

# Carbon Markets 101: What Questions Farmers Should Ask

**I**  
**ILLINOIS**  
Agricultural &  
Consumer Economics  
COLLEGE OF AGRICULTURAL, CONSUMER  
& ENVIRONMENTAL SCIENCES



Sarah Sellars, Gary Schnitkey, and Krista Swanson

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# How are we sharing carbon market information?

What is a Carbon Credit?  
Carbon Markets 101

1 What is a Carbon Credit?  
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2 Carbon Markets - Why Now?  
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3 Carbon Markets 101: What is the Paris Agreement?  
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4 Carbon Markets 101: Price & Cost Questions  
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5 Carbon Markets 101: Agricultural Carbon Credit Contracts and Data Questions  
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6 Carbon Markets 101: Breakeven Prices for Agricultural Practices  
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7 Carbon Markets 101: Can carbon credits increase in price?  
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8 Challenges of Agricultural Carbon Markets  
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- What Questions Should Farmers Ask about Selling Carbon Credits?
- Growing Climate Solutions Act Impact on Farmers

**Carbon Markets 101** YouTube Playlist

<https://www.YouTube.com/farmdocVideo>





# Background

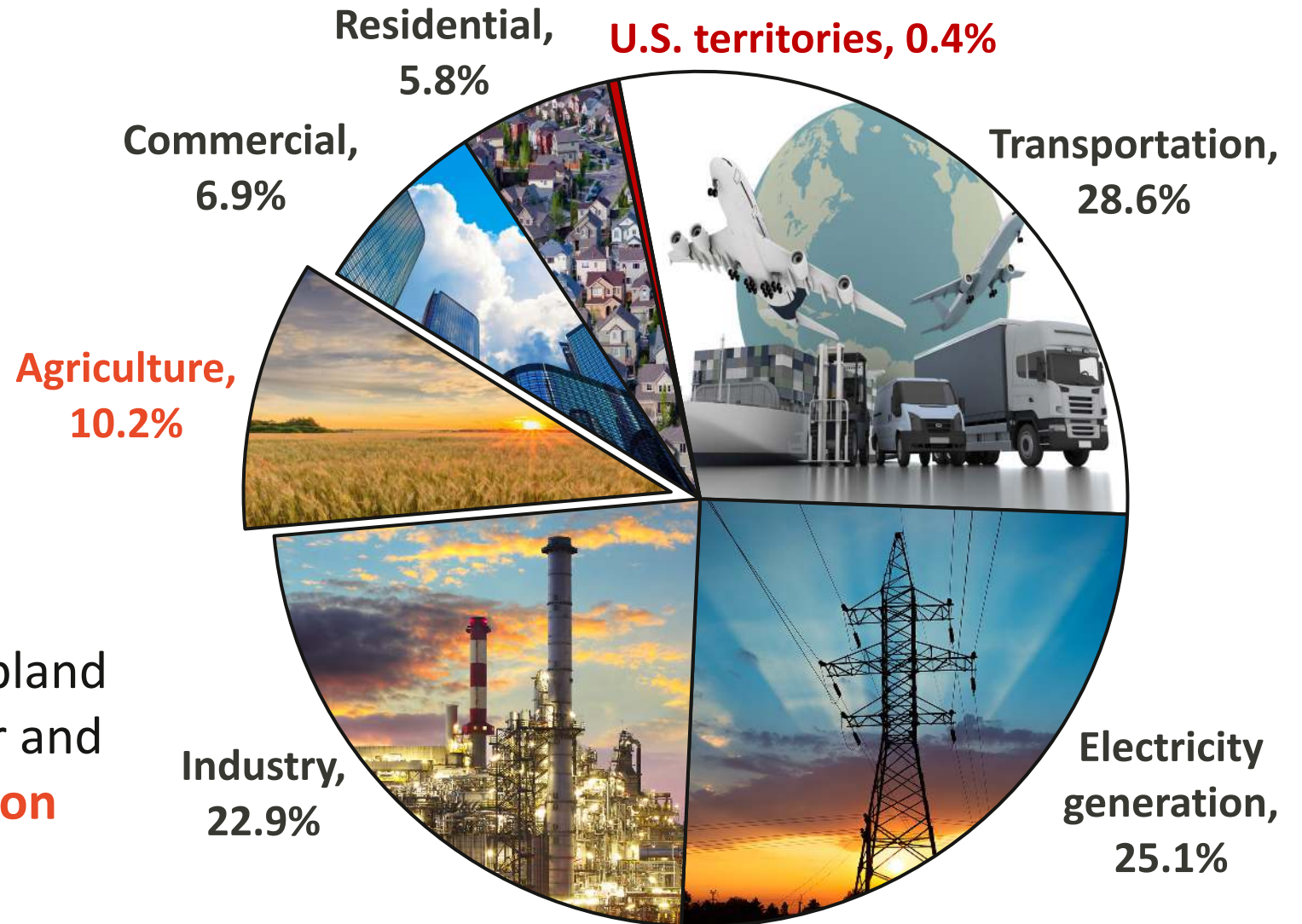
# Background

Agricultural activities are looked at as a sink for carbon

Current sequestration on U.S. cropland is 8.4 millions mt/CO<sub>2</sub>-eq per year and the annual potential is **100 million mt/CO<sub>2</sub>-eq per year**

## Emissions by Economic Sector, 2019

Million Metric Tons CO<sub>2</sub> Equivalent



Data Source: United States EPA

# Two efforts simultaneously

## Government Policy

- Congressional action
- Administrative activities

## “Private Carbon Markets”



# Why Now?

“America’s farmers, ranchers, and forest landowners have an important role to play in combating the climate crisis and reducing greenhouse gas emissions, by sequestering carbon in soils, grasses, trees, and other vegetation and sourcing sustainable bioproducts and fuels.”

Executive Order on Tackling the Climate Crisis  
at Home and Abroad, January 27, 2021

# Why is This Time Different?



- Stock exchange for emission sources and offset projects
- Traded from 2003 to 2010
- Ceased trading at the end of 2010
- Effective final price was between 5 and 10 cents



# Why is This Time Different?

- Increased demand
  - One-fifth of world's largest publicly listed companies have net-zero emissions targets
  - U.S. and companies have made promises to reach net-zero and need to deliver
- Different policy environment

# How Agricultural Carbon Markets Work



# What Does Climate-Smart Mean?

**Climate-smart is activities that store carbon and improve resilience and soil health**

## Examples:

- Reduced and no-till
- Cover crops
- Prescribed grazing
- Reduced GHG emissions (nitrous oxide and methane)
- Ruminant feed management
- Manure management
- Fertilizer management
- Improved on-farm energy efficiency
- Improved forest management

# Private Carbon Markets



- Markets will exist as long as private entities want to buy credits
- Currently many companies want “new” carbon

# Most Common Eligible Practices

- Cover crops
- Changing nitrogen practices
- Diversifying crop rotation
- Reducing tillage
- Grazing livestock

# Benefits of Carbon Markets

- Helps provide financial incentives for farmers to adopt new practices
- Many stackable with other government programs
- Co-benefits of agricultural carbon markets such as air, biodiversity, soil, and water benefits

A magnifying glass is positioned over a bar chart. The chart displays two data series, one in blue and one in green, across four quarters (Q1, Q2, Q3, Q4). The blue series shows a general downward trend from Q1 to Q3, followed by a slight increase in Q4. The green series shows a similar but less pronounced downward trend. A horizontal line is drawn across the chart at a level marked '1,000' on the right side. The text 'Economics of Carbon Markets' is overlaid in the center of the magnifying glass.

# Economics of Carbon Markets

# Payment amount and basis

## Practice per acre

**Bayer:** \$3 per acre for reduced tillage, \$6 for cover crop

## Per metric ton

**Corteva Granular:** \$15 per metric ton

**Indigo Ag:** \$10 per metric ton in 2020, now is \$15 in 2021

**Land O'Lakes:** \$10 per metric ton

**Current carbon price range is \$10 to \$20 per metric ton**

**ton**



# Data requirements

- Most require entry of information by farmer into software
  - Climate view, Bayer
  - Granular Insights, Corteva Granular
  - Gradable, Farmer Business Network
- Many require **three years** of previous information
- Likely require boundaries and practices for the coming year

# Can early adopters participate



Practices have to be adopted since 2011



Practices must be adopted in last two years

# Breakeven Prices: Tillage Practices

	Corn		Soybeans	
	Breakeven Price 2010 \$/mt CO2-eq	Emissions Reduction Potential mt CO2-eq/acre	Breakeven Price 2010 \$/mt CO2-eq	Emissions Reduction Potential mt CO2-eq/acre
Reduced till to no-till	\$30	0.42	\$77	0.13
Conventional till to no-till	\$34	0.65	\$32	0.13
Conventional till to reduced till	\$43	0.22	Negligible emissions reduction	

Source: Prepared by IFC International for USDA 2013

# Examples of per acre payments with \$20 mt CO<sub>2</sub>-eq/acre

	Corn		Soybeans	
	Breakeven Price 2010 \$/mt CO <sub>2</sub> -eq	Emissions Reduction Potential mt CO <sub>2</sub> -eq/acre	Breakeven Price 2010 \$/mt CO <sub>2</sub> -eq	Emissions Reduction Potential mt CO <sub>2</sub> -eq/acre
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**Reduced to no-till**

$$.42 \times \$20 = \$8.40$$

**Conventional to no-till**

$$.65 \times \$20 = \$13.00$$

**Reduced to no-till**

$$.13 \times \$20 = \$2.60$$

**Conventional to no-till**

$$.13 \times \$20 = \$2.60$$

# Breakeven Prices: Fertilizer Practices for Corn

	Breakeven Price (2010 \$/mt CO2-eq)		Emissions Reduction Potential (mt CO2-eq/acre)	
	Low	High	Low	High
Switching from fall to spring application	\$167		0.08	
<b>Nitrous Oxide emissions reduction scenarios</b>	<b>Low</b>	<b>High</b>	<b>Low</b>	<b>High</b>
10% reduction in nitrogen fertilizer application rate	\$174	\$32	0.03	0.16
Use of an inhibitor with nitrogen application	\$63	\$60	0.12	0.12
Switch to VRT nitrogen application	< \$0	< \$0	N/A	N/A

Source: Prepared by IFC International for USDA 2013

# Cover Crops

**Eagle et al. (2012):** planting winter cover crops can sequester up to 1.2 mt CO<sub>2</sub>-eq/acre/year, average of 0.5 mt CO<sub>2</sub>-eq/year

**McNunn et al. (2020):** between 0.16 and 0.35 mt CO<sub>2</sub>-eq/acre/year depending on the crop

**Fargione et al. (2018):** a large percent of the mitigation potential of cover crops could be met at \$10/mt CO<sub>2</sub>-eq/year

# Example of per acre payments with \$20 mt CO<sub>2</sub>-eq/acre

0.5 mt CO<sub>2</sub>-eq/year  
.50 x \$20 = \$10.00/acre



# What Should the Price of Carbon Be?

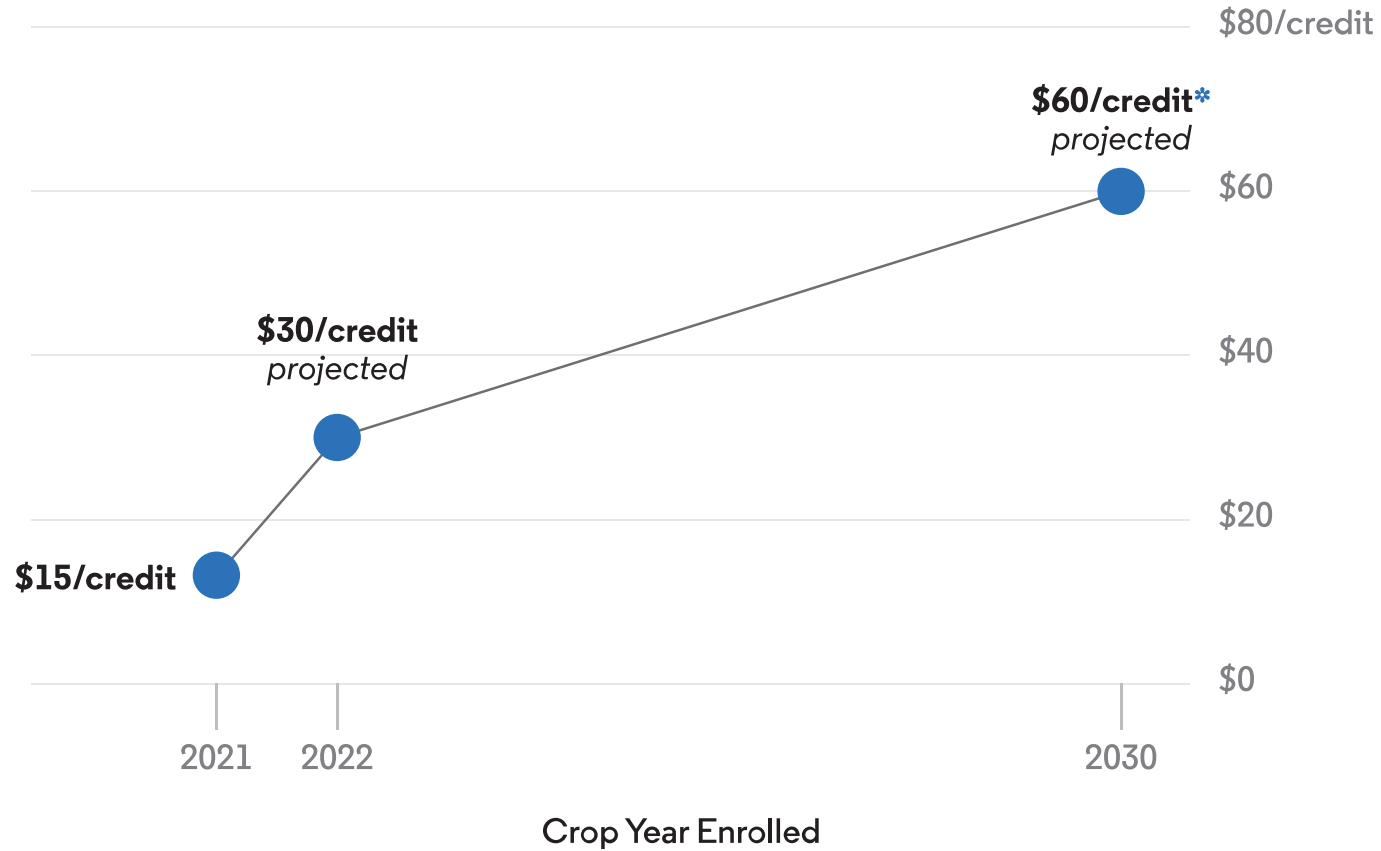
**Fargione et. al (2018): social costs of carbon in 2025 is approximately \$50**

- Price of at least \$100 is needed to keep 100-year avg temp from warming more than 2.5°C (4.5°F)
- Higher price may be needed to meet the Paris Agreement's <2°C (3.6 °F) target



# Corteva's Projection

Carbon credit payments are projected to increase dramatically



\*Source: Forest Trends' Ecosystem Marketplace, "Financing Emissions Reductions for the Future: State of Voluntary Carbon Markets 2019," Washington DC: Forest Trends, 2019.

An aerial photograph of a red tractor pulling a blue plow through a field. The field is divided into two distinct horizontal sections: a dark brown, tilled section on top and a golden-brown, harvested section on the bottom. The tractor is positioned on the boundary between the two sections, moving from the golden-brown area towards the dark brown area. Dust is being kicked up by the plow. Overlaid on the lower half of the image is the text "Farmer Participation in Carbon Markets" in a large, white, sans-serif font.

# Farmer Participation in Carbon Markets

# Credible Information

- 64% of farmers want more trustworthy information to aid in making a carbon market decision (taken March 2021)
- March Purdue Ag Economy Barometer: 1% of 400 farmers surveyed had signed a contract

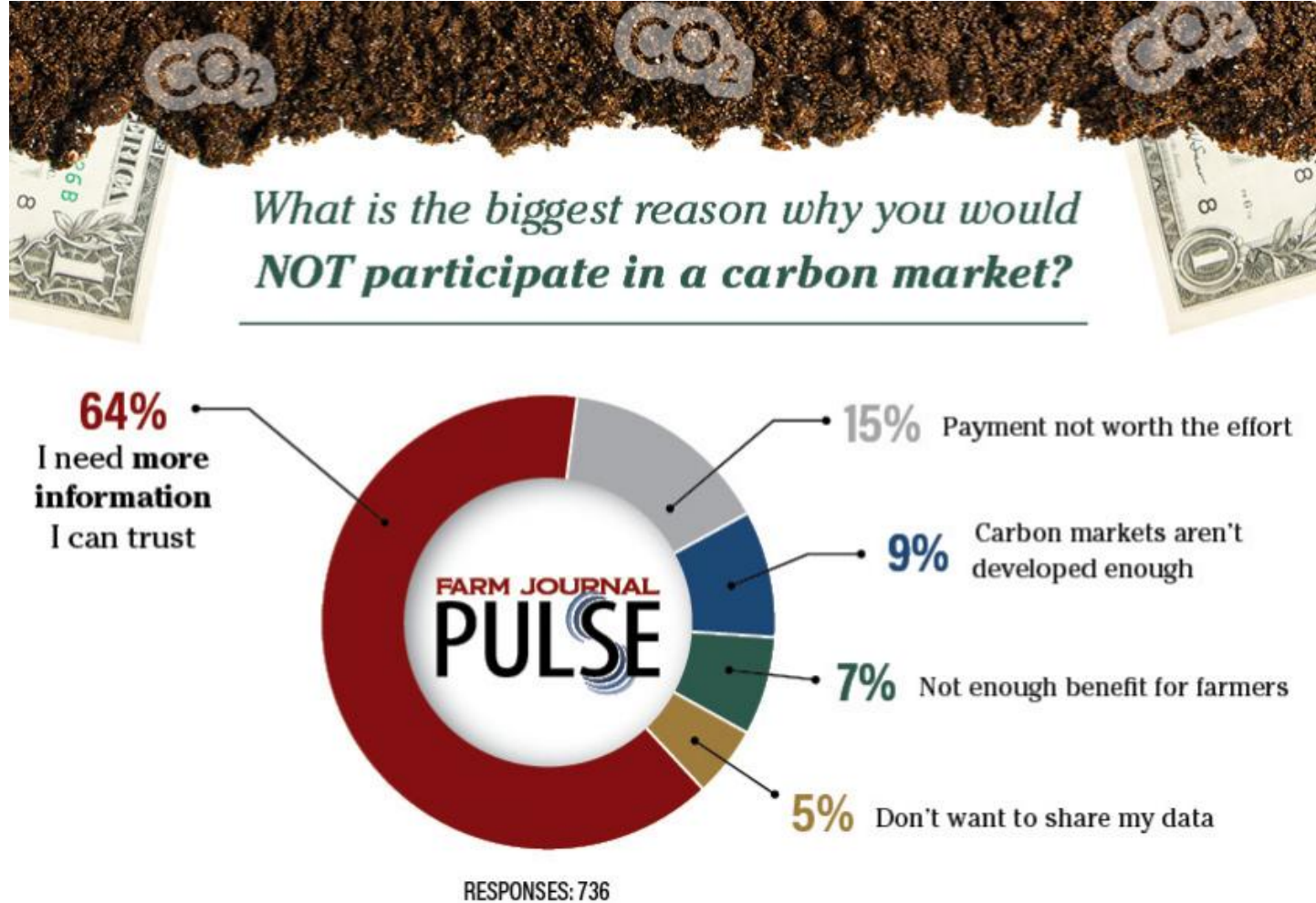


Image From: <https://www.agweb.com/news/policy/farm-journal-pulse/farmers-reality-check-carbon-markets>

# Willingness to Participate

- Agri-Pulse Poll: 61% need at least \$40 per acre, 11% need at least \$30 per acre, and 19% need at least \$20 per acre (published Nov 2021)

# Characteristics and Questions about the Contract



**Length of  
contracts**



**Terms and  
conditions  
of contracts**



**Carbon  
measurement  
in soil**



**Price of  
carbon**

# What Questions Should Farmers Ask?

**What are the approaches for entering a carbon market?**

Aggregator

Data Manager

**How much will I actually be paid?**

Fair distribution of revenue

**Who owns my data? What can be done with my data?**

**What currency is my payment in?**

# What Questions Should Farmers Ask?

**How long will it take to get the money?**

Up front or payment scheme

**Can carbon credits be stored?**

Upside potential in market

**How much will it cost me?**

Soil testing, fees, or  
withholding for carbon losses



# What Questions Should Farmers Ask?

**Can I be paid for practices I am already doing?**

**How many years is the contract?**

Typically see 10 to 20 years

**What happens if the land changes hands?**



# What Questions Should Farmers Ask?

- **Who needs to be involved in the decision?**
  - Attestation of right to sell carbon vs. checking a box
- **What practices are companies paying for?**
- **Is there a per-acre limit of carbon credits?**

# **What Questions Should Farmers Ask?**

**How often will someone need to verify my information?**

**What are the penalties if I do not follow the contract?**

**Is there a limit to the total number of acres I can enroll?**

# Recommendations for Farmers

- Stackability
  - Covers adoption costs
- Protection of upside potential
- Modeling capabilities
- Program that fits with farm goals

# Resources for Carbon Market Information



# Contracts being offered to farmers

Scott Gerlt, American Soybean Association,

<https://soygrowers.com/news-releases/economists-angle-carbon-market-snapshot/>

	Bayer	Corteva Granular	Ecosystem Services Market Consortium	Farmers Business Network Gradable	Indigo Ag	Land O' Lakes TruCarbon*	Nori	Soil and Water Outcomes
<b>Payment amount and basis</b>	\$3 per acre for reduced tillage and \$6 per acre for cover crop adoption (\$9 for both)	\$15 per ton	Depends on outcomes. Amounts are unclear.	\$20 floor on carbon credit for 2019 and 2020. However, farmer can retain credit and sell later if price increases above that level.	\$10 per ton floor for 2020 on first carbon crop. Potential price of \$15.	\$20 per ton	Currently, \$15 per credit fully payable to the farmer plus one unit of cryptocurrency called a NORI token in a restricted account for ten years. The token can be sold back to NORI and has a floor price.	Up to \$40 per acre per year
<b>When is payment made</b>	Once carbon removal is quantified and verified. Typically fall of following year. Compensation is through Bayer PLUS Rewards account and can be redeemed for cash.	Cash payment is made in full after credits are issued.	Sometime after next harvest	60% of credits will be issued to the farmer over a 5-year period. The farmer can decide when to sell these. The remaining 40% are retained to cover future carbon losses and administrative fees.	After results verified and Indigo sells credit, payments are made in 5 installments over 5 years (50% in year 1, 20% in year 2, and 10% in years 3, 4, and 5).	Second half of 2021	As NRT's are sold, suppliers are paid monthly. Nori currently uses first in/first out so the oldest projects are listed first.	50% at time of signing and 50% after verification
<b>Minimum acreage required</b>	Fields must be at least 10 acres	None	None in pilot phase. To be determined for market launch.	250 acres	150 acres	None	Recommended 1,000 or more acres during pilot stage, but smaller farms may aggregate	None
<b>Locations currently offered</b>	IN, IL, IA, KS, WI, ND, SD, NE, MN, MO, MI, OH, AR, MS, LA, MD, DE	IL, IN, and IA	U.S. regions of Corn and Soy Belt, Great Plains, Great Lakes, Pacific NW, CA, others TBD. Market launch will be national.	United States	AR, CO, GA, IL, IN, IA, KS, KY, LA, MN, MS, MO, NE, NC, ND, OH, OK, SC, SD, TN and TX	AR, IA, IL, IN, KS, KY, LA, MD, MI, MN, MS, MO, NE, OH, PA, SD, TN, TX and WI	United States	Particular counties in Iowa, Illinois and Ohio for 2021

# ASA/Gerlt Website: Contracts examined



**CORTEVA**<sup>TM</sup>  
agriscience



<https://soygrowers.com/news-releases/economists-angle-carbon-market-snapshot>



The following information provides a snapshot for crop producers of the carbon market landscape as of August 2021. Most of the current opportunities are for pilot projects and are not operating fully as a market at this point. Payment amounts vary and can be practice-based (with a fixed amount paid for adoption of certain conservation practices) or outcome-based (providing either a guaranteed amount per acre, or an amount based on the quantity of carbon sequestered as estimated through models or measured in soil tests). The information below should help when considering options but will change as the markets evolve.

Carbon Market Snapshot

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<b>Data requirements</b>	Use Climate FieldView (do not have to purchase)	Use Granular Insights. Requires three years of	Contact info, field boundaries, field management info and	Farmers share practice information with Gradable. Three years minimum of	Must use software platform to map field boundaries	Historical data must be provided,	Must enter field boundaries, agronomic practices	Must report 2 to 3 years of baseline operational data

# ASA/Gerlt Website: Categories

- Payment amount and basis
- When payment is made
- Minimum acreage required
- Locations currently offered
- Data requirements
- Program started date
- Data ownership
- Can early adopters participate?
- Must land be owned
- Who pays for monitoring
- Contract length

<https://soygrowers.com/news-releases/economists-angle-carbon-market-snapshot>

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Apr 08, 2021

By Scott Gerlt • ASA Economist

**Economist's Angle**  
A MONTHLY ANALYSIS OF  
U.S. SOYBEAN POLICY & MARKETS

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# IL Sustainable Ag Partnership

E. Bruner and J. Brokish, “Ecosystem Market Information: Opportunity and Program Comparison”

<https://ilsustainableag.org/ecomarkets/>

TABLE 1: MARKET ENTITIES

*As of February 2021*

	Nori	Indigo Ag	Soil & Water Outcomes	ESMC
<b>Acreage Min/Max</b>	None	One-field min, no max	None	None
<b>Contract Length</b>	10 yrs	5 yrs	Annual with yearly renewal	Pilot – Annual Market Launch – Scope 1: 10 yrs; Scope 3: TBD
<b>New Practice Requirement</b>	Yes, with a look-back of up to 5 years during pilot phase	Yes, with a look-back of 2 growing seasons	Yes	Yes, but investigating potential of payments to producers already implementing conservation practices for Scope 3
<b>Payment Schedule</b>	End of month when offset credit is sold	50% yr 1, 20% yr 2, 10% yrs 3, 4, 5	Annually, split 50/50–1 shortly after signing, 1 after verification	Pilot – Annual Market- Launch - Annual to every 5 yrs depending on Scope for carbon 1 vs 3, respectively; annual for water quality.
<b>Ability to Enroll Same Fields in Gov’t Programs/ Other Markets</b>	Designed to stack with both	Designed to stack with both, but other incentives cannot include payments for carbon credits or related assets (financing is okay)	No Note – payment for water quality and carbon outcomes	Designed to stack with gov’t programs; individual fields cannot be in two market programs. Note – ESMC internally stacks carbon with GHG reductions, water quality, and water quantity.
<b>Outcome Estimation</b>	Soil sample reference network-based modeling (Soil Metrics) - cost incurred by Nori. Farmer has option to true-up via soil sampling - farmer incurs sampling cost.	Modeling (biogeochemical and statistical) + soil sampling, Indigo assumes cost (Indigo does not charge growers for anything)	Modeling, with 10% of fields subject to in-field soil and water sampling at no cost to farmer	Modeling (peer reviewed biogeochemical model) + soil sampling. ESMC assumes costs and includes in asset price to buyers.



# Comparison of 11 Private Voluntary Carbon Programs

## How to Grow and Sell Carbon Credits in U.S. Agriculture

Alejandro Plastina and  
Oranuch Wongpiyabovorn  
Iowa State University

<https://www.extension.iastate.edu/agdm/crops/pdf/a1-76.pdf>

## How to Grow and Sell Carbon Credits in US Agriculture

*Ag Decision Maker*  
extension.iastate.edu/agdm

File A1-76

This report compares the requirements to grow and sell carbon and environmental services credits across eleven private voluntary agricultural programs in the United States.

### Why agriculture credits?

A growing number of private initiatives are offering farmers compensation for the generation of agriculture carbon credits as well as other ecosystem services such as improvements in water quality. Credits and ecosystem services are expected to be purchased by large corporations and other entities pursuing a reduction in their environmental footprints. Some large corporations are already purchasing carbon credits generated outside agriculture to comply with environmental regulations and to improve their appeal to environmentally-conscious stakeholders.

According to a 2019 report by the National Academy of Sciences, agricultural practices to enhance soil carbon storage can sequester 250 million tons of carbon dioxide annually in the US, equivalent to around 4% of the country's emissions. An economic assessment conducted by IHS Markit in 2018 concludes that the potential demand for agriculture carbon credits in the US is 190 million tons per year, falling short from the supply potential of 326 million tons per year. That report estimated the size of the US market for carbon credits at \$5.2 billion, and the market for other ecosystem services related to nitrogen and phosphorous management at \$8.7 billion annually.

In an attempt to jumpstart the incipient voluntary agriculture credits market, a few large companies have announced their compromises to purchase credits in the near future: Microsoft announced an agreement with Truterra, while IBM, JP Morgan Chase, Boston Consulting Group, Dogfish Head Craft Brewing, Shopify, Anheuser-Busch, and Barclays announced agreements with Indigo Ag. However, little is known about the exact details

of those transactions. On the supply side, Peoples Company announced the enrollment of 20,000 managed acres with CIBO Impact in January 2021.

The complexities involved in the comparison of agriculture carbon initiatives might discourage agricultural producers from properly evaluating relevant alternatives, resulting in a protracted adoption process, and even an accelerated dis-adoption process if initiatives fail to satisfy producers' expectations. The **Growing Climate Solutions Act of 2021**, which cleared the Senate on June 24, 2021 by a vote of 92-8, supports the development of a voluntary market for agriculture credits derived from the prevention, reduction, or mitigation of greenhouse gas emissions (GHG) or carbon sequestration on agricultural land. The Act creates a voluntary certification program managed by the United States Department of Agriculture (USDA) to help solve technical entry barriers that might prevent farmer participation in private initiatives. In particular, the Act provides the Secretary of Agriculture with an advisory council tasked with ensuring that the USDA certification program remains relevant, credible, and responsive to the needs of farmers and carbon and ecosystem services market participants alike. The advisory council will be composed of a majority of farmers and forest landowners in addition to other agriculture experts, scientists, producers, and others. In an attempt to help farmers navigate the complexities associated with carbon and ecosystem services programs, the present report compares 11 private voluntary programs across 26 variables. The programs include two carbon and ecosystem services credit entities (Ecosystem Services Market Consortium-ESMC and Soil and Water Outcomes Fund), two carbon credit entities (Indigo and Nori), four input suppliers (Agoro Carbon Alliance, Bayer, Corteva, and Nutrien), and three data platforms (CIBO Impact, Gradable, and TruCarbon).

Updated September 2021

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Extension and Outreach

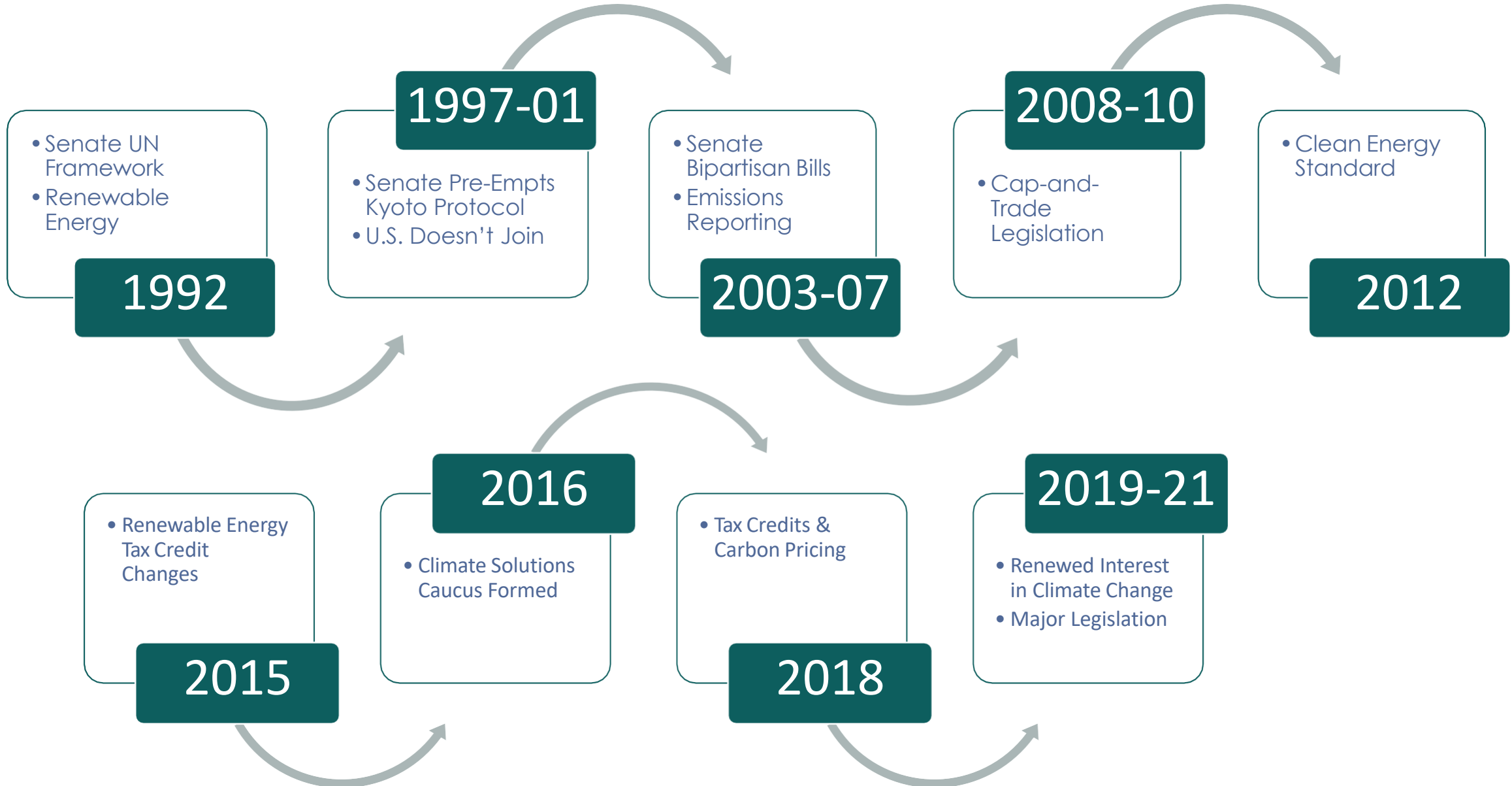
Credits in US Agriculture	Page 5
omes Fund	Fund
ents (soil carbon sequestration) and water quality (ecosystem services)	ists on staff.
ates: DE, IL, IA, MD, NY,	government or its from other
reas	
ut includes no-till, cover, conversion to pasture,	Fund is a partnership of of the Iowa Soybean Partners (a subsidiary il and Water Outcomes on inputs or services. Fund connects farmers carbon credits and
er year across all s.	
reement (spring), 50% after ember/December)	
historical data, and 2-3 ctice change: field data, rotations, fertilization rate, s, tillage type, residue ure applications). Once al data (includes soil and \$).	i, barley, broccoli, corn (grain or ins, dry field pea, mix, lettuce, b, rye, sorghum, ar beets, sunflowers, t (spring or winter). avocado, cherry, grape, lemon/ ectarine, pistachio,
online account at n, map field boundaries, d future cropping system he proposed payment n 1-2 weeks after data mine if you wish to continue he contract to confirm ust comply with the USDA and Wetland Conservation	p rotations and ops; shifting from cing tillage events/ idue management thetic fertilizers with
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y outcomes per acre are	uring the pilot phase; , 2010
Outcomes Fund arranges outcomes with guaranteed cting with farmers.	old. A share of the ill not be distributed for ment of the practices 10 years. Some sed on an NRT score.
elds	ting data and at least ting data or records to ce adoption; annual practices.
aid by Soil and Water	
ive payment.	

# Policy Background

- Congress Climate Milestones
- Paris Agreement
- 2021 Ag Climate Policy Highlights
- Growing Climate Solutions Act
- What To Watch For



# UNITED STATES CONGRESS CLIMATE MILESTONES



# Paris Climate Agreement

- International Treaty on Climate Change
  - United Nearly Every Nation
- Framework for Addressing Global Climate Change
- Control GHG Emissions to Limit Temperature Increase
- “Bottom-Up” Approach to Mitigation
  - Countries Set Own Emission-Reduction Targets



# Paris Climate Agreement

- “Voluntary Cooperation” Approaches
  1. Sell overachievement
  2. Create international carbon market
  3. Non-market climate cooperation between countries
- Still Under Debate
- Could Change or Influence Carbon Markets in U.S.



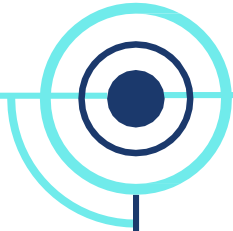
# 2021 AG CLIMATE POLICY HIGHLIGHTS



USDA TO OPEN CRP

USDA PROGRESS REPORT

1/27

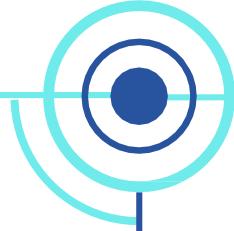


BIDEN E.O. ON CLIMATE CRISIS

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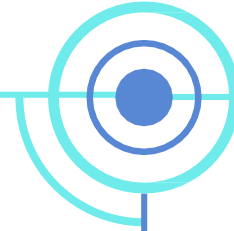


CONSERVATION GOALS REPORT

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SENATE GROWING CLIMATE SOLUTIONS

# GROWING CLIMATE SOLUTIONS ACT

- **Senate Approved With Major Support**
- **Signal Support for Carbon Marketplace**
- **Addresses Lack of Regulation & Consistency**
  - **Protections & Assistance For Farmers**
    - **USDA identify what practices reduce net GHG emissions, set baseline**
    - **USDA to create third-party verification process**
    - **Farmer Advisory Board**
- **Framework for Consistent, Transparent, Science-Based Approach**

CO<sub>2</sub>

# Topics to Watch

- **USDA Carbon Bank**
- **Paris Agreement – International Bank**
- **Defining Terms: Additionality, Carbon leakage**
- **Climate Related Legislation**



# Contact Information



**Krista Swanson**  
[krista@illinois.edu](mailto:krista@illinois.edu)



**Sarah Sellars**  
[ssellar2@illinois.edu](mailto:ssellar2@illinois.edu)



**Gary Schnitkey**  
[schnitke@illinois.edu](mailto:schnitke@illinois.edu)