Dissolved Organic Carbon in riparian wetlands and its effect on the toxicity of metals

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Introduction

- Why does Dissolved Organic Carbon (DOC) matter?
- DOC plays an important functional role in ecosystems, by regulating microbial growth and water acidity that causes changes in behaviour, body chemistry, reproduction, and species diversity of zooplankton, benthos and fish.
- DOC affects the bioavailability, behaviour & fate of pollutants
- Are riparian wetlands important?

  It is well known that riparian wetlands can be the dominant source of dissolved organic carbon to adjacent water bodies. As climate change scenarios predict drier summers alternating with wetter winters, the biochemical and hydrological fate of the wetland carbon pool, and its ecological implications downstream, become increasingly unpredictable.
- What's the link with DTC?

  Riparian wetlands can play an important role in mitigating agricultural water pollution. Their role as buffer zones has been evaluated, however the carbon behaviour within the wetland is not fully understood. This study also aims to provide further insight in the role of the DOC exported from riparian wetlands on the toxicity of contaminants.

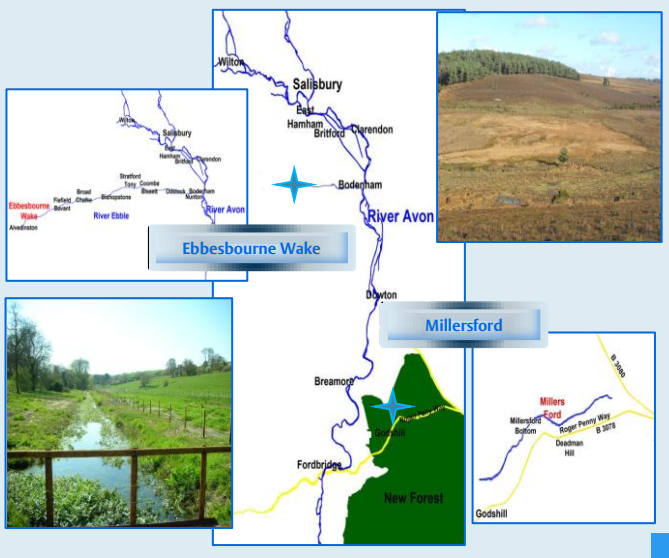
Abstract

This project is being conducted to determine the transformations and ecological significance of carbon exported from riparian wetlands to adjacent streams.

Two wetlands with contrasting characteristics are being evaluated in terms of the relationships among soil properties, hydrology, land use and chemical form of carbon exported from the wetlands.

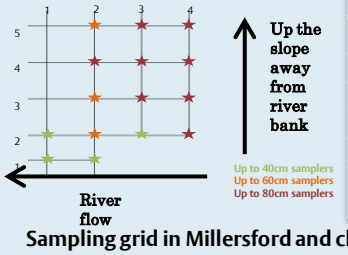
A series of *Daphnia* exposure experiments will provide information on the effect of dissolved organic carbon exported from those wetlands on the bioavailability, behaviour and fate of metals in downstream aquatic environments.

Study area



Experimental design

- ✓ Two wetlands with contrasting characteristics have been chosen
- ✓ Soil pore water is collected, using a grid of suction cup samplers installed at different depths

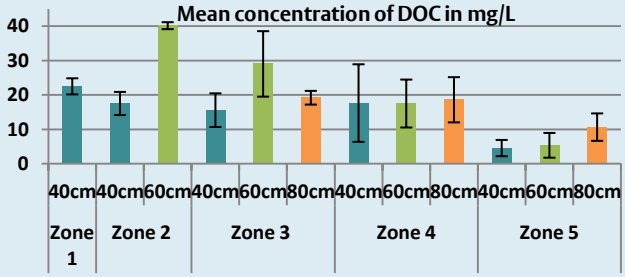


Ebbesbourne	Millersford
Arable catchment	National park
Constructed wetland	Naturally raised bog
Alluvial soils	Peat soils
Seasonally dry	Permanently wet
Seasonal grazing	Extensive grazing
River bisects the wetland	Stream adjacent to bog

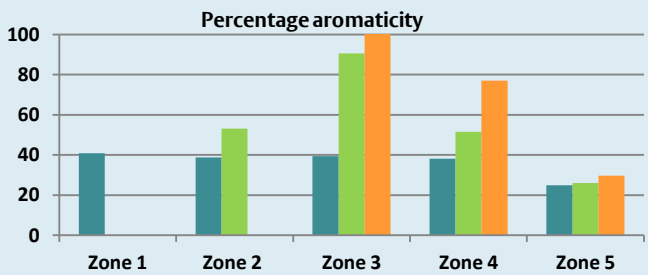
Sampling grid in Millersford and characterisation of the two sites

- ✓ Water samples are collected from the Millersford Brook and River Ebble upstream and downstream from each wetland
- ✓ The samples are analysed for TOC, TN, TP and full C,N,P fractionation, including DOM fluorescence characterisation
- ✓ Exposure experiments are being undertaken to look at the impact of DOC on the toxicity of metals to daphnids (water fleas)

Results from Millersford wetland



- Location across the slope and sample depth influences variability
- Microtopography can play an important role



- DOC biodegradability decreases with depth, possibly caused by a lower oxygen content and enzymatic activity at depth

- ❖ In the river, the mean DOC concentration downstream from the wetland in Millersford is 12.37 mg/L (almost 5 times higher compared to River Ebble).
- ❖ This is significant because studies have shown that DOC in concentrations higher than 2mg/L can reduce the uptake, bioconcentration and toxicity of contaminants in a range of aquatic organisms.

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