Photo: Rob Fitzpatrick

Metal behaviour following the rewetting of sulfuric material

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Outline:

1. Environmental history and setting
2. Aims and Methods
3. Results

Environmental Setting and History

Time line

1. Pre 1920: Natural wetting-drying regime
2. 1920-1940: Construction of locks and weirs along the Murray River
   - Relatively constant pool level to facilitate irrigation and navigation
   - Permanent inundation
     → prolonged reducing conditions
     + increase in $[SO_4^{2-}]$
     → accumulation of sulfidic material

Environmental Setting and History

Time line

3. 2006: Start of most recent drought.
4. 2010: Currency Creek and Finniss River re-flooded
   - Pumping from Lake Alexandrina to Goolwa Channel and seasonal rainfall

August 2007

November 2008

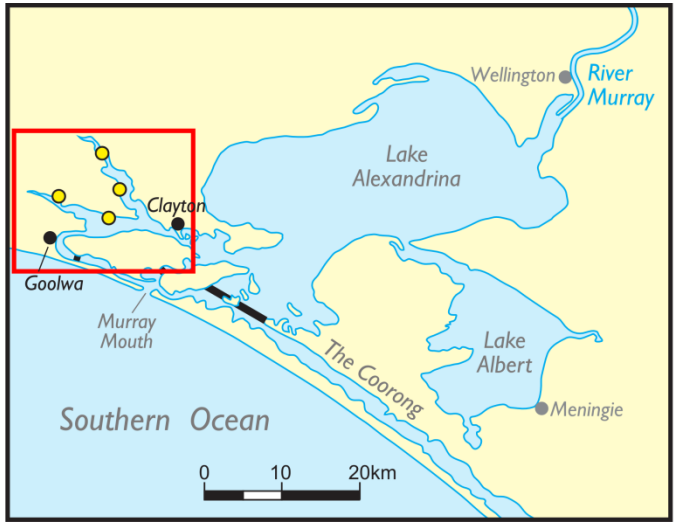
January 2009

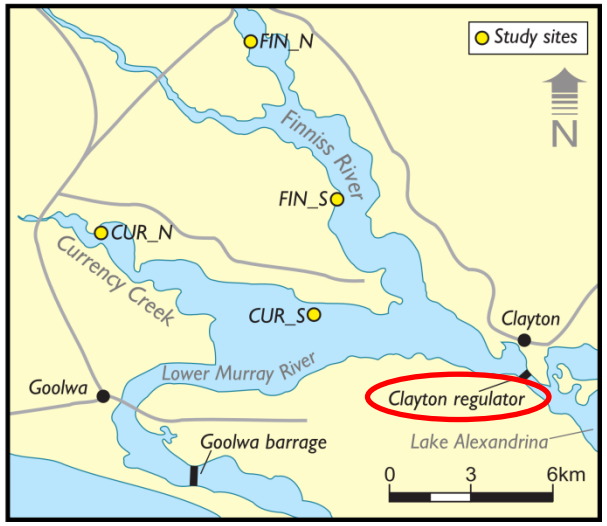
September 2010

Environmental Setting and History

Where are we?

- 4 study sites in lower reaches of Currency Creek and Finniss River catchments.

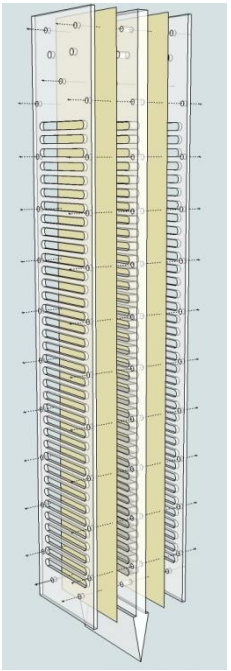




Outline:
Aims and Methods

Aims and Methods

1. Aims
   - Assess changes to pore-water chemistry following re-wetting
     - Mobilisation and transport of dissolved constituents
     - Time scales involved in recovery
2. Methods
   - Peepers
     - Multi-chambered pore-water samplers
     - High resolution (1cm)
     - **Installed twice**
     - **5 months after re-wet (Jan 2010)**
     - **24 months after re-wet (Aug 2011)**



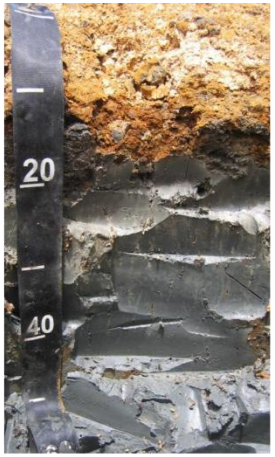
Outline:
Results

Changes to soil pore-water

General attributes

FIN_N

FIN_S



CUR_N

CUR_S

Prior to re-wet

Not spade sampled

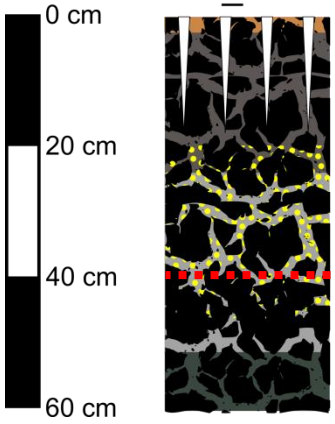
Not spade sampled

5 months following re-wet

Changes to soil pore-water

General attributes

FIN_N



Dark brown medium clay.
Cracks to 50cm, infilled partially with fine sand.

Grey light to medium clay.
Jarosite mottles along root channels.

Dark green grey medium clay.

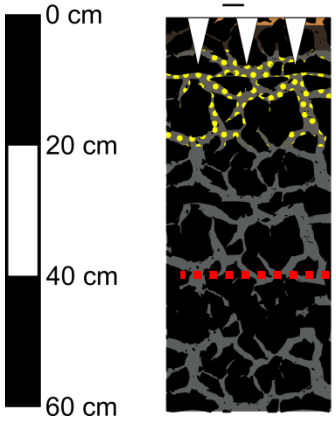
CUR_N

Medium sand.

Grey sandy clay. Jarrosite and brownish red mottles on old root channels and crack surfaces.

Dark olive grey medium clay.

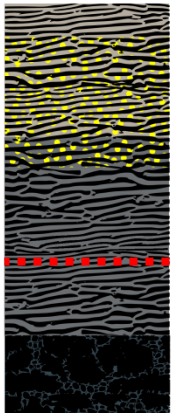
FIN_S



Dark grey heavy clay. Cracks to 15 cm partially infilled.
Jarosite coatings on root channels and coluular ped faces.

Dark olive grey heavy clay

CUR_S

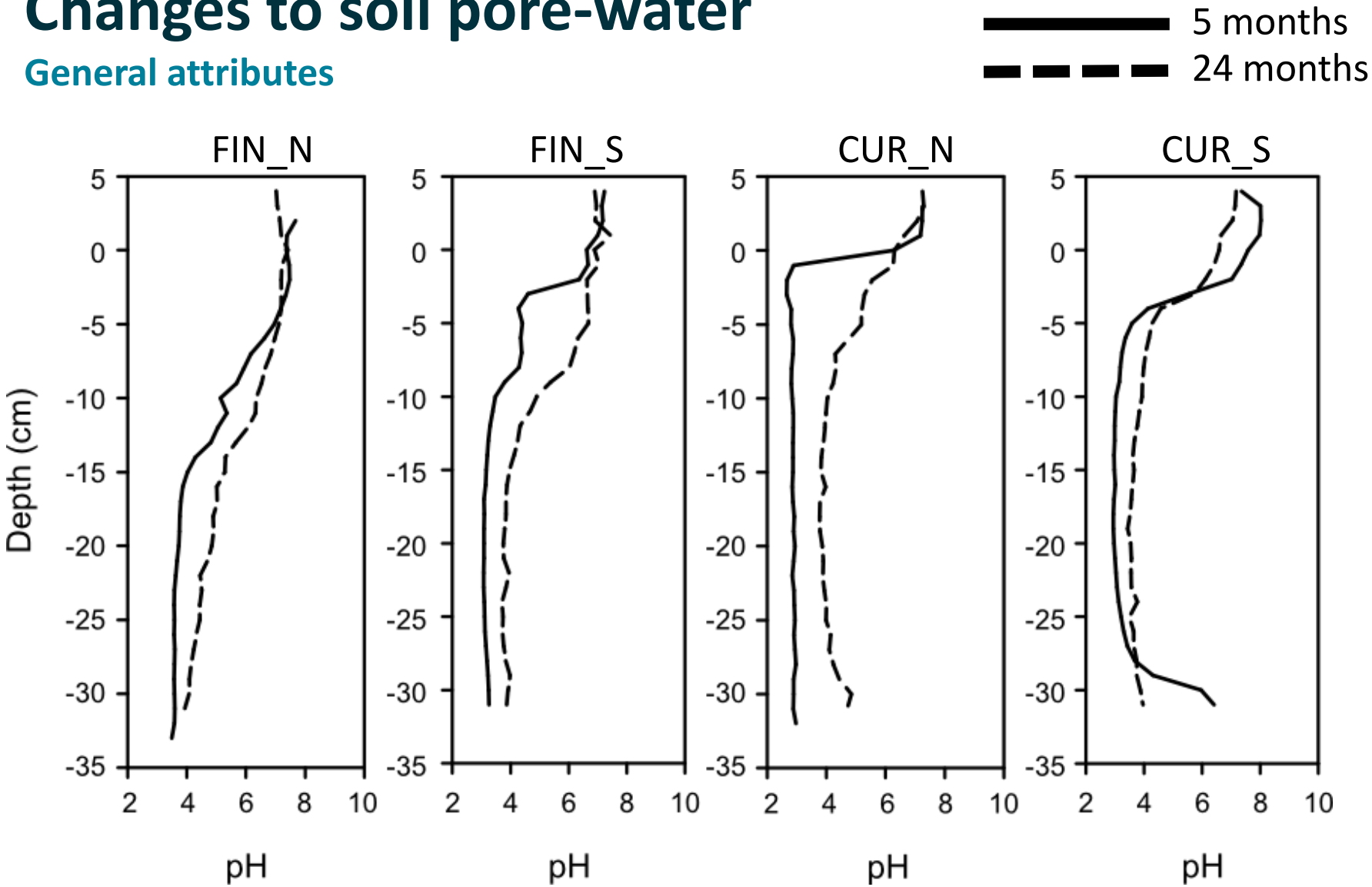


Loose medium sand. Distinct jarosite mottles.

Greyish brown medium sand.

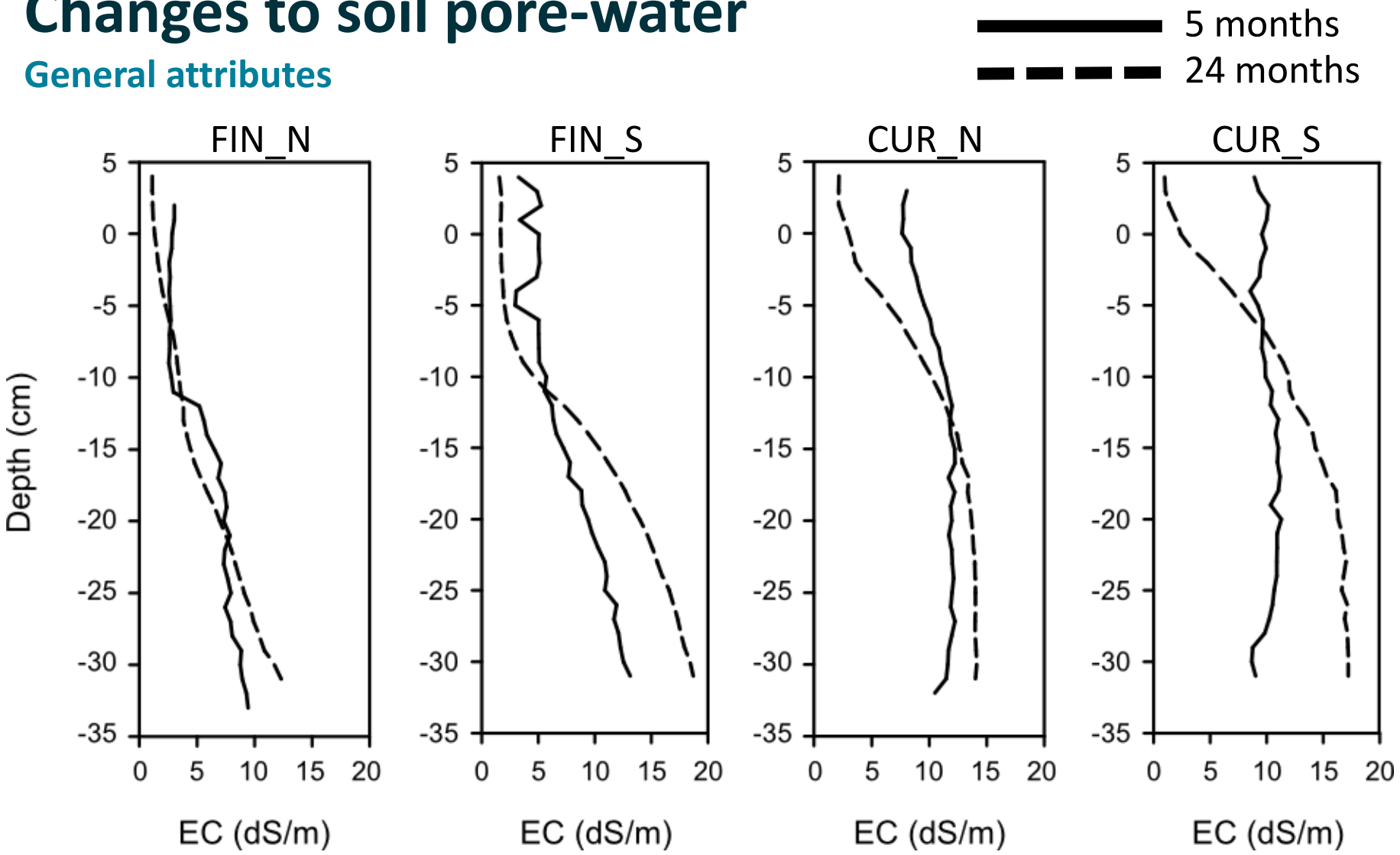
Changes to soil pore-water

General attributes



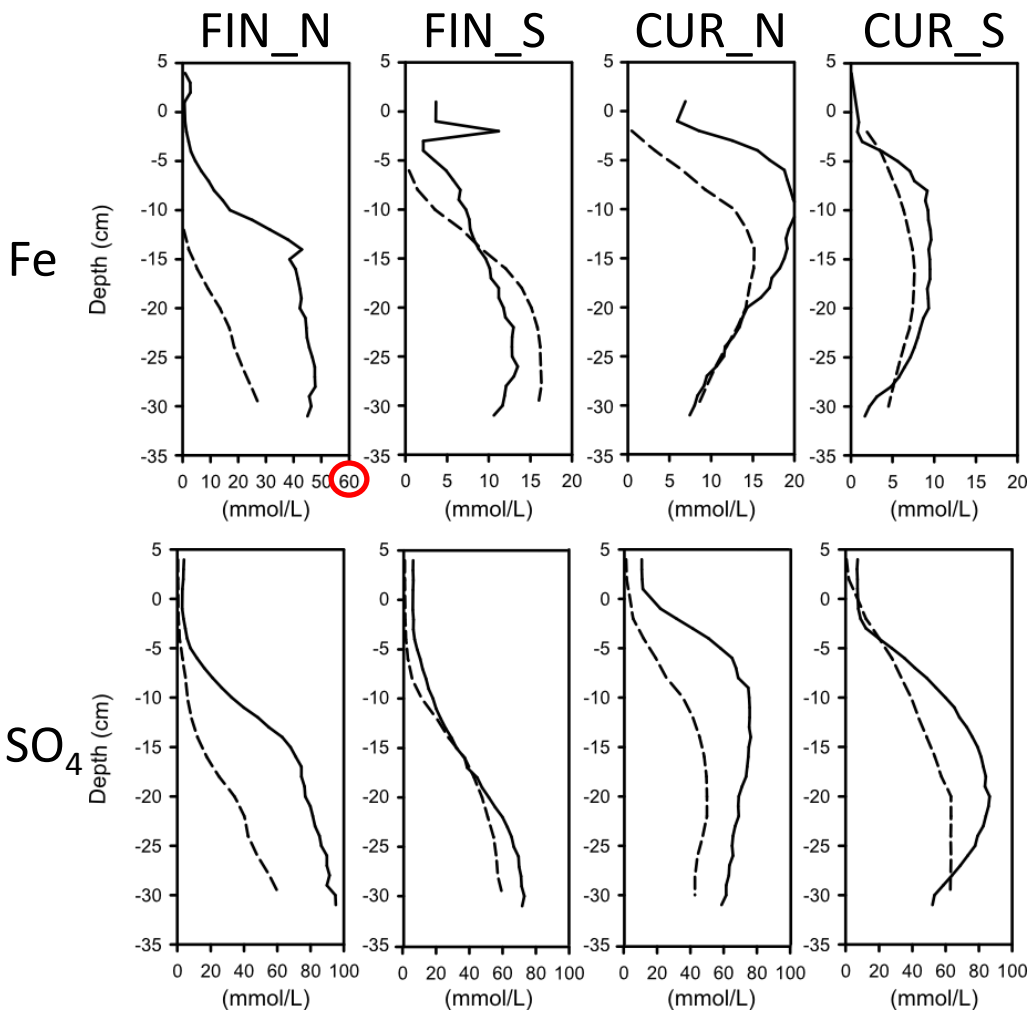
Changes to soil pore-water

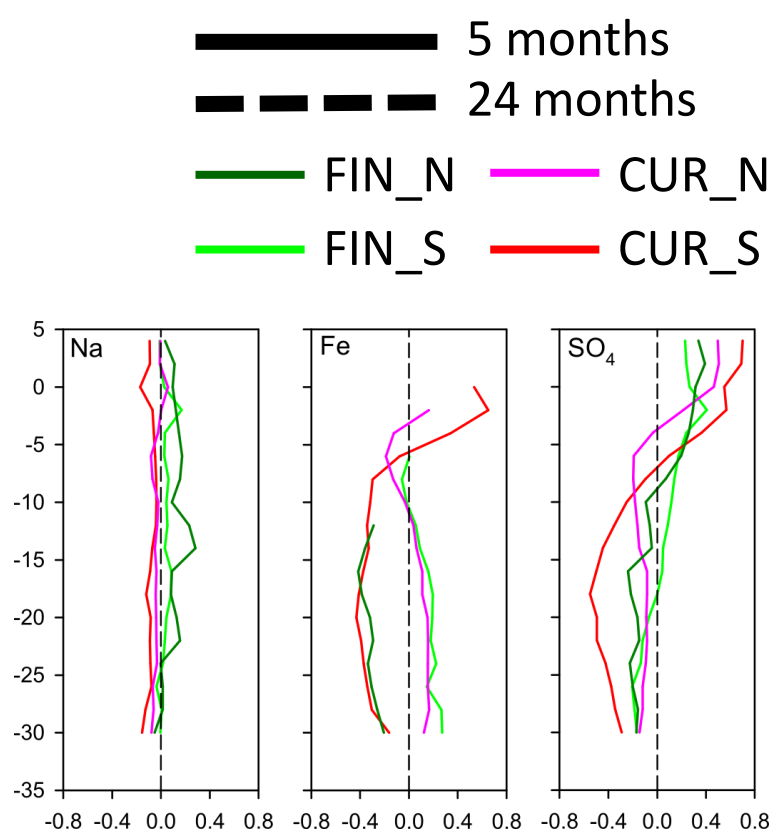
General attributes



Changes to soil pore-water

Iron and Sulfate





Dashed line = Conservative behaviour (Cl)

Left of line = reduction in conc. beyond what would be expected conservatively

Right of line = Gain in conc. beyond what would be expected conservatively

Changes to soil pore-water

Water Quality

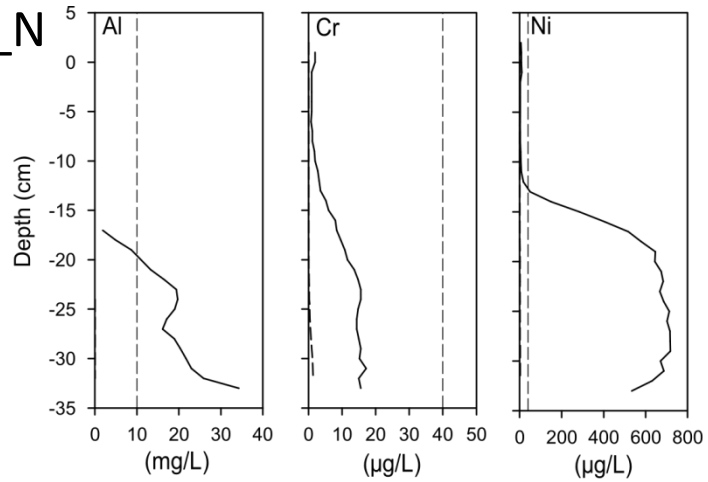
✓ = Below WQ guideline 80%
× = Above WQ guide
ANZECC 80% species protection

	FIN_N		FIN_S		CUR_N		CUR_S	
Months following re-wet	5	24	5	24	5	24	5	24
Al	×	✓	×	×	×	✓	×	×
As	✓	✓	×	✓	×	✓	×	✓
B	✓	✓	×	×	×	×	×	×
Cd	✓	✓	×	✓	×	✓	×	✓
Cr	✓	✓	×	✓	✓	✓	×	×
Cu	×	✓	×	✓	×	✓	×	✓
Mn	×	×	×	×	×	×	×	×
Ni	×	✓	×	×	×	×	×	×
Pb	×	✓	×	✓	×	✓	×	✓
Zn	×	✓	×	×	×	×	×	×

Changes to soil pore-water

Trace metal behaviour

FIN_N



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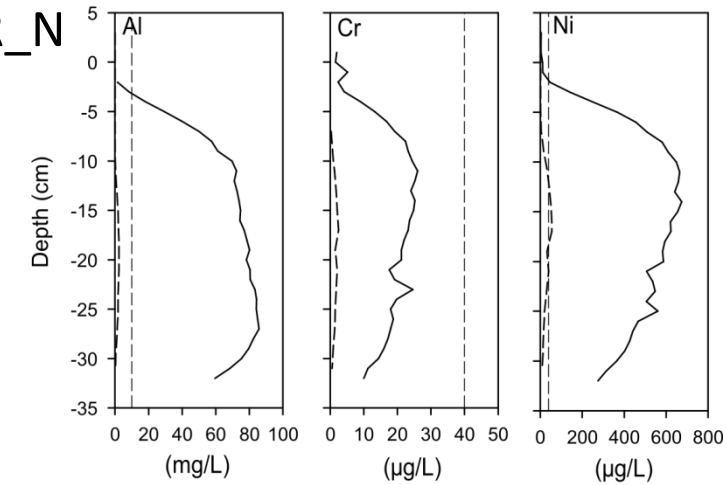
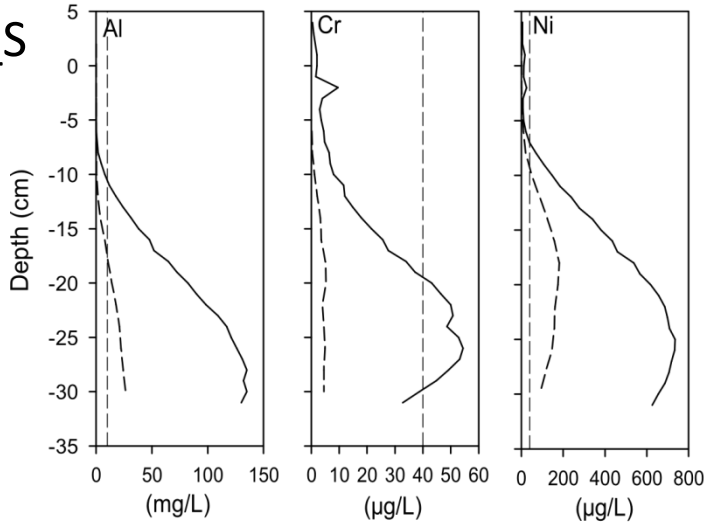
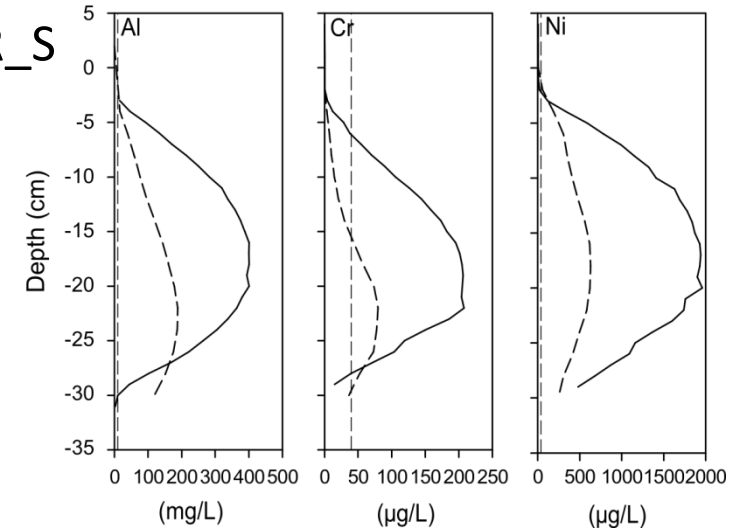


FIN_S



CUR_S

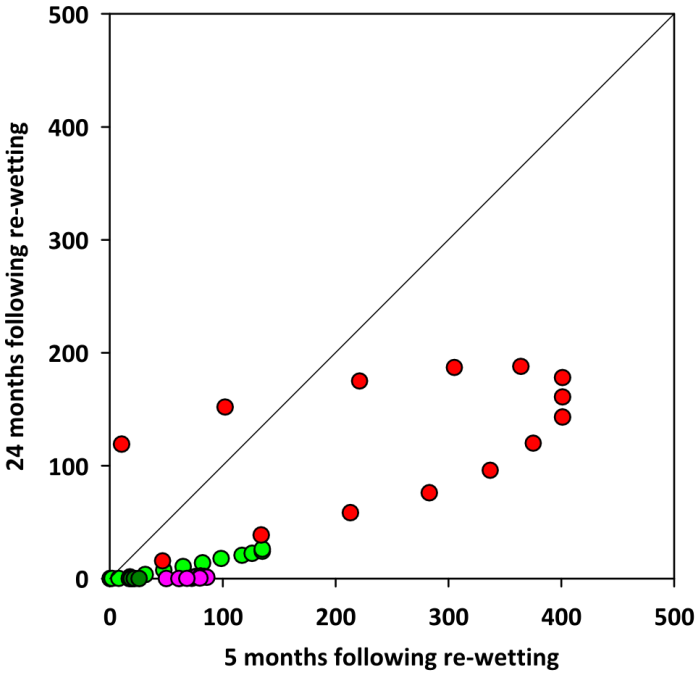


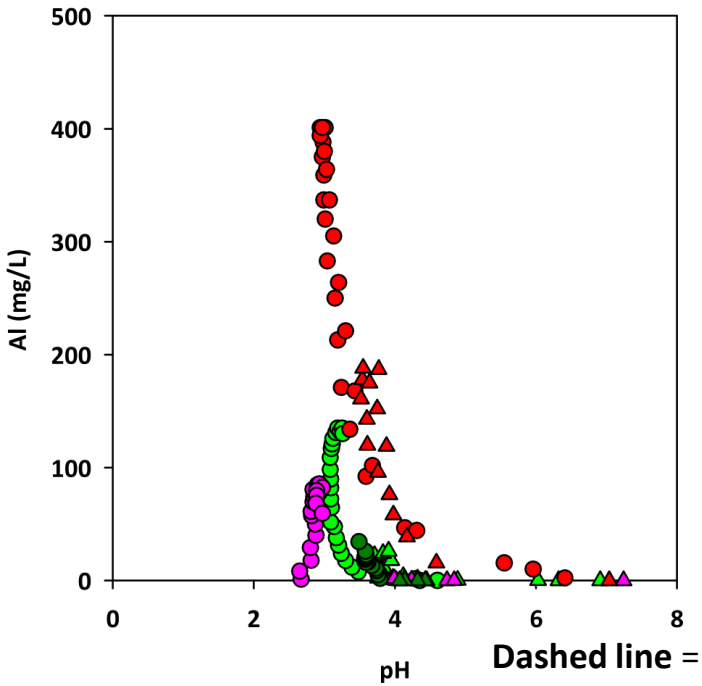
Changes to soil pore-water

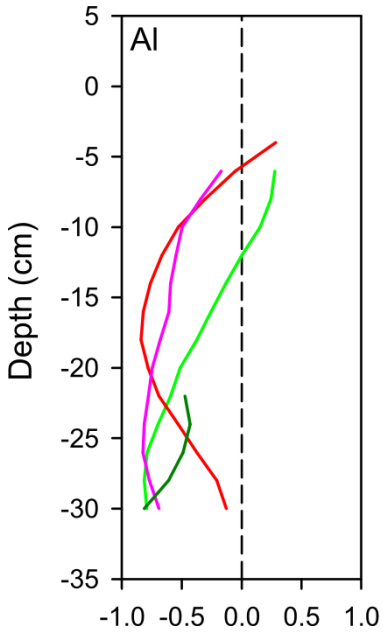
Trace metal behaviour

FIN_N CUR_N
FIN_S CUR_S

Aluminium







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Left of line = Loss beyond what would be expected conservatively

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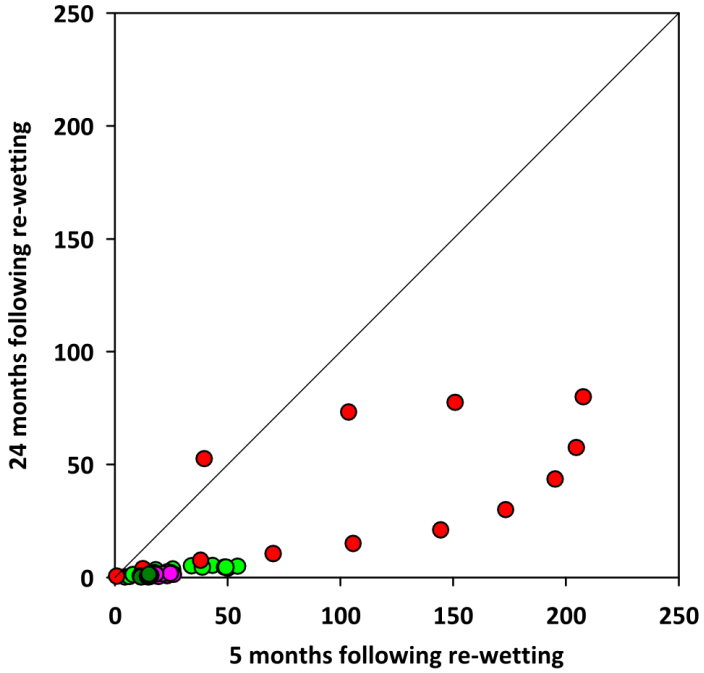
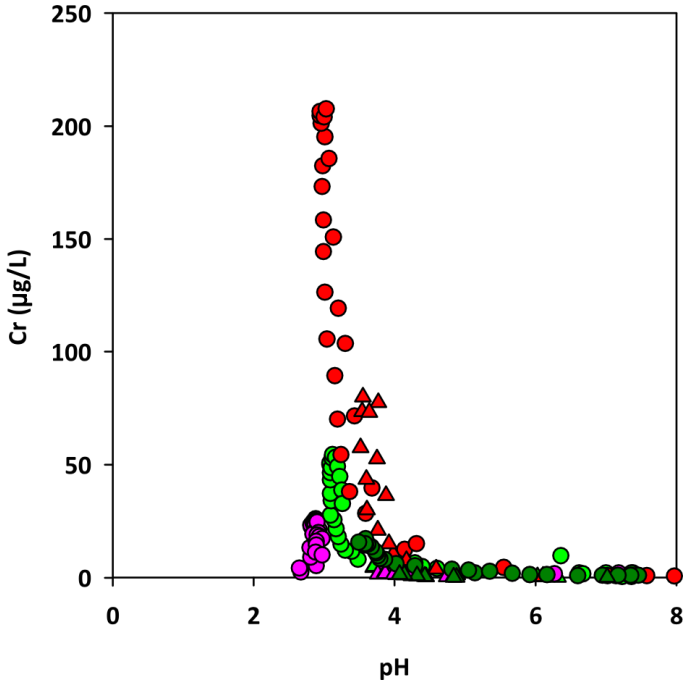
Changes to soil pore-water

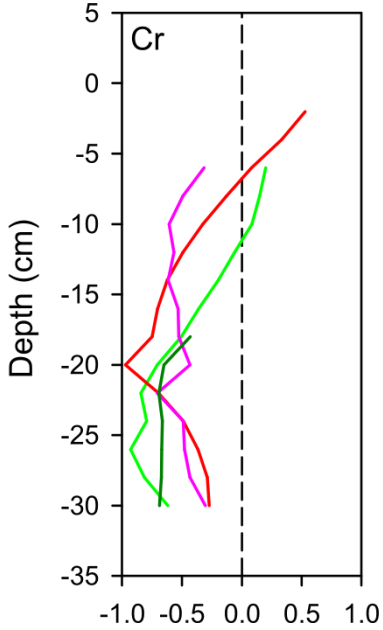
Trace metal behaviour

FIN_N
CUR_N
FIN_S
CUR_S

Chromium





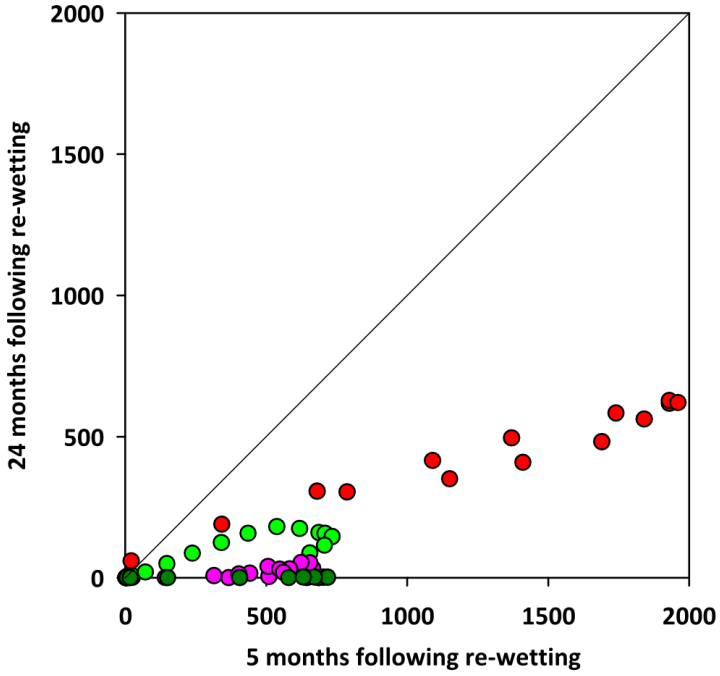


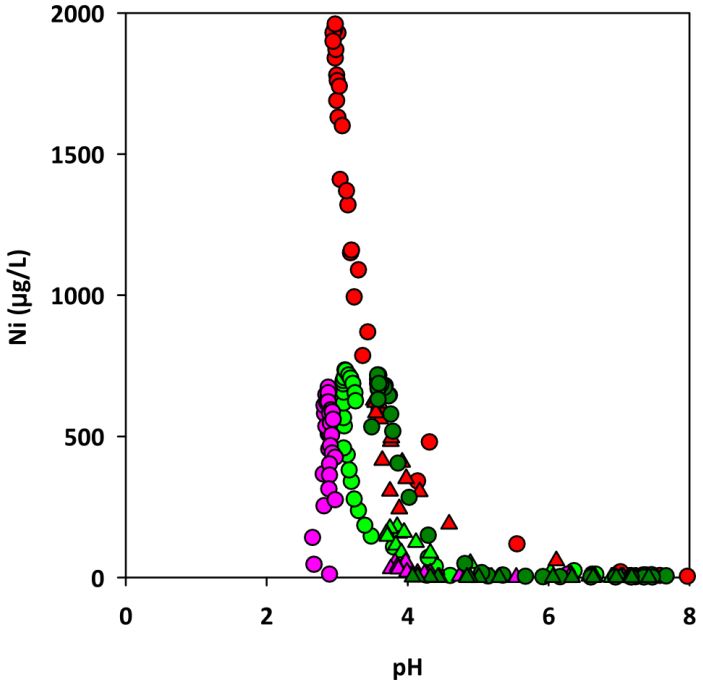
Changes to soil pore-water

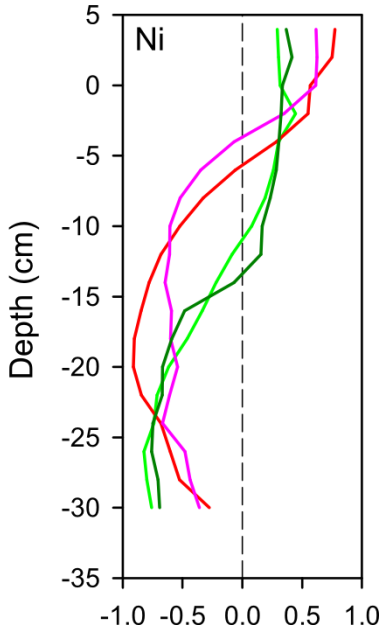
Trace metal behaviour

FIN_N
CUR_N
FIN_S
CUR_S

Nickel







Summary

1. The recovery from oxic–acidic conditions to anoxic-circumneutral conditions is not complete after 24 months.
   - Soils remain acidic
   - Decreases in dissolved trace metal concentrations

2. Yet to come
   - Mobilisation of metals following onset of anoxic conditions. (red. diss.)
   - Reformation of pyrite

3. Future work
   - Continue to monitor recovery
   - Develop conceptual models of soil behaviour following rewet (LEECHM, PHREEQC)

Kiitos
Thankyou

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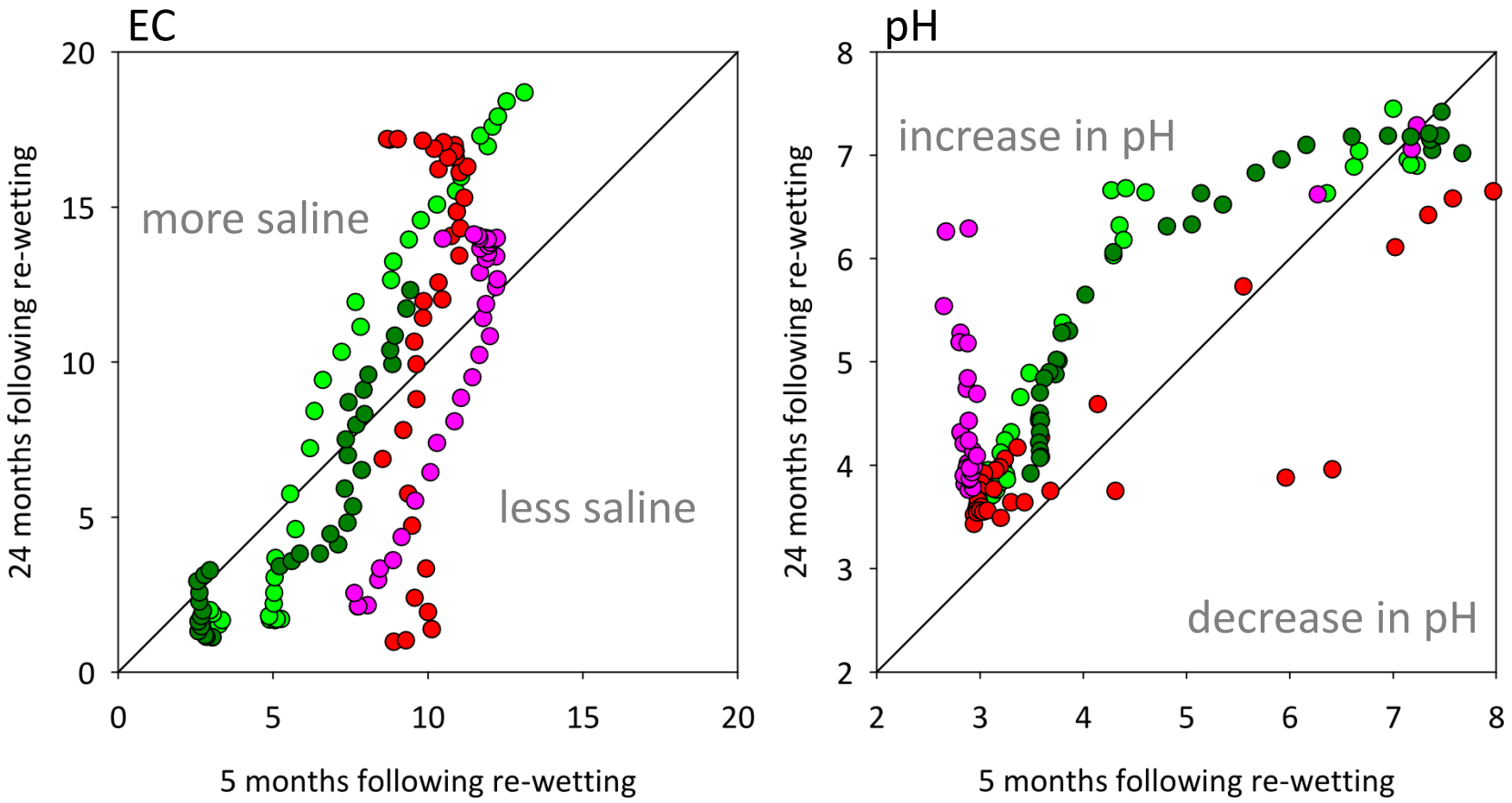
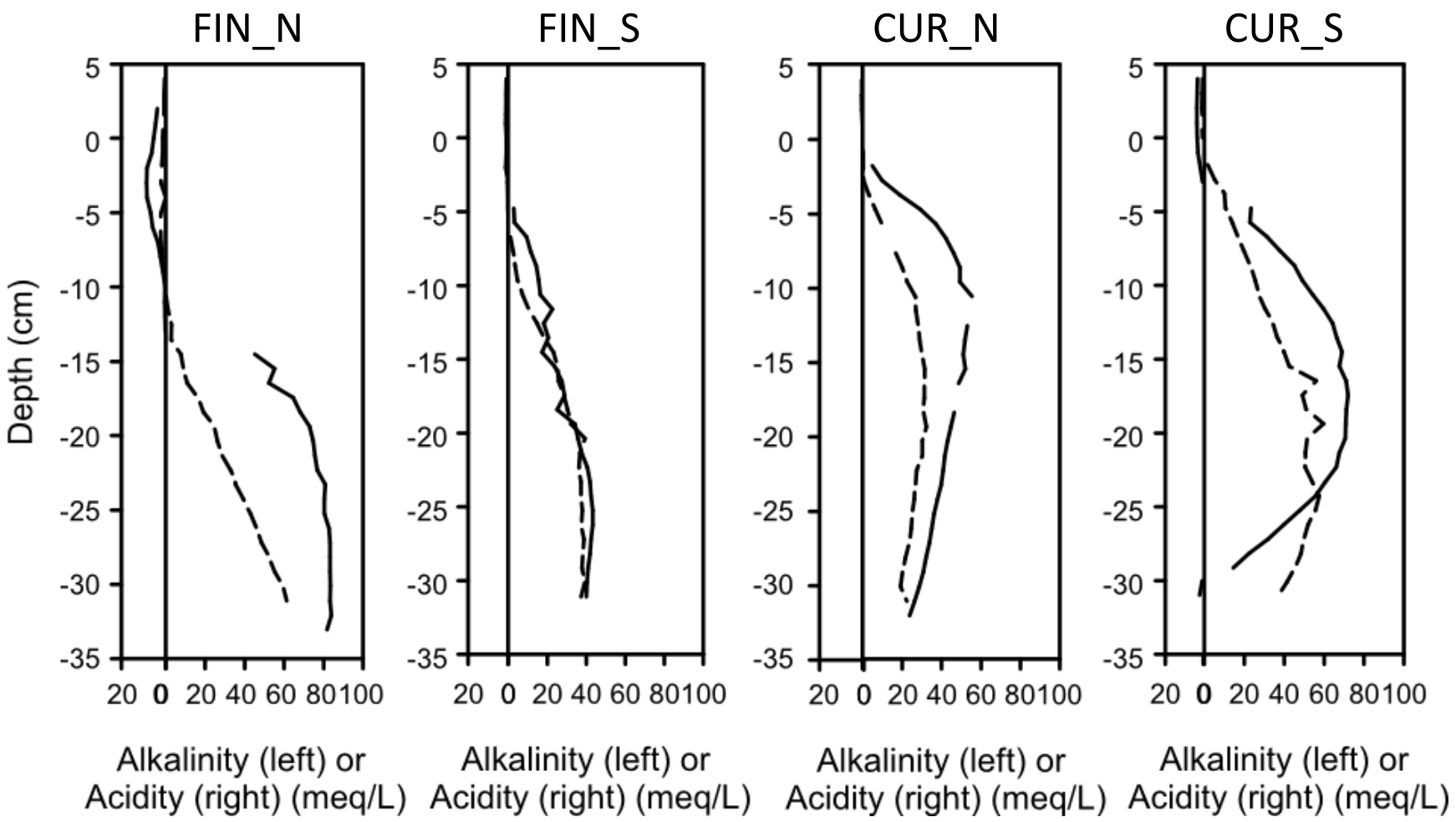
General attributes



Changes to soil pore-water

General attributes



Changes to soil pore-water

Iron and Sulfate