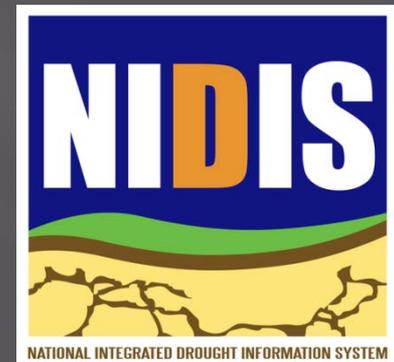


THE LAUNCH OF COCORAHS SOIL MOISTURE

Peter Goble

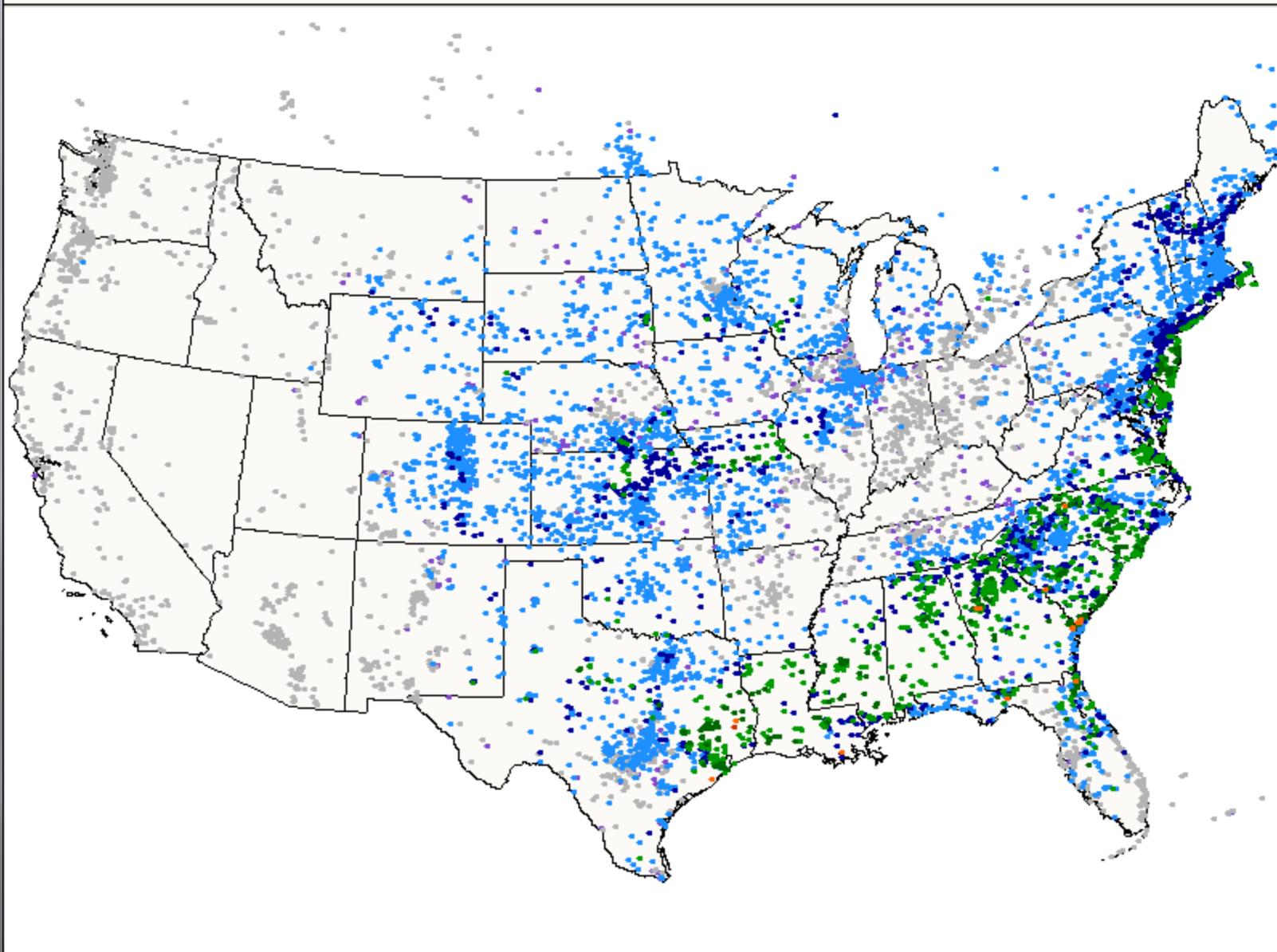
Colorado Climate Center



Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am

USA 5/23/2017

0.0 Trace 0.01 - 0.32 0.33 - 0.64 0.65 - 1.60 1.61 - 3.84 3.85 - 5.76 5.77 - 6.41



CoCoRaHS Extras



- ▣ Reference ET
- ▣ Condition Monitoring
- ▣ Field Photos
- ▣ Ice accretion
- ▣ Now soil moisture!

CoCoRaHS Soil Moisture Timeline

- ▣ 2011 Texas and Oklahoma drought sparks interest in National Soil Moisture Network. Citizen Science identified as a desired component of the network
- ▣ 2012 flash drought insights further interest in soil moisture projects
- ▣ Spring 2014-2016: CoCoRaHS partners with NIDIS to research logistics of a CoCoRaHS soil moisture project
- ▣ Summer 2016: Drafted protocol reviewed and field tested
- ▣ Fall 2016: Protocol revised/simplified (if you can believe it)
- ▣ Spring 2017: CoCoRaHS soil moisture launched

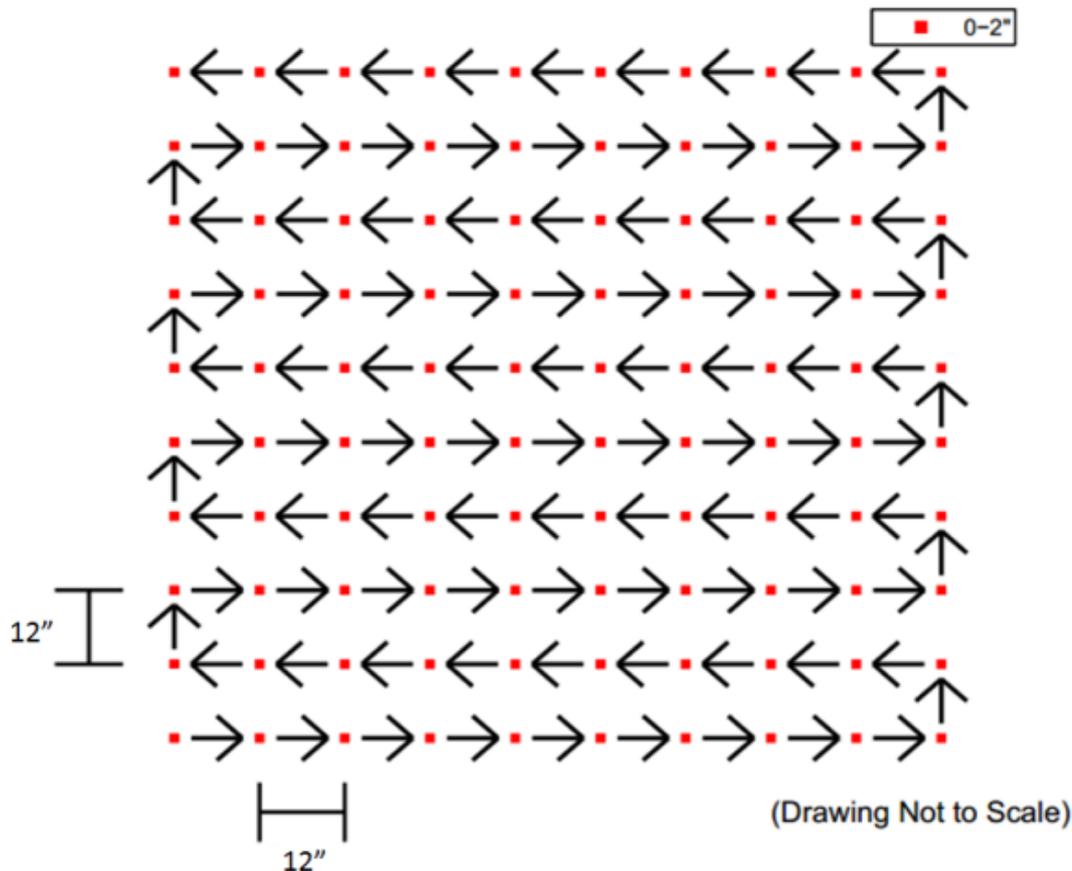
The CoCoRaHS Soil Moisture Measurement



- ❑ Soil type is assessed using a Master Gardner field guide
- ❑ Samples are taken using a rigid brass ring of ~250 cubic cm volume
- ❑ Rocks and roots removed measured with a graduated cylinder
- ❑ Samples oven dried
- ❑ Mass loss measured with CoCoRaHS scale

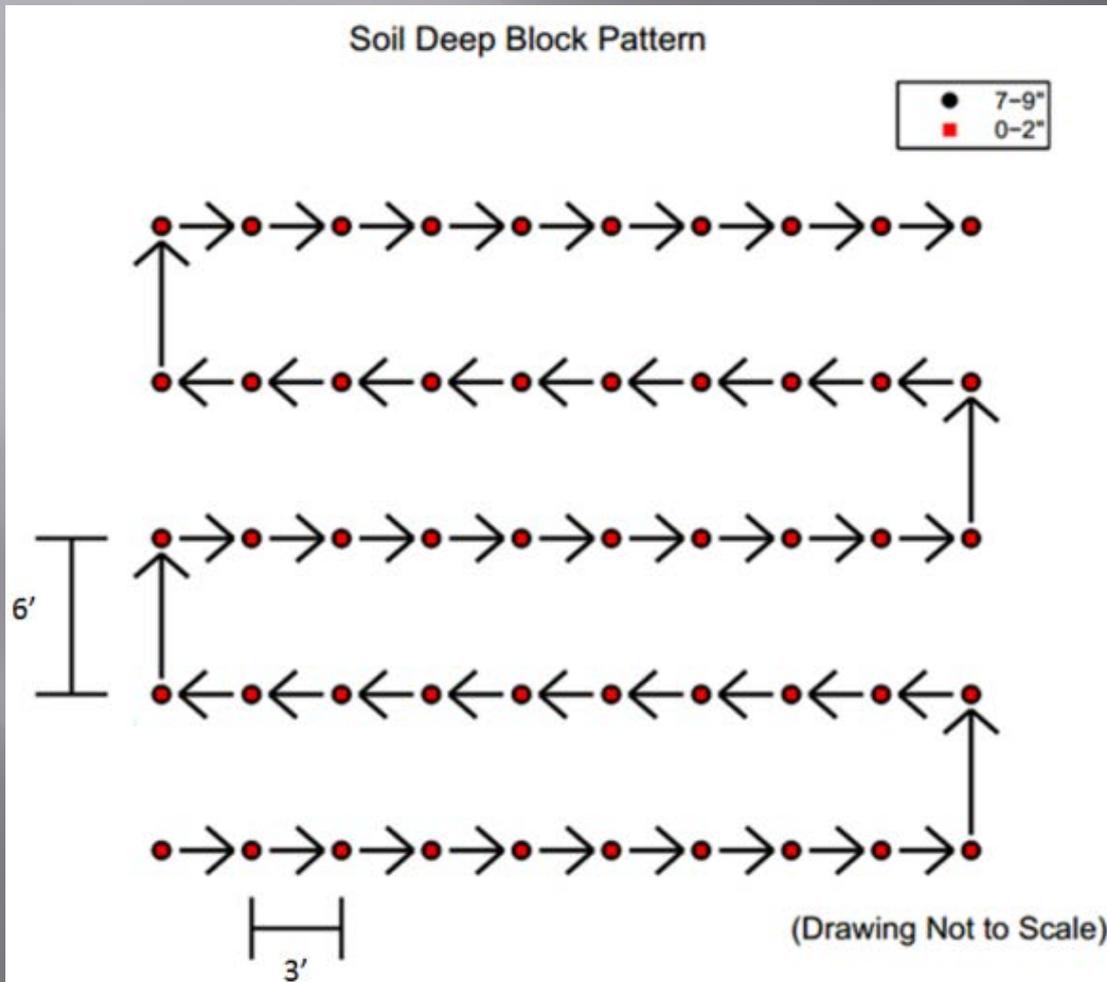
A Protocol Heavily Inspired by GLOBE

Soil Surface GLOBE SMAP Block Pattern



- ▣ Observers will report surface samples in a GLOBE SMAP block pattern
- ▣ Samples may deviate where terrain is rough

The Soil Deep Reporting Pattern



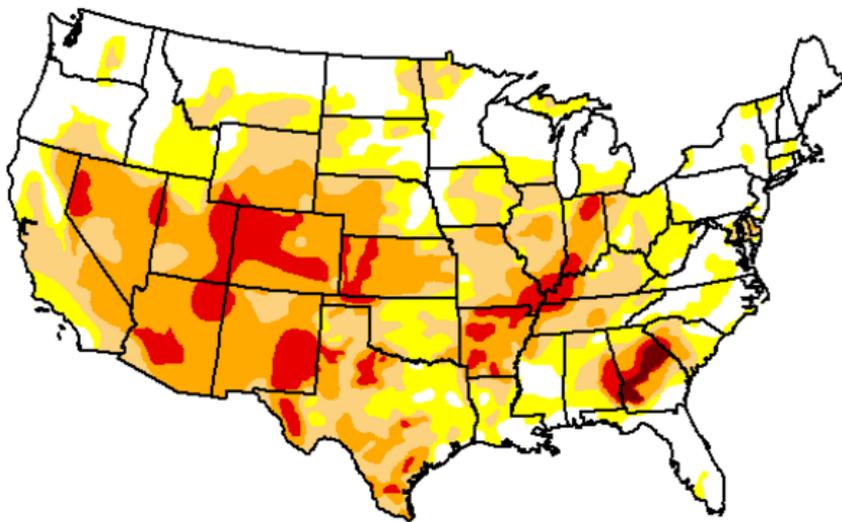
- Observers have the option to take cores at 7-9" as well
- Soil samples from the root zone are more invasive, so samples are further apart.
- The 7-9" range was chosen to conform to USDA standards of 2,4,8,20, and 40" measurements.

Chief Goals of CoCoRaHS Soil Moisture

1. Usefulness as a calibration-validation tool for in-situ sensors, satellites (NASA SMAP), and numerical models
2. Usefulness as a drought monitoring tool for the National Drought Mitigation Center
3. Climate and Hydrology education

Inception of CoCoRaHS Soil Moisture

U.S. Drought Monitor CONUS



June 26, 2012

(Released Thursday, Jun. 28, 2012)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	27.99	72.01	51.13	30.73	8.54	0.41
Last Week 6/19/2012	31.22	68.78	46.72	24.27	5.19	0.29
3 Months Ago 3/27/2012	43.56	56.44	35.93	19.40	6.72	2.15
Start of Calendar Year 1/3/2012	50.41	49.59	31.90	18.83	10.18	3.32
Start of Water Year 9/27/2011	56.45	43.55	29.13	23.44	17.80	11.37
One Year Ago 6/28/2011	63.03	36.97	28.08	23.28	18.38	11.94

Intensity:



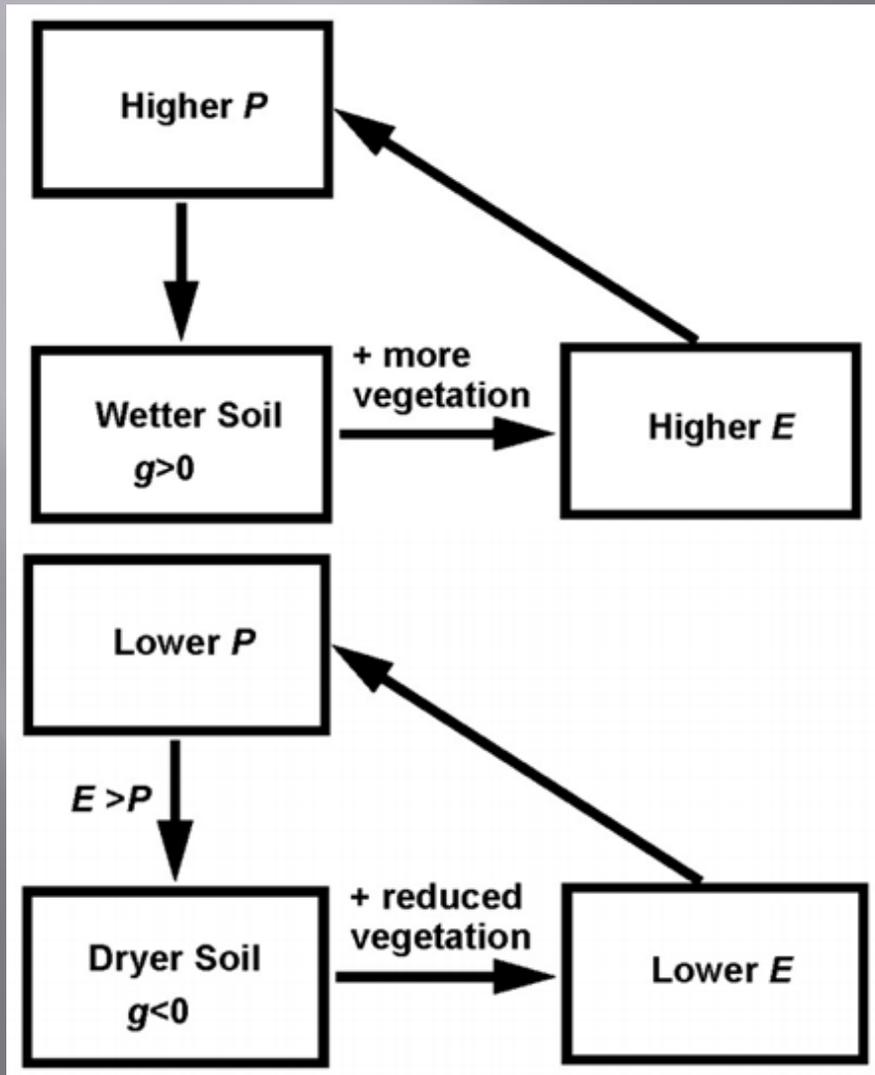
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author(s):
Richard Heim
NCDC/NOAA

- Drought hit the US hard in the summer of 2012
- This was a flash drought, meaning conditions became severe quickly
- Soil moisture monitoring was identified as a weak point in our drought early warning system.



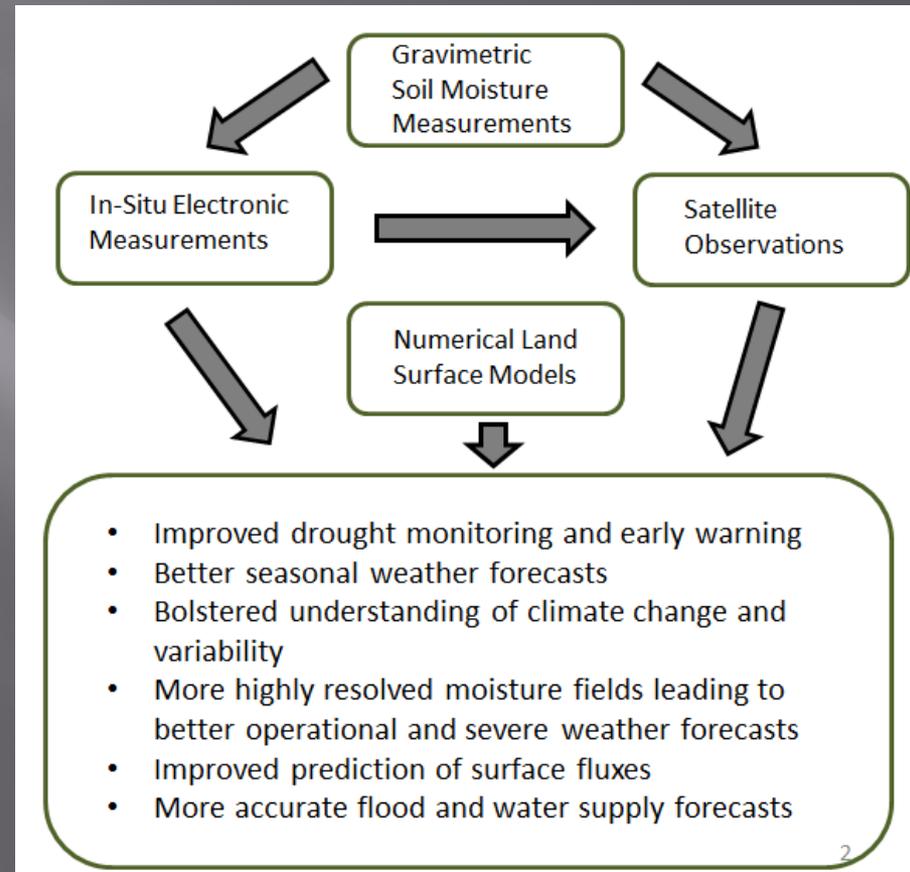
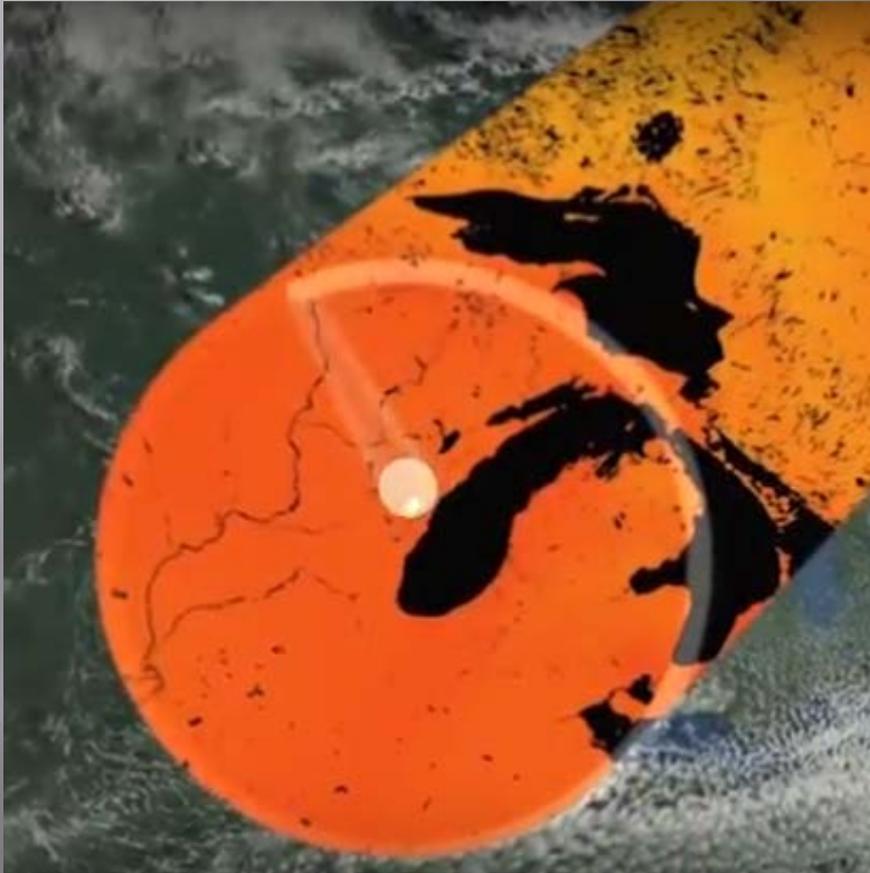
Soil Moisture as an Early Warning Tool



- The atmosphere is chaotic; this makes seasonal forecasting difficult. Soil moisture data is less temporally chaotic, and may offer a partial solution
- If root zone soils are drier (wetter) than usual, it may cause increased subsequent seasonal dryness (wetness) on a seasonal timescale (a positive feedback!)



CoCoRaHS' Roll in the Grand Scheme



What Does the Form Look Like?

My Data Entry : Soil Moisture Report Form

The form is titled "Soil Moisture Report Form" and includes "Submit Data" and "Reset" buttons. It contains the following fields and sections:

- Station Number:** CO-LR-1107
- Station Name:** Fort Collins 4.5 WNW
- Observation Date:** 4/6/2017 (Date picker)
- Observation Time:** AM (Time picker)
- Observation Notes:** (Text area)
- Information about where the sample was taken:**
 - Distance from previous sample in meters: 0.3
 - Is the land irrigated? Yes No
 - Did you begin a new row? Yes No
- Soil Samples Table:**

Depth	Soil Type	Weight Before Drying (grams)	Volume of Rocks and Roots Removed(cm3)	Weight After Drying (grams)
0-2"	Sandy Clay			
7-9"	Sandy Clay Loam			

Numbered callouts (1-10) point to the following elements:

1. Date picker
2. Time picker
3. Comments
4. Sample spacing
5. Irrigation (Y/N)
6. New Row (Y/N)
7. Soil Type
8. Wet Weight
9. Volume Removed
10. Dry Weight

1. Date picker
2. Time picker
3. Comments
4. Sample spacing
5. Irrigation (Y/N)
6. New Row (Y/N)
7. Soil Type
8. Wet Weight
9. Volume Removed
10. Dry Weight

What Does a Completed Submission Look Like?

Soil Moisture Report

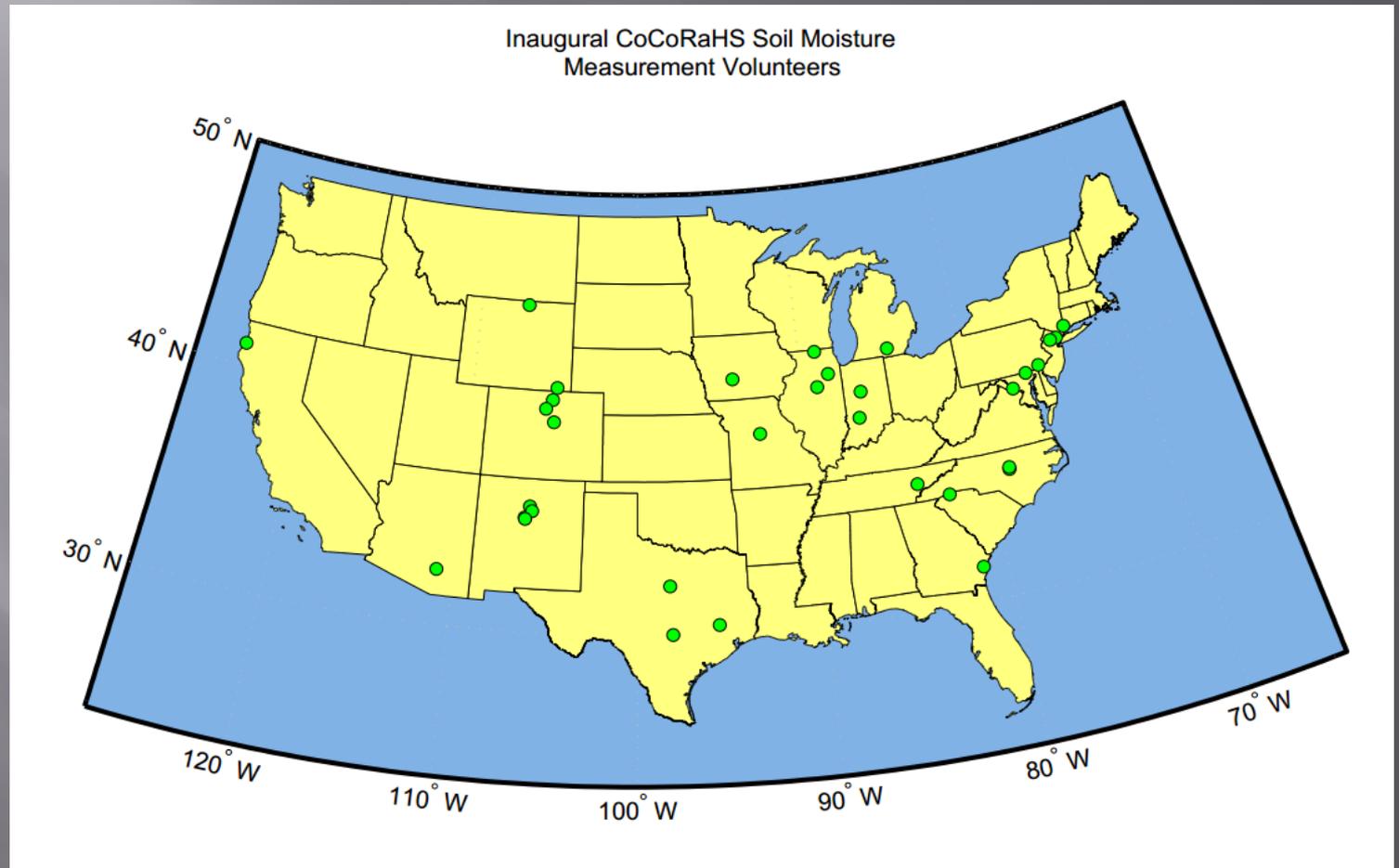
Station Number	NM-SF-70	Observation Date	5/2/2017
Station Name	Santa Fe 10.5 S	Observation Time	4:30 PM
Submitted	5/13/2017 11:24 AM	Is Soil Irrigated	False
Is Sample Part Of New Row	False	Meters From Previous Sample	0

Depth	Pre-Dry Weight (g)	Dry Weight (g)	Volume Removed (cm ³)	Dry Density (g/cm ³)	Volumetric Water Content(%)	Soil Type
0-2"	456	404	2.0	1.61	20.80	
7-9"	--	--	--	--	--	

Notes

2016 Recruits

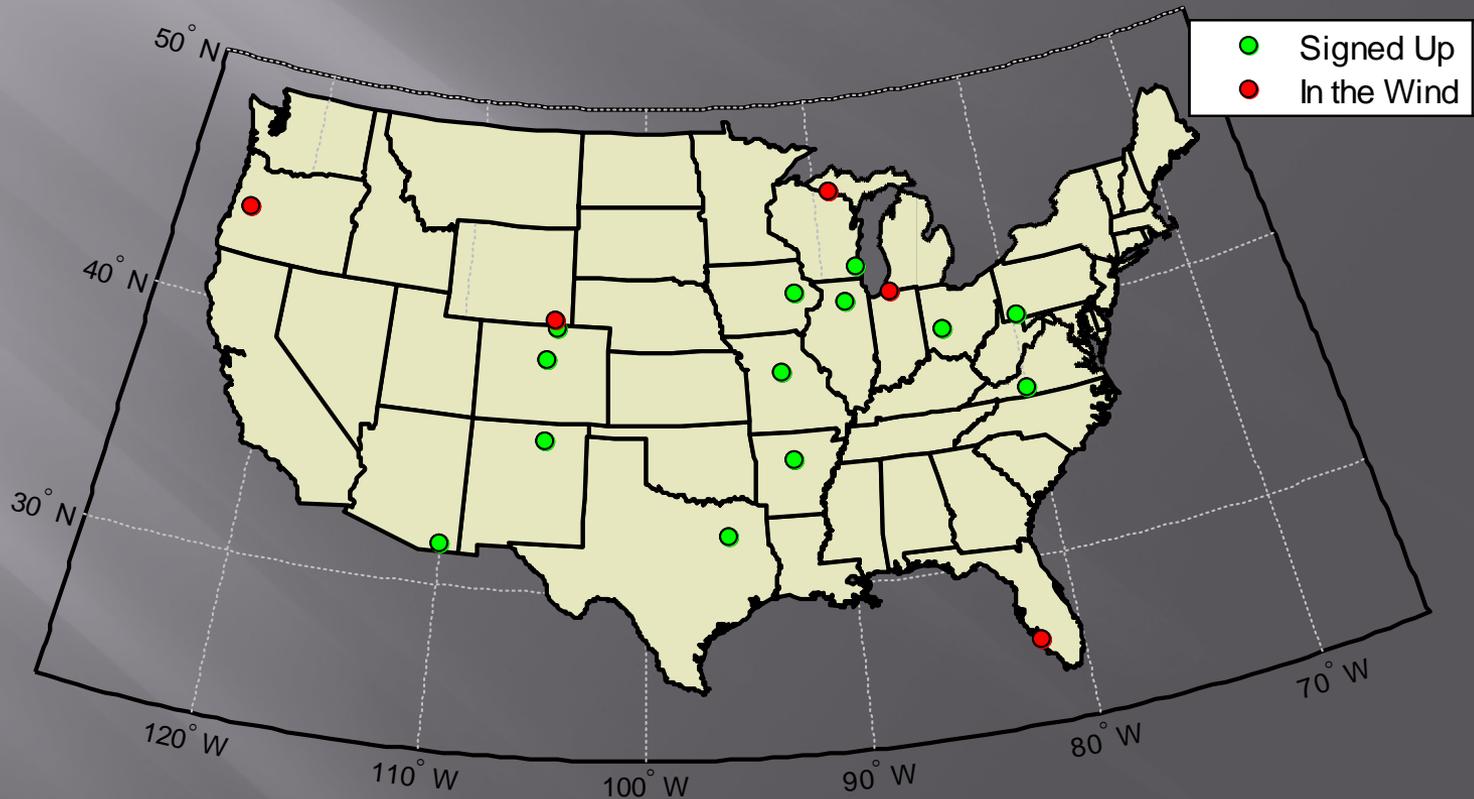
- 33 volunteers have shared their interest with Nolan
- Samples promised from diverse climate regions and soil types



2017 Recruits

- 14 new volunteers signed up so far in 2017
- Awaiting responses from 5 interested observers
- With some additional recruiting energy, we would hope to double or triple this number

CoCoRaHS Soil Moisture 2017
Recruits



Limiting Barriers to Entry



1. Land that is spaced appropriately far from trees and buildings
2. Land that is available for an invasive measurement protocol
3. Observers who don't mind baking dirt
4. Labor-intensive compared to rain gauge measurements

Conclusion: This is not for everyone!

Our short goal: 50+ regular volunteers

Long goal: 200+

Recruitment Concepts

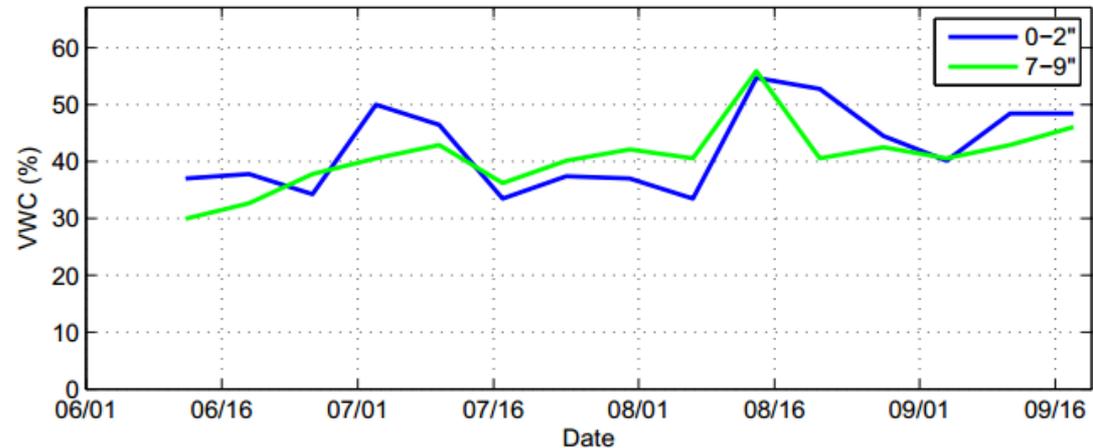
- ❑ This project may be well-suited to partner with 4H. As a land grant university, we can use our ties with extension
- ❑ Soil moisture protocol may lend itself well to school projects, particularly in rural areas
- ❑ Rural observers in areas with extensive dry land Ag are highly-desired participants. CoCoRaHS soil moisture should be promoted at farm shows
- ❑ Observers who signed up through Master Gardner can be targeted



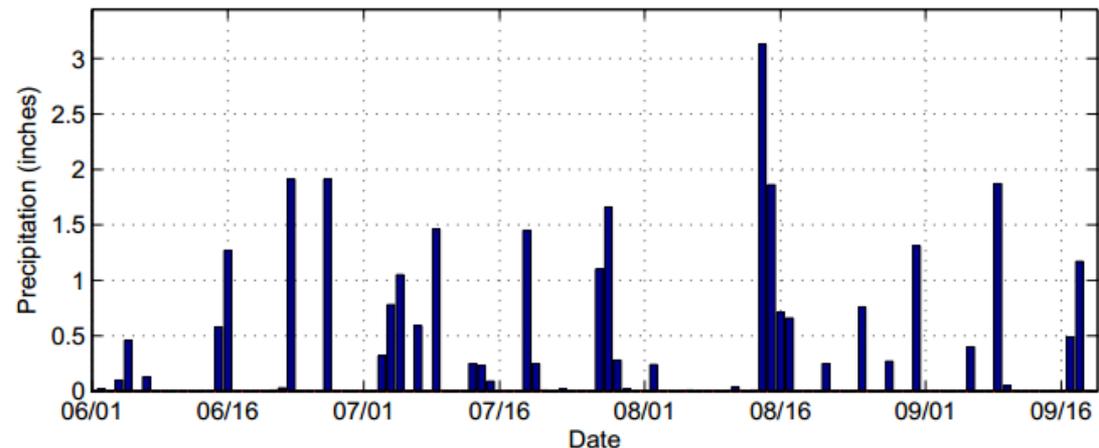
Coming down the Pipe

- Updated protocol including photo documentation, and clarification of a few sticking points (ie what the heck is a bucket scoop?)
- CoCoRaHS Soil Moisture mapping
- CoCoRaHS Soil Moisture training animation
- Possibly soil moisture timeseries

IN-OW-9 Volumetric Water Content



IN-OW-9 Precipitation Measurements



How can you help?

- ▣ Keep an eye out for observers who like to go above and beyond, or have a special passion for the water cycle
- ▣ Remember CoCoRaHS soil moisture when doing Ag-related outreach such as participation at farm shows
- ▣ Keep the recruiting and retaining the precipitation volunteers!
- ▣ If you have questions, or an observer has questions, feel free to send them my way!
peter@cocorahs.org

All Are Welcome

