G.J. Heij and J.W. Erisman (Editors). Acid Rain Research: Do we have enough answers?

Setting critical loads of acidity for dystrophic peat- a new approach

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Abstract

Current methods of determining critical loads for mineral soils cannot be applied to dystrophic peat. The experiment described here aims to a) investigate how peat responds to increases and decreases in acid deposition and b) calculate a critical load.

1. INTRODUCTION

The critical loads approach is now widely accepted as a tool for pollutant abatement strategy. The aim is to maximise environmental benefits by targeting emission reductions in ecologically sensitive areas, rather than uniformly.

Critical load maps for acidity identify soil as the sensitive element, and aim to protect it from further acidification. For mineral soils, the critical load of H^+ is related to the rate of production of base cations (or weathering rate) and is a function of soil type and underlying mineralogy. This approach cannot be used for dystrophic peat soils where the underlying bedrock has no influence on the availability of base cations in the surface layers. Most countries in Europe have arbitrarily allocated these soils to the lowest (most sensitive) weathering class.

National Power Research & Engineering and the Wetland Ecosystems Research Group at Exeter University are using a combination of field and experimental investigations to determine the effect of acid deposition on dystrophic peat with a view to estimating a critical load.

2. METHODS

Intact cores (including the vegetation) of the hydrologically active portion of the peat profile (acrotelm) were taken at 8 sites, using a 10 cm diameter drainpipe. The sites were selected to encompass the range of H^+ deposition and peat type in the UK. In the laboratory they were treated with simulated rain which mimicked the ion composition at the site. The six treatments are equivalent to a reduction in acid loading (0.2x and 0.5x H^+ deposition), an increase in acid loading (2x, 4x and 6x H^+ deposition) and current inputs (1x H^+ deposition). Two years rainfall was applied over 3 months and the leachate analysed weekly. pH and exchangeable cations were determined on the peat itself at the end of the experiment.

3. RESULTS

Figure 1 shows the change in pH of the six different rain solutions after passing through *Calluna* peat from one of the more polluted sites in the South Pennines. Where the change is zero, the pH of leachate leaving the core is the same as that of the rain applied, indicating that the rain and peat are in approximate equilibrium. At this site, peat appears to be in equilibrium with rain between 0.5x and 1x current acid loading. It is thus unlikely to be acidified by current deposition. Increasing acid deposition above current levels did acidify the peat (ie the pH of leachate was increased relative to the rain applied). Data from other sites show that peat can also be in equilibrium with rain that is both more and less acid than it is currently receiving.

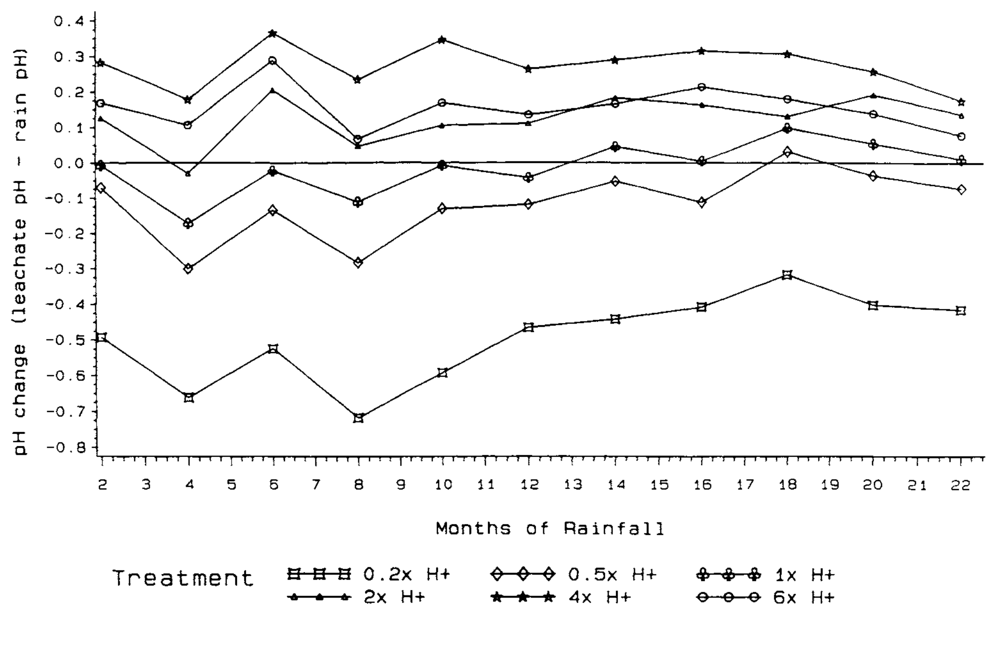

Figure 1. The change in pH of rain passing through *Calluna* peat. The concentration of H^+ in the 1x treatment is equivalent to that in ambient rainfall at the site.

4. DISCUSSION

Preliminary results suggest that drainage waters from peat are more sensitive to changes in acid deposition than the soil itself: changes in leachate pH during the experiment were not reflected in peat pH at the end of the experiment. Since the existing pool of exchangeable H^+ is so large in these acid peat soils, it may take many years for changes in rain acidity to make an impact on the pH of peat. Peats from different sites responded differently to increases and decreases in acid deposition and cannot be treated as a homogenous material. Data from the 8 sampling sites should provide information on how factors such as peat type and deposition history influence this response.

When fully analysed, these results ought to enable us to predict the chemical response of peats to variations in acid load. The data will be used to define a damage function and determine a critical load.