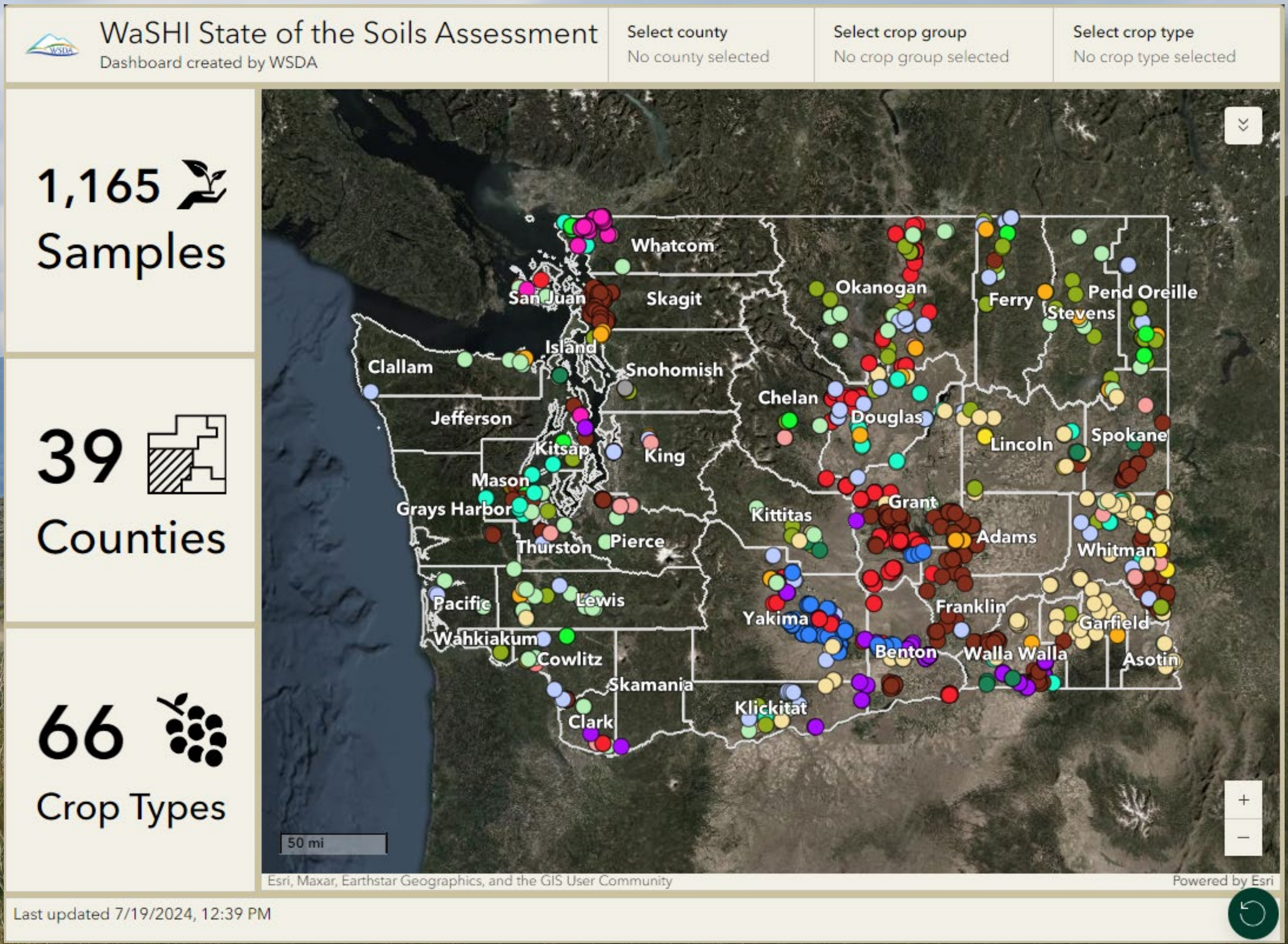
Modernizing data pipelines for accessible and actionable insights

Jadey Ryan
Data Scientist , WSDA

WSU NWREC Lunch & Learn
January 16, 2025

State of the Soils Assessment collected **1,165 samples** & provided **400+ custom reports** over 5 years.

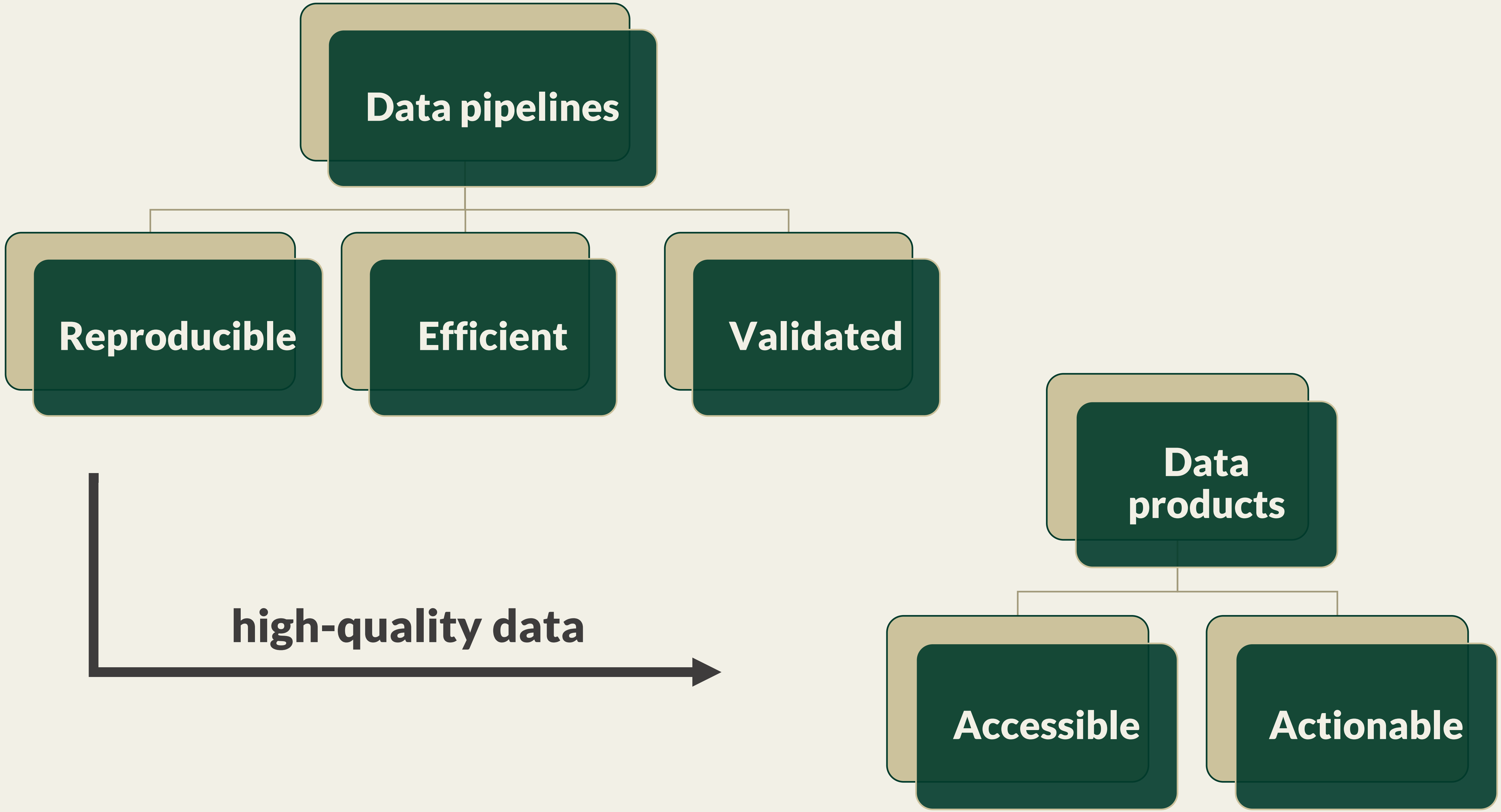
Scan or click! →



Leslie Michel

Data pipeline

Sample IDs & labels → Data collection → QA/QC lab results → Custom reports → Store scripts/data


Data pipelines
Reproducible
Efficient
Validated
high-quality data
Data products
Accessible
Actionable

Pipeline tools & technologies

Pen & Paper

MS Excel

MS Word

ArcGIS

Online

Field Maps

Survey123

quarto

R

GitHub

Art by Jack Corbett

Before: assign sample IDs & provide labels

Site Code and Label Cheat Sheet

Site Code and Sample ID

Each sample is assigned a unique Site Code and a Sample ID. Site Code and Sample ID are similar and only distinguished by the additional depth indicator for the Sample ID. Both include the County ID, Producer ID, Treatment ID, and Field ID. Sample ID includes a sampling depth for each soil sample.

		Item	Description or Abbreviation
Site Code (County – Field ID)	Sample ID (County – Depth)	County	First three letters
		Producer ID	Starting at 001, ascribed by CD
		Treatment ID	See below table, select option for the primary treatment
		Field ID	Starting at 01 for each producer
		Depth	0" to 6" = A, 6" to 12" = B, 0" to 12" = C, Bulk Density = Bd

Counties that have the same first three letters will be abbreviated as follows:

- Clark – CLK
- Grays Harbor – GRH
- Kitsap – KIP
- Skamania – SKM
- Klickitat - KLK

Treatment	Option 1	Option 2	Option 3	Option 4
Land type	Cropland (CL)	Conservation reserve program (CRP)	Native prairie (NP)	Rangeland (RNG)
Tillage	Conventional till (CT)	Strip till (ST)	No till (NT)	
Lime application	Lime application (L)	No lime application (NL)		
Cover crop	Cover crop (CC)	No cover crop (NCC)		
Pesticide application	Conventional (CON)	Organic (ORG)		

Project: WSDA SHI
Sample ID: ______________
Date: __________ Depth: ______
Initials: __________ CD:________

Project: WSDA SHI
Sample ID: ______________
Date: __________ Depth: ______
Initials: __________ CD:________

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Sample ID: ______________
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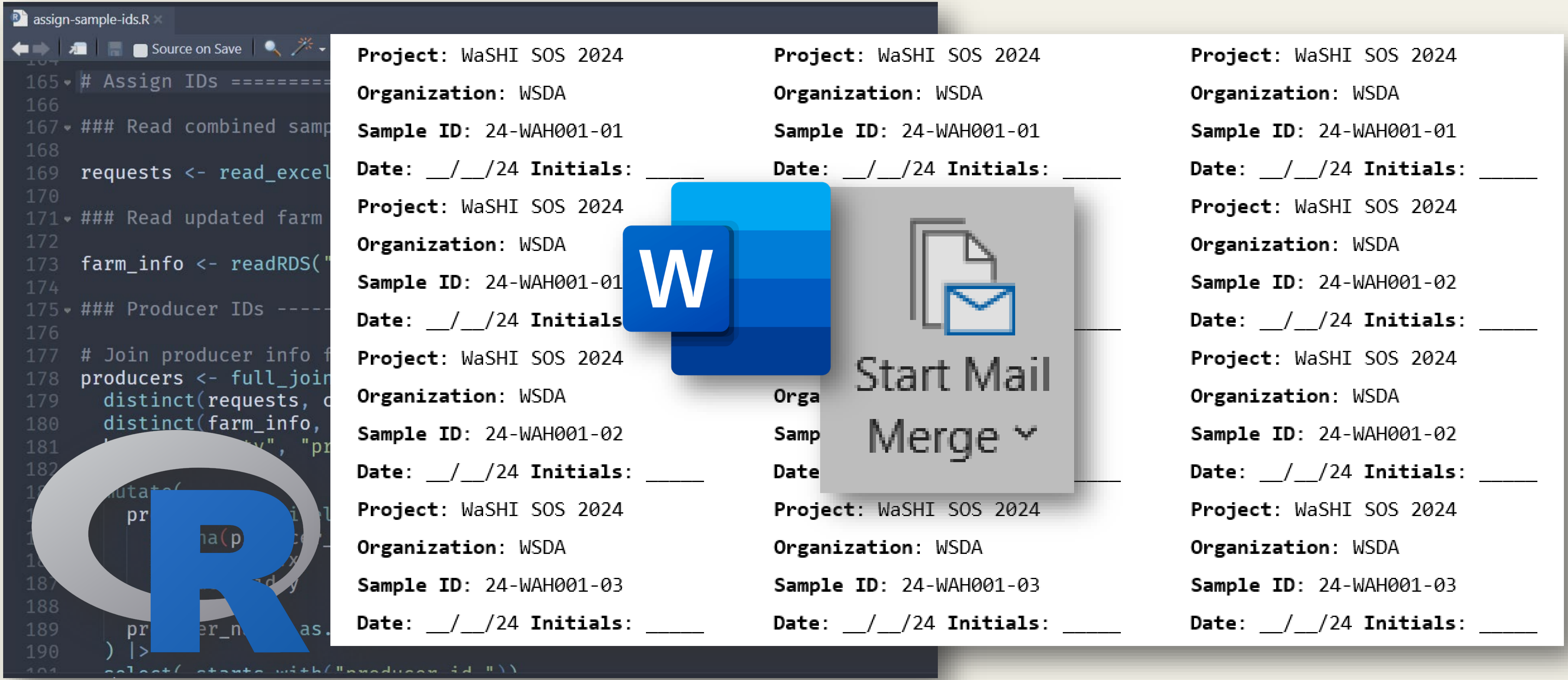
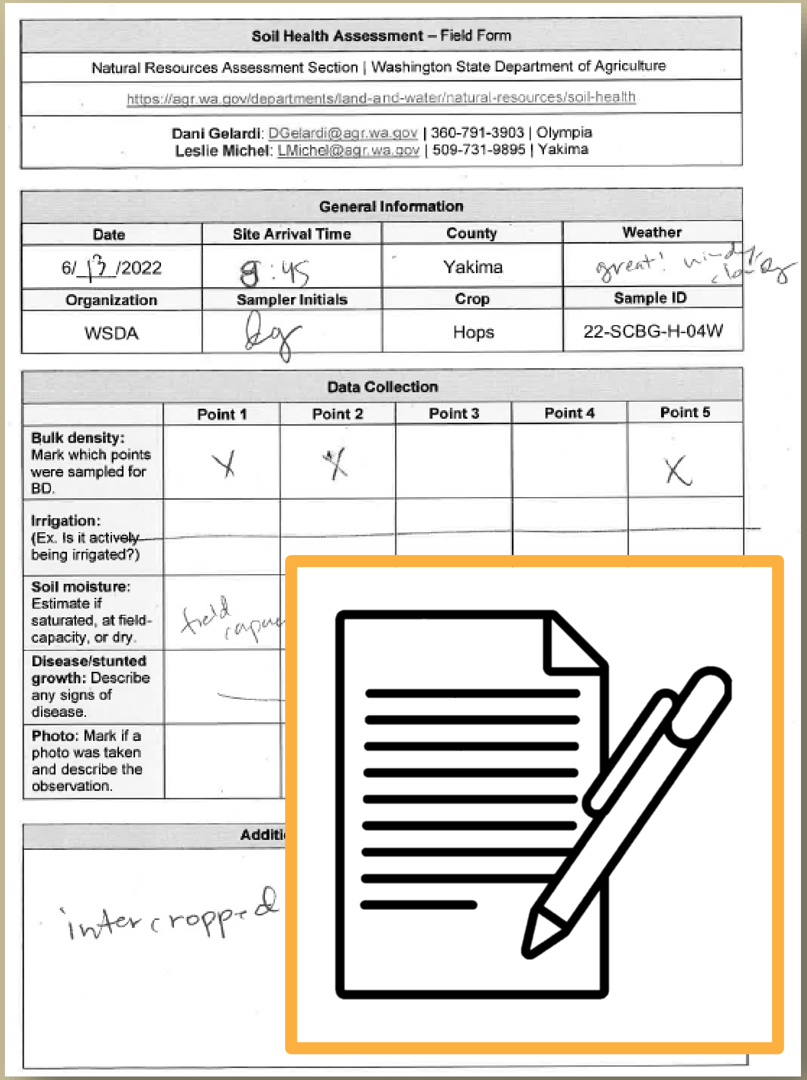
Date: __________ Depth: ______
Initials: __________ CD:________

After: assign sample IDs & provide labels



Before: field forms


Soil Health Assessment – Field Form
Natural Resources Assessment Section | Washington State Department of Agriculture
https://agr.wa.gov/departments/land-and-water/natural-resources/soil-health
Dani Gelardi: DGelardi@agr.wa.gov | 360-791-3903 | Olympia
Leslie Michel: LMichel@agr.wa.gov | 509-731-9895 | Yakima

General Information

Date	Site Arrival Time	County	Weather
6/13/2022	9:45	Yakima	great! windy/cloudy
Organization	**Sampler Initials**	**Crop**	**Sample ID**
WSDA	lg	Hops	22-SCBG-H-04W

Data Collection

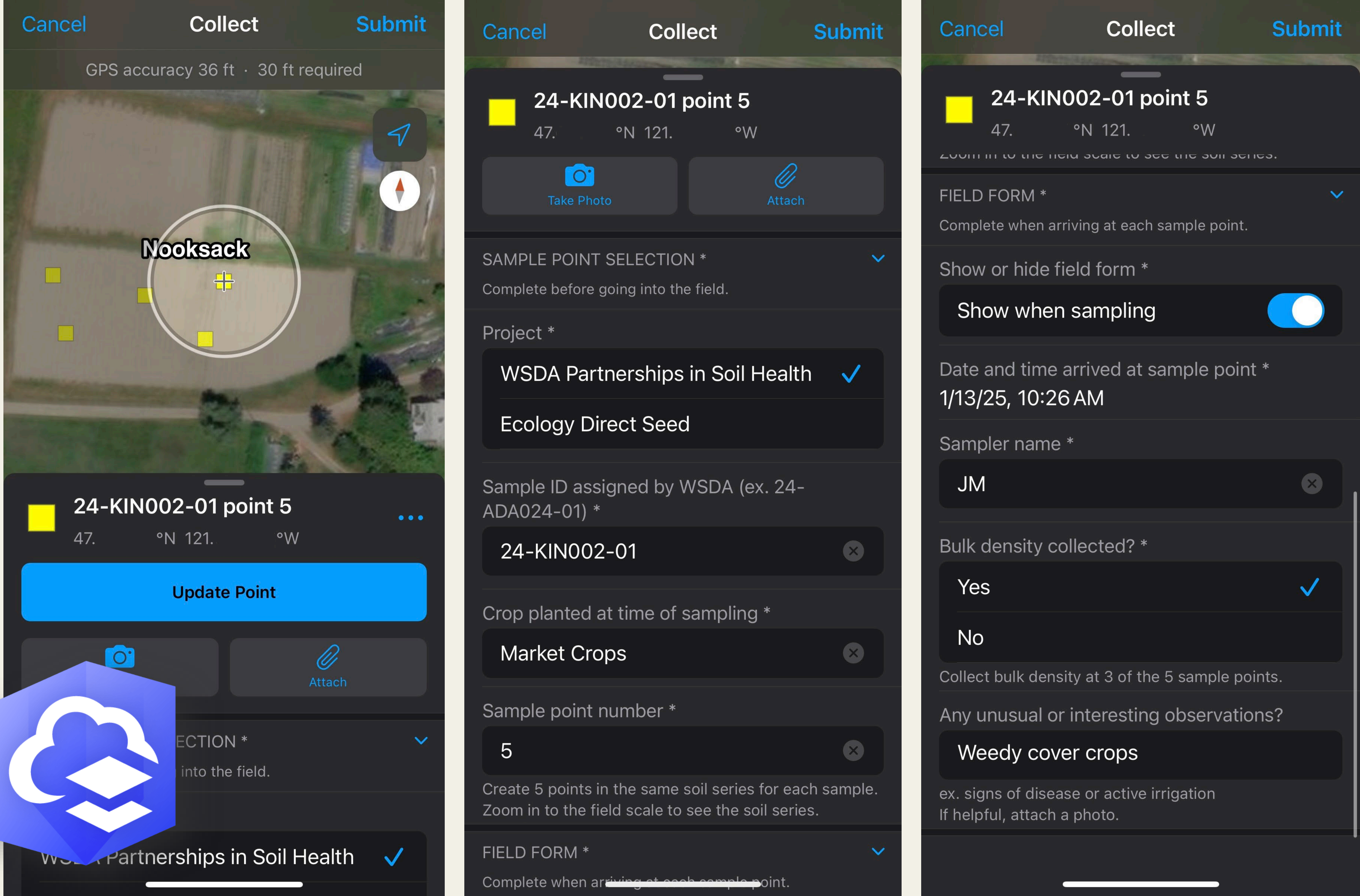
	Point 1	Point 2	Point 3	Point 4	Point 5
Bulk density: Mark which points were sampled for BD.	X	X			X
Irrigation: (Ex. Is it actively being irrigated?)					
Soil moisture: Estimate if saturated, at field-capacity, or dry.	field capac				
Disease/stunted growth: Describe any signs of disease.					
Photo: Mark if a photo was taken and describe the observation.					

Additi

intercropped

	A	B	C	D	E	F	G
1	sampleId	dateTime	crop	irrigation	soilMoisture	diseaseStunted	notes
2	22-CLA001-01-A	5/27/2022 10:00	Pasture	no	sat	no	
3	22-CLA001-02-B	5/27/22 11:00	Pasture	no	sat	no	
4	22-CLA002-01-C	4/26/22 12:00	Market, Brassica, And O	drip	3 fc, 2 sat	no	
5	22-CLA002-02-C	4/26/22 13:00	Cover Crops	drip, drip, drip, no, no	4 fc, 1 sat	no	
6	22-CLA003-01-A	5/27/2022 15:00	Pasture	no	sat	no	
7	22-CLA003-02-B	5/27/2022 14:00	Pasture	no	sat	no	
8	22-CLA006-01-H	4/20/22 10:00	Vegetable (Peppers)	drip	fc - dry	na	
9	22-CLA006-02	4/20/22 10:30	Blueberry	yes	fc	no	
10	22-CLA006-03	4/20/22 9:45	Squash	no	4 fc, 1 sat	no	
11	22-CLA006-04	4/20/22 11:00	Orchard	no	sat	no	
12	22-CLA006-05-H	4/20/22 11:30	Vegetable (Brassica Or	drip	slightly moist	no	
13	22-CLA008-01	4/21/22 9:00	Pasture	no	fc	no	
14	22-CLA009-01	4/19/22 11:00	Meadow	no	fc	no	meadow scaping
15	22-CLA009-02	4/19/22 12:00	Pollinators	no	3 sat, 2 fc	no	field 2 - pasture
16	22-DOU004-03-B	4/26/22 8:25	Wheat	no	dry	no	uniform wheat, lower levels
17	22-DOU007-03-C	5/3/22 9:30	Canola	no	dry	yes, no plants present	canola crop was sewn in durin
18	22-DOU017-01-C	5/3/22 8:35	Wheat	no	4 fairly dry with some moisture, 1 dry top 2" with		field is newly rollled over to
19	22-DOU017-02-C	4/25/22 15:00	CRP/Conservation	no	dry	na	grasses appear healthy and lu
20	22-DOU018-01-D	4/25/22 11:52	Wheat	no	dry	no	small amount of litter left on

After: field forms



Before: management surveys

	A	B	C	D	E	F	G	H	I	J	K	L
1	SAMPLE IDENTIFICATION						TILLAGE (for cash crop)					
2	Site Code	Crop Type	Years in Current Management	Number of crops (including cover crops) in one full	Years of Typical Crop Rotation	Percentage of year with live roots present	Tillage System	Subsoil Tillage (deep ripping) Used	Year of last tillage	Primary Tillage Implement	Secondary Tillage Implement	Ave Tilla c
3	FRA001CT01	Corn, Field	3-5	2	2-4	40-60	Conventional Till	No	2021	Turbotill	Drill, double disk	
4	FRA001CT02	Alfalfa Hay	3-5	1	5-8	40-61	Conventional Till	No	2021	Turbotill	Drill, double disk	
5	FRA001RNG03	CRP/Conservation	>20	0	Not applicable	80-100	Never Tilled	No	Never Tilled	Not applicable	Not applicable	

	A	B	C	D	E	F	G	H	I	J	K	L
1	SAMPLE IDENTIFICATION							TILLAGE (for cash crop)				
2	Site Code	Years Current Manageme nt	Crop Type	Years in Current Management	Number of crops (including cover crops) in one full rotation	Years of Typical Crop Rotation	Percentage of year with live roots present	Tillage System	Subsoil Tillage (deep ripping) Used	Year of last tillage	Primary Tillage Implement	Secondary Implem
3			Alfalfa Hay	1-2		Not applicable	Not applicable	Never Tilled	Yes	Not applicable	Not applicable	Not applicable
4			Alfalfa Seed	3-5		1	0-20	No-till	No	Within 1 week	Aerway	Aerway
5			Alfalfa/Grass Hay	5-10		2-4	20-40	Minimum Till		Within 1 month	Chisel plow	Chisel plow
6			Alkali Bee Bed	10-20		5-7	40-60	Conventional Till		Within 3 months	Chisel plow, with swee	Chisel plow, w
7			Allium	>20		8-10	60-80			Within 1 year	Cultipacker	Cultipacker
8			Apple			>10	80-100			More than 1 year ago	Drill, double disk	Drill, double d
9			Apricot							More than 3 years ago	Drill, hoe/chisel	Drill, hoe/chis
10			Asparagus								Drill, single disk	Drill, single di
11			Barley								Field Cultivator	Field Cultivato
12			Barley Hay								Field Cultivator, with s	Field Cultivato
13			ed								Harrow, coiled tine	Harrow, coiled
14			y								Harrow, pasture	Harrow, pastu
15			rbanzo								Harrow, rotary	Harrow, rotary
16			een								Harrow, spiked tooth	Harrow, spike

After: management surveys

SAMPLE IDENTIFICATION

Farm name:*

Field name:*

Your name:*

Unique sample ID for this field:*

(Enter the identical string of characters provided by WSDA)

Back

Next

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BASIC FIELD INFORMATION

What is currently planted at the time of soil sampling?*

Be as specific as possible!

Ex: Hemp, Spinach (seed), Nursery (lavender), Corn (field), Hay (oat)
Ex: Cover crops (legumes and brassica), Timothy, Fallow (tilled), Fallow (idle)

Approximately when when this crop planted?

Skip this question if not applicable.

MM/DD/YYYY

Approximately how many times has this crop been planted in the field's history?*

-Please select-

Please enter the field history for the last 5 years:

Be as specific as possible!

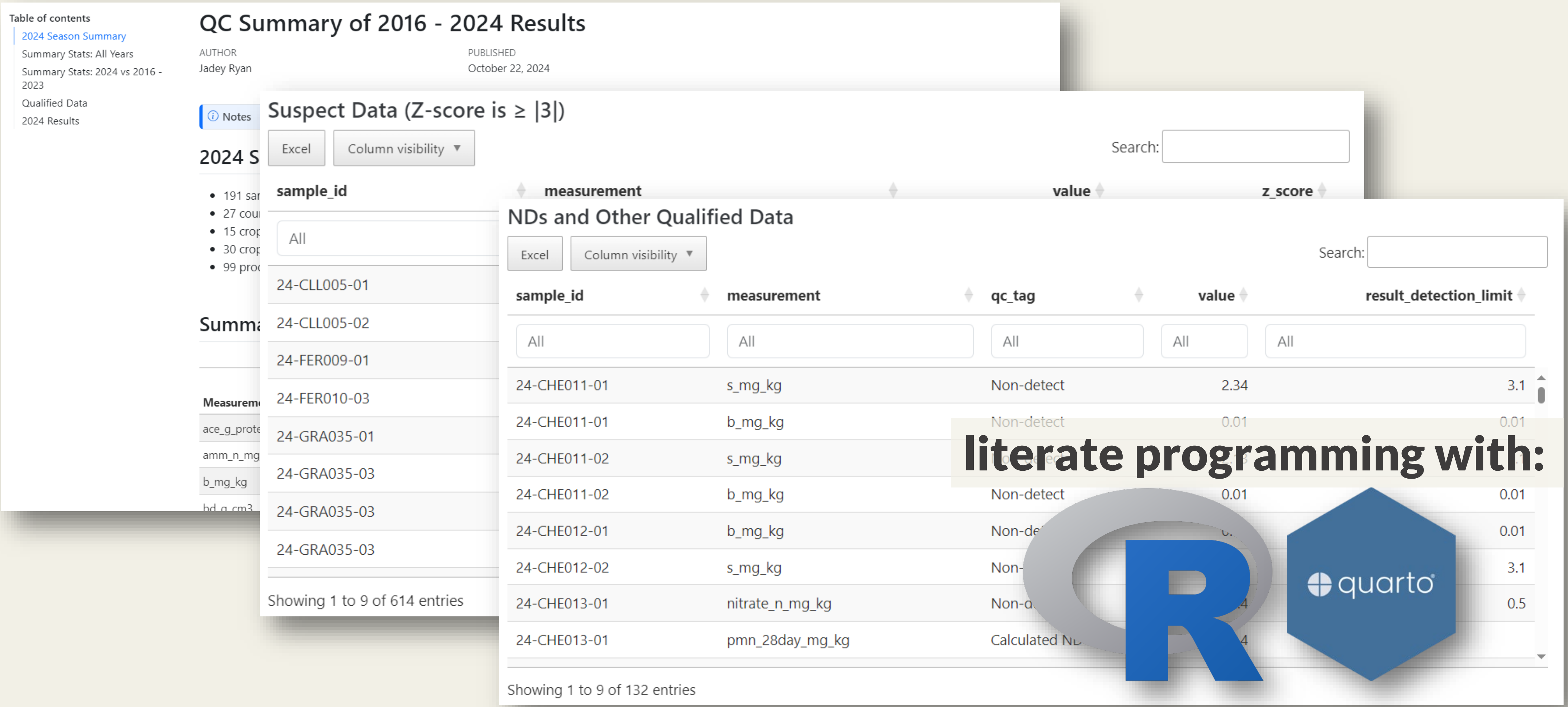
Example:
2024: Fallow (tilled)
2023: Fallow (idle), Tomato, Broccoli, Cover crop
2022: Cover crop, Tomato, Broccoli
2021: Fallow, Watermelons, Fallow
2020: Pear orchard (removed in spring)

2024:*

Before: QA/QC lab results

	A	B	C	D	E	F	G	H	I	J	K	L	M	
1	county	crop	sampleid	date	time	QC_notes	totalN_%	totalC_%	TOC_%	OM_%	poxC_mg.kg	24hrmin C_mgC.kg .day	96hrmin C_mgC.kg .day	amr mg.
2	Asotin	wheat_fallow	ASO001NT01	6/21/2021	0:00:00		0.11374	1.47365	1.47365	2.45	300		33.725	
3	Asotin	wheat_fallow	ASO001NT02	6/21/2021	0:01:00		0.10699	1.3785	1.3785	2.3	341		26.25	
4	Asotin	wheat_fallow	ASO002NT01	7/21/2021	0:02:00		0.14491	2.01225	2.01225	3	464		22.5	
5	Asotin	CRP	ASO003CRP01	6/24/2021	0:03:00		0.09639	0.99438	0.91438	1.7	217.5		45	
6	Asotin	wheat_fallow	ASO003NT01	7/21/2021	0:04:00		0.09882	1.1306	0.9856	1.6	247.5		37.5	
7	Benton	wheat_fallow	BEN001NT01	7/21/2021	0:05:00		0.06116	0.37396	0.33896	0.75	183.5		15	
8	Benton	CRP	BEN002CRP01	6/23/2021	0:06:00		0.06946	0.51007	0.39507	0.95	240		35.625	
9	Benton	wheat	BEN002CT01	6/23/2021	0:07:00		0.06557	0.47945	0.47945	0.85	175.5		26.25	
10	Columbia	wheat_fallow	COL002NL722	6/9/2021	0:08:00		0.12367	1.62855	1.62855	2.8	329.5		41.25	
11	Columbia	wheat_fallow	COL004NL733	5/12/2021	0:09:00		0.13091	1.78665	1.78665	2.85	412		50.625	
12	Columbia	wheat_fallow	COL006NL662	5/12/2021	0:10:00		0.10492	1.23707	1.23707	2	139.5		50.6	
13	Columbia	pea_dry	COL008NL372	6/8/2021	0:11:00		0.10113	1.19601	1.19601	1.95	120		31.875	
14	Columbia	alfalfa_hay	COL009NL971	5/12/2021	0:12:00		0.08637	0.85669	0.85669	1.7	187		28.125	
15	Columbia	pea_dry	COL010NL582	6/10/2021	0:13:00		0.09613	1.16808	1.11308	2	118		48.75	
16	Columbia	wheat_fallow	COL012NL202	5/12/2021	0:14:00		0.16156	2.2784	2.2784	3.8	419		43.125	
17	Columbia	wheat_fallow	COL014NL422	5/12/2021	0:15:00		0.11267	1.3079	1.3079	2.3	197		28.125	
18	Columbia	wheat_fallow	COL018NL131	5/12/2021	0:16:00		0.08865	0.86296	0.86296	1.55	75.5		16.875	
19	Columbia	wheat_fallow	COL020NL152	5/12/2021	0:17:00		0.09629	1.0755	1.0755	1.95	317.5		43.125	
20	Douglas	CRP	DOU004CRP01	6/18/2021	0:18:00		0.06382	0.57784	0.57784	1.15	301		18.75	
21	Douglas	pasture	DOU004RNG01	6/18/2021	0:19:00		0.06371	0.44198	0.44198	1.4	335		31.875	
22	Douglas	wheat_fallow	DOU006NT01	6/18/2021	0:20:00		0.09486	0.75548	0.70548	1.5	363.5		35.625	
23	Douglas	wheat_fallow	DOU006NT02	6/17/2021	0:21:00		0.10444	0.81524	0.81524	2.1	353.5		26.25	
24	Douglas	alfalfa_hay	DOU007AL01	6/18/2021	0:22:00		0.13352	0.95942	0.80442	1.95	475		52.5	
25	Douglas	pasture	DOU007RNG01	6/18/2021	0:23:00		0.05961	0.50447	0.49447	1.1	174.5		22.5	
26	Douglas	wheat_fallow	DOU016CC01	6/17/2021	0:24:00		0.08599	0.50144	0.50144	1.35	304		22.5	
27	Douglas	CRP	DOU016CRP01	6/17/2021	0:25:00		0.07743	0.64407	0.58407	1.15	219.5		31.875	
28	Franklin	corn_field	FRA001CT01	6/28/2021	0:26:00		0.07078	0.58464	0.45464	1.55	303.5		41.25	
29	Franklin	alfalfa_hay	FRA001CT02	6/28/2021	0:27:00		0.0791	0.69075	0.54075	1.4	463.5		18.75	
30	Franklin	pasture	FRA001RNG03	6/28/2021	0:28:00		0.04364	0.23035	0.08535	0.55	150.5		22.5	
31	Grant	pasture	GRA001CL01	6/8/2021	0:29:00		0.13518	1.3164	1.1514	1.75	369.5		46.875	
32	Grant	bean_dry	GRA002CT01	6/7/2021	0:30:00		0.0814	0.72476	0.72476	0.65	159		18.75	
33	Grant	garlic	GRA003CL01	6/8/2021	0:31:00		0.11147	0.96569	0.96569	1.15	289.5		18.75	
34	Grant	bean_dry	GRA004CL01	6/8/2021	0:32:00		0.11624	1.07515	0.88515	1.25	327.5		45	

After: QA/QC lab results



literate programming with:

After: QA/QC lab results

Pointblank Validation Series

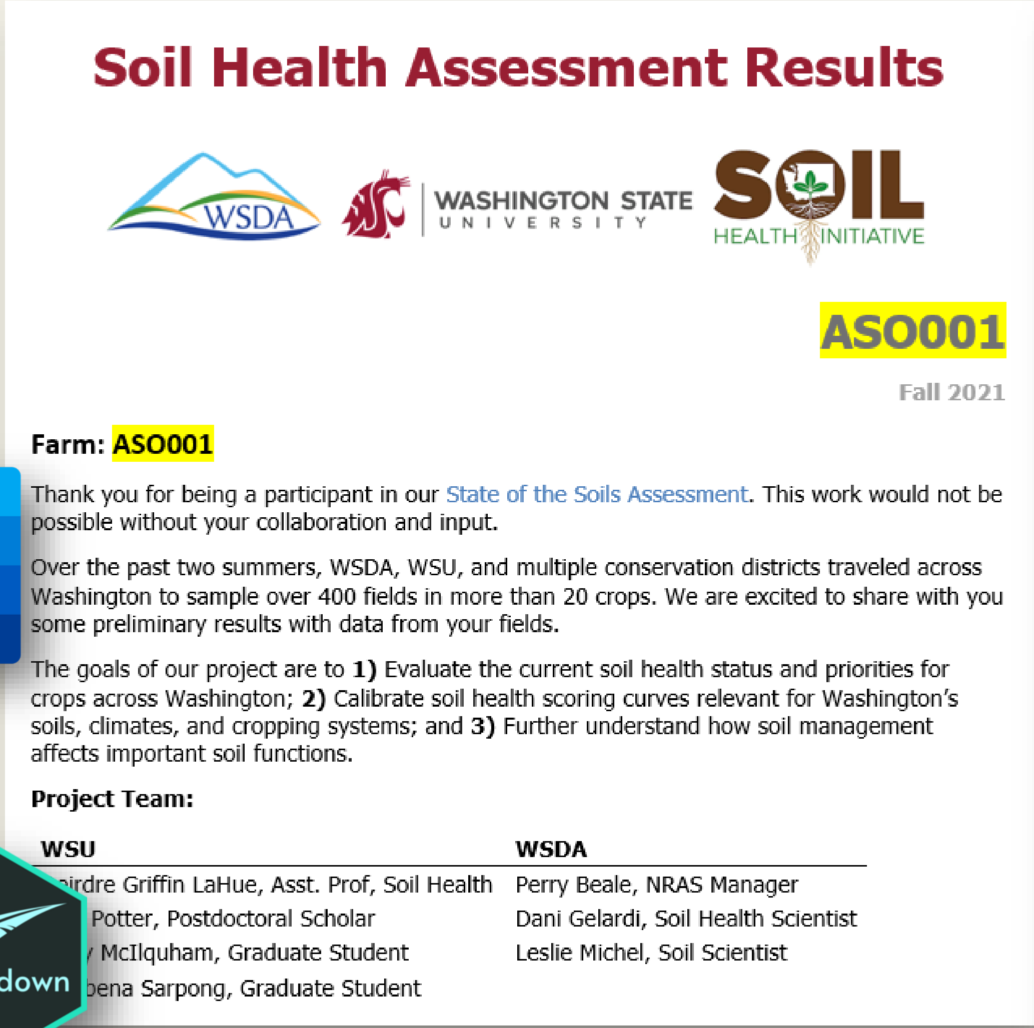
Project Metadata

DATA FRAME sos-project-metadata | WARN 1 | STOP — | NOTIFY —

	STEP	COLUMNS	VALUES	TBL	EVAL	UNITS	PASS	FAIL	W	S	N	EXT
1	project_id is not null `col_vals_not_null()`	project_id	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
2	project_name is not null `col_vals_not_null()`	project_name	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
3	project_description is not null `col_vals_not_null()`	project_descri…	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
4	project_organization is not null `col_vals_not_null()`	project_organi…	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
5	project_organization_type is not null `col_vals_not_null()`	project_organi…	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
6	project_contact_name is not null `col_vals_not_null()`	project_contac…	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
7	project_contact_email is not null `col_vals_not_null()`	project_contac…	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
8	project_id is unique `rows_distinct()`	project_id	—	○→	✓	7	7 1.00	0 0.00	○	—	—	—
9	project_organization is valid `col_vals_in_set()`	project_organi…	Adams CD, Asotin…		✓	12	12 1.00	0 0.00	○	—	—	—
10	project_organization_type is valid `col_vals_in_set()`	project_organi…	Conservation Dis…		✓	12	12 1.00	0 0.00	○	—	—	—
11	project_contact_email is valid `col_vals_within_spec()`	project_contac…	email		✓	12	12 1.00	0 0.00	○	—	—	—

2025-01-08 10:18:34 PST | 2.2 s | 2025-01-08 10:18:36 PST

Before: create reports



Soil Health Assessment Results

WSDA | WASHINGTON STATE UNIVERSITY | SOIL HEALTH INITIATIVE

ASO001

Fall 2021

Farm: ASO001

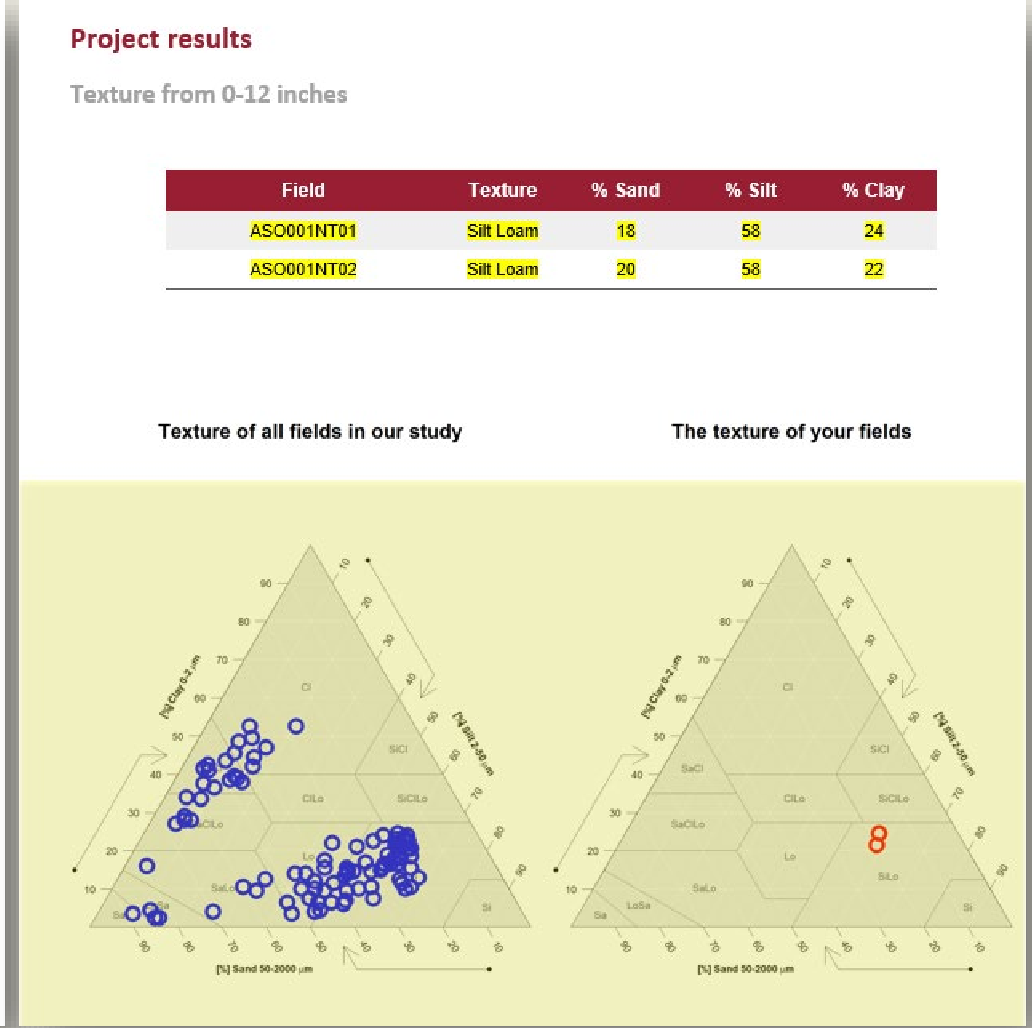
Thank you for being a participant in our State of the Soils Assessment. This work would not be possible without your collaboration and input.

Over the past two summers, WSDA, WSU, and multiple conservation districts traveled across Washington to sample over 400 fields in more than 20 crops. We are excited to share with you some preliminary results with data from your fields.

The goals of our project are to **1)** Evaluate the current soil health status and priorities for crops across Washington; **2)** Calibrate soil health scoring curves relevant for Washington's soils, climates, and cropping systems; and **3)** Further understand how soil management affects important soil functions.

Project Team:

WSU	WSDA
irdre Griffin LaHue, Asst. Prof, Soil Health	Perry Beale, NRAS Manager
Potter, Postdoctoral Scholar	Dani Gelardi, Soil Health Scientist
McIlquham, Graduate Student	Leslie Michel, Soil Scientist
bena Sarpong, Graduate Student	



Project results

Texture from 0-12 inches

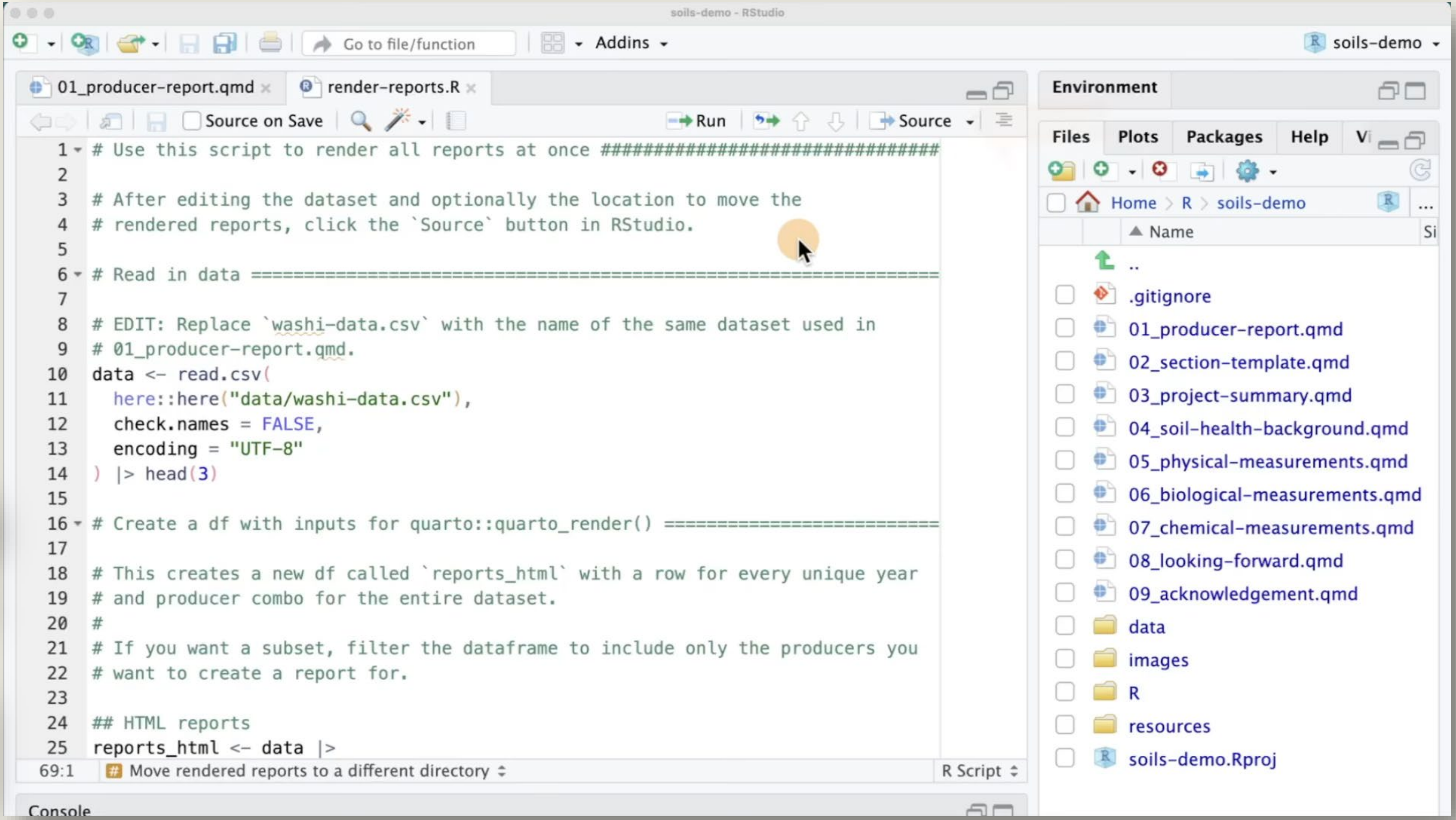
Field	Texture	% Sand	% Silt	% Clay
ASO001NT01	Silt Loam	18	58	24
ASO001NT02	Silt Loam	20	58	22

Texture of all fields in our study

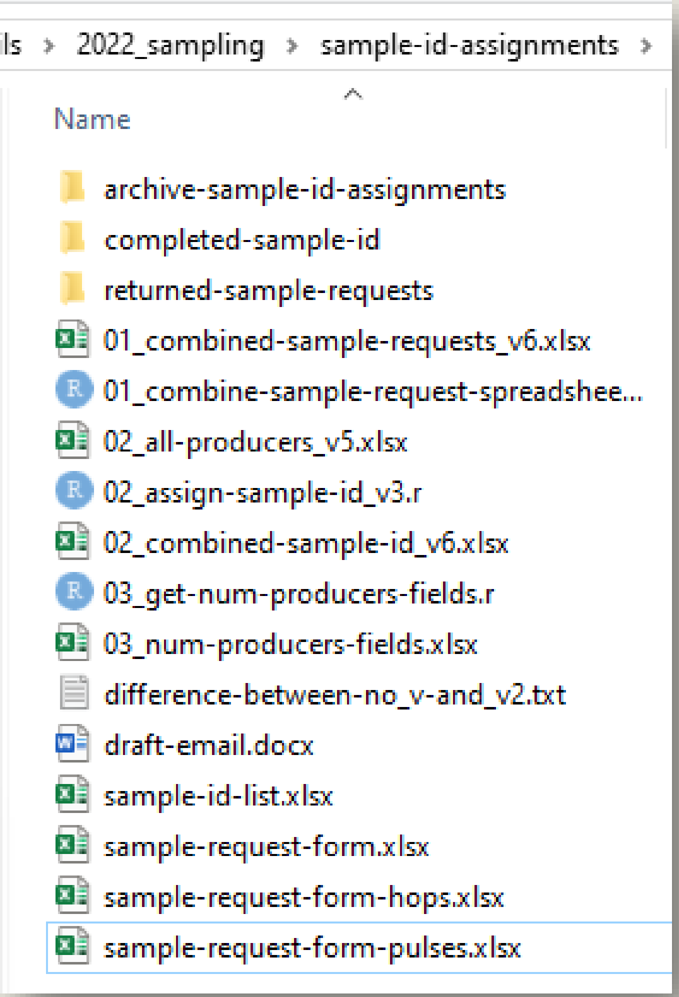
The texture of your fields

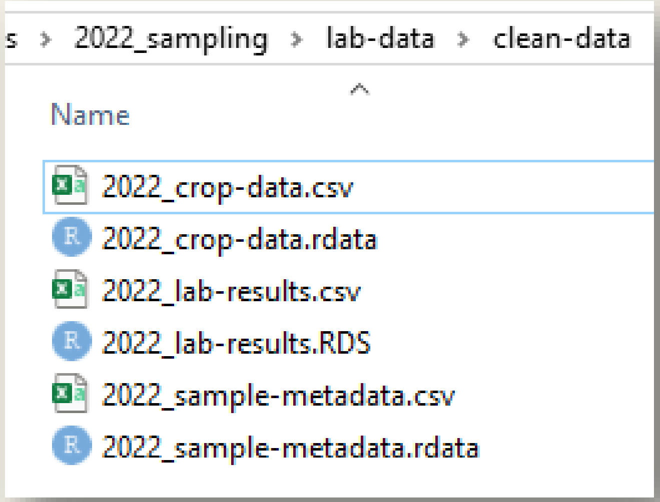
OR

After: create reports



Before: store scripts/data





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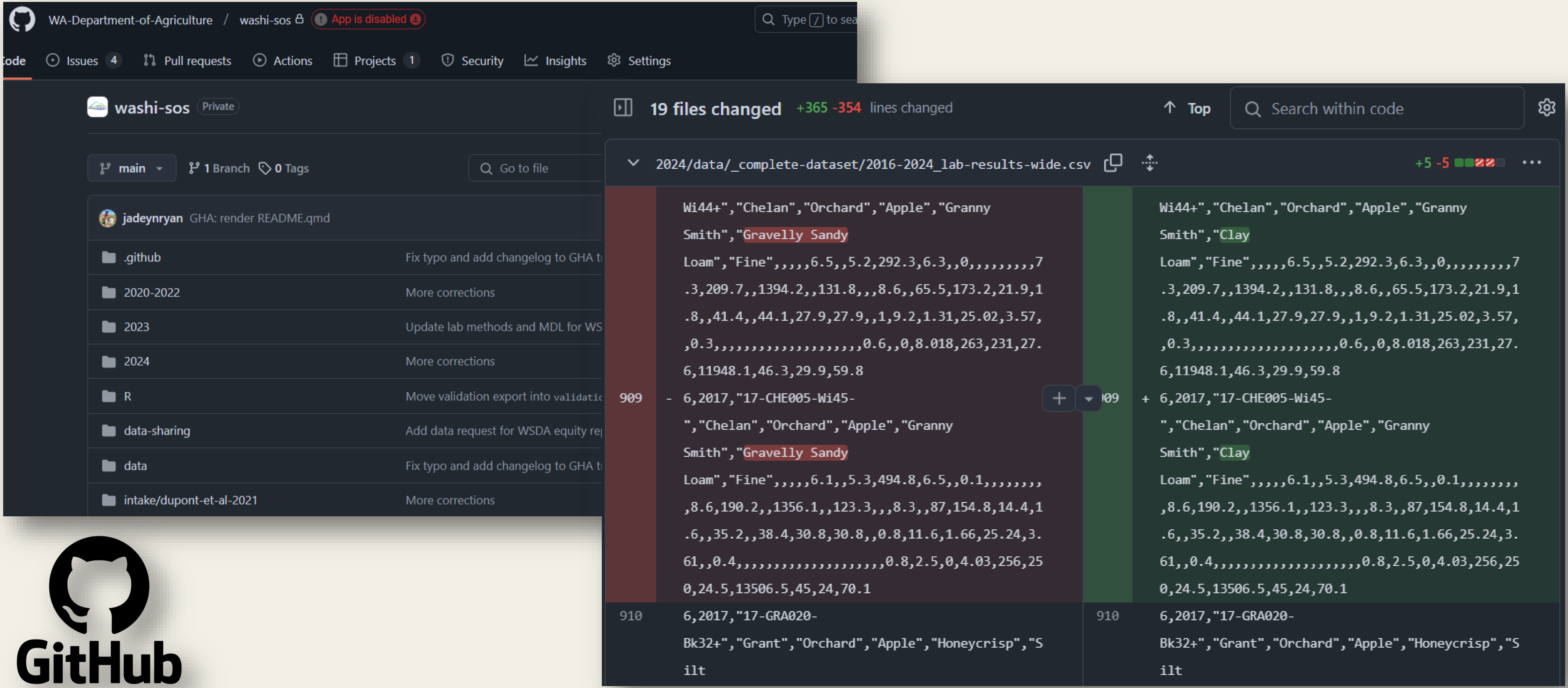
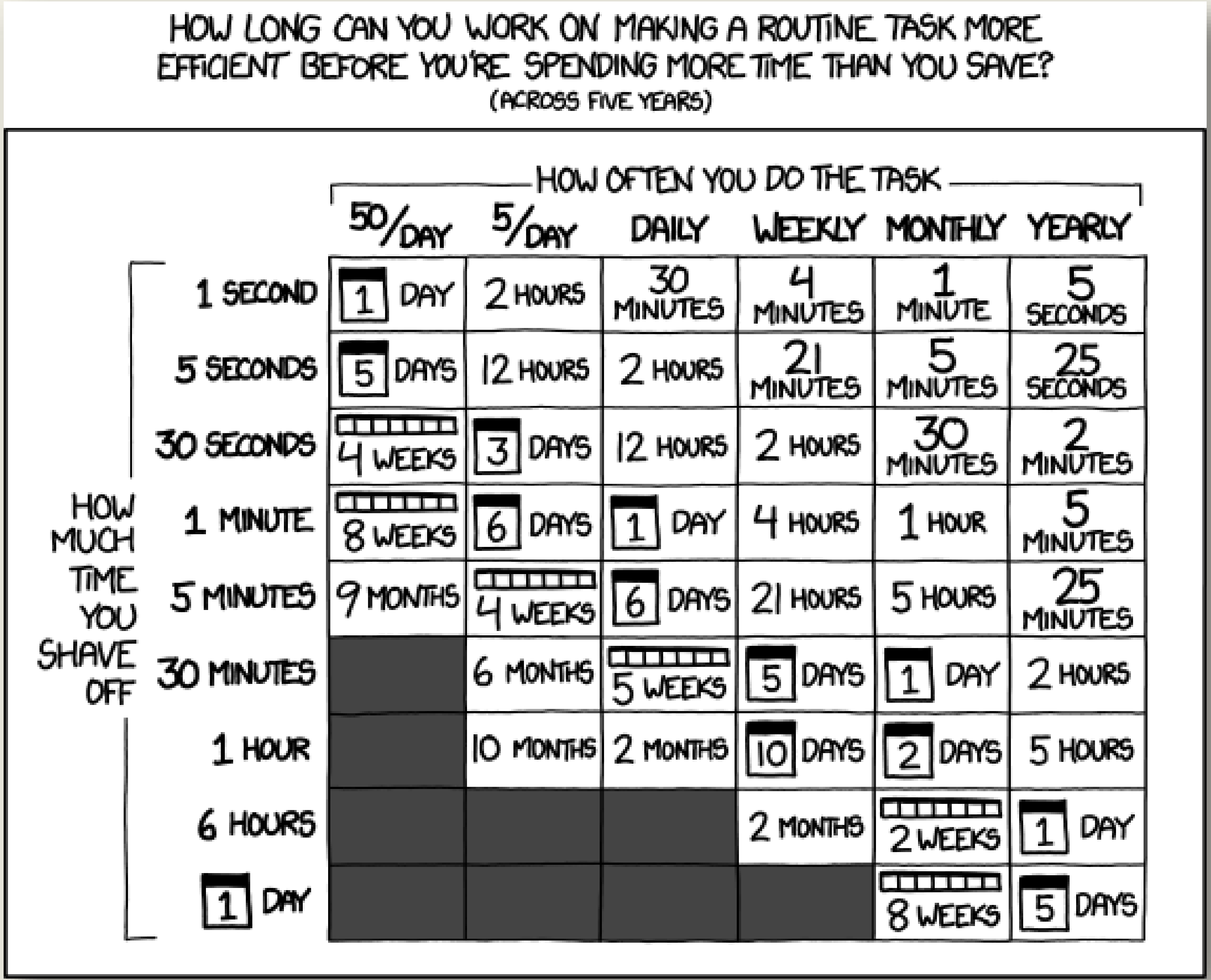




Randall Munroe’s xkcd

How do we use reports to make soils data actionable?

Help participants:

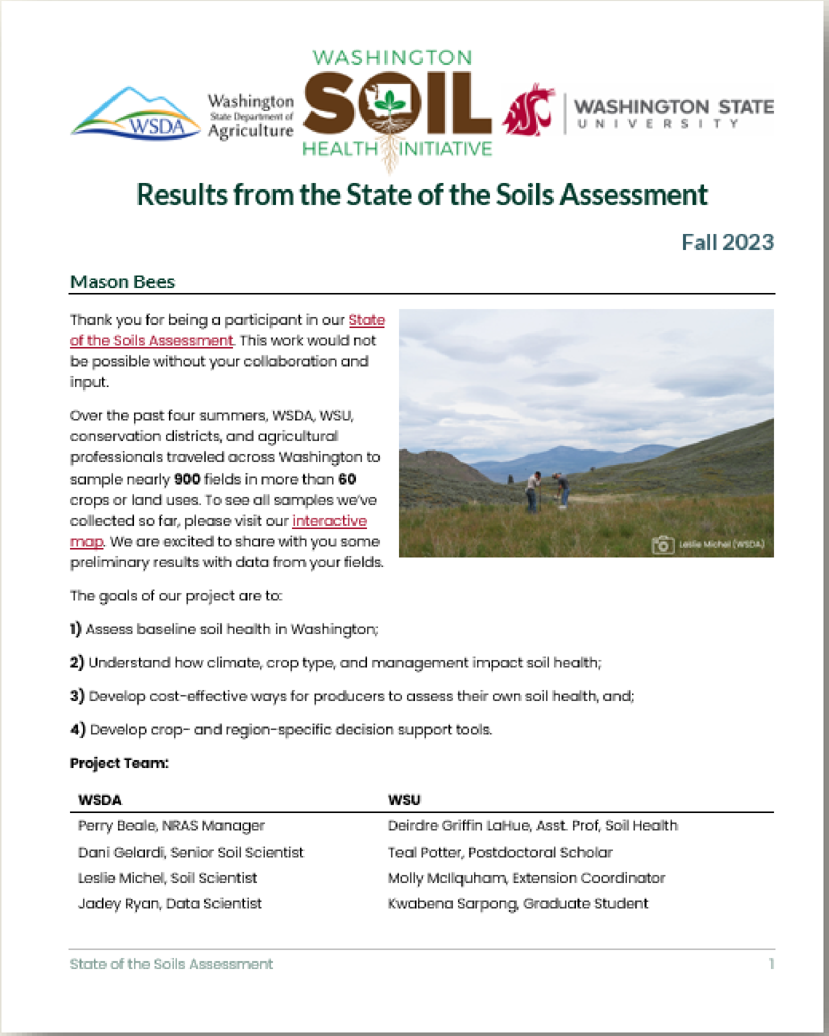
- **Access** their soil health data
- **Interpret** within their crop & region context
- **Translate** into informed management decisions

Access soil health data

Provide the report in multiple formats

Interactive HTML

Printable PDF



WASHINGTON SOIL HEALTH INITIATIVE

WSDA Washington State Department of Agriculture | WASHINGTON STATE UNIVERSITY

Results from the State of the Soils Assessment

Fall 2023

Mason Bees

Thank you for being a participant in our State of the Soils Assessment. This work would not be possible without your collaboration and input.

Over the past four summers, WSDA, WSU, conservation districts, and agricultural professionals traveled across Washington to sample nearly **900** fields in more than **60** crops or land uses. To see all samples we've collected so far, please visit our interactive map. We are excited to share with you some preliminary results with data from your fields.

Leslie Michel (WSDA)

The goals of our project are to:

1) Assess baseline soil health in Washington;

2) Understand how climate, crop type, and management impact soil health;

3) Develop cost-effective ways for producers to assess their own soil health, and;

4) Develop crop- and region-specific decision support tools.

Project Team:

WSDA	WSU
Perry Beale, NRAS Manager	Deirdre Griffin LaHue, Asst. Prof, Soil Health
Dani Gelardi, Senior Soil Scientist	Teal Potter, Postdoctoral Scholar
Leslie Michel, Soil Scientist	Molly McIlquham, Extension Coordinator
Jadey Ryan, Data Scientist	Kwabena Sarpong, Graduate Student

State of the Soils Assessment 1

Make reports self-contained

- Don't make recipient hunt down other info
- Use plain language

Soil Health

Soil health is a term that describes how well a soil ecosystem supports plan
living nature of soils and the importance of soil microorganisms. Healthy so
reduce the effects of climate change, filter air and water, increase crop pro
rural economies.

Qualities of a Healthy Agricultural Soil

- Good soil tilth allows roots to penetrate
- Near neutral pH (6–8) maximizes nutrient availability for most crops, and min
- Sufficient—but not excessive—nutrient supply for crop growth
- Small population of plant pathogens and pests
- Adequate soil drainage and infiltration
- Diverse and active microbial population
- Low weed seed bank
- No residual chemicals or toxins that may harm the crop, including salts
- Resistance to degradation such as from erosion or surface runoff

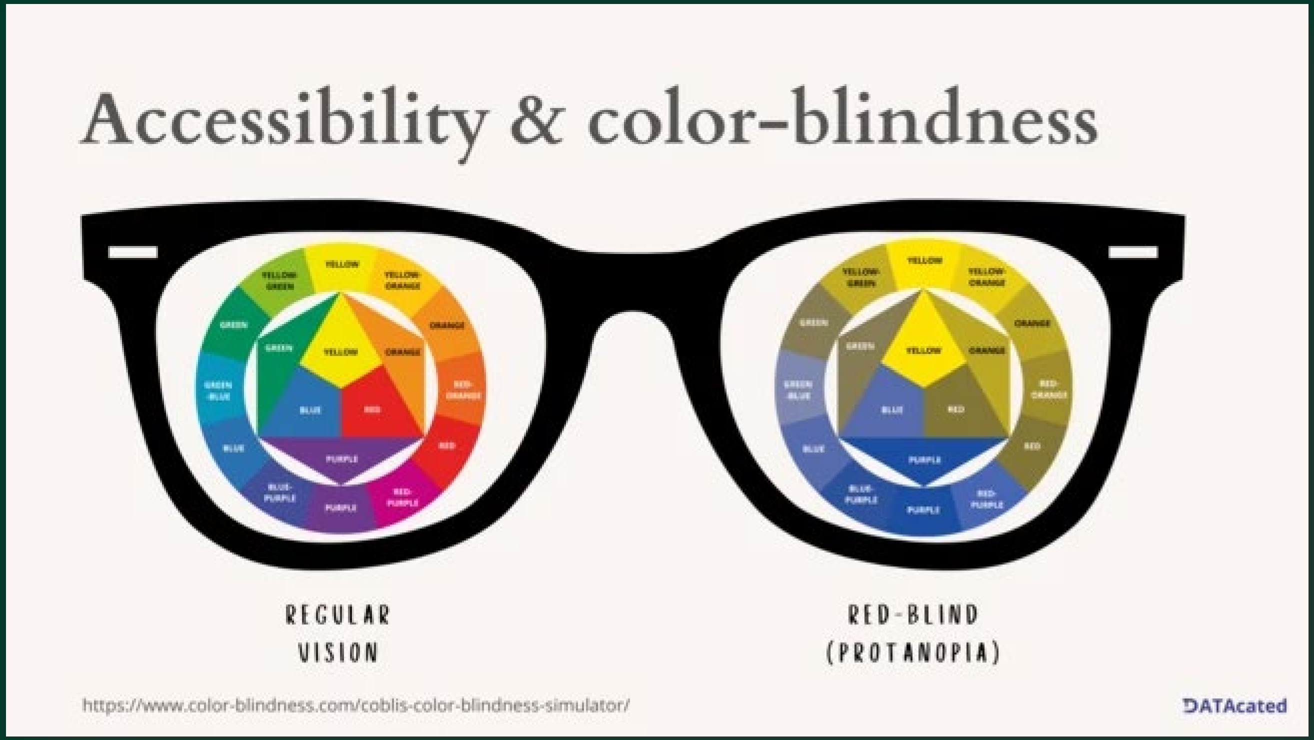
Soil Science 101

A crucial part of the soil health journey is measuring changes in y
measurements. We can measure soil health with a range of indic
properties, which can relate to important soil functions. Each indic
affected differently by management.

To learn more about management practices that support healthy
Conservation Service (NRCS) principles of building soil health.

Create accessible data visualizations

- Color contrast
- Convey info with labels, symbols, annotations, etc.
- Text size
- Alternative text



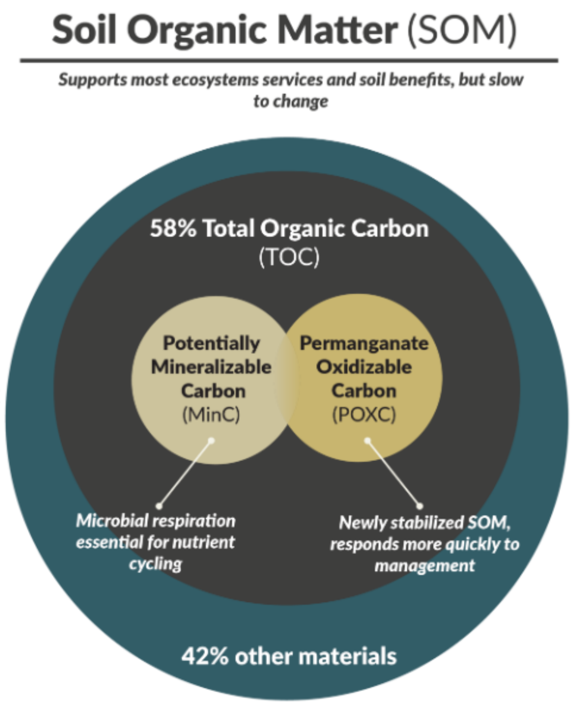
Interpret within crop & region context

Synthesize the latest research

What We Measured in Your Soil

Physical | Biological | Chemical

Soil Organic Matter (SOM) is the portion of soils not made up of minerals, air, and water, but is instead composed of animal, plant, and microbial matter in various stages of decomposition. SOM is comprised of approximately 58% organic carbon (to convert total organic carbon (TOC) to SOM, an easy rule of thumb is to simply multiply by 2). The remaining portion of SOM includes other essential plant nutrients such as nitrogen, phosphorous, and sulfur. SOM varies by inherent soil and landscape properties such as texture, mineralogy, precipitation, and temperature. It is also greatly impacted by management. To learn more about how to increase SOM, read about the NRCS principles of building soil health. SOM underlies many of the benefits and ecosystem services that soils provide. It has a large impact on almost all other soil properties and is often used as a primary indicator of soil health. However, SOM can be slow to change as the result of management. Because of this, many other indicators have been developed to detect more sensitive components in SOM. Keep reading to learn more.

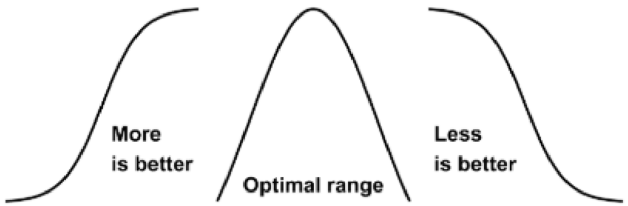


Potentially Mineralizable Carbon (MinC, frequently referred to as "Soil Respiration") measures the release of carbon dioxide (CO_2) from soil. This measurement is done in a laboratory incubation under controlled conditions "ideal" for microbes. The term mineralization refers to the

Offer context for interpretation

Soil Health Indicators

The below table describes: 1. What each indicator helps measure in your soil; 2. Whether you want the measured value to be higher (more is better), lower (less is better), or in the middle (optimal range); and 3. How often to measure each indicator. Our understanding of these indicators is rapidly evolving as researchers measure them in diverse soils, cropping systems, and climates.



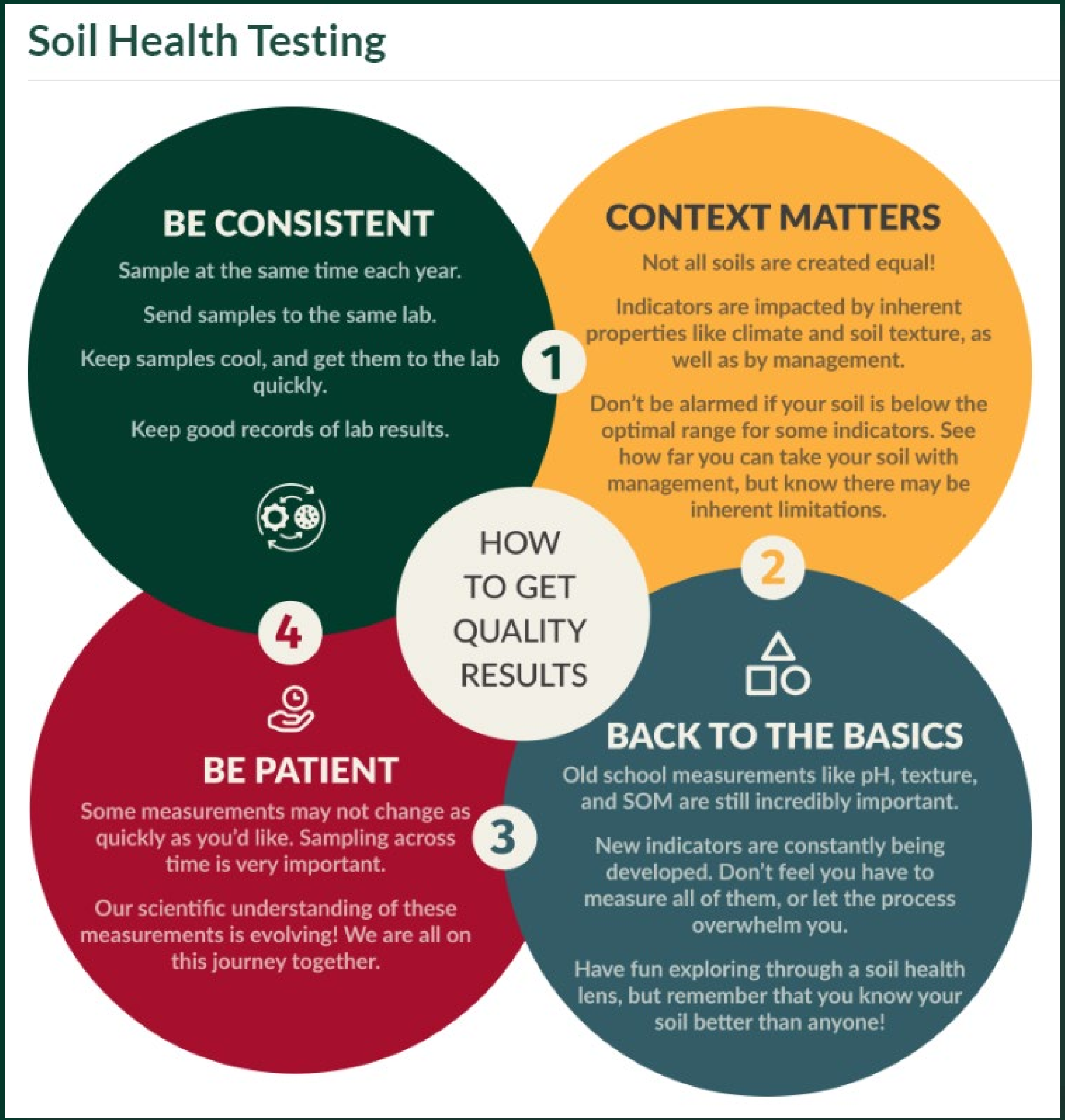
Soil Health Indicator	Soil Function	Scoring Curve Type
Measure every: 1-3 years		
ACE Soil Protein	Nutrient cycling, biodiversity & habitat, filtering & resilience	More is better
Aggregate Stability	Physical support, water relations, biodiversity & habitat, filtering & resilience	More is better
Electrical Conductivity (EC)	Physical support, nutrient cycling, filtering & resilience	Less is better
Mineralizable Carbon	Nutrient cycling, biodiversity & habitat, filtering & resilience	More is better

**more is better,
less is better,
optimal range**

Provide additional resources

Understanding Soil Health Results

Learn more about interpreting your soil health resul

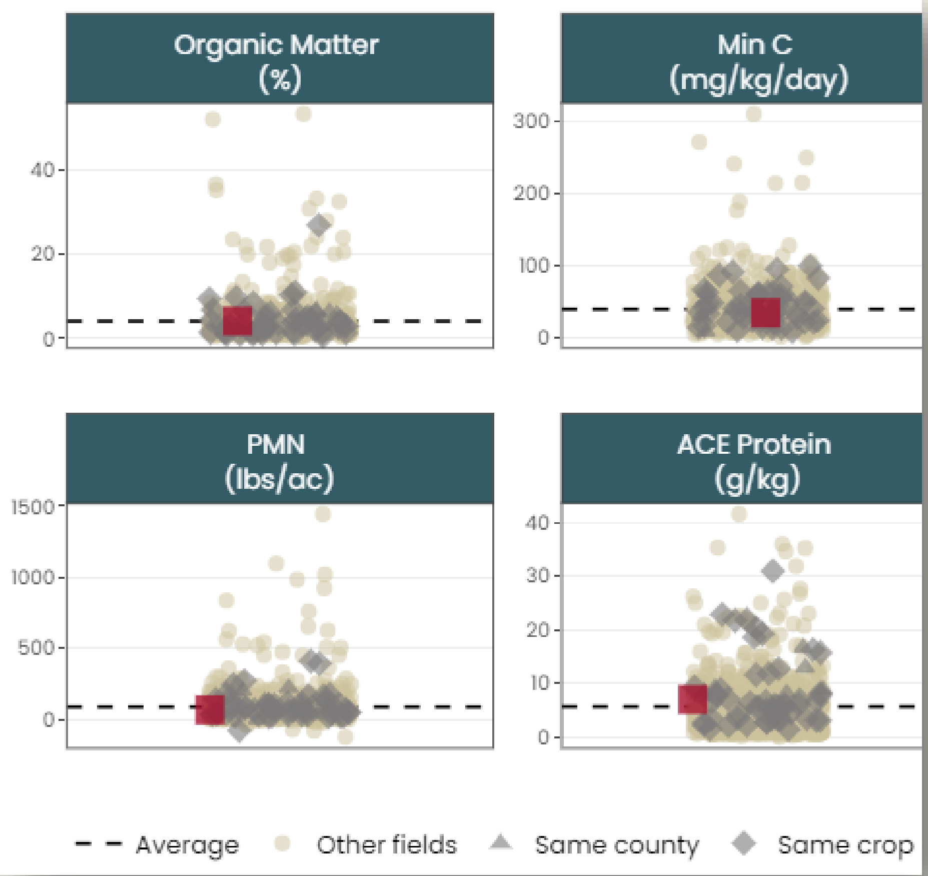


Compare with samples from same **crop, region, & project** in **table & plot representations**

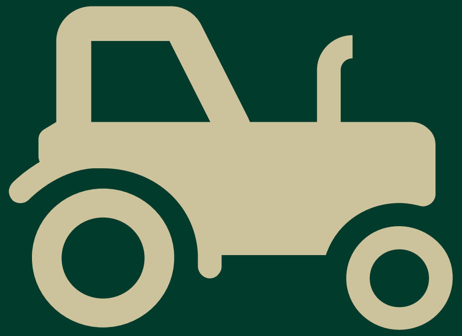
Biological Measurements

Field or Average	Organic Matter	Min C	POXC	PMN	ACE Protein
	%	mg/kg/day	ppm	lbs/ac	g/kg
01	4.2	33.5	462	66.62	6.99
Cowlitz Average (11 Fields)	5.0	40.0	630	120.00	9.00
Native Land Average (54 Fields)	4.2	42.0	520	91.00	8.00
Project Average (877 Fields)	4.2	39.0	450	89.00	5.70

Values ≥ project average have darker backgrounds.
Values < project average have lighter backgrounds.



Translate into informed management decisions



Provide amendment recommendations for fertility*

Thurston Conservation District
EST 1948

2918 FERGUSON ST SW, TUMWATER WA 98512 ◆ WWW.THURSTONCD.COM ◆ @THURSTONCD

Results

	Results	Rating	Short Interpretation	Recommendation
Nitrate-Nitrogen	6 ppm	Low	Soil nitrate-nitrogen is very low. This is typical for this time of year since nitrate-nitrogen leaches out of the soil with seasonal rains. A standard annual application of nitrogen will be needed this spring.	**Add a standard application of nitrogen fertilizer next spring.**
Phosphorus	56 ppm	Optimal	Current levels should easily meet the needs of your vegetables.	No action needed.

*if qualified and you have enough information

Science still developing for management recommendations based on soil health

How can you make custom reports?

{soils} R package

1. comfortable with or willing to learn →

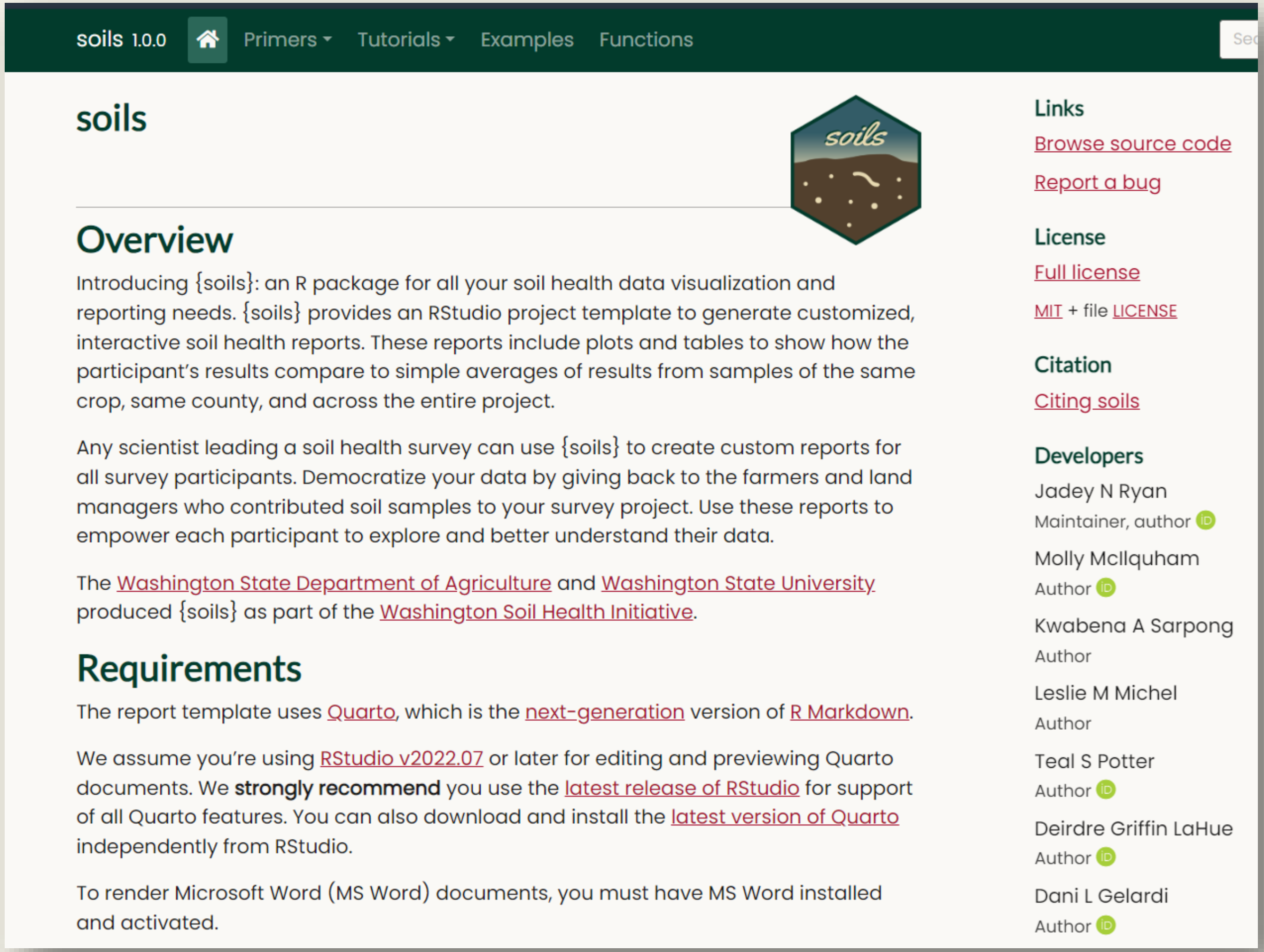
2. have soil sampling data*

   *for any organization and region

   *for multiple project participants

How do you get started?

{soils} package website


soils 1.0.0 Primers Tutorials Examples Functions

soils

Overview

Introducing {soils}: an R package for all your soil health data visualization and reporting needs. {soils} provides an RStudio project template to generate customized, interactive soil health reports. These reports include plots and tables to show how the participant's results compare to simple averages of results from samples of the same crop, same county, and across the entire project.

Any scientist leading a soil health survey can use {soils} to create custom reports for all survey participants. Democratize your data by giving back to the farmers and land managers who contributed soil samples to your survey project. Use these reports to empower each participant to explore and better understand their data.

The Washington State Department of Agriculture and Washington State University produced {soils} as part of the Washington Soil Health Initiative.

Requirements

The report template uses Quarto, which is the next-generation version of R Markdown.

We assume you're using RStudio v2022.07 or later for editing and previewing Quarto documents. We **strongly recommend** you use the latest release of RStudio for support of all Quarto features. You can also download and install the latest version of Quarto independently from RStudio.

To render Microsoft Word (MS Word) documents, you must have MS Word installed and activated.

Links
Browse source code
Report a bug

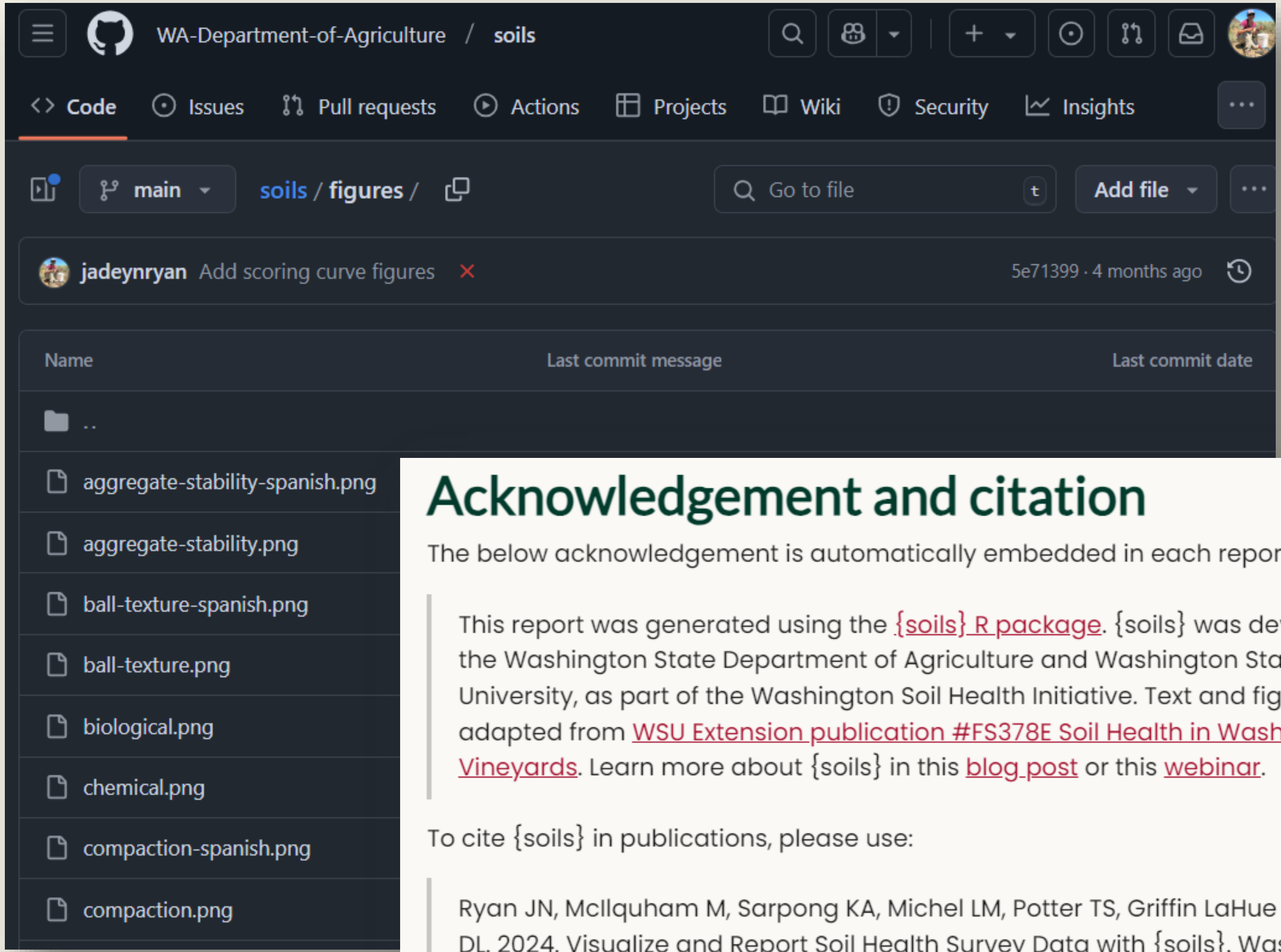
License
Full license
MIT + file LICENSE

Citation
Citing soils

Developers
Jadey N Ryan
Maintainer, author
Molly McIlquham
Author
Kwabena A Sarpong
Author
Leslie M Michel
Author
Teal S Potter
Author
Deirdre Griffin LaHue
Author
Dani L Gelardi
Author

Use or adapt {soils} text & figures

open-source
GitHub repository



Acknowledgement and citation

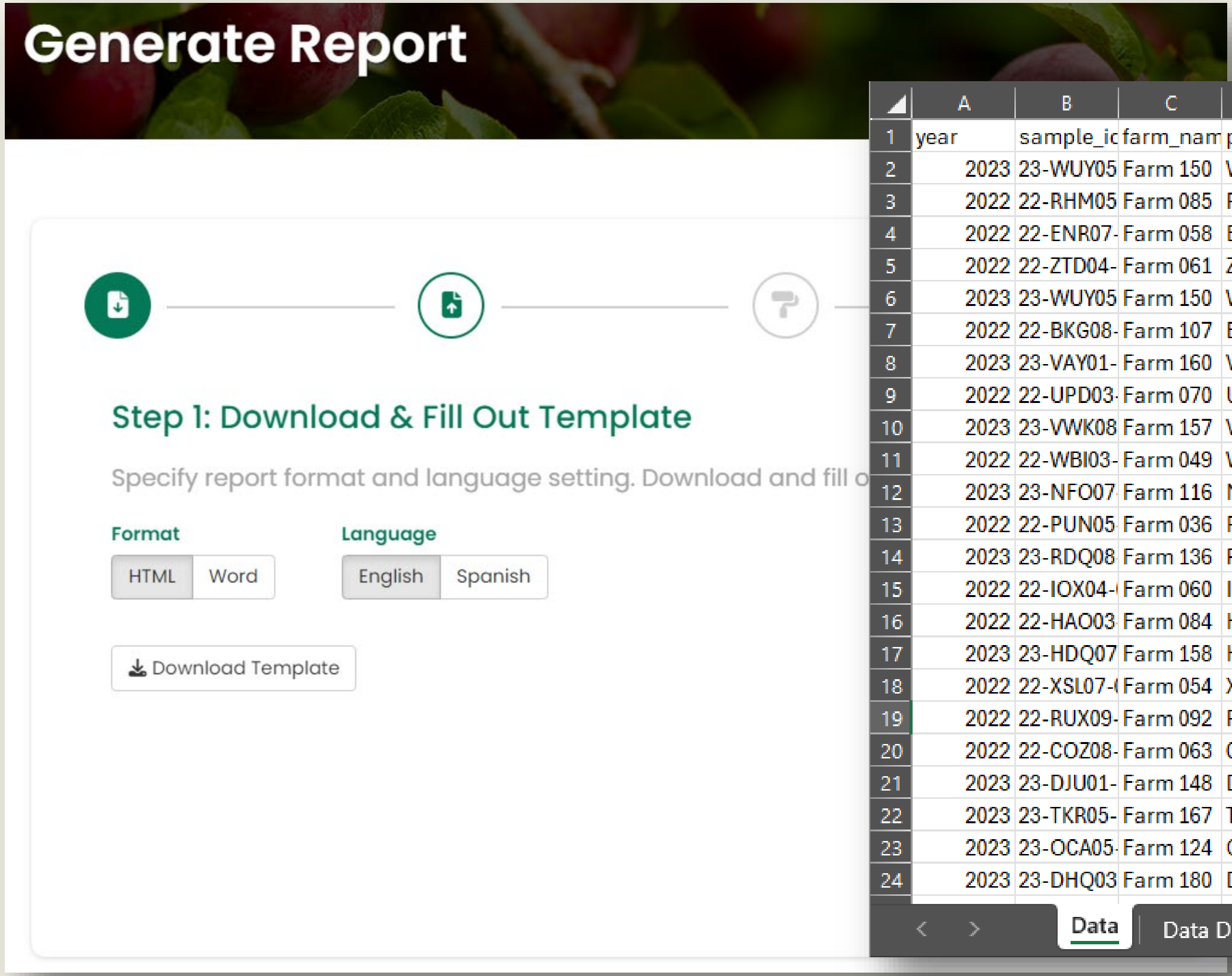
The below acknowledgement is automatically embedded in each report:

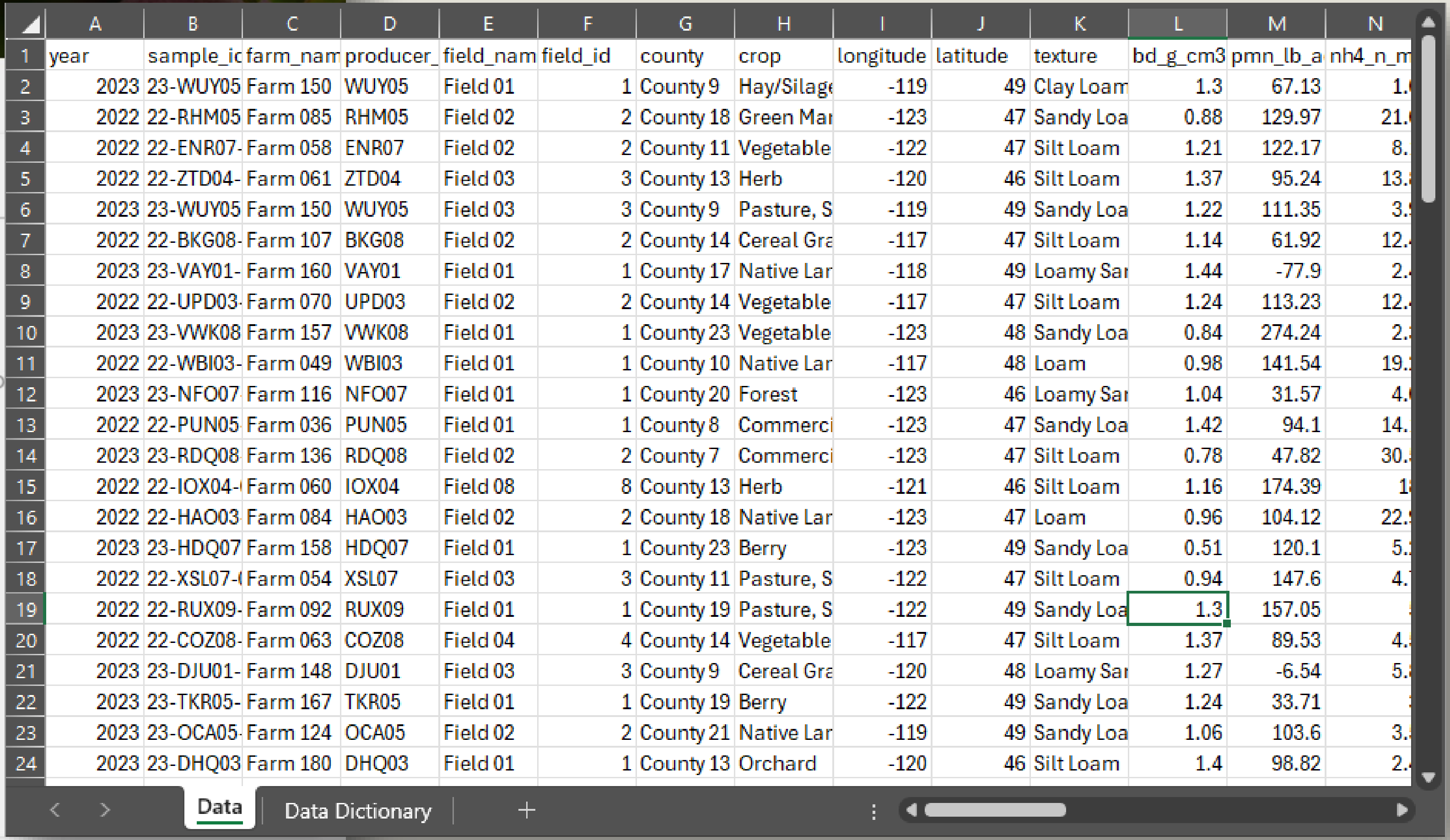
> This report was generated using the {soils} R package. {soils} was developed by the Washington State Department of Agriculture and Washington State University, as part of the Washington Soil Health Initiative. Text and figures were adapted from WSU Extension publication #FS378E Soil Health in Washington Vineyards. Learn more about {soils} in this blog post or this webinar.

To cite {soils} in publications, please use:

> Ryan JN, McIlquham M, Sarpong KA, Michel LM, Potter TS, Griffin LaHue D, Gelardi DL. 2024. Visualize and Report Soil Health Survey Data with {soils}. Washington Soil Health Initiative. https://github.com/WA-Department-of-Agriculture/soils

Coming Spring – Summer 2025: no-code webapp to generate reports





	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	year	sample_ic	farm_nam	producer_	field_nam	field_id	county	crop	longitude	latitude	texture	bd_g_cm3	pmn_lb_a	nh4_n_m
2	2023	23-WUY05	Farm 150	WUY05	Field 01	1	County 9	Hay/Silage	-119	49	Clay Loam	1.3	67.13	1.
3	2022	22-RHM05	Farm 085	RHM05	Field 02	2	County 18	Green Mai	-123	47	Sandy Loa	0.88	129.97	21.
4	2022	22-ENR07-	Farm 058	ENR07	Field 02	2	County 11	Vegetable	-122	47	Silt Loam	1.21	122.17	8.
5	2022	22-ZTD04-	Farm 061	ZTD04	Field 03	3	County 13	Herb	-120	46	Silt Loam	1.37	95.24	13.
6	2023	23-WUY05	Farm 150	WUY05	Field 03	3	County 9	Pasture, S	-119	49	Sandy Loa	1.22	111.35	3.
7	2022	22-BKG08-	Farm 107	BKG08	Field 02	2	County 14	Cereal Gra	-117	47	Silt Loam	1.14	61.92	12.
8	2023	23-VAY01-	Farm 160	VAY01	Field 01	1	County 17	Native Lar	-118	49	Loamy Sar	1.44	-77.9	2.
9	2022	22-UPD03-	Farm 070	UPD03	Field 02	2	County 14	Vegetable	-117	47	Silt Loam	1.24	113.23	12.
10	2023	23-VWK08	Farm 157	VWK08	Field 01	1	County 23	Vegetable	-123	48	Sandy Loa	0.84	274.24	2.
11	2022	22-WBI03-	Farm 049	WBI03	Field 01	1	County 10	Native Lar	-117	48	Loam	0.98	141.54	19.
12	2023	23-NFO07	Farm 116	NFO07	Field 01	1	County 20	Forest	-123	46	Loamy Sar	1.04	31.57	4.
13	2022	22-PUN05	Farm 036	PUN05	Field 01	1	County 8	Commerci	-123	47	Sandy Loa	1.42	94.1	14.
14	2023	23-RDQ08	Farm 136	RDQ08	Field 02	2	County 7	Commerci	-123	47	Silt Loam	0.78	47.82	30.
15	2022	22-IOX04-	Farm 060	IOX04	Field 08	8	County 13	Herb	-121	46	Silt Loam	1.16	174.39	1
16	2022	22-HAO03	Farm 084	HAO03	Field 02	2	County 18	Native Lar	-123	47	Loam	0.96	104.12	22.
17	2023	23-HDQ07	Farm 158	HDQ07	Field 01	1	County 23	Berry	-123	49	Sandy Loa	0.51	120.1	5.
18	2022	22-XSL07-	Farm 054	XSL07	Field 03	3	County 11	Pasture, S	-122	47	Silt Loam	0.94	147.6	4.
19	2022	22-RUX09-	Farm 092	RUX09	Field 01	1	County 19	Pasture, S	-122	49	Sandy Loa	1.3	157.05	
20	2022	22-COZ08-	Farm 063	COZ08	Field 04	4	County 14	Vegetable	-117	47	Silt Loam	1.37	89.53	4.
21	2023	23-DJU01-	Farm 148	DJU01	Field 03	3	County 9	Cereal Gra	-120	48	Loamy Sar	1.27	-6.54	5.
22	2023	23-TKR05-	Farm 167	TKR05	Field 01	1	County 19	Berry	-122	49	Sandy Loa	1.24	33.71	
23	2023	23-OCA05-	Farm 124	OCA05	Field 02	2	County 21	Native Lar	-119	49	Sandy Loa	1.06	103.6	3.
24	2023	23-DHQ03	Farm 180	DHQ03	Field 01	1	County 13	Orchard	-120	46	Silt Loam	1.4	98.82	2.

Data | Data Dictionary

Get notified when it launches!

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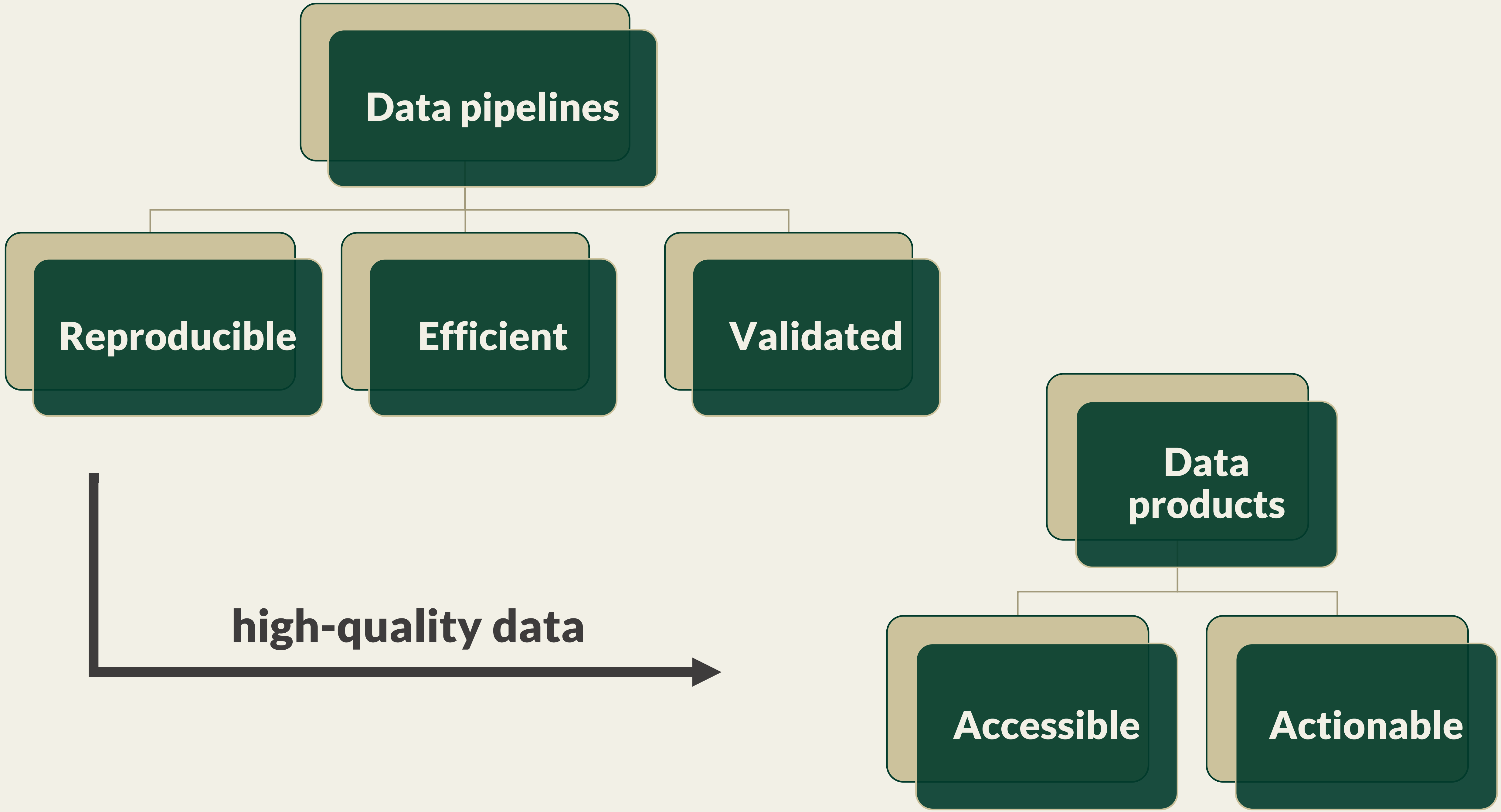
Data pipelines
Reproducible
Efficient
Validated
high-quality data
Data products
Accessible
Actionable

Resources to learn R, Quarto, and {soils}

- RStudio Education: different starting points to begin learning R
- *R for Data Science (2ed)*: book by Wickham et al. (2023)

- Get Started with Quarto: intro and tutorial
- 20-min technical talk: Parameterized soil health reports with Quarto
- Intermediate Quarto Workshop: Parameterized reports with Quarto

- {soils} package website: package documentation & tutorials
- GitHub repository: source code and files
- WaSHI blog post about {soils}
- WaSHI Masking Soils Data Actionable webinar


Questions? Comments? Ideas?
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WASHINGTON STATE UNIVERSITY
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