



**Forever
Green**

Forever Green Initiative
Driving Diversification in
Midwest Agricultural Systems

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Forever Green | In Transition

Dr. Don Wyse
Co-Founder
Visionary

1947-2024



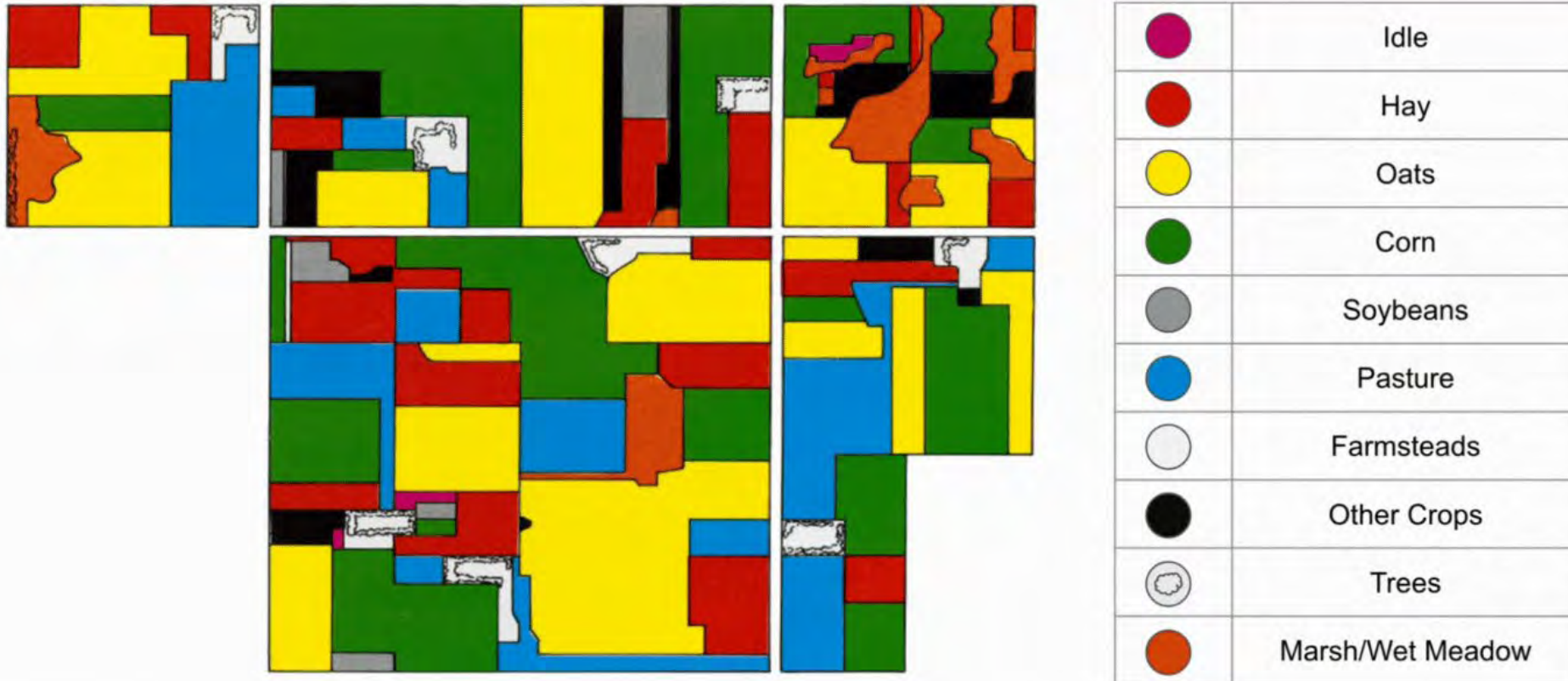
Forever Green | Moving Forward



Forever Green | Challenge: Low crop diversity

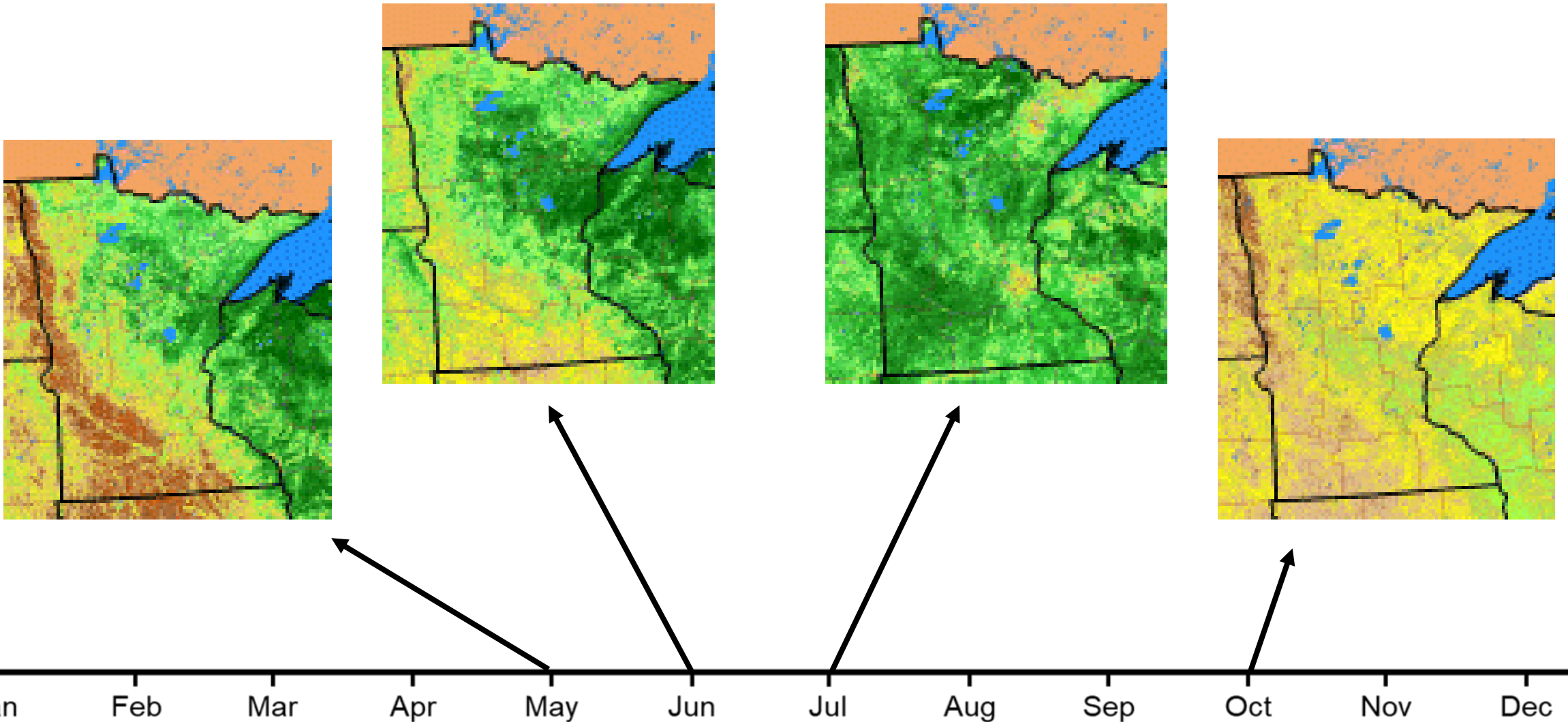
Winnebago Research Area — 1941

Cover map of the Winnebago pheasant study area



Forever Green

| Challenge: Lack of soil cover

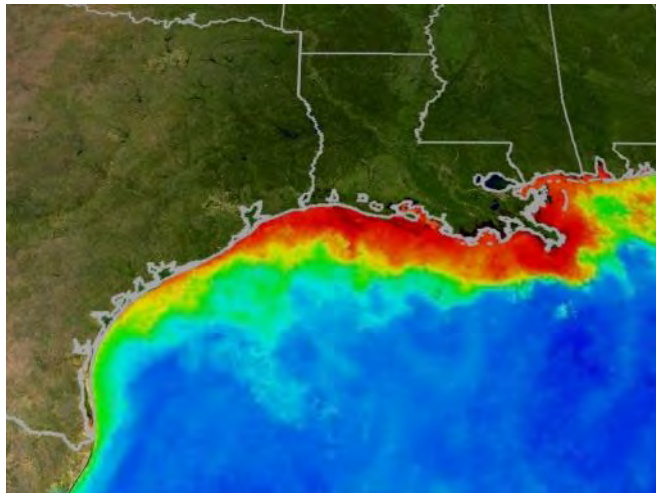


| Challenge: Degraded soil and water

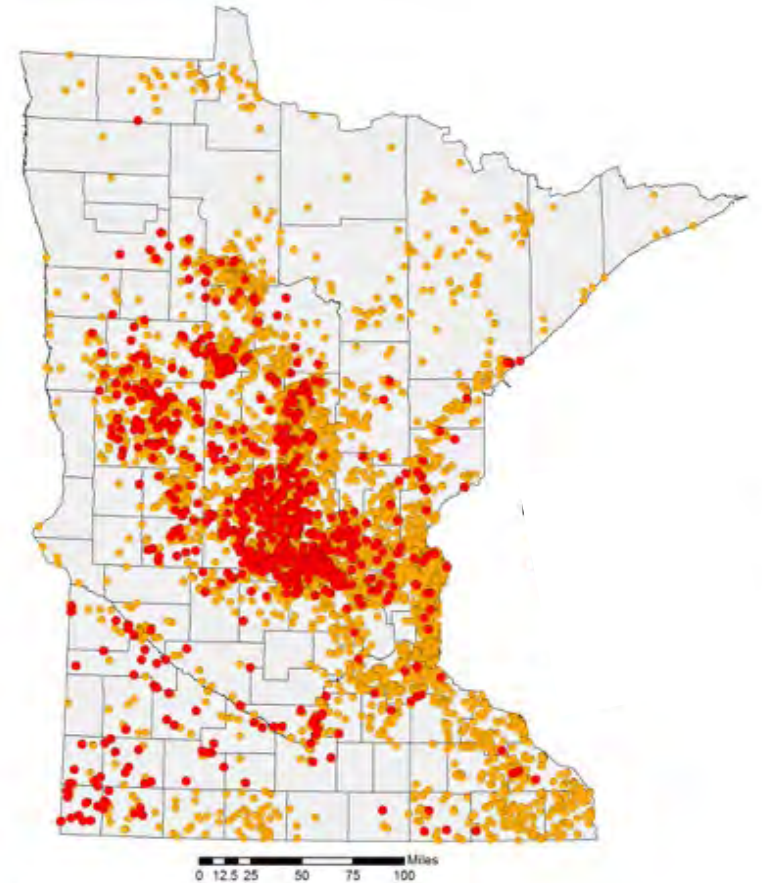
**Catastrophic
Soil Erosion**



**Gulf of Mexico
Hypoxia**



**Nitrate Contamination in
Drinking Water Wells**



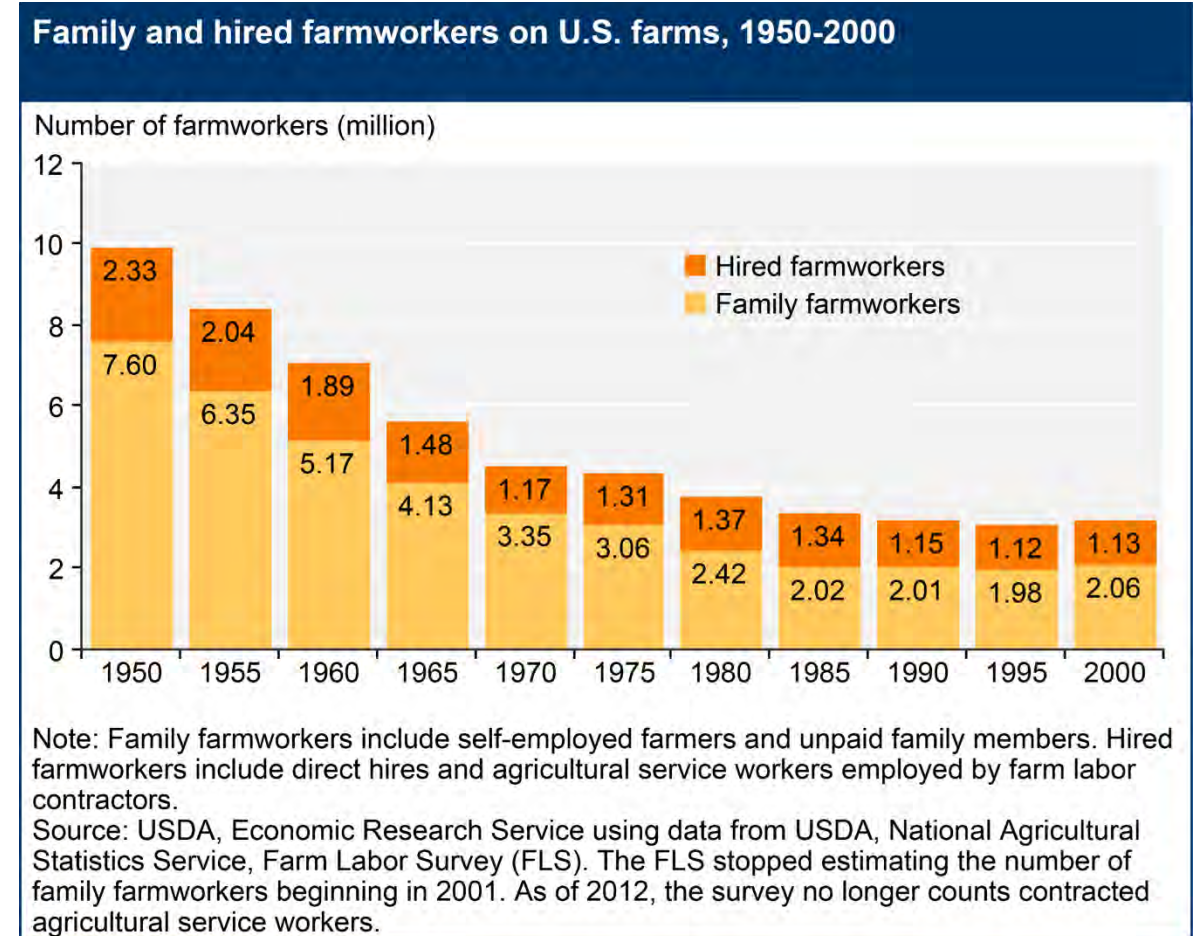
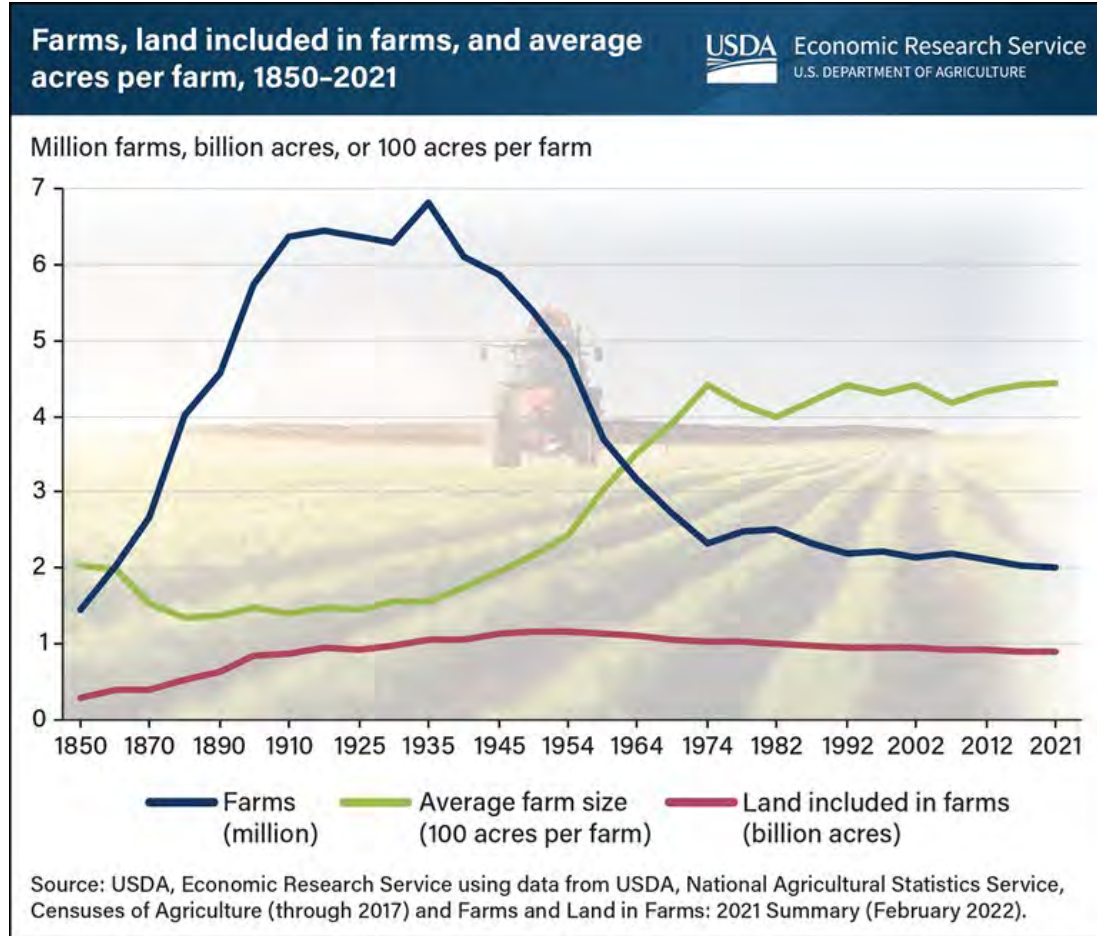
Prepared by the Minnesota Department of Health, October 21, 2014

Forever Green

| Challenge: Climate change



Forever Green | Challenge: Farm viability, rural vitality



Forever Green | Solution: Continuous Living Cover

Fall



- Less erosion
- Less nitrate leaching
- Less phosphorus loss
- Better soil health
- Diversity
- Resilience

Spring



Conventional

"Continuous Living Cover"



**COVER
THE DAMN
SOIL**

Forever Green | Advancing over 15 new crops



Perennial Crops

Kernza®
Perennial wheat
Perennial oats
Perennial cereal rye
Perennial flax
Silphium/silflower
Perennial sunflower
Alfalfa
Kura clover
Native polyculture
grassland mixtures

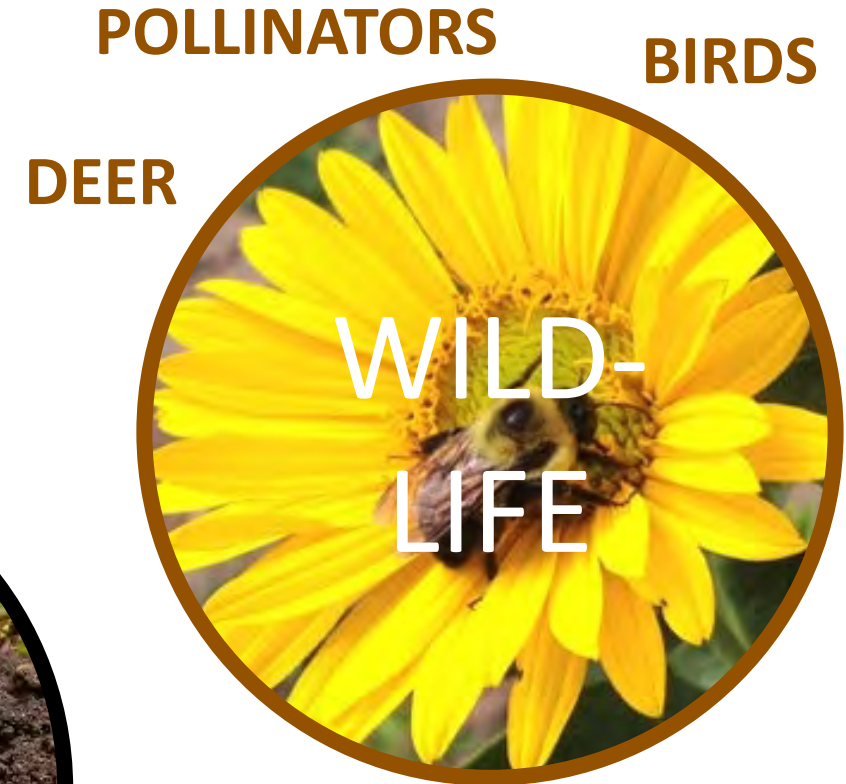
Winter Annuals

Winter camelina
Pennycress
Winter barley
Winter & spring field pea
Winter hybrid rye
Winter durum
Hairy vetch

Native Woody Crops

Hazelnuts
Elderberry
Shrub willow
Agroforestry

Forever Green | Protecting the environment



Forever Green | *Putting Down Roots* report

With widespread adoption of continuous living cover crops in Minnesota:



Nitrogen loss
-23%



Soil erosion
-35%



On-farm
net returns
+20%

+ Figures shown are under a medium-adoption scenario. (*Putting Down Roots*, pg. 11.)

Forever Green

| New and unique ingredients



Oils



Fiber



Protein



Phytonutrients

| New economic opportunities



High-Value Food, Feed and Energy Products



Innovative Healthy Food Products & Low-Carbon Fuels



Tools to Meet Corporate Sustainability Goals



New Economic Opportunities for Farmers and Rural Communities

**Forever
Green**

| Transformative change in ag systems

*New
Crops*



*New
Value
Chains*



*Supportive
Policy*





Forever Green | 15+ interdisciplinary crop teams



Perennial Crops

- Kernza®
- Perennial wheat
- Perennial oats
- Perennial cereal rye
- Perennial flax
- Silphium/silflower
- Perennial sunflower
- Alfalfa
- Kura clover
- Native polyculture grassland mixtures

Winter Annuals

- Winter camelina
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Native Woody Crops

- Hazelnuts
- Elderberry
- Shrub willow
- Agroforestry

Environmental and Economic Clusters of Opportunity

- ✓ Technical Assistance to growers of 4 leading field crops —————→
- ✓ Ecosystem Service payments \$20-50/acre
 - Premium payments in DWSMAs
- ✓ Risk Management payment of half the cost of production in event of crop or market failure
- ✓ Targeted support for hazelnut and elderberry producers

Hybrid
Winter Rye



Kernza®
Perennial Grain



Winter Camelina



Winter Barley

Forever Green

| Market: Value chain development



Industry Partners

Small and medium-sized enterprises

Start-ups



*Legitimacy, market makers,
scale*



Innovation ecosystems



*Disruptive change, focused
innovators, investability*

Forever Green | Partnership: Driving systemic change





Intermediate Wheatgrass

A PERENNIAL, MULTIFUNCTIONAL FOOD, FEED AND ECO-FRIENDLY CROP

Intermediate Wheatgrass or Kernza®

Thinopyrum intermedium



Perennial grass with high biomass and large grain size

Enterprises:

- Food
- Beer/Whiskey
- Forage and Grazing
- Biomass





Annual wheat (on left in each panel) and Perennial wheatgrass

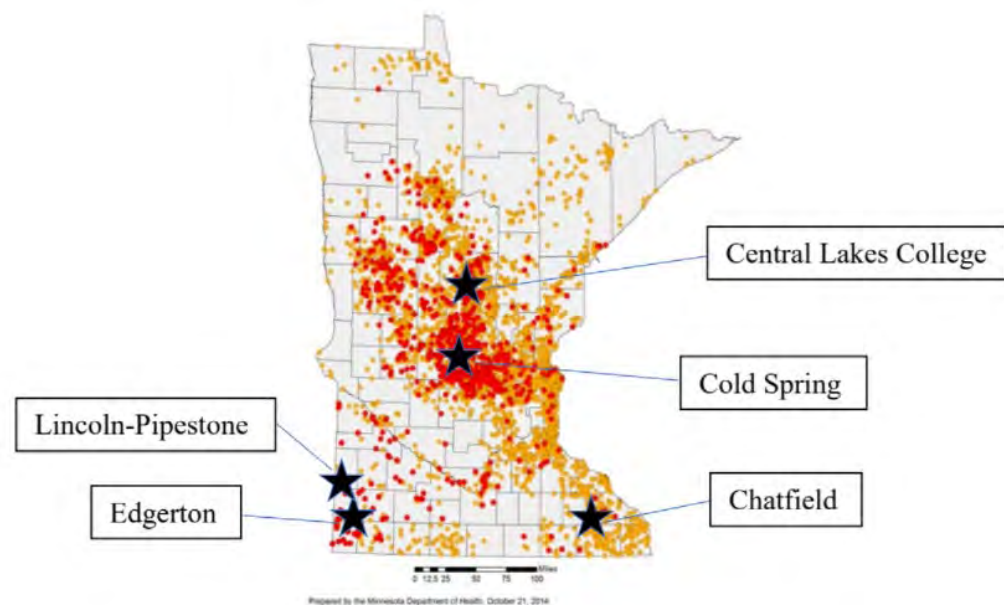
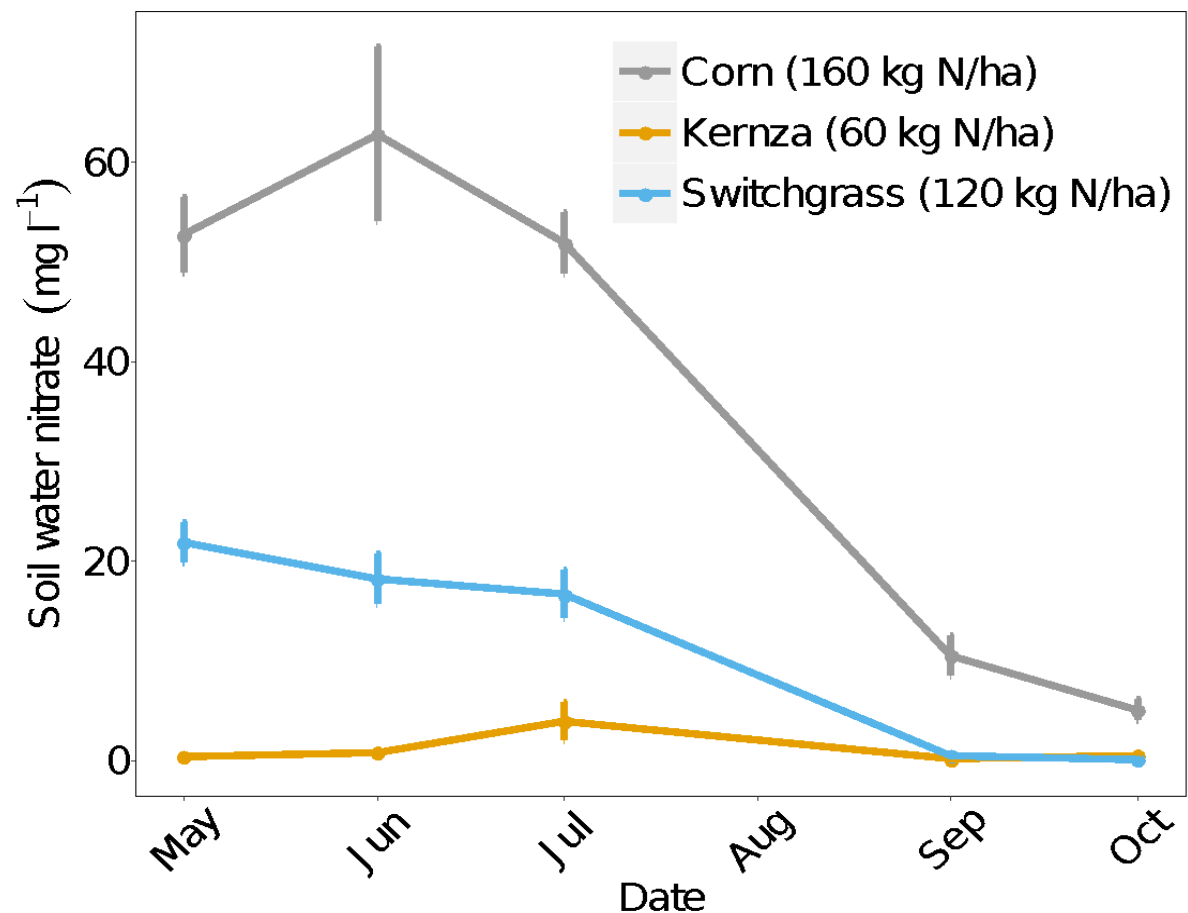
Kernza: Water Quality



Jake Jungers

Drastic reductions in nitrate leaching potential

KERNZA
LONG ROOT



Private wells at risk of nitrate contamination in Minnesota.
Credit: Minnesota Department of Health.

Releases of 'MN-Clearwater' & 'MN-Itasca'





Winter Camelina

A NEW SHORT SEASON WINTER ANNUAL
OILSEED CROP FOR USE IN DIVERSE ROTATIONS



Pennycress

Winter Oilseeds: Overview

Pennycress



- Brassicas
- Extremely hardy winter annuals
- Produce small oilseeds
- High yielding
 - Up to 1,500 lb/acre
- High oil content
 - ~35-40%

Camelina



Winter Oilseeds: Markets

Low-Carbon Fuels



Heart-Healthy Oils



High-Protein Feeds



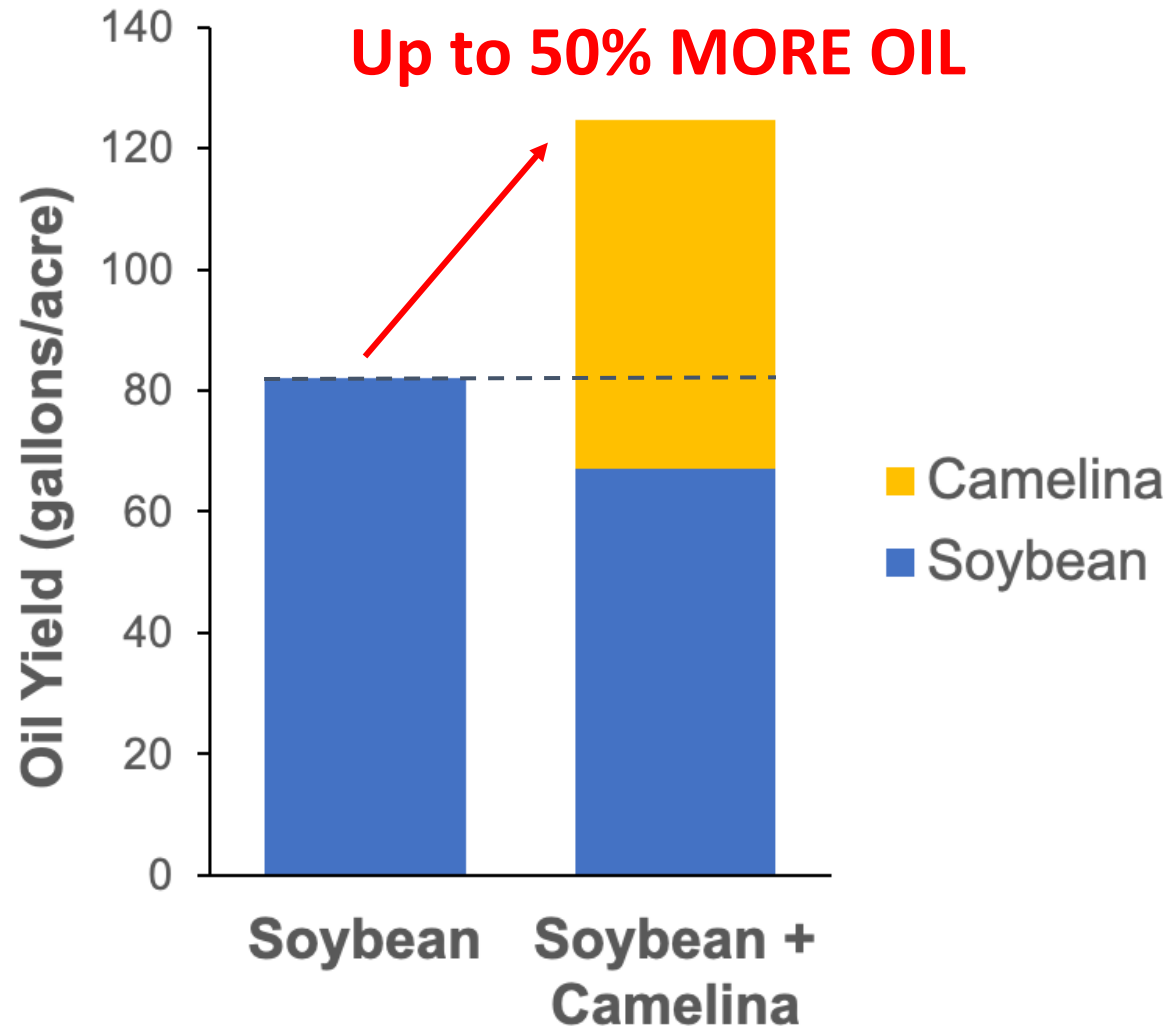
Winter Oilseeds: Crop Rotations

	Summer	Winter	Summer	MN Acres
NOW	 	 	Relay Soybean is Second Crop 	2M
FUTURE			Or dry beans, sunflower, etc.	8M

Increase Oil Production Per Acre



Russ Gesch
USDA ARS



Very Low Carbon Intensity



UP
TO **70%**

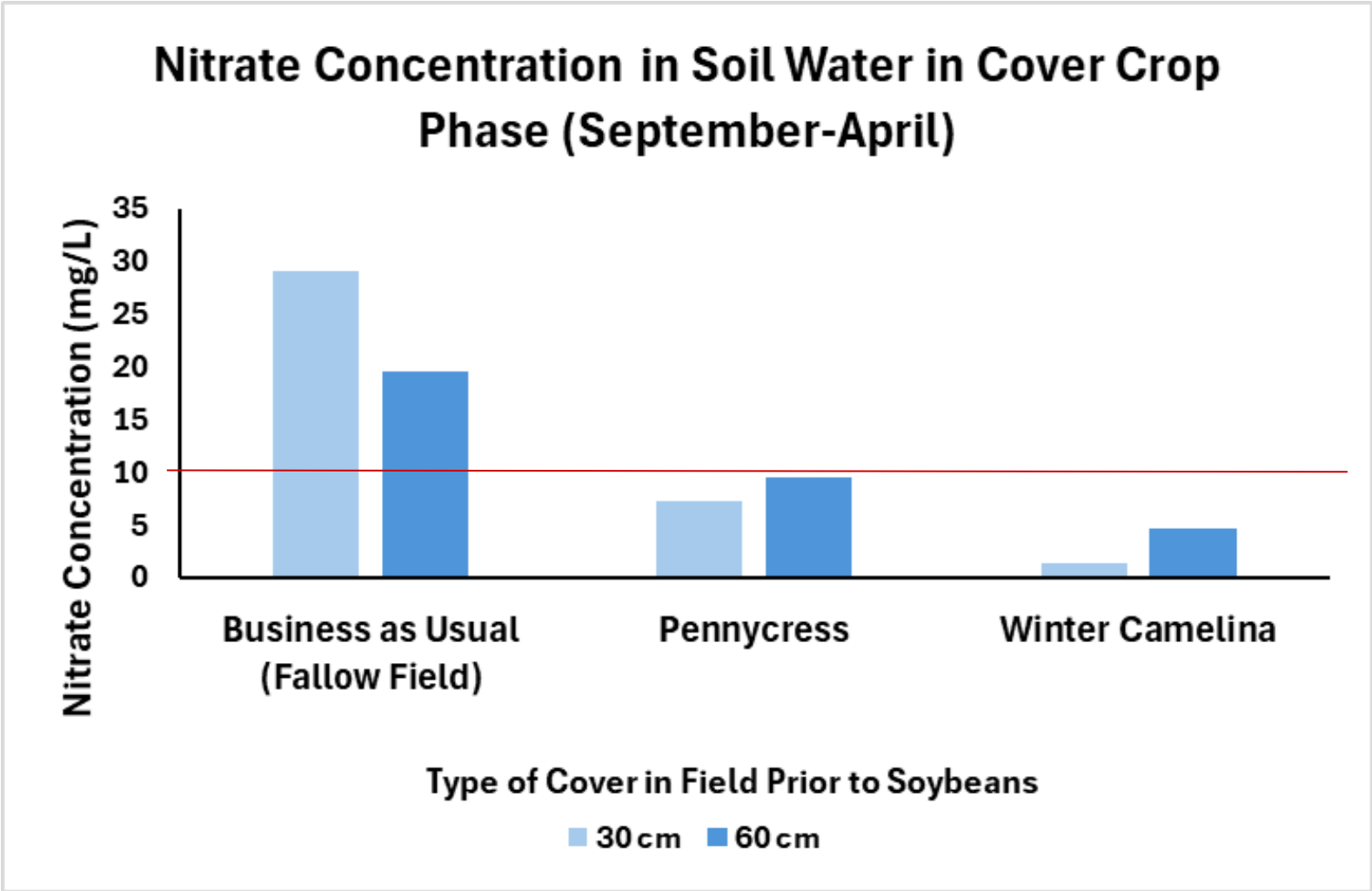
**LOWER THAN
PETROLEUM
JETFUEL**

Reduce Nitrate Leaching

Measurement Method:
Lysimeters

Years:
2015 & 2016

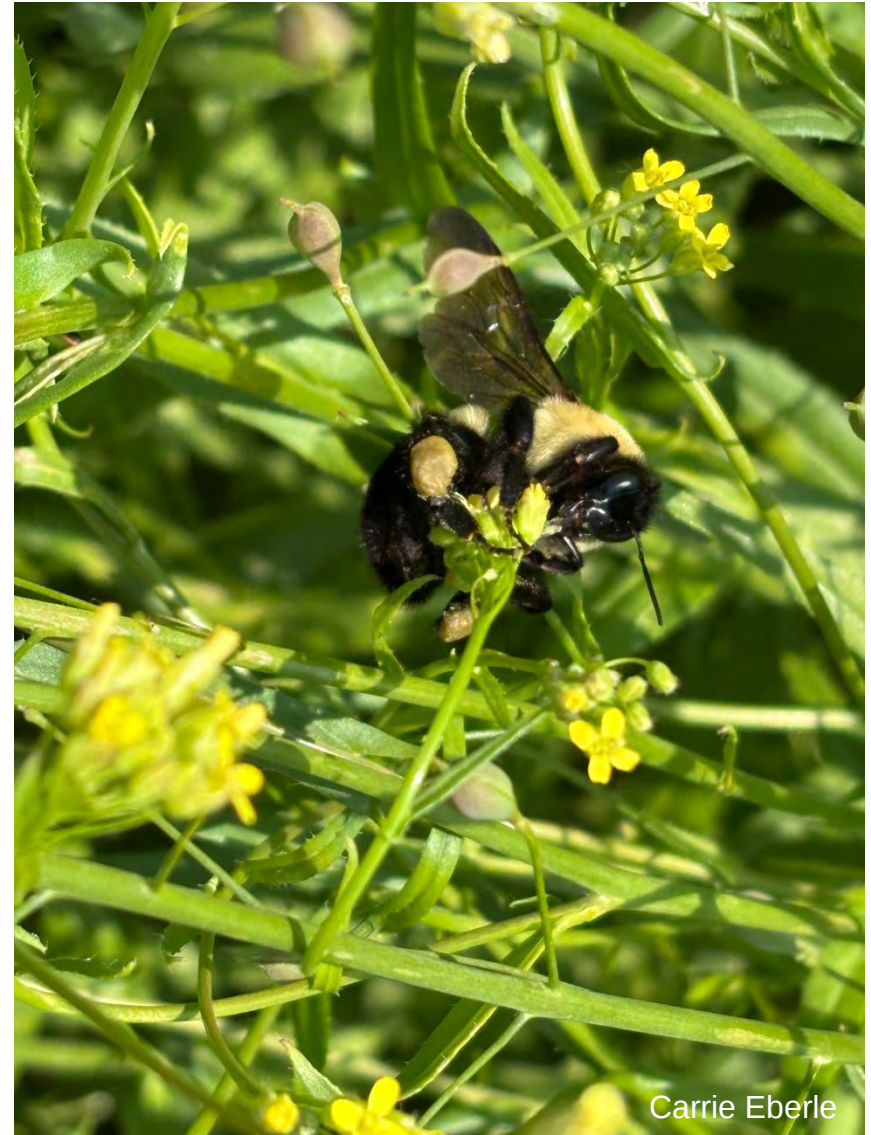
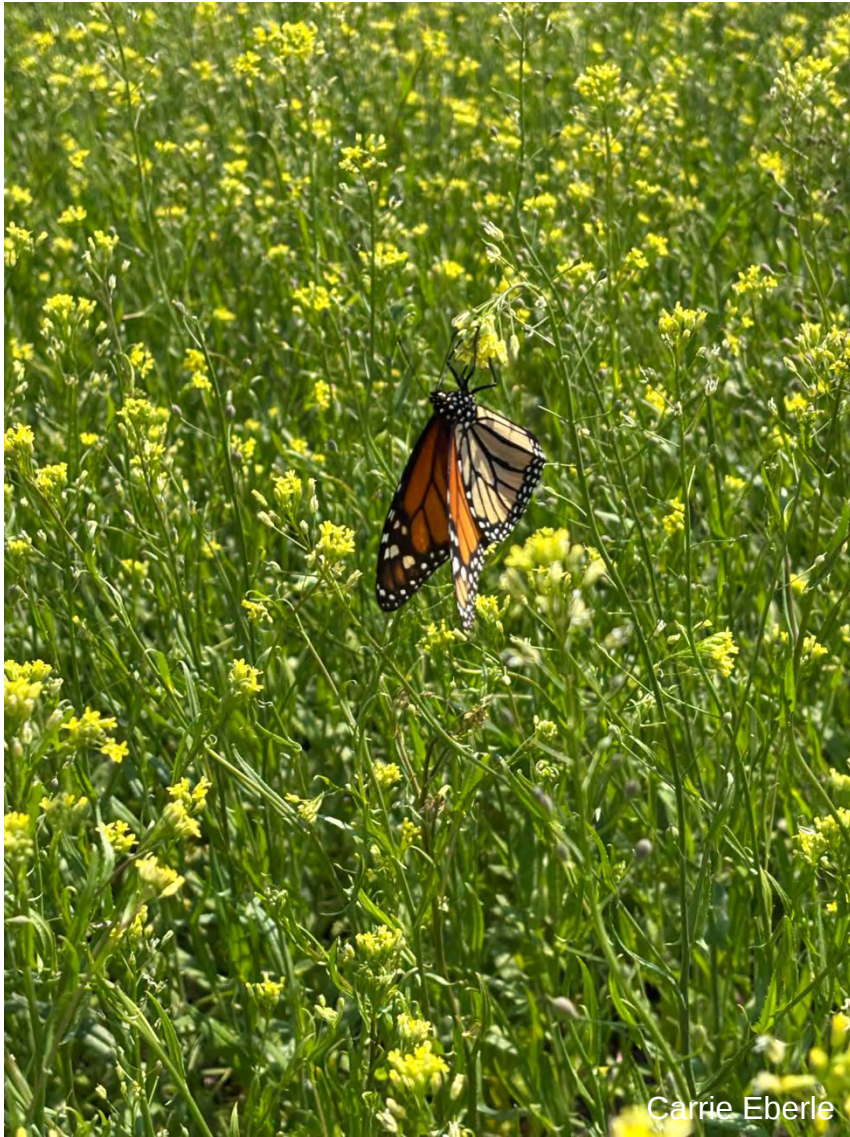
Location:
Stevens County, MN



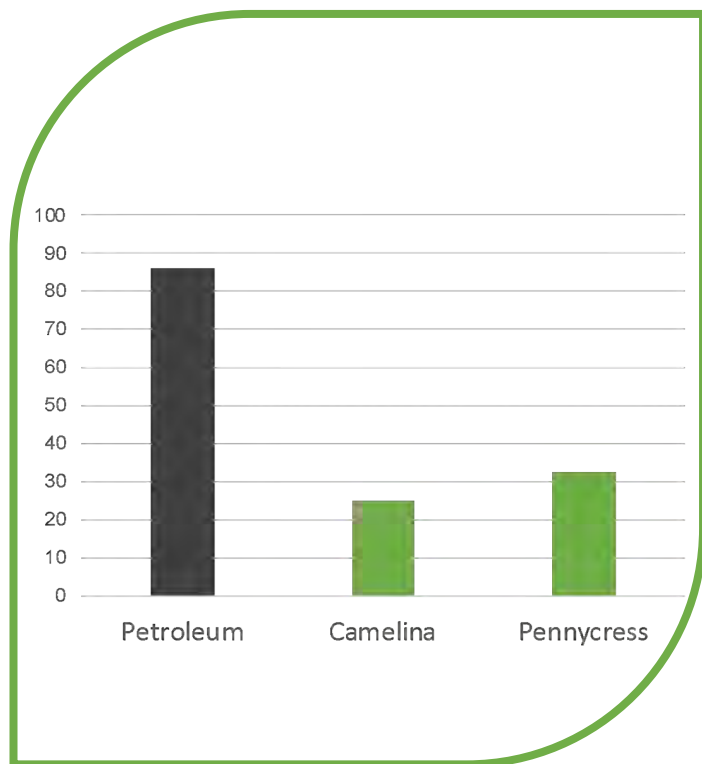
EPA drinking
water
standard for
nitrate

Note: Business-as-Usual = no-till management with fallow field prior to soybean planting

Pollinator Friendly



Renewable Fuel Crop with Multifaceted Benefits



**VERY LOW
CARBON INTENSITY**



**HIGH PRODUCTIVITY &
SCALING POTENTIAL**



**PROTECT SOIL AND
WATER**

Forever
Green

| Thanks to our supporters





**Forever
Green**

Thank You

Let's Discuss!

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