

Has the extent of rush (*Juncus* spp) in upland hay meadows increased, and what might the effect be on environmental and agricultural outputs?

Agri-environment monitoring theme: Upland priority habitats

What are the issues?

Upland Hay Meadows (UHM) are a rare and threatened grassland priority habitat, centred on the North Pennines of northern England. Whilst rushes are a typical component of damper meadows, farmers and ecologists have reported increases in sharp-flowered rush (*Juncus acutiflorus*), soft rush (*Juncus effusus*) and to a lesser extent compact rush (*J. conglomeratus*), potentially affecting agricultural and botanical quality. There is however little quantifiable evidence of change in rush cover in meadow habitats or the factors that might influence any such change. Understanding the potential agronomic impacts of rush encroachment will also help to achieve a balance between environmental and agricultural outcomes in upland hay meadows.

What are the aims of the project?

The project aimed to explore concerns raised by farmers in the North Pennines over apparent increases in rush species on their meadows and effect on hay quality (Figure 1).

The specific aims of the project were:

- to more accurately quantify the extent and recent spread of rushes within UHM, with a particular focus on the North Pennines, and to assess the extent to which current farming practice is contributing to the spread of rushes within hay meadows, including the contribution of agri-environment measures;

- to identify soil and hydrological conditions and management factors that increase the risk of rush expansion; and

- to provide an economic assessment of the impact of rushes on forage production and quality.

The project utilised existing data collected under agri-environment and other monitoring as a baseline, and a sample of around 50 meadows were re-surveyed using both fixed-point quadrats and a site-scale structured walk. The results provide some background and context to a rush treatment investigation taking place in part of the North Pennines.



Figure 1: A survey site in Dentdale, Cumbria

Which policy areas will the research inform?

This work will support the development of advice and guidance to inform the new environmental land management system, and can feed into an outcomes-based approach in helping farmers and ecologists understand the trade-offs between production and biodiversity enhancement. This is in line with government's ambition for a more sustainable farming sector as set out in its 25 Year Environment Plan.



Department
for Environment
Food & Rural Affairs

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What are the results from the project and how will they be used?

The literature review found little available information on rush ecology and management in species-rich grassland, and no studies relating to their control in upland hay meadows.

Due to differences in baseline methods, the sample of re-surveyed meadows was split into different groups for analysis. A significant increase in frequency of all rush species was detected at the whole site level (figure 2), but not for individual species, and no statistically significant changes were detected at the more detailed quadrat level, for frequency or cover. There is however an indication of non-significant increases for sharp-flowered rush.

Although quadrats containing sharp-flowered rush were not found to have significantly greater species diversity, the average number of positive indicator species were consistently higher where this species was present.

No statistically significant changes over time in species life history strategies (competitor/ stress-tolerator/ ruderal) classes, indices of plant response to light, moisture, pH and fertility, or for positive and negative indicator species over time were found. A highly significant decrease in soil phosphorus was found, which may be due to reduced fertilizer use, but no significant change in other parameters was detected. Canonical Correspondence Analysis (CCA) revealed only weak relationships between rush presence and environmental variables, primarily decreasing phosphate, potassium and pH.

The Farm Management Questionnaire revealed drainage system to be largely 'old' with variable maintenance. Around half of respondents managed rushes, with a range of views on techniques. The agronomic assessment of the potential impact of rush found that estimated hay yield across the sample sites was slightly lower than recent DEFRA averages, and may relate to the presence of rushes. A negative relationship was detected between whole-field cover of rush and estimated hay yield, although the majority of farmers felt yield hadn't changed significantly

over 10 years. There is an apparent relationship between increasing rush cover and declining hay quality with rushes considered to negatively influence feed value whilst increasing wastage and spoilage of bales. Analysis of individual farmer responses suggests that the financial losses due to rushes could range from £0/ha to £338/ha, but the estimates include impacts that are hard to quantify with the evidence available.

The report makes some recommendations on improving our ecological and agronomic knowledge, along with monitoring methods to better quantify change in rush occurrence, and the collection of field management data. The work will help inform future management strategies, including through Land Management Schemes.

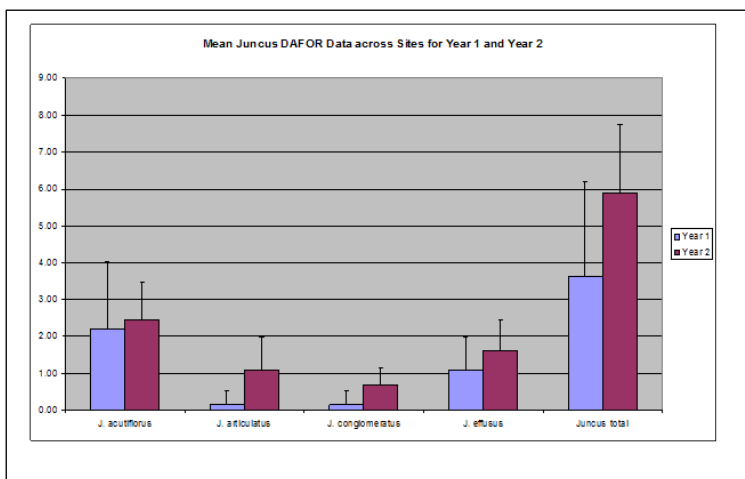


Figure 2: Average rush frequency from the whole site dataset for baseline and re-survey years. Only the change in total rush cover, in the last column, is statistically significant.

Where can I find further information about this and related research?

A copy of the final reports can be found on [Defra Science pages](#) (LM0469).

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Alternatively, please contact Defra's Sustainable Land and Soils Unit

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