Attributing biological controls on recent changes in carbon cycling in organic soils

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Hypothesis

- Decreasing sulphur deposition caused recovery from soil acidification and increased DOC leaching from organic soils.

History- Acid Deposition

$SO_2 + OH \rightarrow \mathbf{HOSO_2}$

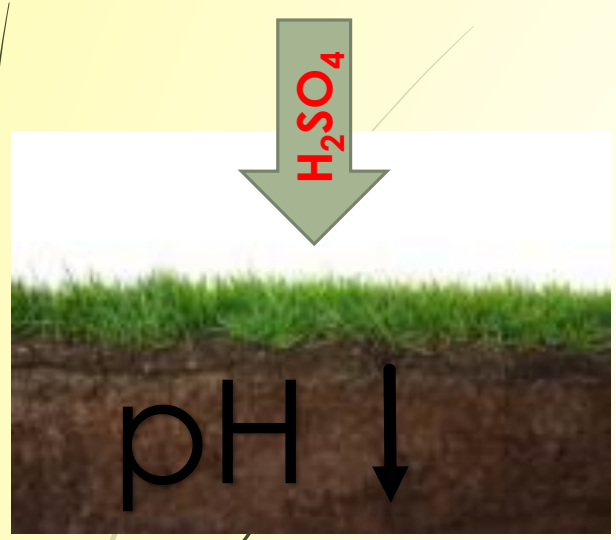
$HOSO_2 + O_2 \rightarrow \mathbf{HO_2 + SO_3}$

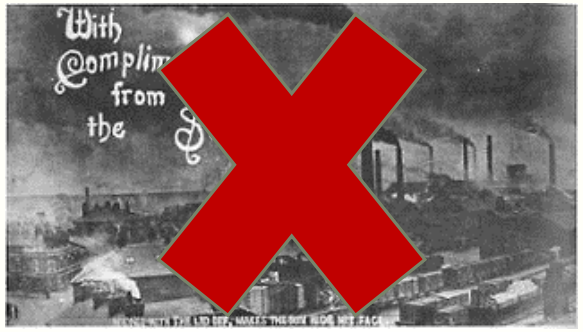
SO_2

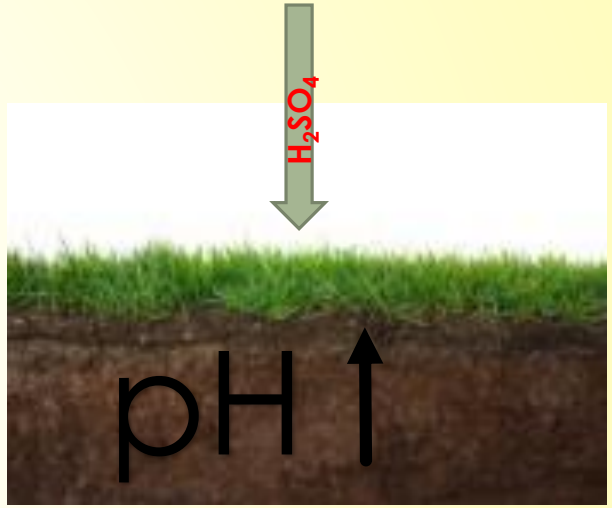
SO_3 (g) + H_2O (l) → **H_2SO_4** (aq)

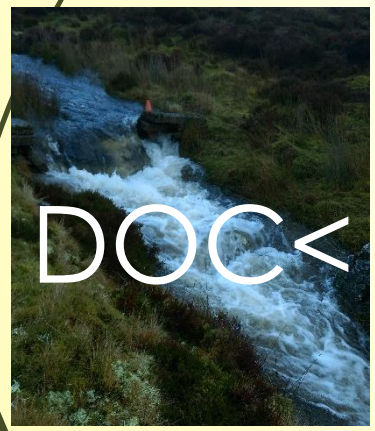
H_2SO_4

History- Acid Deposition and DOC



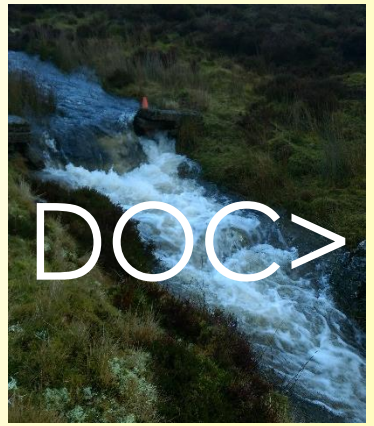






SO_4 Deposition Reductions (1986-2001):
-71% dry
-45% wet

Fowler et al, 2005. Changes in the atmospheric deposition of acidifying compounds in the UK between 1986 and 2001, Env Pol, **137** (1), p.p. 15-25.



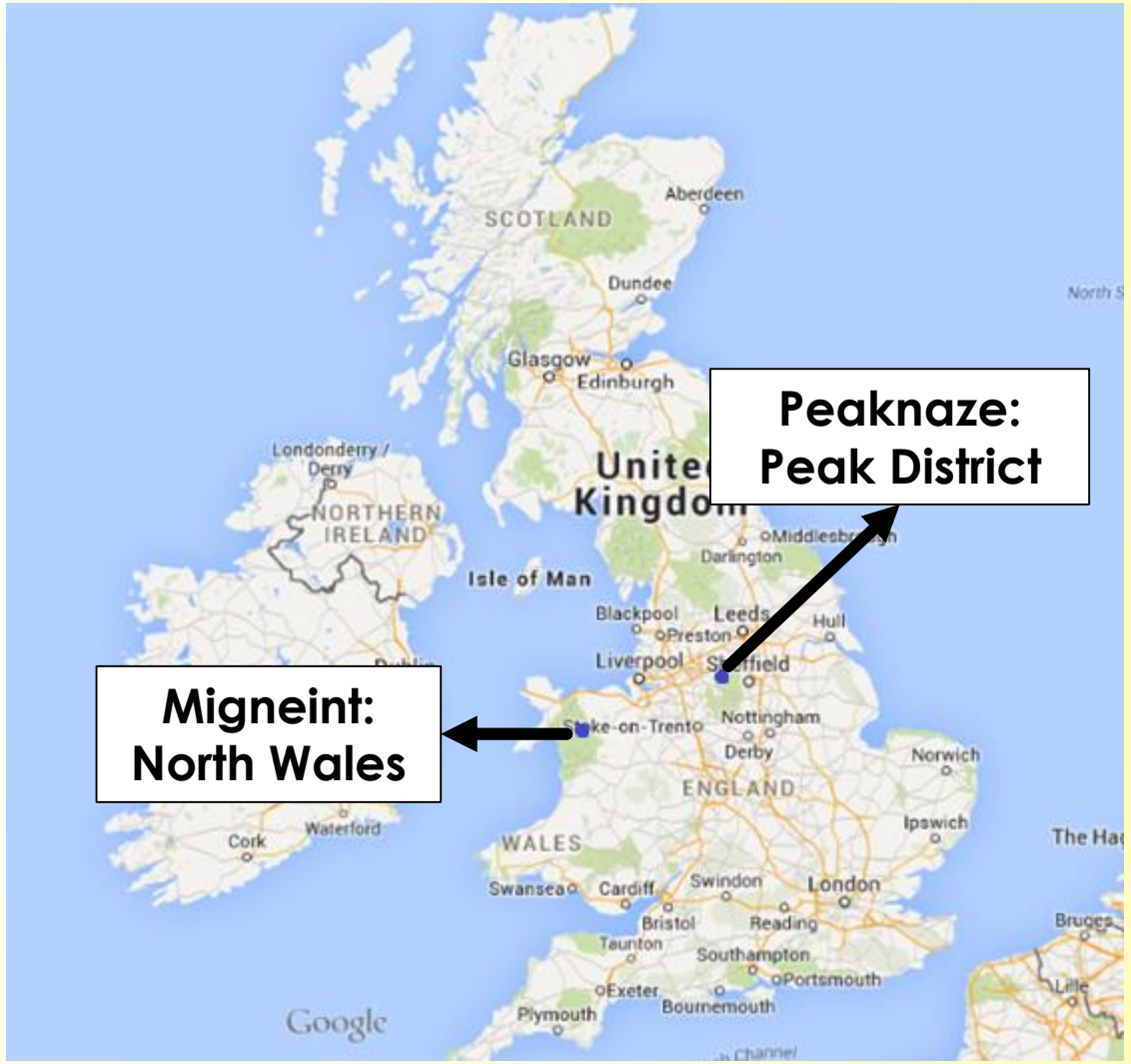
Hypothesis

- Changes in the chemistry of atmospheric deposition and resulting changes in pH have altered **soil microbial community structures and functions**, including **DOC consumption and production**, which have contributed to changes in DOC fluxes in organic soils.

Field Experiment

Two field site locations of upland moorland:

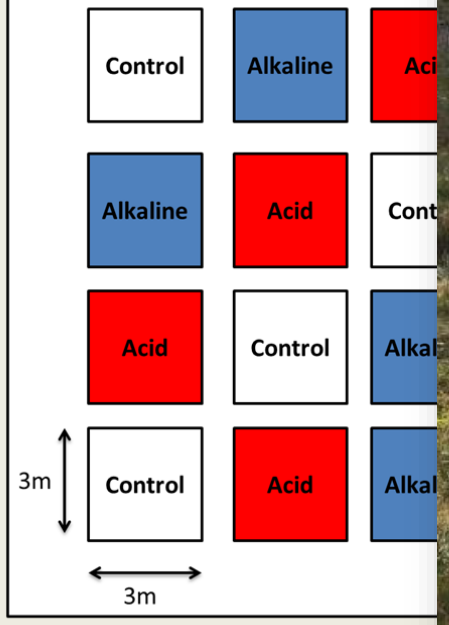
- Migneint
  - Intact
  - Historically low pollution levels
- Peaknaze:
  - Degraded
  - Historically high pollution levels

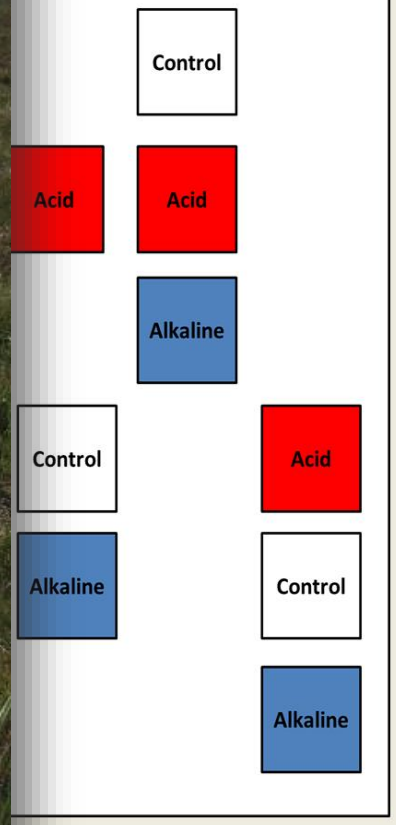


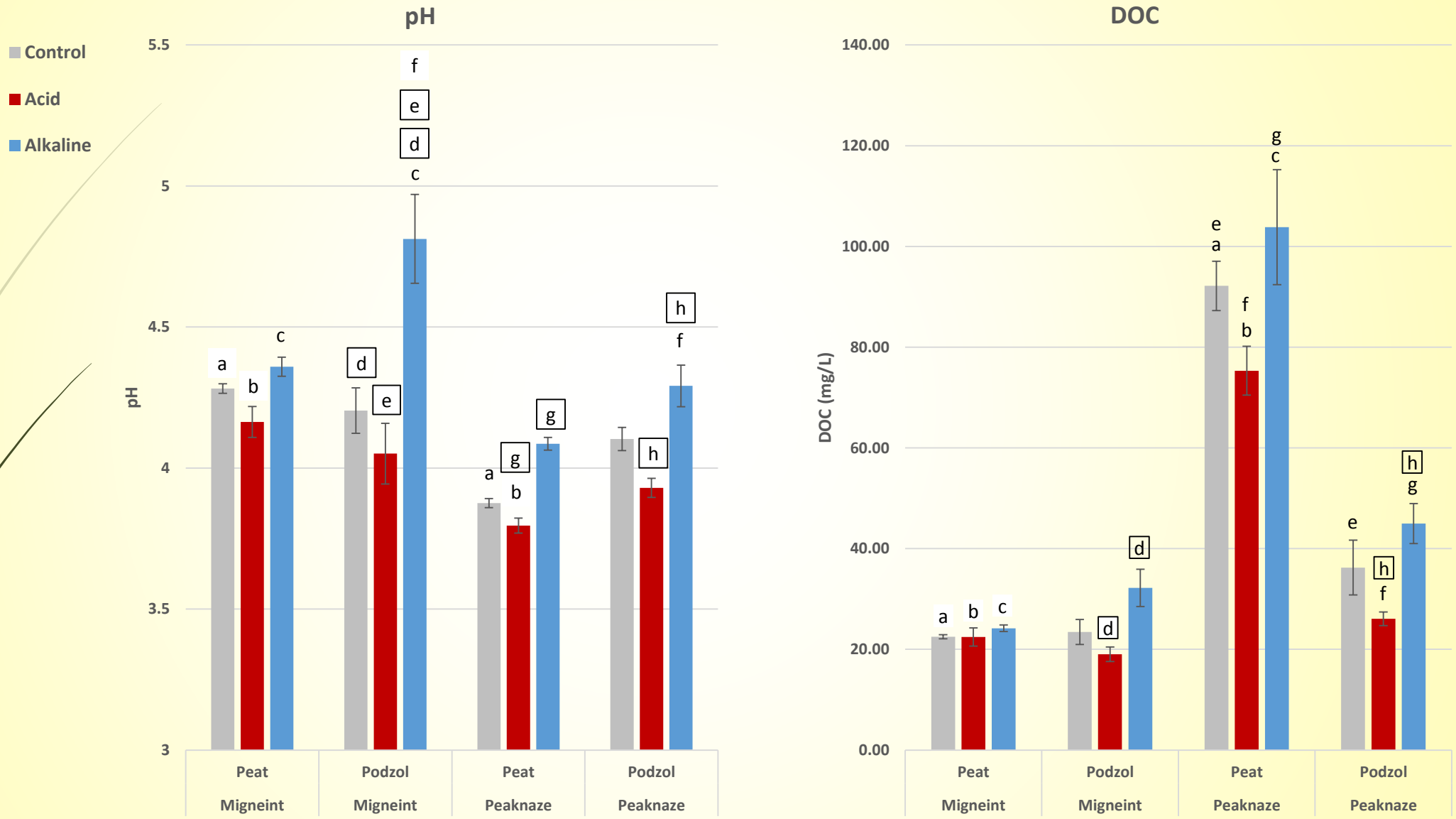
Migneint

Peaknaze

Treatments


Peat
Control
Alkaline
Alkaline
Acid
Acid
Control
Control
Acid
3m
3m


odzol
Control
Acid
Acid
Alkaline
Control
Acid
Alkaline
Control
Alkaline


pH
Control
Acid
Alkaline
5.5
5
4.5
4
3.5
3
pH
a
b
c
d
e
f
g
h
Peat
Migneint
Podzol
Migneint
Peat
Peaknaze
Podzol
Peaknaze
DOC
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
DOC (mg/L)

Microbial Analysis

- Next Generation Sequencing

- Enzyme Assays

Enzyme Assay	Degradation/Function
B-1,4-glucosidase (BG)	Celliobiose → Glucose
B-Cellobiosidase (CB)	Cellulose/Cellotetrase → Celliobiose
B-N-acetylglucosaminidase (NAG)	Chitin
Leucyl aminopeptidase (LAP)	Amino acids of proteins and peptides
Phenol oxidase (POX)	Aromatic polymers e.g. Lignin
Dehydrogenase (Dhd)	Total intracellular oxidative activity
Fluorescein diacetate hydrolysis (FDH)	Total hydraulic capacity

Thanks for Listening
Any Questions?