Effects of peatlands drainage on water quality:

a case study of the shallow blanket bogs of Exmoor, UK

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Introduction

Drainage of the shallow peatlands of Exmoor in the 19th and 20th Century for fuel and agricultural reclamation has dried and modified the hydrological behaviour of the peat. This is causing increased peat decomposition, erosion and vegetation change, and also affects the supply of drinking water and the support of rare habitats. There is currently little quantitative evidence on the effect of restoration of shallow peatland. This study presents first water quality results from the drained shallow peatlands of Exmoor.

Methods

Selected ditches representative of damaged conditions, i.e. small- (30 x 30cm ditches), medium- (50x50cm), large- (1-2m ditches) and headwater catchment-scales, were monitored in great details on two small catchments, Aclands and Spooners (Figure 1). Water samples were taken flow-proportionally during selected rain events. Upon return to the laboratory, samples were analysed for dissolved organic carbon (DOC) using a TriOS Pro-PS (UV-Spectrometer), and colour, using a UV-vis spectrometer (absorbance at 400nm); Fulvic to Humic acid ratio (E4/E6) was calculated using Abs465/Abs665.

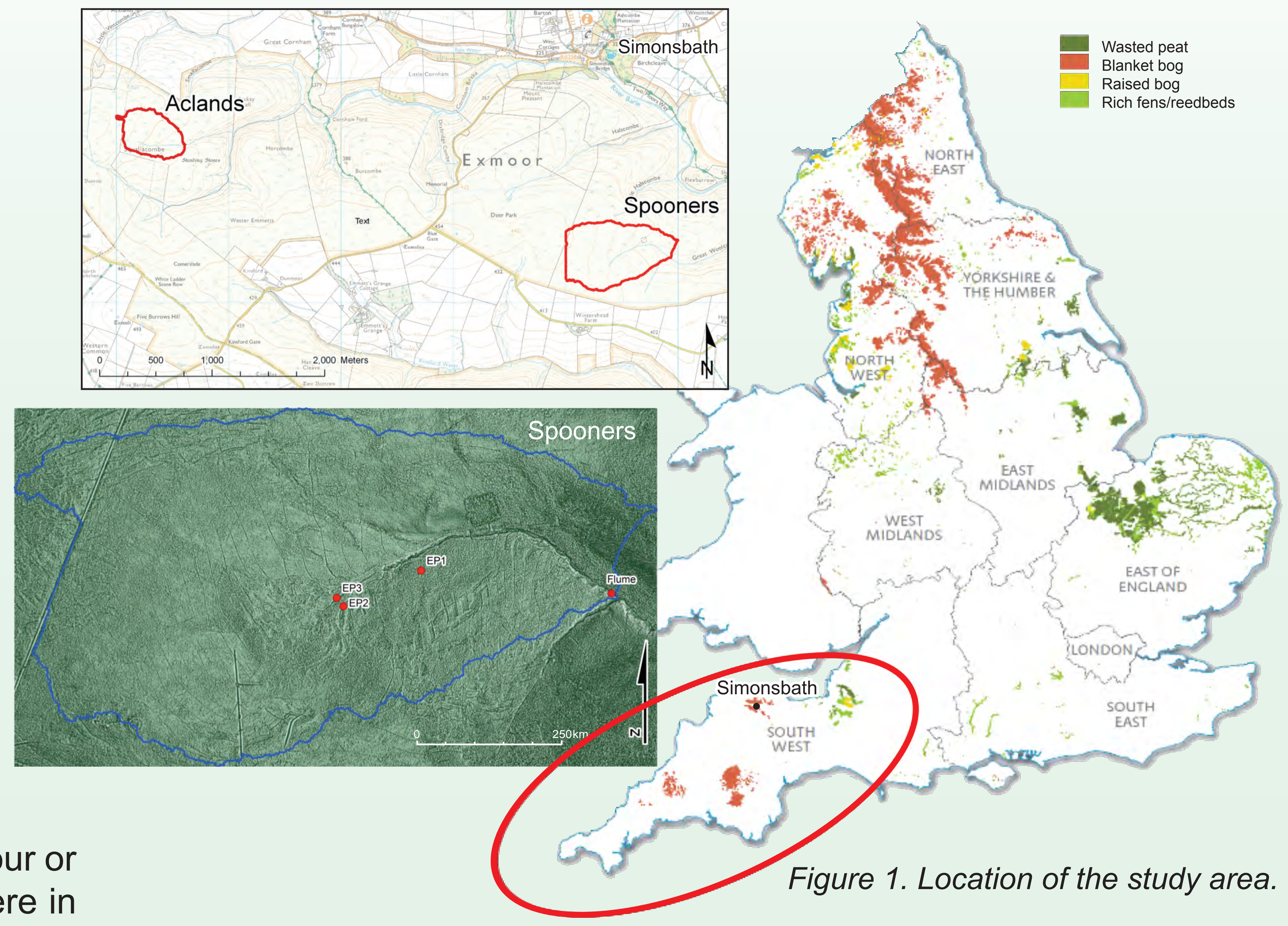

Figure 1. Location of the study area.

Results

Results show no significant difference between the two catchments for DOC, colour or E4/E6 (Figure 2); DOC values are lower than what has been measured elsewhere in the UK (see Table).

Reference	Location	DOC (mg/L)	Colour (AU/m, Abs 400nm)
This study	**Spooners (Exmoor)**	**5-12**	**2-17**
Armstrong *et al.*, 2010	National average, UK	31-36	~16-21
Wallage *et al.*, 2006	Oughtershaw Beck, N. England	~5-30	~ 2-8
Wilson *et al.*, 2011	Lake Vyrnwy, Wales	~25 (average)	/

Table: DOC and colour concentrations to in the UK.

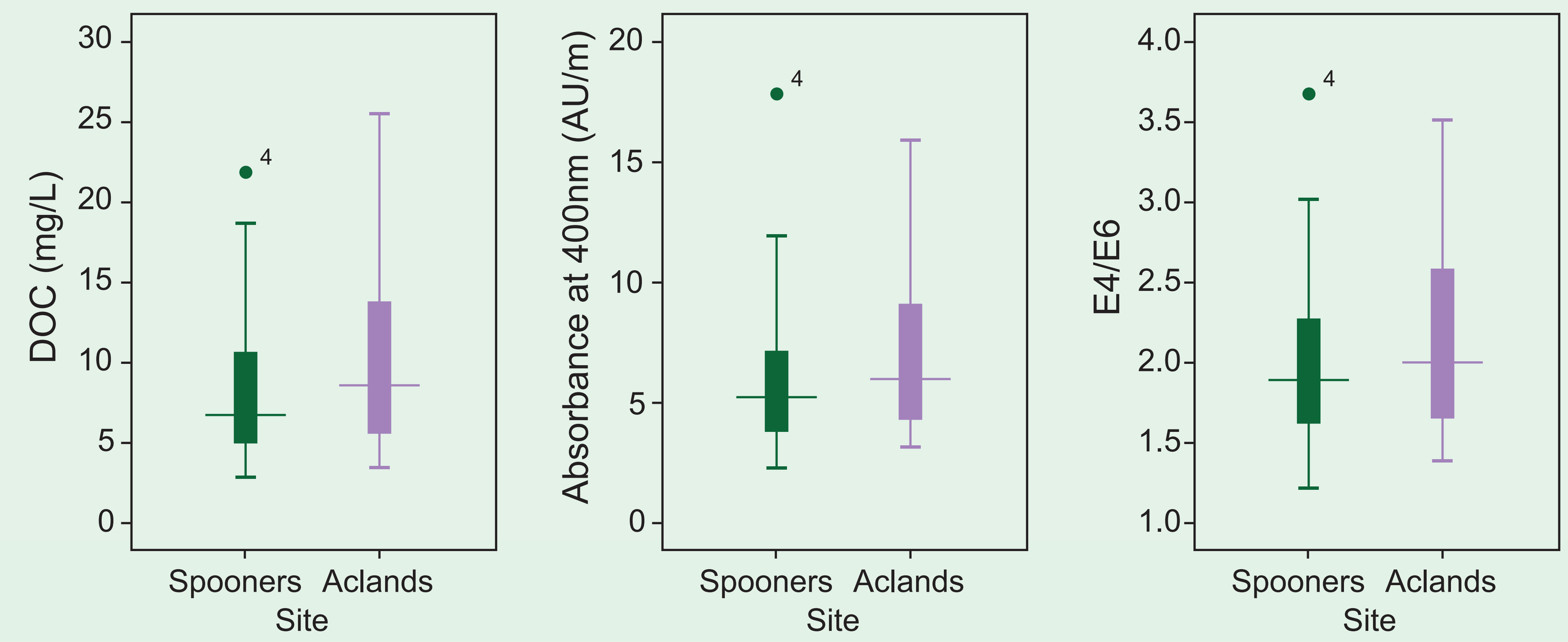

Figure 2. DOC, colour and E4/E6 range for two drained catchments, Spooners and Aclands.

In our larger catchment (Spooners), difference between drains were significant (ANOVA, $P<0.05$, df: 3) for both DOC and colour, with the smallest drain, EP1, experiencing the larger amplitude and highest concentrations (Figure 3). Emissivity data from TABI and modelled watersheds for each drain highlight a drier contributing area for the smallest drain, suggesting higher decomposition and DOC concentrations (Figure 4).

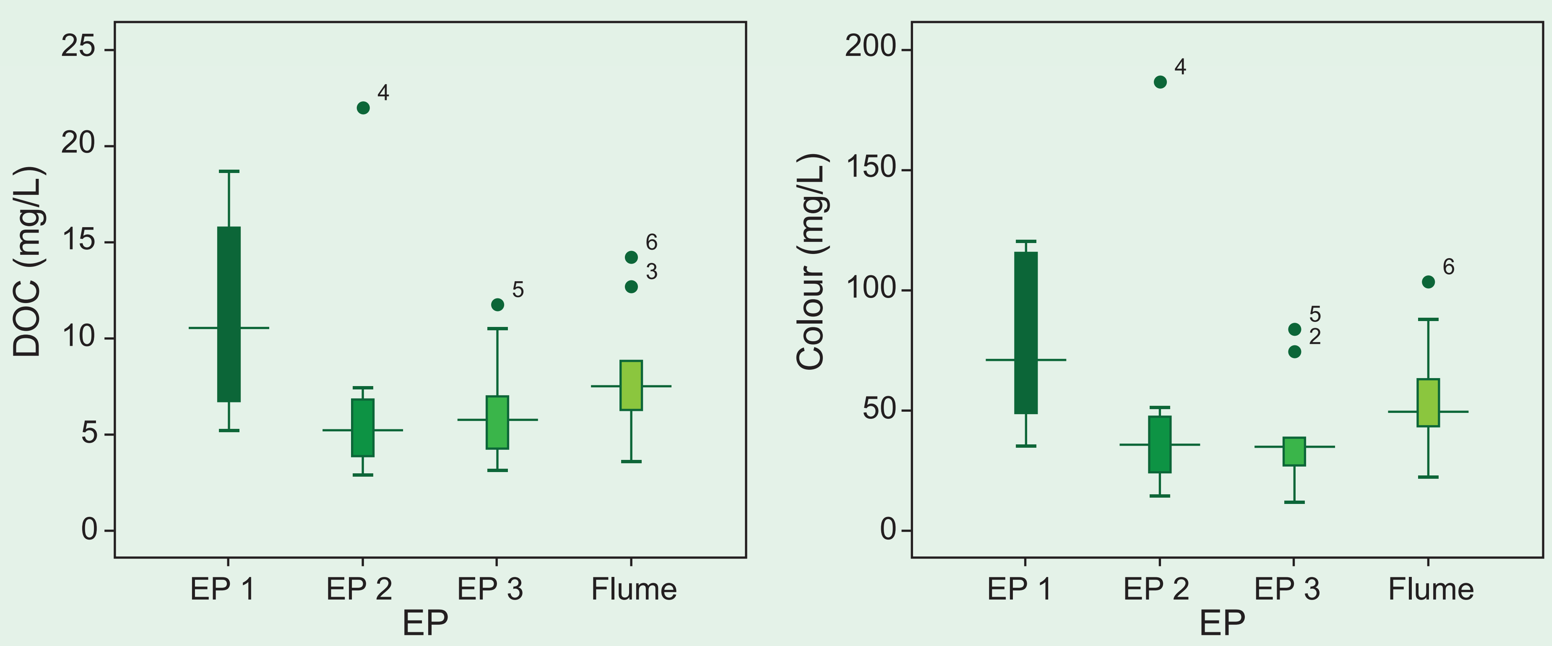

Figure 3. DOC and colour concentrations for small - (EP1), medium- (EP2), large- (EP3) drain and catchment outlet (Flume) at Spooners.

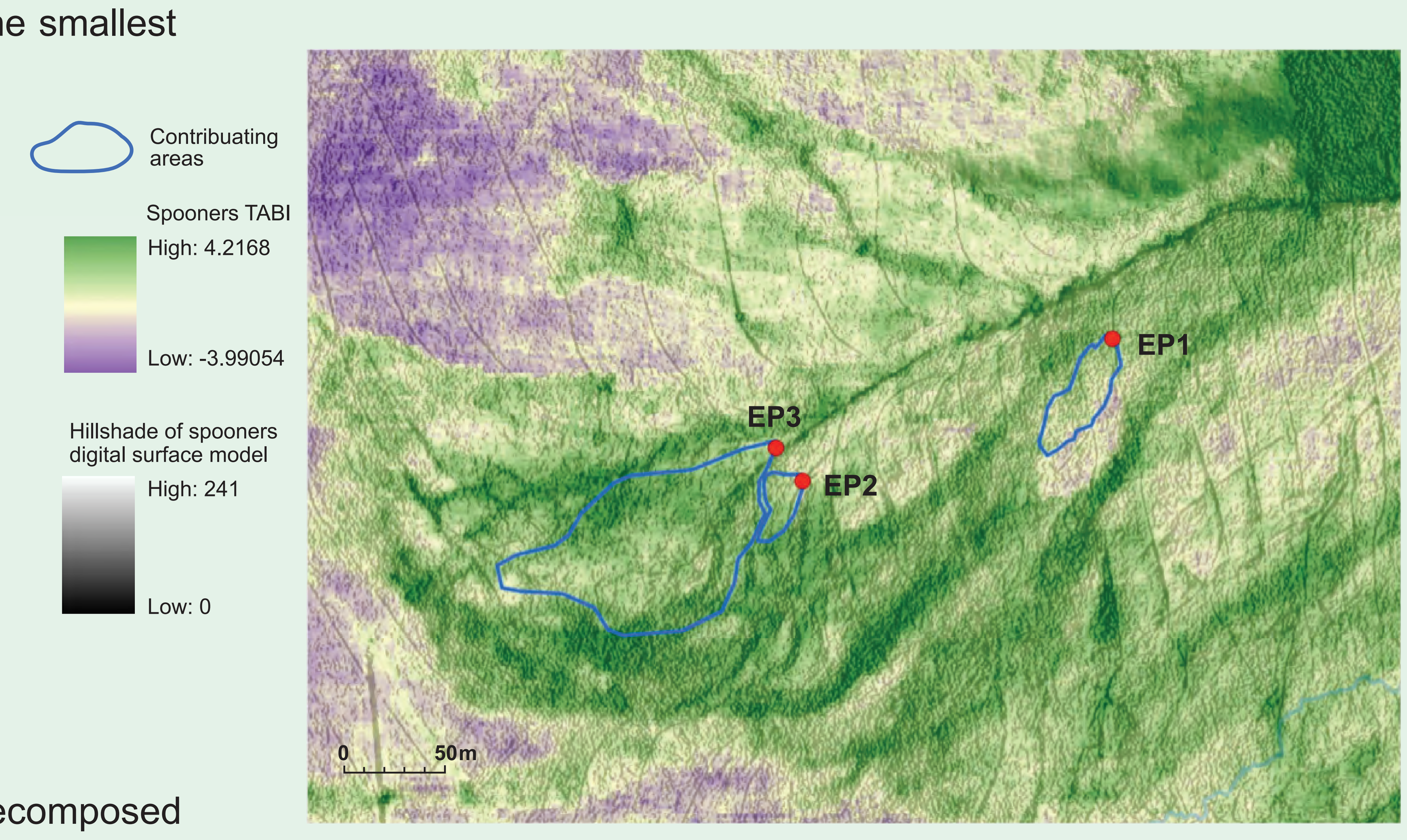

Figure 4. Contributing watersheds for small - (EP1), medium- (EP2), and large- (EP3) drains at Spooners based on modelled flowpath and wetness from TABI.

E4/E6 ratios range below 1.5 and 2.5, indicating a predominance of highly decomposed humic acid (Figure 5); differences between drains are significant (One way ANOVA, $P<0.05$, df: 3). These results correlate with degraded peatlands in Wales (Wilson *et al.*, 2011), whereas more fulvic acid was generally lost in more northerly degraded peatlands (i.e.Wallage *et al.*, 2006).

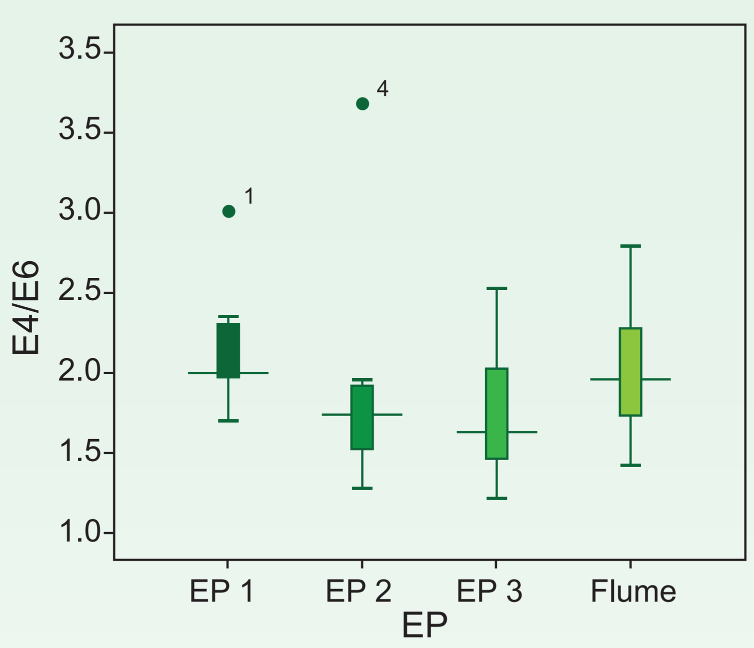

Figure 5. Pre-restoration E4/E6 ratio for small - (EP1), medium- (EP2), large- (EP3) drain and catchment outlet (Flume) at Spooners

Conclusions

- These results highlight the importance of considering local environmental conditions (e.g. peat depth, vegetation, flowpath, wetness) to understand water quality variability in drained peatlands
- DOC in damaged shallow peatlands is dominated by Humic acids, and differs from that of more northerly peatlands;
- The characterisation of drains' behaviour during various rain events prior to restoration is needed to understand the DOC losses in the whole catchment, and in turn the effect of restoration.

References

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