APPENDIX D

SOIL MOISTURE UNIT CONVERSIONS

Soil moisture sensors measure volumetric water content (SWC). Often, conversion of soil moisture to other units will be required. Some common conversions are provided below. * Note: θ_{WP}, θ_{FC}, and bulk density can be measured as per NRCS recommended standards and methods.

Measurement units	Conversion units	Conversion formula	Examples of conditions necessitating conversion
Volumetric soil moisture (SWC), θ $\frac{cm^3}{cm^3}$	Fraction available water content (FAW)	$FAW = \frac{\theta - \theta_{WP}}{\theta_{FC} - \theta_{WP}}$ $\theta_{WP} = SWC\ at\ wilting\ point$ $\theta_{FC} = SWC\ at\ field\ capacity$	Stakeholder requirements (see Table 2, Chapter 3)
Gravimetric soil moisture, θ_g ($\frac{g}{g}$)	SWC, θ $\frac{cm^3}{cm^3}$	$\theta = \theta_g x bulk\ density$	Field calibration or lab calibration exercise
Volumetric soil moisture (SWC), θ $\frac{cm^3}{cm^3}$	Equivalent water depth, D cm	$D = \theta x thickness\ of\ representative\ soil\ layer$	Stakeholder requirements (see Table 2, Chapter 3)
Volumetric soil moisture (SWC), θ $\frac{cm^3}{cm^3}$	Plant Available Water, PAW, cm	$PAW = (\theta_{FC} - \theta_{WP})\ x thickness\ of\ representative\ soil\ layer$	Stakeholder requirements (see Table 2, Chapter 3)

Example conversions between different soil moisture units are provided in the following below for two different soil types in Georgia in Tables D1 and D2. The corresponding soil moisture graphs are shown in Figure 10, Appendix D.

Table D1. Water retention information for the upper 100 cm of a Cecil soil in the Georgia Piedmont

Depth or represented soil increment cm	Thickness cm	Centered depth of soil core cm	Bulk Density (g cm^{-3})	GravFC (kg kg^{-3})	GravWP (kg kg^{-3})	ThetaFC %	ThetaWP %	PAW	Equivalent Depth of Water, D (cm)	AWHC in upper 100 cm (cm)
			Mass Oven-dry soil/Volume of sample	Mass water at FC/Oven-dry soil mass	Mass water at WP/Oven-dry soil mass	GravFC*BD	GravWP*BD	ThetaFC - ThetaWP	PAW* Thickness	Sum of Water thickness
0-6	6	5	1.35	0.13	0.04	0.17	0.05	0.12	0.72	11.67
6-15	9	10	1.46	0.12	0.03	0.18	0.05	0.13	1.13	
15-30	15	20	1.51	0.12	0.05	0.18	0.08	0.10	1.54	
30-75	45	50	1.56	0.12	0.05	0.19	0.08	0.11	5.11	
75-100	25	96	1.52	0.23	0.14	0.35	0.22	0.13	3.18	

Table D2. Water retention information for the upper 100 cm of a Tifton soil in the Georgia Coastal Plain

Depth or represent-ed soil increment cm	Thickness cm	Centered depth of soil core cm	BD (g cm^{-3})	GravFC (kg kg^{-3})	GravWP (kg kg^{-3})	ThetaFC %	ThetaWP %	PAW	Equivalent Depth of Water, D (cm)	AWHC in upper 100 cm (cm)
			Mass Oven-dry soil/Volume of sample	Mass water at FC/Oven-dry soil mass	Mass water at WP/Oven-dry soil mass	GravFC*BD	GravWP*BD	ThetaFC - ThetaWP	PAW*Thick-ness	Sum of Water thickness
0-6	6	5	1.41	0.14	0.05	0.20	0.07	0.14	0.82	9.47
6-15	9	10	1.57	0.12	0.03	0.18	0.05	0.13	1.20	
15-30	15	20	1.65	0.10	0.03	0.16	0.05	0.11	1.72	
30-75	45	50	1.70	0.14	0.09	0.23	0.15	0.09	3.93	
75-100	25	100	1.55	0.15	0.11	0.24	0.17	0.07	1.79	

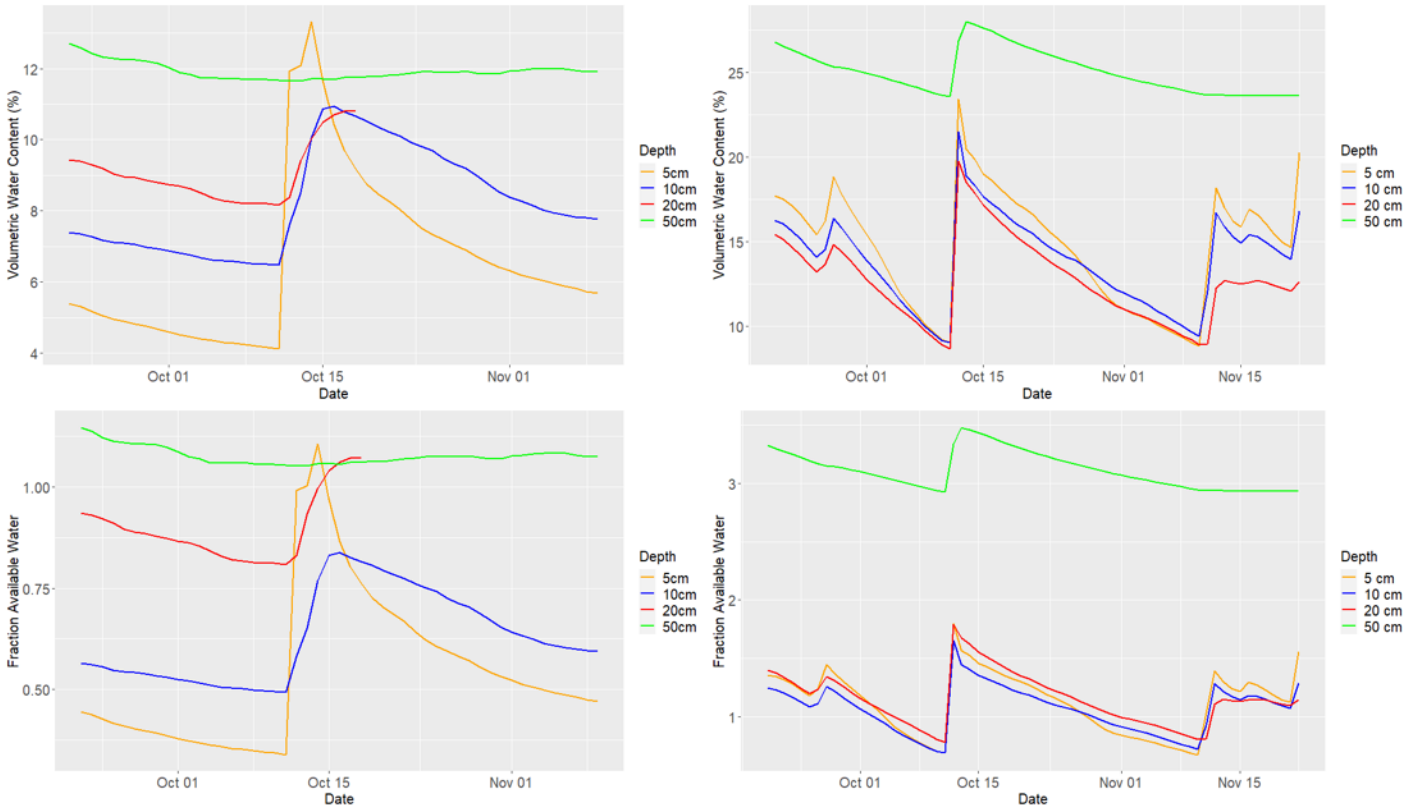

Figure D1. Volumetric water content and fraction available water (FAW) for four depths for a Cecil soil (left panel) and Tifton soil (right panel) in the Georgia Piedmont. Image Credit: Matthew Levi.