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Managing habitats: Grazing

Grazing is an important technique for maintaining certain valuable habitats and landscapes for maintaining biodiversity. This Factsheet:

- Summarises the effects of grazing
- Illustrates its use in a variety of habitats
- Discusses the difficulties of getting grazing management right

Grazing animals such as sheep and cattle remove the leaves and shoots of trees, shrubs and grasses. Without grazing (or mowing), most grasslands would turn back into woodland via the process of **succession**.

Grazing can be used to remove dominant species, reducing shading and competition and enabling rarer, smaller or less dominant species to survive.

Different animals graze in different ways; rabbits graze grassland very short, sheep also graze close to the ground but cattle prefer longer growing grasses. Horses graze very selectively, preferring certain species and vegetation heights.

Thus, by eating vegetation selectively (and by trampling vegetation) and preventing the normal process of succession, grazing animals maintain a **deflected succession** in which an altered species composition is maintained and a true climatic climax cannot be reached.

Heather moorland

Heather moorland is recognised as being of high conservation value by both UK (e.g. UK BAP Priority Habitat Action Plans) and European designations (e.g. Annex 1 habitat in the EC Habitats Directive). This conservation importance is due to:

- valuable dwarf shrubs and bryophytes
- rich invertebrate diversity
- feeding and breeding bird populations

However, over the last 150 years, much heather heathland has been lost due to:

- agricultural improvement
- natural succession
- conversion to forestry
- high grazing densities that allowed grasses to out-compete the heather

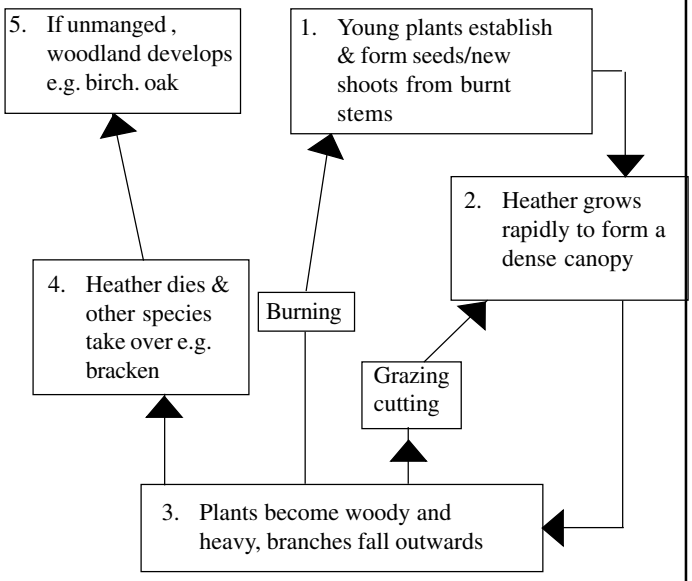
Many of the agri-environment and conservation schemes designed to protect heather moorland aim to limit grazing intensity by setting maximum stocking levels for livestock. Now it is becoming apparent that this approach is too simplistic; it isn't just the sheer numbers of e.g. sheep on a moorland that matters and more effort has to be put into monitoring and manipulating factors such as:

- the proportion of heather relative to the more preferred grasses
- the available biomass for grazing
- the respective preferences of the grazer for the different species present

So how should we set stocking levels on a valuable heather moor? Recent studies have monitored the percentage of annual growth that is removed by the grazers but which can be tolerated by the heather.

Typical Exam Question

The diagram shows steps in the management of heather moorland.



(a) Explain why heather moorland can be described as a ***plagioclimax*** (2).

(b) Outline the process of succession that could turn heather moorland into woodland (3)

Markscheme

(a) grazing prevents establishment of anything other than heather/grasses;
without grazing, the heather would be outcompeted by other types of vegetation;

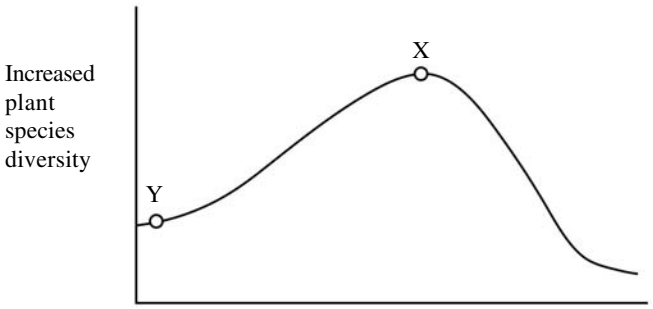
(b) Establishment of bushy species/trees would reduce e.g. light levels to heather/ would alter soil pH/ alter other biotic factor;
That would encourage other species;
Over time, heather would be replaced by dominant species; e.g. oak/birch;

Chalk grasslands

Chalk grassland communities such as those on the South Downs are maintained by grazing by sheep and rabbits.

Scientists have investigated the impact of grazing intensity on plant species diversity on the Downs (Fig.1)

Fig.1 Relationship between grazing intensity and plant species diversity



Typical Exam Question

Explain the effect on plant species diversity of increased grazing Intensity (3)

You need to get your eye in!

As you can see, at low levels of grazing (Y), increasing the amount of grazing actually leads to an increase in plant species diversity. This is because the fastest growing or dominant species are eaten and kept in check by the rabbits and sheep. This allows slower growing/less dominant species to survive alongside the more dominant species. Without the grazers these less dominant species would be shaded out or wouldn't be able to get sufficient nutrients from the soil.

However, beyond a certain grazing intensity (X) the plant species diversity decreases because the sheer number of herbivores is resulting in just about everything being eaten! Even so, you can see that even at the highest grazing intensity, plant species diversity doesn't fall to zero – a few resistant species are surviving.

Resistant plant species usually have features that allow them to tolerate grazing by herbivores:

- Low or underground growing points
- Rosette growth habit
- Underground stems or rhizomes
- Deep root systems or tubers
- Protective features e.g. thorns, spines, stings, resin etc.
- Unpalatable leaves

Chalk grassland is also an important habitat for butterflies. To maintain a good habitat for butterflies, the height of the grass has to be controlled by sheep grazing.

Table 1 shows the effects of sheep grazing on the population of the meadow brown butterfly (*Maniola jurtina*) in three different areas of a chalk grassland.

Table 1 Effect of sheep grazing on meadow brown butterfly population

Management scheme	Population of meadow brown butterflies		Chi - squared value
	1990	2000	
Area A: grazed by sheep in summer	435	415	0.47
Area B: grazed by sheep in winter	522	595	4.77
Area C: no grazing	287	239	4.38

Table 2 shows part of a chi-squared table

Table 2 Chi-squared values

Degrees of freedom	Probability					
	0.50	0.25	0.10	0.05	0.02	0.01
1	0.45	1.32	2.71	3.84	5.41	6.64

Typical Exam Question

Did any of the management schemes lead to significant differences in the population sizes of meadow brown butterflies between 1990 and 2000? Use the 95% level of significance. (3)

Markscheme

no significant difference in A because $0.47 < 3.84$;
significant increase in B because $4.77 > 3.84$;
significant decrease in C because $4.38 > 3.84$;

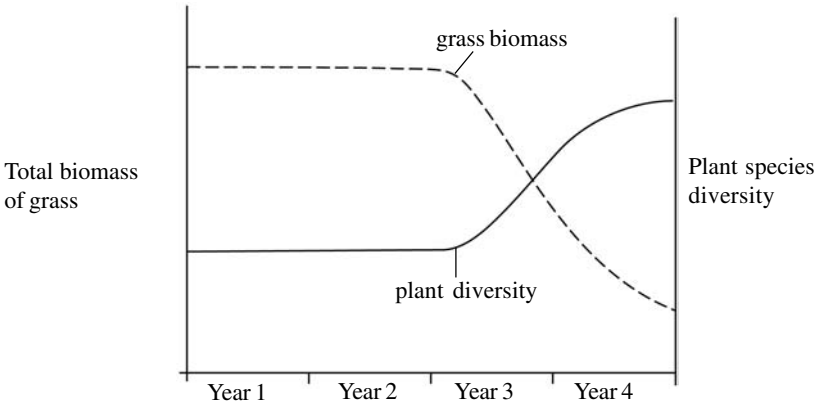
So we can conclude that:

- grazing in summer has no statistically significant effect on the butterfly population
- grazing in winter significantly increases the butterfly population
- no grazing significantly decreases the butterfly population

Practice Questions

1. Scientists investigated the effects of sheep grazing on a field over 4 years. The field was not grazed in the first two years and was then grazed in years 3 and 4.

   Each year the plant species diversity and total biomass of grass species was calculated. The graph shows the results.



   (a) Explain the effects of sheep grazing on:
   (i) grass biomass (2)
   (ii) plant species diversity (2)
   (iii) The number of sheep grazing the field was increased after year 4.
   Suggest how this would affect the diversity of plant species in the field. Justify your answer.

2. The warden at a nature reserve wanted to improve the species composition of an area of grassland. In an investigation, she fenced off a 20m x 20m area of grassland to prevent the entry of rabbits over spring and summer. In September she used 10 random quadrats (0.25 x 0.25m) to sample both the grazed area and ungrazed area of the grassland. In each quadrat the grass was cut, separated by species and then dried and weighed. The table shows the results.

	Mean dry mass of grass/ gm^{-2}	
Grass species	**Grazed area**	**Ungrazed area**
Lolium perenne	20.4	31.8
Poa annua	14.9	7.5
Phleum pratense	8.0	4.8

   (a) Suggest one criticism of the experimental design (1)
   (b) Suggest an explanation for these data (3)

Answers

1. (a) (i) Biomass decreased because grass was eaten;
   New plant species were smaller;
   (ii) Diversity increased because sheep ate dominant/suppressing species;
   which reduced competition allowing less vigorous species//new species to become established;
   (iii) Diversity would decrease;
   overgrazing;

2. (a) Insufficient quadrats/sample too small;
   Fenced area may not be representative of the grassland;
   (b) rabbits selectively graze *L. perenne*;
   P.annua may be unpalatable to rabbits;
   P. annua may be able to compete more effectively with *L. perenne* when rabbits are grazing it / *L. perenne* out-competes *P.annua* in the absence of rabbits;
   P. *annua and P. pratense* may benefit from the presence of rabbits;

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