Carbon Credit Markets: Current Opportunities and Future Prospects

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Who's paying for carbon credits and why?

Corporate Climate Pledges

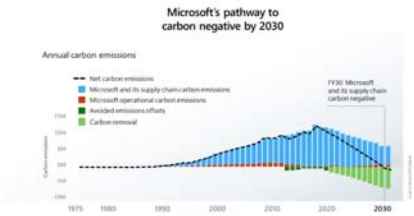
Cargill

Source

PepsiCo

Source

Microsoft



Source

Buyers

- McDonald's
- Pepsi
- Microsoft

Buy carbon credits to offset their emissions.

Intermediary

- Nori
- Indigo
- Ecosystem Services Market Consortium

Matches buyers with sellers and verifies the carbon offset.

Sellers

- Farmers

Implement a practice that sequesters carbon in the soil or reduces greenhouse gas emissions.

Demand

- How big is current demand?
  - 93 million carbon credits purchased in 2020
  - At $15/credit this is roughly 1.4 billion dollars
  - Volume of sales increased by 33% since 2019
- Of the 1.3 million metric tons of offsets Microsoft contracted for 2021, almost 200,000 metric tons are from soil carbon sequestration

Quality assurance issues in carbon credits.

What determines carbon credit quality?

1. Additionality
2. Permanence
3. Leakage
4. Uncertainty

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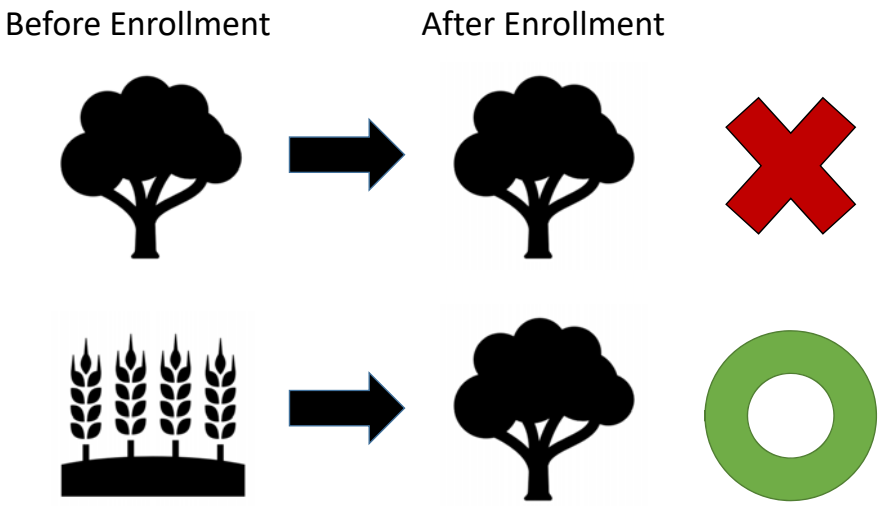

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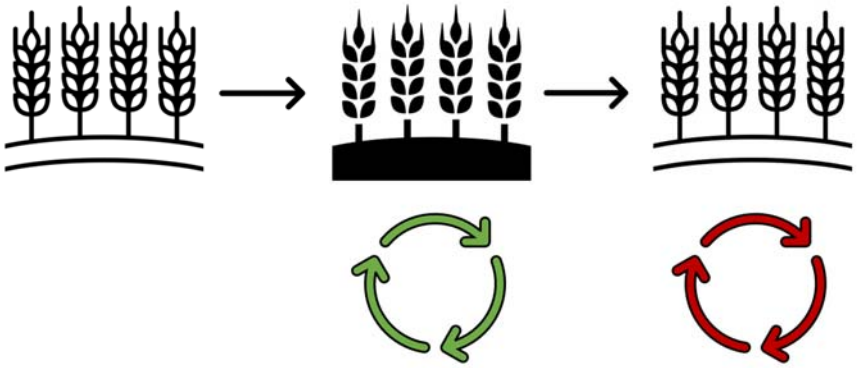

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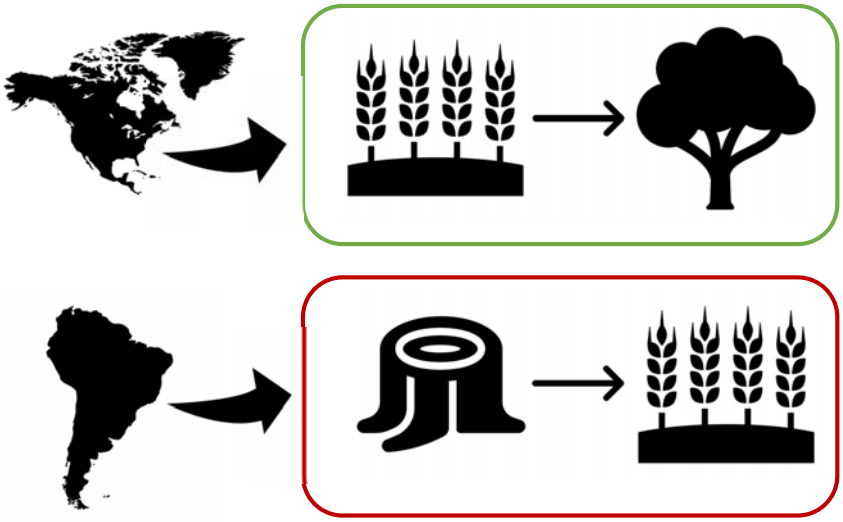

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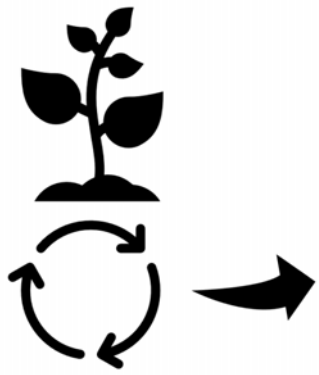


How much carbon does cover-cropping sequester?
+.15 tC/ acre /year?
+.22 tC/acre/year?

Uncertainty - continued

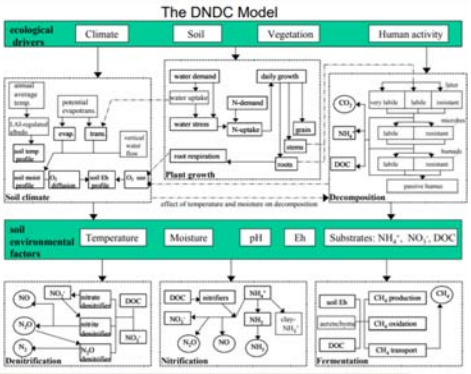
Practice Adopted	Estimated carbon sequestration per acre	Payment per acre (assuming $15/ton CO2)
No-till - Warm and dry climate - Loamy, Silty, or Clayey soil	0.08 tC/acre/year (−0.06, 0.21) - From Ogle et al. 2019	$4.40/acre/year
No-till - Warm and dry climate - Sandy soil	0.07 tC/acre/year (-0.04, .19) - From Ogle et al. 2019	$3.85/acre/year
Cover Cropping with NT - Hesston, KS - Late soybean in winter-wheat/sorghum	.15 tC/acre/year - From Blanco-Canquil et al. 2011	$8.24/acre/year
Cover Cropping with NT - Hesston, KS - Sunn hemp in winter wheat/sorghum	.22 tC/acre/year - From Blanco-Canquil et al. 2011	$12.24/acre/year

Verification/Quantification

Most methodologies use a Model and Measure Approach:

1. Model soil carbon/GHG fluxes with a process-based model
   - COMET Farm, DNDC, CENTURY

1. Incorporate site-specific soil samples



Current Opportunities - KS

Market Administrator	Eligibility Criteria	Data Required	Quantification Methodology
Bayer	Adopt cover-crops, no-till/strip-till, or both after Jan. 1, 2012	Farm management records; share enrolled acreage using Climate FieldView platform	Unclear
Indigo – "Carbon by Indigo"	Adopt at least one regenerative practice such as: cover crops, improving cover crop diversity or growth period, reduced tillage or fertilizer, diversifying crop rotation	3-5 years of historical data plus current season data; Soil samples optional	Model and/or Measure – VERRA protocol
Nori	Adopted regenerative practices since 2010. No CRP for enrolled area since 2000.	3 years of farm management records prior to new practice adoption, soil samples optional	Comet Farm (USDA-NRCS) and soil samples if available

How big are the payments?

- Nori – $15 currently per Nori Carbon Removal Ton; Nori estimates producers generate 0.2-1.5 tons per acre/year → $3/acre/year to $22.50/acre/year
- Bayer - $3 acre/year for no-till/strip-till; $6/acre/year for cover cropping; $9/acre/year for adopting both
- Indigo – estimates $2/acre/year for cover crops, $7/acre/year for reduced tillage, and $8/acre/year for both in Garden City

$$Net\ Payment\ per\ acre = \frac{\$}{ton\ of\ carbon} \times \frac{tons\ of\ carbon\ sequested}{acre} - transaction\ cost$$

- Example marginal cost: If soil sampling is required every 5 years, 5 samples are needed per 100 acres, and it's $20 to run each sample. The cost of sampling a 100 acre project could be $0.30/acre/year over a 10 year term.

What's next?

Ask questions of Market Administrators (e.g. Nori) before enrolling

1. Who owns the credits? → If the price of carbon goes up will my payment increase?
   - Indigo sells credits on producers behalf, Bayer is pay-for-practice, Nori gives the producers the credits to sell
2. Can my farm management data be shared after it's used to quantify carbon sequestration?
   - If yes, who is my management data being shared with?
3. How long does a field need to be enrolled in the program? What happens if the practice cannot be maintained for the length of the contract?

Things to keep an eye on

- Growing Climate Solutions Act of 2021
  - Would authorize USDA to create two programs designed to assist producers in entering voluntary environmental credit markets
    1. Greenhouse Gas Technical Assistance Provider
    2. Third-Party Verifier Certification Program
- What if the cost of carbon increases?
  - The EU price of carbon was $68 per ton in May 2021 and Futures Prices are currently around $55
- Upcoming Market Administrators and Opportunities
  - **Cargill** – Currently enrolling producers in Illinois, Indiana, Ohio, Missouri, Arkansas, Tennessee
  - **TruCarbon by TruTerra** - launching this year and paying $20 per ton; Truterra will pay for and handle soil testing
  - **Ecosystem Services Market Consortium** – One project in KS with General Mills focused on wheat acreage. ESMC hopes to produce credits for additional services (water quality, erosion control, etc.)

Example Case: Nori

- For Croplands, the carbon fluxes are quantified using the COMET-Farm platform developed by scientists at Colorado State University in collaboration with USDA NRCS
  - COMET-Farm includes the following changes as eligible practices at present:
    - Altering crop rotations and intensity
    - Cover cropping or changing from annuals to perennials
    - Changes to tilling frequency and intensity, along with different residue management
    - Adoption of improved irrigation management practices
    - Switching synthetic fertilizers for organic matter additions
- Suppliers required to give GPS coordinates or GIS files indicating the project area
- Must have 3 years of data prior to the "Switch" date when a practice is adopted, and adopting must have occurred after Jan. 1st, 2010
- Minimum term for registering a project is 10 years

Nori – Data Collection

- Baseline Data Options
  1. Direct upload to Nori
  2. Instruct Data Manager at farm management system (Granular, MyJohnDeere, etc.) to transfer data
  3. Create third party farm management data platform
  4. If baseline data are unavailable, Nori can use publicly available data to create baseline
- If a supplier provides additional data (e.g. soil testing) showing better outcomes than COMET predicts, Nori can adjust its quantification of credits
- Soil Metrics does the actual quantification of carbon fluxes

Example COMET Output

	TCO2e/year, avg over 10 years		
		No Till	
assume: field is 60 acres	Baseline	Actual	*Change*
SOC stock change			
soil	-9.7	-41.4	-31.7
biomass	0.0	0.0	0.0
dead	0.0	0.0	0.0
CO2	10.0	8.0	-2.0
CO	0.0		0.0
N2O	50.0	48.0	-2.0
CH4	5.0	4.0	-1.0
Total	**55.3**	**18.6**	**-36.7**
Energy Use (Diesel only) GHGs			
CO2+ CH4+ N2O	10.8	2.3	-8.5
N2O			0
CH4			0
total energy use	10.8	2.3	-8.5
Total GHGs	**66.1**	**20.9**	**-45.2**

Nori – The Cost

- Verification is performed by third party actors who bid on suppliers' projects after the data is submitted to Nori.
- Suppliers choose the verifier and bear the cost of verification.

Nori - The Payoff

- The Suppliers receive 1 token per Nori removal ton split between Restricted and Unrestricted accounts. The split is determined by the project's score, a measure of the uncertainty and risk of retention
- So, a supplier producing 100 NRTs with a score of 50 will receive the same amount of Nori tokens as a supplier producing 75 NRTs with a score of 67.
  - Additional data verifying carbon sequestration will improve this score
- As of July, a Nori Carbon Removal Tonne was selling for $15
- Nori states suppliers can generate between 0.2 to 1.5 tons of carbon per acre per year