Impact of change in start date of grazing on limestone grassland communities, Deep Dale, Derbyshire, UK

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SUMMARY

Deep Dale is situated within the carboniferous limestone area of the Peak District National Park. The study site occupies an area of 36 hectares, representing the south-eastern slopes of the dale. During the period from 1950 to 1996, the site was grazed by cattle, traditionally from the beginning of May each year. Then, from 1997 to 2012, the grazing start date was delayed to the beginning of July in order to comply with the requirements of agri-environment schemes. Repeat surveys indicate that this change in start date appears to have resulted in few pronounced changes to the vegetation. Some areas of grassland on shallow soils (conforming to National Vegetation Community CG2d) have become more herb-rich with an increase in abundance of kidney vetch *Anthyllis vulneraria*, common milkwort *Polygala vulgaris*, devilsbit scabious *Succisa pratensis* and autumn gentian *Gentianella amarella*. However, it appears that these changes are mainly associated with areas grazed preferentially (first) by livestock, whilst in an area of CG2d grazed later, fewer positive indicator species have shown an increase in their abundance and there are early signs of a decline in condition, including a decrease in the abundance of fairy flax *Linum catharticum* and an increase in the abundance of bryophytes. Most significantly, areas of acid U4c grassland have shown a notable increase in the abundance of hawthorn *Crataegus monogyna* seedlings, and in the abundance of wavy hair-grass *Deschampsia flexuosa.*

BACKGROUND

Deep Dale lies within the White Peak (Carboniferous limestone) area of the Peak District National Park, between the villages of Taddington and Ashford-in-the-Water in Derbyshire at grid reference SK 165 698. The study site is a nature reserve that is owned and managed by Plantlife, and which occupies an area of 36 hectares (90 acres) comprising one half of the dale; the opposite, southeast-facing slope being in private ownership. Its aspect is predominantly northwest and west facing, the altitude is from 150 m to 325 m, and the principal grassland communities include CG2c, CG2d, U4c, MG5a and MG5b.

Details of grazing on the study site prior to 1950 are not known, but from 1950 to 1996 the site was generally grazed by 30 beef cattle from the first week in May until the last week of November each year. These were mostly Hereford steers and heifers. It is understood that neither manure nor lime were ever used on any part of the reserve, and there was no supplementary feeding of livestock. The land was never grazed by sheep during this time, other than by occasional escapees from neighbouring land. From 1997 to 2012, the study site was again grazed by around 30 beef cattle each year, but the start date was delayed such that grazing was generally from early July through until the last week of November. These cattle were principally Charolais, and were again mainly steers and heifers, around 18 months old.

Plantlife acquired the reserve in 1999, and in 2001 a baseline for long-term surveillance of the grassland vegetation was established. The survey was repeated in 2003, and again in 2012.

The reason for establishing the vegetation surveillance was principally to detect change in the condition of the grassland habitats, and thereby inform further development of management prescriptions for maintaining the nature conservation interest. However, the monitoring data also provide an opportunity to assess the impact of the historic change in the grazing management when, in 1997, the previous owner entered a Wildlife Enhancement Scheme agreement. Our survey data do not allow a rigorous assessment of this management change, since the baseline was conducted four years after the change in management. However, the impact on species composition of the change in management is a gradual process that has continued over the period from 2001 to 2012.

ACTION

The impact on the grassland vegetation of the change in grazing management was monitored using a survey methodology taken from Hodgson et al. (1995), which is based on sampling using nested quadrats, randomly located within fixed plots. Details are as follows:

1. Fixed monitoring plots were established in three areas:

   A Dale side CG2d grassland in the central part of the study site (north-westerly aspect at an altitude of 250 m).
   B Dale side CG2d grassland in the southern part of the study site (westerly aspect at an altitude of 280 m).
   C U4c grassland on the upper slopes of the dale side (westerly aspect at an altitude of 290 – 320 m).

2. Within each of the above plots, five sub-plots (0.2 – 0.5 ha in size) were established each with a relatively uniform vegetation. The sub-plots are permanent and were marked on the ground to enable easy re-location.

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3. Within each sub-plot, eight 1 x 1 m quadrats were surveyed. The quadrats were positioned randomly within each sub-plot.

4. For each 1 m^2 quadrat, the species present in the bottom left 10 x 10 cm cell were noted. Subsequently, records were made of the additional species present when the cell size was increased successively to 20 x 20 cm, 30 x 30 cm, 40 x 40 cm, 50 x 50 cm and 100 x 100 cm.

5. For the initial 'baseline' survey, all broad-leaved herbs, small woody species and ferns were recorded irrespective of their rarity. For the subsequent surveys, only a short-list of species (selected as being potentially-useful indicators) was recorded.

6. Data analysis is based on calculating a value for changed abundance of each species. This is done using a simple formula as follows:
∑ (no of occurrences at time 2 – no of occurrences at time 1) for all cell sizes.

CONSEQUENCES

The graphs below show some of the key species recorded during survey work and indices of their change in abundance between 2001 and 2003, and between 2003 and 2012. A positive index signifies an increase in abundance, whilst a negative index signifies a decrease.

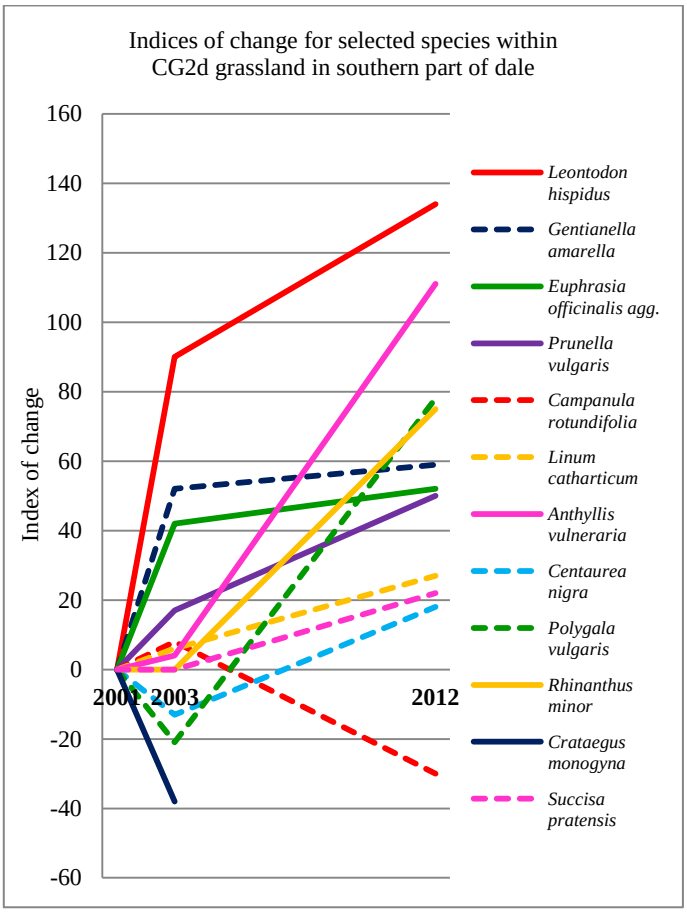

Figure 2. Monitoring area on CG2d grassland in southern part of dale

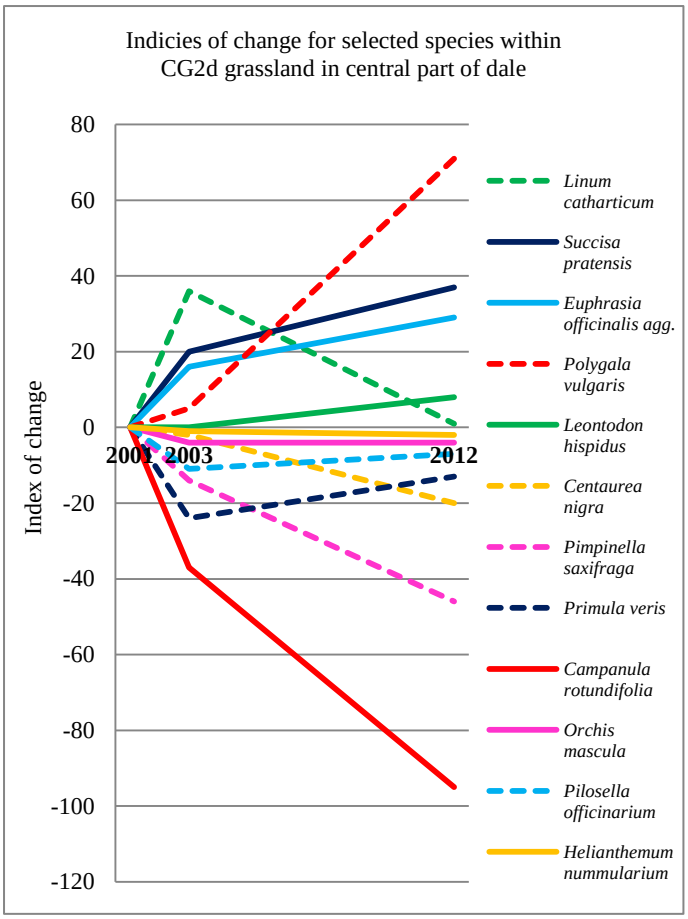

Figure 1. Monitoring area on CG2d grassland in central part of dale

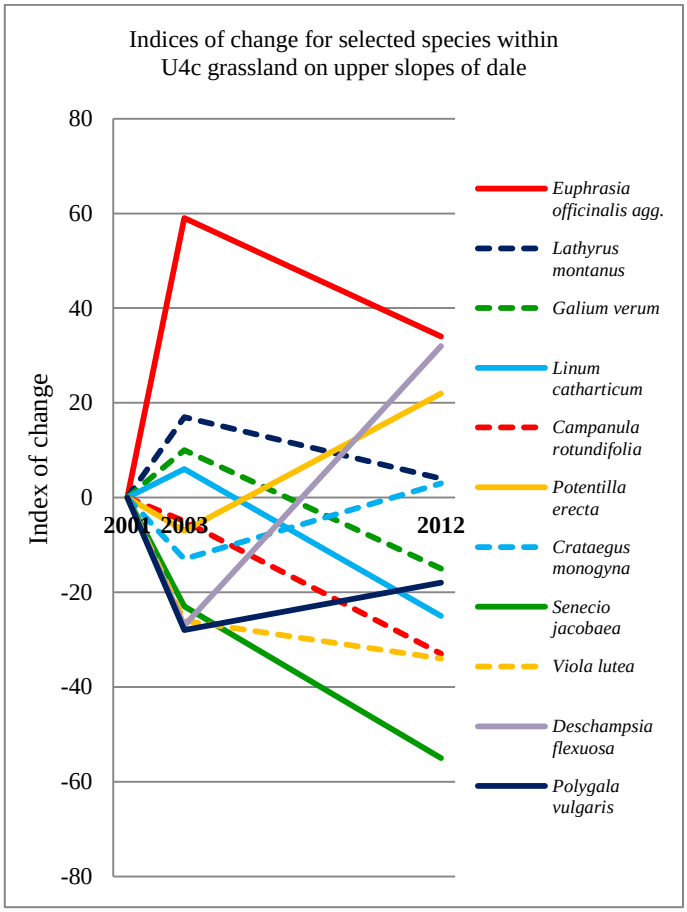

Figure 3. Monitoring area on U4c grassland on upper slopes of dale

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The results of the surveys present a mixed picture. The area of CG2d grassland in the southern part of the reserve appears to have become more species-rich. Late flowering species, such as devilsbit scabious and autumn gentian, appear to have increased following the delayed start to the grazing season. Similarly, eyebrights *Euphrasia officinalis agg*. and yellow rattle *Rhinanthus minor* have also increased in abundance, perhaps suggesting that grazing pressure is sufficiently high to prevent build-up of thatch and to open up niches for germination in the sward; these species rely on reproduction by seed and do not have long-lived seed banks. Within this monitoring plot, there was also a decline in the abundance of hawthorn seedlings, and a marked increase in the abundance of kidney vetch and common milkwort.

Within the other CG2d monitoring plot, in the central part of the dale, there were similarly marked increases in the abundance of devilsbit scabious and common milkwort. Other positive indicator species have also maintained good populations, including early purple orchid *Orchis mascula*, mouse-ear hawkweed *Pilosella officinarium* and common rockrose *Helianthemum nummularium*. However, there are initial signs that the sward might be under grazed. For example, fairy flax, a species that does not fare well in under-grazed swards, increased in abundance between 2001 and 2003, but has declined markedly between 2003 and 2012. The surveyor also noted anecdotally that bryophytes had become more abundant in 2012. The latter change may be a consequence of the lighter grazing pressure, but may also reflect the high rainfall experienced during recent summers. Overall, however, these results support expectations that this central area of CG2d would begin to show impacts of under grazing before the area in the southern part of the reserve, since livestock tend to prefer the latter area and so graze that area first.

However, it is the area of U4c grassland that could be expected to show the first signs of under grazing. Livestock tend to graze the calcareous and mesotrophic grassland before moving onto the acid grassland. If they get to the acid grassland too late in the season, they find the sward relatively unpalatable; there does seem to be evidence that this has happened following the change in grazing management to a later start date. Decreases in the abundance of eyebrights and common ragwort *Senecio jacobaea* suggest that the sward has become closer-knit with fewer opportunities for germination. Increases in the abundance of hawthorn seedlings, and in the abundance of wavy hair-grass, also suggest that the U4c grassland is becoming coarser and scrub encroachment is taking place. While the increase in wavy hair-grass may also suggest a shift towards the U4e sub-community, there has not been any clear increase in the abundance of other key species, such as mat-grass *Nardus stricta* and bilberry *Vaccinium myrtillus*, which are similarly associated with that sub-community.

DISCUSSION

The CG2d grassland at Deep Dale, and other similar sites in the local area, is recognised by Natural England's Higher Level Stewardship Scheme as Lowland Calcareous Grassland and is subject to the HK6 'Maintenance of species-rich semi-natural grassland' option. Prescriptions under this option include a 1st July start date for grazing. However, the dales grassland was historically the least-valued grazing on farms with which they were associated. They would be grazed only when the more productive meadows were shut up (i.e. grazing excluded) to grow hay. As such, grazing the dales earlier in the season would have traditionally been the norm, as it was at Deep Dale where it is known that grazing would usually begin in May.

The change in start date from May to July appears (at least over the first 15 years) to have caused few pronounced changes to the vegetation at Deep Dale, and where there has been change, at least one area of CG2d grassland appears to have become more species-rich. However, such positive impacts on habitat condition appear to be mainly associated with those areas grazed preferentially (first) by livestock, whilst areas grazed later (including some central and northern parts of the reserve and the acid grassland areas) have shown little benefit and some early signs of a decline in their condition.

The monitoring data would seem to support the case for a more varied grazing management than is currently the case. Grazing the site from as early as May in some years could be beneficial, combined with continued monitoring to assess on-going change.

REFERENCES

Hodgson, J. G., Colasanti, R. & Sutton, F. (1995). *Monitoring Grasslands: Volume 1*. English Nature Research Report, No. 156.

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