

# Washington's

# Soil Health Initiative

# &

# Climate Smart Estimator



Jadey Ryan  
Leslie Michel and Dani Gelardi  
WADE Conference  
June 13, 2023



Washington  
State Department of  
Agriculture





**WaSHI offers research, outreach, education, policy support, and funding opportunities, to help farmers, the environment, and the people of Washington.**



Chad Kruger



A close-up, low-angle shot of a field of golden wheat. The wheat stalks are tall and dense, with their heads clearly visible. The background is a clear, bright blue sky. The overall scene is bright and sunny, suggesting a healthy, thriving crop.

# **Goal 1: Increase awareness of soil health**







# **Goal 2: Document the state of the soils**





A photograph of a potato field with rows of green plants. The sky is overcast with grey clouds. The text is overlaid in the center.

# **Goal 3: Improve understanding of soil health building practices**





A photograph of a rural scene featuring several black cows in a field. In the foreground, there is a large, dark, textured pile of soil or manure. The cows are standing behind some green plants, looking towards the camera. The background is a clear, light blue sky.

# **Goal 4: Increase adoption of soil health building practices**





**We need diverse solutions for diverse soils.**



Molly McIlquham

Washington Soil Health Initiative





The Soil Health Roadmap identifies challenges, knowledge gaps, and goals for improving soil health.



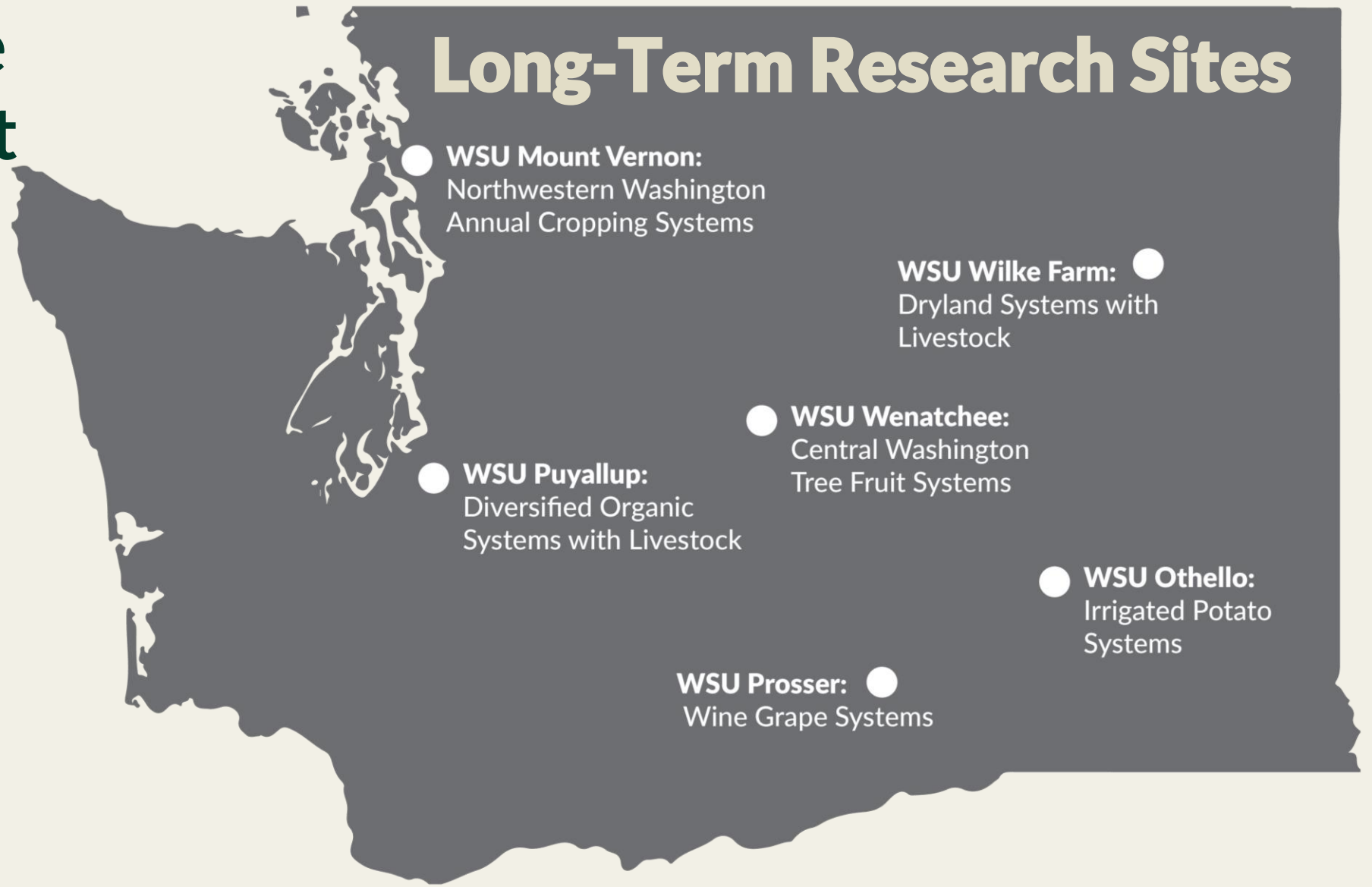




**Red raspberry will be added  
to the roadmap soon!**



WaSHI has the country's most densely populated network of LTAREs to measure management impacts over time.





**The State of the Soils Assessment is  
building soil health understanding  
across Washington.**

**876** Sites sampled

**30** Counties

**67** Crops/land use types

**30** Soil health indicators



Leslie Michel



Washington  
State Department of  
Agriculture



Washington Soil Health Initiative



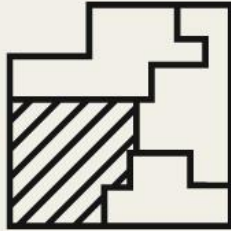


# 702



## Samples

# 26

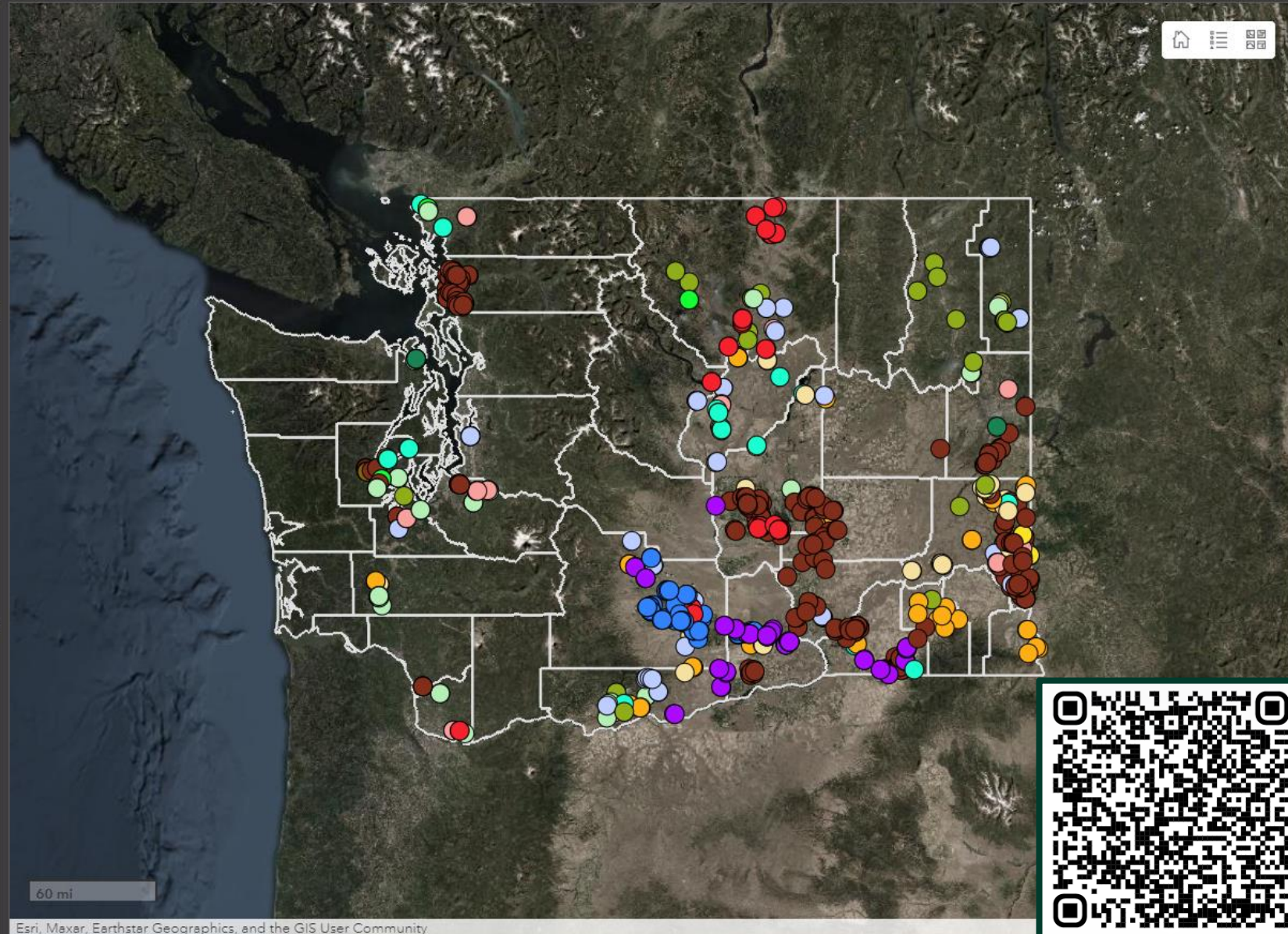


## Counties

# 50



## Crop Types



Esri, Maxar, Earthstar Geographics, and the GIS User Community





# Understanding soil tests

SCC Center for Technical Development



**Dani Gelardi**, WSDA Senior Soil Scientist  
**Deirdre Griffin LaHue**, WSU Assistant Professor  
*March 14<sup>th</sup>, 2023*



1:36 / 55:06 • Intro >





**STAR will create economic opportunities for Washington producers.**





**STAR is a free, voluntary program created by farmers for farmers to reward healthy land management.**





# WE ARE HIRING

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Washington  
State Department of  
Agriculture



**First review June 12**  
**Continuous recruitment**

## Soil Health Economic Development Coordinator

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Join Washington State Department of  
Agriculture to implement, promote, and  
coordinate the nationally recognized,  
Saving Tomorrow's Agricultural Resources  
program in Washington.



**Apply at: [bit.ly/soilhealthecon](https://bit.ly/soilhealthecon)**



**STAR improves the business case for soil health to ensure thriving Washington economies and ecosystems.**



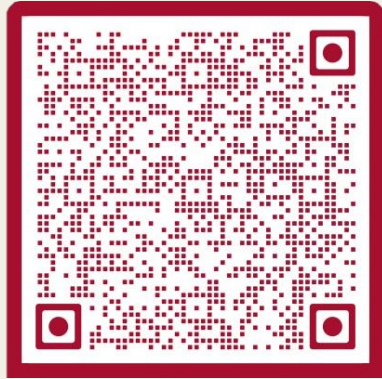
**STAR Science Committee forms July 2023**

**Producer enrollment begins June 2024**



# WaSHI Resource Roundup

## Newsletter



**NEW WaSHI  
WEBSITE  
COMING SOON!**



**SAVE THE DATE**

**SOILCON**

**Field Day**

THURSDAY, JULY 27TH, 2023  
12-4 PM

Mount Vernon NWREC

- Experiment Site Tour
- Equipment Demonstrations
- Soil Health Conversations

WASHINGTON  
**SOIL**  
HEALTH INITIATIVE

WASHINGTON STATE UNIVERSITY  
Center for Sustaining Agriculture  
and Natural Resources

WESTERN  
**SARE**  
Sustainable Agriculture  
Research & Education



**@WSU\_SoilHealth**

## WSDA Soil YouTube



**@WSU\_SoilHealth**



# Questions? Comments? Ideas?



**Dani Gelardi**  
**dgelardi@agr.wa.gov**



Leslie Michel



Use greenhouse gas inventory & conservation scenario analysis tools to estimate climate benefits.





# There are three primary tools.





# There are many use cases for climate benefit estimates.

**Incentive Programs**

**Conservation Farm Plans**

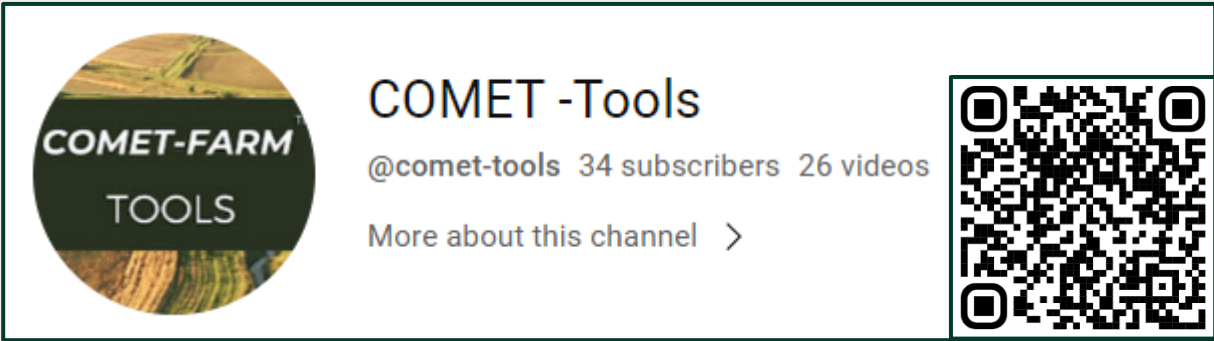
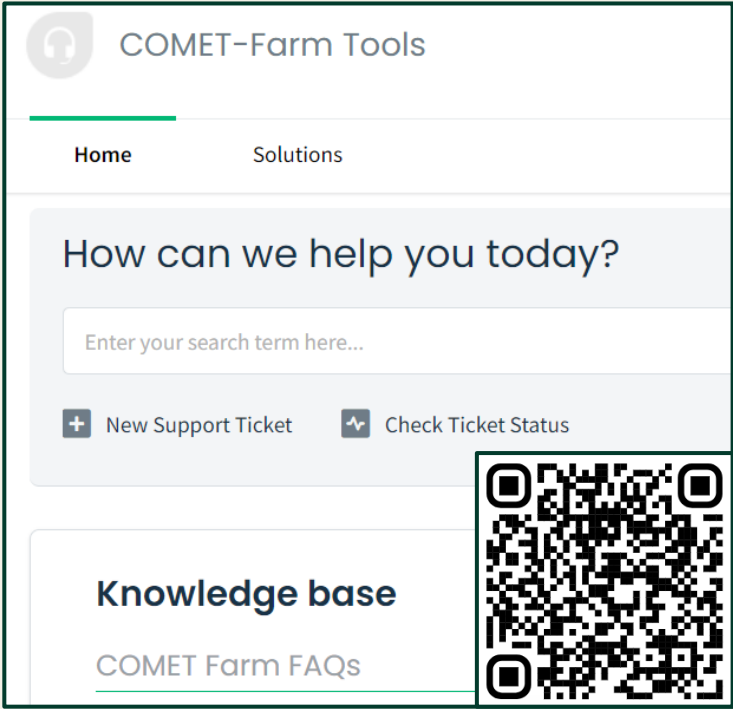
**Decision Making**

**Carbon Market**





# COMET Methods & Resources





# Why make another tool?



Explore  
more  
with  
less



Visualize &  
interpret  
results

Compare  
climate benefits



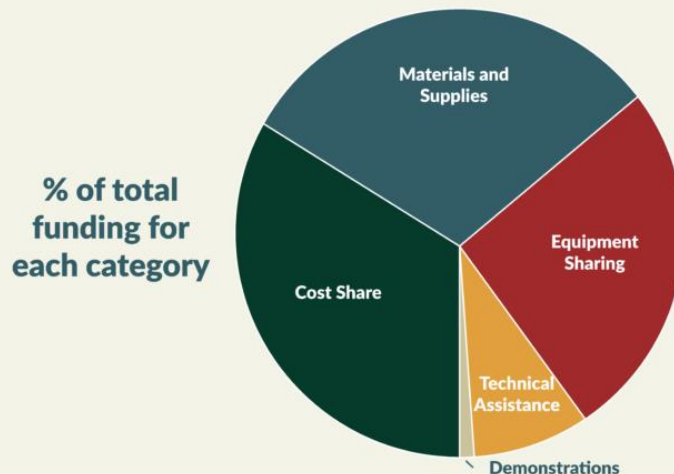


# Sustainable Farms and Fields 2023 Funded Projects

The Sustainable Farms and Fields program provides technical and financial assistance and funds shared equipment to make it easier and more affordable for farmers and ranchers to implement climate smart practices – or those that increase carbon sequestration and reduce greenhouse gas emissions

## What are the projects?

**\$1.8** million awarded to **53** projects



**12**  
projects for  
equipment sharing



**12**  
projects for  
technical assistance



## How are the climate impacts of projects being estimated?



Anticipated impacts  
estimated using  
Washington's Climate  
Smart Estimator

Is there funding available  
for next year?

**\$1.5** million  
anticipated for 2024

For the first fiscal year,  
funding awarded to  
**25/45**  
Washington's Conservation  
Districts and one County  
government

Eligible land use types:

  
Aquaculture  
Tideland

  
Rangeland

  
Farmland





# COMET and WaCSE Comparison

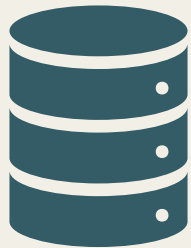
**User Interface**



**Visualization**



**Data**



**Report**

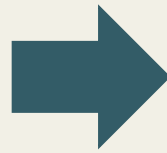




# COMET-Farm requires 20 years of historical management to generate a 10-year prediction.



Farm  
scale



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: Circle1

Data complete Data incomplete Selected

Parcel Management Summary

[ Delete Selected Crop ]

Drag and Drop Crop Rotation

2000 Alfalfa

2001 Fallow Alfalfa

2002 Alfalfa

2003 Fallow Alfalfa

2004 Alfalfa

2005 Fallow Alfalfa

Tillage, Implements, Manure/Compost & Planting Application Liming

Crop and Planting Date Irrigation Fertilizer Application Burning

For Parcel Circle1 in 2000 what crop did you plant, when did you plant, and when did you harvest?

What type of crop?:  
☒ Annual Crop/Hay/Grass ☐ Seasonal Cover Crop ☐ Orchard/Vineyard Crop

Crop Alfalfa

☐ Continue perennial crop from last year?

Planting Date 01/01/2000

Harvest Table

Add New Harvest

Harvest Date	Grain / Fruit / Seed / Root / Tuber?	Yield (tons/ac)	Straw / Stover / Hay / Residue Removal (% dry matter)	Delete
08/30/2000	<input type="checkbox"/>	1.67	50	X
07/16/2000	<input type="checkbox"/>	1.67	50	X
06/01/2000	<input type="checkbox"/>	1.67	50	X



# COMET-Planner requires no management history to generate an annual average over 10 years.



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

Project Name:

State:  


Washington

County:  


Lincoln

Multi-county scale


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




Cropland Management




Grazing Lands



Cropland To Herbaceous Cover



Restoration of Distrurbed Lands



Woody Plantings

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.

Conservation Practice Standard (CPS):

☐ Combustion System Improvement (CPS 372)

☐ Conservation Crop Rotation (CPS 328)

☒ Cover Crop (CPS 340)

☐ Mulching (CPS 484)

Conservation Practice Implementation:

☒ Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Irrigated Cropland

☐ Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland

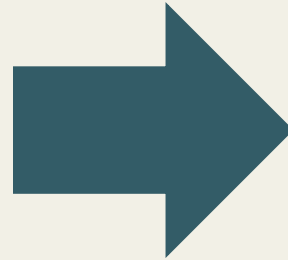
☐ Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to Non-Irrigated Cropland

☐ Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to Irrigated Cropland





COMET-Planner uses **generalized**  
COMET-Farm outputs.



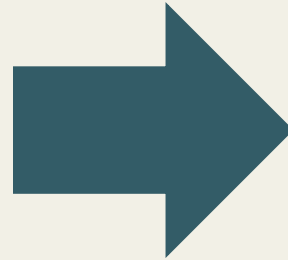
**COMET-Planner**





WaCSE uses COMET-Planner data  
(filtered to WA).

COMET-Planner





**Step 1. County**

Adams × Snohomish × ×

**Step 2. Conservation Class**

Select NRCS categories that describe the practices you are interested in.

Grazing Lands × ×

**Step 3. Conservation Practice**

Select NRCS conservation practice standards (CPS) you are interested in.

Prescribed Grazing (CPS 528) × ×

**Step 4. Current Land Use**

Select how the land currently is used.

Rangeland × Pasture × ×

**Step 5. Irrigation Type**

Select how the current system is irrigated.

Irrigated × Non-Irrigated × ×

WaCSE uses similar inputs as COMET-Planner but allows county comparison.





# COMET-Planner includes **only** tables.



## Approximate Carbon Sequestration and Greenhouse Gas Emission Reductions\*

(tonnes CO<sub>2</sub> equivalent per year) ⓘ

NRCS Conservation Practices		Acreage	Carbon Dioxide	Nitrous Oxide	Methane	Total CO <sub>2</sub> Equivalent
 ⓘ	Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100 ac	-8	14	0	6
 ⓘ	Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100 ac	-5	8	0	3
Totals		200	-13	22	0	9



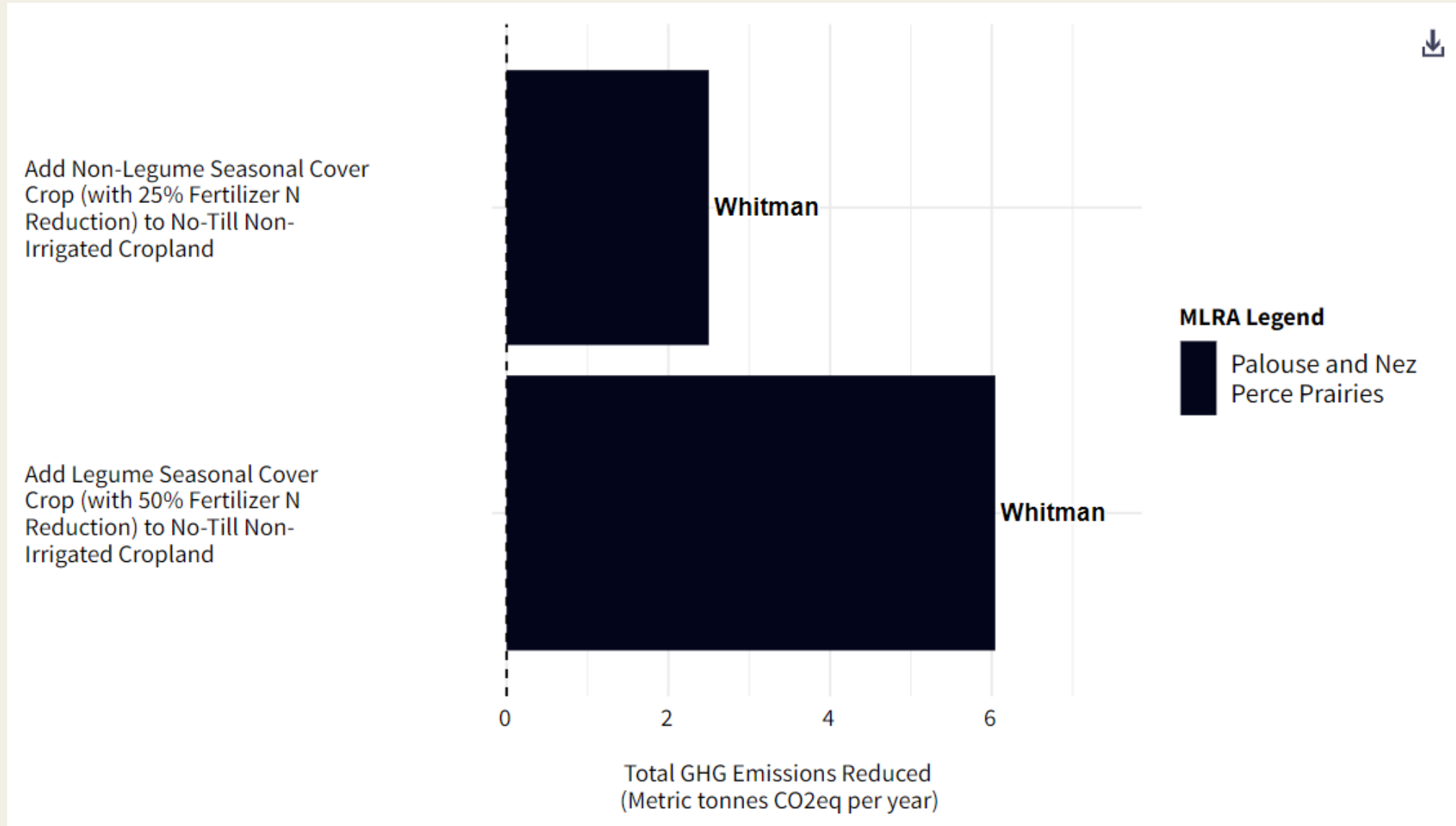
# WaCSE includes tables.



County*	Conservation Practice	Practice Implementation	Acres	Carbon Dioxide	Nitrous Oxide	Methane	Total GHG
				Emission reductions in MT CO <sub>2</sub> eq/yr**			
Whitman	Cover Crop (CPS 340)	Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100	-8.02	14.06	0.00	6.04
Whitman	Cover Crop (CPS 340)	Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100	-5.47	7.97	0.00	2.50



# WaCSE also includes plots.





# WaCSE also includes EPA's equivalency calculator.



## 8.5 metric tonnes of CO<sub>2</sub>eq is equivalent to CO<sub>2</sub> emissions from:

**1.7**

Homes' electricity use for one year



**956**

Gallons of gas consumed



**1,033,962**

Number of smartphones charged



## 8.5 metric tonnes of CO<sub>2</sub>eq is equivalent to GHG emissions avoided by:

**2.9**

Tons of waste recycled instead of landfilled



**0.4**

Trash bags of waste recycled instead of landfilled



**322**

Incandescent lamps switched to LEDs



## 8.5 metric tonnes of CO<sub>2</sub>eq is equivalent to carbon sequestered by:

**141**

Tree seedlings grown for 10 years



**10**

Acres of US forests in one year



**0.1**

Acres of US forests preserved from conversion to cropland in one year





# COMET-Planner's report only includes the table.

## COMET-Planner Report: Approximate Carbon Sequestration and Greenhouse Gas Emission Reductions

Project Name:

State: Washington

County: Whitman

Date: 2023/6/12 23:9:3

NRCS Conservation Practices	Acreage	Carbon Dioxide	Nitrous Oxide	Methane	Total CO2 Equivalent
Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100	-8	14	0	6
Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100	-5	8	0	3
Totals	200	-13	22	0	9

## And a table footnotes.

\*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

For more information on how these estimates were generated, please visit [www.comet-planner.com](http://www.comet-planner.com).



# WaCSE's report includes background info.



## Washington Climate Smart Estimator Report [wsda.shinyapps.io/WaCSE](https://wsda.shinyapps.io/WaCSE)

**Demo Project** report generated by **Demo Farm** on June 12, 2023

### **Who and what is WaCSE for?**

The Washington State Department of Agriculture developed WaCSE for the Washington State Conservation Commission to use in the Sustainable Farms and Fields (SFF) program. Intended users are the Conservation Commission, conservation districts, growers, and anyone interested in reducing agricultural greenhouse gas (GHG) emissions. This interactive tool estimates the reduction of GHG emissions from different conservation practices across Washington's diverse counties.

### **What are carbon dioxide equivalents?**

Carbon dioxide equivalent (CO<sub>2</sub>eq) is a unit used to compare various greenhouse gases based on their relative global warming potential.

### **What are total greenhouse gases?**

Total greenhouse gases (GHG) are the sum of carbon dioxide, methane, and nitrous oxide in units of CO<sub>2</sub>eq. Estimates include those associated with soils and woody biomass, but do not include off-site emissions like those from transportation.

### **What are emission reduction coefficients?**

Emission reduction coefficients were calculated by COMET-Farm, which uses USDA greenhouse gas inventory methods. More information on quantification methods can be found in the COMET-Planner Report.

### **What are major land resource areas?**

Major Land Resource Areas (MLRA) are defined by the NRCS as regions with similar physiography, climate, soils, biological resources, and land use (USDA-NRCS 2006). The GHG emission reduction estimates were calculated at the spatial scale of these multi-county MLRAs (Swan et al. 2022).

Counties within the same MLRA will have the same estimate, unless the county falls within multiple MLRAs. Visit WSDA's online map to identify which county is in which MLRA.



# and tables



## View your estimated GHG emission reductions

### Table Notes

- Counties are grouped by dominant MLRA.
- **Emission Reduction Calculation:** Area (Acres) × Emission Reduction Coefficient (ERC)
- Negative emission reductions indicate a loss of carbon or increased emissions of GHG.
- “Not estimated” indicates the NRCS has not evaluated this county and practice.

**Table 1:** Summary of Estimated Total Greenhouse Gas (GHG) Emission Reductions by County

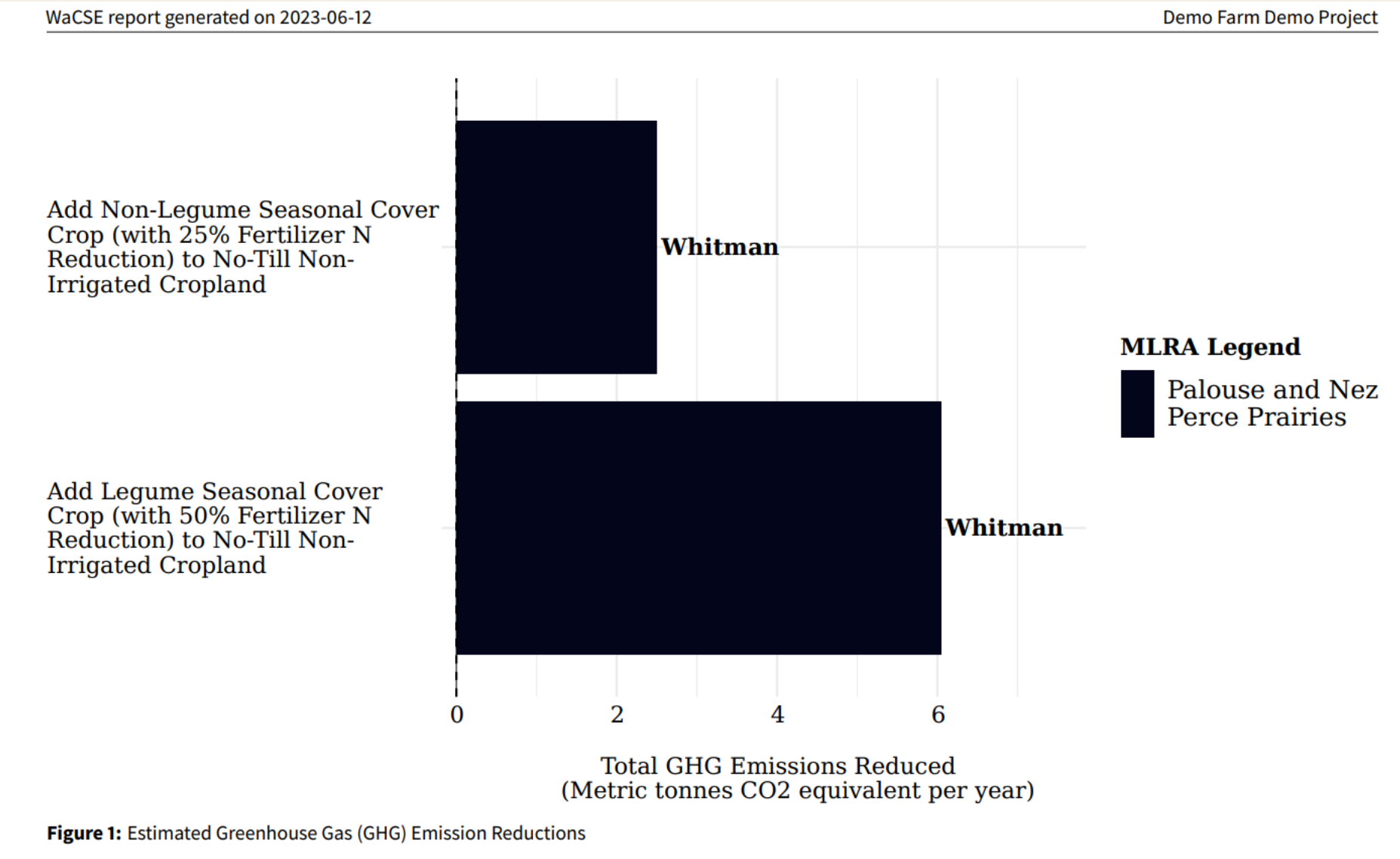
MLRA	County	Unique Practice Implementations	Total Acres	Total GHG (MT CO2eq/yr)
Palouse and Nez Perce Prairies	Whitman	2	200	8.5
<b>Totals</b>		<b>2</b>	<b>200</b>	<b>8.5</b>

**Table 2:** Estimated Greenhouse Gas (GHG) Emission Reductions

County	Practice	Implementation	Acres	(Metric tonnes CO2eq per year)			Total GHG
				Carbon Dioxide	Nitrous Oxide	Methane	
Whitman	Cover Crop (CPS 340)	Add Legume Seasonal Cover Crop (with 50% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland	100	-8.0	14	0	6.0



# and plots





# and the EPA equivalencies.



## Understand your impact

The values shown here are your total estimated esmissions reductions converted into terms you are more likely familiar with. Assumptions and equations used to calculate these values are provided in the Environmental Protection Agency's (EPA) [Greenhouse Gases Equivalencies Calculator](#). Results may differ slightly from those returned by EPA's calculator due to rounding.

**Your total estimated GHG emission reduction is: 8.5 metric tonnes CO2eq per year.**

This is equivalent to CO2 emissions from:	
1.7	homes' electricity use for one year
961	gallons of gas consumed
1,038,992	number of smartphones charged
This is equivalent to GHG emissions avoided by:	
3	tons of waste recycled instead of landfilled
0.4	trash bags of waste recycled instead of landfilled
324	incandescent lamps switched to LEDs
This is equivalent to carbon sequestered by:	
141	tree seedlings grown for 10 years
10	acres of US forests in one year
0.1	acres of US forests preserved from conversion to cropland in one year



# Washington Climate Smart Estimator

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## Demo



<https://wsda.shinyapps.io/WaCSE/>



# Which tool should you use?

**COMET-Planner**



- **Farm details not known**
- **Quick and dirty estimate**



- **Farm details known**
- **Detailed analysis**



Ball, K.R. et al.  
(2022) provides  
a detailed tool  
comparison,  
starting on  
page 35.



	Site & Climate		Soil		Land Management			Cropping			Inputs				Other GHG Sources		Useability		
	Climate & Weather	Geographical Location	Texture / Water Holding Capacity / Bulk Density	Initial SOC / SOM Content	Historical Management	Conservation Practice Status	Tillage / Ground Operations	Crop Type	Crop Rotation	Planting & Harvest Dates	Fertilizer	Organic Amendments	Irrigation	Grazing	Fuel & Energy	Transport	Predictive Scope (years)	Data Requirement	Required Operational Skill Level
DAY-CENT																	100+ years	High	High
COMET Farm																	10 years	Low	Med.
COOL Farm																	1 year	Low	Low
WaCSE																	1 year	Low	Low

Fully user-defined via manual entry or input flexibility
 Defined from external data/other related tools

Defined through drop down (restricted choices)
 Not defined



# Try WaCSE Out for Yourself!



<https://wsda.shinyapps.io/WaCSE/>



Leslie Michel





# Questions? Comments? Ideas?

**Jadey Ryan**  
**[jryan@agr.wa.gov](mailto:jryan@agr.wa.gov)**



Leslie Michel