

Striving Towards a More Sustainable Agriculture

Colloque Fouragères - Drummondville QC | 5 February 2026

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IOWA STATE UNIVERSITY
Bioeconomy Institute



1976/September



Family Picnic at Grandma [Julia] Scheuermann's
September, 1976
L to R: Jill Scheuermann [cut off], Julia, Tammy Scheuermann,
Becky Johnson, Amy Meier, Jerilyn Scheuermann, Lisa Schulte



ALVIAN WARDHANA
Indonesia

 **WORLD FOOD PRIZE FOUNDATION**
TOP AGRI-FOOD PIONEERS

JASON WARGENT
United Kingdom



Image: Polk Co., Iowa; World Food Prize Foundation

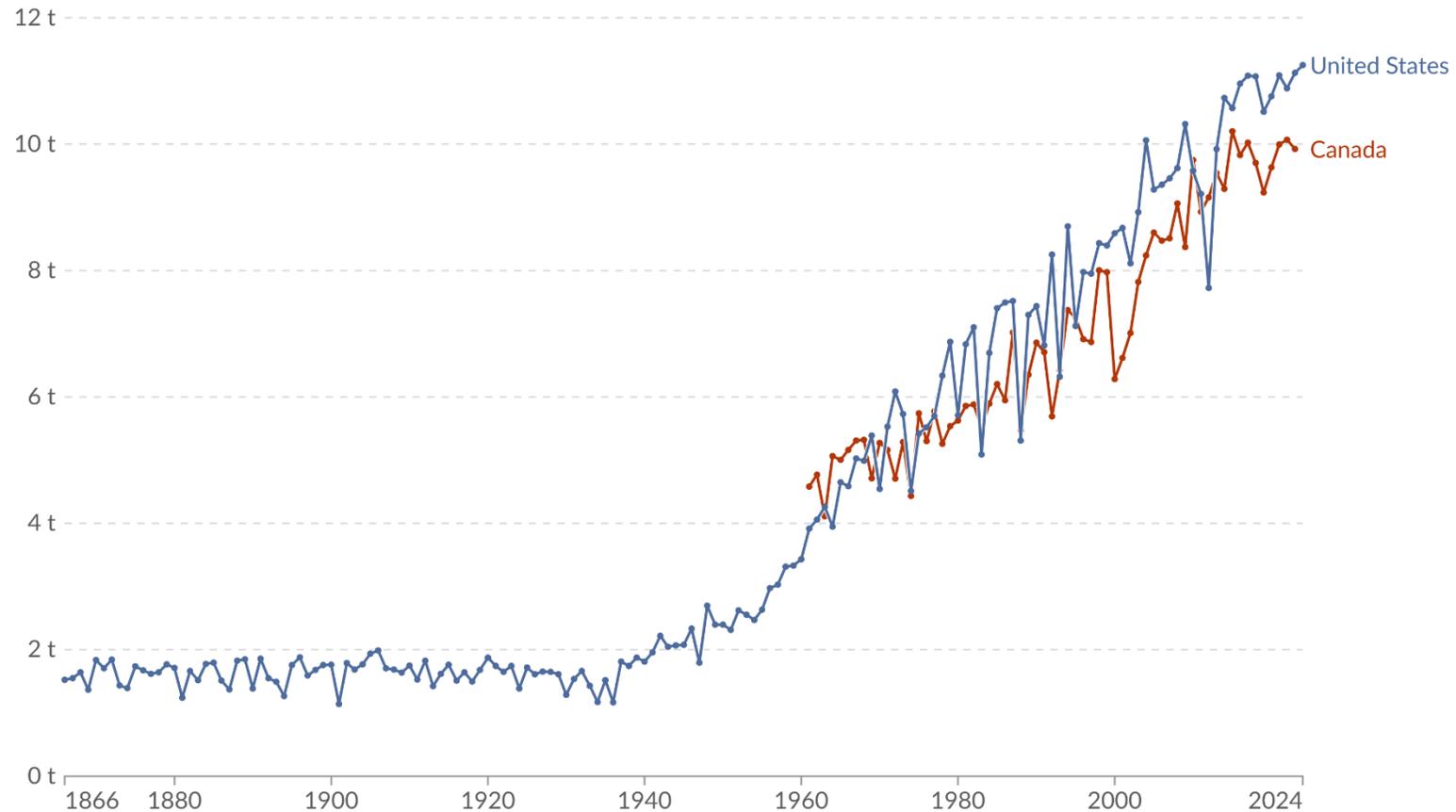
**HOW DO WE PROVIDE FOR
A GROWING HUMAN
WORLD...**



TRULY ASTOUNDING GAINS IN PRODUCTIVITY...

Corn yields, 1866 to 2024

Yields are measured in tonnes per hectare.



Data source: USDA National Agricultural Statistics Service (NASS) (2024); Food and Agriculture Organization of the United Nations (2025)
OurWorldinData.org/crop-yields | CC BY

...WITH TREMENDOUS ENVIRONMENTAL BENEFIT

Global land spared as a result of cereal yield improvements

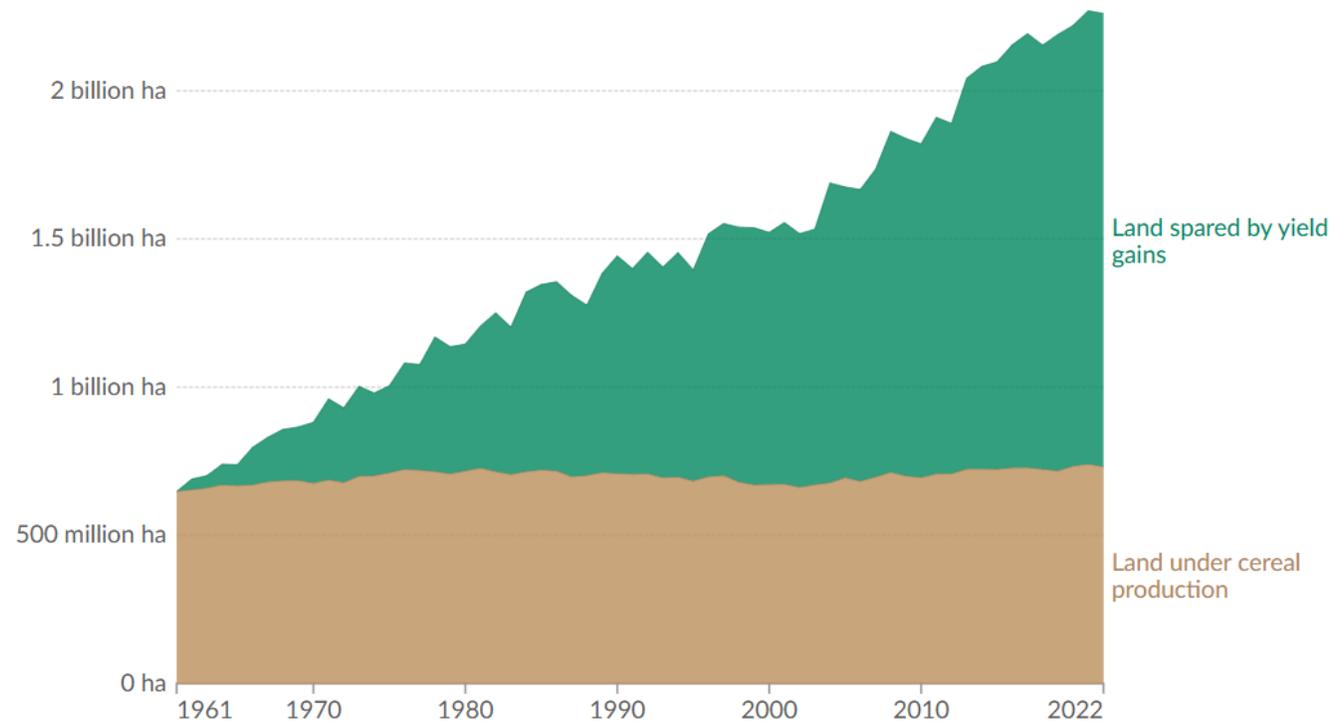
Our World
in Data

Land sparing is calculated as the amount of additional land that would have been needed to meet global cereal production if average crop yields had not increased since 1961.

Table

Chart

Settings



1961



2022

Data source: Food and Agriculture Organization of the United Nations (2023) - [Learn more about this data](#)
OurWorldinData.org/land-use | CC BY

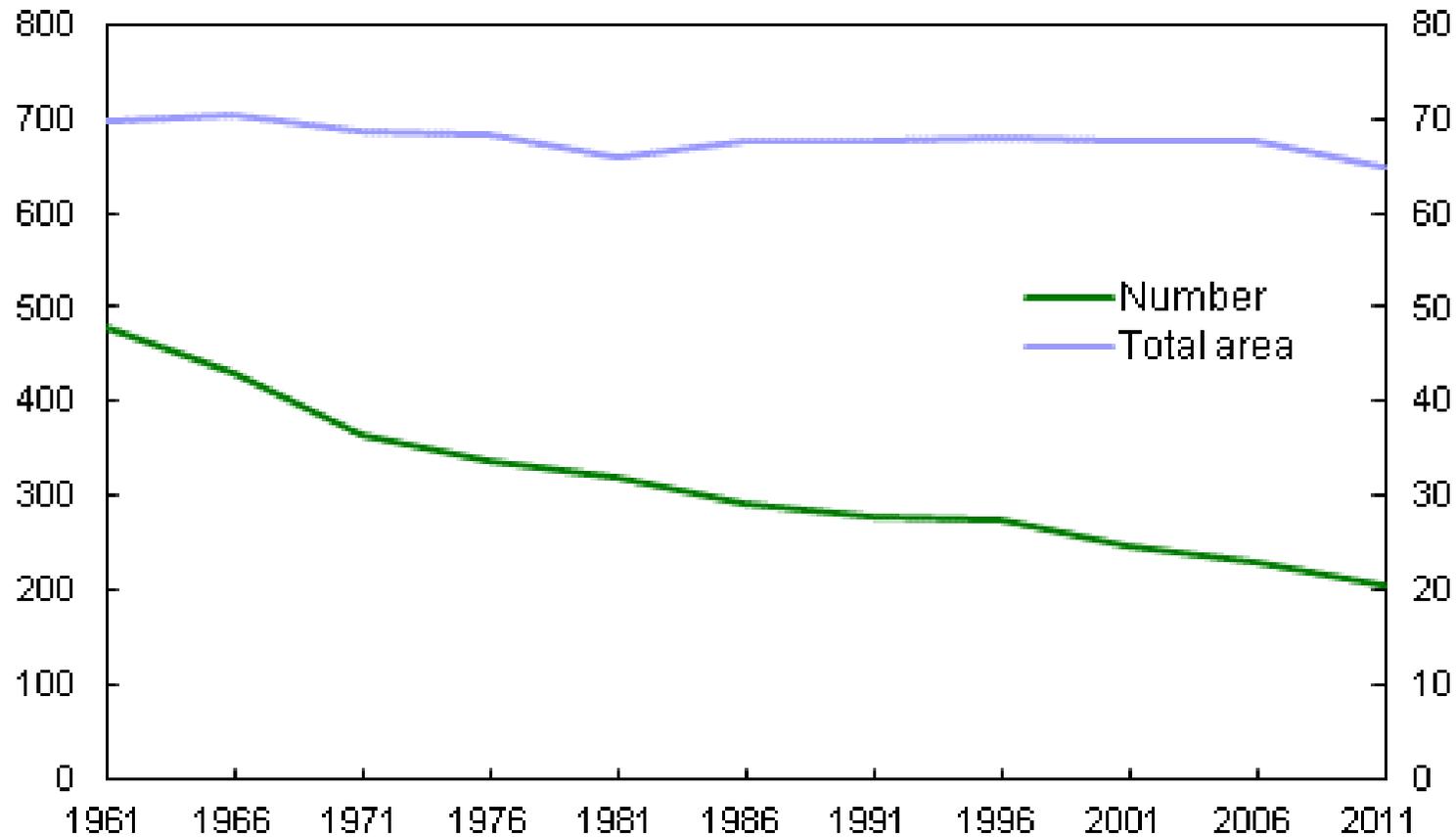


WITH SOME COSTS

Number and area of farms

thousands of
farms

millions of
hectares



Source: Statistics Canada, censuses of agriculture.

WITH SOME COSTS



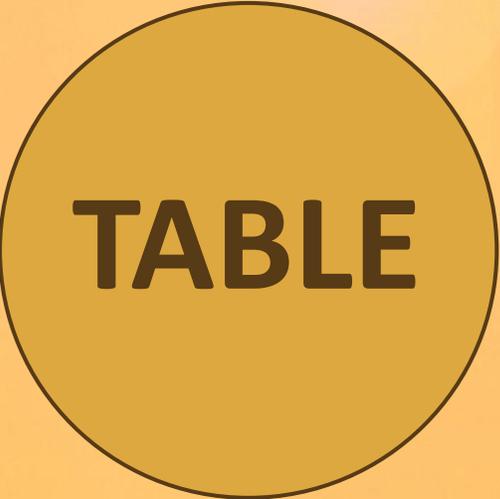
WITH SOME COSTS



**HOW DO WE PROVIDE FOR
A GROWING HUMAN
WORLD...**

**WHILE SUSTAINING
RURAL LIVELIHOODS
AND
A LIVABLE PLANET?**



**WE NEED
EVERYONE
AT THE TABLE**



ISU



Canvas



Schulte Moore Lab



BEI



C-CHANGE



PEWI



STRIPS



Horizon II



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Tous les événements / Colloque sur les plantes fourragères 2026

Informations Programme Exposants Autres



Informations

Le Colloque sur les plantes fourragères met en avant les dernières innovations et solutions concrètes pour une agriculture durable. Les participants découvriront les avancées du secteur lors de conférences animées par des expert(e)s reconnu(e)s.

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05 février 2026
08 h 00 → 16 h 00

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Drummondville

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Canada

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OUTLINE FOR TALK

INTRODUCTION

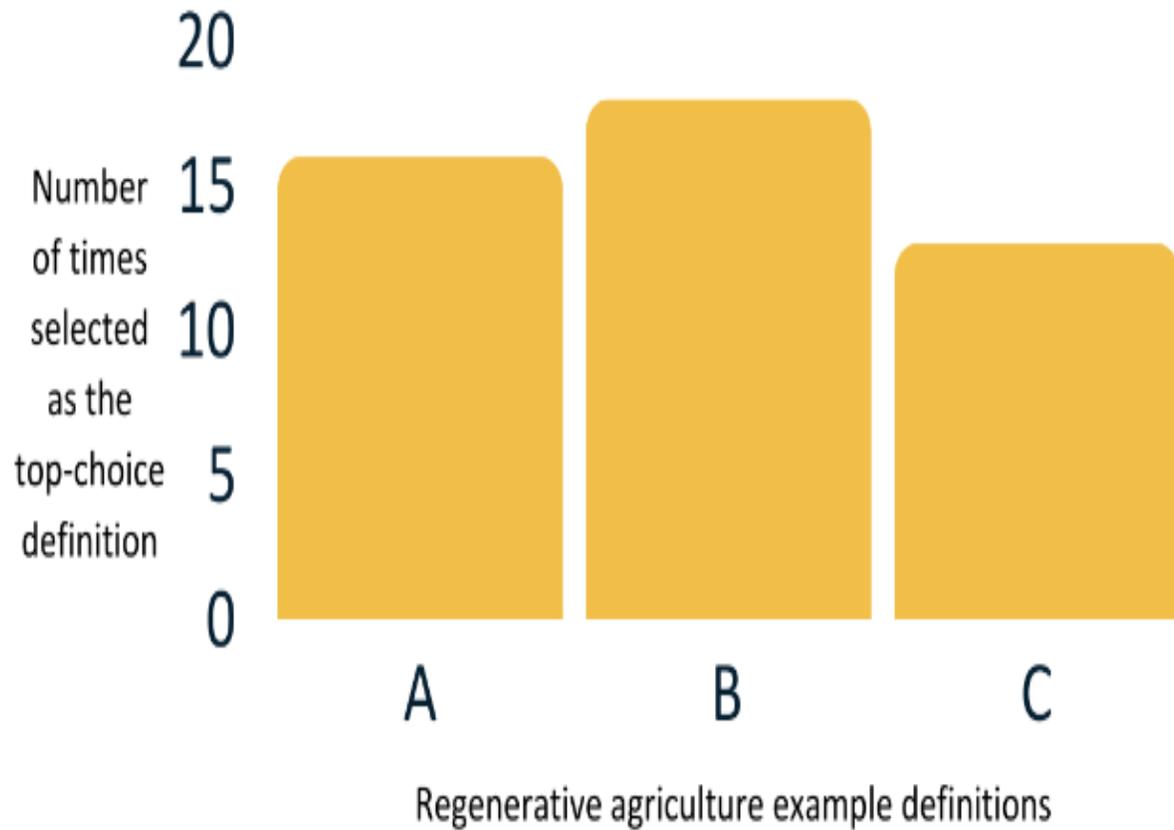
4 REASONS TO BE HOPEFUL

WHAT YOU CAN DO

1. CROSS-SECTOR CONVERSATIONS

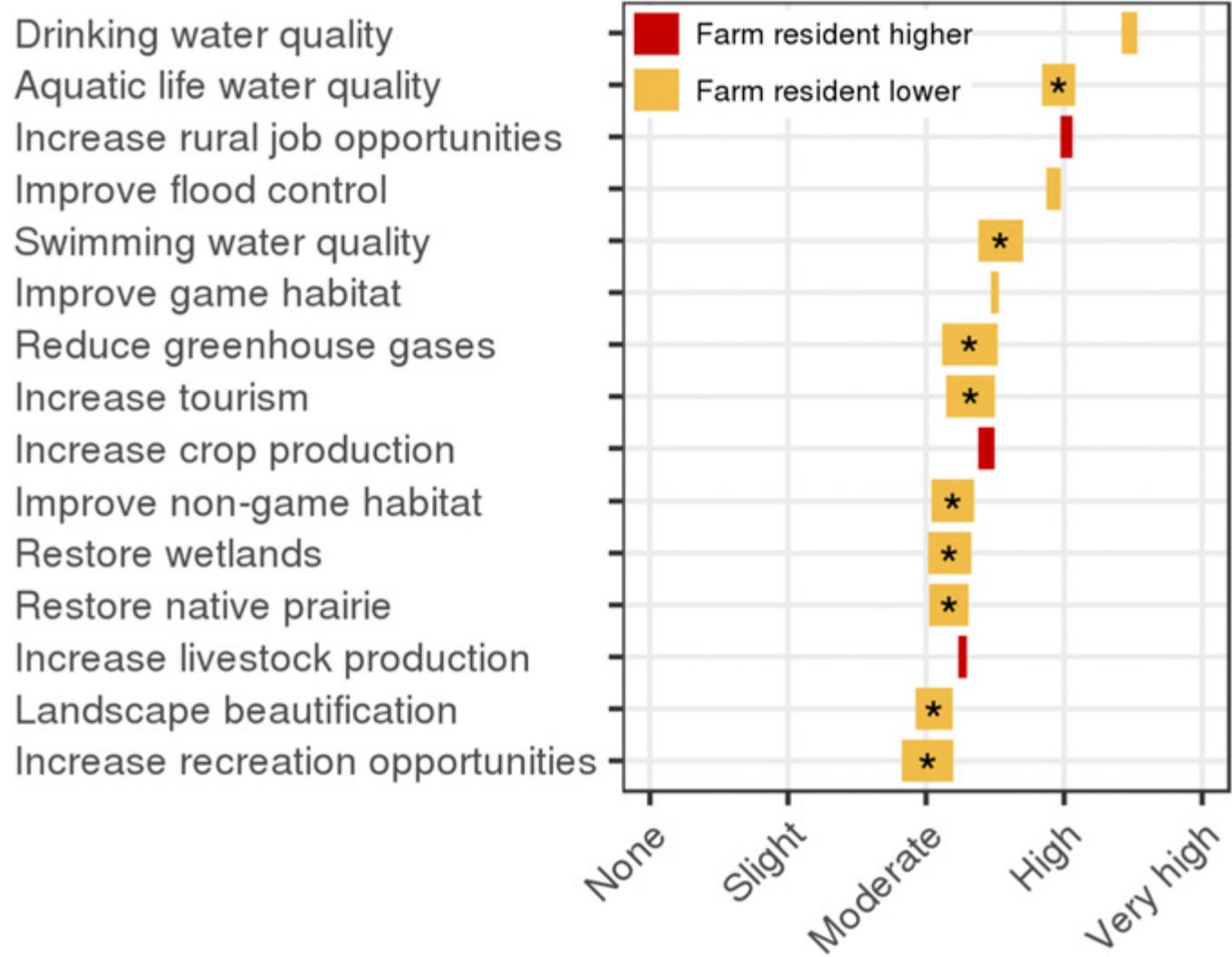


POINTS OF DIVERGENCE: STAKEHOLDERS ON REGENERATIVE AG DEFINITIONS



- A. Emphasis on soil and productivity
- B. Emphasis on reducing negative externalities within supply chains
- C. Emphasis on people and nature

POINTS OF CONSENSUS: PRIORITIES FOR AG POLICIES AND PROGRAMS



Source: Schulte et al. 2017. Prairie strips improve biodiversity and the delivery of multiple ecosystem services from corn-soybean croplands. PNAS 114 (42): 201620229.

POINTS OF CONSENSUS: GENERAL AGREEMENT ON VISION, STRATEGY, & TACTICS

VISION:

Agricultural Products *and* Environmental Benefits

STRATEGY:

Cross-Sector Partnerships *and* Landscape Planning

TACTICS:

Improved In-field Management *and* Targeted Landscape Change

2. CROSS-SECTOR PARTNERSHIPS





MENU ▾

[Canada.ca](#) > [Agriculture et Agroalimentaire Canada](#) > [Environnement](#) > [Changements climatiques](#) > [Solutions agricoles pour le climat](#)

Solutions agricoles pour le climat – Laboratoires vivants



Lancé en 2021, le programme Solutions agricole pour le climat — Laboratoires vivants (SAC-LV) de 185 millions de dollars permettra à Agriculture et Agroalimentaire Canada (AAC) de bâtir et de renforcer un réseau pancanadien de laboratoires vivants sur une période de 10 ans.

Chaque laboratoire vivant réunit des producteurs agricoles, des scientifiques et d'autres intervenants du secteur qui élaboreront conjointement et qui mettront à l'essai des technologies et des pratiques agricoles innovantes visant à réduire les émissions de gaz à effet de serre (GES) et à séquestrer le carbone dans des conditions réelles. Le programme s'inspire de la même [approche des laboratoires vivants](#) que la précédente [Initiative des laboratoires vivants \(2018 à 2023\)](#). Les producteurs étant au cœur de chaque

Les producteurs étant au cœur de chaque



SCIENCE-BASED TRAILS OF ROWCROPS INTEGRATED WITH PRAIRIE STRIPS

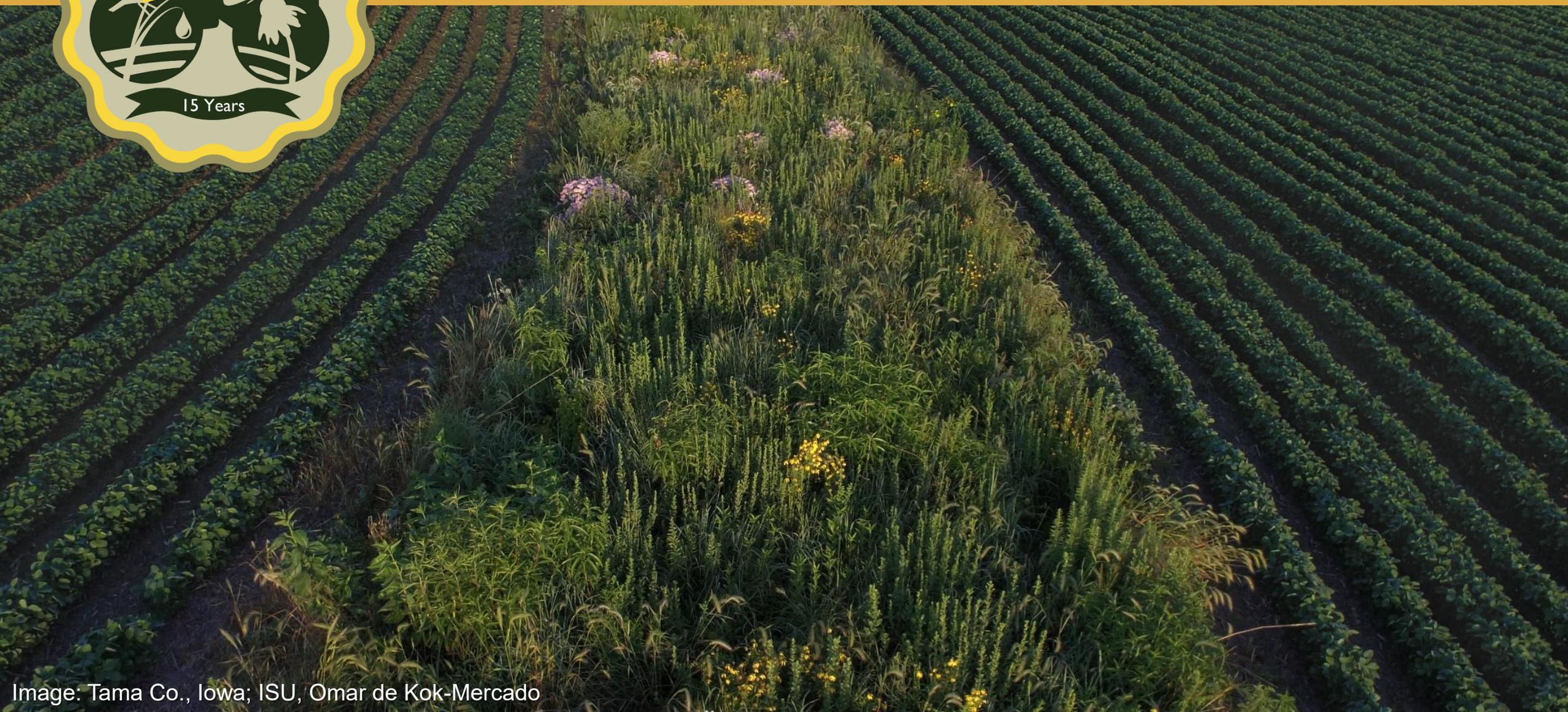


Image: Tama Co., Iowa; ISU, Omar de Kok-Mercado

STRIPS PARTNERSHIPS



IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY



USDA **ARS** Agricultural Research Service



Tallgrass Prairie
CENTER
Restoring a National Treasure



Iowa Natural Heritage
Foundation



IOWA
economic development



Des Moines
Water Works
Water You Can Trust for Life



IAWA
IOWA AGRICULTURE
WATER ALLIANCE

THE
UNIVERSITY
OF IOWA



The
WALTON FAMILY
FOUNDATION



MICHIGAN STATE

DEPARTMENT OF
AGRICULTURE



syngenta
Global



MacArthur
Foundation

CropLife
FOUNDATION



11th Hour Project
The Schmidt Family Foundation

Smithfield

FDCE
Conservation & Bioenergy



Image: Jasper Co., Iowa; ISU, Anna MacDonald

100% crops



90% crops:
10% prairie



100% prairie





STRIPS

**Prairie Strips
Collaborator**

www.prairiestrips.org



Image: Tama Co., Iowa; Lynn Betts



Image: Bremer Co., Iowa; Patrick Williams



Image: Wright Co., Iowa; Lynn Betts



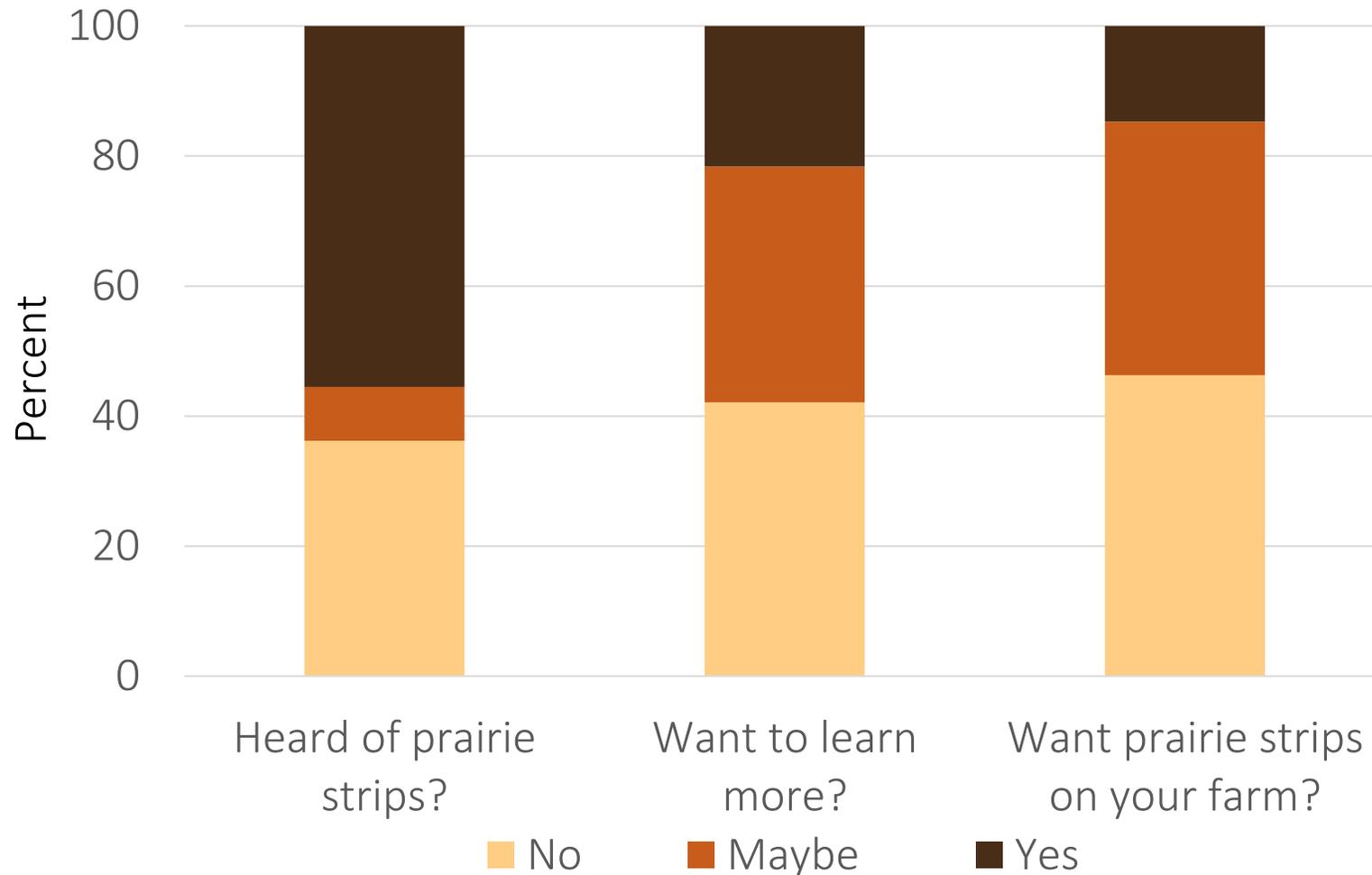
Image: Cass Co., Iowa; ISU, Omar de Kok-Mercado



Image: Tama Co., Iowa; ISU, Omar de Kok-Mercado

DATA + FARMER TESTIMONIALS: CHANGING FARMER ATTITUDES

2018 Iowa Farm and Rural Life Poll



DATA + CROSS-SECTOR SUPPORT: CHANGING POLICIES

2018 Farm Bill (Agricultural Improvement Act of 2018)

Subtitle B—Conservation Reserve Program

SEC. 2201. CONSERVATION RESERVE.

H. R. 2—42

(b) ELIGIBLE LAND.—Section 1231(b) of the Food Security Act of 1985 (16 U.S.C. 3831(b)) is amended—

(1) in paragraph (1)(B), by striking “Agricultural Act of 2014 (except for land enrolled in the conservation reserve program as of that date)” and inserting “Agriculture Improvement Act of 2018, on the condition that the Secretary shall consider to be planted cropland enrolled in the conservation reserve program”;

(2) by redesignating paragraphs (4) and (5) as paragraphs (5) and (6), respectively;

(3) by inserting after paragraph (3) the following:

“(4) cropland, marginal pasture land, and grasslands that will have a positive impact on water quality and will be devoted

“(A) a grass sod waterway;

“(B) a contour grass sod strip;

“(C) a prairie strip;

“(D) a filterstrip;

“(E) a riparian buffer;

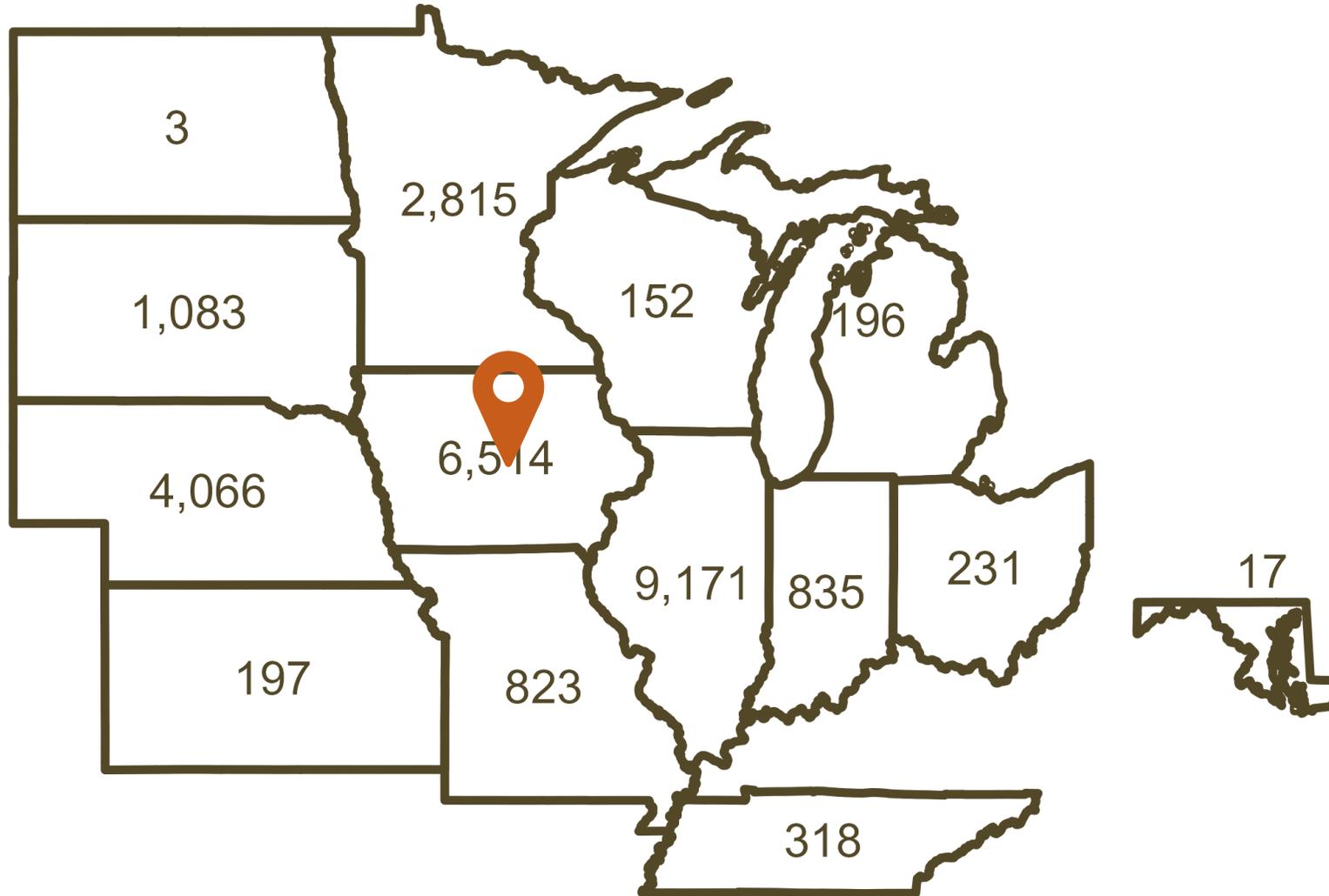
“(F) a wetland or a wetland buffer;

“(G) a riparian buffer;

47% of Iowa farmers indicate a willingness to establish prairie strips if they could receive a CRP rental payment on those acres. Another 22% indicate “maybe.”

Source: Iowa Farm and Rural Life Poll (Arbuckle 2020)

CHANGING POLICY → CHANGING ADOPTION: AREA OF PRAIRIE STRIPS



10,692
ha of CP43
Prairie Strips

106,000
ha of cropland
protected

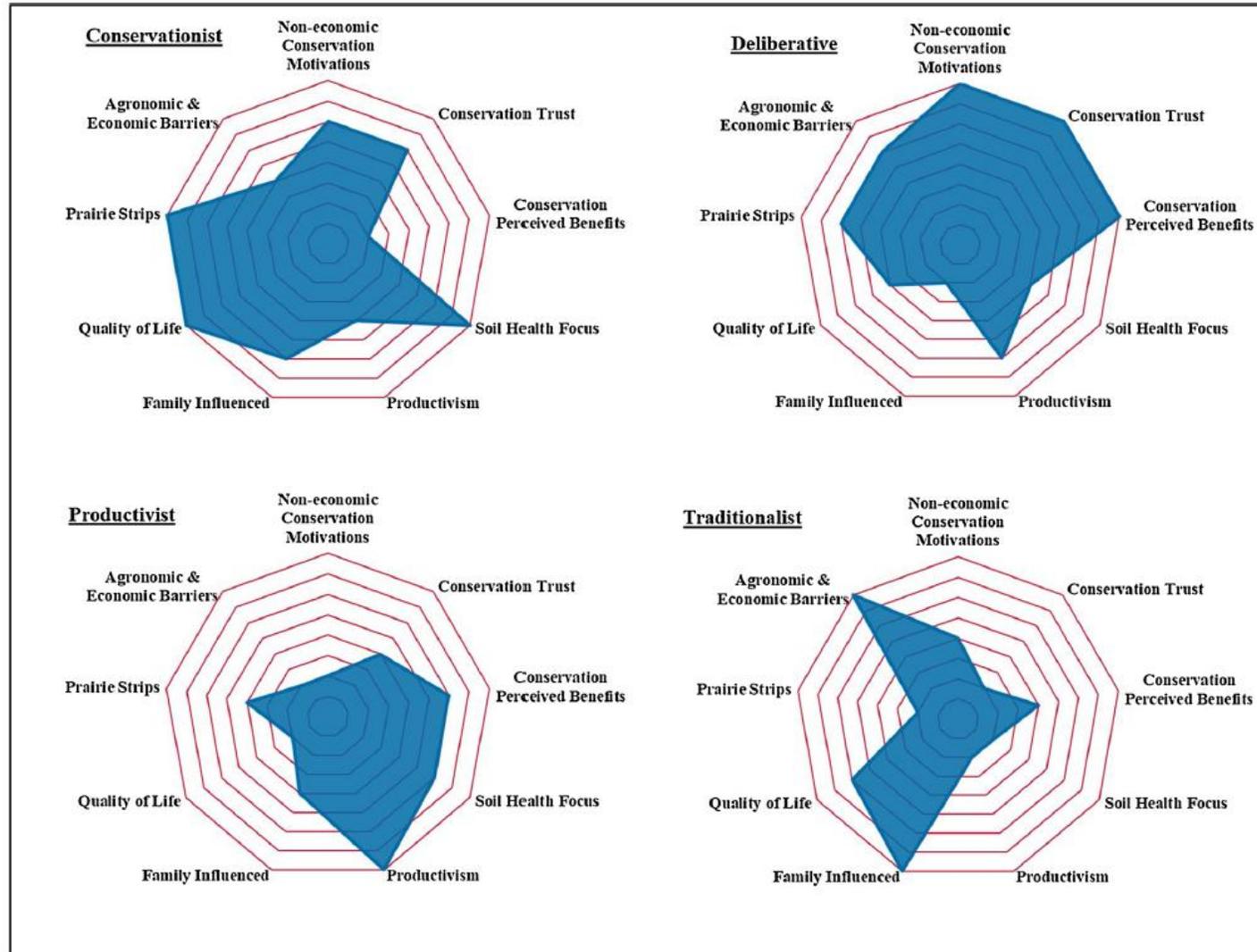
13
US states

3. BETTER KNOWLEDGE, PRACTICES, TOOLS



POINTS OF DIVERGENCE: FARMERS VIEWPOINTS ARE VARIED

Conservationist
28.2% OF POP.



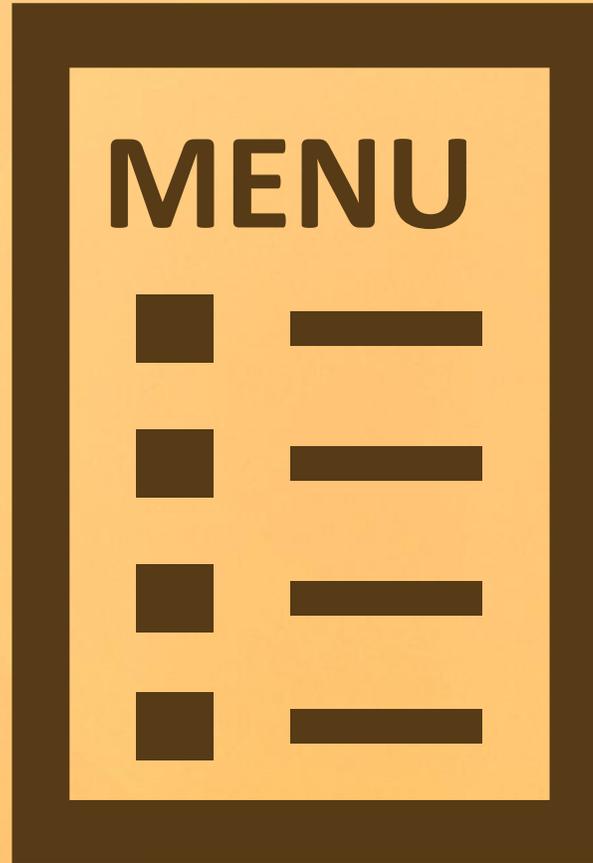
Deliberative
26.8% OF POP.

Productivist
17.6% POP.

Traditionalist
27.4% OF POP.

POINTS OF CONSENSUS:
THERE'S NO "ONE SIZE FITS ALL" SOLUTION

SUPPORT A



OF OPTIONS

4R PLUS OF NUTRIENT STEWARDSHIP



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT TIME

Makes nutrients available when crops need them.



RIGHT RATE

Matches amount of fertilizer type to crop needs.



RIGHT PLACE

Keeps nutrients where crops can use them.

The “Plus” Includes Soil Health Practices Like:



Reducing tillage



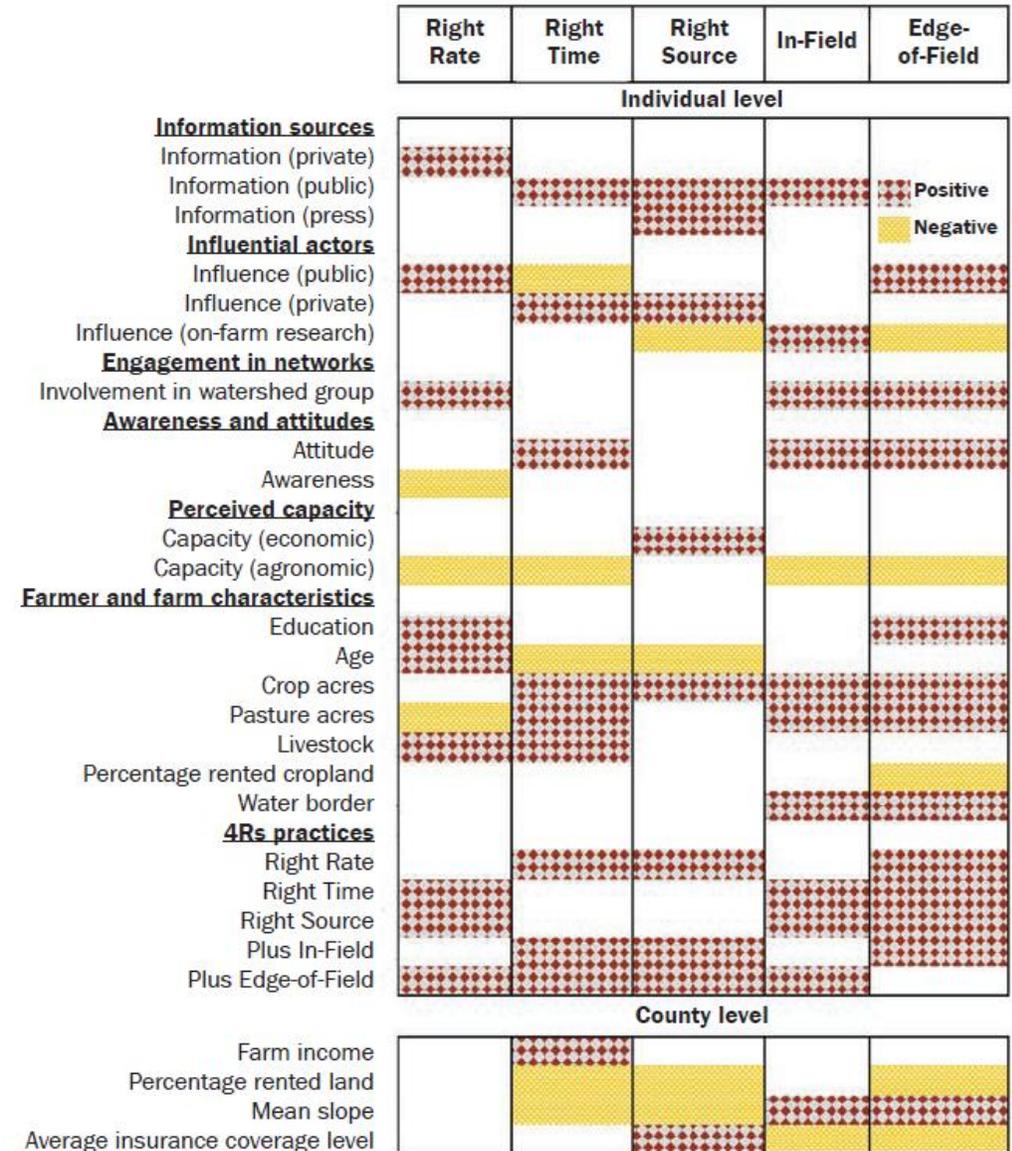
Planting cover crops



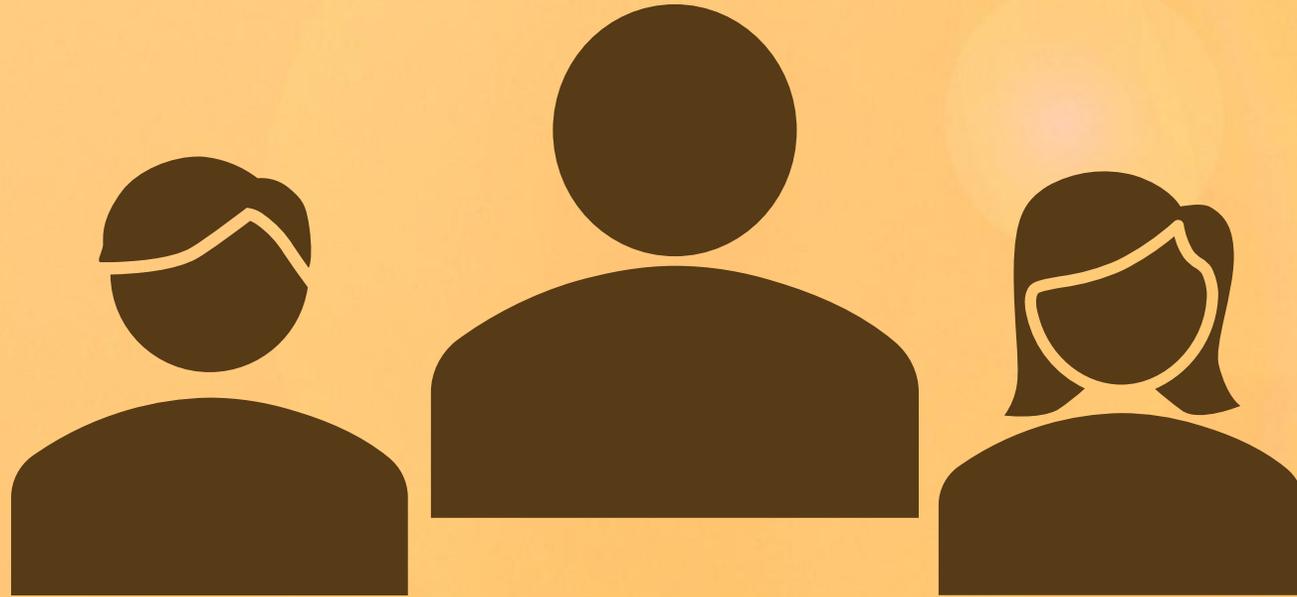
Adding structures such as contour strips, grass waterways, stream buffers or terraces

FARMER ADOPTION OF 4R PLUS PRACTICES

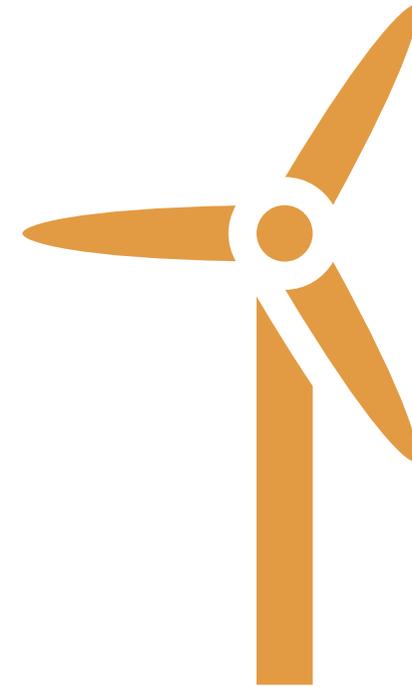
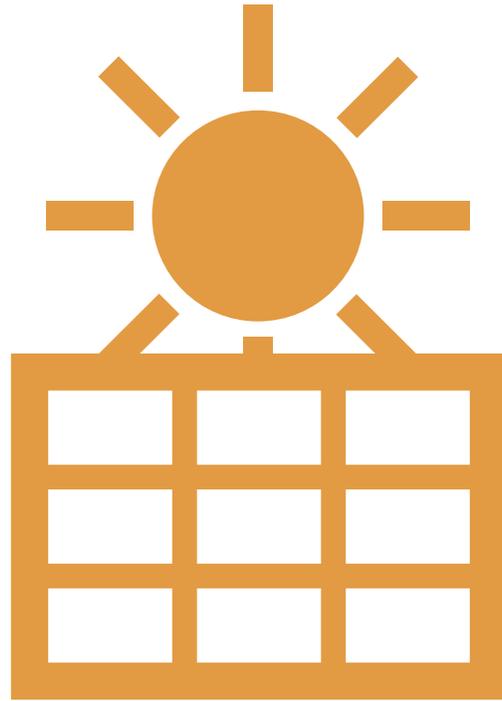
- 6,006 farmer responses
- Most farmers use 1 or more practices
- Both individual and county-level barriers
 - Lack of agronomic capacity
 - ‘Plus’ practices on sloped land
 - Crop insurance is a barrier to adopting no-till, cover crops, and perennial practices



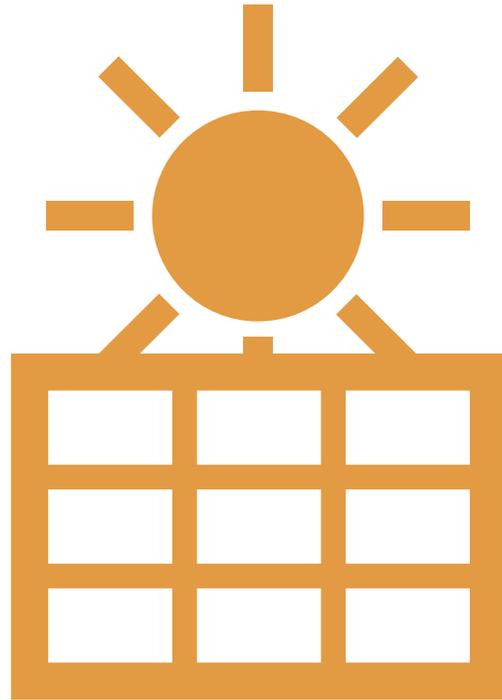
4. NEXT GENERATION CREATIVITY, SKILL, & PASSION



POINTS OF CONSENSUS: RURAL AREAS NEED NEW MARKETS



POINTS OF DIVERGENCE: THE TYPE OF ENERGY TO PURSUE



GRASS2GAS PROJECT



C-CHANGE Grass2Gas is advancing an agricultural value chain based on the production of **renewable natural gas (RNG)** and associated products through the anaerobic digestion of **herbaceous feedstocks** combined with manure

Funded by:



United States Department of Agriculture
National Institute of Food and Agriculture

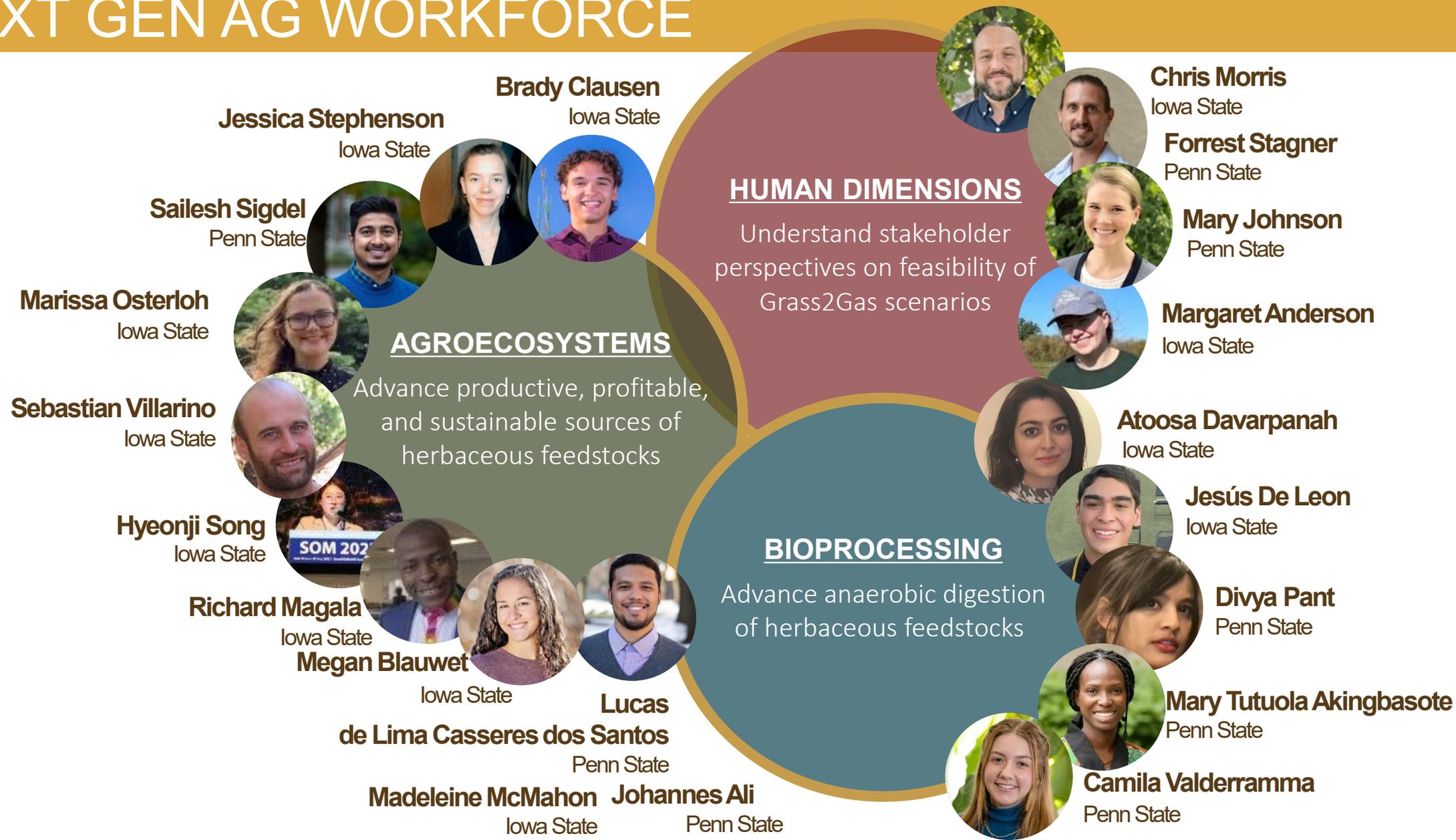
Grant ID: 2020-68012-31824

Partner
Institutions:

IOWA STATE
UNIVERSITY



POINTS OF CONSENSUS: NEXT GEN AG WORKFORCE



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WHAT YOU CAN DO



Canvas



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BEI



C-CHANGE



PEWI



STRIPS



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**WHILE SUSTAINING
RURAL LIVELIHOODS
AND
A LIVABLE PLANET?**



YOUR ASSIGNMENT: CROSS-SECTOR CONVERSATIONS



YOUR ASSIGNMENT:

**WHAT'S GIVING YOU
HOPE?**





Image: Linn Co., Iowa; ISU, Tim Youngquist

**NEVER DOUBT WHAT
A SMALL GROUP
OF HOPEFUL,
COMMITTED
INDIVIDUALS
CAN DO...**



THANK YOU!

FOR MORE INFO:

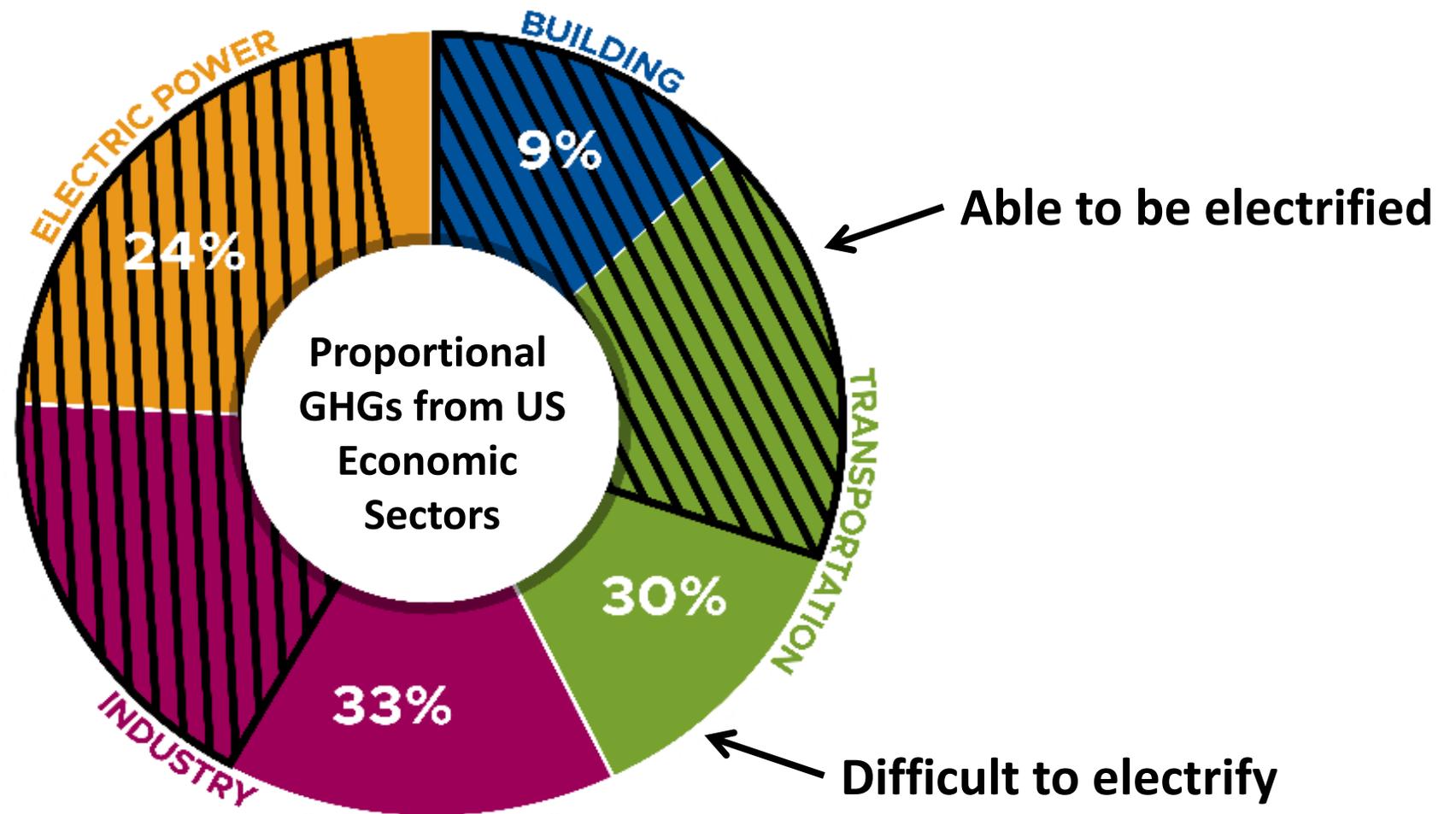
www.prairiestrips.org

www.agcchange.org

www.biorenew.iastate.edu



WE STILL NEED LIQUID FUELS



Source: Shaw et al. 2024. Closing the carbon cycle: net-zero carbon emissions for difficult to electrify segments of our economy. Nature Reviews.

Grass2Gas

BIOPROCESSING

Advance anaerobic digestion
of herbaceous feedstocks

AGROECOSYSTEMS

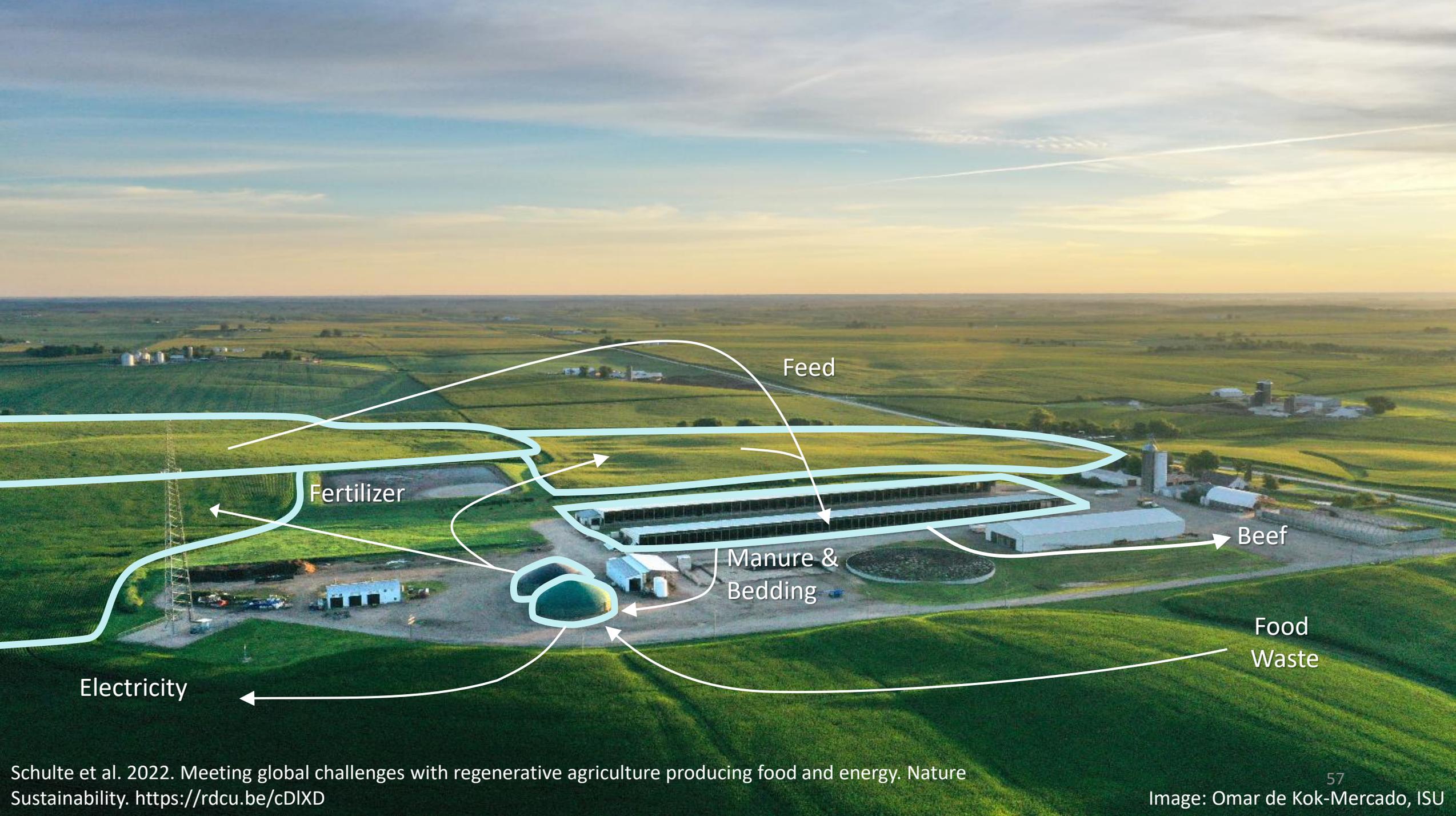
Advance productive, profitable,
and sustainable sources of
herbaceous feedstocks

HUMAN DIMENSIONS

Understand stakeholder
perspectives on feasibility of
G2G scenarios



Image: Scott Co., Iowa; ISU, Omar de Kok-Mercado



Feed

Fertilizer

Manure & Bedding

Beef

Food Waste

Electricity

KEY FINDINGS: GRASS2GAS

- On-farm feedstock production costs vary significantly by type and management approach^a
- The biomethane potential of winter rye > prairie grasses > prairie forbs > corn stover^b
- RNG from grassy biomass emits 15.1 gCO₂-eq/MJ, >75% emissions reduction compared to fossil natural gas^c
- Field data combined with simulations indicate harvested fertilized rye crops before soybean planting ↓ N loads to the Gulf of Mexico by 27%; 3.5x 2022 US cellulosic biofuel production^d
- Digestate ↑ soil organic carbon by 47% on commercial farm fields within 10 yrs in field study^e
- Immediate ↑ water quality and ↓ GHG emissions under prairie systems in field studies, but markets to support environmental outcomes not steady or lucrative^{f,g,h}
- Stakeholder support exists, but the details matter: concerns from those against concentrated animal agriculture and those seeking more opportunity for smaller farmsⁱ
- Substantial policy and financial barriers to grass-to-gas, whereas the pathway and financial proposition are clearer for manure-to-gas^j

Sources: ^aJordahl et al. 2025; ^bRahic et al. Unpublished data; ^cOlafasakin et al. 2024; ^dMalone et al. 2023; ^eVillarino et al. 2025; ^fLiebman & Helmers 2024; ^gSong et al. Unpublished data; ^hAudia et al. 2022; ⁱMorris et al. 2025, ^jKorkut et al. 2023

RESULTS | TECHNOECONOMIC & LIFE CYCLE ANALYSIS

Natural Gas (NG) Production from Shale Gas & Conventional Gas = 4.6 g/MJ

- NG/Shale gas recovery
- NG/Shale gas processing



Gas Transportation to Refueling Station via Pipeline = 1.9 g/MJ

NG Compression to Compressed Natural Gas (CNG) = 2.6 g/MJ



CNG Transportation & Distribution via Pipeline = 1.7 g/MJ



CNG Combustion = 50.3 g/MJ

- Tailpipe CO₂ emissions



Conventional Natural Gas

Total emissions = 61.1 g/MJ

Grassy Biomass Production = 7.95 g/MJ

- Diesel for non road application
- Farm machinery energy use
- Chemical production and use



Biomass Transportation to Anaerobic Digester = 2.6 g/MJ



Biogas Production via Anaerobic Digestion = -14.07 g/MJ

- Digester energy use
- Digestate credits



Biogas Transportation to Upgrading Facility = 2.7 g/MJ



Biogas Upgrading to Renewable Natural Gas (RNG) = 2.6 g/MJ

- Upgrading energy use
- RNG losses



CNG Transportation & Distribution via Pipeline = 1.7 g/MJ



CNG Combustion = 0 g/MJ

- Tailpipe CO₂ emissions are offset

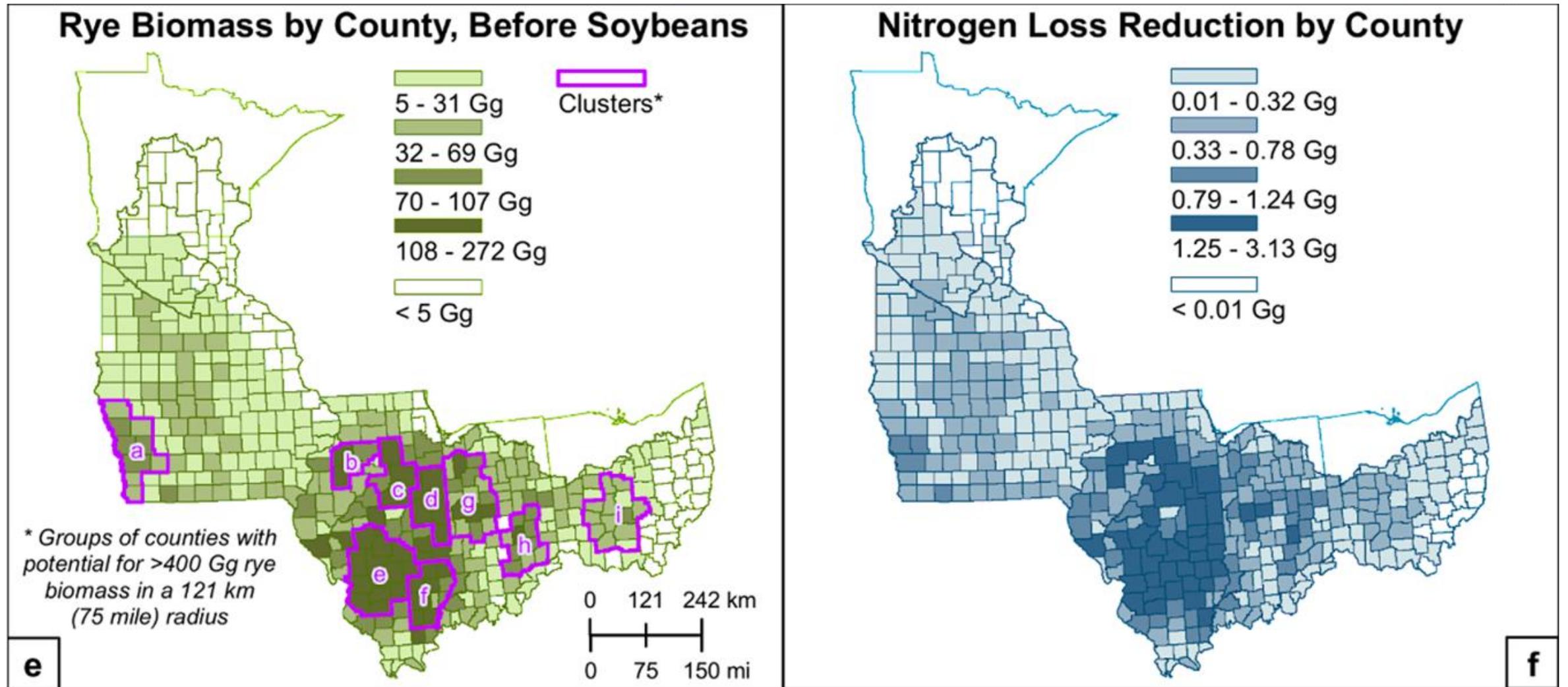


by biogenic emissions during grass production

Renewable Natural Gas

Total emissions = 18.4 g/MJ

RESULTS | WINTER CROP BIOMASS & WATER QUALITY



Source: Malone et al., 2023. Harvested winter rye energy cover crop: multiple benefits for North Central US. Environmental Research Letters 18:074009.

RATIONALE FOR GRASS2GAS

ENERGY INDEPENDENCE AND RURAL ECONOMIES

Biofuels have long been a national goal for these reasons

DISPATCHABLE RENEWABLE ENERGY TO BUTTRESS WIND AND SOLAR

Plants store sunlight for use when sun not shining and wind not blowing

WE STILL NEED LIQUID FUEL

Reliable energy for cold climates, remote locations, heavy-duty and long-haul trucking, aviation, marine transport, high-heat manufacturing processes

CHEAPER THAN HYDROGEN

Can use existing electrical and natural gas grid infrastructure

MARKET-BASED WAY TO PROVIDE ENVIRONMENTAL BENEFITS

Links with farmer identity to restore perennial grasslands on the landscape

Allowing Cover Crop Termination Through Harvest Could Encourage more Wide-spread Adoption

New research indicates positive impacts from harvesting fertilized winter rye grown in a corn-rye-soybean rotation

- Long-term winter rye biomass yield across drained North Central US corn-soybean belt before soybean planting was over 5 Mg/ha (2.2 t/ac) on average without a soybean yield reduction (Malone et al. 2023)
- Central Iowa field study showed rye biomass yield before soybean planting of about 6 Mg/ha (2.7 t/ac) and potentially positive producer revenue (cost and revenue of ~\$100 and \$400 per Mg), but perhaps a small soybean yield reduction (Herbstritt et al., 2022; Malone et al., 2022)
- Most studies find increased net returns and greater overall crop production per unit area with relay or double cropping (e.g., corn-rye-soybean) than prevailing systems (Tanveer et al., 2017)

Sources: Herbstritt et al. 2022. Rye as an energy cover crop: management, forage quality, and revenue opportunities for feed and bioenergy. Agriculture; Malone et al., 2023. Harvested winter rye energy cover crop: multiple benefits for North Central US. Environmental Research Letters; Malone et al. 2022 Rye-soybean double-crop: planting method and N fertilization effects in the North Central US. Renewable Agriculture and Food Systems; Rogovska et al, 2023, Long-term conservation practices reduce nitrate leaching while maintaining yields in tile-drained Midwestern soils, Agricultural Water Management; Tanveer et al., 2017. Relay cropping as a sustainable approach: problems and opportunities for sustainable crop production. Environmental Science and Pollution Research.

Funding: This research was a contribution from the Long-Term Agroecosystem Research network and was supported by the USDA-ARS. Further support was provided by USDA-NIFA (2020-68012-31824) and USDOE-BETO (EE0007088).

Fertilized and Harvested Winter Rye can also Enhance Agro-Environmental Benefits

- Fertilized and harvested winter rye can provide similar water quality benefits to conventional unfertilized and unharvested cover crop management, especially if nitrogen fertilizer is applied early in the spring rather than the fall (Ramcharan and Richard, 2017; Malone et al. 2018; 2023)
- Winter crops can reduce pest and weed pressure on summer crops (Tanveer et al., 2017). Fertilized winter rye yields exceed the 5 Mg/ha recommended for effective weed suppression much faster (Malone et al. 2023; Nichols et al. 2020), reducing planting delays for summer crops.
- Fertilized and harvested winter rye increases soil carbon accumulation relative to a conventionally managed winter rye cover crop (Ramcharan and Richard, 2017), while use of the harvested biomass for energy can generate large additional carbon benefits (Herbstritt et al., 2022; Malone et al., 2023)

Sources: Ramcharan and Richard, 2017. Carbon and nitrogen environmental trade-offs of winter rye cellulosic biomass in the Chesapeake Watershed. *Agricultural Systems*; Malone et al. 2018. Harvesting fertilized rye cover crop: simulated revenue, net energy, and drainage nitrogen loss. *Agricultural & Environmental Letters*; Malone et al., 2023. Harvested Winter Rye Energy Cover Crop: Multiple Benefits for North Central US. *Environmental Research Letters*; Tanveer et al., 2017. Relay cropping as a sustainable approach: problems and opportunities for sustainable crop production. *Environmental Science and Pollution Research*; Nichols et al., 2020. Cover crops and weed suppression in the U.S. Midwest: A meta-analysis and modeling study. *Agricultural & Environmental Letters*; Herbstritt et al. 2022. Rye as an Energy Cover Crop: Management, Forage Quality, and Revenue Opportunities for Feed and Bioenergy. *Agriculture*.

Harvested Winter Rye Could be Used for Biogas Production

- Since 2014, renewable natural gas (RNG) from biogas has grown from 0% to 95% of US cellulosic biofuel
- Converting rye biomass to RNG can provide 11.3 GJ RNG per 1 Mg dry rye
- Potential on-farm revenue can average ~ \$400 per Mg dry rye
- The minimum rye prices needed for fertilized and harvested rye to be profitable averaged ~\$100/Mg
- Simple conversions show 1 Mg rye as biogas feedstock produces ~480 Liters of ethanol equivalent energy
- 1 Mg corn produces ~420 Liters ethanol; price of ethanol ~\$2.30 per gallon or \$0.6/Liter
- 1 Mg rye = \$288 = 480 L x \$0.6/L, as ethanol equivalent energy and not including coproducts or incentives
- So, cost and revenue of harvesting rye is ~\$100 and ~\$300-400/Mg-1, with ~\$200-300 income