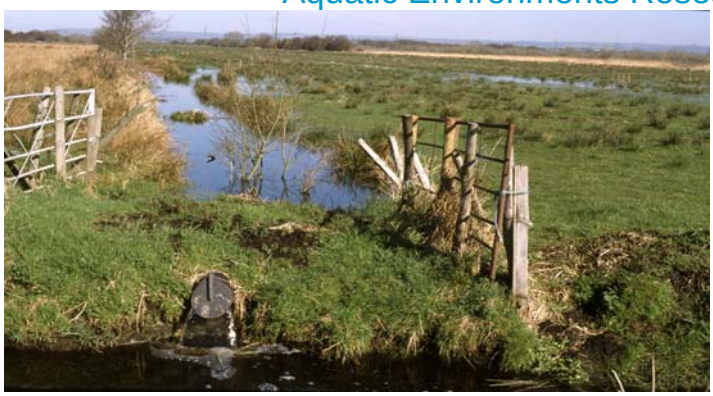
# On-site Assessment of $Fe^{2+}$ in Waters of a UK Wetland


## Dr Geoff Warren[+] and Dr Albert Niedermeyer

[+] Aquatic Environments Research Centre, University of Reading

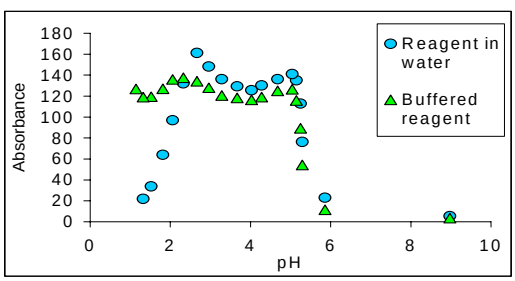
## Background

The dynamics of phosphorus in peat soils are influenced by iron (Fe) through the redox potential of the Fe(II)/Fe(III) ratio. Therefore, as part of research on P losses from degraded peat wetlands, studies were made on the concentrations of ferrous ion ($Fe^{2+}$) in waters at a Somerset wetland.

## Equipment and method

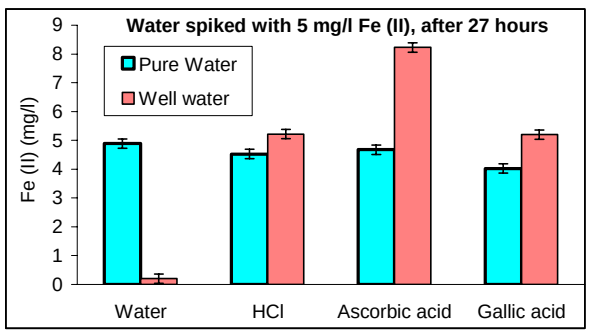
A "Heliflow" battery-powered, portable flow-injection analyser (WPA Ltd., Ware, Herts., UK) was used. The determination is based on the reaction of $Fe^{2+}$ with 2,2' bipyridyl forming a red complex measured at 520 nm

*Sample pH*. In water, the absorbance of 5 mg $L^{-1}$ $Fe^{2+}$, showed peaks at pH 2.6 and 5.0, and colour formation was inhibited outside the pH range 2.5 to 5.1. Above pH 6, $Fe^{2+}$ was rapidly oxidised to $Fe^{3+}$. The working pH range was extended to <pH 1.2 if the reagent was made up in 0.4M sodium acetate buffer.




*Possible methods to preserve $Fe^{2+}$ in sampled waters.* Treatments were (i) control (pure water), (ii) 0.01M HCl, (iii) 0.01M ascorbic acid (reducing agent) and (iv) 0.01M gallic acid (complexing agent). Samples of purified water and well-water were spiked with 5 mg $L^{-1}$ $Fe^{2+}$, stored at 22°C and measured after 3, 9 and 27h.

All $Fe^{2+}$ was oxidised in 3h in untreated well-water. $Fe^{2+}$ additional to the 5 mg $L^{-1}$ spike was released from the well-water by the acid treatments. Ascorbic acid reduced all $Fe^{3+}$ to $Fe^{2+}$.

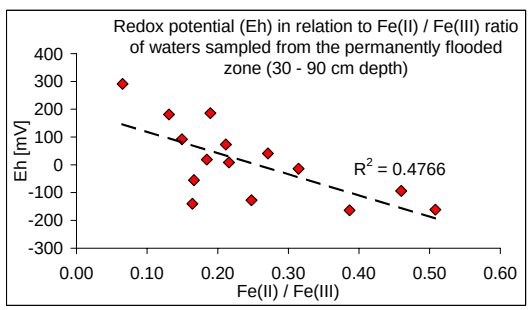



## Conclusion

A buffered reagent was used because the results are less sensitive to pH variations in the samples. $Fe^{2+}$ in sample waters could not be stabilised, so analysis in the field is required.

## Selected field results

Water samples were taken from suction cups at monthly intervals and analysed for Fe(II) at the site, and total Fe by ICP-OES. Redox potential (Eh) was measured by an automated data-logging system. Redox was correlated significantly with Fe(II) / Fe(III) in the permanently flooded zone, but not in the 0 - 30 cm zone, which undergoes drainage and rewetting cycles.




## Find out more…


Niedermeier A and Robinson JS 2007. Hydrological controls on soil redox dynamics in a peat-based, restored wetland. *Geoderma* 137:318-326.



**Contact:** Geoff Warren: g.p.warren@reading.ac.uk