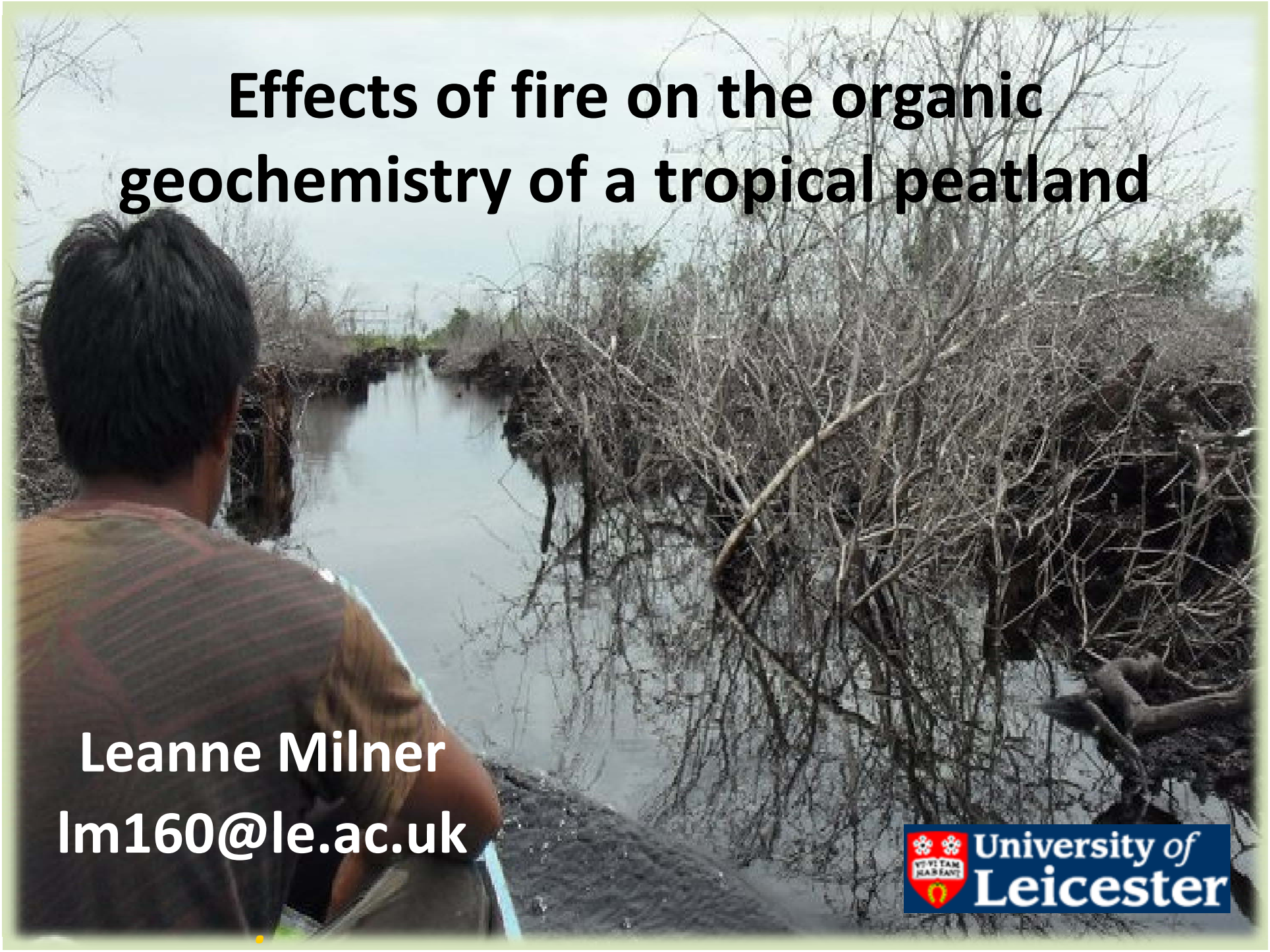
Effects of fire on the organic geochemistry of a tropical peatland



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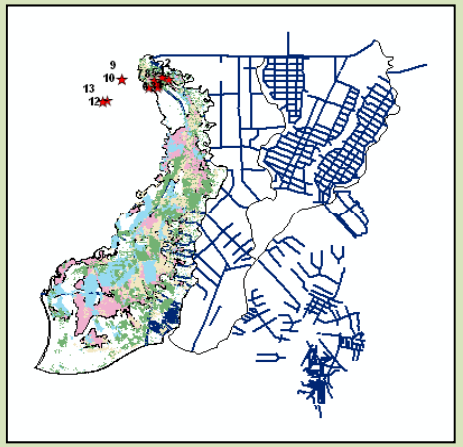
Research overview

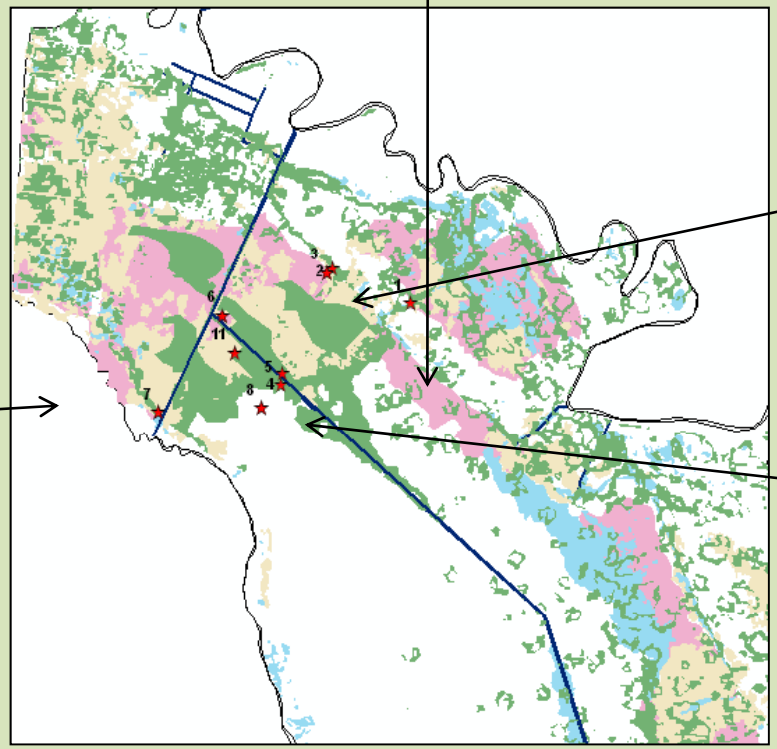
- Improve understanding of the effects of fire on geochemistry of tropical peat
- Obtain a detailed fingerprint of the organic matter at the molecular level pre and post fire.
- Understand how fire alters peat nutrient status.
- Spatial and temporal geochemical variation in fire prone peatlands.

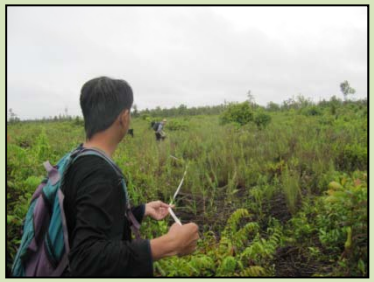
Methods & Sampling



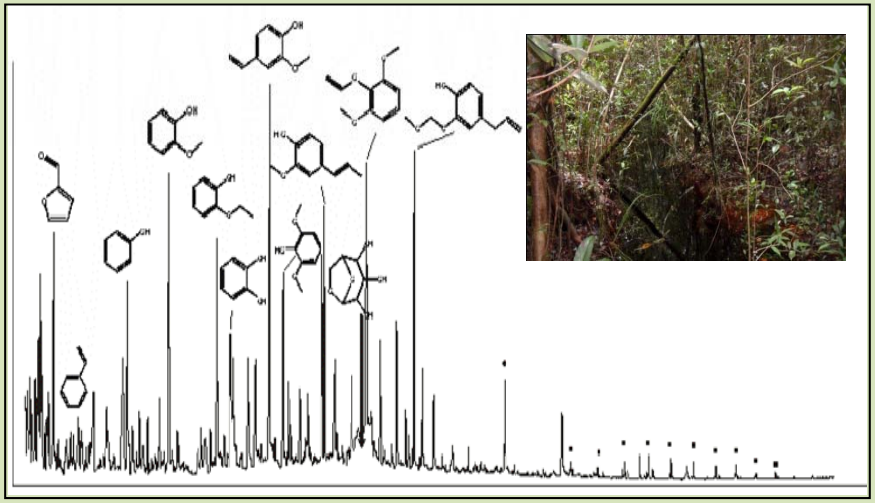
Legend

- ★ coordinates for 2011 sampling.csv Events
- 2009_burnedlandcover
- 2006_burnedarea_landcover
- burn_scars2002_ETM_AgH
- burn_scars1997_TM_AgH

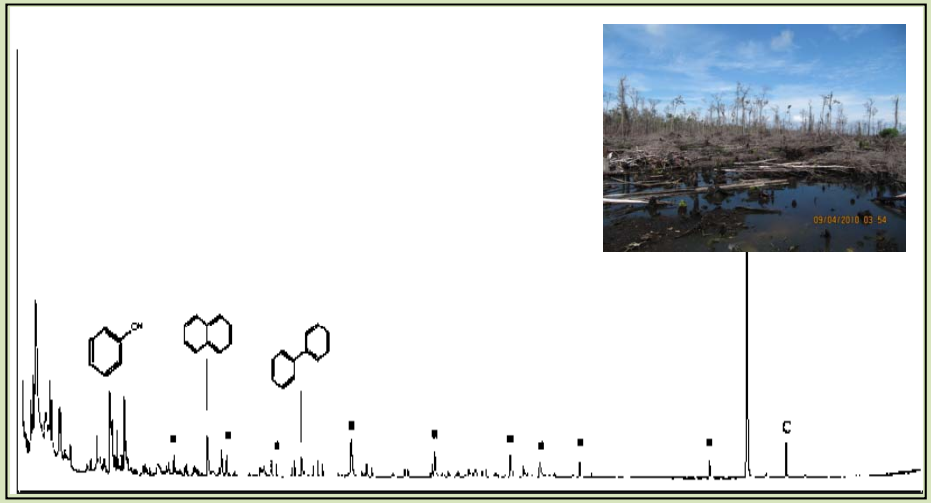




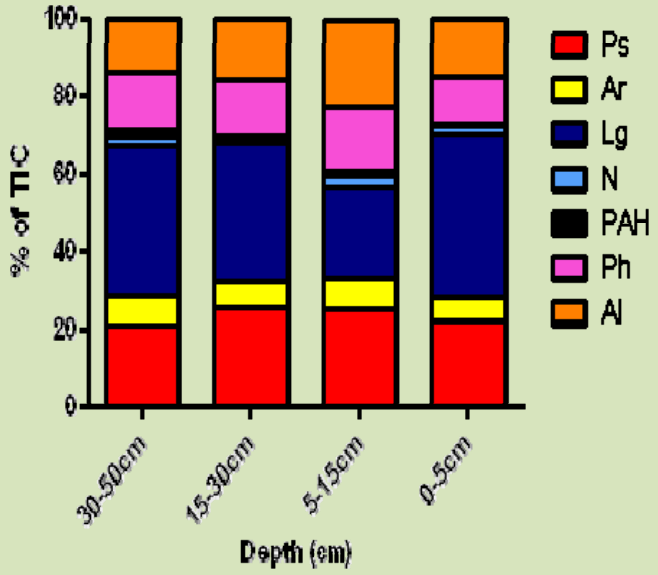
OM alteration- immediately post fire

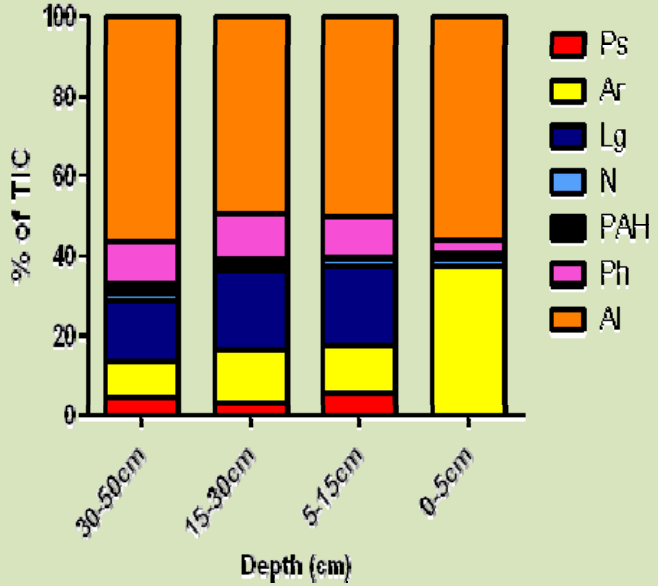


Pre -fire

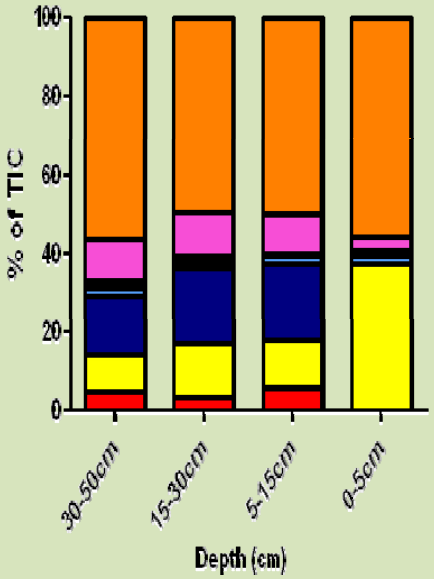


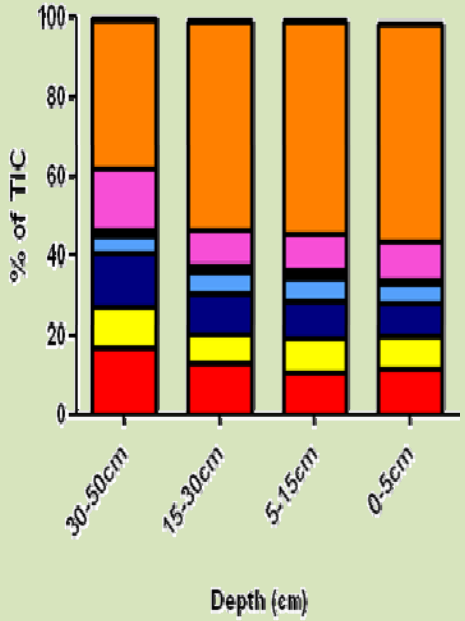
1 month post -fire

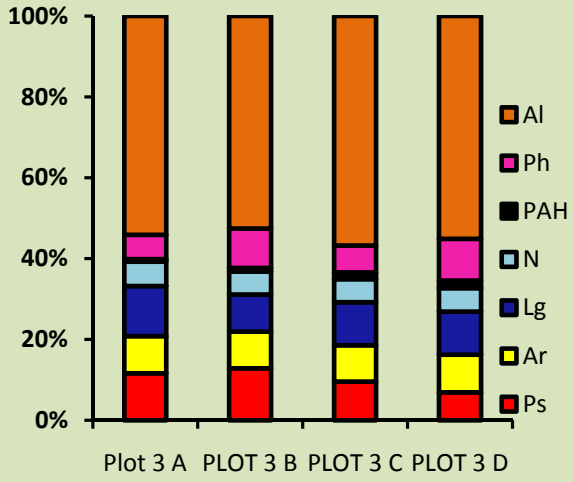




Organic matter alteration – 1 month to 13 years post fire





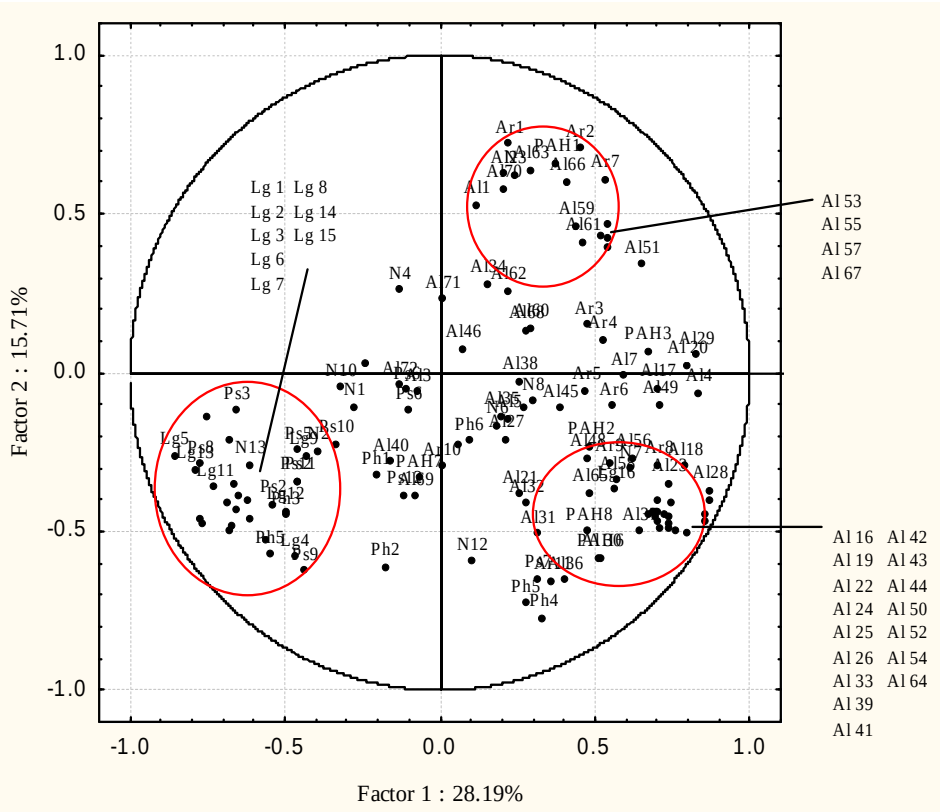


1 month

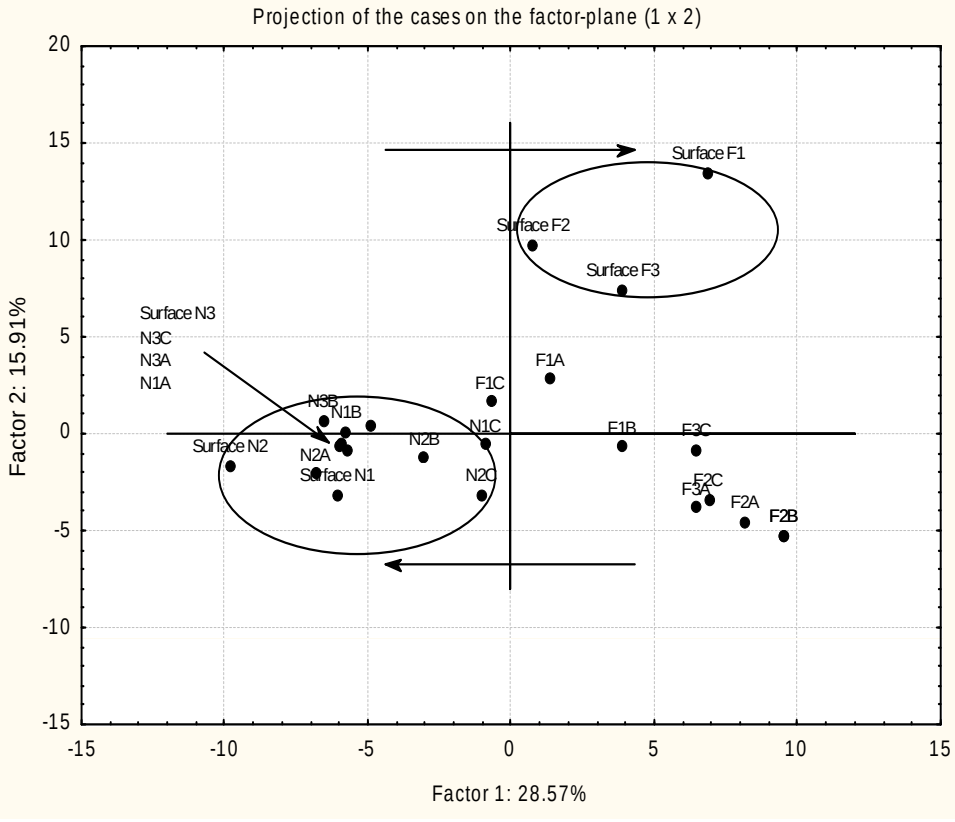
18 months

13 years

Time since fire



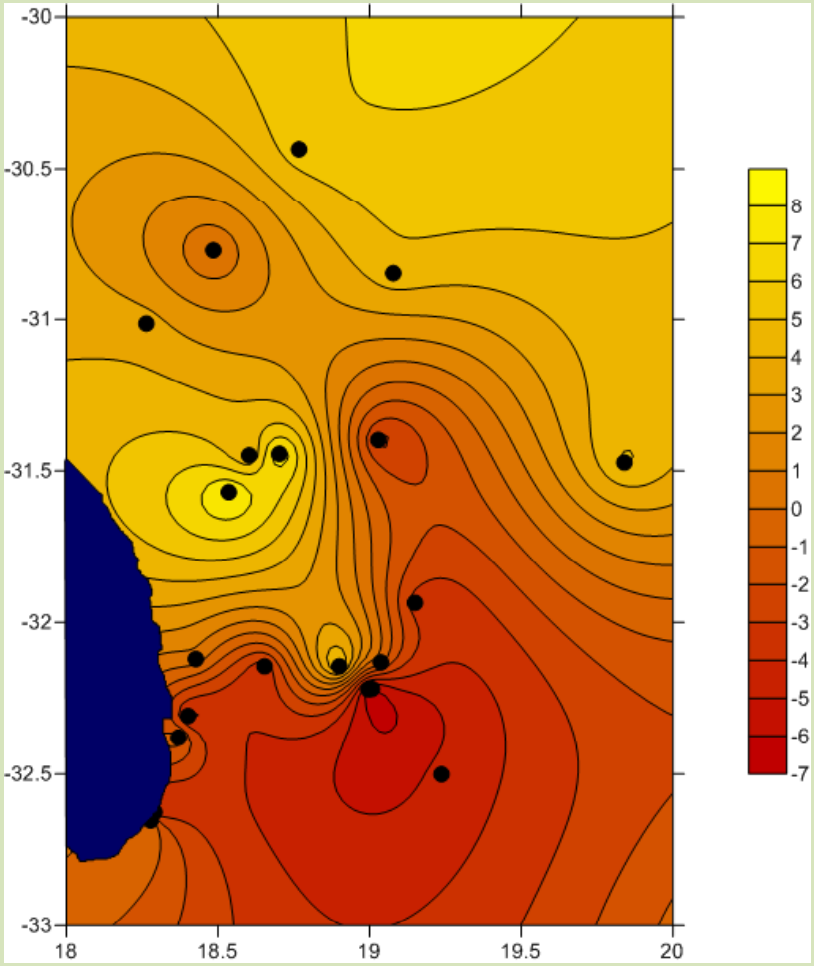
Plot of cases shows how the strongly the bulk samples plot in factor space. Burnt samples ‘F’ plot in the top right quarter with a positive loading on factor 2 and surface samples have positive loadings on both factors- showing clear structural differences between surface and subsurface fire.



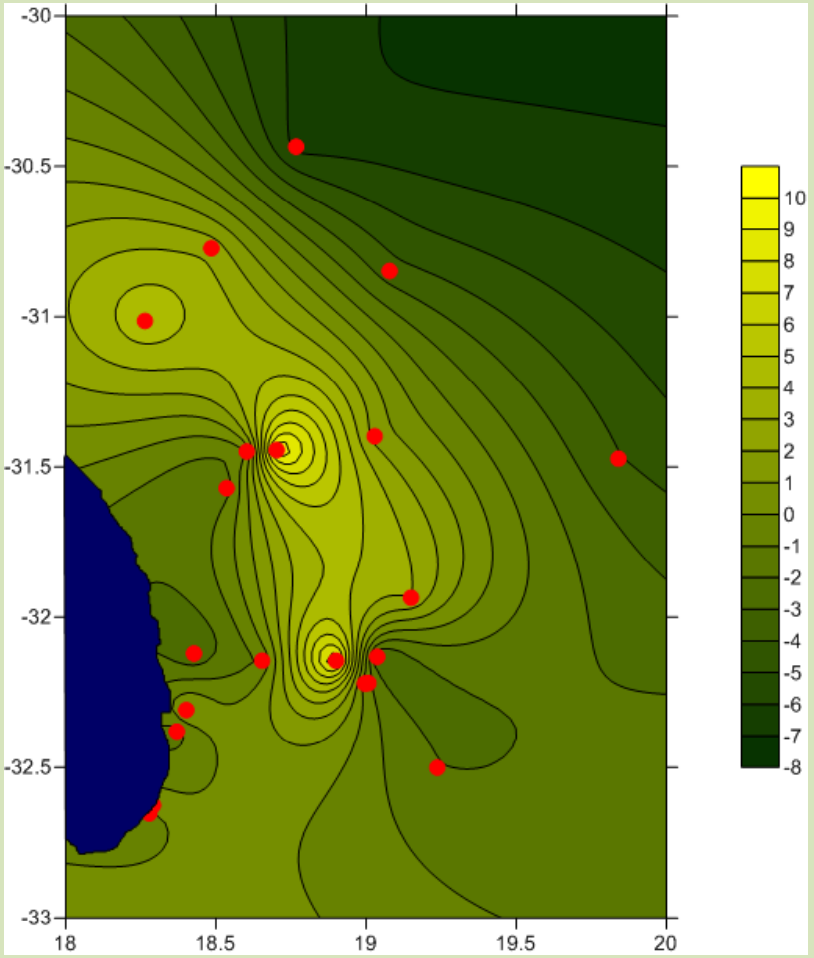
Organic compounds plotted in factor space – shows groups of chemically similar compounds and proves that they are similar to each other and how different compounds are related to the different ‘factors’ which may be attributed to geochemical differences in burnt and unburnt peat soils.

Spatial variation in OM composition

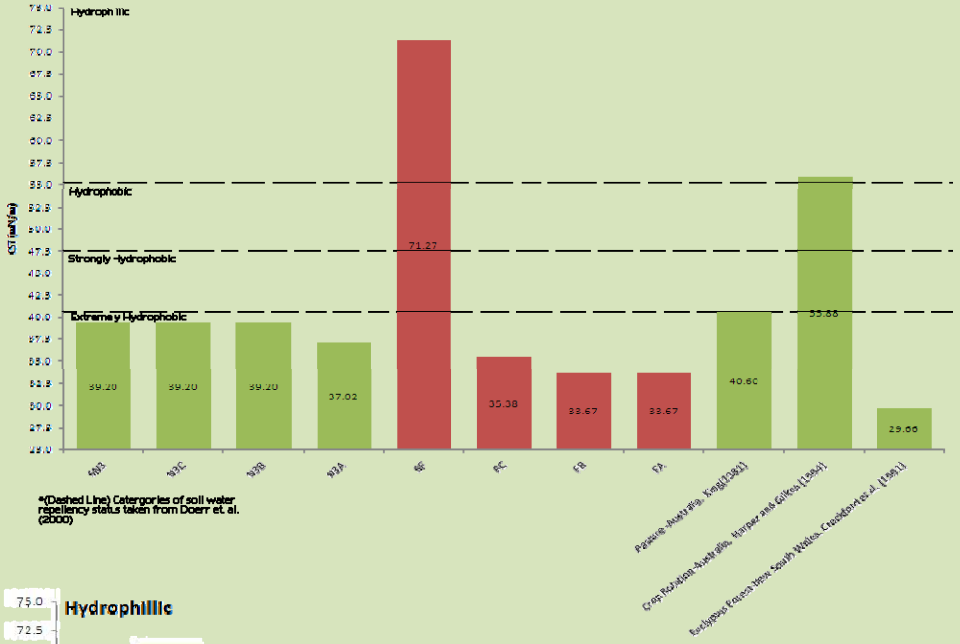
Factor 1 –OM Preservation

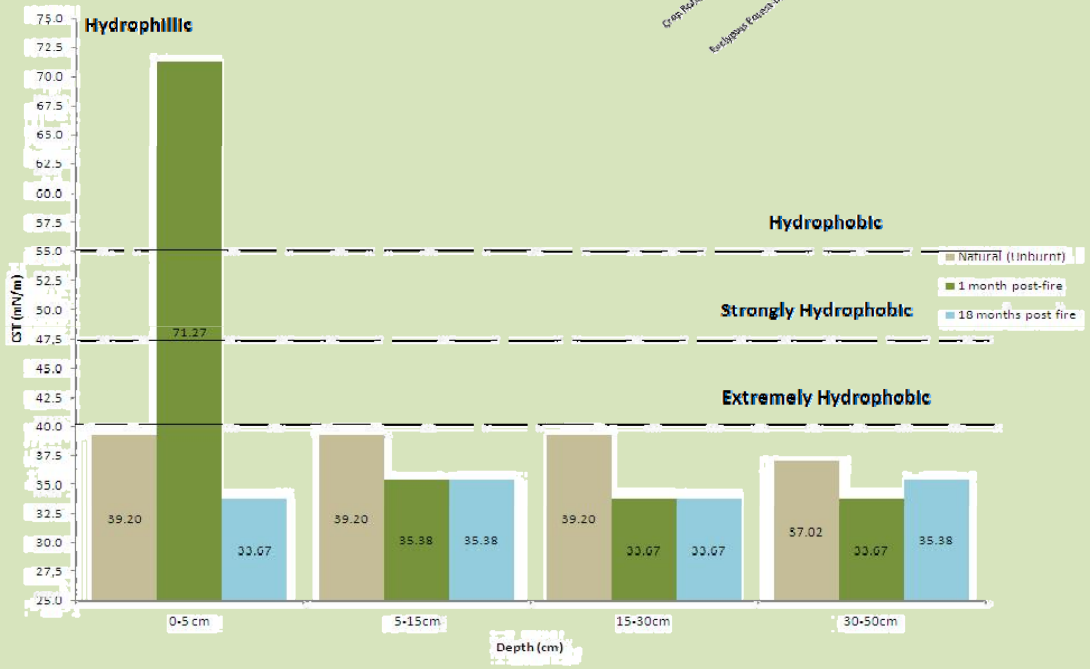


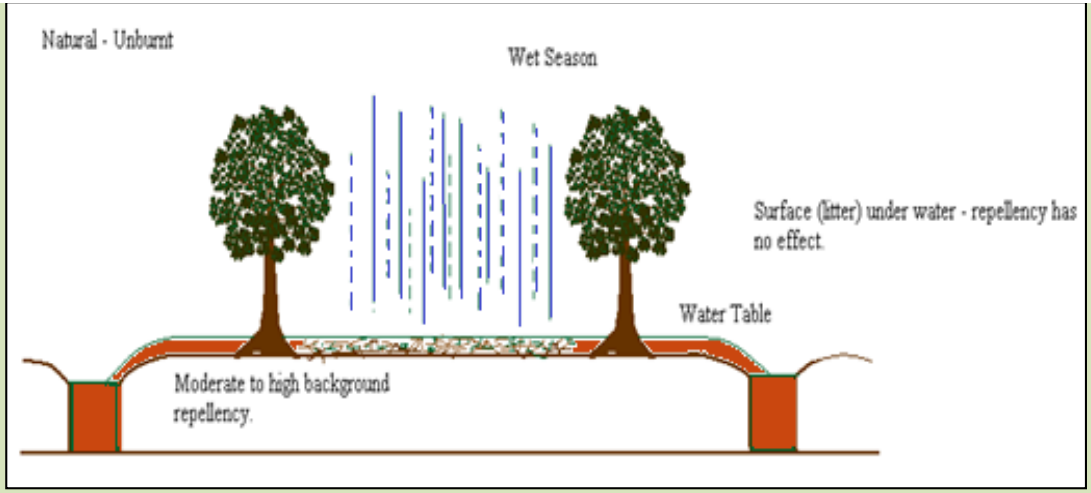
Factor 2 – Aliphatic content

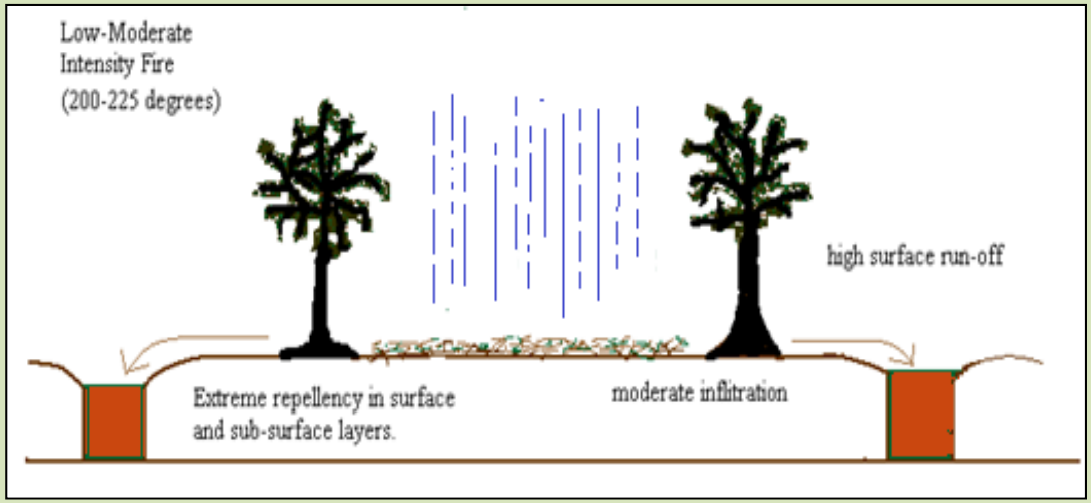


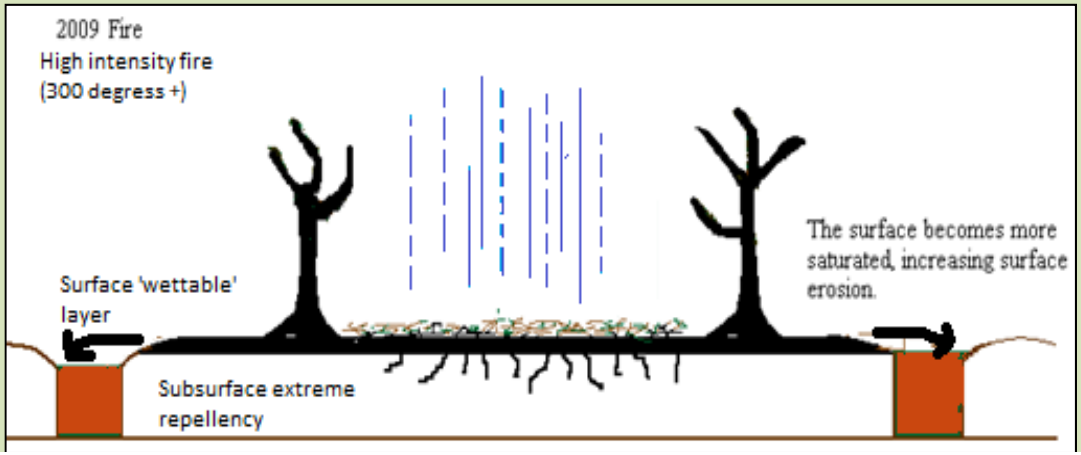
Water repellence of tropical peat






Natural - Unburnt
Wet Season
Surface (litter) under water - repellency has no effect.
Water Table
Moderate to high background repellency.


Low-Moderate Intensity Fire
(200-225 degrees)
high surface run-off
Extreme repellency in surface and sub-surface layers.
moderate infiltration


2009 Fire
High intensity fire
(300 degress +)
The surface becomes more saturated, increasing surface erosion.
Surface 'wettable' layer
Subsurface extreme repellency

Sample	Time since burn	TC (%)	TN (%)	C:N	CEC
SN	/	39.26	1.22	39.26	107.93 ± 10.19
NC	/	28.02	1.93	28.02	104.73 ± 12.54
NB	/	29.65	1.86	29.65	106.12 ± 9.15
NA	/	29.95	1.82	29.95	102.51 ± 16.55
SF	1 month	78.63	0.73	107.72	75.84 ± 4.12
FC	1month	56.62	0.99	56.62	83.27 ± 6.89
FB	1 month	55.53	0.92	55.53	103.62 ± 7.16
FA	1 month	41.78	1.36	41.78	100.70 ± 3.25
S1.5	18 month	56.63	0.82	69.06	
1.5C	18 months	46.24	0.59	68.14	
1.5B	18months	49.02	0.76	64.09	
1.5A	18 months	53.37	0.76	69.93	
S13	13 years	56.85	1.12	50.70	
13C	13 years	56.28	1.12	50.28	
13B	13 years	55.24	0.99	51.16	
13A	13 years	54.60	1.07	55.91	

Conclusions

- Organic composition is modified during burning as well as thermal alteration at depth to a minimum of 50cm below the surface- burnt peat is more recalcitrant.

- Increase relative contributions of apolar (hydrophobic) compounds enhances background levels of water repellence in subsurface.

- % C content increase from (47- 55 %) to (71- 55 %) after burning. C:N ratios increase post-fire from (29 – 40) to (107 – 49).

- CEC decreases immediately post fire.