Statistical Consulting Report

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Soil Incubation Study

Background and objectives

Soil from study sites in the lower coastal plain forested wetland area contains high organic matter. Carbon storage and turnover of this organic carbon enriched soil are believed to be controlled by environmental factors including temperature and soil water content by affecting soil decomposition rate. Furthermore, the influence of the temperature by water factors on soil could be separated by different soil depths and soil fractions which is associated with ages of carbon. Soil carbon also responds to land use and management.

Lab incubation study provides controls over temperature and soil moisture and thus making it possible to distinguish how these two factors alter soil carbon dynamics. *The purpose of this study* is to characterize temperature and water effects on decomposition rates of different soil fractions.

Sampling in the field

Soil samples were collected from 3 plots in the field. Two soil samples will be collected from each field; one is "Top" which is the combination of soil from the top two levels (0-15 cm and 15-30 cm) while the other is "Bottom" which is from the bottom two levels (45-60 cm and 60-75 cm).

Factors

Temperature (T): 3 levels (base, +2, +4)
Soil moisture (VWC): 3 levels (20%, 30% and 40%)
Harvest times (HT): 3 levels (0, 60, 240 days of incubation)
2 Reps (Temp x VWC x Depth), it was split into two subsamples

The major hypotheses are;

1) The main effects of temperature levels are not significantly different from each other for chemical and isotope (H0: t1=t2=t3=0). Similarly the soil moisture levels are not significantly different for soil carbon dynamics (H0: W20=W30=W40=0)

2) The interaction between T and W is not significant. In other words, the level of chemical and isotope does not change for different levels of moisture and temperature levels.

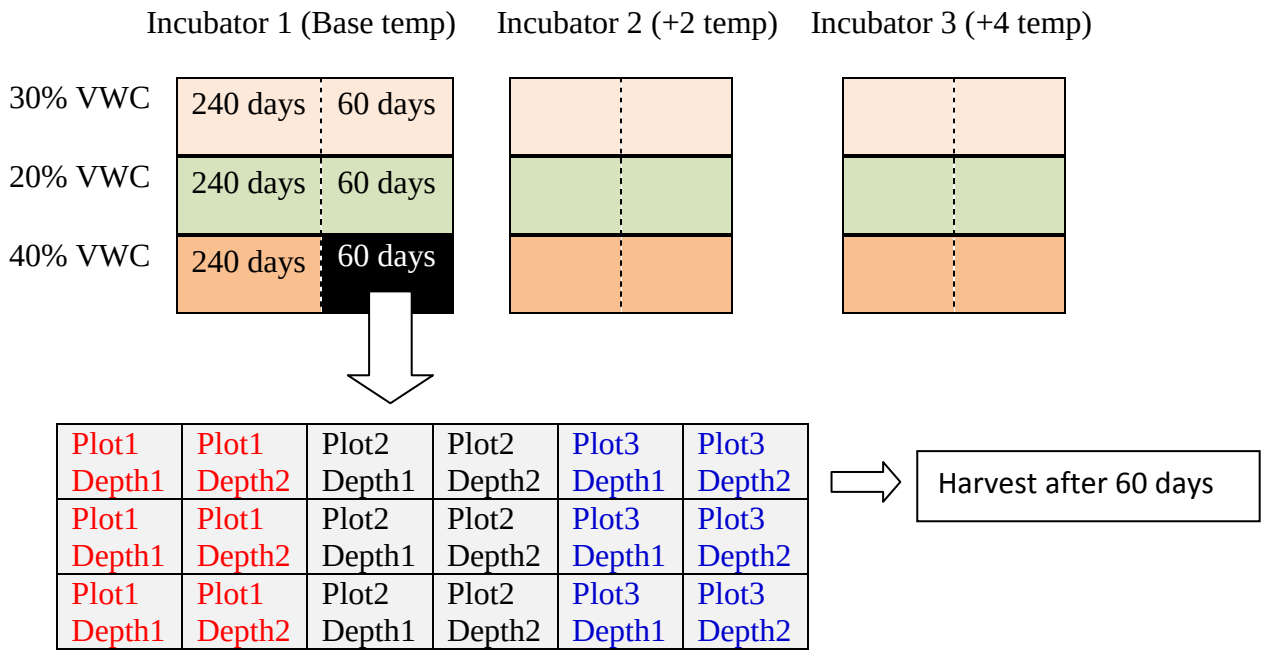
COMMENTS:

For the study 3 incubators are available.

A classical split plot design experiment can be used to test the major hypotheses. In such a design, the available 3 incubators in the lab can be treated as the main plots (factor T). Each incubator will have 3 subplots, one for each moisture level (factor VWC). Within each main plot, the b levels of between factors VWC are randomized to the b subunits (sub-plots). The interaction of T x VWC would be the error term 1 to test the hypotheses for factors Temps and Moisture. In such a design the highest precision will be obtained for T and VWC.

The b sub-plots (3 in each incubator) will be split into 2 sub-sub plots for two different harvests (60 days and 240 days). Each sub-sub-plot will include 12 soil samples (3 field plots x 2 depths x 6 for each harvest).

DESIGN in the LAB



Measure all for harvest 0 (Control),
Harvest 162 after 60 days
(3 incubators (Temps) x 3 VWC x 3 field plots x 2 depths x 3 jars per depth)

Harvest another 162 after 240 days.
Total samples to be processed: 324

Using the PLAN procedure of SAS, the following split plot design was generated.

```
Split-Split Plot Design      10:09 Friday, September 4, 2009   1

                              The PLAN Procedure

Factor          Select      Levels      Order

Temps                3           3    Ordered
Mositure             3           3    Random
harvest              2           2    Random
plot                 3           3    Random
depth                2           2    Random
sample               3           3    Random
```

Temps	Mositure	harvest	plot	depth	sample		
1	3	2	1	2	2	3	1
				1	1	2	3
			2	2	2	3	1
				1	2	3	1
			3	2	1	3	2
				1	1	2	3
		1	1	2	3	1	2
				1	3	1	2
			3	2	1	3	2
				1	2	3	1
			2	2	3	1	2
				1	2	3	1
	2	2	1	2	2	3	1
				1	1	3	2
			3	2	1	2	3
				1	2	1	3
			2	2	3	2	1
				1	2	1	3
		1	1	2	3	1	2
				1	3	1	2
			3	2	3	1	2
				1	2	1	3
			2	2	3	2	1
				1	2	3	1
	1	2	1	1	3	2	1
				2	2	3	1
			2	1	1	2	3
				2	1	2	3

			3	2	2	3	1
				1	2	3	1
		1	3	2	3	2	1
				1	3	1	2
			1	1	2	1	3
				2	2	3	1
			2	2	3	2	1
				1	3	2	1

Temps	Mositure	harvest	plot	depth	sample		
2	1	2	3	2	2	3	1
				1	3	2	1
			1	2	2	3	1
				1	1	2	3
			2	1	1	2	3
				2	3	1	2
		1	2	2	2	3	1
				1	2	3	1
			3	2	3	2	1
				1	3	2	1
			1	2	1	3	2
				1	2	3	1
	3	1	1	2	2	1	3
				1	3	2	1
			3	2	1	3	2
				1	1	3	2
			2	2	2	1	3
				1	2	3	1
		2	1	1	2	3	1
				2	1	3	2
			3	2	1	3	2
				1	3	1	2
			2	1	3	1	2
				2	1	2	3
	2	2	3	1	2	3	1
				2	1	3	2
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				2	3	2	1
			2	1	1	3	2
				2	3	1	2
		1	2	2	3	1	2
				1	2	1	3

			1	1	1	2	3
				2	1	3	2
			3	2	2	3	1
				1	2	1	3

Temps	Mositure	harvest	plot	depth	sample		
3	1	1	3	2	2	3	1
				1	2	1	3
			1	1	2	3	1
				2	3	2	1
			2	2	1	2	3
				1	3	1	2
		2	1	2	1	2	3
				1	2	1	3
			2	1	2	1	3
				2	3	1	2
			3	1	1	2	3
				2	3	2	1
	3	1	2	1	3	2	1
				2	2	1	3
			1	1	3	1	2
				2	1	3	2
			3	1	1	3	2
				2	2	3	1
		2	3	1	2	1	3
				2	3	2	1
			1	2	3	2	1
				1	3	1	2
			2	1	2	3	1
				2	3	1	2
	2	2	1	2	3	2	1
				1	1	3	2
			2	2	1	2	3
				1	1	3	2
			3	1	2	1	3
				2	3	1	2
		1	1	2	2	1	3
				1	2	3	1
			3	2	3	1	2
				1	3	1	2
			2	2	1	2	3
				1	3	2	1