2050. In response, the "Growing Climate Solution Act" is proposed to Congress and may pass as a legislation creating protocols that will allow farmers and ranchers to choose from technical service providers and third-party verifiers to monetize conservation practices and reduce their carbon footprint. At state level, California is progressing climate resiliency through its Cap-and-Trade Program that allowed companies to use more than 200 million metric tons of carbon offsets through 2020. Payments received are then directed to fund sectors to reduce greenhouse gas emissions including funds allocated to agriculture (Example of rice growers in Table 1). Another successful example is the European Union ETS that includes agriculture as one of the sectors for carbon sequestration. As a result of EU ETS, total EU emissions have reduced by 350 million tCO<sub>2e</sub>. In summary, effective environmental policies strengthening climate adaptation and mitigation across economies will further drive demand for carbon credits in agriculture.

Private Sector Investments: Carbon offsets have become a business imperative for companies that realize the emerging opportunities in low carbon markets. In 2019, 1,600 companies worldwide disclosed that they currently use internal carbon pricing or that they anticipate doing so within 2 years<sup>4</sup>. In a study on ecosystems mechanisms, S&P Global examined companies across several sectors including, energy, industrial, airlines, chemical, fertilizer, financial, information and telecommunications to evaluate potential demand for carbon credits.

S&P Global study estimates that food and beverage sector accounts for 57% of total potential demand for carbon credits in agricultural lands and based on all sectors examined, internal company prices currently range from \$5 to \$60/tCO<sub>2e</sub>.

Participating companies had vested interest in directly being involved with farmers in the value chain through reducing carbon in upstream and downstream activities. Many food and beverage companies are already committed to working with their suppliers in the value chain to reduce their carbon footprint. Hence, private sector is a significant demand driver for voluntary and compliance carbon markets today.

## Notes

### Driving Forces of Carbon Demand

<sup>5</sup>Noble Research, S&P Global, 2022

**Figure 2: Examples of carbon credit initiatives by public & private sector**

|  | <b>Cargill</b>  | <b>Indigo Ag</b>  | <b>California Air Resources Board (CARB)</b>  |
|--|---|---|---|
| <b>Goal</b>  | Cargill made a commitment to reduce supply chain emissions by 30% by 2030 that aligns with commitment goals set out in the Paris Climate Agreement.   | Indigo Ag, an agricultural technology company, intends to remove one trillion tons of carbon dioxide from the atmosphere across 12 billion acres.   | CARB introduced the “Rice Cultivation Projects Compliance Offsets Protocol” in 2015, which is the first protocol that measures GHG reductions from crop-based agriculture. Part of the Cap-and-Trade program, private sector can buy carbon credits for their offset targets.               |
| <b>Carbon Mitigation &amp; Sequestering Activities</b> | In collaboration with Iowa Soybean Association and using USDA’s COMET-Farm Tool to measure carbon sequestration, the Soil and Water Outcomes Fund will allow Cargill to pay farmers to adopt sustainable practices such as reduced tillage and cover crops to sequester carbon. | The “Terraton Initiative”, aims to reduce emissions by encouraging farmers to adopt regenerative farming practices. This includes planting cover crops, reduce the use of chemicals and fertilizers, rotate different crops and integrate livestock to improve soil health. | Rice farmers that’ve been cultivating for min. 2 years and have soil with 3% or less organic content in the top 10 cm on the soil, volunteer to implement one of three methods included in the protocol to sequester carbon: dry seeding, early drainage, or alternative wetting or drying. |
| <b>Participants</b>                                    | Till date, 10,000 acres of farmland has been enrolled by Iowa farmers.  | Till date, 20 million acres have submitted plans to apply practices through Indigo Carbon, a payment system set up for the initiative.  | As of 2019, 21 rice growers across 22,000 acres had signed up for the Protocol.   |
| <b>Carbon Price/ Payments</b>                          | The program estimates carbon payments to be \$30-\$45/acre.   | Farmers are paid \$15 per verified 1 MT of CO <sub>2</sub> e.   | Price is set according to the market e.g., in 2017, price per ton CO <sub>2</sub> e was \$7.  |
| <b>Financial Incentives &amp; Co-Benefits</b>          | It is estimated that through this program, 7,500 tons of CO <sub>2</sub> e will sequestered. Revenue of \$30,000 to \$45,000 for Iowa farmers.  | For every acre, 2-3 credits per year were sold. About 40-60 MMT CO <sub>2</sub> e is sequestered with this initiative. In addition, farmers can expect an increase of \$30-\$45/acre/year in potential gross income due to enrichment of soils.                             | Rice farmers can expect positive co-benefits such as water savings from dry seeding, healthier rice plants due to reduced flooding of rice paddies etc.   |

As seen in above analysis, market potential of agricultural solutions to offset carbons is indeed growing in recent years.

**S&P Global estimates that in North America, the total potential supply of carbon credits in the agricultural sector is on a yearly basis is 326 million tCO<sub>2</sub>e compared with potential demand by corporate buyers totaling to 190 million tCO<sub>2</sub>e depending on the region. The market is valued at \$5.2 billion based on market prices and internal company prices<sup>5</sup>.**

## Notes

### Carbon sequestration rate by agricultural activity

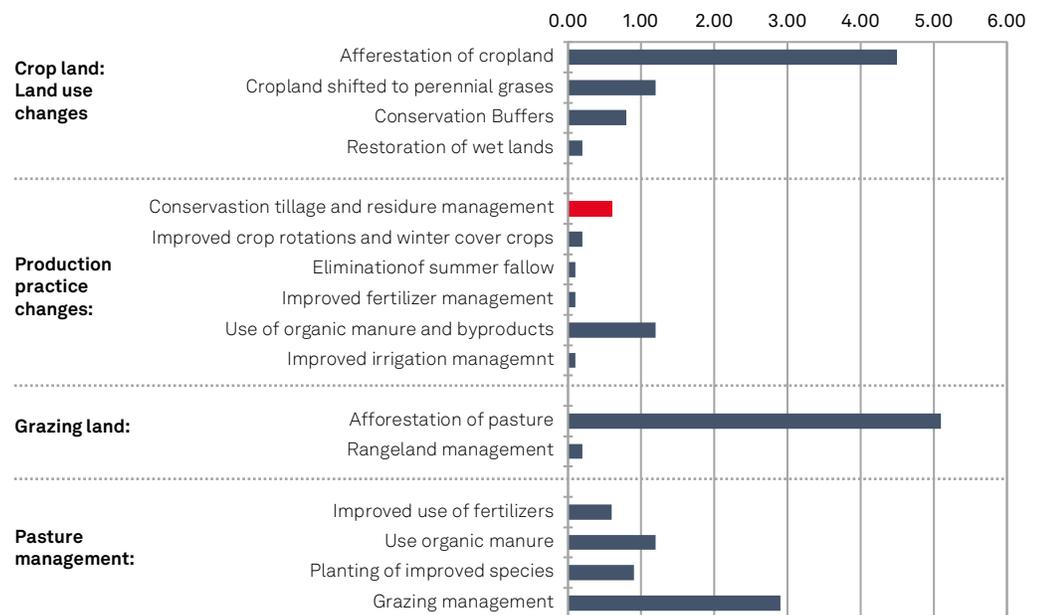
## Opportunities for Farmers & Ranchers

US farmers and ranchers have many opportunities to impact their own carbon footprint and in some situations partner with other segments of the economy to reduce emissions from outside agriculture. Carbon farming is a financial incentive that is additive to environmental and social co-benefits as a result of the carbon reducing activities. Many current carbon opportunities can extend benefits to farmers and society at large.

**Financial Benefits:** With unpredictable yields caused by climate change, farmers welcome the additional income stream as a result of the carbon market. Growing demand of the carbon market has led to new agricultural programs and pledges by agribusiness and food retailers resulting in opportunities for farmers to participate. It is, however, crucial for a program to price the carbon higher than implementation costs to ensure farmer interest.

As shown in the graph below, income from carbon sequestration will depend on the agricultural activity type. Examples of programs identified previously in this paper showcase the current market price that will evolve with new opportunities for farmers and ranchers in the future.

**Figure 3: Carbon Sequestration Rates – Mt CO<sub>2</sub>e/ac**



Source: S&P Global, 2022

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## Notes

<sup>6</sup> Fleming A., Stilzlein C. et. Al, 2019

### Environmental and Social Co-benefits:

A recent study<sup>6</sup> interviewed 110 farmers and agribusiness stakeholders and concluded that framing of agriculture carbon market as only a financial incentive creates a barrier to how farmers perceive participation in the carbon markets. The study reveals that farmers had increased attention towards opportunities that highlighted economic incentives from environmental and social co-benefits.

Carbon credit programs consider co-benefits as part of the marketing strategy to ensure higher adoption rates by farmers. For example, Locus Ag, an agricultural input company, markets the carbon price as \$75 - \$105/acre for their “CARBONNOW” program depending on the crop.

This value is divided into financial incentive from carbon credits and co-benefits such as reduced use of fertilizer, 9-12-bushel increase in corn yields etc. that can be quantified into economic incentives. There are also social opportunities that arise as co-benefits from carbon farming, for example, increase in number of seasonal jobs for farmers to perform conservation practices.

## Notes

<sup>7</sup> Greenhouse Gas Mitigation Options and Costs for Agricultural Land and Animal Production within the United States, ICF, International, NRCS/USDA

# Challenges to Realize “Agri-Carbon” Market Potential

Scaling the carbon market will require resources and capacity. While the following list is not exhaustive, they are reinforced by stakeholders (farmers, corporate buyers etc.) as issues that need to be well-established in order to facilitate a successful “agri-carbon” market.

Figure 4: Challenges to Realize “Agri-Carbon” Market Potential

| Inadequate Carbon Pricing  | Lack of Institutional & Technical Capacity   | Additionality Risks   |
|--|--|---|
| <p>Breakeven prices for applying carbon offset practices (e.g., no tillage) can vary sharply on region and crop. A USDA study<sup>7</sup> estimates the potential breakeven prices for converting from conventional till to no-till by region and crop varied from \$21/tCO<sub>2</sub>e in the Northern Plains to as high as \$104/ tCO<sub>2</sub>e in Corn Belt in US.</p> <p>IHS estimates that in US, carbon prices currently range from \$3.30 to \$200/tCO<sub>2</sub>e depending on region and whether markets are voluntary or compliance markets.</p> <p>The price depends on the type of carbon offset project, the carbon standard under which it was developed, the location of the offset, the co-benefits associated with the project, and the vintage year. Europe, on the other hand, has prices as high as \$35/tCO<sub>2</sub>e as emission regulations are stricter there.</p> | <p>Adoption of “agri-carbon” protocols will require extensive technical capacity available at the institutional and farm level. Moreover, technical knowledge of verification and certification of carbon credits through on-farm inspections or third-party review, establishing payment systems etc. is imperative for successful implementation of emissions reducing projects.</p> | <p>Farmers must demonstrate that the emissions offsets generated are in addition to what would have occurred through regular operations. In the California Rice Offsets Protocol, to prove additionality fields must have management records that demonstrate cultivation using flooding for at least 100 days during two previous cultivation cycles. Fields already implementing techniques that qualify for offset credits can still pursue credits, but existing practices will be built into the baseline management scenario, and do not meet additionality requirements. Undetermined additionality in carbon programs can lead to overestimating reduction of carbon emissions.</p> |

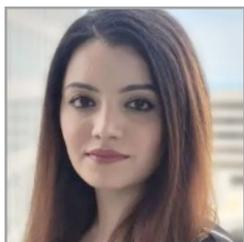
## S&P Global Outlook: Will Carbon Farming become an Incentive or an Expense for Farmers?

Are farmers well positioned to participate in carbon market without increasing transaction costs? Is the regulatory environment enabling farmers and companies to undertake carbon reducing activities and trade carbon credits?

What is needed for agriculture to become a prominent participant in the carbon market? S&P Global team answers these questions through studies that analyze new drivers that will shift the demand and supply of carbon markets such as the impact of the new Biden administration rejoining the Paris Agreement on agriculture; impact of European New Green Deal on European carbon market; the efforts by USDA Bill to develop carbon sequestration protocols; current carbon market assessments in agricultural sector; carbon pledges by global agribusinesses etc. As observed, carbon demand and prices will continue to evolve in different ways and S&P Global predicts:

1. Like other commodities, as demand for carbon credit grows, so will the price which will eventually normalize or slow down the demand in carbon markets. Demand may also reduce as companies try to offset carbon emissions internally through new technology and may not need to buy carbon credits to reduce CO<sub>2</sub>e from “business as usual”. The latter observation is evidenced by increasing number of carbon pledges to reduce Scope 1 and Scope 2 carbon emissions (i.e. internal direct and indirect carbon emissions).
2. If carbon price continues to be lower than transaction costs and marketed to farmers as an additional incentive to co-benefits (e.g. higher yields), then supply may shrink as farmers exit the carbon market. This case would only be true if the market remains voluntary and is not regulated. In US, the Growing Climate Solution Act will put forward bipartisan policies wherein participation is voluntary. Other large emitting countries like China have systems (e.g. Emissions Trading Scheme) in place but implementation remains largely uncertain in agricultural sector.

## Subject Matter Expert



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Sana Khan has a strong background in market assessments, competition analysis, agricultural commodity forecasting and economic modelling. She has 8+ years of experience in agribusiness sector with private, public and intergovernmental organizations. Prior to joining S&P Global, she worked for The World Bank based in Washington, DC within the Agriculture and Climate Change Global Practices. She worked on several projects including agribusiness policy benchmarking for 100+ countries within the seeds and fertilizer sector and assessment of carbon credit programs and markets in 10 developing countries.

Sana received a master's degree in business administration, her study concentrations were operational management and efficiency.

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