



Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

GHG and Carbon Quantification Tool and Carbon Markets



Presented by:
Dr. Adam Chambers
Adam.chambers@usda.gov

FARM PRODUCTION AND CONSERVATION
FSA | NRCS | RMA | Business Center

We are the first....generations to fully understand the problem

... and the last with the ability to solve it...



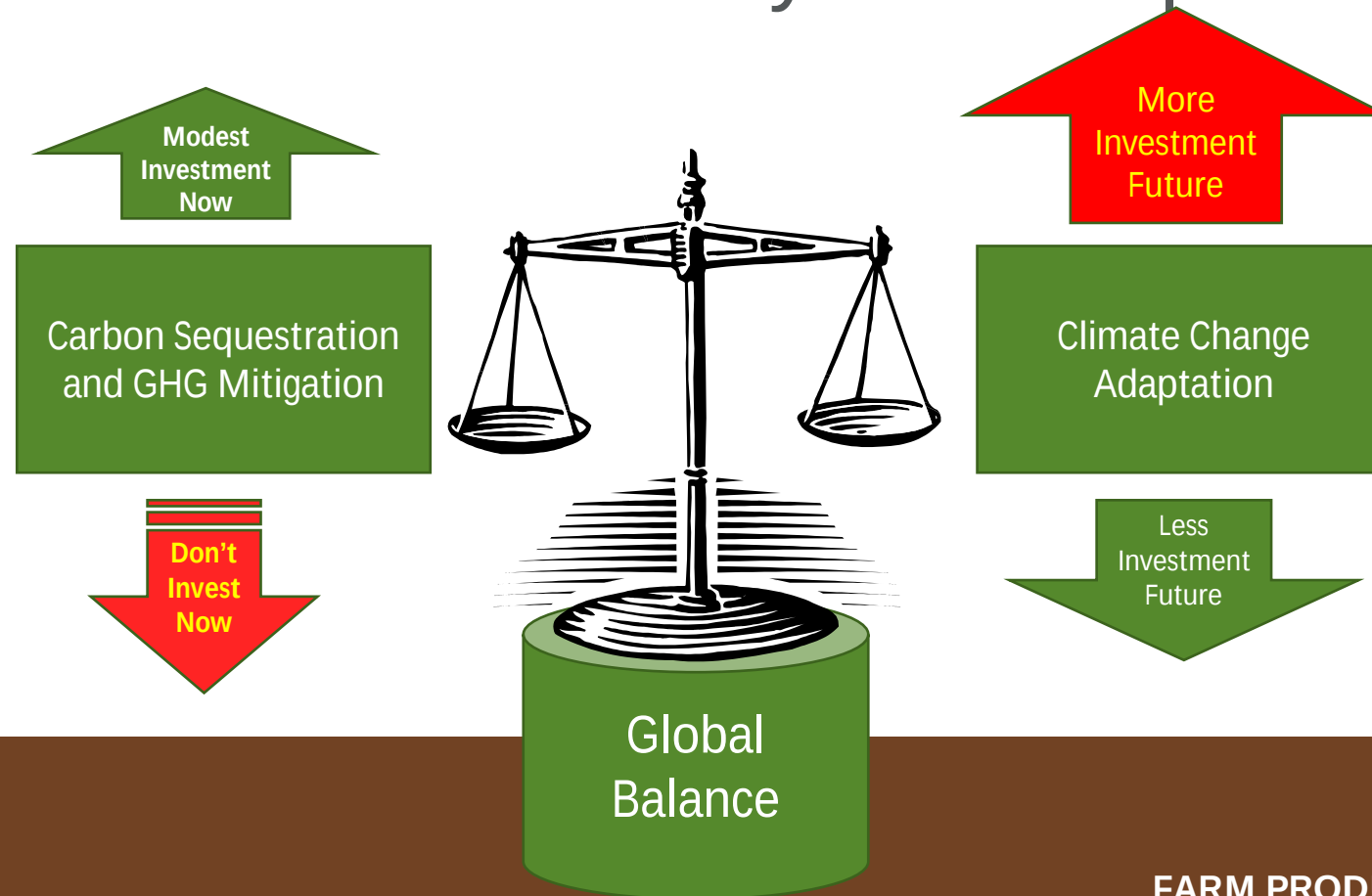
We are the first....generations to fully understand the problem

... and the **last** **FIRST** with the **ability** **TOOLS** to solve it...





Climate Change Agriculture and Forestry – 2 x Exposed



Working Lands Agriculture and the Atmosphere: Three Main GHGs and Numerous Intervention Opportunities

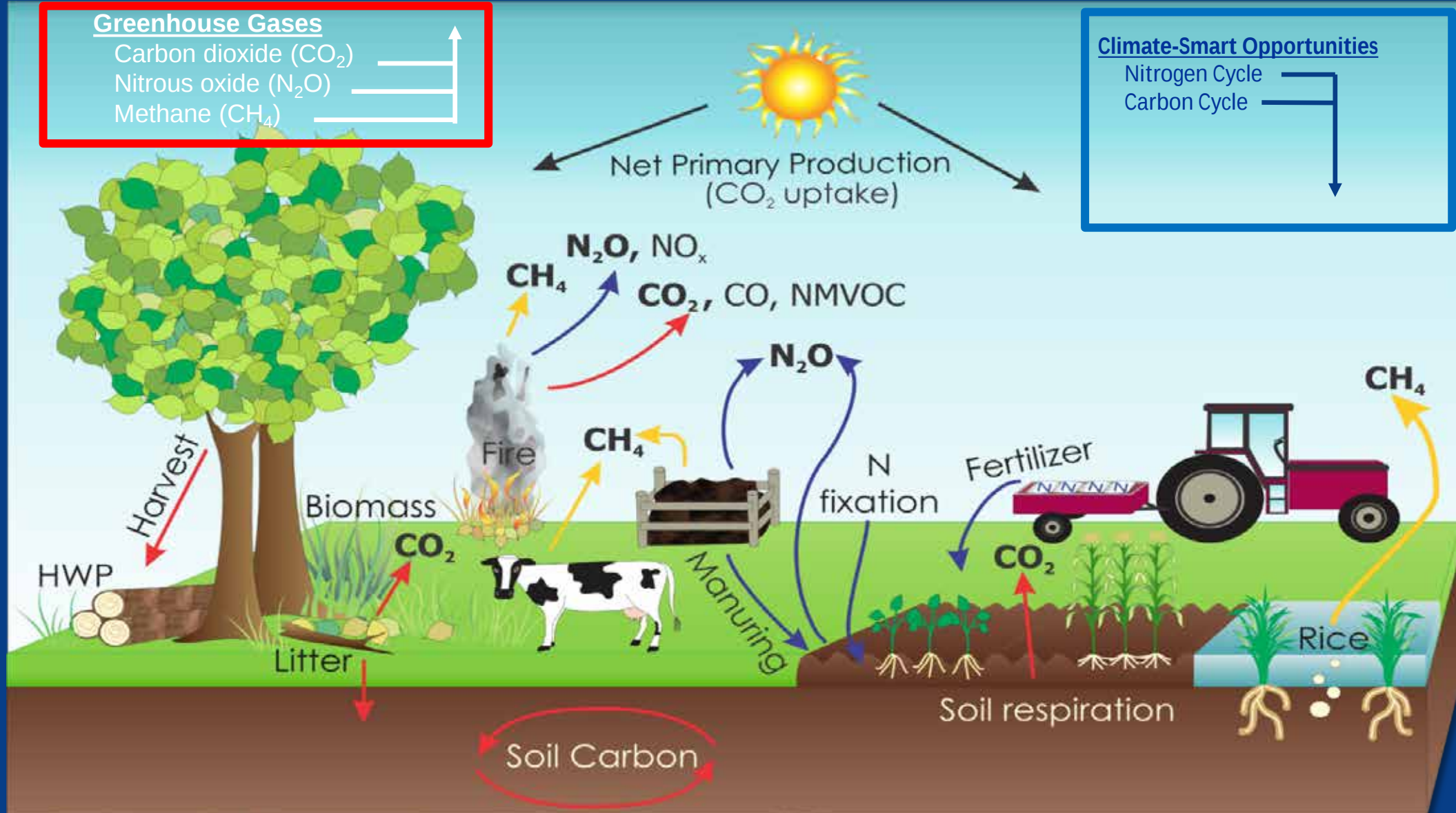
Greenhouse Gases

Carbon dioxide (CO_2)
Nitrous oxide (N_2O)
Methane (CH_4)



Climate-Smart Opportunities

Nitrogen Cycle
Carbon Cycle



NRCS Working Lands Practices... Work! - as Climate Solutions



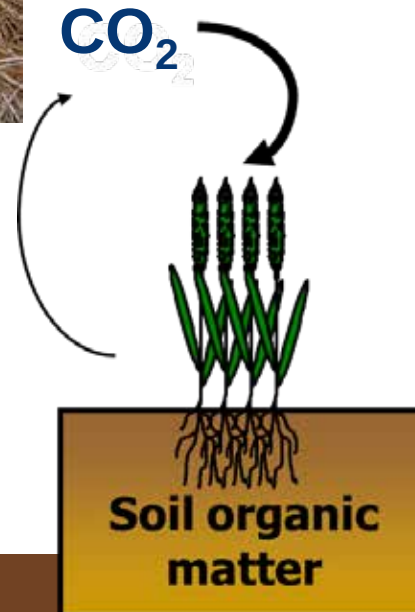
Cover crops



Anaerobic digester



Conservation buffers



Conservation tillage



Transition to Grass Waterway and Perennial Cover

Conservation Co-Benefits - Soil Health, Water Quality, Atmospheric Carbon



Transition to No-Till/Reduced Till and Residue Management

Conservation Co-Benefits - Soil Health, Atmospheric Carbon, Nitrogen Mgmt., Sustainability

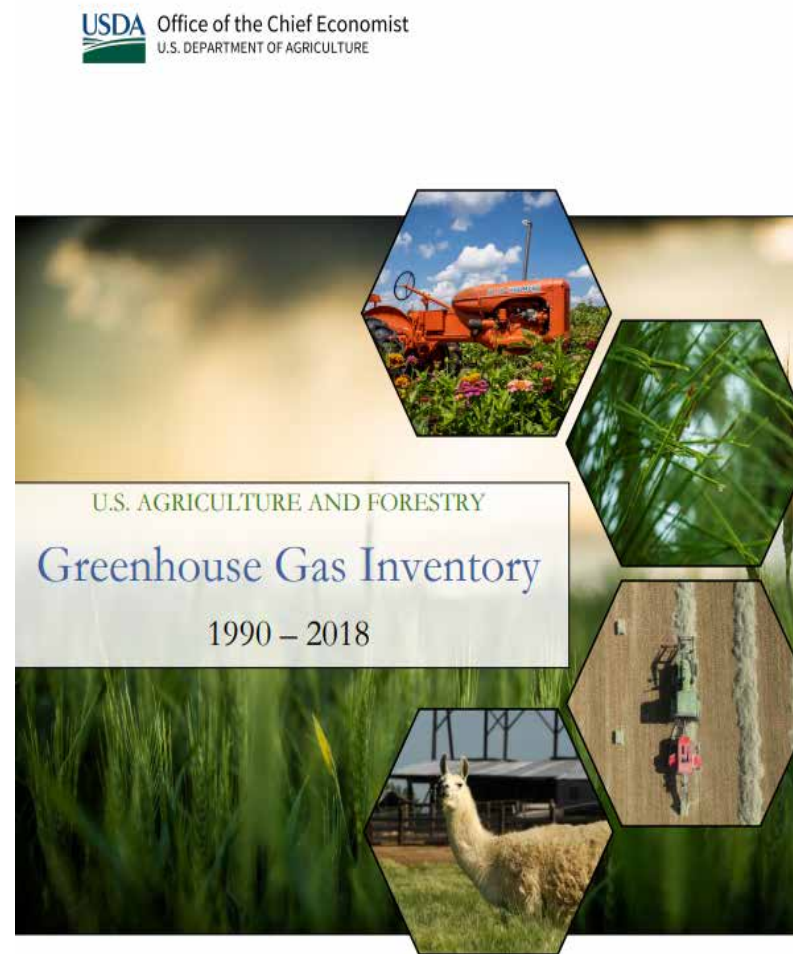
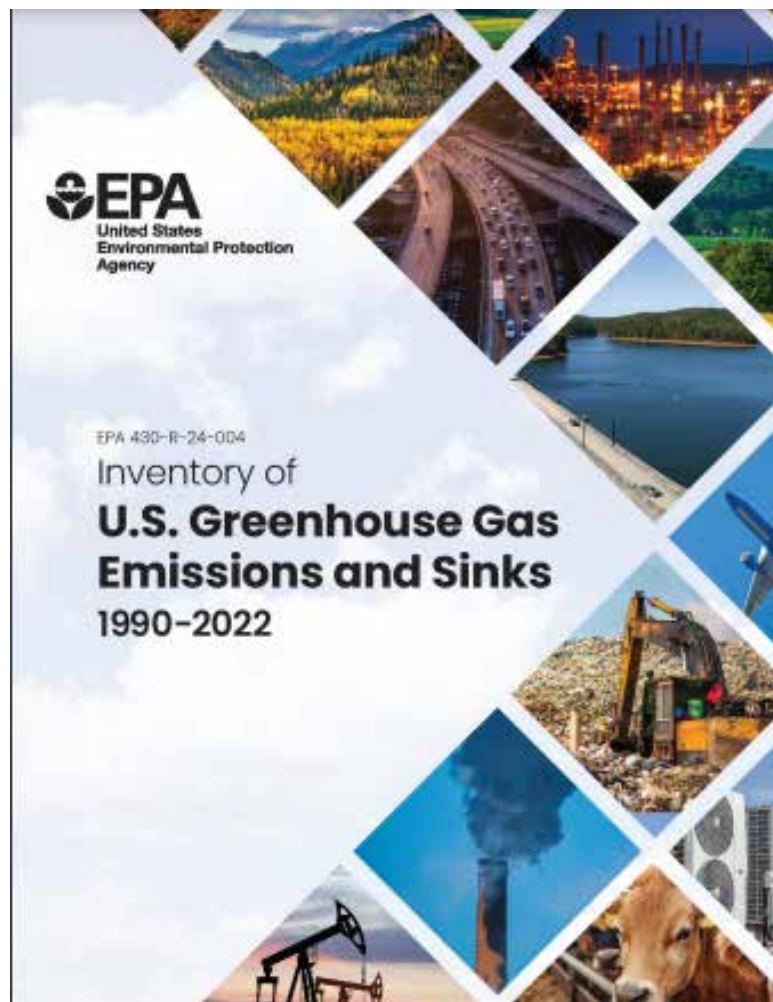


Transition to Riparian Buffer

Conservation Co-Benefits - Soil Health, Atmospheric Carbon, Riparian Health, Sustainability

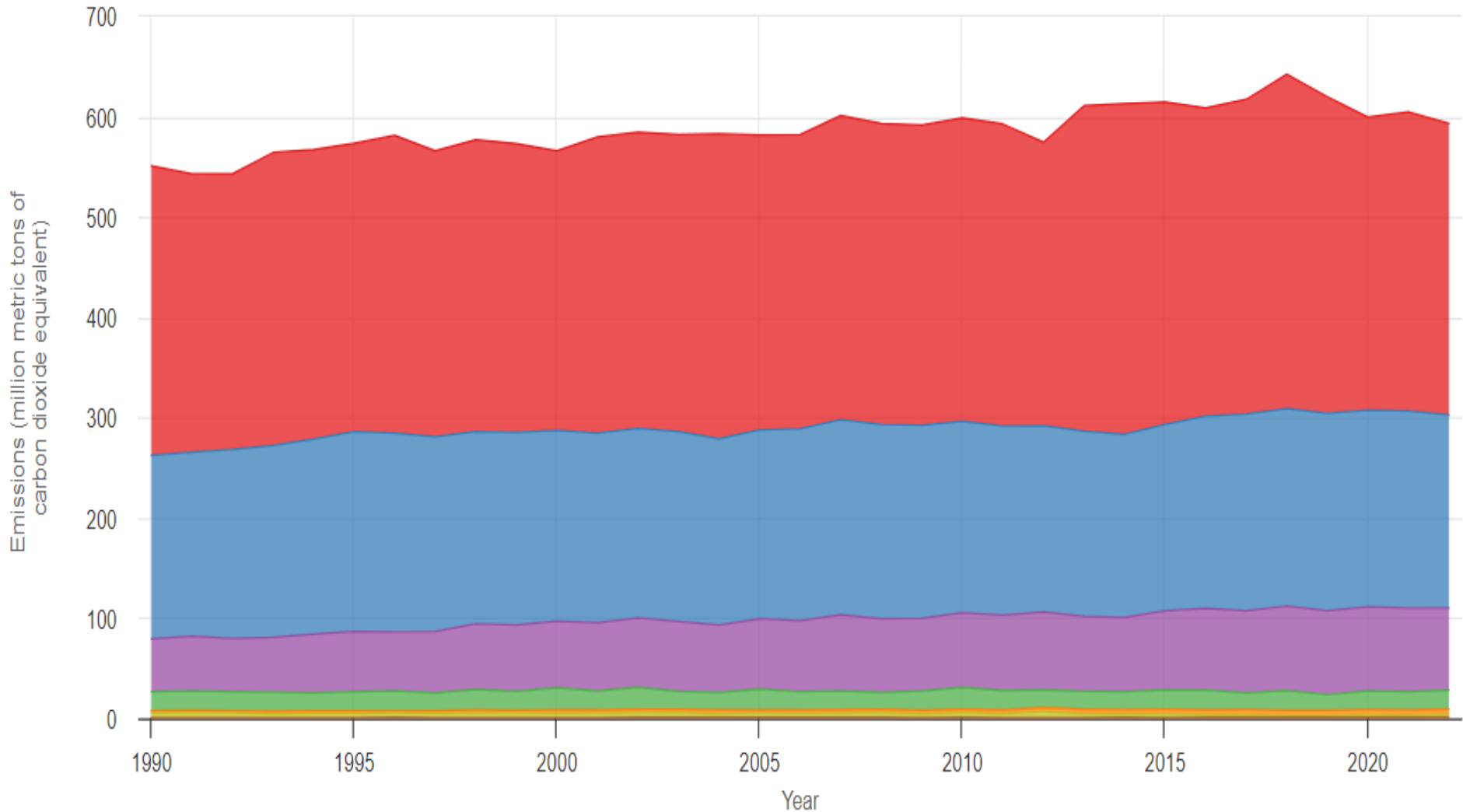


Tracking the Agricultural Sector Emissions



U.S. Greenhouse Gas Emissions from Agricultural Activities, by Category, 1990–2022

≡ Export

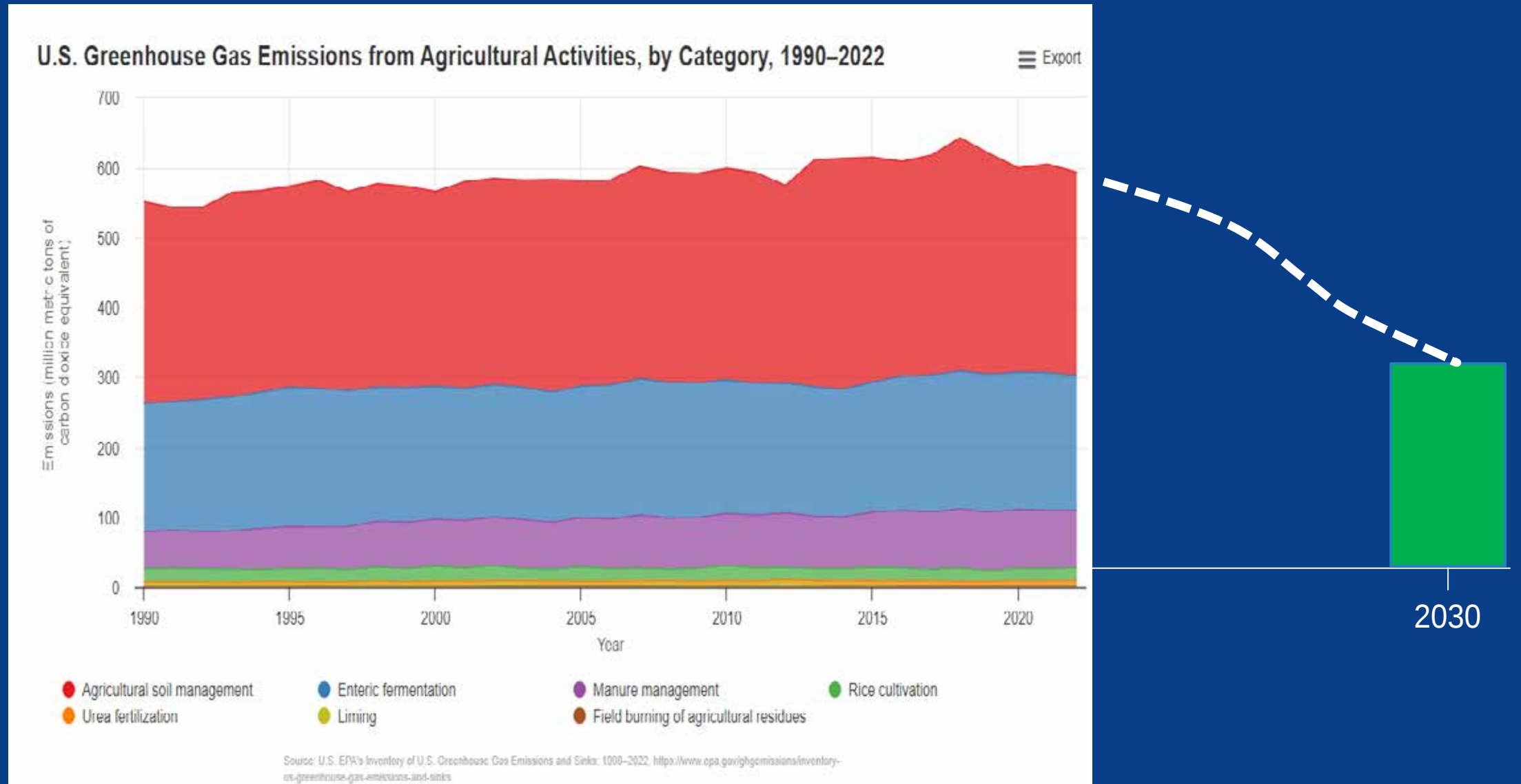


- Agricultural soil management
- Enteric fermentation
- Manure management
- Rice cultivation
- Urea fertilization
- Liming
- Field burning of agricultural residues

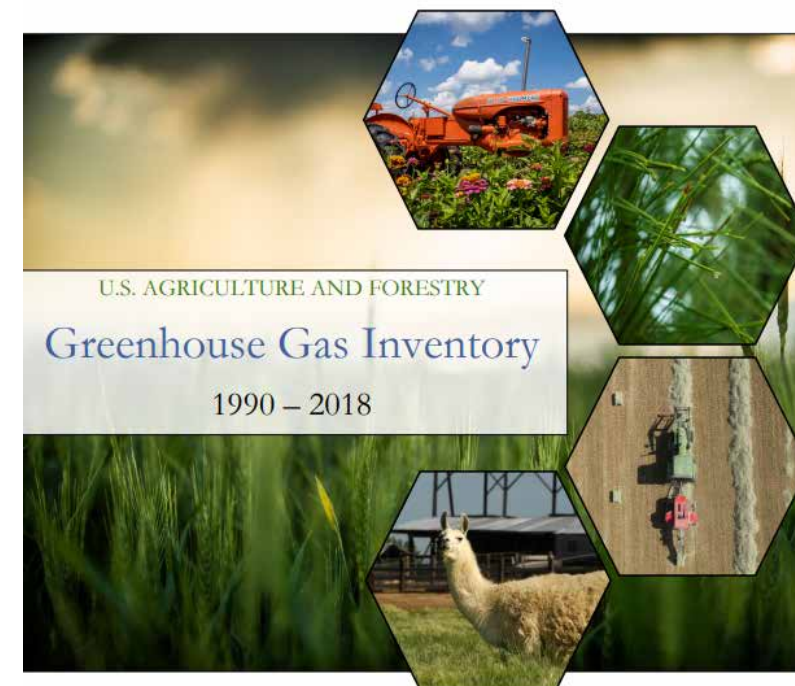
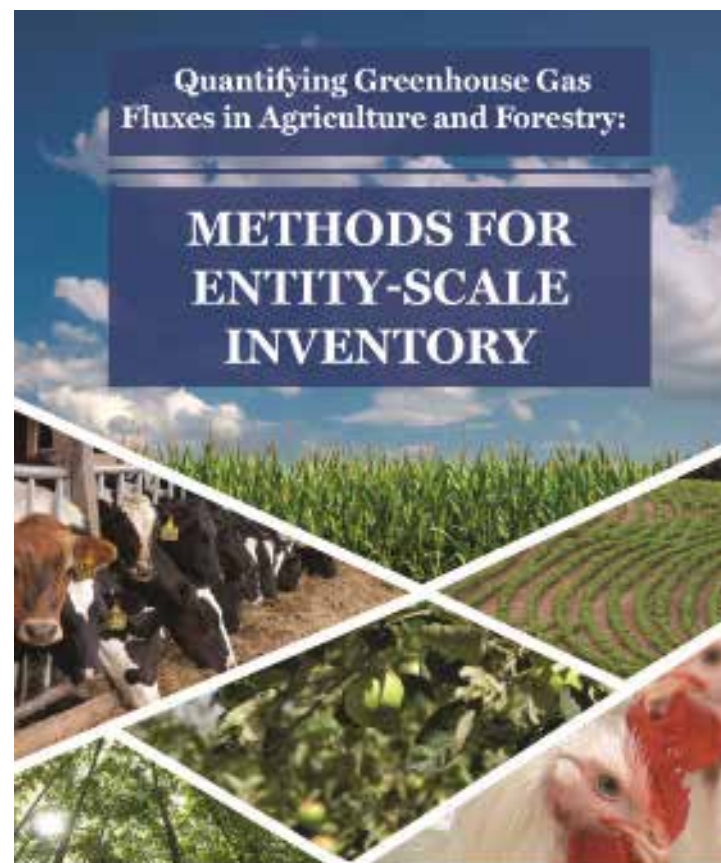
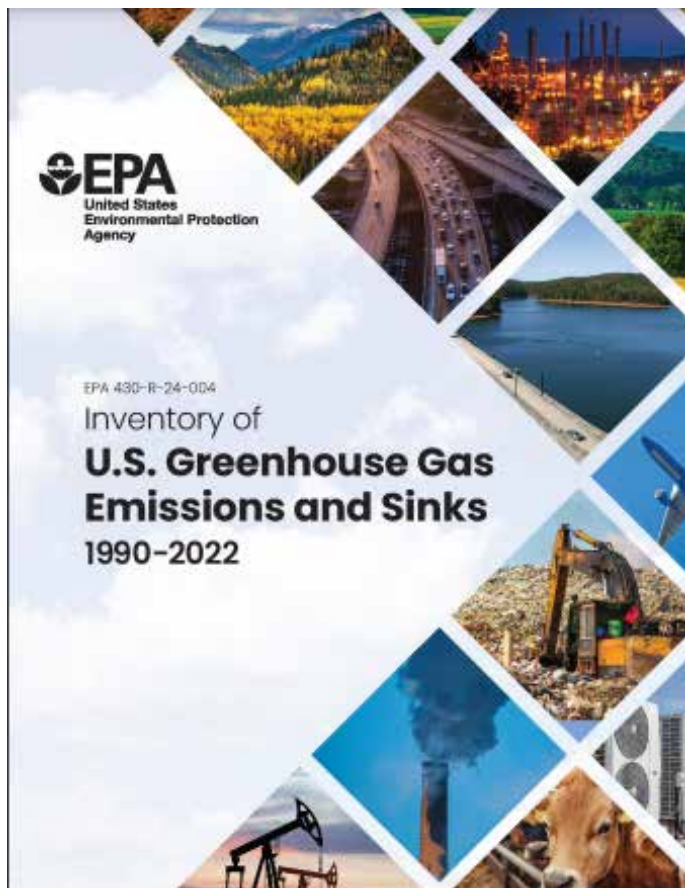
Source: U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

Partnerships for Bending the Curve

50-52 percent reduction by 2030 economy wide – April 22, 2021



Science Underpinning the COMET Tools





COMET-Planner

www.comet-planner.com

Recommended user of COMET-Planner: This evaluation tool is designed to provide generalized estimates of the greenhouse gas impacts of conservation practices and is intended for initial planning purposes. Site-specific conditions (not evaluated in this tool) are required for more detailed assessments of greenhouse gas dynamics on your farm. Please visit COMET-Farm if you would like to conduct a more detailed analysis.

[Home](#) [Download](#) [Help](#) [California Healthy Soils Tool](#)

EVALUATE POTENTIAL CARBON SEQUESTRATION AND GREENHOUSE GAS REDUCTIONS FROM ADOPTING NRCS CONSERVATION PRACTICES

INTRODUCTION
VIDEO



NRCS Conservation Practices included in COMET-Planner are only those that have been identified as having greenhouse gas mitigation and/or carbon sequestration benefits on farms and ranches. This list of conservation practices is based on the qualitative greenhouse benefits ranking of practices prepared by NRCS.

Step 1: Begin by naming your project and selecting your state and county

Project Name:

State:

Washington



County:

Whitman



Step 2: Select the class of conservation practices that best describes the practice you would like to evaluate



Cropland
Management



Grazing Lands



Woody Plantings



Cropland To
Herbaceous Cover



Restoration of
Disturbed Lands

Step 3: Select a NRCS Conservation Practice Standard and a Practice Implementation that best describes your system. You may add multiple practices. If you would like to add a practice under a different class of practices, return to Step 2.

Step 4: Enter the acreage associated with each conservation practice you selected

Approximate Carbon Sequestration and Greenhouse Gas Emission Reductions*
(tonnes CO₂ equivalent per year)^[Info]

NRCS Conservation Practices (Click Practice Name for Documentation)	Enter Acreage	Carbon Dioxide	Nitrous Oxide	Methane	Total CO ₂ -Equivalent
[Info] Cover Crop (CPS 340) - Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to Irrigated Cropland [delete]	100 ac	18	-1	0	17
[Info] Cover Crop (CPS 340) - Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to Non-Irrigated Cropland [delete]	100 ac	9	-2	0	7
Totals:	200.00	27	-3	0	24

*Negative values indicate a loss of carbon or increased emissions of greenhouse gases

**Values were not estimated due to limited data on reductions of greenhouse gas emissions from this practice

[Download COMET-Planner Results](#)



COMET-Farm
www.comet-farm.com



United States Department of Agriculture

COMET Farm



United States Department of Agriculture
Natural Resources Conservation Service



Whole Farm and Ranch
Carbon and Greenhouse Gas
Accounting System.

Welcome Adam Chambers
Current Project: Washington Whitman County
[sign out](#) | [change password](#)



[HOME](#) [TOOL](#) [INFO](#) [HELP](#)

Step 1
Activities

Step 2
Field Management

Step 3
Report

Parcel Locations

Historic Management
Pre-2000

Baseline Management
2000-2021

Scenario Management
Scenarios for 10 year period

I am done
defining parcels

Find Location

Add Parcel
by Point

Add Parcel
by Polygon

Add Parcel
by Circle

Modify Parcel

Drag Parcel

Delete Parcel

Delete All
Parcels

ESRI Shape
File Upload

View Soil
by Click

Export Soil
Information

How do I?





United States Department of Agriculture

COMET Farm



United States Department of Agriculture
Natural Resources Conservation Service



Whole Farm and Ranch
Carbon and Greenhouse Gas
Accounting System.

Step 1

Activities

Step 2

Field Management ▼

Step 3

Report

Parcel Locations →

Historic Management →

Pre-2000

Baseline Management →

2000-2021

Scenario Management

Scenarios for 10 year period

Select a parcel: F1 ▼



F1 (146 acres)



Data complete



Data incomplete



Selected

For parcel F1 (selected at left) what was its historic management?

Pre-1980 Management

Upland Non-Irrigated (Pre 1980s) ▼

Was this parcel enrolled in
Conservation Reserve
Program(CRP) at anytime
before 2000?

☒ No ☐ Yes

1980-2000 Management

Non-Irrigated: Fallow-Grain ▼ ?

1980-2000 Tillage

Intensive Tillage ▼ ?

<< Back

Copy

Next >>

Set Baseline Period



United States Department of Agriculture

COMET Farm



United States Department of Agriculture
Natural Resources Conservation Service



Whole Farm and Ranch
Carbon and Greenhouse Gas
Accounting System.

Step 1
Activities

Step 2
Field Management

Step 3
Report ▼

Cropland, Pasture, Range, Orchards/Vineyards

Cropland Graphical Report

Available Water Holding Capacity

Report finished: 00:02:19 100% Complete

NAME: Adam Chambers
PROJECT: Washington Whitman County
REPORTING YEARS: 2022 - 2031

JOBID: 3054_46330_NONE
Time: Thu Feb 10 2022 11:48:51 GMT-0700 (Mountain Standard Time)
Version: Cloud deployment version 2.5.0, build 3.2.8007.18860 (03-Dec-2021)



United States Department of Agriculture
Natural Resources Conservation Service

Source	Baseline Emissions		No Till and Cover			
	Emissions	+/-	Emissions	+/-	Change	+/-
F1 (147 acres - Annual Rye, Spring Wheat, Fallow)						
[-] C (tonnes CO ₂ equiv./yr.)	-20.6	NR [†]	-91.0	NR [†]	-70.4	NR [†]
Soil	-20.6	NR [†]	-91.0	NR [†]	-70.4	NR [†]
Woody Biomass	0.0	NR [†]	0.0	NR [†]	0.0	NR [†]
[+] CO ₂ (tonnes/yr.)	1.2	+0/-0	1.2	+0/-0	0.0	+0/-0
[+] CO (tonnes CO ₂ equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
[+] N ₂ O (tonnes CO ₂ equiv./yr.)	46.7	NR [†]	46.7	NR [†]	0.0	NR [†]
[+] CH ₄ (tonnes CO ₂ equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	27.3	NR[†]	-43.1	NR[†]	-70.4	NR[†]
Total (all parcels)						
	27.3	NR [†]	-43.1	NR [†]	-70.4	NR [†]



2025 Mitigation Practice List

2025 CSAF Mitigation Activities (12 pages)



Highlighted activities have been added or updated in FY2025.

Code	Conservation Practice Standard Name ⁽¹⁾ (practice unit)	Code	Conservation Stewardship Program (CSP) Enhancement Activities ⁽²⁾
311	Alley Cropping (acres)		None Available
313	Waste Storage Facility (number) Used to implement compost bedded-pack⁽³⁾		None Available
314	Brush Management (acres) Used to remove woody invasive vegetation in arid regions and the removed material will be left onsite⁽⁴⁾	E314A	Brush management to improve wildlife habitat
315	Herbaceous Weed Treatment (acres) Used to release desired deep rooted perennial species⁽⁵⁾	E315A	Herbaceous weed treatment to create desired plant communities consistent with the ecological site
317	Composting Facility (number)		None Available
327	Conservation Cover (acres)	E327A	Conservation cover for pollinators and beneficial insects
		E327B	Establish Monarch butterfly habitat
		E327C	Wildlife habitat for nesting and brooding in non-cropped areas
328	Conservation Crop Rotation (acres)	E328A	Resource conserving crop rotation
		E328B	Improved resource conserving crop rotation
		E328E	Soil health crop rotation
		E328F	Modifications to improve soil health and increase soil organic matter
		E328H	Conservation crop rotation to reduce the concentration of salts
		E328N	Intercropping to improve soil health
		E328O	Perennial grain crop conservation rotation
329	Residue and Tillage Management, No Till (acres)	E329A	No till to reduce soil erosion
		E329B	No till to reduce tillage induced particulate matter
		E329C	No till to increase plant-available moisture
		E329D	No till system to increase soil health and soil organic matter content
		E329E	No till to reduce energy
332	Contour Buffer Strips (acres)		None Available
336	Soil Carbon Amendment (acres)		None Available
338	Prescribed Burning (acres) To reduce wildfire hazards in forest systems at risk of wildfire⁽⁶⁾		None Available

Highlighted activities have been added or updated in FY2025

2025	2	de	Conservation Stewardship Program (CSP) Enhancement Activities ⁽¹⁾
ated in FY2025		6A	Enhanced field borders to reduce soil erosion along the edge(s) of a field
		6B	Enhanced field borders to increase carbon storage along the edge(s) of the field
		6C	Enhanced field borders to decrease particulate emissions along the edge(s) of the field
		6D	Enhanced field borders to increase food for pollinators along the edge(s) of a field
		6E	Enhanced field borders to increase wildlife food and habitat along the edge(s) of a field
		6A	Increase riparian herbaceous cover width for sediment and nutrient reduction
		6B	Increase riparian herbaceous cover width to enhance wildlife habitat
		1A	Increase riparian forest buffer width for sediment and nutrient reduction
		1B	Increase stream shading for stream temperature reduction
		1C	Increase riparian forest buffer width to enhance wildlife habitat
		2A	Extend existing filter strip to reduce water quality impacts
		2A	Enhance a grassed waterway
		2A	Establish pollinator habitat
		6B	Establish monarch butterfly habitat
			None Available
			None Available
			None Available
			None Available
		9B	Alternated Wetting and Drying (AWD) of rice fields
			None Available
		4A	Mulching to improve soil health
		4B	Reduce particulate matter emissions by using orchard or vineyard generated woody materials as mulch
		4C	Mulching with natural materials in specialty crops for weed control
		4D	Lowbush Blueberry Mulching for Moisture Management

	Used to reduce fossil fuel energy use^[2]
543	Land Reclamation, Abandoned Mined Land (acres) ^[2]

ighted activities have been added or updated in FY2025.

rd	Code	Conservation Stewardship Program (CSP) Enhancement Activities ¹⁾
	E512A	Cropland conversion to grass-based agriculture to reduce soil erosion
	E512B	Forage and biomass planting to reduce soil erosion or increase organic matter to build soil health
	E512C	Cropland conversion to grass for soil organic matter improvement
	E512D	Forage plantings that help increase organic matter in depleted soils
	E512I	Establish pollinator and/or beneficial insect and/or monarch habitat
	E512J	Establish wildlife corridors to provide habitat continuity or access to water
	E512L	Diversifying forage base with interseeding forbs and legumes to increase pasture quality
	E512M	Forage plantings that improve wildlife habitat cover and shelter or structure and composition
	E528A	Maintaining quantity and quality of forage for animal health and productivity
	E528D	Grazing management for improving quantity and quality of food or cover and shelter for wildlife
	E528E	Improved grazing management for enhanced plant structure and composition for wildlife
	E528F	Stockpiling cool season forage to improve structure and composition or plant productivity and health
	E528G	Improved grazing management on pasture for plant productivity and health with monitoring activities
	E528H	Prescribed grazing to improve/maintain riparian and watershed function-elevated water temperature
	E528I	Grazing management that protects sensitive areas-surface or ground water from nutrients
	E528J	Prescribed grazing on pastureland that improves riparian and watershed function
	E528L	Prescribed grazing that improves or maintains riparian and watershed function-erosion
	E528M	Grazing management that protects sensitive areas from gully erosion
	E528N	Improved grazing management through monitoring activities
	E528Q	Clipping mature forages to set back vegetative growth for improved forage quality
	E528P	Implementing Bale or Swath Grazing to increase organic matter and reduce nutrients in surface water
	E528R	Management intensive rotational grazing
	E528S	Soil Health Improvements on Pasture
	E528T	Grazing to Reduce Wildfire Risks on Forests
	E528U	Contingency Planning for Resiliency
	E533C	Install VFDs on pumps
	E533D	Switch fuel source for pumps
		None Available



Brief Review of Carbon Markets



Climate Smart and Carbon Markets

Environmental Markets and Carbon

- Specifically mentioned in 2018 Farm Bill
- Compliments NRCS mission and toolbox
“get more conservation on the ground”
- USDA develops quantification tools
- Enables Farmers, Ranchers and Private Forestland Owners to VOLUNTARILY participate in markets

What is a Carbon Offset?

- A carbon offset is the reduction of greenhouse gas (GHG) emissions in one place to balance out GHG emissions made elsewhere.
- Polluters of hard to control emissions pay other parties to implement practices that reduce GHG emissions.
- For example, Chevrolet purchased carbon offsets generated through avoided grassland conversion to offset corporate emissions.



Market Potential for the Agriculture Sector

Croplands:

- Conservation tillage and reduced field pass intensity
- Crop diversity through rotations, cover cropping, continuous cropping, and reducing dry land fallow
- Efficient nutrient management: timing, type, method, rate, and nitrogen inhibitors
- Improving nitrogen fertilizer use efficiency
- Reducing the frequency and duration of flooding of rice paddies
- Reducing carbon emissions from organic soils



Market Potential for the Agriculture Sector

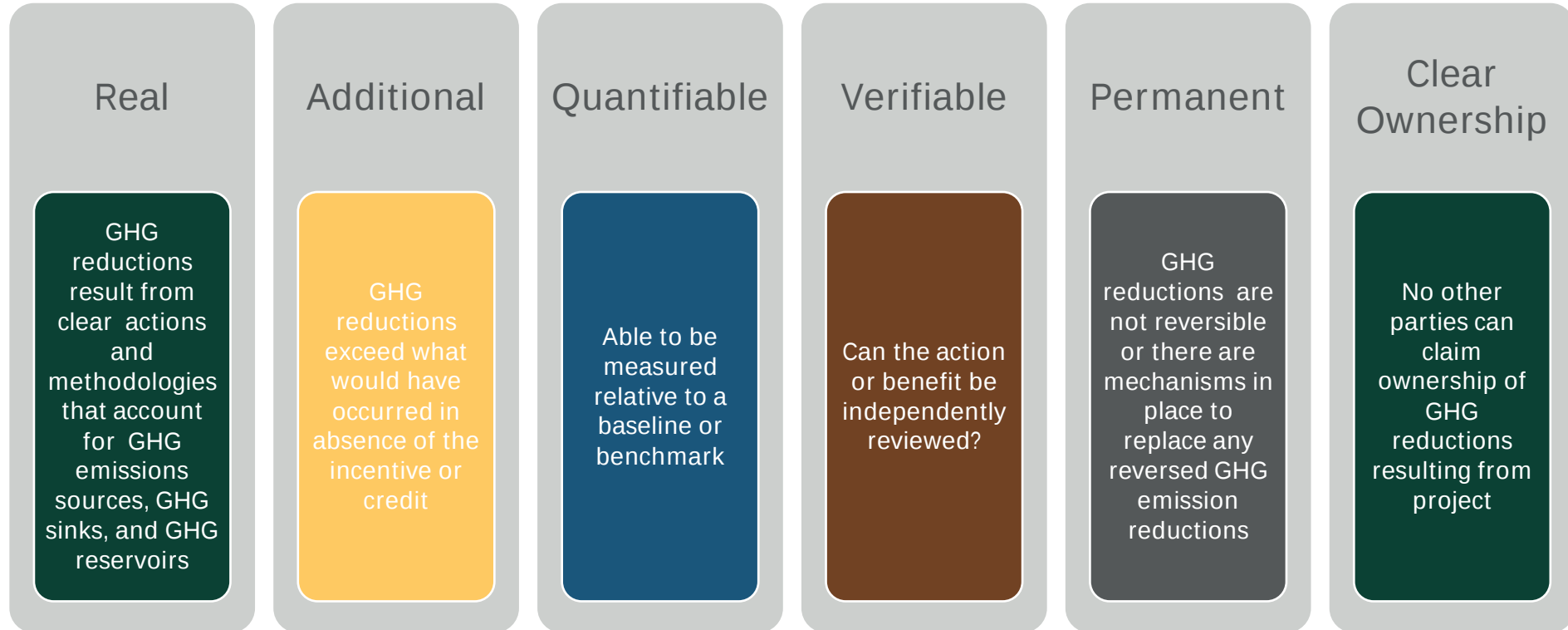
Animal Agriculture

- Reducing greenhouse gas emissions from manure and effluent
- Anaerobic digesters
- Improving animal management practices, including dietary modifications
- Grassland conservation and rotational grazing



Rules developed by registries for offsets...

...are aimed at addressing concerns



Carbon Registries

Carbon registries provide the critical infrastructure necessary for a well-functioning carbon market. Roles include:

- Develop rigorous, science-based standards and methodologies to calculate the GHG reductions from voluntary practices.
- Approve and oversee independent third-party verification bodies who audit carbon offset projects.
- Issue carbon credits generated from projects and track the transaction of credits between parties.



CLIMATE
ACTION
RESERVE



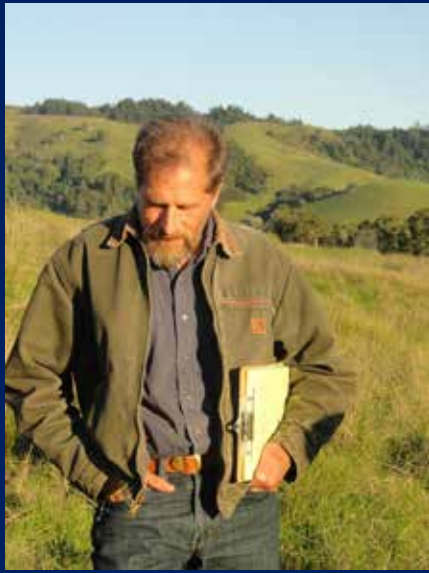
Gold Standard®

Climate Security & Sustainable Development



Verified Carbon
Standard

A VERRA STANDARD





Examples of Carbon Market Transactions

Carbon Market Transactions – USDA Leadership



General Motors Global Public Policy Executive Director Greg Martin speaks at a press conference announcing the completion of the first-of-its kind purchase of verified carbon credits generated on working ranch lands by Chevrolet, at the U.S. Department of Agriculture (USDA), in Washington, D.C. on Monday, Nov. 17, 2014. (L to R Senator Debbie Stabenow (MI), General Motors Global Public Policy Executive Director Greg Martin, Ducks Unlimited Paul Schmidt, The Climate Trust Executive Director Sean Penrith, and USDA Natural Resources and Environment (NRE) Under Secretary Robert Bonnie). USDA photo by Tom Witham.

MONEYBOX

Emission Statement

A carbon tax won't happen anytime soon. Chevrolet just proved it should.

BY PETER MOSKOWITZ

NOV 19, 2014 • 4:22 PM

USDA, Chevrolet and Ducks Unlimited help ranchers sell carbon credits

11/18/14 9:18 PM By Agri-Pulse staff

USDA and Partners Complete First-of-Its-Kind Sale of Carbon Credits from Working Ranch Grasslands



United States Department of Agriculture

Storing Carbon and Preserving Working Ranch Lands



Easements

Ranchers, working with Ducks Unlimited, voluntarily place grasslands under permanent conservation easements to prevent tilling.



Keeping Working Lands Working

Land grazed and hayed – soil is undisturbed, storing carbon.



Measuring Carbon Stored in Soil

Conservation Innovation Grant from NRCS is used by Ducks Unlimited, The Climate Trust, and American Carbon Registry to develop protocol for calculating carbon stored in the soil.



Selling Carbon Credits

Carbon stored in soil is quantified, third-party verified, and turned into tradable carbon credits by Ducks Unlimited and partners.



DUCKS
UNLIMITED



CO₂
Credits

The
Climate
Trust



Chevrolet Purchases Carbon Credits

Chevrolet purchases and retires nearly 40,000 tons of carbon credits. Part of Chevy's commitment to reduce eight million metric tons of carbon dioxide emissions to the atmosphere.



Final Result

Working lands remain working and permanently retain carbon in healthy soil.



U.S. Rice Farmers Turn Sustainability into Carbon Credits, with Microsoft as First Buyer

By changing how they use water, rice growers in Arkansas, Mississippi and California cut their methane emissions and opened a door for agriculture in carbon markets.



BY GEORGINA GUSTIN

[Follow @georgina_gustin](#)

JUN 26, 2017



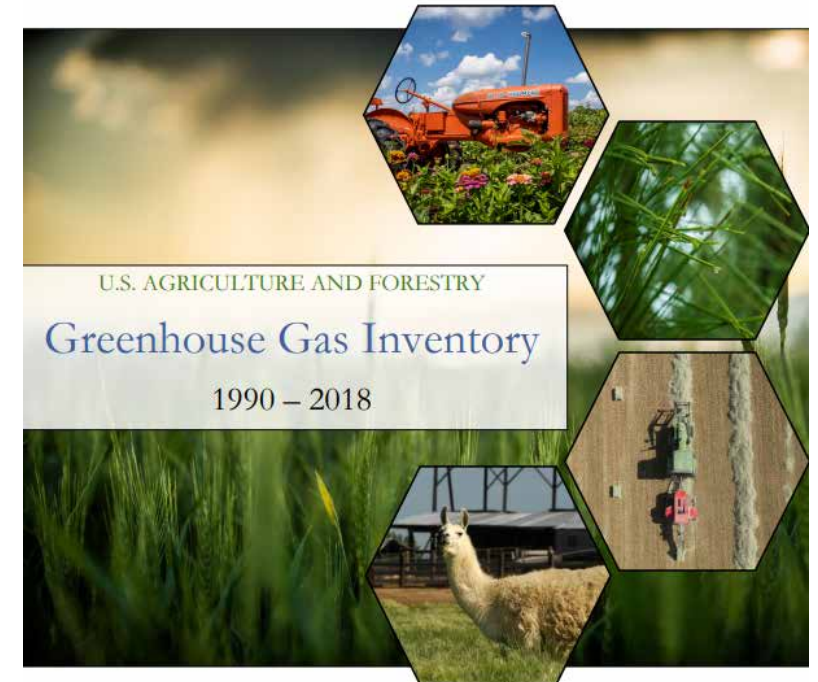
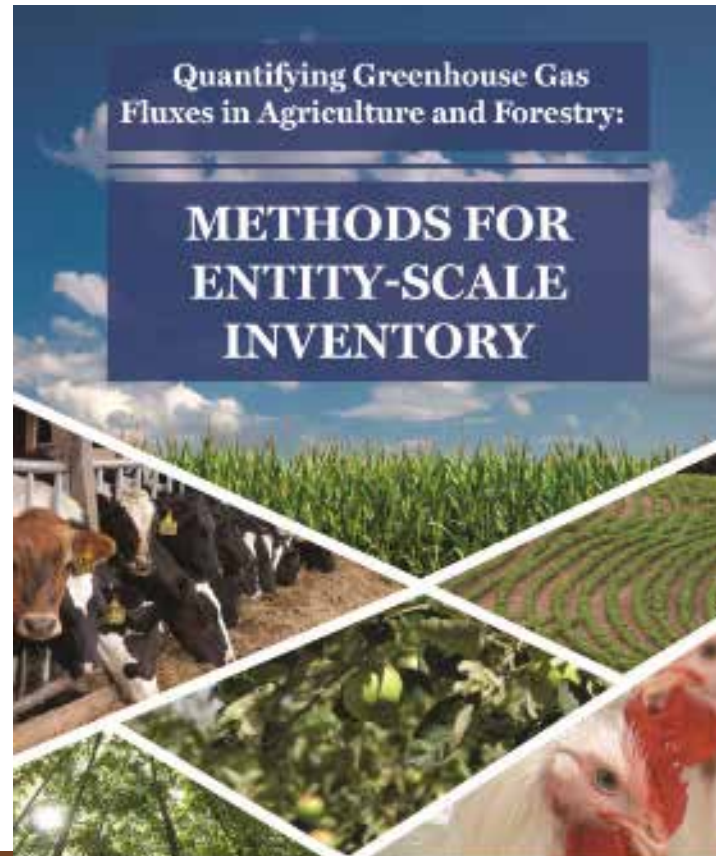
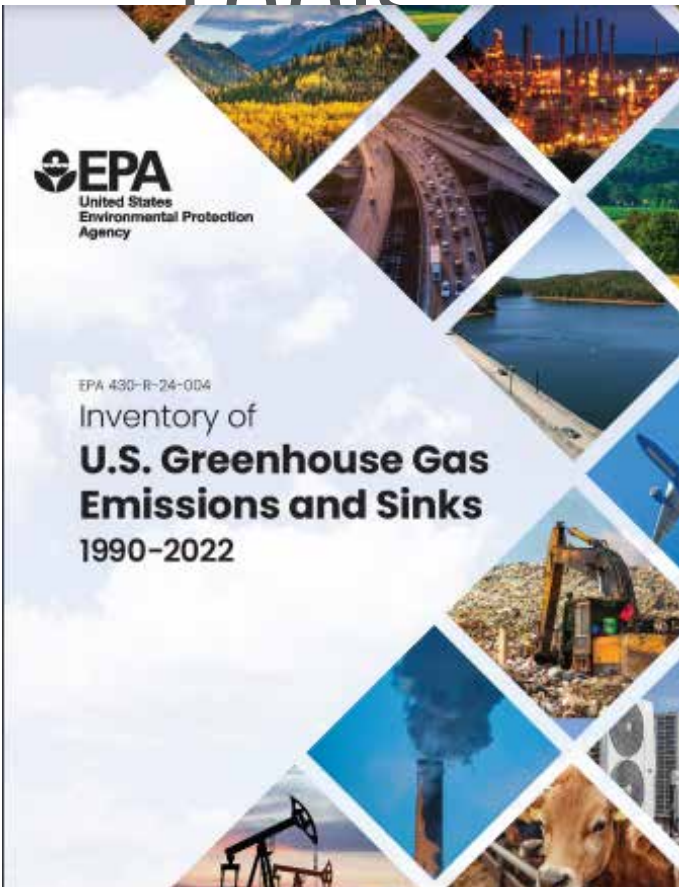
A novel program for sustainably grown rice is opening the door for U.S. agriculture to participate in carbon trading markets. These rice fields are near Sacramento, California. Credit: Mark Miller/CC-BY-3.0



Science Underpinning the COMET Tools



USDA Office of the Chief Economist
U.S. DEPARTMENT OF AGRICULTURE



We are the first....generations to fully understand the problem

... and the **last** **FIRST** with the **ability** **TOOLS** to solve it...





United States Department of Agriculture



Dr. Adam Chambers
Ecological Sciences Division, Science and Technology
National Environmental Markets Leaders
Washington, D.C.
Adam.chambers@usda.gov

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.