

## ***Interactive comment on “Nitrogen impacts on vascular plants in Britain: an analysis of two national observation networks” by P. A. Henrys et al.***

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Received and published: 1 November 2011

The reviewer has raised some very interesting points that the authors have found very interesting and we think that the comments made have helped to significantly improve the manuscript. We would therefore like to thank the reviewer. // Comment: I expected the authors to discuss in more details results obtained from their large scale investigation. I believe that discussion and conclusion of this important paper deserve to be improved. Response: We agree that in the original submission of the manuscript our discussion of the results was very descriptive and did not fully discuss any implications of the results in terms of the wider ecosystem or offer any detailed interpretation of

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the results for the reader. To rectify this we have added a complete new section to the discussion entitled “Ecosystem effects”. This addresses the issues mentioned by the reviewer and provides a much broader reflection on the results from our analysis. Specific points addressing the implication of our results on ecosystem function and productivity have been included. This addition to the discussion provides an overview of how species loss can affect the ecosystem as a whole and puts the individual species results we see in a wider context. // Comment: Title: Why only nitrogen and not nitrogen deposition? If you leave only Nitrogen it could lead to misleading (e.g., N fertilization). Response: Agreed, this has been rectified. // Comment: Abstract: Results and their implication should be better presented. Response: Agreed, abstract has been completely re-written giving more weight to the results and drawing on text in our new ecosystem effects section of the discussion. // Comment: Methods-Paragraph 2.1. It would be useful to describe in more details the habitats included in the studies, with particular reference to their spatial distribution. Indeed, in addition to the table 1 a map could be add in order to provide a view of how the different habits are distributed across the UK. Response: Agreed, a new figure with the mapped distributions of the habitats over Great Britain has been included to provide a visual guide to their spatial distribution. // Comment: Methods- Paragraph 2.2. In the second line the authors mention “N deposition”, but it is not clear whether they consider “total N deposition”, i.e., wet+dry N deposition or “total inorganic N deposition”. Please provide more specific information here. Response: Agreed, we have rectified this to say that we consider total N deposition. // Comment: Methods- Paragraph 2.2. In the lines 3-4 the authors specify the variables included in the model. I am very surprised that they included only total annual rainfall and not the summer rainfall. Giving that precipitation during summer might be critical in some areas of the Country (i.e., South-East of England), including it might be relevant. Response: Whilst we agree that it would be interesting to look at the effects of summer precipitation, this could be confounded by an argument that winter precipitation could also be important. Using data from the met office, the correlation between total summer precipitation and total winter precipitation was greater than 0.8 and there-

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fore realistically only one of these precipitation terms could be included in the model. To encompass both seasons and ensure that no effect was missed, we decided to use total annual precipitation, which is also in line with many other ecological modelling examples. // Comment: Methods- Paragraph 2.2- Discussion. What is missing there (and I believe would be interesting to see) is the interaction effect between N deposition and the other variables included on the individual species occurrence. Response: We agree that it would be interesting to look at the interaction between N deposition and other variables. However, we see this as a next stage in our analysis of these datasets, where we may also look more closely at the marginal effects of the other variables. A key issue is whether for example, high S deposition may have suppressed an observed eutrophication response via acidification. While we recognise this is one example of a plausible and interesting interaction it was thought to be better treated as further work after considering patterns found in this initial investigation. In this instance, the main aim of the study was to seek main effects of N deposition at average levels of other covariates. Due to the inclusion of the other variables and the smooth function they were also allowed to take, the number of parameters to be estimated was large. The inclusion of interaction effects and hence more parameters to estimate would therefore require large amounts of data and hence reduce the number of species it was possible to investigate. Also, it was thought more important to accurately estimate the marginal effects of variables than to compromise this by including interaction terms, which may have led to convergence problems within the model. Further to this, within the flexible GAM modelling framework we have used, interaction effects can often be difficult to model. This is because many smoothing techniques would, in 2 dimensions, have to assume the same degrees of freedom along both axes, which would be an inappropriate assumption in this case. Recent work has sought to overcome this, hence why we consider this to be the next stage in the analysis of these datasets. A comment has been included in the discussion to suggest that this is something we intend to investigate in the future. // Comment: Caption to figures 2-7. It would be good to specify in the caption that only species with significant P-values are shown. Response: Agreed,

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captions have been amended to make them clearer to understand and this has been added to make it clear that only significant results are plotted.

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Interactive comment on Biogeosciences Discuss., 8, 7441, 2011.

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