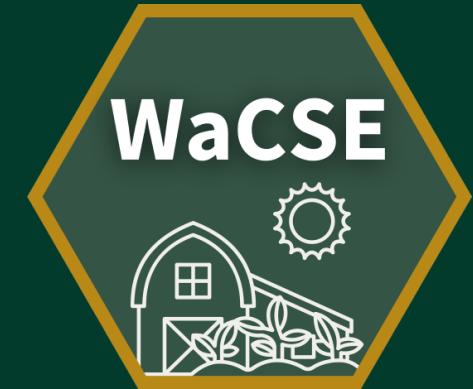


# Washington's Soil Health Initiative

&

# 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

Washington Soil Health Initiative

A close-up photograph of a wheat field under a clear blue sky. The wheat stalks are tall and golden-yellow, with many long, thin awns extending from the seed heads. The perspective is from a low angle, looking up at the vast expanse of grain.

# Goal 1: Increase awareness of soil health



Leslie Michel



# Goal 2: Document the state of the soils



Leslie Michel

A wide-angle photograph of a agricultural field. The foreground is filled with rows of young, green plants, possibly soybeans, growing in dark brown soil. The plants have large, heart-shaped leaves. In the background, the field stretches to a distant horizon under a vast, cloudy sky.

# Goal 3: Improve understanding of soil health building practices



Leslie Michel

A photograph of a field where several dark-colored cattle are grazing on lush green vegetation. The foreground shows the dark, textured soil and some dry plant material. The cattle are scattered across the frame, with some in sharp focus and others slightly blurred in the background. The sky above is a clear, pale blue.

# Goal 4: Increase adoption of soil health building practices



Leslie Michel

# We need diverse solutions for diverse soils.



Molly Mcilquham

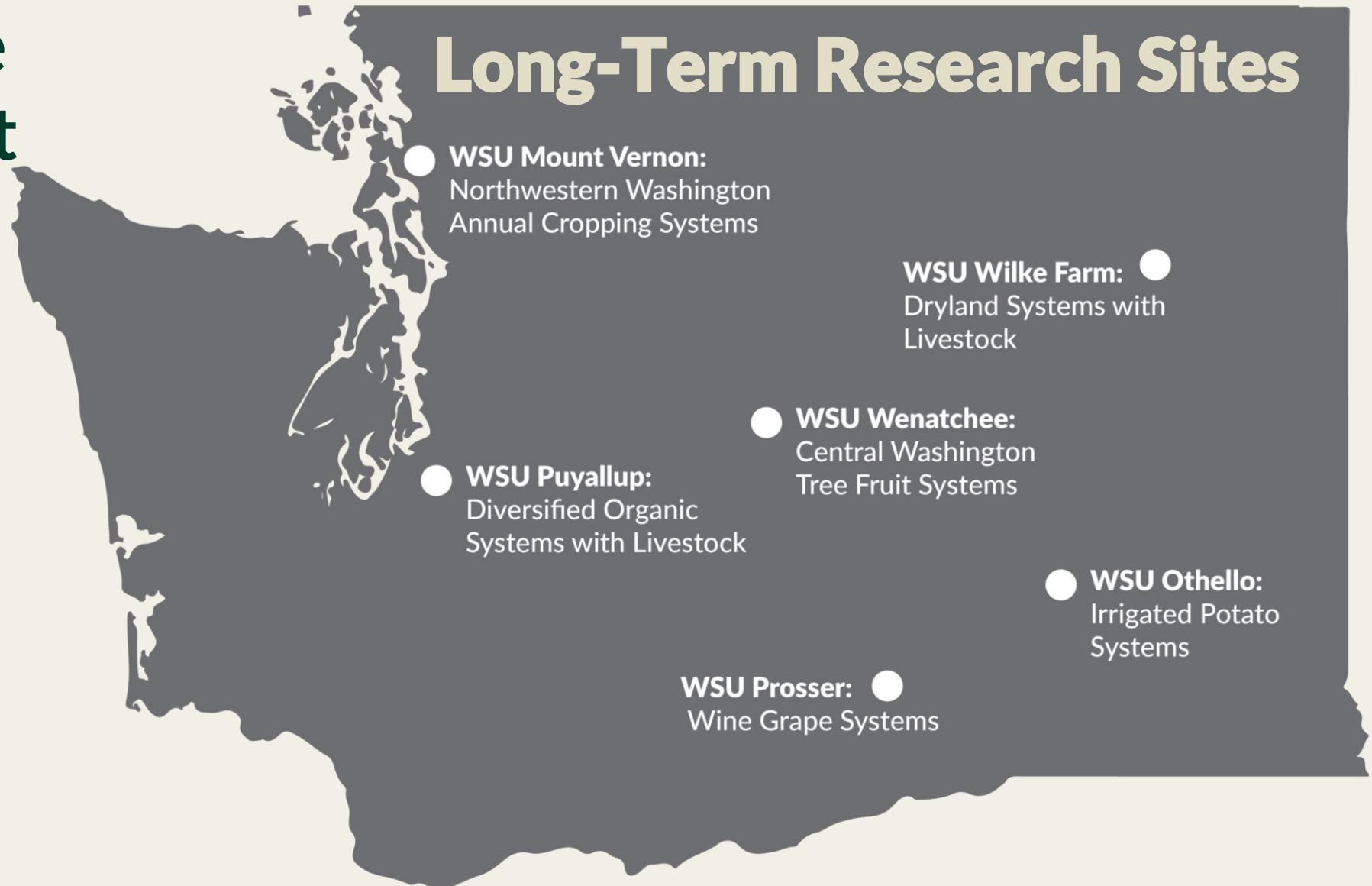


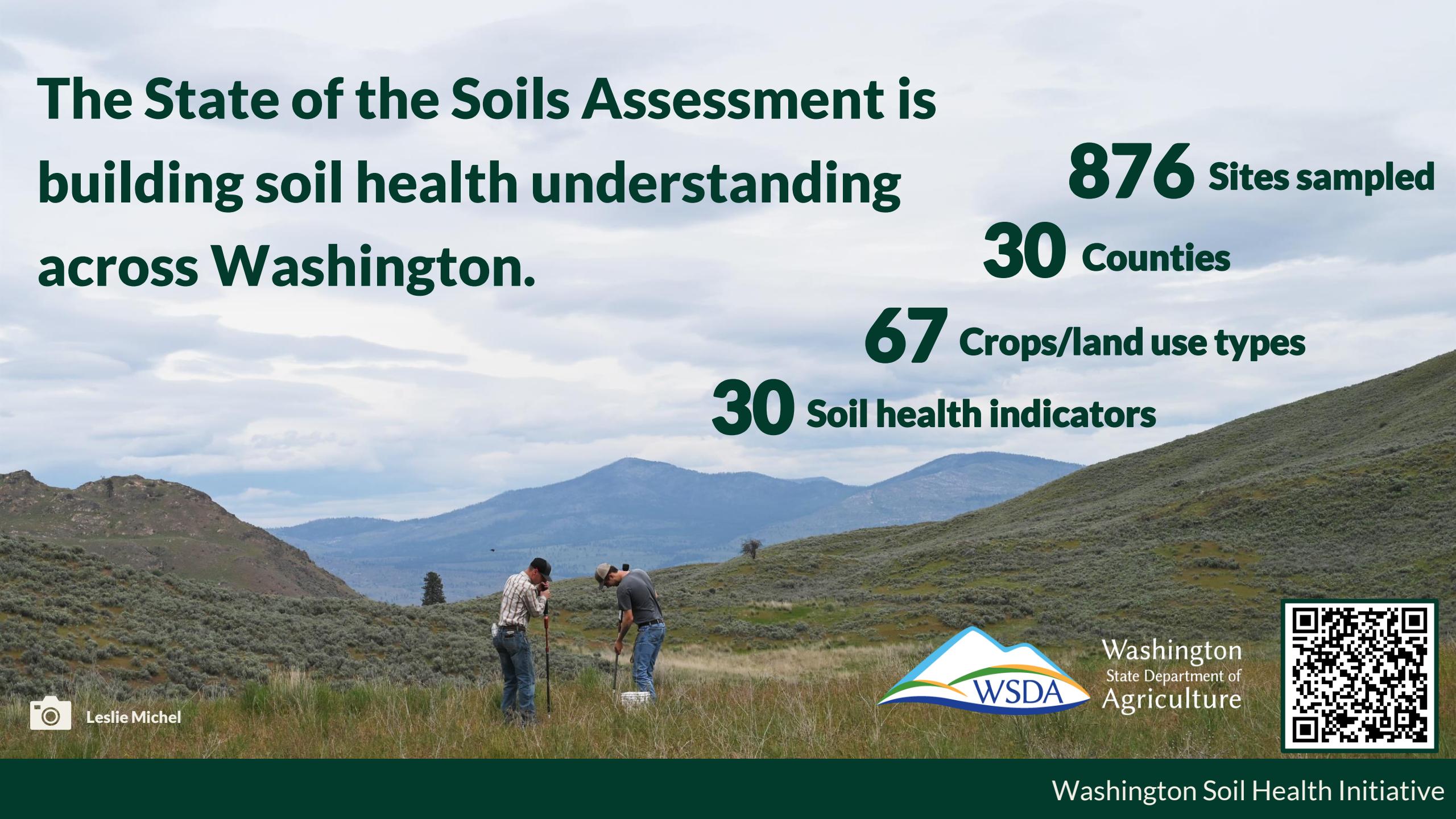
The Soil Health Roadmap identifies challenges, knowledge gaps, and goals for improving soil health.

A close-up photograph of ripe red raspberries on green stems. The raspberries are clustered together, showing their characteristic凹 (depressions) and凸 (elevations). The background is slightly blurred.

**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

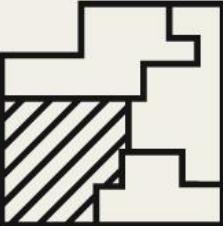


Washington Soil Health Initiative



702 

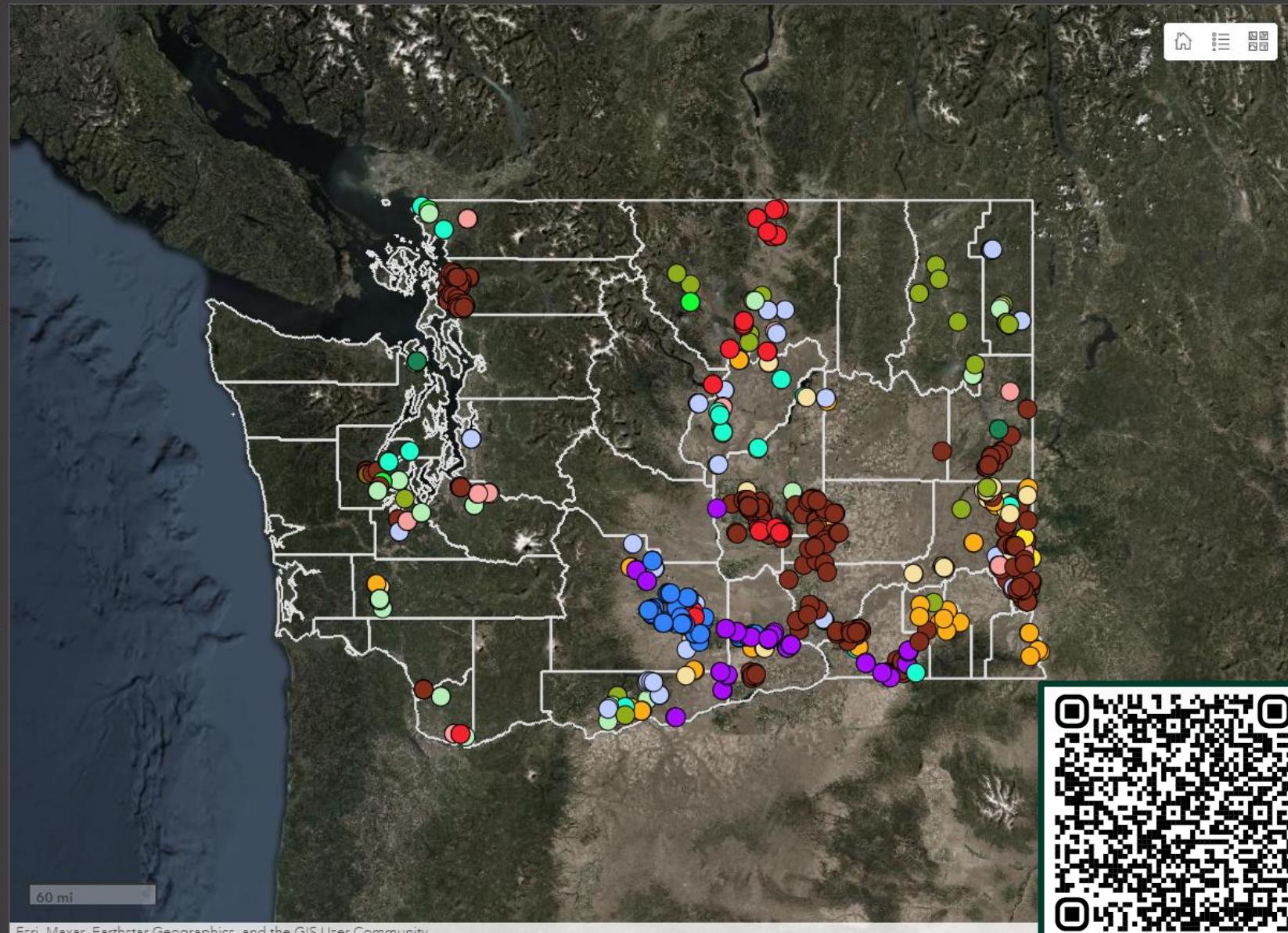
Samples

26 

Counties

50 

Crop Types





A woman with long dark hair, Dani Gelardi, is shown from the chest up. She is wearing a black over-the-ear headset with a microphone. The background is blurred, suggesting an office environment. A blue vertical bar is on the left side of the frame.

# 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*



**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.**



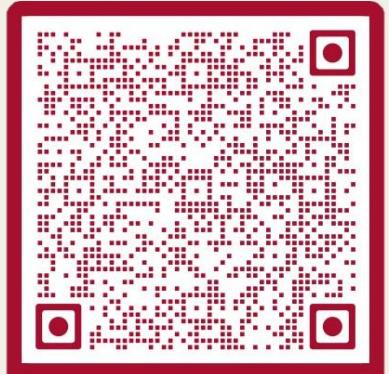
**STAR Science Committee forms July 2023**

**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



WESTERN  
SARE  
Sustainable Agriculture  
Research & Education

WSU Soil Health  
@WSU\_SoilHealth

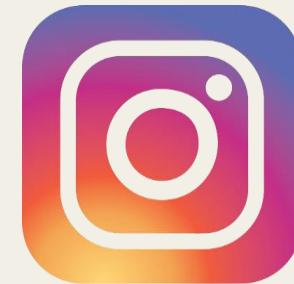
Some fava bean seedlings are soaking up a few sun rays during a break in the clouds @WSU\_NWREC. Fava beans are atmospheric nitrogen-fixing legumes and can be grown over the winter as a cover crop in Northwestern Washington.



9:51 AM · 26 Oct, 2022



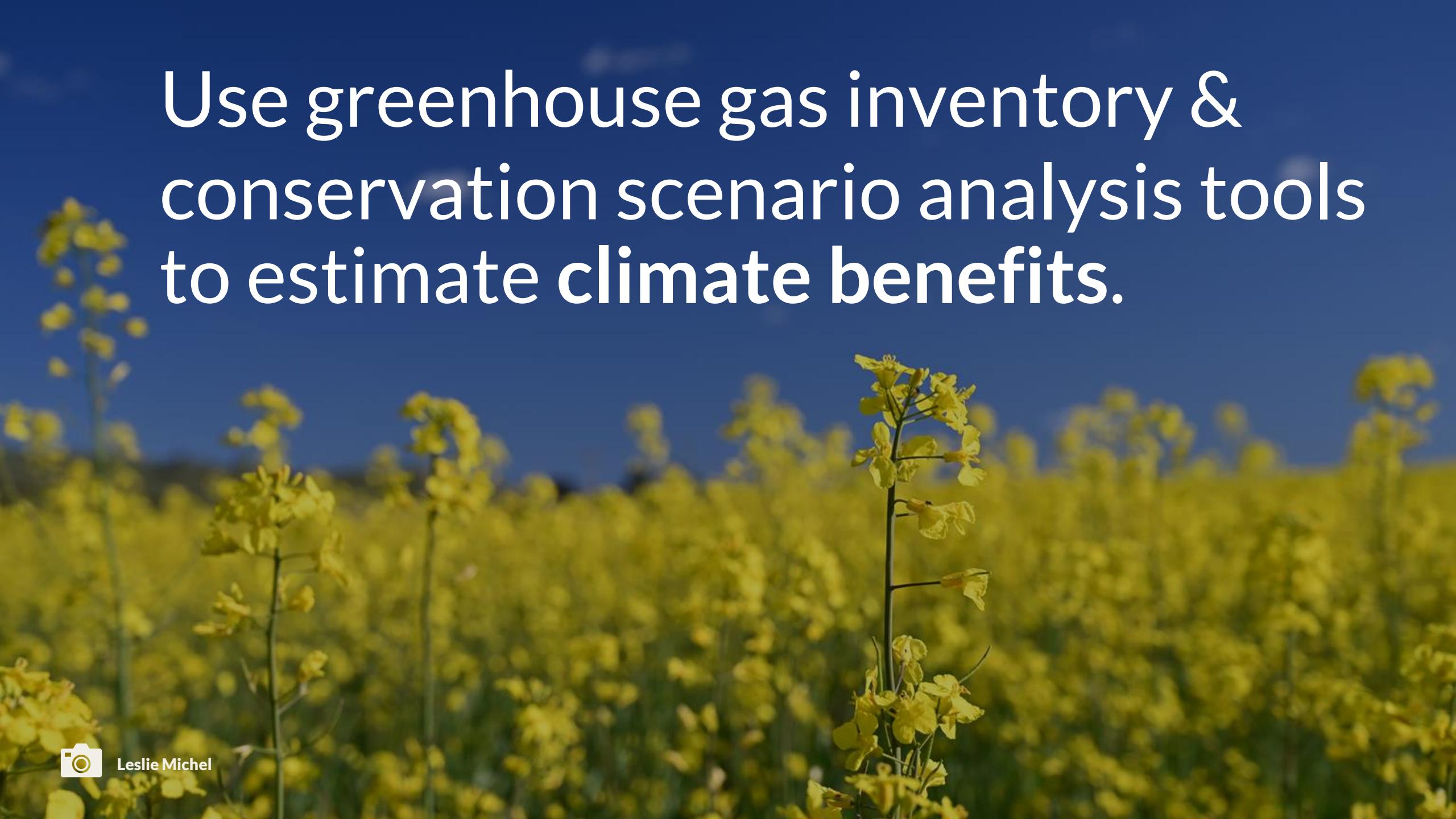
## WSDA Soil YouTube



@wsu\_soilhealth

# Questions? Comments? Ideas?

Dani Gelardi  
[dgelardi@agr.wa.gov](mailto:dgelardi@agr.wa.gov)

A photograph of a vast field of yellow flowering rapeseed plants (canola) under a clear blue sky. The plants are in sharp focus in the foreground and middle ground, while the background is blurred. The flowers are small and yellow, growing on tall green stems.

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



Leslie Michel

# There are three primary tools.

**COMET**  
Farm



United States Department of Agriculture  
Natural Resources Conservation Service



Whole Farm and Ranch  
Carbon and Greenhouse Gas  
Accounting System.

**COMET-Planner**



Natural Resources Conservation Service  
U.S. DEPARTMENT OF AGRICULTURE



**COLORADO STATE  
UNIVERSITY**



A photograph of a green tractor plowing a dark, tilled field. The sky is a warm orange and yellow at sunset. The tractor is positioned in the center-left of the frame, moving away from the viewer.

# There are many use cases for climate benefit estimates.

Incentive Programs

Conservation Farm Plans

Decision Making

Carbon Market



Leslie Michel

# COMET Methods & Resources



The image shows a screenshot of the COMET-Farm Tools website. The top navigation bar includes a user icon, the title "COMET-Farm Tools", and links for "Home" and "Solutions". Below the navigation is a search bar with the placeholder "Enter your search term here...". Underneath the search bar are two buttons: "New Support Ticket" and "Check Ticket Status". To the right of these buttons is a QR code. The main content area features sections for "How can we help you today?", "Knowledge base", and "COMET Farm FAQs".

The image shows a screenshot of a YouTube channel page for "COMET -Tools". The channel has 34 subscribers and 26 videos. The channel art is a circular image of agricultural fields. To the right of the channel information is another QR code.

# Why make another tool?



Explore  
more  
with  
less



Visualize &  
interpret  
results



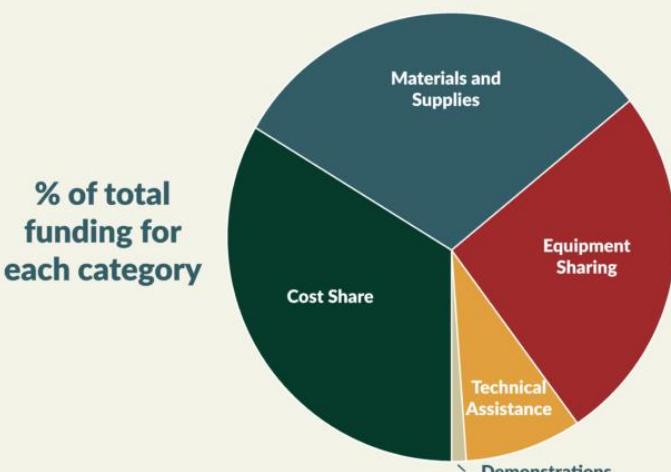


# Sustainable Farms and Fields 2023 Funded Projects

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



% of total  
funding for  
each category

**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

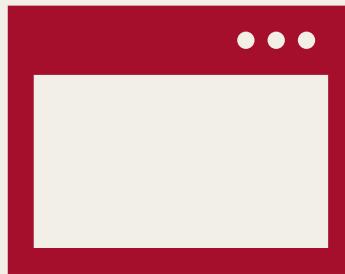


Farmland



# COMET and WaCSE Comparison

## User Interface



## Data



## Visualization



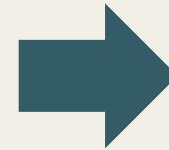
## Report





# 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 → Baseline Management → Scenario Management

Pre-2000 2000-2021 Scenarios for 10 year period

Select a parcel: Circle1

Circle2 (21 acres)

Circle1 (125 acres)

Data complete Data incomplete Selected

Tillage, Implements, Manure/Compost 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

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

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		1.67	50	X
07/16/2000		1.67	50	X
06/01/2000		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:

Enter 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



## 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):

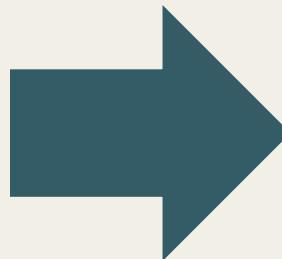
- Combustion System Improvement (CPS 372)
- Conservation Crop Rotation (CPS 328)
- Cover Crop (CPS 340)
- Mulching (CPS 484)

### 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.

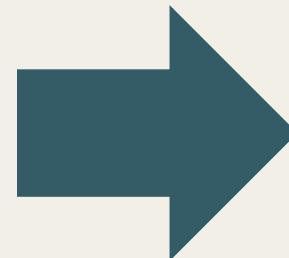


COMET-Planner



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

COMET-Planner



Filter the data ?



#### 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

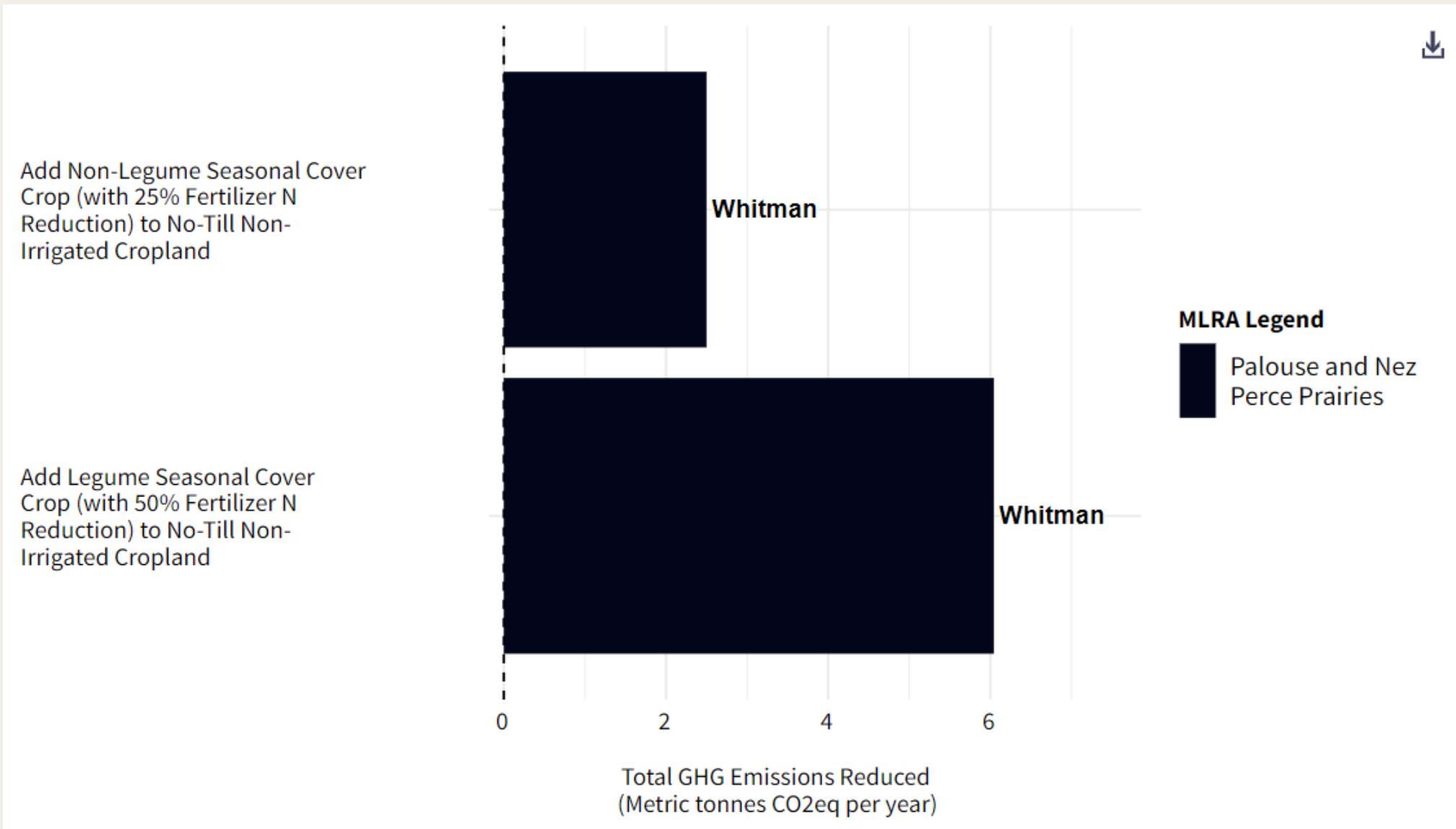


# WaCSE includes tables.

County*	Conservation Practice	Practice Implementation	Acres	Carbon Dioxide	Nitrous Oxide	Methane	Total GHG
<i>Emission reductions in MT CO2eq/yr**</i>							
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 CO <sub>2</sub> eq/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 CO <sub>2</sub> eq 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

WaCSE report generated on 2023-06-12

Demo Farm Demo Project

Add Non-Legume Seasonal Cover Crop (with 25% Fertilizer N Reduction) to No-Till Non-Irrigated Cropland

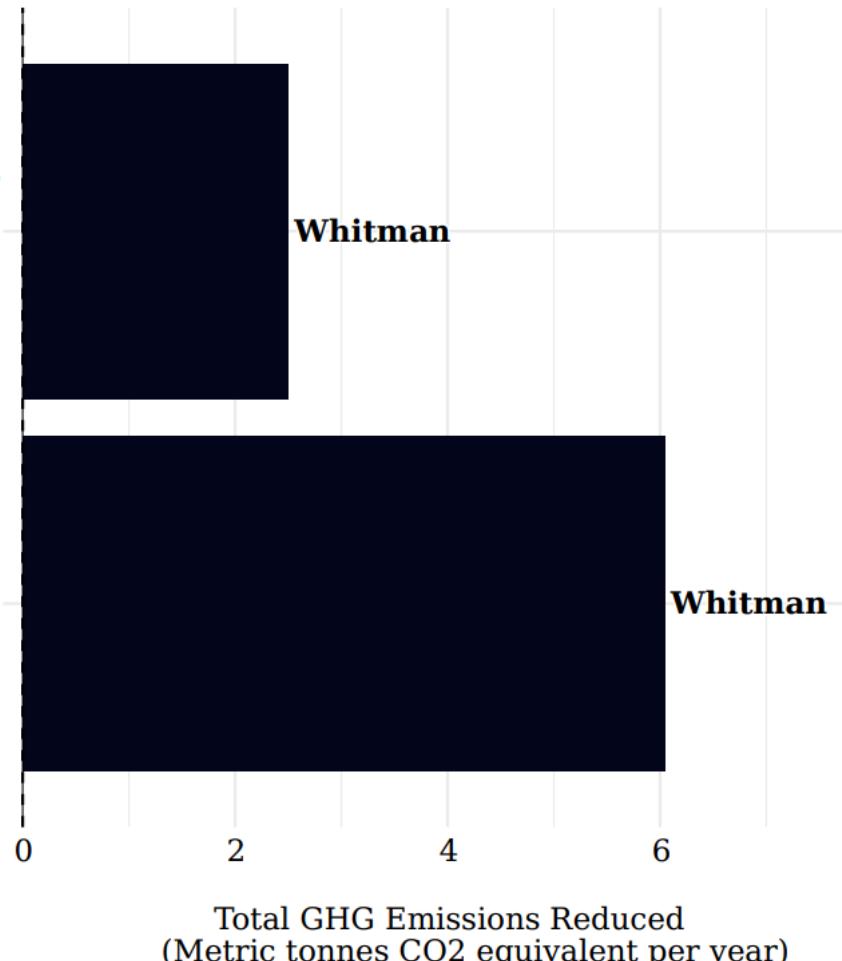
**Whitman**

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

**Whitman**

## MLRA Legend

 Palouse and Nez Perce Prairies



**Figure 1:** Estimated Greenhouse Gas (GHG) Emission Reductions



# and the EPA equivalencies.

## Understand your impact

The values shown here are your total estimated emissions 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 CO<sub>2</sub>eq per year.**

---

### This is equivalent to CO<sub>2</sub> 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

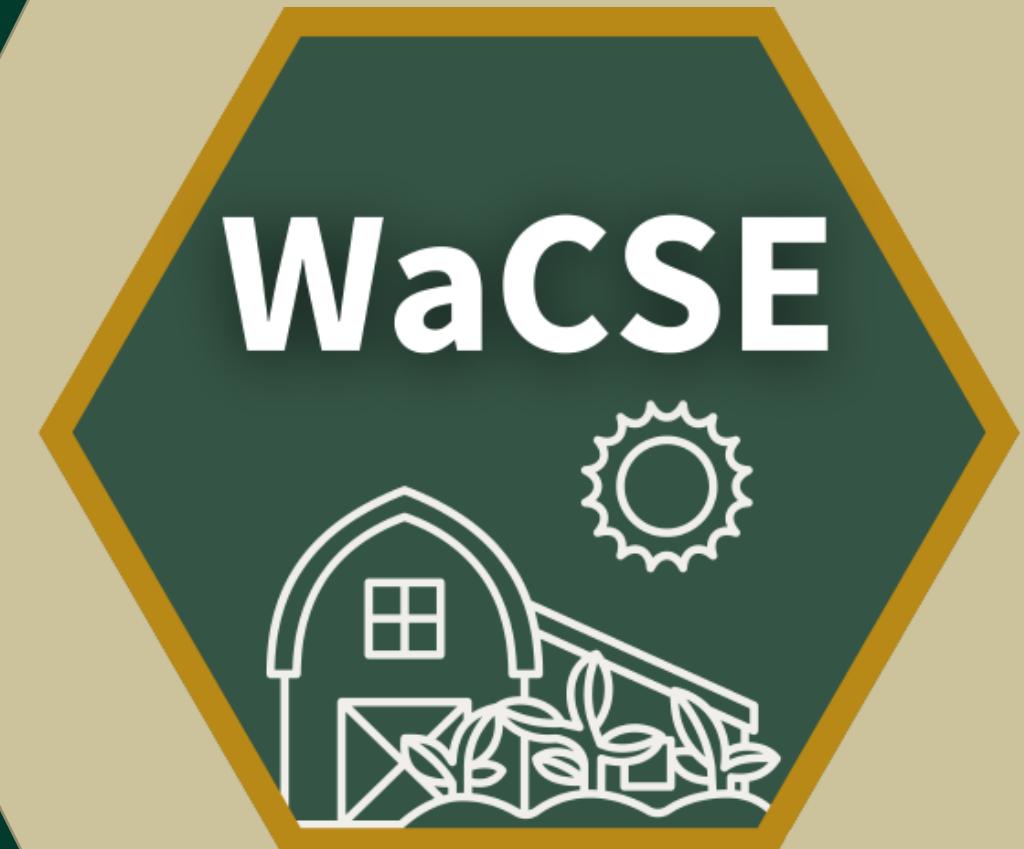
**10** acres of US forests in one year

**0.1** acres of US forests preserved from conversion to cropland in one year

# Washington Climate Smart Estimator

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## Demo



## WaCSE

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

# Which tool should you use?

COMET-Planner



COMET  
Farm

- **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	Usability
	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

Washington Soil Health Initiative

# Questions? Comments? Ideas?



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



Leslie Michel