

Update on Reference Sample Exchange



Soil profile near sample collection area in Underhill State Park, VT

Brief history

- Samples collected from Underhill State Park, western slopes of Mt. Mansfield in 2003 or so.
- About 30 gallons of each sent to Mike Amacher, USFS, Utah. Sieved, homogenized and stored. Five gal. (20 liters) of each sent back to UVM.
- The remaining portion was originally intended for a sample exchange run out of Utah but, at last word, only being used as a pH reference.
- UVM now has another 5 gallon pail of each.

Reference soil update

- Our idea was to use it as a reference soil for analysis of samples from our 200-yr soil monitoring plots.
- Distributed through this group (NESMC) beginning a five years ago.
- Participation (not all labs have run all tests)
 - 2008 6 labs
 - 2009 9 labs
 - 2010 11 labs
 - 2011 13 labs with one more in progress
 - 2013 3 more labs given samples (1 CN and pH only)

Participating labs and numbers of results

		Cations	Cations	pH	pH	CN
		Oa	Bs	Oa	Bs	
USFS Durham	Lab 1	15	12	7	7	?
UVM (batch)	Lab 2	6	23		10	6
GLFC	Lab 3	7	7	3	3	
Maine	Lab 4	2	2	2	2	
Dartmouth	Lab 5			3	3	3
ESF (Russ)	Lab 6	?	?	?	?	?
USGS Troy	Lab 7	11	5	3-5	3-5	25
Soutein Sientifique	Lab 8	3	3	3	3	3
Duke	Lab 9					3
Syracuse (Chris)	Lab 10	?	5			4
FIA	Lab 11		3		1	3
Ontario Forest Res Inst	Lab 13	5	5			5
UNH (Vadeboncoeur)	Lab 14					?

	Cations	Cations	pH	pH	CN
	Oa	Bs	Oa	Bs	
Number of labs w results	9	10	7	9	11
Number with $n = 6$	4	3	1	2	2
Number with $n = 3$	6	8	5	6	8
5 labs reporting exchangeable acidity					
5-6 labs reporting LOI					
3 labs reporting 'total'					
New labs:					
Trent (Julian A.)					
U. Georgia (Dan Mark.)					
Cornell (Christy/Guin)					

Extractable Cations, Bs horizon

Removed for revised statistics								
Outside of 95% confidence interval of revised statistics								
Bs								
	n	Ca	Mg	K	Na	Al	Fe	Mn
		cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg	cmol/kg	cmol/kg
Lab 1	12	0.156	0.074	0.041	0.022	11.29		0.023
Lab 2	23	0.168	0.069	0.037	0.012	4.90	0.202	0.008
Lab 3	7	0.210	0.093	0.041	0.021	6.43	0.179	0.012
Lab 6		0.181	0.207					
Lab 7	5	0.149	0.066	0.037	0.015	12.64		
Lab 8	3	0.143	0.069	0.034	0.014	5.13	0.121	0.005
Lab 10	5	0.143	0.061	0.024	0.015	6.81		
Lab 11	3	0.096	0.065	0.140	0.057	4.64	0.063	0.005
Lab 12	6	0.137	0.065	0.040		7.489		0.010
Lab 13	5	0.080	0.057	0.036				
<i>All</i>		Ca	Mg	K	Na	Al		
	Grand mean	0.147	0.083	0.048	0.022	7.45		
	<i>n</i>	10	10	9	7	8		
	Std Dev	0.032	0.047	0.038	0.016	3.27		
	95% confidence int.	0.020	0.029	0.025	0.012	2.26		
	acceptable min	0.127	0.054	0.023	0.010			
	acceptable max	0.166	0.112	0.073	0.034			
<i>With outliers removed</i>		Ca	Mg	K	Na	Al		
	Grand mean	0.147	0.069	0.037	0.016			
	<i>n</i>	8	9	8	6			
	Std Dev	0.015	0.013	0.004	0.004			
	95% confidence int.	0.010	0.008	0.002	0.003			
	acceptable min	0.136	0.061	0.034	0.013			
	acceptable max	0.157	0.078	0.039	0.020			

Extractable Cations, Oa horizon

			Left out of statistics						
			Outside of 95% confidence interval of revised statistics						
Oa									
	Sol:soil ratio		Ca	Mg	K	Na	Al	Fe	Mn
			cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg	cmolc/kg
Lab 1	15	mean	1.10	0.56	0.51	0.08	20.89		0.08
Lab 2	6	mean	1.15	0.46	0.55		9.96	0.18	0.02
Lab 3	7	mean	0.98	0.55	0.52	0.07	10.75	0.47	0.04
Lab 6		mean	1.07	0.39					
Lab 7	11	mean	1.02	0.55	0.54	0.06	4.83		
Lab 8	3	mean	0.94	0.51	0.47	0.05	10.74	0.29	0.02
Lab 10		mean	0.87	0.44	0.41	0.04	10.72		
Lab 13	5	mean	0.53	0.42	0.51				
<i>All</i>			Ca	Mg	K	Na	Al		
		Grand mean	0.95	0.48	0.50	0.06	11.13		
		<i>n</i>	8	8	7	5	6		
		Std Dev	0.10	0.06	0.03	0.02	5.27		
		95% confidence int.	0.07	0.04	0.02	0.01	4.22		
		acceptable min	0.88	0.44	0.48	0.04			
		acceptable max	1.02	0.53	0.52	0.07			
<i>With outlier removed</i>			Ca	Mg	K	Na	Al		
		Grand mean	1.01	0.50	0.51				
		<i>n</i>	7	7	6				
		Std Dev	0.09	0.05	0.03				
		95% confidence int.	0.07	0.03	0.02				
		acceptable min	0.94	0.46	0.49				
		acceptable max	1.08	0.53	0.54				

% C and N

	Oa	Oa			Oa	Oa	
	%C	%N			%C	%N	
Lab 1	29.27	1.65		Outlier removed			
Lab 3	27.00	1.64		Lab 1	29.27	1.65	
Lab 5	30.60	1.73		Lab 3	27.00	1.64	
Lab 6	21.02	1.30		Lab 5	30.60	1.73	
Lab 7	30.34	1.78		Lab 7	30.34	1.78	
Lab 8	31.56	1.68		Lab 8	31.56	1.68	
Lab 9	29.41	1.73		Lab 9	29.41	1.73	
Lab 10	26.68	1.49		Lab 10	26.68	1.49	
Lab 11	28.42	1.68		Lab 11	28.42	1.68	
Lab 13	28.57	1.60		Lab 13	28.57	1.60	
Lab 14	28.99	1.63		Lab 14	28.99	1.63	
Grand mean	28.35	1.63		Grand mean	29.08	1.66	
n	11.00	11.00		n	11	11	
Std Dev	2.83	0.13		Std Dev	1.53	0.08	
95% confidence	1.67	0.08		95% confidence	0.90	0.05	
	Way outside of 95% confidence interval of statistics						

pH
(about the
same as 2010)

Way outside of 95% confidence interval of statistics				
	Oa	Oa	Bs	Bs
	pH _{Ca}	pH _w	pH _{Ca}	pH _w
Lab 1	3.45		3.61	
std dev	0.067		0.038	
<i>n</i>	7		7	
Lab 2				4.04
std dev				0.05
<i>n</i>				10
Lab 3	3.51	4.37	3.63	4.04
std dev	0.06	0.11	0.04	0.04
<i>n</i>	3	3	3	3
Lab 4	3.47	4.53	3.58	4.10
std dev				
<i>n</i>				
Lab 5	3.49	3.84	3.73	3.93
std dev				
<i>n</i>	3	3	3	3
Lab 6	3.55	4.22	3.50	4.04
std dev				
<i>n</i>				
Lab 7	3.45	4.21	3.48	3.96
<i>n</i> =3-5				
Lab 8	3.50	4.30	3.77	4.13
std dev				
<i>n</i>	3	3	3	3
Lab 11			3.73	4.10
std dev				
<i>n</i>			1	1
Grand mean	3.51	4.22	3.63	4.04
<i>n</i>	7	6	8	8
Std Dev	0.05	0.25	0.12	0.08
% confidence int.	0.04	0.20	0.08	0.05

Next steps?

- Require a minimum number of reps from each participating lab?
- We should have enough of the samples to send more. Email: dross@uvm.edu
- Journal article?
 - Comparison of labs across region / forest soils
 - Challenges with low-Ca soils
 - Comparison of methods, differences in Al
- Publish in Environmental Monitoring and Assessment?