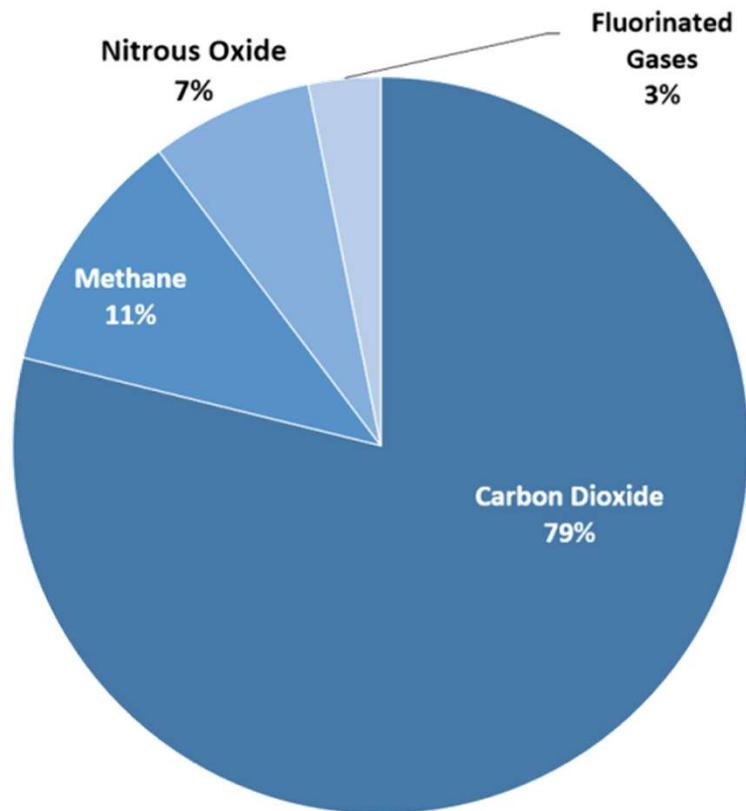




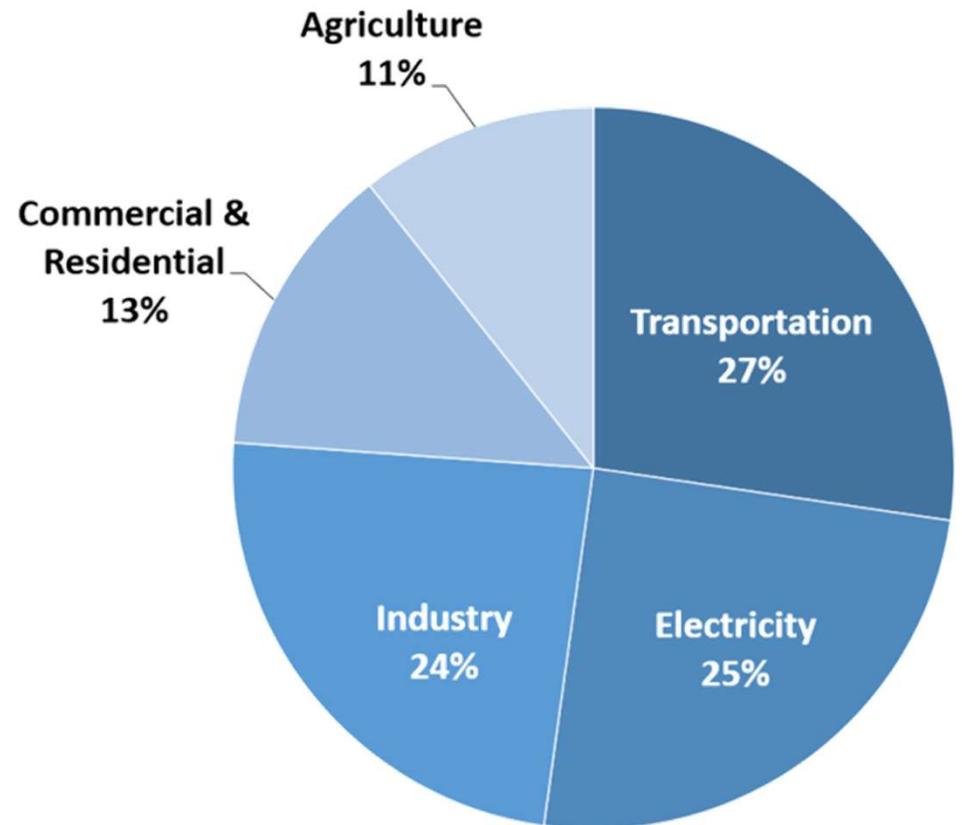
Tools for Communicating On-farm Opportunities to Combat Climate Change and Generate Carbon Credits



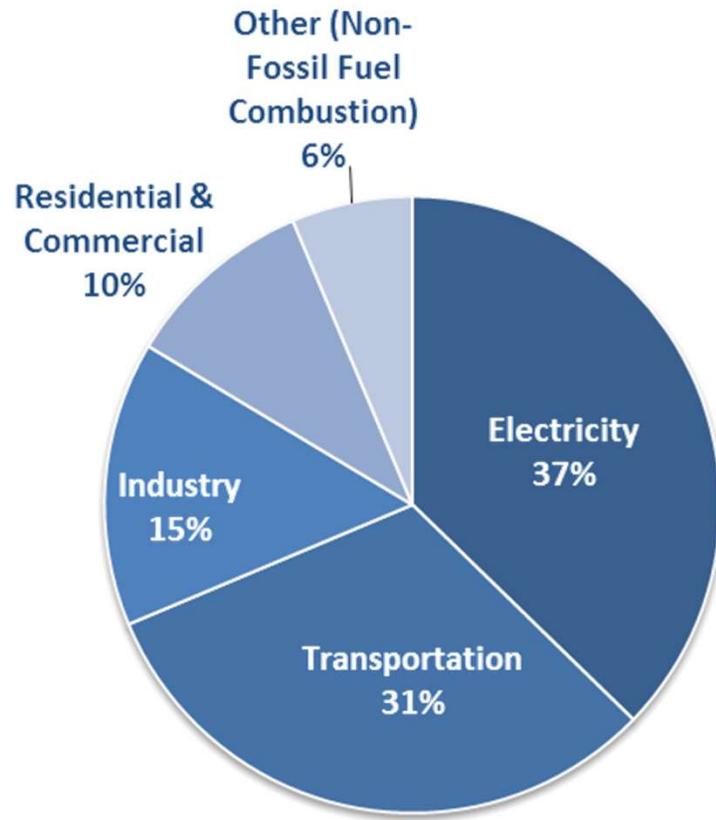
Overview of U.S. Greenhouse Gas Emissions in 2020



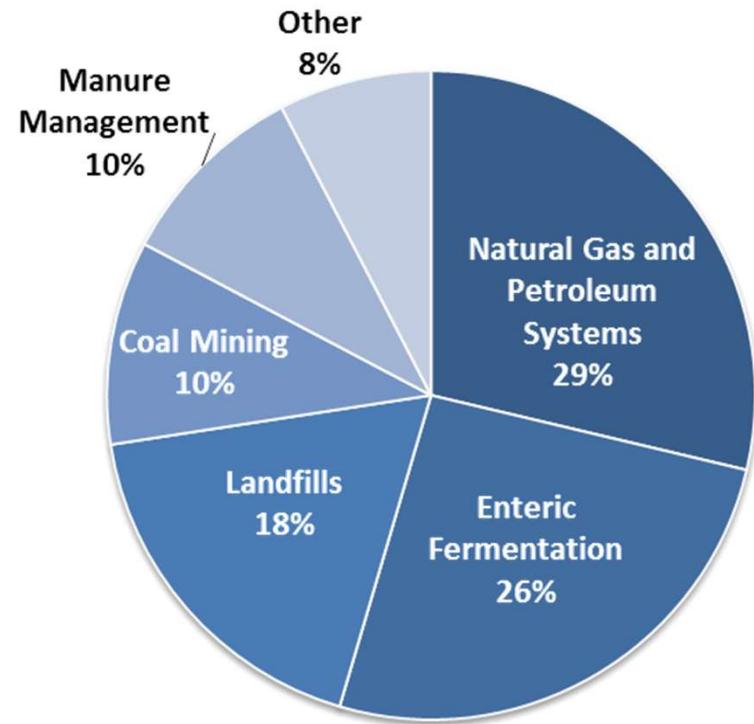
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2020



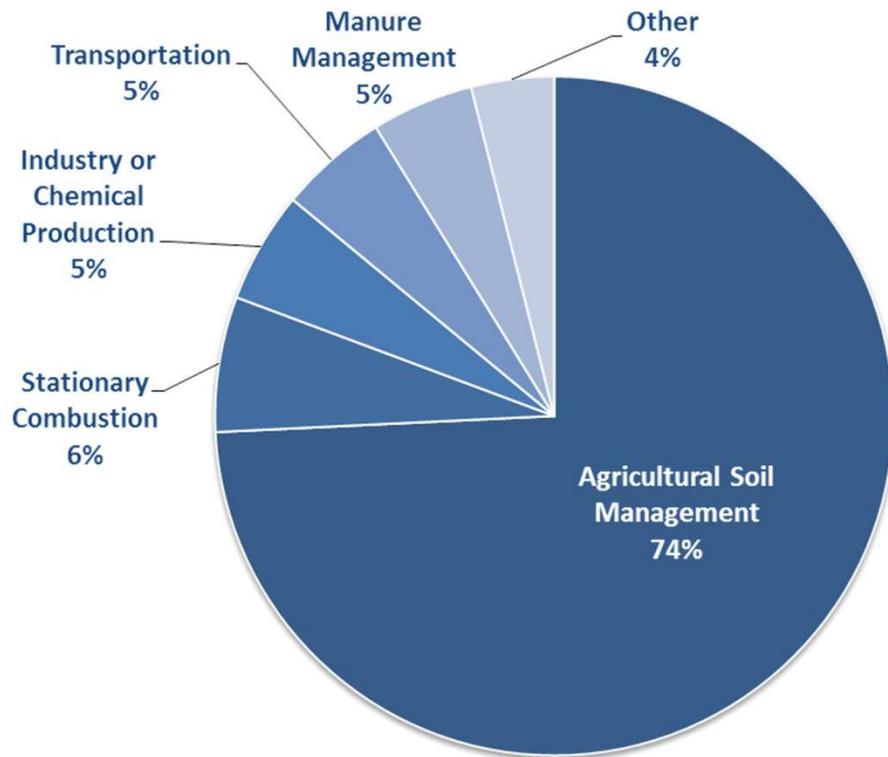
Carbon Dioxide



Methane



Nitrous Oxide



Agriculture is largest source of N₂O > Agricultural Soil Management

- Synthetic fertilizers
- Organic amendments (manure, compost, biosolids, etc.)
- Residue N
- Mineralization and Asymbiotic Fixation
- Drained organic soils

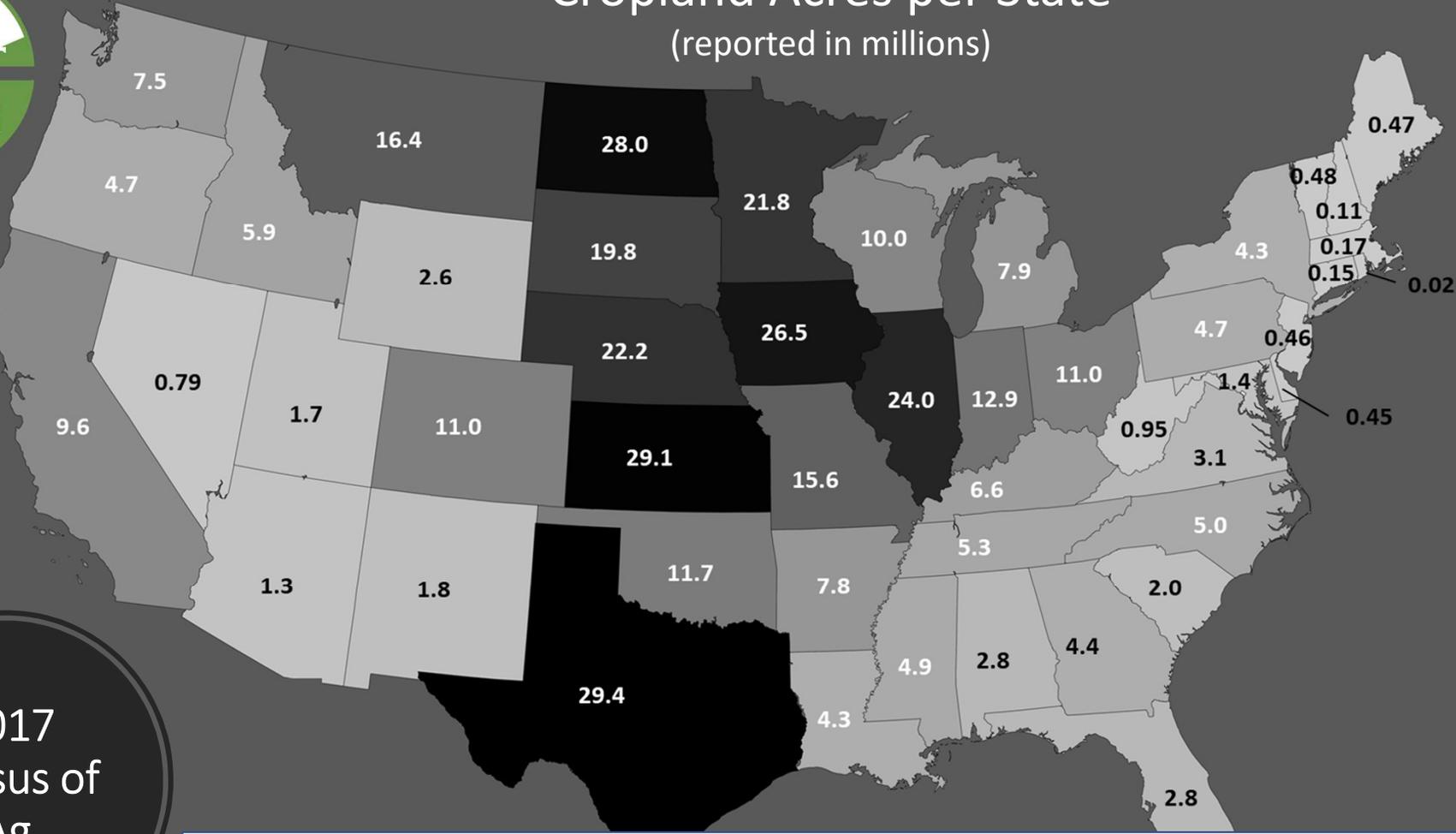
Understanding Carbon Dioxide Equivalents

- Values in this presentation are expressed as carbon dioxide equivalents (CO₂e) and reported in metric ton (tonne) increments.
- CO₂e is a measure used to compare the emissions from various greenhouse gases based on their global-warming potential
- The three main GHGs reported for agricultural practices include
 - Carbon Dioxide (global warming potential of 1)
 - Nitrous Oxide (global warming potential of 298)
 - Methane (global warming potential of 25)



Cropland Acres per State

(reported in millions)



2017
Census of
Ag

In total there are nearly **400 million acres of cropland** in the U.S.
<https://farmlandinfo.org/publications/combating-climate-change-on-us-cropland/>

What is the GHG reduction potential for farmland?

IT DEPENDS!

Practice	Average Emission Reduction Coefficients
Cover Crops	0.16 – 0.77 Tonnes CO ₂ e / ac / yr
No-till / Strip Till	0.40 – 0.74 Tonnes CO ₂ e / ac / yr
Combined Practices (including Spring N application)	0.76 – 1.13 Tonnes CO ₂ e / ac / yr

Table depicting ranges of average emission reduction coefficients summarized from meta-analysis and various cropping system models across multiple soil depths and geographic regions.

<https://farmlandinfo.org/publications/combating-climate-change-on-us-cropland/>

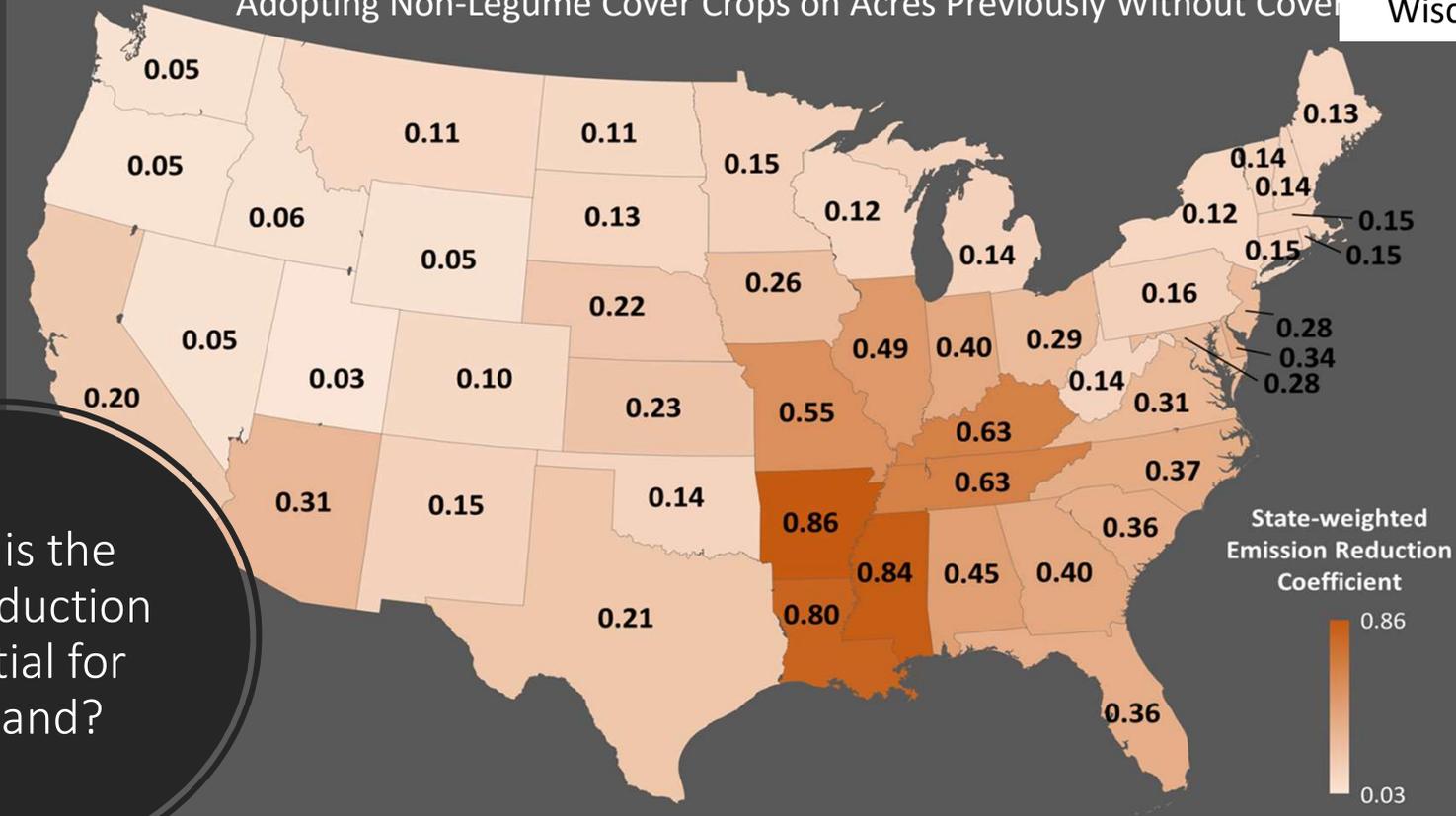




Estimates of GHG Reduction Potential: Cover Crops

tonnes CO2e/ac/yr
Illinois = 0.49
Iowa = 0.26
Minnesota = 0.15
Wisconsin = 0.12

Adopting Non-Legume Cover Crops on Acres Previously Without Cover



What is the GHG reduction potential for farmland?

<https://farmlandinfo.org/publications/combating-climate-change-on-us-cropland/>



Estimates of GHG Reduction Potential: N

tonnes CO₂e/ac/yr
Illinois = 0.73
Iowa = 0.71
Minnesota = 0.58
Wisconsin = 0.54



What is the GHG reduction potential for farmland?

<https://farmlandinfo.org/publications/combating-climate-change-on-us-cropland/>

Benefits of Investing in Soil Health



↑ insulative cover
↓ evaporation

↑ infiltration
↑ H₂O storage
↓ runoff / **flooding risks**
↓ drought risk / **irrigation needs**

↑ weed suppression
↓ herbicide use / **fuel use**

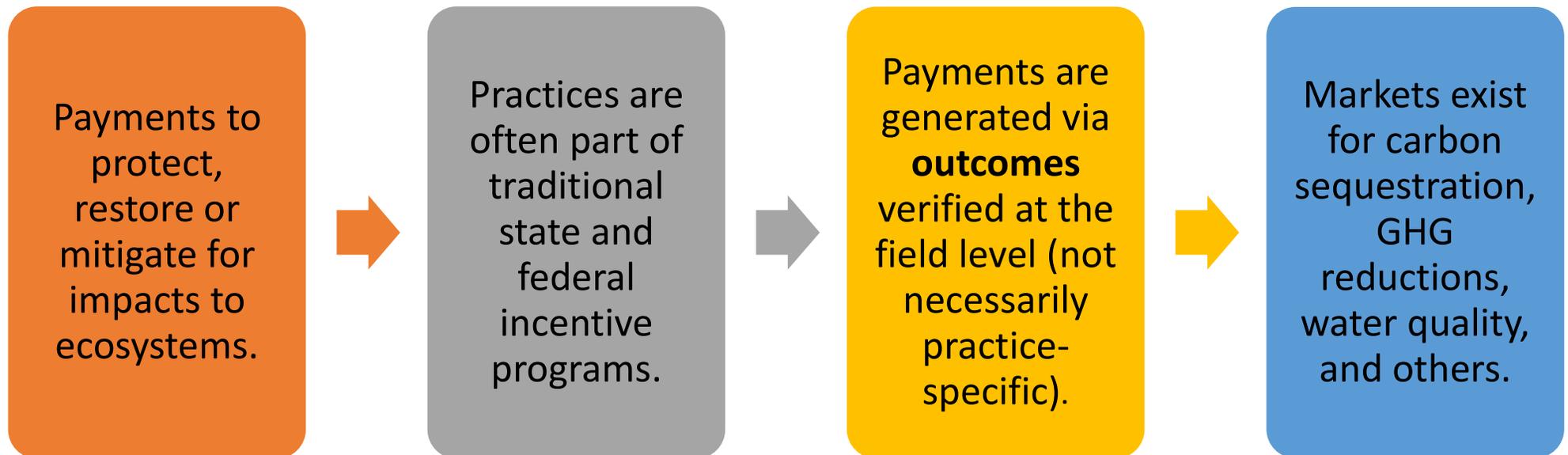
↑ soil organic matter / **carbon sequestration**
↓ compaction

↑ diversity
↓ plant stress
↓ pesticide use

↑ nutrient cycling
↓ fertilizer inputs / **N₂O emissions**
↓ **water pollution**

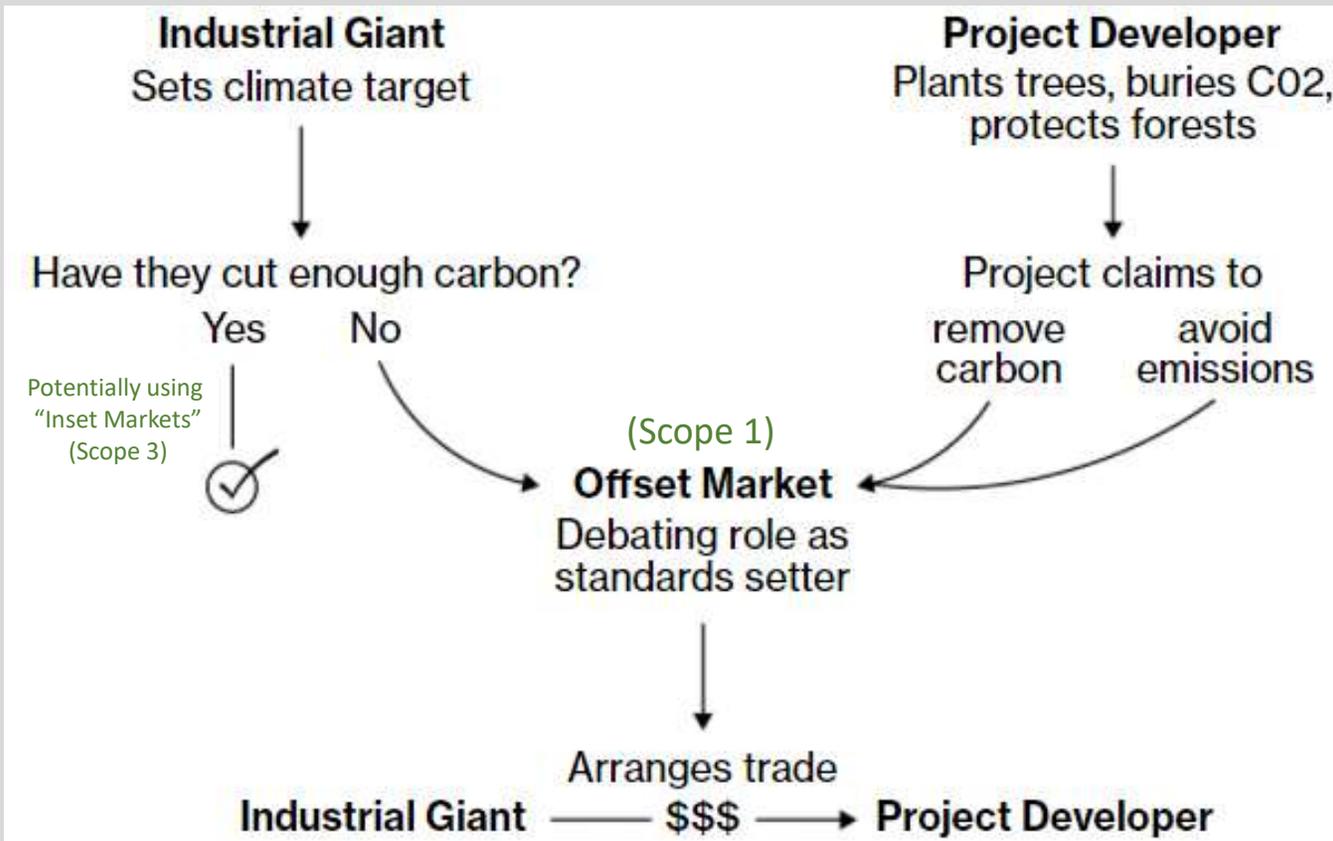
Bold items are prospects for ecosystem market incentives

Background - *What are ecosystem markets?*



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

Carbon Credits (Simplified)



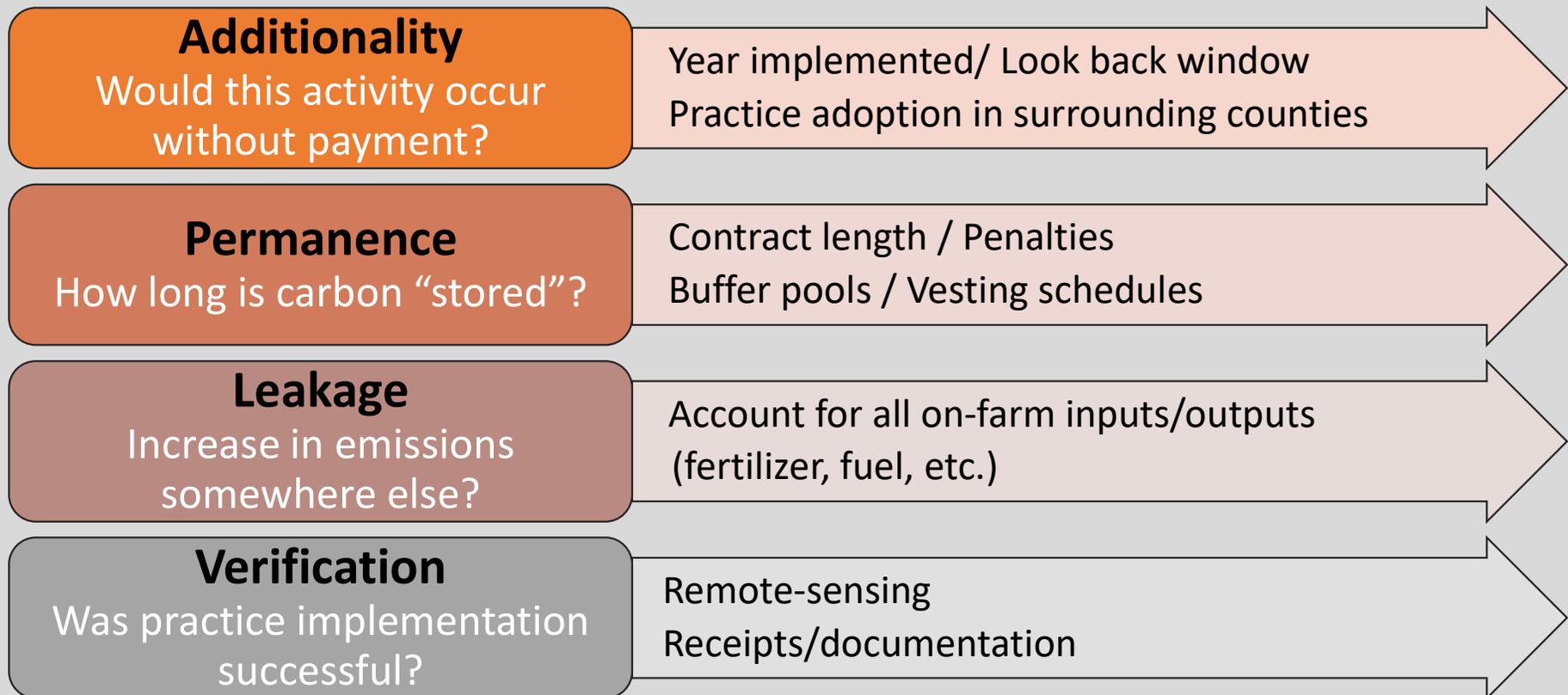
Measurable reduction or avoidance of GHG

Equivalent to 1 metric tonne (2,205 lbs) CO₂e

Includes CO₂, methane, N₂O

Traded via compliance or voluntary market

Keys to Credit Generation



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



indigo



Ecosystem Market Information
Background and Comparison Table 2

<https://ilsustainableag.org>

According to the US Environmental Protection Agency (EPA), ecosystem services markets allow companies, communities and other beneficiaries to pay landowners and managers to protect, restore or mitigate for impacts to ecosystems. While many of the practices that offer the greatest ecosystem benefits are typically assistance programs, market payments are generated via output specific. Current active and pilot markets seek for several ecosystem services (ESG) reduction, water quality and quantity improvement resources focus on agricultural opportunities for carbon and water quality.

What is a carbon offset – According to the US Government, the reduction of GHG emissions from an activity or project in one location. Carbon offsets are typically measured in metric tons.

What is a water quality credit – The EPA defines a water quality credit as a permit for a discharge of pollutants that is equivalent to the reduction of pollutants from a source. Credits can be generated by industrial and technologies or via implementation of management practices. General water quality market information can be found on EPA.

	Bayer	Corteva	Nutrien
Acreage Min/Max	10 acres per field minimum	None	None
Contract Length	10 yr enrollment (newly enrolled farmer was paid for historical practices) + additional 10 yr extension of practice; no penalty for leaving the program if written notice is provided 30 days prior to end of current program yr.	10 yr contract, option to opt-out at the end of yr 2. Opt-out option at the end of each year for years 3 - 10.	1 to 5 years, depending on pilot project
New Practice Requirement	New practice in adoption within 10 yrs are eligible for payback for up to 5 yrs.	Yes, no look-back period.	Yes, no look-back period.
	Payments are made upon practice verification.	Payments are made after practices are verified.	Pilot dependent, but most often at the end of



<https://ilsustainableag.org/ecomarkets>

Additionally, AFT's [Guide to Water Quality, Climate, Social and Ecosystem Tools and Best Methods](#).

Note: While this resource list is not intended to be exhaustive or comprehensive, it does provide a good starting point for an extensive reference list that can serve as a good starting point for an

Background on Featured Entities

Bayer Crop Science – Bayer's US Carbon Program pays \$3 per acre for cover crop adoption, and \$5 per acre for adopting both no-till and cover crops. The program is currently available in 17 states including IA, MO, and DE and looking to expand eligible geographic areas.

Corteva Agriscience – Corteva Invests Granular Insights: Introducing cover crops and/or reduced tillage. Corteva is looking to expand to additional states later in 2021.

Nutrien – Nutrien's Carbon Program is designed to provide for carbon and water incentives, depending on the pilot. See Canadian provinces.

	Bayer	Corteva	Nutrien
Practice Verification	Utilizes various methods, including the Climate FieldView platform and Operational Tillage Information System (OTIS) technologies, plus soil sampling every 5 yrs.	Soil sampling by Corteva, with additional verification and verification conducted by RMAC.	Verification of all data is done for all projects by the grower and where needed by Nutrien staff or other partners.
Data Collected on Enrollment	During enrollment, growers share their fields via Climate FieldView and select which practices are used and when they were adopted.	Current crop year + 3 yrs of historical field data, including crop type, nitrogen applications, tillage data, harvest data, and cover cropping data (if applicable).	Field level practice data, soil samples, and field shape files.
Penalty for Temporary Break in Practice Implementation	Situations in which one or both selected practices are not implemented due to environmental conditions will be evaluated on a case-by-case basis.	If the weather prevents the use of practice changes, a grower will see reduced crediting and thus reduced payments.	Pilot project dependent.
Enrollment Assistance	Customer Success team available to answer questions via carbonprogram@bayer.com or 833-877-7934.	Assistance in navigating program participation (according to payments) provided by Corteva Carbon Sales and Support. Visit Corteva.com/Carbon .	Pilot project dependent.
Technical / Agronomic Assistance	Free agronomic support from Bayer agronomists. Cover crop discount and selection available through LaCrosse Seed.	Free agronomic recommendations on practice changes and implementation provided by local Pioneer Seed Agents or other Corteva Advisors.	Free technical assistance from a variety of Nutrien staff.

*Data program information is included in Table 2 (Bayer), E and British, 1 (2021) Ecosystem Market Information: Background and Comparison Table (not shown). Source: Sustainable Ag Partnership.

Market information was provided and verified by company representatives. Questions regarding this document can be sent to plv@ilsustainableag.org or ask@ilsustainableag.org.

Suggested citation: Bauer, E. and British, J. (2021) Ecosystem Market Information: Background and Comparison Table 2 (not shown). Illinois Sustainable Ag Partnership.



Potential Payments (back of envelope)

		Illinois	Iowa	Minnesota	Wisconsin
Cover Crop	tonnes CO2e	0.49	0.26	0.15	0.12
	Payment ⁽¹⁾	\$ 7.35	\$ 3.90	\$ 2.25	\$1.80
	EQIP ⁽²⁾	\$ 34.90	\$ 23.02	\$ 22.13	\$33.00
No-till	tonnes CO2e	0.73	0.71	0.58	0.54
	Payment ⁽¹⁾	\$ 10.95	\$ 10.65	\$ 8.70	\$8.10
	EQIP ⁽²⁾	\$ 17.29	\$ 11.25	\$11.38	\$17.19

Values are per acre basis

(1) Average carbon payment = \$15 / tonne of CO2e

(2) FY22 Payment Schedules – cover crop payment based on “basic” component (single species, winter kill); no-till payment for no-till / strip-till component.

Markets Take-away

Market incentives alone may not be the most cost-effective means to accelerate practice adoption

- May not be sufficient to justify management changes
- Not currently competitive with existing financial incentives

May be right for a farmer already planning to change

Increased ROI when payments are stacked

An orange circular graphic on the left side of the slide, partially overlapping the white background.

Advice for
Farmers

Realistic Goals / WHY?

Management Changes

Technical Support

Records Requirements

Components of a Soil Health System

- No-till or Reduced Tillage
- Cover Crop
- Crop Rotation
- Integrate Livestock
- Rotational Grazing
- Pollinator Planting
- Organic mulches
- Strip cropping
- Silvopasture
- Agroforestry
- Controlled Traffic
- Prescribed Fire
- Nutrient Mngt
- IPM
- Residue Retention
- Mulching
- Composting
- Biochar
- Add perennials to rotation



Practices on list have potential for incentive payments, sequester / reduce GHG, improve water quality, and increase profits



American
Farmland
Trust

Benefits of Investing in Soil Health



- ↑ insulative cover
- ↓ evaporation
- ↑ infiltration
- ↑ H₂O storage
- ↓ runoff / **flooding risks**
- ↓ drought risk / **irrigation needs**
- ↑ weed suppression
- ↓ herbicide use / **fuel use**



- ↑ soil organic matter / **carbon sequestration**
- ↓ compaction
- ↑ diversity
- ↓ plant stress
- ↓ pesticide use
- ↑ nutrient cycling
- ↓ fertilizer inputs / **N₂O emissions**
- ↓ **water pollution**

Bold items are prospects for ecosystem market incentives



Summary

- ✓ We have an enormous opportunity to scale adoption of soil health systems on over 400 million acres of cropland in the United States
- ✓ Increasing adoption of cover crops and no-till will require additional investment
- ✓ Ecosystem markets can help to increase implementation beyond acreages incentivized via state and federal programs
- ✓ Not all practices and programs fit every farm. Farmers should set realistic goals and then find a program that suits their needs.

For More Info:

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Resources to help you...

Stay Tuned! Will be updating ISAP's website with additional resources!



<https://farmland.org/project/farms-under-threat/>



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



Combating Climate Change on US Cropland

Affirming the Technical Capacity of Cover Cropping and No-Till to Sequester Carbon and Reduce Greenhouse Gas Emissions

Report prepared by Bruner, E., Moore, J., Hunter, M., Roesch-McNally, G., Stein, T., and B. Sauerhaft

<https://farmlandinfo.org/publications/combating-climate-change-on-us-cropland/>

Weekly Farm Econ

What Questions Should Farmers Ask a

Sarah S. D.

Department

<https://farmdocdaily.illinois.edu/2021/04/what-questions-should-farmers-ask-about-selling-carbon-credits.html>

Practice	Crop Type	Breakeven Price (2010 \$/mt CO ₂ -eq)	Reduction Potential (mt CO ₂ -eq/acre)
Tillage Practices			
Reduced till to no-till	Corn	\$30	0.42
Conventional till to no-till	Corn	\$34	0.65
Conventional till to reduced till	Corn	\$43	0.22
Conventional till to no-till	Soybeans	\$32	0.13
Reduced till to no-till	Soybeans	\$77	0.13
Conventional till to reduced till	Soybeans	Negligible emissions reduction	
Fertilizer Practices			

Thank you!



ILLINOIS
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American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

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