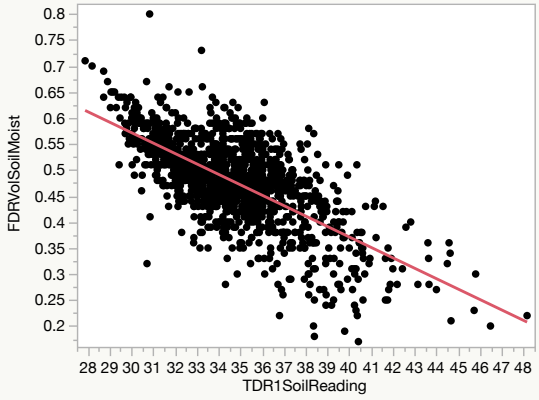
Cross-sensor regressions based on paired sensors in each of the 18 CARBONO plots

These regressions are based on the final, screened total data set through 11 Oct. 2018, the final biweekly readings of soil-moisture in the CARBONO plots. In the pre-regression screening, apparently anomalous data were removed (but preserved in the notes). Anomalies were identified during plot-wise screens of sorted FDR and TDR1 data, and by plot-level data-graph inspections. The finalized regression (below) is based on all the screened data from all 18 plots. For only one plot, A5, did the FDR data at the end of the record indicate sensor failure, and these data were filtered out of the dataset (see notes).

After data screening, at the individual plot level, all 18 plots each had a highly significant plot-level regression ($p < 0.0001$) between FDR and TDR sensors, but the r^2 values varied widely (0.82 to 0.17). The large range in plot-level r^2 we attribute to the marked microspatial soil variation within the plots (in some plots, the two sensors could have been in quite different soil conditions – e.g., only one affected by a leaf-cutter ant nest). The highly significant regressions between sensor types indicate that the long-term FDR sensors were still working well in most plots (A5, with a failed FDR sensor at the end of the period, is the exception; see below). Also, when plots had 2 TDR sensors, the two TDR sensors were highly correlated (see last graph).

The FDR-TDR regression based on all screened data from all 18 plots:

Bivariate Fit of FDRVolSoilMoist By TDR1SoilReading



Linear Fit

Linear Fit

FDRVolSoilMoist = 1.1740175 - 0.0200679*TDR1SoilReading

Summary of Fit

RSquare	0.456031
RSquare Adj	0.455627
Root Mean Square Error	0.059448
Mean of Response	0.476993
Observations (or Sum Wgts)	1350

Analysis of Variance

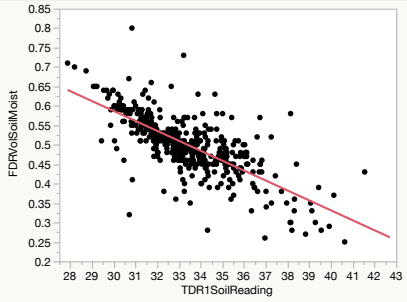
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3.9937322	3.99373	1130.082
Error	1348	4.7638577	0.00353	Prob > F
C. Total	1349	8.7575899		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.1740175	0.020798	56.45	<.0001*
TDR1SoilReading	-0.020068	0.000597	-33.62	<.0001*

Because the FDR-TDR regressions differed among the 3 plot types (A, L, P; 6 CARBONO plots per type), we used the plot-type-specific regressions for gap-filling the finalized soil-moisture data based on TDR data when an FDR value was lacking. The three plot-type regressions:

Bivariate Fit of FDRVolSoilMoist By TDR1SoilReading PlotType=A



Linear Fit

FDRVolSoilMoist = 1.3539087 - 0.0255704*TDR1SoilReading

Summary of Fit

RSquare	0.535911
RSquare Adj	0.534779
Root Mean Square Error	0.052798
Mean of Response	0.499976
Observations (or Sum Wgts)	412

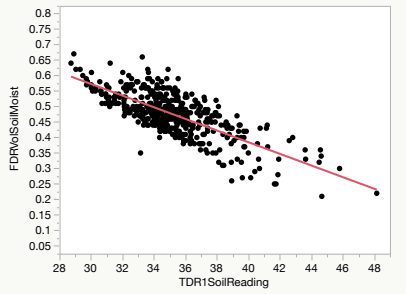
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.3197885	1.31979	473.4517
Error	410	1.1429113	0.00279	Prob > F
C. Total	411	2.4626998		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.3539087	0.039331	34.42	<.0001*
TDR1SoilReading	-0.02557	0.001175	-21.76	<.0001*

Bivariate Fit of FDRVolSoilMoist By TDR1SoilReading PlotType=L



Linear Fit

FDRVolSoilMoist = 1.136654 - 0.018793*TDR1SoilReading

Summary of Fit

RSquare	0.543679
RSquare Adj	0.542678
Root Mean Square Error	0.048388
Mean of Response	0.475852
Observations (or Sum Wgts)	458

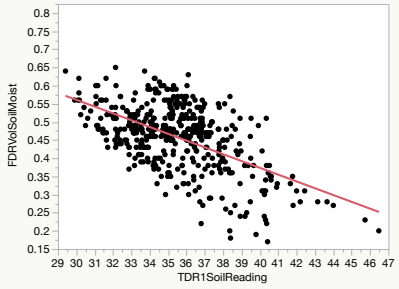
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.2720556	1.27206	543.2967
Error	456	1.0676623	0.00234	Prob > F
C. Total	457	2.3397179		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.136654	0.02844	39.97	<.0001*
TDR1SoilReading	-0.018793	0.000806	-23.31	<.0001*

Bivariate Fit of FDRVolSoilMoist By TDR1SoilReading PlotType=P



Linear Fit

FDRVolSoilMoist = 1.1230972 - 0.0187396*TDR1SoilReading

Summary of Fit

RSquare	0.315994
RSquare Adj	0.314563
Root Mean Square Error	0.071476
Mean of Response	0.458354
Observations (or Sum Wgts)	480

Analysis of Variance

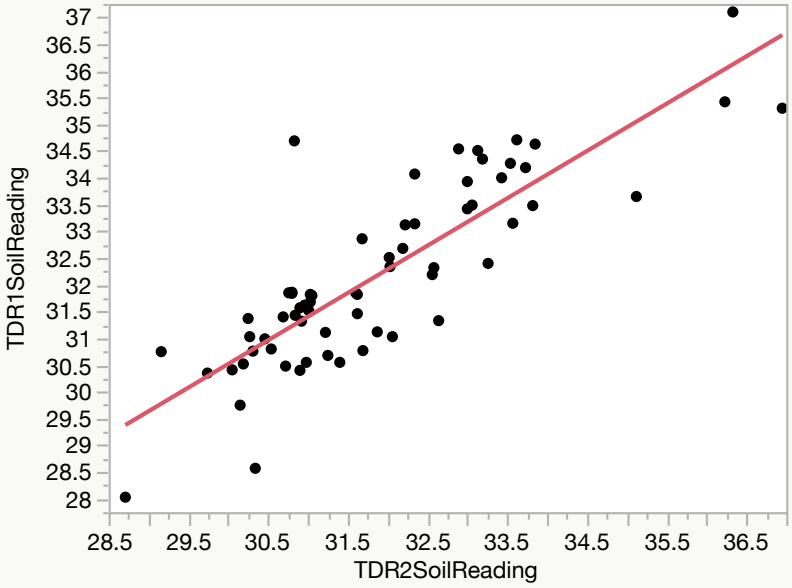
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.1281603	1.12816	220.8239
Error	478	2.4420395	0.00511	Prob > F
C. Total	479	3.5701998		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.1230972	0.044852	25.04	<.0001*
TDR1SoilReading	-0.01874	0.001261	-14.86	<.0001*

The data from the CARBONO plots with two simultaneously deployed TDR sensors (TDR1, TDR2) showed high correlation between the two sensors in the plot, indicating the reliability of the TDR sensors:

Bivariate Fit of TDR1SoilReading By TDR2SoilReading



Linear Fit

Linear Fit

TDR1SoilReading = 3.9799334 + 0.8846691*TDR2SoilReading

Summary of Fit

RSquare	0.717821
RSquare Adj	0.713342
Root Mean Square Error	0.915871
Mean of Response	32.19462
Observations (or Sum Wgts)	65

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	134.43141	134.431	160.2627
Error	63	52.84561	0.839	Prob > F
C. Total	64	187.27702		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.9799334	2.231631	1.78	0.0793
TDR2SoilReading	0.8846691	0.069882	12.66	<.0001*