

Carbon Markets 101:

What Questions Farmers Should Ask?

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Krista Swanson



Sarah Sellars

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



Gary Schnitkey

How are we sharing carbon market information?

What is a Carbon Credit?
Carbon Markets 101
2:58
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Carbon Markets - Why Now?
3:05
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Carbon Markets 101: What is the Paris Agreement?
6:12
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Carbon Markets 101: Price & Cost Questions
5:15
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Carbon Markets 101: Agricultural Carbon Credit Contracts and Data Questions
3:06
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Carbon Markets 101: Breakeven Prices for Agricultural Practices
4:25
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Carbon Markets 101: Can carbon credits increase in price?
4:33
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Challenges of Agricultural Carbon Markets
3:36
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8 videos • 59 views • Last updated on Jul 13, 2021

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Carbon Markets 101 YouTube Playlist
<https://www.YouTube.com/farmdocVideo>



farmdocDAILY.Illinois.edu

- **What Questions Should Farmers Ask about Selling Carbon Credits?**
- **Growing Climate Solutions Act Impact on Farmers**

Topics

1. Background
2. Carbon Markets
3. Example of Carbon Contracts
4. Questions to Ask
5. Policy Environment and “Climate Smart Agriculture & Forestry”



How many acres will Illinois have in Carbon Market in 5 years

- Less than 5%
- 5% to 25%
- 25% to 50%
- Over 50%

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Background

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Background

Results of last election has a great deal to do with current emphasis on climate change and carbon markets

- **The election may have brought the inevitable**
- **Future switches in Congress/Administration may change speed and approaches, but not trajectory**

Stated Policy Goal:

Have man-made activities be carbon neutral.

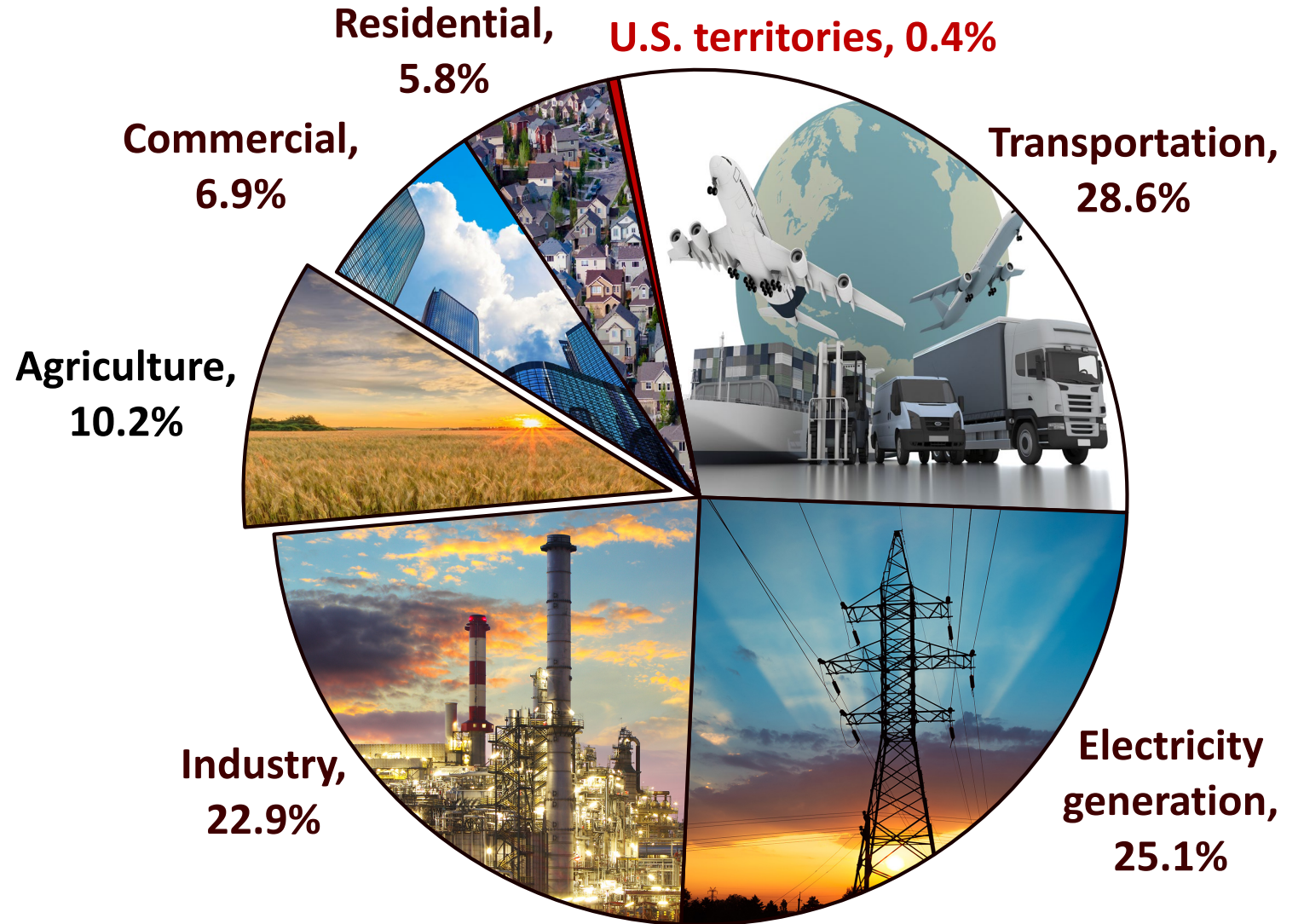
Background:

Agricultural activities are looked at as a sink for carbon

Sequestering carbon in the soil is an emphasis

Emissions by Economic Sector, 2019

Million Metric Tons CO₂ Equivalent



Data Source: United States EPA

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

Two efforts simultaneously

Government Policy

- Congressional action
- Administrative activities

“Private Carbon Markets”



Carbon Markets

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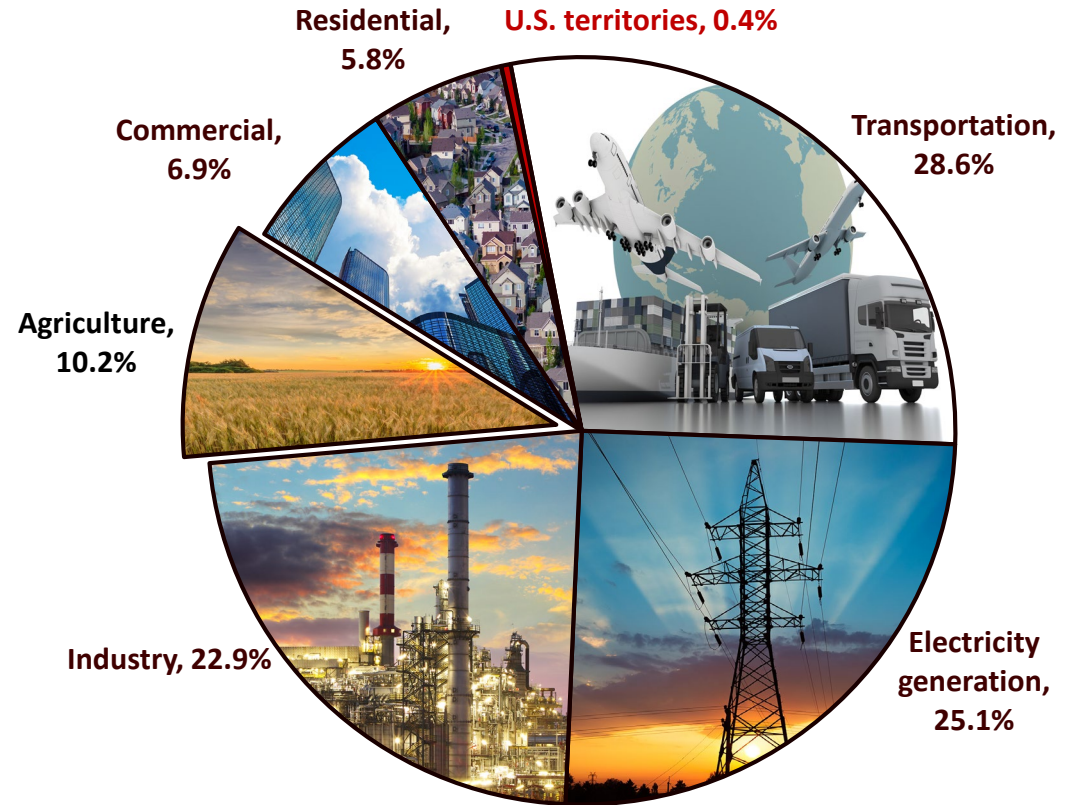


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Agriculture's Sequestration Potential

- U.S. pledged to reach net-zero emissions **no later than 2050**
- One-fifth of world's largest publicly listed companies have net-zero emissions targets
- U.S. agriculture and forestry could provide **10 to 20%** of the sequestration and emission reductions
- Current sequestration on U.S. cropland is 8.4 millions mt/CO₂-eq per year and the annual potential is **100 million mt/CO₂-eq per year**



What Does Climate-Smart Mean?

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

Examples:

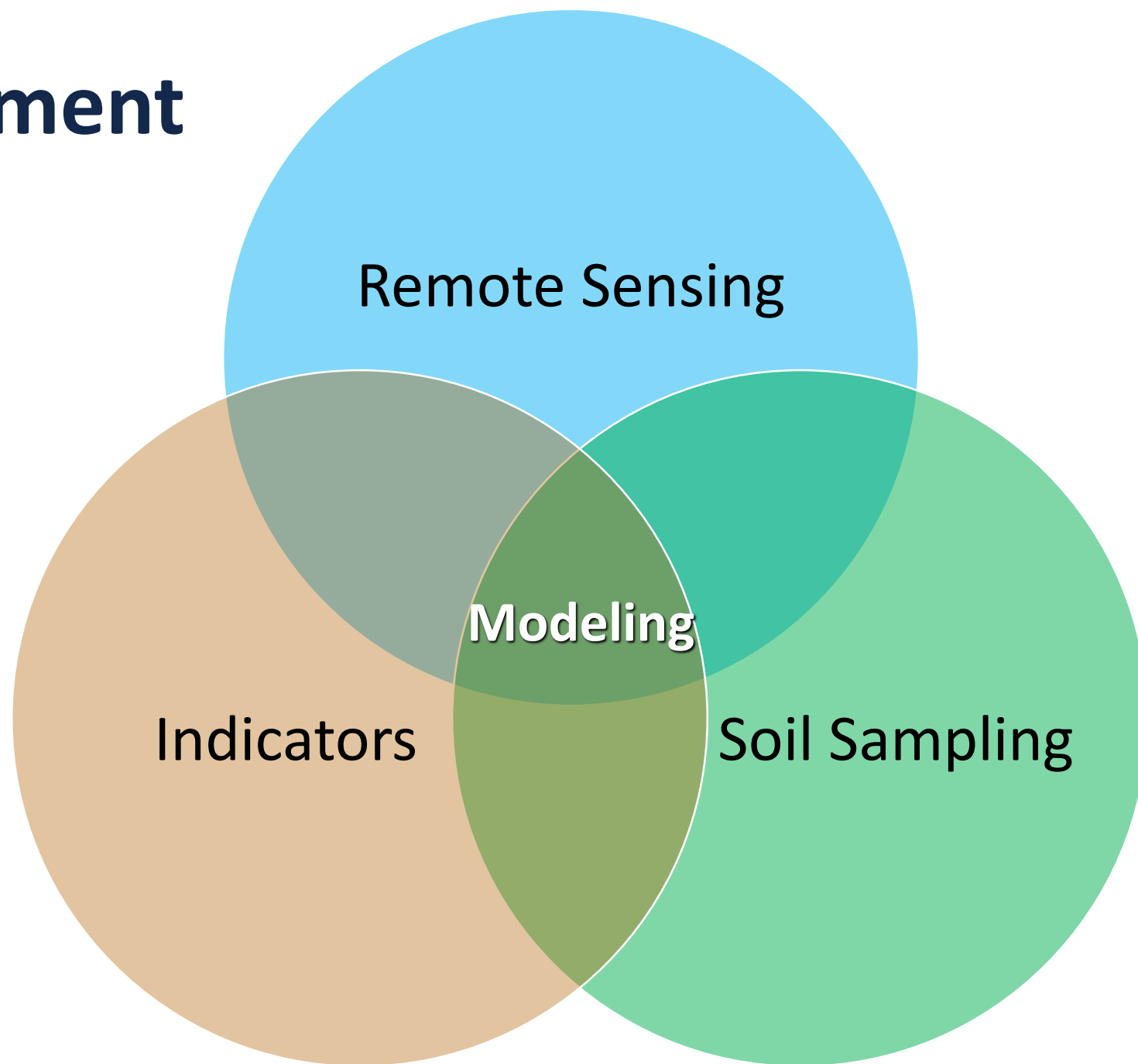
- Reduced and no-till
- Cover crops
- Prescribed grazing
- Reduced GHG emissions (nitrous oxide and methane)
- Ruminant feed management
- Manure management
- Fertilizer management
- Improved on-farm energy efficiency
- Improved forest management

Private Carbon Markets



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

Measurement



Source: Woodbury, Paying for Carbon Webinar

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

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 CO₂-eq/acre

| | Corn | | Soybeans | |
|------------------------------|---|--|---|--|
| | Breakeven Price 2010 \$/mt CO ₂ -eq | Emissions Reduction Potential mt CO ₂ -eq/acre | Breakeven Price 2010 \$/mt CO ₂ -eq | Emissions Reduction Potential mt CO ₂ -eq/acre |
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| Conventional till to no-till | \$34 | 0.65 | \$32 | 0.13 |

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) | |
|--|--|-------------|--|-------------|
| Switching from fall to spring application | \$167 | | 0.08 | |
| Nitrous Oxide emissions reduction scenarios | Low | High | Low | High |
| 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 |

Cover Crops

Eagle et al. (2012): planting winter cover crops can sequester up to 1.2 mt CO₂-eq/acre/year, average of 0.5 mt CO₂-eq/year

McNunn et al. (2020): between 0.16 and 0.35 mt CO₂-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 CO₂-eq/year

Example of per acre payments with \$20 mt CO₂-eq/acre

0.5 mt CO₂-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

Have you (or someone you know) entered a contract for 2022 or before?

- Yes
- No, but in the process of signing contract
- No, but interested
- No, will wait and see

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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 |
|------------------------------------|--|--|---|---|--|---|---|---|
| Payment amount and basis | \$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 |
| When is payment made | 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 |
| Minimum acreage required | 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 |
| Locations currently offered | 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[™]
agriscience



Gradable[™]



Soil and Water Outcomes Fund

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

The screenshot shows the ASA website with the article title 'Economist's Angle: Carbon Market Snapshot' dated April 08, 2021, by Scott Gerlt. Below the title is a photo of Scott Gerlt and a graphic that says 'Economist's Angle: A MONTHLY ANALYSIS OF U.S. SOYBEAN POLICY & MARKETS'. Below the photo is a paragraph of text and a table titled '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.

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| Data requirements | 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>

The screenshot shows the ASA website header with navigation links: Soy Action Center, SoyPAC, Soy Ink Seal, Events & Registration, Board & State Portal, Contact, ABOUT, KEY ISSUES & INITIATIVES, EDUCATION & RESOURCES, INTERNATIONAL PROGRAMS, NEWS & MEDIA, STATES & MEMBERSHIP. The article title is 'Economist's Angle: Carbon Market Snapshot' dated Apr 08, 2021, by Scott Gerlt, ASA Economist. A featured image shows a man in a suit with the text 'Economist's Angle A MONTHLY ANALYSIS OF U.S. SOYBEAN POLICY & MARKETS'. Below the image is a paragraph of text and a table titled 'Carbon Market Snapshot'.

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Payment amount and basis

Practice per acre

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

Per ton of carbon credit

Corteva Granular: \$15 per ton of carbon credit

Indigo Ag: \$10 per ton in 2020, may be \$15 in 2021

Land O'Lakes: \$10 per ton

Current carbon price range is \$10 to \$20 per 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

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?

Carbon credits are in the \$10 to \$20 per ton range. What will the value be in 5 years?

- \$0, no carbon market for Ag
- Up to \$10 per ton
- \$10 to \$20 per ton
- \$20 to \$50 per ton
- Over \$50 per ton

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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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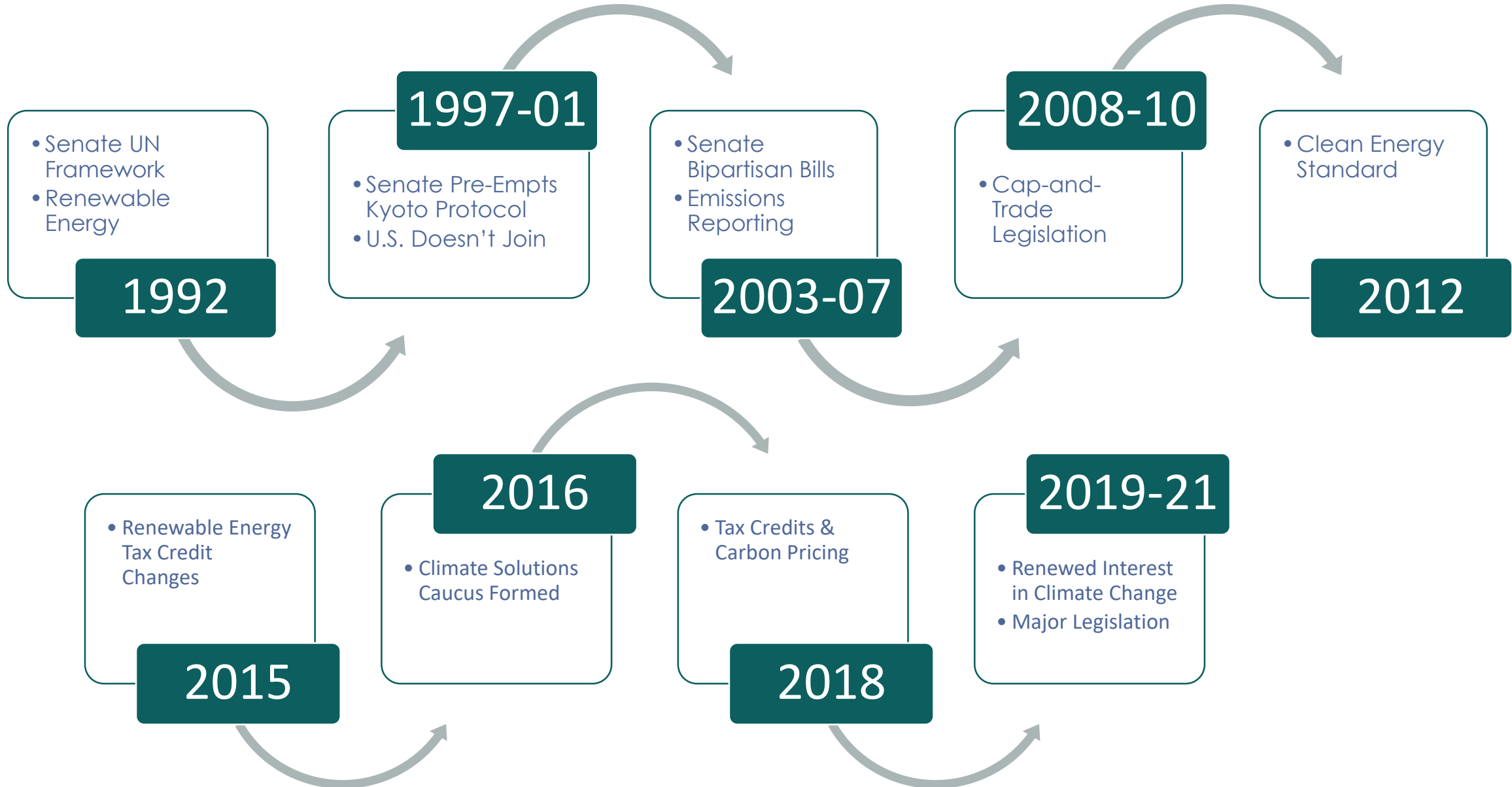
| Program Name | Key Features | Notes |
|---------------------------|--|--|
| Soil Carbon Sequestration | Includes soil carbon sequestration, water quality, and ecosystem improvements. | Requires staff. |
| Government or Other | Government or other entities. | |
| Partnership | Partnership of Iowa Soybean Partners (subsidiary of Water Outcomes Fund) connects farmers with carbon credits. | |
| Yearly | Yearly across all states. | |
| Payment | Payment (spring), 50% after November/December. | |
| Crop Rotation | Historical data, and 2-3 crop rotations, fertilization rate, tillage type, residue management (includes soil and S). | Barley, broccoli, corn (grain or silage), dry field pea, lettuce, rye, sorghum, sunflowers, (spring or winter), avocado, cherry, grape, lemon/lime, pistachio. |
| Map | Online account to map field boundaries, future cropping system, and proposed payment. | 1-2 weeks after data collection; shifting from tillage events/residue management to synthetic fertilizers with |
| Retention | 10-year retention. | |
| Model | Publicly supported model (Nutrient Tracking Tool) and soil data. | NRT tokens or |
| Water Outcomes Fund | Water Outcomes Fund: remote sensing. | Price per NRT set by a transaction fee to an NRT to the buyer. |
| Outcomes | Outcomes per acre are | During the pilot phase; 2010 |
| Guaranteed | Outcomes Fund arranges outcomes with guaranteed pricing with farmers. | Sold. A share of the profit will not be distributed for the first 10 years. Some are based on an NRT score. |
| Fields | Fields | Using data and at least one record to track adoption; annual practices. |
| Soil and Water | Paid by Soil and Water | |
| Payment | One-time 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



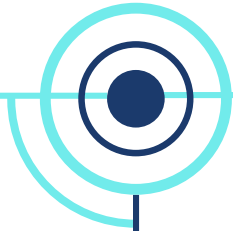
2021 AG CLIMATE POLICY HIGHLIGHTS



USDA TO OPEN CRP

USDA PROGRESS REPORT

1/27



BIDEN E.O. ON CLIMATE CRISIS

4/21



5/6

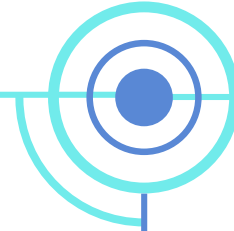


CONSERVATION GOALS REPORT

5/20



6/24



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**

CO₂

Topics to Watch

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

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Upcoming Webinars

Grain Outlook

**11:00 to noon CT, Thursday September 16th
by Scott Irwin and Joe Janzen**

After several years of trade difficult, grain markets have boomed. We will discuss the factors impacting grain markets and provide some projections for the future.

Brazil and the US

**11:00 to noon CT, Thursday September 23rd
by Joana Colussi and Gary Schnitkey**

Brazil is the United States' major competitor in agriculture, with Brazil now producing more soybeans than the U.S. Here we will discuss Brazil's past development, and prospects for the future.

Thank You for joining us!

Please submit your questions



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Latest Article

Gardner Policy Series
An Evolving Path to Declining US Crop Acres
September 8, 2021
Carl Zulauf
US crop agriculture is on an evolutionary path to fewer acres. Supporting evidence is discussed. This path points to an important strategic question for both the US and US agriculture: "Is yield enhancing research sufficient to maintain the current size..."

[Read the Article](#)

| | |
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