

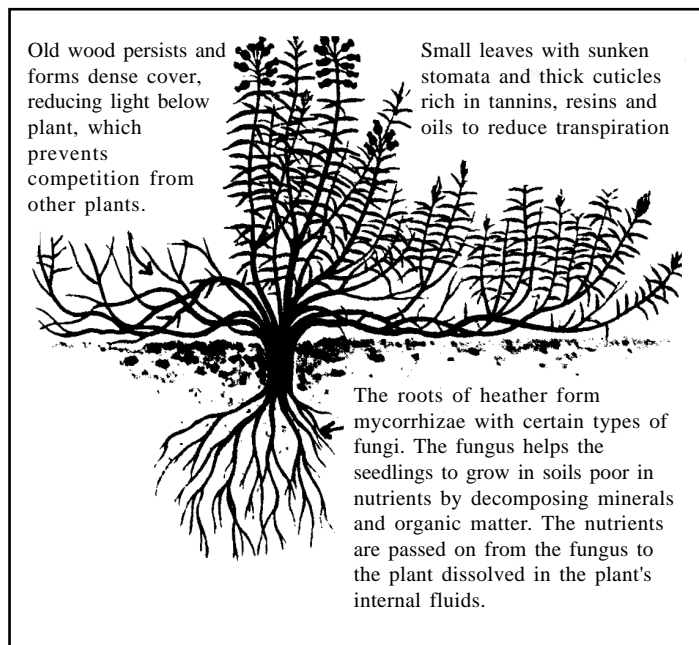


Heathland and Moorland Ecosystems

Introducing the ecosystems

Heaths can be defined as dwarf scrub plant communities with woody branching stems, and very small evergreen leaves, adapted to reduce water loss from transpiration, as the heaths cannot tolerate periods of prolonged drought. Heaths are also adapted to grow on soils with low nutrient availability such as **acidic podsol**s which have a pH of between 3.5 and 5. Fig 1 shows how the heather plant is adapted to its habitat.

Fig 1. The heather plant and its adaptations

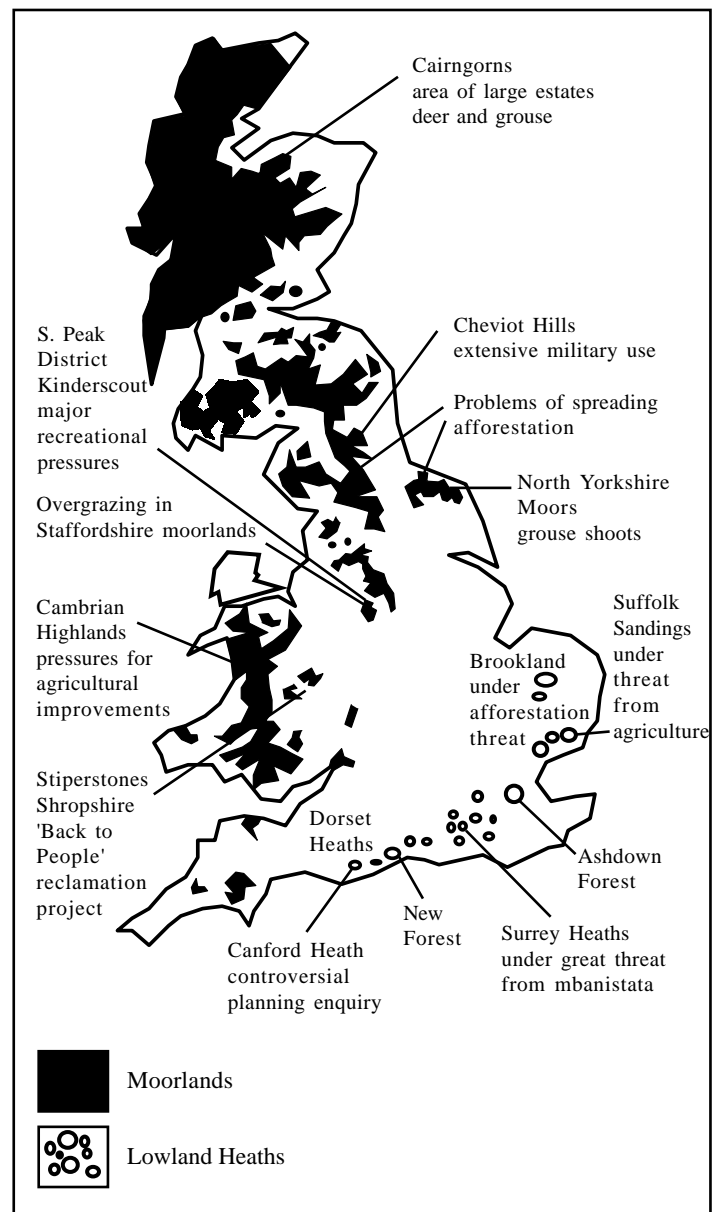


Heathlands can occur in **lowland** areas such as Southern Britain or Eastern Netherlands. They form on porous sandy soils such as those associated with tertiary sands (e.g. Bagshot) or outwash sands from icesheets (Eastern Netherlands or Jutland). Where the soils are cleared of woodland cover, the rain **leaches** out the nutrients, leaving the soil impoverished and only able to support plants that are specially adapted to these acidic conditions. **Lowland** heaths are often dominated by species of heather, usually ling, and gorse, but if poorly managed encroachment by bracken and grass takes place.

Moorlands can be defined as **upland** heathlands. In Britain they occur above 250 metres, mainly on resistant impervious rocks of upland Britain, such as the Millstone grit of the Pennines. Many of these rocks are acidic and therefore supply few nutrients to the soil, which combines with the climatic conditions to provide an environment which restricts plant growth. The high altitude leads to strong winds, lower temperatures (impact of an environmental lapse rate of 1°C per 100 metres), increased relief rainfall often of over 12500 mm per annum, and the greater cloud cover restricts the amount of sunshine. The result is an ecosystem of low **primary productivity** and **low diversity** dominated by heathers (*Calluna* and *Erica*). The heather moors are associated with grass moorland and blanket peat bogs. Sedges and rushes develop in wetter grassland areas and on flat badly drained sites peat bogs develop.

Fig 2. summarises the distribution of the two types of heathland community in Great Britain.

Fig 2. Distribution of Heathlands in Great Britain



However whilst it is possible to distinguish between lowland heaths and upland heather moorlands and they form two very distinctive ecosystems (see Figs 3a and 3b overleaf) they do have many common features (see p3).

Fig 3a. The Heathland Ecosystem

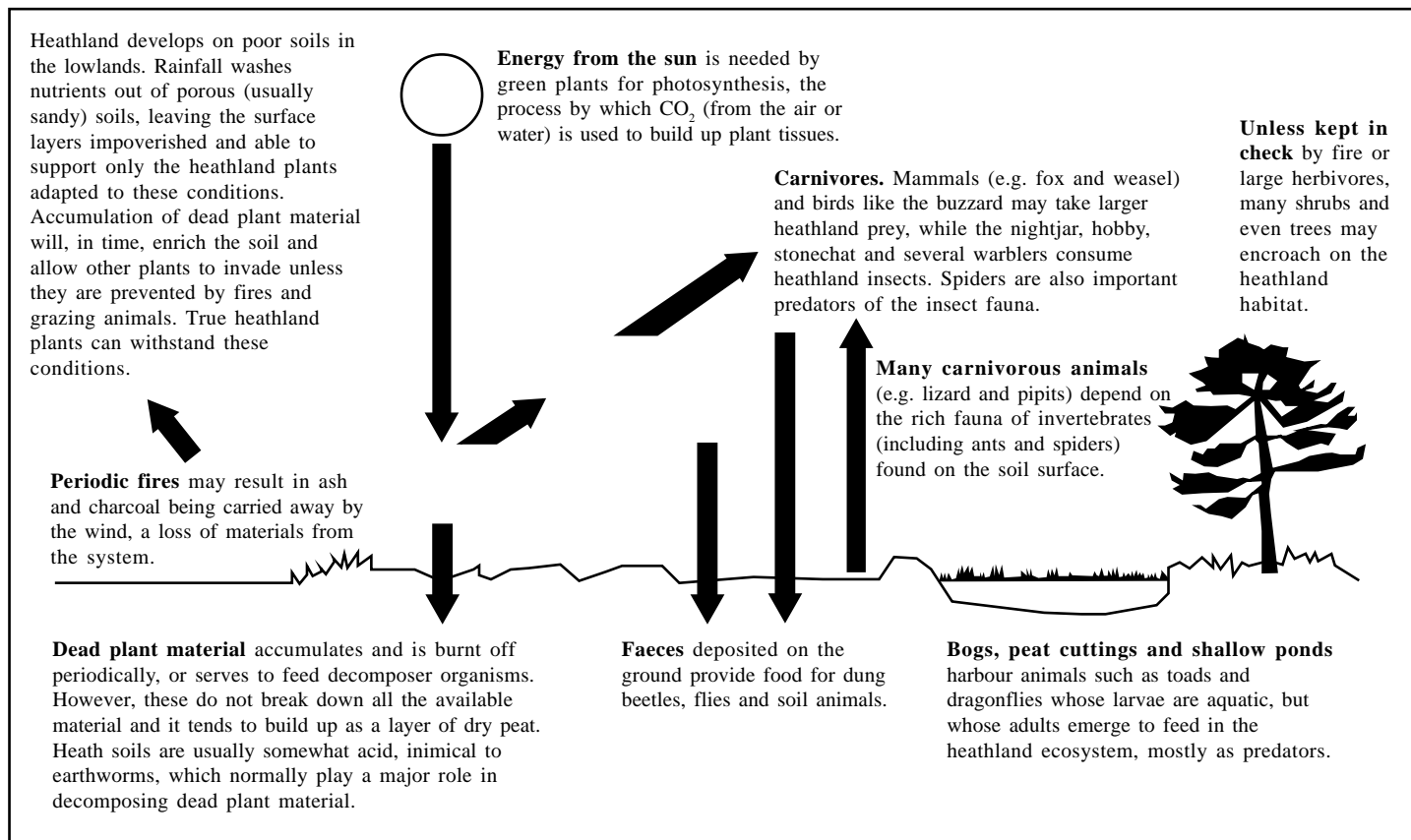
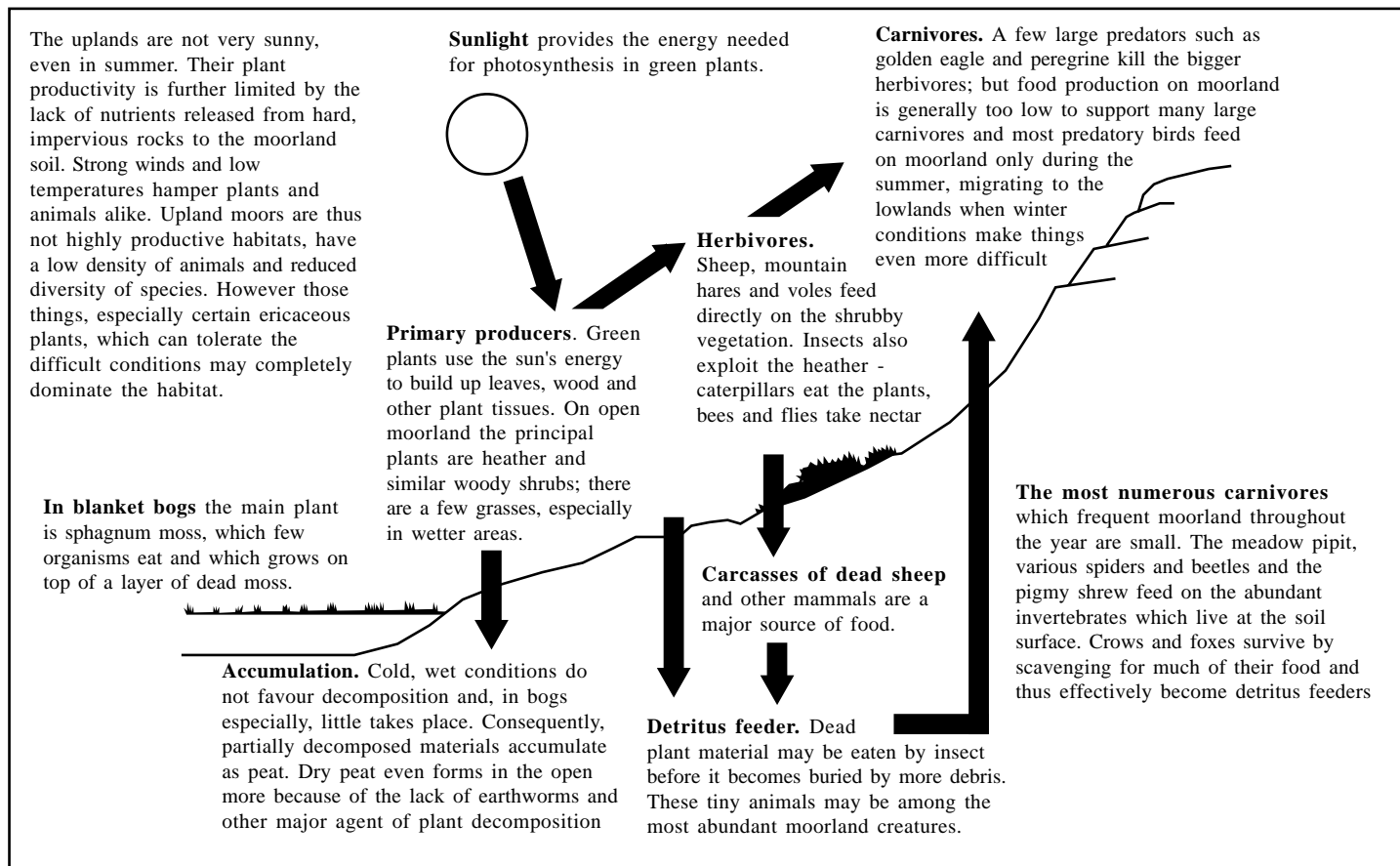


Fig 3b. The Upland Moorland Ecosystem



- Firstly they form open landscapes dominated by dwarf shrubs with few or no trees.
- Secondly in spite of a natural appearance, these ecosystems are actively managed in some way as they need frequent grazing, cutting or burning to maintain their biological and economic value. Only above 750 metres could heather be considered to be a **climatic climax**.
- Thirdly they are found in areas with less favourable conditions which leads to low biodiversity, although this provides a unique habitat which contains several rare sometimes endangered species (see Figs 3a and 3b for details).
- Fourthly they provide areas of great beauty, with an aesthetic and recreational value. Moorlands are perceived as beautiful wild open places, and heathers have a culture value as an important ‘lucky’ Scottish symbol.
- Fifthly, both ecosystems are under threat from a range of human activities. As they have high scientific value this is a major area for concern. Some conservationists however argue that the ecosystems should be returned to their natural state.

Heathlands and Moorlands – managed ecosystems

If you look at Fig 4, which shows generalised moorland succession you will see that what we think of as a natural ecosystem is in fact a **plagio climax** – a human induced climax to the succession, which results from the **deflecting** actions of grazing and burning. Heather is a particularly valuable evergreen forage plant. It is the staple diet of the red grouse, or deer and one of the major winter food sources for the hardier breeds of hill sheep (e.g. Scotch Blackface) as well as useful support grazing for lowland sheep. For over 200 years burning has been the main means of maintaining the heather as rough grazing forage.

The object of burning is to keep as much heather as possible at its most productive stage; i.e. when the proportion of edible green shoots to woody tissue is at its highest. Burning should be done in small areas **or mosaics** of about one hectare, to provide sufficient cover, as well as feeding within the territory of each pair of breeding grouse, and to prevent uncontrolled fires. As can be seen from Fig 5 heather should be burnt when it is about 12 years old before it reaches the mature phase. Monitoring of burnt mosaics suggests that the process needs to be repeated around every 15 years or the heather degenerates, plants become woody and the branches fall over allowing bracken to take over.

Grazing is also part of the equation. The major issue here is getting the correct stocking rates – grazing by sheep can also reactivate the growth of the young shoots but overgrazing can kill off the young heather. Farmers find heather moorland difficult to farm, as they have to move the sheep from the moorlands at mating and lambing time to pasture land and also around the moorland mosaics all of which requires expensive labour. Farmers experience great pressures to improve moorland and convert it into enclosed pastures, thus increasing their livestock numbers to gain more income.

Typical Exam Question
 Study Figs 3a and 3b and answer the following.

(a) Explain why both environments can only support heathers.

(b) Draw two diagrams to show the trophic levels present in the ecosystems. Compare and contrast the two ecosystems in terms of flora and fauna.

(c) Suggest why the flora and fauna of the lowland heathlands is generally more diverse than that of the upland areas.

Fig 4. Generalised Moorland Succession

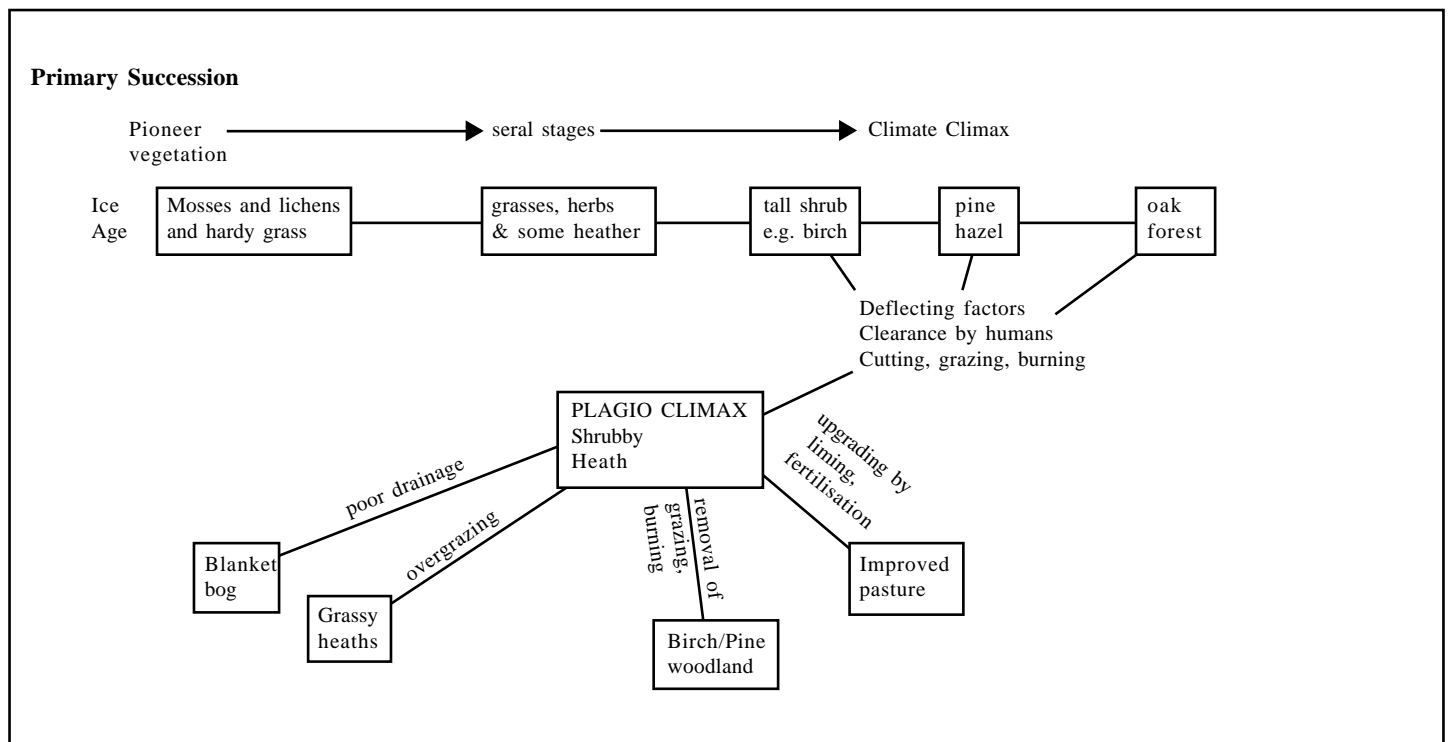
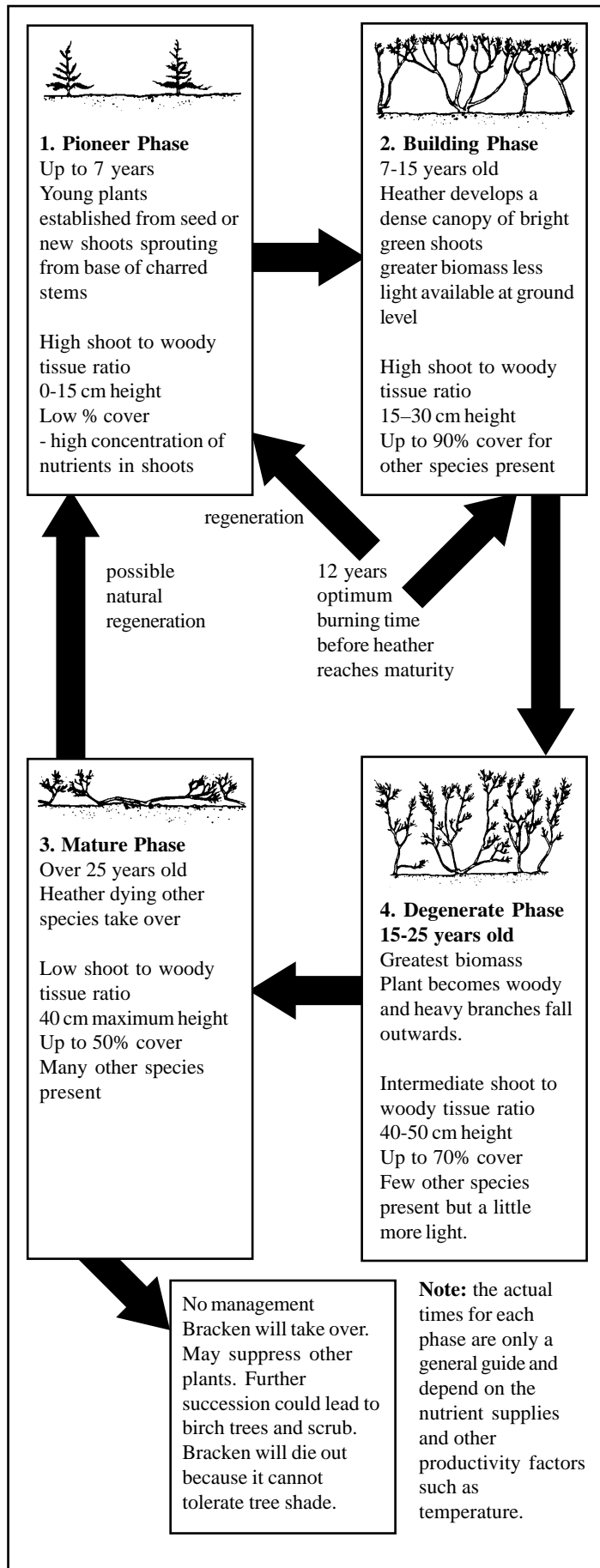


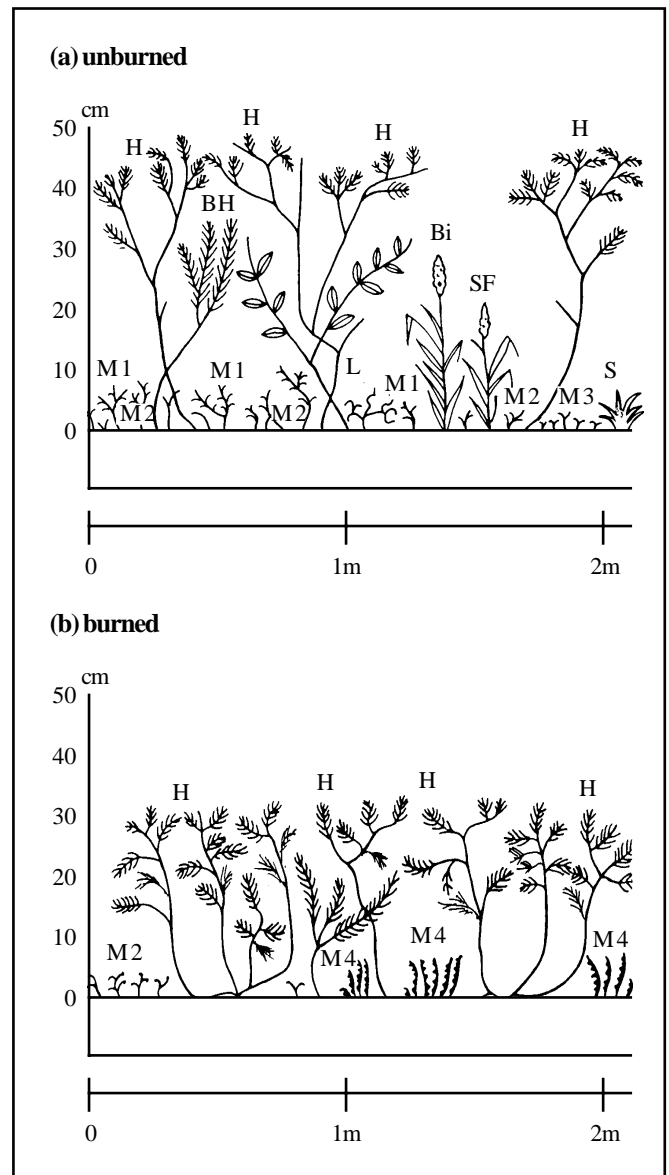
Fig 5. The life cycle of heather



Typical Exam Question

Study Fig 6 which shows the impact of burning on a moorland heather community.

Fig 6.



(a) Describe and suggest reasons for the changes in the structure and composition of the moorland ecosystem.

Hints

Structure – Describe the changes in height of the heather, the number of green shoots, changes in the ground layers etc. Consider impact of light.

Composition – Describe which species have gone, which have appeared. Consider how diverse the ecosystem is before and after burning.

Heathlands and Moorlands under threat – Case studies from Great Britain

(A) Lowland Heaths

In counties such as Dorset, Surrey and Suffolk between 80-90% of heathland has been lost in the last 20 years. This is occurring at an accelerating rate because of rising population pressures on South Eastern England and the desirability of heathlands (dry, flat, relatively easy to clear) for development. Whilst the loss is paralleled throughout North Western Europe, it is very important that something is done about it in Great Britain because it has 40% of Europe’s remaining lowland heaths. Loss of heathland can also lead to fragmentation, which diminishes the value of the heathland areas and makes them more vulnerable to invasion by rival species, and damage and destruction from urban pressures. It is not just the loss of the heathland vegetation, but of the unique ecosystem. The favourable climate of the Southern heathlands supports a rich assemblage of insects such as grasshoppers and bees as well as all six of all native species of reptiles such as the sand lizard, and one rare bird unique to the environment – the Dartford Warbler.

Table 1. Threats to lowland heaths

% of lowland heath threatened	Threat
18%	Agriculture is a major threat. Soils can be limed, fertilised and improved to form arable land e.g. in the Eastern Netherlands or ploughed up and reseeded for pasture and lucerne.
6%	Excessive fire damage –a problem in dry summers e.g. 1976 in Surrey. Nearly 20% of heaths were heavily damaged especially near urban areas where arson was a problem e.g. Aldershot.
1%	Nutrient enrichment by spray drift from agricultural fertilisers encourages weeds and grasses to grow at the expense of heather – especially where heathland areas are fragmented.
3%	Afforestation for example of Breckland Suffolk, with conifers was a problem. It has largely stopped but self seeding pines from the forests encroach on the heathland.
64%	Development for Urban expansion for roads and utilities had led to enormous losses e.g. Canford Heath. Fragmented heaths are under threat from dumping etc.
2%	Removal of sheep flock or the death of the rabbit population from myxomatosis encourages woodland encroachment as regular encroachment as regular grazing ceased.
6%	Excessive recreational use often for inappropriate activities such as motorbike scrambling has caused problems e.g. New Forest.
Concerns <ul style="list-style-type: none"> • loss of rare reptiles etc. • loss of aesthetically beautiful and unusual areas. • competing pressures - especially for building and development land. • comparatively rare Ecosystems. Limited extent. 	

The loss of habitat is clearly a concern and a number of strategies have been developed to control the threats and conserve the remaining lowland heaths.

Strategies include:

- fire breaks
- control of car park spaces and camping sites
- development of environmentally sensitive areas (ESAs)
- removal of pine seedlings
- habitat management for lizards/Dartford Warblers
- creation of protected areas such as SSSIs and Nature Reserves
- trade off deals with builders and developers whereby in return for building sites on heathlands they agree to conserve and manage other nearby areas of heathland.

Review

Using two headings – control of threats, and conservation of remaining heathlands. Make a table to explain the purpose of the strategies listed above.

(B) Upland Moorlands

Very large areas of moorland have been lost to other uses. Over the last 50 years some 50% of Welsh moorlands, 25% of English moorlands and 15% of Scottish moorlands have been lost to other uses. In Scotland this represents nearly 200,000 hectares – a huge area.

Table 2. Indirect threats exist which are summarised below

Indirect Threats
<p>Agricultural Improvements adding lime and phosphates to improve grassland moors. Ploughing of gentle slopes for grassland leys often supported by grants - a particular problem in Wales.</p> <p>Excessive burning devalues the habitat quality. It kills off shoots to prevent further growth.</p> <p>Afforestation by Forestry Commission and Economic Forestry Group, often called creeping coniferisation, is very much a current problem. Selling the land for forestry is one way of making a living, often supported by grants e.g. in Northumberland.</p> <p>Recreational pressures in honeypot areas leads to erosion of tops of Kinderscout on Long Mynd. Tourism can generate accidental fires.</p> <p>Increased military use e.g. in the Otterburn area of Northumberland. Whilst military use may lead to natural ecosystems it places managed heather moorlands under considerable strain.</p> <p>Both overgrazing and undergrazing can have very serious effects. Under farming may lead to bracken invasion and then woodland development. Overgrazing kills the heather and leads to replacement by coarse grassland. It can lead to trampling and over dunging. Overgrazing encouraged by Hill Farming subsidies e.g. in Staffordshire Moorlands.</p> <p>Demise of the grouse 'estates' management for grouse and other game is a very expensive process. As fortunes of the aristocracy fail they may be unable to maintain grouse moors e.g. in NW Highlands.</p>
<p>Concerns</p> <ul style="list-style-type: none"> • The total amount of land lost – may be a low % but a huge area. • Problems of financing intensive management by burning. • Pressures on hill farmers to change from their lifestyle to survive. • Uniqueness of weather environment.

The interesting fact here is that it is Government and EU subsidies which have led to the destruction of the moorlands. Given the limitations imposed by a harsh climate and impoverished soils, the rearing of livestock is virtually the only farming option in the uplands. With poor basic services, and

many deprivation problems facing remote communities, special Government subsidies have been granted since the 1940s to upland areas. Farmers in these less favoured areas receive subsidies for each animal kept (**Headage**) and for improving the productivity of the land, by draining, and fertilising the moorland to improve grazing. Grants are also available for building new roads, which can exacerbate localised erosion. The result is that since 1947 sheep numbers have doubled with high stock numbers leading to localised overgrazing, especially a problem in winter where sheep trample feeding sites, and also when they rely on heather shoots as a major food supply. It is a fine balance – to continue the social support would continue to promote the overgrazing, but to withdraw it would push the farmers to sell moorlands for large scale afforestation, or to leave the hill areas completely. A way has to be sought to maintain the income of hill farmers, while at the same time encouraging environmentally sensitive management.

Solutions include:

- Encouraging optimum burning strategies i.e. a 12 year mosaic strategy.
- Encouraging diversification by grants for farm tourism etc.
- Establishment of optimum stocking rates (1 sheep per 2 hectares).
- Development of environmentally sensitive areas for example in the Cambrian Mountains of Wales whereby farmers are able to claim payments for conservation features or by sticking to traditionally low intensity methods.
- Encouraging farmers to rear young animals and sell them to lowland farmers to fatten.

The dramatic fall in farm prices during the late 1990s means that the future of these upland moorlands is now under considerable discussion, especially as many great estates are finding the costs of greater conservation for grouse shooting and deer an increasingly expensive option.

Conclusion

You have an opportunity to review all the issues raised and then by further research answer the following essay question.

Practice Question

Assess the relative significance of threats to the lowland heaths and upland moorlands. Illustrate your answer with detailed case studies.

You should do further research on some of the areas shown on Fig 2. Some useful websites include English Nature and MAFF, Local Wildlife Trusts.

Hints

Introduction

- Define the two communities, a locational map may help.

Main Body

- Assess the ecological and economic value of the two communities.
- Discuss the range of threats in each of the two communities – evaluate nature of damage, or whether total destruction. Obtain facts on rate and scale of these damaging actions with reference to sample areas.
- Evaluate possible solutions to the threats in terms of feasibility, cost etc.

Conclusion

- Consider **relative significance** of threats. Which is the worst scenario or are both equally bad.

Acknowledgements;

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ISSN 1351-5136