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Five years of monitoring grassland transplantation at Potatopot, West Cumbria

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GRASSLAND TRANSLOCATION AND ITS MONITORING AT POTATOPOT - WEST CUMBRIA

EXECUTIVE SUMMARY BY ENGLISH NATURE

A major grassland translocation was undertaken at British Coal's opencast coal site at Potatopot between 1988 - 1989. This report sets out the conclusions of the intensive 5-year monitoring programme undertaken between 1987 and 1992 by the Nature Conservancy Council and its successor organisation, English Nature.

Potatopot represented the second largest area of lowland acidic grassland in West Cumbria. It exhibited a range of community types with wet Juncus flushes, uniform swards of mixed sedges and species-rich grassland. In addition, a number of locally uncommon species occurred on the site, for example the lesser butterfly orchid Platanthera bifolia.

In 1985, British Coal (then the NCB) applied for planning permission for opencast operations at Potatopot. NCC advised against approval of the application and requested amendments, including the avoidance of key environmental areas. These were not acceptable to BC, who considered that they would make operations unworkable.

Although NCC requested that restoration of the wetland and species-rich grasslands be included as a planning condition, planning permission was granted without agreement over restoration proposals, although their agreement was a pre-condition to opencast extraction. BC subsequently agreed to transplant areas of existing wet grassland subject to a site survey in 1986.

The survey in June 1986 revealed that over 3ha of the 15ha grassland were of SSSI quality. BC offered to move 0.5ha of this.

The transplantation took place in four main stages:

- Trial moves in 1988 of about 200m^2 as 1m x 1m turves. This technique was discontinued, being judged by BC as too time consuming and expensive on a large scale.

- A 'rescue' operation in 1988 initiated by BC using volunteers to transplant turves (combined area of about 130m^2) containing orchids, particularly Platanthera bifolia.

- The main transplantation in 1989 of about 0.5ha as 1.9m x 1.5m turves.

- An additional transfer in 1989 of bladed topsoil and vegetation.

Monitoring of the transplantations was undertaken by NCC/English Nature as part of a wider transplantation study. Additional monitoring was undertaken by ecological consultants working for BC.

With regard to changes in the vegetation communities at Potatopot, these can be summarised as:

- 2.5ha of SSSI quality grassland have been lost together with another 12ha of lower quality acidic grassland.

- 0.5ha of SSSI quality grassland have been transplanted but with the loss of its ecological integrity and significant changes in its species composition and structure.

- Transplanted turves have shown an increase in invasive species and a decrease in some less vigorous species characteristic of the original grassland (including orchid and sedge species).

- The factors responsible for changes have not been identified but an apparent lack of appropriate vegetation management immediately prior to and subsequent to transplantation is likely to be a key factor.

- Given appropriate management it may be possible to retain some of the wildlife interest ane enhance it in the longer term.

- Use of bladed material may enhance the 2-3ha of new grassland which has been created.

In addition, English Nature draws the following general conclusions from the transplantation at Potatopot:

- It supports English Nature's policy that where important wildlife habitats are threatened, in situ site safeguard is the only cost effective safeguard; transplantation is not a substitute.

- Transplantation may be of some wildlife benefit where in situ site safeguard has failed or where wildlife habitats are of lower value.

- To maximise transplantation opportunities a detailed programme needs to be drawn up and agreed prior to any transplantation work being undertaken.

- The need for expert ecological supervision of transplantation operations.

- The importance of continuity of appropriate vegetation management eg. grazing or cutting, prior to, during and subsequent to transplantation, to the success of the transplantation.

- The need for appropriate long term land management safeguards.

We are grateful to British Coal for their co-operation and considerable commitment to undertaking the transplantation operations at Potatopot. We hope that British Coal are able to ensure that the grasslands created will be managed to enhance their wildlife value.

We are grateful to British Coal for funding the monitoring work in 1992 and the production of this report.

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English Nature

SUMMARY

This report summarises the five years of botanical monitoring prior to and following the transplantation of species rich acidic grassland and mire communities at Potatopot, West Cumbria due to the opencast mining of the site by British Coal.

Monitoring has shown a steady increase in invasive species, notably *Holcus lanatus*, *Molinia caerulea*, *Deschampsia cespitosa* and *Juncus conglomeratus* and a corresponding decline in less vigorous species (including *Nardus stricta*, *Carex flacca*, *C. panicea*, *C. pilulifera*, *C. pulicaris*, *Dactylorhiza fuchsii*, *Achillea ptarmica*, *Ranunculus acris* and *R. flammula*) which were characteristic of the original grassland.

These trends have resulted in a significant decline in the botanical interest of the grassland at Potatopot.

Evidence of this trend precedes the transplantation of turves in 1989 and it is concluded that the absence of grazing both prior to and following transplantation is the main cause of this decline in botanical interest of the grassland. Other factors which may have resulted in the decline in botanical interest are: differences in the hydrology of the donor and receptor sites; nutrient release caused by soil disturbance during transplantation; in the turf the small size of the transplanted turves may be a factor in the decline of orchid species.

Potatopot highlights the importance of management, particularly post transplantation, in the success or otherwise of habitat transplantation schemes. It is clearly evident that if the management that maintained the scientific interest of a site does not continue both immediately prior to (when the original land manager may have been replaced by the developer) and after transplantation at the receptor site (when the developer is also likely to be responsible for management) then the scientific interest of the site will decline and there will have been little point in having carried out the transplantation. Poor supervision of the transplantation operation may result in conditions at the receptor site being unsuitable for the appropriate management to be carried out.

At Potatopot management is required to halt the decline in the botanical interest of the grassland. Grazing should continue at increased intensity. Mowing and the removal of cuttings from the site to reduce the level of bulky herbage which is swamping out slow growing species should also be considered.

The effectiveness of transplantation as a means of site conservation must be considered. At Potatopot the developer was only willing to relocate 0.5ha of the 3ha of grassland identified as being of special interest due to the cost of the operation. As a consequence 2.5ha of species rich grassland have been lost.

CONTENTS

1. INTRODUCTION

This is the concluding report on five years of monitoring work at Potatopot, West Cumbria (NY 040240) initiated by the England Field Unit (EFU) of the Nature Conservancy Council (NCC) and continued by the author under contract to English Nature.

Potatopot was an area of acidic rough pasture with areas of *Festuca ovina - Agrostis capillaris - Galium saxatile* grassland, *Nardus stricta - Galium saxatile grassland, Juncus acutiflorus - Galium palustre* rush pasture and *Molinia caerulea - Potentilla erecta* mire with large populations of several locally uncommon species including *Platanthera bifolia.* In 1988-89 0.5ha of the 3ha of grassland identified by NCC as being of SSSI quality was transplanted by British Coal to the present location to make way for open cast mining. This area was transplanted in the form of turves in August 1989 with the agreement of NCC under the supervision of BC's ecological consultants (Penny Anderson Associates). This grassland constitutes the 90 x 30m and 30 x 30m monitoring plots. Following the recommendation of Penny Anderson Associates remaining areas of grassland and top soil were scraped up and spread over land to the north of the turf receptor site which was being restored. Monitoring plots A, B and C lie in this "bladed" area. In addition the Cumbria Trust for Nature Conservation transplanted turves containing orchids (particularly *Platanthera bifolia*) to the turf receptor site in July/August 1988 without consultation with NCC. The turves from this operation constitute the "orchid" plot. Figures 1-3 in the Appendix (from Leach et al. 1991) show the location of the donor and receptor sites.

Following initial survey by NCC regional staff in 1986 EFU carried out a detailed survey of the donor site in 1987 (Buckingham, 1987). The area to be transplanted was marked out in 1988 and EFU set up a scheme to monitor vegetation change in this area. Monitoring work was carried out annually from 1988 to 1992, giving two years of data for the grassland plots prior to transplantation and three years post transplantation data. Monitoring was extended in 1989 to cover the "orchid" plot post transplantation and in 1990 to cover the "bladed" area. (Further details of the sequence of events at Potatopot and monitoring methods employed can be found in Leach *et al.*, 1991, Anderson, 1990, Anderson *et al.*, 1990 and Buckingham, 1987).

2. METHODS

2.1. Field Methods

The methodology used by EFU was designed to detect changes in species composition and relative abundance of species in the sward of two selected plots prior to and post transplantation. Three recording methods were employed:

1. The compilation of species lists with DAFOR estimates of species abundance.
2. The assessment of species frequency using large numbers of randomly located 10 x 10cm mini-quadrats (see Byrne (1991) for methodology).
3. The establishment and re-recording of randomly located permanent quadrats. This data has not been analysed by EFU and does not fall under the remit of this report.

Methods 1 and 2 were carried out in each year between 1988 and 1992 for the 90 x 30m Plot and 30 x 30m Plot transplanted in 1989, while permanent quadrats were only recorded in 1988 to 1990. In addition in 1987 a detailed survey of the donor site was carried out (Buckingham 1987).

Methods 1 and 2 were also employed to assess vegetation change post transplantation in the 19 x 7m "orchid" plot and in three 50 x 50m plots in the area which received bladed topsoil and turf fragments from the donor site in 1989 (plots A, B and C).

2.2. Analysis

2.2.1. Species lists with DAFORs

Species lists are used solely to confirm the arrival and extinction of species in the plots and provide some confirmatory evidence of changes in frequency from quadrat sampling as detailed below.

2.2.2. Frequency of species in randomly located 10 x 10cm quadrats

The 90 x 30m and 30 x 30m plots were analysed statistically for changes in species frequency between years using an Analysis of Variance. An ANOVA was carried out for each successive pair of years (1988/'89, '89/'90, etc.) and 1988/92 for each species that showed an overall change in frequency between 1988 and 1992.

For the post transplant data from the "Orchid" plot chi-squared tests were used to identify statistically significant changes in species frequency between successive years and between 1989 and 1992.

For the post transplant data from the three "bladed" plots chi-squared tests were used to identify statistically significant changes in species frequency between successive years and between 1990 and 1992.

2.2.3. Species composition using Plant Strategy Theory (CSR)

Paragraph 2.2.4 of Leach *et al.* (1991) provides a summary of the CSR model of plant life history strategy and its use here (see also Byrne, 1991. Figures referred to from Leach *et al.*, 1991, can be found in the Appendix to this report.):

> "The CSR model provides a way of describing the ecological strategies of plant species (Grime *et al.*, 1988). It originates from the suggestion of Grime (1974) that it is useful to classify the external factors which affect vegetation into two broad categories, namely stress and disturbance. Stress consists of phenomena which restrict photosynthetic production, such as unfavourable temperatures, shortages of light, water and nutrients, whilst disturbance consists of partial or total destruction of the plant biomass, caused either by the activities of herbivores, pathogens and humans, or phenomena such as drought, frost, soil-erosion, wind and fire.
>
> There are four permutations of high and low stress with high and low disturbance, of which only three are viable as plant habitats. (the combination of high stress and high disturbance effectively prevents the establishment of vegetation). Grime (1974) suggested that there are three primary strategies which plants use to survive in these conditions, and the plants which use them are classified as **competitors** (exploiting conditions of low stress and low disturbance), **stress-tolerators** (high stress and low disturbance), and **ruderals** (low stress and high disturbance).
>
> Competitors are often robust perennials of high potential growth rate which form a tall and dense canopy of leaves, and have well-defined peaks of leaf production coinciding with periods of maximum potential productivity. Examples are *Urtica dioica* and *Chamerion angustifolium.*

Stress-tolerators are often small, leathery or needle-leaved evergreens with a relatively low potential growth rate, and which have a long established phase in their life histories. They are also often unpalatable to herbivores. Examples are *Primula veris*, *Danthonia decumbens* and *Nardus stricta*.

Ruderals are usually small and fast growing species which reproduce early in the short established phase of their life histories, and they devote a large proportion of their annual production towards the formation of seeds. Examples are *Capsella bursa-pastoris* and *Senecio vulgaris*.

There are other plants which exploit the various intermediate conditions between stress, disturbance and competition, and these can be displayed in a triangular diagram (Fig 4).

Plant Strategy Theory is potentially of immense value in identifying and interpreting vegetation changes, and in understanding their likely causes. Species having particular strategies - or having particular physiological, autecological or morphological traits - may increase or decrease in abundance as a result of particular environmental changes (Fig. 5), enabling us to distinguish between for example, disturbance effects and the effects of changes in management (or, in the case of Potatopot, the continuing absence of management).

For the purposes of the present report we subdivided the `Sheffield Triangle' into four, partially overlapping, sectors:- an S-sector (comprising S, SR and SC strategies); an R-sector (R, SR and CR strategies); a C-sector (C, SC and SR strategies); and a CSR-sector (CSR strategy) (Fig. 6). In the following account we examine for particular groups of species the proportions falling within each of these sectors. For example an increase in C-sector species would suggest dereliction (as indicated in Fig. 5c), while an increase in R-sector species would suggest disturbance (Fig. 5e). This `bulking up' from the seven strategies to four strategic `sectors' is particularly useful when, as is often the case, the numbers of species in the groups being examined are small."

3. RESULTS AND DISCUSSION

Due to the possibility of confusion between *Festuca rubra* and *Festuca ovina* and between *Agrostis capillaris* and *Agrostis canina* changes in frequency in these species, unless very pronounced have been omitted from the analysis.

3.1. The 90 x 30m Plot: Changes in species composition

3.1.1. Species which have disappeared from the sward between 1988 and 1992 (Table 3)

Fifteen species have been lost from the original species complement of the 90 x 30m plot. Of these six disappeared before transplantation and nine since. All with the exception of *Prunella vulgaris* were recorded as rare or very rare in the last year they were recorded in. The most significant loss appears to be that of *Ranunculus acris* which prior to transplantation was locally frequent but was dramatically reduced in 1990 and became extinct in 1991. Although this might appear to have been a direct result of transplantation it should be noted that Table 4 shows that it was decreasing in frequency prior to transplantation ('88/'89) as well indicating that other factors such as management

were probably involved. *Ranunculus flammula* also shows a similar decline and eventual extinction in 1992. Four sedge species became extinct in 1989 and 1990 prior to transplantation.

3.1.2. Species showing a decline in frequency of occurrence (Table 4)

Eleven species (including *Ranunculus acris* and *R. flammula* which became extinct). Several species have shown very dramatic declines in species frequency, particular *Nardus stricta, Carex flacca, C. panicea, C. pilulifera* and *Leontodon autumnalis*, which were all moderately frequent in 1988 but have declined steadily. *Potentilla erecta* which occurs at relatively high frequency also shows a gradual decline in frequency. The increase in frequency of *Carex pilulifera* in 1992 is probably due to this species being under recorded in 1991 due to the lateness of the season of the field work in 1991.

3.1.3. Species which have arrived in the sward since 1988 (Table 5)

Five species, all recorded as rare or very rare, have appeared in the sward and remained established in 1992 (eleven other species were recorded as new species between 1988 and 1991 but had disappeared prior to 1992, Table 6). The majority of these species were first recorded in 1990 the first year after transplantation.

3.1.4. Species showing an increase in frequency of occurrence (Table 7)

Seven species have increased in frequency over the study period (however it is possible that the increase in *Agrostis capillaris* may be spurious due to confusion between *Agrostis capillaris* and *Agrostis canina*). The majority of these species are vigorous grasses with a tendency to dominate swards in an absence of management (*Holcus lanatus, Deschampsia cespitosa* and *Molinia caerulea*). *Juncus conglomeratus* and *Centaurea nigra* are also species characteristic of under-managed swards.

3.1.5. CSR analysis of species composition

The overall species composition of the 90 x 30m plot in terms of Plant Strategy Theory appears to have remained roughly constant over the study period. However the CSR profile of species declining and becoming extinct shows a distinct bias towards the S and CSR-sectors. Species on the increase show a very marked bias towards the CSR-sector, and to a lesser extent the S and C-sectors.

3.1.6. Discussion

There are clear signs that this plot is being taken over by vigorous grasses (*Deschampsia cespitosa, Molinia caerulea* and *Holcus lanatus*), rushes (*Juncus conglomeratus*) and to a lesser extent herbs such as *Centaurea nigra* with the loss of less competitive species, largely slow growing stress tolerant species such as *Nardus stricta, Carex hostiana, C. caryophyllea* and *C. pulic aris*. There does not appear to be a link between these changes and the transplantation and it seems most likely that they are due to changes in management, principally a lack of grazing which has in the past allowed the less vigorous species to survive by keeping the more competitive species in the sward under control.

3.2. The 30 x 30m Plot: Changes in species composition

3.2.1. Species which have disappeared from the sward between 1988 and 1992 (Table 10)

Eleven species have become extinct in this plot since 1988. Of these many were rare in 1988, however five, *Ranunculus acris, Nardus stricta, Carex echinata, C. pilulifera* and *C. pulicaris* were

recorded as being at least occasional or locally frequent in the plot in 1988. All of these species became extinct post transplantation and Table 11 shows that they all suffered a major decline in species frequency between 1989 and 1990 coinciding with transplantation and only *Ranunculus acris* showed signs of being in decline prior to transplantation.

3.2.2. Species showing a decline in frequency of occurrence (Table 11)

Ten species showed a decline in species frequency over the study period (including five which became extinct). The decline in frequency of *Carex panicea* and *Danthonia decumbens* appears to have been gradual but steady over the five years, but that of *Carex flacca* and *Achillea ptarmica* has been exclusively post transplantation.

3.2.3. Species which have arrived in the sward since 1988 (Table 12)

Only four new species have managed to remain established in the sward since their arrival A further eight species entered the plot sward and then vanished again between 1988 and 1992 (Table 13). Of the species that remained established only *Cerastium fontanum* is the only one which appears to have become anything other than a minor sward component.

3.2.4. Species showing an increase in frequency of occurrence (Table 14)

Four species have shown a significant increase in frequency since 1988. As in the 90x 30m plot these are mainly aggressive species which thrive in unmanaged and under grazed grassland (*Deschampsia cespitosa*, *Holcus lanatus* and *Juncus conglomeratus*). The increases in *Deschampsia cespitosa*, *Juncus conglomeratus* and *Rumex acetosa* appear to be post transplantation, while that of *Holcus lanatus* has been mainly pre- transplantation.

3.2.5. CSR analysis of species composition

The CSR profile of the30 x 30m plot has not changed greatly between 1988 and 1992, though there has been a slight increase in the proportion of competitive species (C-sector). The species lost from the plot are mainly in the S and CSR-sectors and a similar pattern, though with a strong bias towards the S-sector is found in those species declining in frequency. Sample numbers are small for species increasing in frequency and new species. New species show a leaning towards the C and R-sectors, while species on the increase show a strong bias towards the CSR-sector. The overall picture here is not clear but it may show the gradual decline and loss of stress tolerant species and the ascendancy in more competitive species in an under-grazed sward.

3.2.6. Discussion

This plot shows, as might be expected, very similar trends as the 90 x 30m plot. Vigorous species such as *Deschampsia cespitosa*, *Holcus lanatus* and *Juncus conglomeratus* have increased in the sward while less competitive species such as a number of sedges, *Achillea ptarmica* and *Ranunculus acris* have declined or become extinct. Again this appears to be linked to a lack of grazing rather than the transplantation, though the decline of *A. ptarmica* and *Carex flacca* appears to have been entirely post transplantation.

3.3. The 19 x 7m "Orchid" Plot: Changes in species composition

3.3.1. Species which have disappeared from the sward between 1989 and 1992 (Table 17)

Fifteen species were lost from the Orchid plot between 1989 and 1992, half of which were lost in 1991/92. This may indicate poor searching for species during the compilation of the species list with

DAFORs in 1992. The most significant extinction's are those of *Ranunculus acris* which has also become extinct in the 90 x 30m and 30 x 30m plots. Extinction in this plot appears to have occurred immediately post transplantation, however data are not available pre-transplantation so a true assessment cannot be made. All the species which have become extinct were rare or very rare in 1989 with the exception of *Ranunculus acris* and *Carex pulicaris* which were rare/occasional.

3.3.2. Species showing a decline in frequency of occurrence (Table 18)

Five species have shown a significant decline in frequency since 1989 (one of which, *Ranunculus acris* has become extinct). All these declines have been pronounced, particularly that of *Carex panicea* which has halved in its frequency of occurrence! Also of concern is the marked decline of *Dactylorhiza fuchsii* which was recorded in one quarter to one third of the mini-quadrats in 1989 and 1990 but was not recorded at all in these in 1991 and 1992.

3.3.3. Species which have arrived in the sward since 1989 (Table 19)

Only three species have been newly recorded in the plot since 1989 and remained established until 1992 (a further eight species colonised the sward but failed to remain established (Table 20)). The presence of *Hydrocotyle vulgaris* is of particular not as it was recorded as being occasional in its first year in the plot (1992), other new species being rare.

3.3.4. Species showing an increase in frequency of occurrence (Table 21)

Five species have shown an increase in frequency since 1989. These are again competitive species, mainly grasses and rushes, which are also the main species increasing in frequency in the 90 x 30m and 30 x 30m plots, though here *Juncus conglomeratus* is replaced by *Juncus acutiflorus*. Of particular note is the dramatic increase in frequency of *Lotus uliginosus* which has increased from 17% to 90% frequency since 1989!

3.3.5. CSR analysis of species composition

The CSR profile of the orchid plot shows a very slight shift towards the S-sector with a corresponding decline in the CSR-sector. This is mirrored to some extent by the profiles of species lost a bias towards C and CSR-sectors with relatively few S-sector species lost. Species in decline are in the S and CSR-sectors, particularly the latter. No pattern can be discerned from the species new to the sward. Species on the increase are mainly in the S and C-sectors, with a notable, though predictable lack of ruderals.

3.3.6. Discussion

This again shows similar trends to those expressed in the 90 x 30m and 30 x 30m plots. *Deschampsia cespitosa*, *Holcus lanatus*, *Molinia caerulea* and *Juncus acutiflorus* all increasing in frequency. In addition in this plot *Lotus uliginosus* has shown a very dramatic increase in frequency. A number of less competitive species such as *Carex pulicaris* and most notably *Dactylorhiza fuchsii*, have declined or become extinct. The decline of *D. fuchsii* is of particular concern as this plot was the result of the selective transplantation of areas rich in orchids.

3.4. The turf plots as a whole

The patterns of vegetation change in these three plots are very similar. All have seen an increase in species frequency of invasive and competitive species, notably *Deschampsia cespitosa*, *Holcus lanatus*, *Molinia caerulea*, *Juncus conglomeratus* and, in the orchid plot, *Juncus acutiflorus* and

Lotus uliginosus. This has been mirrored by a decline in slow growing stress tolerant species such as *Nardus stricta, Carex pilulifera, C. pulicaris* and, in the orchid plot, *Dactylorhiza fuchsii.* In addition all three plots have seen the extinction of *Ranunculus acris* and *R. flammula.* These trends and extinctions started prior to transplantation and seem to be related to the lack of grazing since 1985 rather than the transplantation. The increase in *Ranunculus flammula* and *Carex flacca* in the damp Plot A (see below) may indicate that other factors such as changes in hyrology may have contributed to the loss or decline of some species in the turf plots.

3.5. Plot A: Changes in species composition

3.5.1. Species which have disappeared from the sward between 1990 and 1992 (Table 24)

Nineteen species have been lost from the 1990 species complement in Plot A. The number of species lost is spread equally between 1991 and 1992.

3.5.2. Species showing a decline in frequency of occurrence (Table 25)

Only two species have shown a consistent and significant decline in frequency since 1990, *Carex demissa* and *Plantago lanceolata.*

3.5.3. Species which have arrived in the sward since 1990 (Table 26)

Ten species have arrived and have become successfully established since 1990, of which *Carex hostiana* and *C. ovalis* are perhaps the most surprising. The abundance of *Lotus corniculatus* in its first year is also of note.

3.5.4. Species showing an increase in frequency of occurrence (Table 27)

Six species have increased in frequency since 1990. Of these *Juncus acutiflorus* and *Juncus conglomeratus* are the most notable as they are now the dominant species in the plot. The increase in *Carex nigra* and *C. flacca* are also notable as in turfed plots sedges have tended to be in decline. *Ranunculus flammula* has also increased here while declining elsewhere.

3.5.5. CSR analysis of species composition

As might be expected the CSR profile for this plot has shifted away from ruderal species towards competitive and stress tolerant species since the establishment of the plot by the spreading of top soil and turf fragments which created a very high level of disturbance followed by two years with virtually no disturbance. The profile of the species lost from the plot also shows this trend with a bias towards R-sector (and CSR-sector) species. No conclusions can be drawn from the profile of species in decline due to the small sample number. In the species colonising the plot since 1990 there is a strong bias towards competitive species. Of the species increasing in frequency there is a bias away from R-sector species, with the main increase being in the S and C-sectors.

3.5.6. Discussion

The species composition of this plot has fluctuated dramatically since its establishment and this is likely to be due to the nature of its establishment, with a wide variety of species initially becoming established but with many of them being unable to compete in the prevailing conditions in subsequent years. Due to the dampness of this plot it has been the rushes which have shown the most dramatic increases. Interestingly *Carex flacca* and *Ranunculus flammula* have also done well in this plot while having declined in the turfed plots, this is due no doubt to their ability to survive in the damp conditions.

3.6. Plot B: Changes in species composition

3.6.1. Species which have disappeared from the sward between 1990 and 1992 (Table 30)

Ten species have been lost from Plot B since 1990, the majority being ruderals, notably *Poa annua* which was frequent in the disturbed soil of 1990 but disappeared in subsequent years in the absence of further disturbance.

3.6.2. Species showing a decline in frequency of occurrence (Table 31)

Seven species show a decline in frequency since 1990, two of which (*Poa annua* and *Polygonum persicaria*) became extinct. Of particular interest is the marked decline of *Alopecurus genticulatus* which was present in over 90% of mini-quadrats in 1990 but only 40% in the following years. This may be related to the lack of disturbance in the plot in the later years as *A. genticulatus* tends to be found where there is at least some degree of disturbance. Many of the other species showing a decline also have ruderal tendencies.

3.6.3. Species which have arrived in the sward since 1990 (Table 32)

Twelve species have arrived in the sward since 1990. Of particular interest is the appearance of *Ranunculus acris* which has become extinct in the turfed plots.

3.6.4. Species showing an increase in frequency of occurrence (Table 33)

Seven species show an increase in frequency in this plot. In general they are competitive species typical of under-grazed grassland, though *Anthoxanthum odoratum* is something of an oddity here. Rushes are again seen to be on the increase here as they are in the other plots. The most notable increase however is that of *Lotus uliginosus* which has increased from 10% to nearly 80% frequency over the study period.

3.6.5. CSR analysis of species composition

Between 1990 and 1992 there has been a marked shift towards the CSR-sector in the CSR profile of Plot B, with a particular decline in the R-sector. This probably coincides with the decline in levels of disturbance and the onset of conditions more favourable to more competitive species with the establishment of the sward. The decline of R-sector species is clearly seen in the CSR profile of the species declining in frequency and species lost from the sward where there are marked biases towards this sector. This trend is also followed by species that have increased in the sward. Here there is also a marked trend towards C and CSR-sector species. The majority of species new to the plot are in the CSR-sector. All of this indicates increasing dereliction in this plot since its establishment.

3.6.6. Discussion

This plot has a well established grassy sward and one might expect vigorous grasses to be on the increase here as they are elsewhere, however the overwhelmingly dominance of *Holcus lanatus* appears to be suppressing the spread of other grasses (though the less competitive *Cynosurus cristatus* and *Anthoxanthum odoratum* do show an increase in frequency). Rushes have however spread through the sward. Several ruderal species, such as *Poa annua, Juncus bufonius* and *Polygonum persicaria*, which were frequent in the disturbed conditions when the plot was established but have disappeared from the plot in more stable conditions which followed.

3.7. Plot C Changes in species composition

3.7.1. Species which have disappeared from the sward between 1990 and 1992 (Table 36)

Twenty species have been lost from the 1990 species complement of Plot A. Many of these are ruderal species such as *Poa annua, Polygonum persicaria, etc.* reliant on the disturbance of the initial soil spreading for their presence and unable to survive in the subsequent low disturbance levels.

3.7.2. Species showing a decline in frequency of occurrence (Table 37)

Of the four species decreasing in frequency in this plot two (*Poa annua* and *Cerastium fontanum*) became extinct.

3.7.3. Species which have arrived in the sward since 1990 (Table 38)

Nine species have become established in Plot C since 1990, most notably *Carex binervis, C. hostiana, C. ovalis, C. pallescens* and *Dactylorhiza fuchsii,* which have been in decline in the turfed plots.

3.7.4. Species showing an increase in frequency of occurrence (Table 39)

Eight species have increased in frequency since 1990 and again rushes are prominent amongst these. The most dramatic increase though has been by *Festuca rubra* rising from 10% to 72% frequency over the study period. Despite its high frequency *Festuca rubra* is largely present as individual isolated plants scattered over the largely bare ground. *Ranunculus flammula* also shows a notable increase, considering that it has declined in the turfed plots.

3.7.5. CSR analysis of species composition

The CSR profile shows a fall in R-sector species and an increase in S and CSR-sector species. There is a strong bias amongst those species lost from the plot towards the R-sector. The species in decline are confined to the CSR and R-sectors indicating a drop in disturbance levels since 1990. There is a strong trend towards S-sector species in the new colonists and this is also reflected in those species that have been on the increase in the plot. Much of the ground in Plot C is unvegetated and may be partly composed of sub-soil and the increase in stress tolerant species may be due to low nutrient levels.

3.7.6. Discussion

This plot differs from the other bladed plots as it has extensive areas of bare soil which have remained un-colonised since its establishment. *Festuca rubra* appears to be the main species to be successful in colonising the bare soil, though it is only present as small individual plants and does not contribute significantly to the vegetative cover in the plot. Rushes have also shown a slight increase along with several sedges and *Ranunculus flammula* which have also been able to colonise the bare ground. Ruderal species have declined in the plot following the decline in disturbance since transplantation.

4. CONCLUSIONS

There is little evidence that transplantation itself has had a significant effect on the species composition of the two plots for which there is pre-transplantation data available. The affects of changes in environmental factors such as hydrology are difficult to assess but Buckingham (1987) suggested that improved drainage may result in an increase in invasive species such as *Molinia caerulea* at the expense of sedges and herbs. Invasive species have certainly increased in the plots at the expense of sedges, however the increase in frequency of these invasive species appears to have begun prior to transplantation and therefore one must presume that it is more likely to be the result of a lack of grazing rather than hydrological changes. Changes in hydrology may have contributed to the decline of some species and the increase of *Carex flacca* and *Ranunculus flammula* in Plot A (species which have declined and become extinct respectively in the turf plots) suggests that this may be the case.

The main changes that have occurred seem to be due to changes in management. Until 1985 the site was regularly grazed by sheep (Buckingham, 1987), but since then until 1991 the only grazing which took place was by stray sheep. In 1991 and 1992 grazing by sheep was introduced, however this appears to have had little affect on the increased prominence of *Holcus lanatus*, *Molinia caerulea*, *Deschampsia cespitosa* and *Juncus* spp. in the sward. In its present state it would be desirable to graze the site hard with cattle to reduce bulky herbage of the dominant species. Unfortunately this is not practical due to the high frequency of gaps (10-15cm wide) between the turves which are a danger to cattle (and humans). In the absence of grazing by cattle consideration should be given to mowing the site and removing the cuttings, bearing in mind that this may have to be done by hand as heavy machinery may damage the turves. Sheep grazing should continue and possibly needs to be increased in intensity.

Other factors which may have had an influence on species changes are the release of nutrients from the soil as a consequence of soil disturbance during transplantation. This is especially likely to have been the case on the bladed plots where soil disturbance has been pronounced. In the Orchid Plot the small size of the hand transplanted turves may have contributed to the decline of orchid species due to damage to the roots. The evidence for these influences on the transplanted grassland is limited due to the lack of control plots.

One of the lessons to be learnt from this project is that greater care needs to be taken when laying the transplanted turves and that it is important to lay the turves so that they abut each other closely. This is a relatively simple task for an experienced well supervised machine operator to perform. Gaps between turves will also have affected the hydrology of the transplanted sward, increasing desiccation of the turf in times of drought *etc.* There seems little point in transplanting vegetation threatened by development if the way the vegetation has been transplanted precludes the management of the site in later years to maintain the special interest of the transplanted vegetation.

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TABLES

TABLE 1 90m x 30m PLOT: SPECIES AND DAFOR VALUES 1988-1991

Sample date	29/06/88	26/06/89	27/06/90	12/08/91	02/07/92
Recorders	SAB CPB SJL	SAB CPB SJL	SJL CPB JHSC	RFJ JHLA	RFJ
Trees and Shrubs					
Crataegus monogyna	VR	VR	VR	VR	VR
Salix aurita	-	VR	-	-	-
Salix cinerea	VR	R	VR	VR	-
Ulex europaeus	R	-	R	R	R
Grasses					
Agrostis canina	F	F-LFA	FA	O	F
Agrostis capillaris	F-LA	FA	F	A	F
Agrostis stolonifera	-	-	R	-	-
Anthoxanthum odoratum	F-LA	F	RO	O	F
Arrhenatherum elatius	-	-	R	-	-
Briza media	R	O	R-LO	R	O
Cynosurus cristatus	O	O	RO	R	O
Dactylis glomerata	R	R	VR	-	-
Danthonia decumbens	O	O	RO-LO	O	OR-LO
Deschampsia cespitosa	LO	O	O-LF	F-LA	F
Festuca ovina	A	FA	A	A	F-LA
Festuca rubra	R	R-LF	OF	FA	F
Holcus lanatus	A	F-LA	A	FA-LA	F
Molinia caerulea	OF-LAD	O-LFA	O	F-LA	F-LA
Nardus stricta	O-LF	RO-LF	RO	O	RO-LF
Poa pratensis	R	-	R	R	R
Poa trivialis	-	-	-	R	R
Sedges					
Carex caryophyllea	VR	-	-	-	-
Carex binervis	R	-	-	-	-
Carex demissa	RO	R	R	-	VR
Carex echinata	O-LF	RO-LF	R	R	R-LF
Carex flacca	O-LF	RO	O	R	O
Carex hostiana	VR	VR	-	-	-
Carex nigra	O-LA	R	O	R	OF
Carex ovalis	R	-	-	R	R
Carex pallescens	R	-	-	-	-
Carex panicea	OF-LAD	O-LA	O-LF	RO	O-LF
Carex pilulifera	F	O	RO	(R)	RO-LF
Carex pulicaris	F	O	R-LRO	R	R
Forbs					
Achillea ptarmica	O	RO	O	OF	O
Ajuga reptans	LO	RO	RO	R	RO
Angelica sylvestris	R	R	R	O	RO
Calluna vulgaris	VR	VR	R	VR	-
Centaurea nigra	O-LF	RO	O	F	F
Cerastium fontanum	RO	RO	RO	RO	O
Cirsium arvense	-	-	R	R	VR
Cirsium palustre	O-LF	O	O	OF	RO
Dactylorhiza fuchsii	OF	R	RO	O	R
Dactylorhiza maculata	R	R	R	(R)	R
Equisetum arvense	-	-	R	R	R
Euphrasia sp.	R	-	VR	VR	-
Galium palustre	R	-	-	-	VR
Galium saxatile	O	R-LO	RO	R	R
Hypochaeris radicata	O	O	RO	F	OR
Juncus acutiflorus	OF-LAD	OF-LA	O-LA	F-LA	O-LF
Juncus articulatus	-	-	-	O	-
Juncus conglomeratus	O-LA	O-LF	OF	FA	F-LA
Juncus effusus	R	-	R	(RO)	R
Juncus squarrosus	-	-	R	(R)	VR

90 x 30m Plot continued:					
Sample date	29/06/88	26/06/89	27/06/90	12/08/91	02/07/92
Recorders	SAB CPB SJL	SAB CPB SJL	SJL CPB JHSC	RFJ JHLA	RFJ
Lathyrus pratensis	-	-	R	R	R
Leontodon autumnalis	R	R	R	R	R
Lotus corniculatus	LA	RO-LOF	R-LOF	O-LA	O-LA
Lotus uliginosus	F	O-LFA	O-LF	FA	OF
Luzula campestris/multiflora	F	F	O	O	F
Pedicularis sylvatica	OF	RO	R	R	VR
Plantago lanceolata	O-LF	O-LA	O-LF	OF	O
Platanthera bifolia	O	R	R	-	VR
Potentilla erecta	A	FA	A	F-LA	FA
Prunella vulgaris	R	-	R	RO	-
Ranunculus acris	O-LF	O	R	-	-
Ranunculus flammula	O	RO	R	(R)	-
Ranunculus repens	R	R	VR	R	-
Rhinanthus minor	R	R	RO-LOF	R-LF	RO-LF
Rumex acetosa	RO	RO-LF	O-LF	O	O
Senecio erucifolius	-	-	VR	-	-
Senecio jacobaea	-	-	VR	-	-
Sonchus asper	-	-	VR	-	-
Stachys palustris	R	R-LF	R	RO-LA	R-LF
Succisa pratensis	A	A	F-LA	FA	A
Taraxicum officinale	R	RO	R	O	R
Trifolium medium	-	-	R	-	-
Trifolium pratense	RO	R	R	(R)	-
Trifolium repens	RO	R	RO	R	R
Vaccinium myrtillus	-	-	-	VR	-
Valeriana officinalis	-	VR	-	VR	-
Veronica chamaedrys	R	-	-	-	-
Veronica officinalis	-	-	-	R	-
Vicia cracca	R	-	-	-	-
Viola palustris	VR	R	-	R	R
No of vascular plant species recorded	68	58	67	65	57

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

TABLE 2 90 x 30m PLOT FREQUENCY OF SPECIES

Sample date	29/06/88 - 04/07/88		27/06/89 - 29/06/89		02/07/90		14/08/91 - 25/08/91		02/07/92 - 06/07/92	
Recorders	SAB CPB SJL		SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	180		216		216		216		216	
	No	%	No	%	No	%	No	%	No	%
Trees and Shrubs										
Crataegus monogyna	0	0	0	0	0	0	1	1	0	0
Ulex europaeus	0	0	0	0	0	0	1	1	1	0
Grasses										
Agrostis canina	49	27	63	29	98	45	58	27	48	22
Agrostis capillaris	107	59	119	55	137	63	157	73	164	76
Anthoxanthum odoratum	46	26	67	31	49	23	56	24	72	33
Briza media	1	1	7	3	1	1	0	0	1	0
Cynosurus cristatus	6	3	4	2	2	1	1	1	1	0
Dactylis glomerata	0	0	0	0	1	1	0	0	0	0
Danthonia decumbens	19	11	22	10	37	17	31	14	18	8
Deschampsia cespitosa	12	7	22	10	39	18	53	25	37	17
Festuca ovina	75	42	72	33	134	62	74	34	121	56
Festuca rubra	37	21	74	34	67	31	88	41	56	26
Holcus lanatus	85	47	117	54	145	67	167	77	157	73
Molinia caerulea	21	12	54	25	47	22	78	36	50	23
Nardus stricta	66	37	32	15	32	15	11	5	15	7
Poa pratensis	3	2	3	1	3	1	9	4	7	3
Poa trivialis	0	0	0	0	0	0	1	1	2	1
Sedges										
Carex caryophyllea	1	1	1	1	0	0	0	0	0	0
Carex demissa	0	0	1	1	1	1	0	0	0	0
Carex echinata	4	2	12	6	4	2	4	2	2	1
Carex flacca	52	29	20	9	29	13	10	5	15	7
Carex hostiana	1	1	1	1	0	0	0	0	0	0
Carex nigra	79	44	70	32	80	37	88	41	75	35
Carex ovalis	1	1	0	0	0	0	3	1	0	0
Carex panicea	68	38	67	31	73	34	40	19	35	16
Carex pilulifera	32	18	27	13	12	6	0	0	13	6
Carex pulicaris	15	8	8	4	5	2	2	1	2	1
Forbs										
Achillea ptarmica	31	17	20	9	14	6	18	8	14	6
Ajuga reptans	1	1	1	1	3	1	1	1	5	2
Angelica sylvestris	0	0	1	1	3	1	3	1	3	1
Calluna vulgaris	0	0	1	1	2	1	1	1	0	0
Centaurea nigra	8	4	7	3	7	3	23	11	23	11
Cerastium fontanum	1	1	2	1	5	2	4	2	2	1
Cirsium arvense	0	0	0	0	0	0	1	1	1	0
Cirsium palustre	8	4	5	2	12	6	14	6	4	2
Dactylorhiza fuchsii	2	1	1	1	0	0	1	1	1	0
Dactylorhiza fuchsii x maculata	0	0	1	1	0	0	0	0	0	0
Dactylorhiza sp.	0	0	0	0	2	1	1	1	1	0
Equisetum arvense	0	0	0	0	2	1	0	0	1	0
Euphrasia sp.	0	0	0	0	0	0	1	1	0	0
Galium palustre	0	0	1	1	0	0	0	0	1	0
Galium saxatile	4	2	3	1	7	3	3	1	2	1
Hypochaeris radicata	11	6	6	3	13	6	7	3	8	4
Juncus acutiflorus	46	26	57	26	53	25	59	27	54	25
Juncus conglomeratus	16	9	22	10	32	15	89	41	59	27
Juncus effusus	0	0	0	0	1	1	1	1	2	1
Juncus squarrosus	0	0	3	1	0	0	0	0	1	0
Lathyrus pratensis	0	0	0	0	0	0	0	0	1	0

90 x 30m Plot continued										
Sample date	29/06/88 - 04/07/88		27/06/89 - 29/06/89		02/07/90		14/08/91 - 25/08/91		02/07/92 - 06/07/92	
Recorders	SAB CPB SJL		SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	180		216		216		216		216	
	No	%	No	%	No	%	No	%	No	%
Leontodon autumnalis	28	16	8	4	6	3	7	3	3	1
Lotus corniculatus	16	9	31	14	4	2	10	5	20	9
Lotus uliginosus	63	35	39	18	85	39	76	35	76	35
Luzula campestris/multiflora	28	16	39	18	80	37	27	13	42	19
Pedicularis sylvatica	9	5	0	0	2	1	1	1	1	0
Plantago lanceolata	26	14	21	10	23	11	33	15	28	13
Platanthera bifolia	1	1	0	0	0	0	0	0	0	0
Potentilla erecta	145	81	170	79	168	78	146	68	146	68
Prunella vulgaris	1	1	2	1	3	1	0	0	0	0
Ranunculus acris	42	23	21	10	5	2	0	0	0	0
Ranunculus flammula	8	4	7	3	1	1	0	0	0	0
Ranunculus repens	0	0	0	0	1	1	1	1	0	0
Rhinanthus minor	0	0	0	0	2	1	1	1	4	2
Rumex acetosa	5	3	4	2	15	7	21	10	17	8
Stachys palustris	1	1	0	0	0	0	4	2	2	1
Succisa pratensis	104	58	133	62	134	62	128	59	128	59
Taraxicum officinale	6	3	13	6	10	5	9	4	9	4
Trifolium pratense	0	0	0	0	1	1	0	0	0	0
Trifolium repens	10	6	6	3	6	3	1	1	8	4
Valeriana officinalis	0	0	0	0	0	0	1	1	0	0
Veronica officinalis	0	0	0	0	0	0	1	1	0	0
Viola palustris	2	1	0	0	1	1	0	0	1	0
Bare ground	25	14	9	2	8	4	0	0	2	1

TABLE 3 90 x 30m PLOT: SPECIES LOST BETWEEN 1988 AND 1992

Species	DAFOR in 1988	DAFOR in last year recorded	Last year recorded	Established strategy
Salix cinerea	VR	VR	1991	C
Dactylis glomerata	R	VR	1990	C/CSR
Carex caryophyllea	VR	VR	1988	S
Carex binervis	R	R	1988	S
Carex hostiana	VR	VR	1989	S
Carex pallescens	R	R	1988	S
Calluna vulgaris	VR	VR	1991	SC
Euphrasia sp.	R	VR	1991	SR
Prunella vulgaris	R	RO	1991	CSR
Ranunculus acris	O-LF	R	1990	CSR
Ranunculus flammula	O	R	1991	CR/CSR
Ranunculus repens	R	R	1991	CR
Trifolium pratense	RO	R	1991	CSR
Veronica chamaedrys	R	R	1988	S/CSR
Vicia cracca	R	R	1988	C/CSR

TABLE 4 90 x 30m PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1988 AND 1992

Species	% Frequency					Significance of frequency change between years from an analysis of variance [1]						Established strategy
	1988	1989	1990	1991	1992	Overall	88/89	89/90	90/91	91/92	88/92	
Cynosurus cristatus	3	2	1	1	0	*					*	CSR
Nardus stricta	37	15	15	5	7	***	***		**		***	S
Carex flacca	29	9	13	5	7	***	**		*		**	S
Carex panicea	38	31	34	19	16	***			*		**	S
Carex pilulifera	18	13	6	0	6	***			**	(**)	**	S
Carex pulicaris	8	4	2	1	1	*					*	?
Achillea ptarmica	17	9	6	8	6	*						CR/CSR
Leontodon autumnalis	16	4	3	3	1	***	**				***	R/CSR
Potentilla erecta	81	79	78	68	68	*					*	S/CSR
Ranunculus acris	23	10	2	0	0	***		*	*		***	CSR
Ranunculus flammula	4	3	1	0	0	***		**			*	CR/CSR

[1] ANOVA: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 5 90 x 30m PLOT: SPECIES GAINED BETWEEN 1988 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Poa trivialis	1991	R	R	CR/CSR
Cirsium arvense	1990	R	VR	C
Equisetum arvense	1990	R	R	CR
Juncus squarrosus	1990	R	VR	S
Lathyrus pratensis	1990	R	R	CSR

TABLE 6 90 x 30m PLOT: SPECIES WHICH HAVE APPEARED AND THEN DISAPPEARED BETWEEN 1988 AND 1992

Species	Years present	Maximum DAFOR recorded	Established strategy
Salix aurita	1989	VR	C or SC ?
Agrostis stolonifera	1990	R	CR
Arrhenatherum elatius	1990	R	C/CSR
Juncus articulatus	1991	O	CSR
Senecio erucifolius	1990	VR	?
Senecio jacobaea	1990	VR	R/CR
Sonchus asper	1990	VR	R/CR
Trifolium medium	1990	R	CS/CSR
Vaccinium myrtillus	1991	VR	SC
Valeriana officinalis	1989, 1991	VR	CSR
Veronica officinalis	1991	R	S/CSR

TABLE 7 90 x 30m PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1988 AND 1992

Species	% Frequency					Significance of frequency change between years from an analysis of variance [1]						Established strategy
	1988	1989	1990	1991	1992	Overall	88/89	89/90	90/91	91/92	88/92	
Agrostis capillaris	59	55	63	73	76	***			**		**	CSR
Deschampsia cespitosa	7	10	18	25	17	***	*		*	(*)	**	SC/CSR
Holcus lanatus	47	54	67	77	73	***		*	*		***	CSR
Molinia caerulea	12	25	22	36	23	***	**		*	(*)	**	SC
Centaurea nigra	4	3	3	11	11	***			**		*	S/CSR
Juncus conglomeratus	9	10	15	41	27	***			***	(**)	***	CS/CSR
Rumex acetosa	3	2	7	10	8	**		*				CSR

[1] ANOVA: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

TABLE 8 30m x 30m PLOT: SPECIES AND DAFOR VALUES 1988-1991

Sample date	28/06/88	26/06/89	01/07/90	12/08/91	01/07/92
Recorders	SAB CPB SJL	SAB CPB SJL	SJL CPB JHSC	RFJ * JHLA	RFJ
Trees and Shrubs					
Ulex europaeus	VR	VR	-	VR	R
Grasses					
Agrostis canina	FA	FA	FA	FA	OF
Agrostis capillaris	FA	FA	F	A	O
Agrostis stolonifera	-	-	-	(R)	-
Anthoxanthum odoratum	F	FA	O	OF	OF
Arrhenatherum elatius	-	-	VR	(VR)	-
Briza media	O	O-LF	RO	RO	R
Cynosurus cristatus	O	RO	RO-LO	RO	O
Danthonia decumbens	O	O	RO	O	R
Deschampsia cespitosa	O	OF	O	A	A-LD
Festuca ovina	O-LF	FA	FA	FA	O
Festuca rubra	O	F	F	O	OF
Holcus lanatus	F	A	A	A	F
Molinia caerulea	F-LA	A	F-LA	A	A-LD
Nardus stricta	O-LF	O	O	R	-
Poa pratensis	R	R	-	R	R
Poa trivialis	R	R	-	-	R
Sedges					
Carex demissa	R	R-LO	R	(R)	R
Carex echinata	R-LF	O	R	-	-
Carex flacca	F-LA	OF-LF	O	F	R
Carex nigra	O	O	O-LF	R	O
Carex ovalis	-	R	R	(VR)	R
Carex pallescens	R-LF	R	R	R	RO
Carex panicea	O	O	OF	OF	R
Carex pilulifera	O	O	R	-	-
Carex pulicaris	O-LF	F	R	-	-
Forbs					
Achillea ptarmica	O	RO	O	O	R
Ajuga reptans	O-LF	O-LF	O-LA	FO-LFA	RO
Angelica sylvestris	R	RO	RO	RO	O
Centaurea nigra	F-LA	OF	F	F-LA	F
Cerastium fontanum	-	RO	O	RO	O
Cirsium arvense	-	-	VR	-	R
Cirsium palustre	O	O	O	O	R
Dactylorhiza fuchsii	OF	R	R	-	VR
Dactylorhiza sp.	-	-	-	R	-
Dactylorhiza maculata	R	VR	R	-	-
Galium saxatile	-	-	R	-	-
Hypochaeris radicata	R	RO	RO	R	R
Juncus acutiflorus	O-LF	O-LFA	OF	OF-LA	O
Juncus conglomeratus	O-LA	O-LF	O-LF	OF-LA	F-LA
Juncus squarrosus	-	R	R	-	-
Lathyrus pratensis	R	R	R	R	-
Leontodon autumnalis	R	R	-	-	-
Lotus corniculatus	R	RO	-	(RO)	-
Lotus uliginosus	F	O-LF	F	F-LA	F
Luzula campestris/multiflora	O-LF	F	O	O	RO
Pedicularis sylvatica	R	R	R	(R)	VR
Plantago lanceolata	R	O-LOF	O	O	O
Platanthera bifolia	R	R	R	-	-
Potentilla erecta	+	F	FA	O-LF	OF
Prunella vulgaris	VR	-	-	R	-
Ranunculus acris	FA	O	R	-	-
Ranunculus flammula	-	-	VR	-	-

30 x 30m Plot continued:					
Sample date	28/06/88	26/06/89	01/07/90	12/08/91	01/07/92
Recorders	SAB CPB SJL	SAB CPB SJL	SJL CPB JHSC	RFJ * JHLA	RFJ
Ranunculus repens	-	-	R	-	-
Rhinanthus minor	R	-	R	R	VR
Rumex acetosa	R	R	O	RO	O
Rumex crispus	-	-	-	VR	VR
Stachys officinalis	VR	VR	R	R	R
Stellaria holostea	-	-	-	R	-
Succisa pratensis	F-LA	A	FA-LA	OF	F
Taraxicum officinale	R	-	RO	VR	RO
Trifolium medium	-	R-LF	RO-LF	-	-
Trifolium pratense	O	R	R	R-LOF	R
Trifolium repens	R	R	R	R	O
Viola palustris	R	RO-LFA	R-LOF	VR	VR
No of vascular plant species recorded	52	53	55	50	45

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

+ present but not given a DAFOR rating

TABLE 9 30 x 30m PLOT: FREQUENCY OF SPECIES

Sample date	29/06/88 04/07/88		27/06/89		02/07/90		14/08/91 25/08/91		01/07/92	
Recorders	SAB CPB SJL		SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	60		72		72		72		72	
	No	%	No	%	No	%	No	%	No	%
Grasses										
Agrostis canina	10	17	18	25	33	46	47	65	9	13
Agrostis capillaris	37	62	46	64	33	46	46	54	51	71
Anthoxanthum odoratum	11	18	23	32	11	15	14	19	17	24
Briza media	0	0	1	1	1	1	2	3	1	1
Cynosurus cristatus	3	5	1	1	1	1	1	1	0	0
Danthonia decumbens	5	8	3	4	3	4	2	3	0	0
Deschampsia cespitosa	7	12	10	14	17	24	26	36	26	36
Festuca ovina	13	22	27	38	31	43	5	7	10	14
Festuca rubra	20	33	28	39	49	68	27	38	43	60
Holcus lanatus	21	35	38	53	42	58	56	78	38	53
Molinia caerulea	48	80	52	72	52	72	65	90	53	74
Nardus stricta	6	10	5	7	1	1	0	0	0	0
Poa pratensis	0	0	4	6	3	4	1	1	1	1
Poa trivialis	0	0	0	0	0	0	0	0	6	8
Sedges										
Carex demissa	0	0	0	0	0	0	0	0	1	1
Carex echinata	2	3	1	1	0	0	0	0	0	0
Carex flacca	24	40	28	39	30	42	17	24	3	4
Carex nigra	12	20	22	31	23	32	13	18	18	25
Carex ovalis	0	0	0	0	1	1	0	0	1	1
Carex panicea	20	33	8	11	18	25	19	26	7	10
Carex pilulifera	3	5	4	6	1	1	0	0	0	0
Carex pulicaris	5	8	6	8	2	3	0	0	0	0
Forbs										
Achillea ptarmica	14	23	7	10	2	3	2	3	1	1
Ajuga reptans	12	20	11	15	21	29	13	18	6	8
Angelica sylvestris	1	2	1	1	1	1	0	0	0	0
Centaurea nigra	22	37	14	19	18	29	30	42	25	35
Cerastium fontanum	0	0	0	0	4	6	3	4	1	1
Cirsium arvense	0	0	0	0	0	0	0	0	1	1
Cirsium palustre	2	3	2	3	3	4	4	6	0	0
Dactylorhiza fuchsii	1	2	0	0	0	0	0	0	1	1
Hypochaeris radicata	4	7	0	0	0	0	0	0	0	0
Juncus acutiflorus	7	12	12	17	7	10	11	15	6	8
Juncus articulatus	0	0	0	0	1	1	0	0	1	1
Juncus conglomeratus	3	5	7	10	7	10	19	26	18	25
Lathyrus pratensis	0	0	0	0	1	1	1	1	0	0
Leontodon autumnalis	1	2	0	0	0	0	0	0	0	0
Lotus corniculatus	5	8	3	4	0	0	0	0	0	0
Lotus uliginosus	25	42	32	44	38	53	34	47	30	42
Luzula campestris/multiflora	6	10	15	21	14	19	5	7	6	8
Pedicularis sylvatica	0	0	0	0	0	0	0	0	1	1
Plantago lanceolata	1	2	5	7	7	10	7	10	3	4
Platanthera bifolia	0	0	1	1	0	0	0	0	0	0
Potentilla erecta	34	57	49	68	53	74	45	63	40	56
Prunella vulgaris	0	0	0	0	1	1	0	0	0	0
Ranunculus acris	26	43	15	21	3	4	0	0	0	0
Rhinanthus minor	0	0	0	0	0	0	1	1	0	0
Rumex acetosa	0	0	0	0	2	3	6	8	5	7
Stellaria holostea	0	0	0	0	0	0	1	1	0	0
Succisa pratensis	19	32	21	29	31	43	29	40	25	35

30 x 30m PLOT continued										
Sample date	29/06/88 04/07/88		27/06/89		02/07/90		14/08/91 25/08/91		01/07/92	
Recorders	SAB CPB SJL		SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	60		72		72		72		72	
	No	%	No	%	No	%	No	%	No	%
Taraxicum officinale	1	2	1	1	1	1	1	1	2	3
Trifolium medium	0	0	0	0	1	1	0	0	0	0
Trifolium pratense	1	2	0	0	0	0	2	3	0	0
Trifolium repens	7	12	1	1	0	0	1	1	0	0
Viola palustris	3	5	3	4	1	1	0	0	2	3
Bare ground	0	0	2	3	4	6	0	0	0	0

TABLE 10 30 x 30m PLOT: SPECIES LOST BETWEEN 1988 AND 1992

Species	DAFOR in 1988	DAFOR in last year recorded	Last year recorded	Established strategy
Nardus stricta	O-LF	R	1991	S
Carex echinata	R-LF	R	1990	S
Carex pilulifera	O	R	1990	S
Carex pulicaris	O-LF	R	1990	?
Dactylorhiza maculata	R	R	1990	S
Lathyrus pratensis	R	R	1991	CSR
Leontodon autumnalis	R	R	1989	R/CSR
Lotus corniculatus	R	RO	1991	S/CSR
Platanthera bifolia	R	R	1991	?
Prunella vulgaris	VR	R	1991	CSR
Ranunculus acris	FA	R	1990	CSR

TABLE 11 30 x 30m PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1988 AND 1992

Species	% Frequency					Significance of frequency change between years from an analysis of variance [1]					Established strategy
	1988	1989	1990	1991	1992	Overall	88/89	89/90	90/91	91/92	88/92	
Danthonia decumbens	8	4	4	3	0							S
Nardus stricta	10	7	1	0	0							S
Carex flacca	40	49	42	24	4	**			*		*	S
Carex panicea	33	11	25	26	10	*						S
Carex pilulifera	5	6	1	0	0	*						S
Carex pulicaris	8	8	3	0	0							?
Achillea ptarmica	23	10	3	3	1	**					*	CR/CSR
Lotus corniculatus	8	4	0	0	0	*						S/CSR
Ranunculus acris	43	21	4	0	0	***					*	CSR
Trifolium repens	12	1	0	1	0	**					*	CR/CSR

[1] ANOVA: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 12 30 x 30m PLOT: SPECIES GAINED BETWEEN 1988 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Carex ovalis	1989	R	R	S
Cerastium fontanum	1989	RO	O	R/CSR
Cirsium arvense	1990	VR	R	C
Rumex crispus	1991	VR	VR	R/CR

TABLE 13 30 x 30m PLOT: SPECIES WHICH HAVE APPEARED AND THEN DISAPPEARED BETWEEN 1988 AND 1992

Species	Years present	Maximum DAFOR recorded	Established strategy
Agrostis stolonifera	1991	R	CR
Arrhenatherum elatius	1990, 1991	VR	C/CSR
Galium saxatile	1990	R	S
Juncus squarrosus	1989, 1990	R	S
Ranunculus flammula	1990	VR	CR/CSR
Ranunculus repens	1990	R	CR
Stellaria holostea	1991	R	CSR
Trifolium medium	1989, 1990	RO-LF	SC/CSR

TABLE 14 30 x 30m PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1988 AND 1992

Species	% Frequency					Significance of frequency change between years from an analysis of variance [1]					Established strategy
	1988	1989	1990	1991	1992	Overall	88/89	89/90	90/91	91/92	88/92	
Deschampsia cespitosa	12	14	24	36	36						*	SC/CSR
Holcus lanatus	35	53	58	78	53	***			*	(*)		CSR
Juncus conglomeratus	5	10	10	26	25						*	CS/CSR
Rumex acetosa	0	0	3	8	7	*						CSR

[1] ANOVA: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

TABLE 15 19m x 7m ORCHID PLOT: SPECIES AND DAFOR VALUES, 1988-1992

Sample date	26/6/89	1/7/90	12/8/91	1/7/92
Recorders	SAB CPB SJL	SJL CPB JHSC	RFJ * JHLA	RFJ
Trees & Shrubs				
Ulex europaeus	VR	R	O	O
Ferns				
Dryopteris sp	VR	VR	-	-
Athyrium felix-femina	-	-	VR	-
Grasses				
Agrostis canina	FA	F	OF	FA
Agrostis capillaris	FA	O	A	FA
Anthoxanthum odoratum	F	O	F	F
Briza media	O	RO	F	O
Cynosurus cristatus	O	RO	F	F
Dactylis glomerata	-	VR	VR	-
Danthonia decumbens	RO	O	OF	R
Deschampsia cespitosa	OF	OF	FA	O
Festuca ovina	F	F	FA	F
Festuca rubra	F	O	A	F
Glyceria fluitans	VR	-	-	-
Holcus lanatus	FA	OF	FA	FA
Lolium perenne	-	-	-	R
Molinia caerulea	O	OF	A	FA
Nardus stricta	RO	RO	RO	R
Poa pratensis	VR	R	R	-
Poa trivialis	R	-	R	O
Sedges				
Carex binervis	VR	VR	-	RO
Carex demissa	-	R	-	R
Carex echinata	RO	O	-	O
Carex flacca	O	OF	OF	F
Carex nigra	+	O	OF	F
Carex pallescens	O	O	RO	O
Carex panicea	FO	F	F	F
Carex pilulifera	RO	R	(+)	RO
Carex pulicaris	RO	R	R	-
Forbs				
Achillea ptarmica	O	RO	O	O
Ajuga reptans	O	OF	R	RO
Angelica sylvestris	O	OF	RO	O
Calluna vulgaris	R	R	R	-
Cardamine pratensis	-	-	R	-
Centaurea nigra	O	OF	A	F
Cerastium fontanum	RO	RO	O	O
Cirsium arvense	-	-	VR	-
Cirsium palustre	RO	OF	R	R
Dactylorhiza fuchsii	OF	F	O	O
Hybrid fuchsii x maculata	?	O	-	-
Dactylorhiza maculata	R	O	O	R
Dactylorhiza purpurella	R	R	-	-
Equisetum arvense	-	R	-	-
Euphrasia sp.	-	-	R	-
Galium palustre	R	R	R	R
Galium saxatile	-	R	-	-
Hydrocotyle vulgaris	-	-	-	O
Hypericum pulchrum	-	R	-	-
Hypochaeris radicata	R	R	RO	F
Juncus acutiflorus	+	OF-LA	F	FA
Juncus articulatus	VR	-	-	-
Juncus conglomeratus	F	FA	F	F

19 x 7m Orchid Plot continued				
Sample date	26/6/89	1/7/90	12/8/91	1/7/92
Recorders	SAB CPB SJL	SJL CPB JHSC	RFJ * JHLA	RFJ
Juncus squarrosus	R	R	(+)	VR
Lathyrus pratensis	R	O	OF	O
Leontodon autumnalis	R	R	-	-
Lotus corniculatus	O	R	F-LA	F
Lotus uliginosus	O	FA	F-LA	F
Luzula campestris/multiflora	O	O	O	O
Mentha aquatica	VR	-	R	-
Pedicularis sylvatica	RO	R	-	VR
Plantago lanceolata	O	F	F	F
Platanthera bifolia	R	O	O	R
Potentilla erecta	OF	A	F	F
Pulicaria dysenterica	-	-	VR	-
Prunella vulgaris	R	RO	R	-
Ranunculus acris	RO	-	-	-
Ranunculus flammula	R	VR	(+)	-
Ranunculus repens	R	-	-	-
Rhinanthus minor	VR	RO	OF	F
Rumex acetosa	RO	R	F	OF
Stachys officinalis	RO	RO	O	R
Succisa pratensis	FA	A	A	A
Taraxicum officinale	R	R	R	OF
Trifolium medium	R	RO	O	-
Trifolium pratense	R	-	O	RO
Trifolium repens	R	R	R	OF
Valeriana officinalis	R	-	R	-
Vicia cracca	VR	RO	O-LF	O
Viola palustris	R	-	R	VR
No of vascular plant species recorded	64	62	62	55

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

+ present but not given a DAFOR rating

TABLE 16 19 x 7m "ORCHID" PLOT: FREQUENCY OF SPECIES

Sample date	29/06/89		02/07/90		15/08/91		01/07/92	
Recorders	SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	30		30		30		30	
	No	%	No	%	No	%	No	%
Trees and Shrubs								
Ulex europaeus	5	17	4	13	1	3	1	3
Grasses								
Agrostis canina	9	30	14	47	11	37	9	30
Agrostis capillaris	18	60	14	47	16	53	11	37
Anthoxanthum odoratum	10	33	4	13	15	50	16	53
Briza media	0	0	2	7	2	7	3	10
Cynosurus cristatus	0	0	2	7	1	3	6	20
Danthonia decumbens	1	3	1	3	2	7	1	3
Deschampsia cespitosa	2	7	7	23	8	27	8	27
Festuca ovina	9	30	16	53	0	0	17	57
Festuca rubra	12	40	11	37	18	60	5	17
Holcus lanatus	12	40	10	33	18	60	25	83
Molinia caerulea	5	17	12	40	17	57	12	40
Nardus stricta	2	7	0	0	4	13	2	7
Poa pratensis	1	3	2	7	1	3	0	0
Poa trivialis	0	0	0	0	1	3	1	3
Sedges								
Carex demissa	0	0	1	3	0	0	1	3
Carex echinata	0	0	0	0	0	0	2	7
Carex flacca	7	23	12	40	3	10	9	30
Carex nigra	3	10	8	27	25	83	4	13
Carex pallescens	1	3	2	7	1	3	2	7
Carex panicea	20	67	17	57	10	33	10	33
Carex pilulifera	0	0	1	3	0	0	3	10
Carex pulicaris	3	10	1	3	0	0	0	0
Forbs								
Achillea ptarmica	6	20	5	17	3	10	3	10
Ajuga reptans	14	47	8	27	3	10	3	10
Angelica sylvestris	0	0	3	10	1	3	1	3
Cardamine pratense	0	0	0	0	1	3	0	0
Centaurea nigra	8	27	12	40	11	37	7	23
Cerastium fontanum	1	3	0	0	0	0	1	3
Cirsium palustre	1	3	2	7	3	10	2	7
Dactylorhiza fuchsii	7	23	9	30	0	0	0	0
Dactylorhiza maculata	1	3	1	3	0	0	0	0
Dactylorhiza sp.	0	0	0	0	2	7	0	0
Galium palustre	0	0	0	0	1	3	0	0
Hypochaeris radicata	0	0	5	17	1	3	2	7
Juncus acutiflorus	4	13	14	47	18	60	12	40
Juncus conglomeratus	7	23	7	23	12	40	10	33
Juncus squarrosus	0	0	0	0	0	0	1	3
Lathyrus pratensis	1	3	3	10	1	3	4	13
Lotus corniculatus	6	20	1	3	2	7	2	7
Lotus uliginosus	5	17	17	57	23	77	27	90
Luzula campestris/multiflora	11	37	14	47	9	30	5	17
Mentha aquatica	0	0	0	0	1	3	0	0
Pedicularis sylvatica	0	0	2	7	0	0	0	0
Plantago lanceolata	4	13	8	27	13	43	4	13
Platanthera bifolia	0	0	2	7	0	0	1	3
Potentilla erecta	18	60	20	67	21	70	17	57
Prunella vulgaris	1	3	0	0	1	3	0	0
Ranunculus acris	4	13	0	0	0	0	0	0

19 x 7m Orchid Plot continued

Sample date	29/06/89		02/07/90		15/08/91		01/07/92	
Recorders	SAB CPB SJL		SJL CPB JHSC		RFJ JHLA		RFJ	
Total no. of quadrats	30		30		30		30	
	No	%	No	%	No	%	No	%
Ranunculus flammula	1	3	0	0	0	0	0	0
Rhinanthus minor	0	0	0	0	3	10	5	17
Rumex acetosa	2	7	4	13	2	7	3	10
Stachys officinalis	0	0	2	7	1	3	1	3
Succisa pratensis	21	70	21	70	22	73	26	87
Taraxicum officinale	2	7	0	0	1	3	1	3
Trifolium medium	0	0	1	3	0	0	0	0
Trifolium pratense	0	0	0	0	1	3	0	0
Trifolium repens	3	10	0	0	1	3	1	3
Valeriana officinalis	0	0	0	0	2	7	0	0
Vicia cracca	1	3	2	7	2	7	3	10
Viola palustris	0	0	0	0	1	3	0	0
Bare ground	0	0	0	0	0	0	0	0

TABLE 17 19 x 7m ORCHID PLOT: SPECIES LOST BETWEEN 1989 AND 1992

Species	DAFOR in 1989	DAFOR in last year recorded	Last year recorded	Established strategy
Dryopteris sp.	VR	VR	1990	?
Glyceria fluitans	VR	VR	1989	CR
Poa pratensis	VR	R	1991	CSR
Carex pulicaris	RO	R	1991	?
Calluna vulgaris	R	R	1991	SC
Dactylorhiza purpurella	R	R	1990	?
Juncus articulatus	VR	VR	1989	CSR
Leontodon autumnalis	R	R	1990	R/CSR
Mentha aquatica	VR	R	1991	C/CR
Prunella vulgaris	R	R	1991	CSR
Ranunculus acris	RO	RO	1989	CSR
Ranunculus flammula	R	-	1991	CR/CSR
Ranunculus repens	R	R	1989	CR
Trifolium medium	R	O	1991	SC/CSR
Valeriana officinalis	R	R	1991	CSR

TABLE 18 19 x 7m ORCHID PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1989 AND 1992

Species	% Frequency				Significance of frequency change between years [1]				Established strategy
	1989	1990	1991	1992	89/90	90/91	91/92	89/92	
Carex panicea	67	57	33	33				**	S
Ajuga reptans	47	27	10	10				**	CSR
Dactylorhiza fuchsii	23	30	0	0		**		**	S/CSR
Lotus corniculatus	20	3	7	7	*				S/CSR
Ranunculus acris	13	0	0	0	*			*	CSR

[1] Chi-square: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 19 19 x 7m ORCHID PLOT: SPECIES GAINED BETWEEN 1989 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Lolium perenne	1992	R	R	CR/CSR
Carex demissa	1990	R	R	S
Hydrocotyle vulgaris	1992	O	O	CSR

TABLE 20 19 x 7m ORCHID PLOT: SPECIES WHICH HAVE APPEARED AND THEN DISAPPEARED BETWEEN 1989 AND 1992

Species	Years present	Maximum DAFOR recorded	Established strategy
Dactylis glomerata	1990, 1991	VR	C/CSR
Cardamine pratensis	1991	R	R/CSR
Cirsium arvense	1991	VR	C
Equisetum arvense	1990	R	CR
Euphrasia sp.	1991	R	SR
Galium saxatile	1990	R	S
Hyperichum pulchrum	1990	R	S
Pulicharia dysenterica	1991	VR	SC

TABLE 21 19 x 7m ORCHID PLOT: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1989 AND 1992

Species	% Frequency				Significance of frequency change between years [1]				Established strategy
	1989	1990	1991	1992	89/90	90/91	91/92	89/92	
Deschampsia cespitosa	7	23	27	27				*	SC/CSR
Holcus lanatus	40	33	60	83		*	*	***	CSR
Molinia caerulea	17	40	57	40	*			*	SC
Juncus acutiflorus	13	47	60	40	**			*	SC
Lotus uliginosus	17	57	77	90	**			***	SC

[1] Chi-square: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

TABLE 22 BLADED PLOT A: SPECIES AND DAFOR VALUES, 1990-1992

Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Trees & Shrubs			
Salix cinerea	-	(VR)	-
Ulex europaeus	O	O	O
Ferns			
Athyrium felix-femina	-	-	VR
Grasses			
Agrostis canina	FA	FA-LA	F
Agrostis capillaris	F	FA	F
Agrostis stolonifera	R	R	R
Alopecurus genticulatus	RO-LF	R-LF	O
Anthoxanthum odoratum	F	RO	O
Arrhenatherum elatius	VR	(R)	VR
Briza media	VR	R	-
Cynosurus cristatus	RO	R	R
Danthonia decumbens	R	R	R
Deschampsia cespitosa	RO	RO-LO	RO
Festuca ovina	R	R	OF
Festuca rubra	RO	(R)	R
Glyceria fluitans	-	(R)	VR
Holcus lanatus	FA-LA	FA-LA	F
Molinia caerulea	RO	RO	R
Nardus stricta	VR	VR	-
Phleum pratense	-	VR	-
Poa annua	R	-	-
Poa pratensis	R	VR	-
Poa trivialis	-	-	O
Sedges			
Carex demissa	O	OF-LFA	O-LF
Carex flacca	R	O	O-LF
Carex hostiana	-	-	R
Carex nigra	R	+	O
Carex ovalis	-	-	R
Carex pallescens	R	(R)	R-LO
Carex panicea	O-LF	OF-LF	O-LF
Forbs			
Achillea ptarmica	RO	O	O
Angelica sylvestris	R-LO	R-LO	O
Bellis perennis	R	R	-
Centaurea nigra	RO	RO	O
Cerastium fontanum	O	RO	-
Cirsium arvense	VR	-	-
Cirsium palustre	R	RO-LO	O
Cirsium vulgare	-	(R)	-
Dactylorhiza fuchsii	VR	-	R
Equisetum arvense	VR	R	VR
Filipendula ulmaria	-	VR	-
Galium palustre	RO	RO	R-LO
Geranium dissectum	VR	-	-
Hypericum pulchrum	VR	R	-
Hypochaeris radicata	O	O	O
Isolepis setacea	VR	-	-
Juncus acutiflorus	FA-LAD	A-LD	D
Juncus articulatus	R	R-LF	VR
Juncus bufonius	O	-	R
Juncus conglomeratus	RO	A	F-LA
Juncus effusus	-	(RO)	R
Lathyrus pratensis	-	O	-
Leontodon autumnalis	-	R	-

Plot A continued			
Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Lotus corniculatus	-	-	O-LF
Lotus uliginosus	-	F	F
Luzula campestris/multiflora	RO	-	O
Pedicularis sylvatica	R	RO	-
Plantago lanceolata	OF	O	O
Polygonum persicaria	R	+	-
Potentilla erecta	O	O	F
Prunella vulgaris	R	OR	O-LA
Ranunculus acris	R	RO	-
Ranunculus flammula	OF	F	F
Ranunculus repens	R-LO	R-LO	O
Rhinanthus minor	R	R	R-LF
Rumex acetosa	RO	R-LO	F
Rumex crispus	VR	(R)	VR
Rumex obtusifolius	-	VR	VR
Sagina procumbens	VR	-	-
Sanguisorba officinalis	VR	-	-
Senecio jacobaea	-	-	VR
Sonchus asper	VR	-	-
Stachys officinalis	VR	-	-
Stellaria alsine	R	-	-
Succisa pratensis	RO	R	R-LO
Taraxicum officinale	R	(R)	-
Trifolium medium	-	(R)	-
Trifolium pratense	VR	R	VR
Trifolium repens	R	R	R
Vicia cracca	-	O	R
Vicia sativa ?	-	+	-
No of vascular plant species recorded	61	63	54

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

+ present but not given a DAFOR rating

TABLE 23 PLOT A FREQUENCY OF SPECIES

Sample date	04/07/90		12/08/91		30/06/92	
Recorders	CPB SJL		RFJ JHLA		RFJ	
Total no of quadrats	50		50		50	
	No	%	No	%	No	%
Trees & Shrubs						
Ulex europaeus	11	22	3	6	2	4
Grasses						
Agrostis canina	38	76	45	90	26	52
Agrostis capillaris	29	58	29	58	25	50
Agrostis stolonifera	1	2	7	14	0	0
Alopecurus geniculatus	1	2	0	0	1	2
Anthoxanthum odoratum	12	24	1	2	14	28
Cynosurus cristatus	0	0	2	4	3	6
Danthonia decumbens	1	2	0	0	1	2
Deschampsia cespitosa	1	2	5	10	5	10
Festuca ovina	5	10	2	4	10	20
Festuca rubra	3	6	0	0	6	12
Glyceria fluitans	0	0	0	0	1	2
Holcus lanatus	25	50	40	80	29	58
Molinia caerulea	1	2	8	16	4	8
Poa annua	1	2	0	0	0	0
Poa pratensis	3	6	1	2	0	0
Sedges						
Carex demissa	15	30	13	26	5	10
Carex echinata	0	0	0	0	1	2
Carex flacca	1	2	15	30	13	26
Carex hostiana	0	0	0	0	2	4
Carex nigra	2	4	7	14	8	16
Carex ovalis	0	0	0	0	1	2
Carex pallescens	0	0	0	0	1	2
Carex panicea	11	22	14	28	15	30
Forbs						
Achillea ptarmica	4	8	6	12	1	2
Angelica sylvestris	1	2	1	2	2	4
Centaurea nigra	2	4	16	32	11	22
Cerastium fontanum	2	4	1	2	0	0
Cirsium arvense	1	2	0	0	0	0
Cirsium palustre	3	6	4	8	2	4
Equisetum arvense	1	2	0	0	1	2
Galium palustre	1	2	0	0	0	0
Hypericum pulchrum	1	2	0	0	0	0
Hypochaeris radicata	2	4	1	2	2	4
Isolepis setacea	1	2	0	0	0	0
Juncus acutiflorus	19	38	32	64	42	84
Juncus articulatus	1	2	0	0	2	4
Juncus bufonius/bulbosus	2	4	0	0	1	2
Juncus conglomeratus	0	0	15	30	22	44
Juncus effusus	0	0	0	0	1	2
Lathyrus pratensis	0	0	1	2	0	0
Leontodon autumnalis	2	4	0	0	0	0
Lotus corniculatus	0	0	0	0	1	2
Lotus uliginosus	2	4	13	26	4	8
Luzula campestris/multiflora	7	14	0	0	1	2
Pedicularis sylvatica	0	0	2	4	0	0
Plantago lanceolata	19	38	12	24	5	10
Potentilla erecta	21	42	27	54	17	34
Prunella vulgaris	0	0	1	2	0	0
Ranunculus acris	1	2	0	0	0	0
Ranunculus flammula	9	18	21	42	19	38

Plot A continued						
Sample date	04/07/90		12/08/91		30/06/92	
Recorders	CPB SJL		RFJ JHLA		RFJ	
Total no of quadrats	50		50		50	
	No	%	No	%	No	%
Ranunculus repens	5	10	2	4	1	2
Rumex acetosa	5	10	5	10	1	2
Sagina procumbens	1	2	0	0	0	0
Stachys officinalis	0	0	0	0	1	2
Stellaria alsine	2	4	0	0	0	0
Succisa pratensis	2	4	0	0	2	4
Trifolium repens	4	8	1	2	3	6
Vicia cracca	0	0	0	0	2	4
Bare ground	0	0	0	0	4	8

TABLE 24 PLOT A: SPECIES LOST BETWEEN 1990 AND 1992

Species	DAFOR in 1990	DAFOR in last year recorded	Last year recorded	Established strategy
Briza media	VR	R	1991	S
Nardus stricta	VR	VR	1991	S
Poa annua	R	R	1990	R
Poa pratensis	R	VR	1991	CSR
Bellis perennis	R	R	1991	R/CSR
Cerastium fontanum	O	RO	1991	R/CSR
Cirsium arvense	VR	VR	1990	C
Geranium dissectum	VR	VR	1990	R/SR
Hyperichum pulchrum	VR	R	1991	S
Isolepis setacea	VR	VR	1990	CSR
Pedicularis sylvatica	R	RO	1991	SR
Polygonium persicaria	R	+	1991	R
Ranunculus acris	R	RO	1991	CSR
Sagina procumbens	VR	VR	1990	R/CSR
Sanguisorba officinalis	VR	VR	1990	?
Sonchus asper	VR	VR	1990	R/CSR
Stachys officinalis	VR	VR	1990	S
Stellaria alsine	R	R	1990	CR/CSR
Taraxicum officinale	R	R	1991	R/CSR

TABLE 25 PLOT A: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Carex demissa	30	26	10		*	*	S
Plantago lanceolata	38	24	10			**	CSR

[1] Chi-square: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 26 PLOT A: SPECIES GAINED BETWEEN 1990 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Athyrium felix-femina	1992	VR	VR	C/SC
Glyceria fluitans	1991	R	VR	CR
Poa trivialis	1992	O	O	CR/CSR
Carex hostiana	1992	R	R	S
Carex ovalis	1992	R	R	S
Juncus effusus	1991	RO	R	C/SC
Lotus corniculatus	1992	O-LF	O-LF	S/CSR
Rumex obtusifolius	1991	VR	VR	CR
Senecio jacobaea	1992	VR	VR	R/CR
Vicia cracca	1991	O	R	C/CSR

TABLE 27 PLOT A: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Carex flacca	2	30	26	***		***	S
Carex nigra	4	14	16			*	S/SC
Centaurea nigra	4	32	22	***		**	S/CSR
Juncus acutiflorus	38	64	84	**	*	***	SC
Juncus conglomeratus	0	30	44	***		***	CS/CSR
Ranunculus flammula	18	42	38	**		*	CR/CSR

[1] Chi-square: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

TABLE 28 BLADED PLOT B: SPECIES AND DAFOR VALUES 1990-1992

Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Trees & Shrubs			
Ulex europaeus	RO	RO-LF	R
Grasses			
Agrostis canina	R	R	R
Agrostis capillaris	OF-LFA	F-LA	FA
Agrostis stolonifera	VR	O	-
Alopecurus genticulatus	FA	FA	A
Anthoxanthum odoratum	F	F	F
Cynosurus cristatus	O	O	FA
Deschampsia cespisosa	-	-	O
Festuca ovina	R	-	-
Festuca rubra	-	O	R
Glyceria fluitans	RO-LF	R-LO	O-LF
Holcus lanatus	AD	AD	AD
Lolium perenne	R	R	R
Phleum pratense	R	VR	R
Poa annua	F	-	-
Poa pratensis	R	R	R
Poa trivialis	R	RO	O
Sedges			
Carex binervis	-	-	R
Carex demissa	R	(VR)	-
Carex nigra	-	RO	R
Forbs			
Achillea ptarmica	-	R	R
Bellis perennis	RO	R	-
Cardamine pratense	RO	R	-
Centaurea nigra	R	R	O
Cerastium fontanum	F	O	O
Cirsium palustre	-	R	O
Cirsium vulgare	-	VR	R
Hypochaeris radicata	O	O	F
Juncus acutiflorus	R	F	F
Juncus articulatus	-	RO	R
Juncus bufonius/bulbosus	OF-LA	R	R
Juncus conglomeratus	R	R	F
Juncus effusus	R	OF	F
Lathyrus pratensis	-	R	O
Leontodon autumnalis	-	R	R
Lotus corniculatus	RO	R	F
Lotus uliginosus	O-LF	A	OF
Luzula campestris/multiflora	R	R	OF
Pedicularis sylvatica	R	R	-
Plantago lanceolata	RO	RO	RO
Polygonum persicaria	RO	R	-
Potentilla erecta	O	R	R
Prunella vulgaris	-	R	R
Ranunculus acris	-	(O)	O
Ranunculus flammula	OF	R	R
Ranunculus repens	FA-LA	F	F-LA
Rumex acetosa	O	O	O
Rumex acetosella	-	VR	-
Rumex crispus	VR	VR	-
Sagina procumbens	O-LF	O-LF	R
Sanguisorba officinalis	-	-	R
Sonchus asper	R	(R)	-
Stellaria alsine	RO	-	-
Succisa pratensis	R	-	-
Taraxicum officinale	-	-	R

Plot B continued			
Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Trifolium dubium	R	-	-
Trifolium pratense	VR	R	F
Trifolium repens	RO	R-LOF	F
Vicia cracca	R	R-LO	OF
No of vascular plant species recorded	44	50	45

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

+ present but not given a DAFOR rating

TABLE 29 PLOT B: FREQUENCY OF SPECIES

Sample date	04/07/90		12/08/91		29/06/92	
Recorders	CPB SJL		RFJ JHLA		RFJ	
Total no of quadrats	50		50		50	
	No	%	No	%	No	%
Trees & Shrubs						
Ulex europaeus	2	4	2	4	1	2
Grasses						
Agrostis canina	3	6	1	2	1	2
Agrostis capillaris	29	58	26	52	32	64
Agrostis stolonifera	1	2	6	12	0	0
Alopecurus genticulatus	47	92	21	42	21	42
Anthoxanthum odoratum	11	22	6	12	25	50
Cynosurus cristatus	4	8	15	30	17	34
Deschampsia cespitosa	0	0	0	0	2	4
Festuca ovina	1	2	0	0	0	0
Festuca rubra	0	0	3	6	2	4
Glyceria fluitans	8	16	7	14	14	28
Holcus lanatus	49	98	50	100	47	94
Lolium perenne	1	2	1	2	1	2
Phleum pratense	0	0	1	2	0	0
Poa annua	24	48	0	0	0	0
Poa pratensis	5	10	0	0	2	4
Poa trivialis	1	2	6	12	18	36
Sedges						
Carex demissa	1	2	0	0	0	0
Carex nigra	0	0	3	6	1	2
Forbs						
Bellis perennis	4	8	0	0	0	0
Cardamine pratensis	2	4	1	2	0	0
Centaurea nigra	2	4	1	2	2	4
Cerastium fontanum	22	44	9	18	5	10
Cirsium palustre	1	2	2	4	3	6
Hypochaeris radicata	4	8	19	38	1	2
Juncus acutiflorus	0	0	6	12	4	8
Juncus articulatus	0	0	0	0	1	2
Juncus bufonius/bulbosus	13	26	1	2	1	2
Juncus conglomeratus	1	2	6	12	14	28
Juncus effusus	1	2	6	12	14	28
Lathyrus pratensis	0	0	1	2	3	6
Leontodon autumnalis	0	0	3	6	1	2
Lotus corniculatus	1	2	0	0	3	6
Lotus uliginosus	5	10	33	66	39	78
Luzula campestris/multiflora	2	4	1	2	4	8
Plantago lanceolata	5	10	8	16	5	10
Polygonum persicaria	10	20	0	0	0	0
Potentilla erecta	8	16	13	26	3	6
Ranunculus acris	0	0	0	0	3	6
Ranunculus flammula	7	14	11	22	10	20
Ranunculus repens	31	62	36	72	33	66
Rumex acetosa	7	14	6	12	5	10
Rumex acetosella	1	2	0	0	0	0
Sagina procumbens	10	20	6	12	1	2
Sonchus asper	1	2	0	0	0	0
Stellaria alsine	3	6	0	0	0	0
Taraxicum officinale	0	0	0	0	1	2
Trifolium repens	1	2	21	42	18	36
Vicia cracca	0	0	0	0	3	6
Bare ground					7	14

TABLE 30 PLOT B: SPECIES LOST BETWEEN 1990 AND 1992

Species	DAFOR in 1990	DAFOR in last year recorded	Last year recorded	Established strategy
Poa annua	F	F	1990	R
Bellis perennis	RO	R	1991	R/CSR
Cardamine pratense	RO	R	1991	R/CSR
Pedicularis sylvatica	R	R	1991	SR
Polygonium persicaria	RO	R	1991	R
Rumex crispus	VR	VR	1991	R/CR
Sonchus asper	R	R	1991	R/CR
Stellaria alsine	RO	RO	1990	CR/CSR
Succisa pratensis	R	R	1990	S
Trifolium dubium	R	R	1990	R/SR

TABLE 31 PLOT B: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Alopecurus genticulatus	94	42	42	***		***	CR
Poa annua	48	0	0	***		***	R
Cerastium fontanum	44	18	10	**		***	R/CSR
Juncus bufonius/bulbosus	26	2	2	***		***	R ?
Polygonium persicaria	20	0	0	***		***	R
Potentilla erecta	16	26	6		**		S/CSR
Sagina procumbens	20	12	2			**	R/CSR

[1] Chi-square: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 32 PLOT B: SPECIES GAINED BETWEEN 1990 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Deschampsia cespitosa	1992	O	O	SC/CSR
Carex binervis	1992	R	R	S
Carex nigra	1991	RO	R	S/SC
Achillea ptarmica	1991	R	R	CR/CSR
Cirsium vulgare	1991	VR	R	CR
Juncus articulatus	1991	RO	R	CSR
Lathyrus pratensis	1991	R	O	CSR
Leontodon autumnalis	1991	R	R	R/CSR
Prunella vulgaris	1991	R	R	CSR
Ranunculus acris	1991	O	O	CSR
Sanguisorba officinalis	1992	R	R	?
Taraxicum officinale	1992	R	R	R/CSR

TABLE 33 PLOT B: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Anthoxanthum odoratum	22	12	50		***	**	SR/CSR
Cynosurus cristatus	8	30	34	**		**	CSR
Poa trivialis	2	12	36		**	***	CR/CSR
Juncus conglomeratus	2	12	28		*	***	CS/CSR
Juncus effusus	2	12	28		*	***	C/SC
Lotus uliginosus	10	66	78	***		***	SC
Trifolium repens	2	42	36	***		***	CR/CSR

[1] Chi-square: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

TABLE 34 BLADED PLOT C: SPECIES AND DAFOR VALUES, 1990-1992

Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Trees & Shrubs			
Crataegus monogyna	VR	(VR)	-
Ulex europaeus	O	F	F
Ferns			
Dryopteris sp	-	(VR)	-
Grasses			
Agrostis canina	OF	FA	OF
Agrostis capillaris	F	A	F
Agrostis stolonifera	-	O	-
Alopecurus genticulatus	RO	R	O
Anthoxanthum odoratum	F	O	F
Cynosurus cristatus	R-LRO	O	F
Dactylis glomerata	-	-	R
Danthonia decumbens	R	(R)	-
Deschampsia cespitosa	R	VR	RO
Festuca ovina	R	F	?
Festuca rubra	RO	F	O
Glyceria fluitans	-	RO	OF
Holcus lanatus	A	A	F-LA
Molinia caerulea	R	R-LO	VR
Phleum pratense	R	-	-
Poa annua	RO-LF	(VR)	-
Poa pratensis	R	RO	+
Poa trivialis	-	O	F
Sedges			
Carex binervis	-	-	RO
Carex demissa	-	O-LF	F
Carex flacca	R	(R)	F
Carex hostiana	-	-	VR
Carex nigra	R	O	O
Carex ovalis	-	-	R
Carex pallescens	-	-	R
Carex panicea	RO	O	F
Forbs			
Achillea ptarmica	RO	OF	O
Ajuga reptans	-	R	-
Angelica sylvestris	R	O	R
Bellis perennis	R	R	R
Calluna vulgaris	-	(VR)	-
Cardamine pratense	R	-	-
Centaurea nigra	R-LO	OF	F
Cerastium fontanum	RO	R	-
Cirsium palustre	O	RO	OF
Cirsium vulgare	VR	R	-
Dactylorhiza fuchsii	-	-	VR
Epilobium brunnescens	-	VR	-
Equisetum arvense	-	R	R
Euphrasia sp.	-	O	-
Filipendula ulmaria	VR	R	O
Galium palustre	-	VR	-
Galium saxatile	VR	R	-
Hypericum sp	VR	-	-
Hypochaeris radicata	O	FA	F
Juncus acutiflorus	RO	FA	A
Juncus articulatus	VR	R	-
Juncus bufonius	RO	-	F
Juncus bulbosus	-	R	-
Juncus conglomeratus	R	O-LF	F-LA

Plot B continued			
Sample date	3/7/90	12/8/91	29/6/92
Recorders	CPB SJL	RFJ * JHLA	RFJ
Juncus effusus	VR	R	O
Lathyrus pratensis	-	R	-
Leontodon autumnalis	R	OF	O
Leucanthemum vulgare	R	-	-
Lotus corniculatus	RO	O	O
Lotus uliginosus	RO	F	F
Luzula campestris/multiflora	RO	O	O
Pedicularis sylvatica	R	OF	-
Plantago lanceolata	OF	F	F
Plantago major	-	(VR)	-
Polygonum lapathifolium	R	-	-
Polygonum persicaria	RO	(R)	-
Potentilla erecta	OF	F	F
Prunella vulgaris	R	O	O-LF
Ranunculus acris	R	O	R
Ranunculus flammula	RO	O	F
Ranunculus repens	R-LO	OF	R
Rhinanthus minor	R	O	-
Rubus fruticosus	-	VR	-
Rumex acetosa	O	R	O
Rumex acetosella	+	-	-
Rumex crispus	VR	-	-
Sagina procumbens	R	R	O
Senecio jacobaea	-	(R)	-
Sonchus asper	R	-	-
Stachys palustris	VR	R	R
Stellaria alsine	VR	-	-
Succisa pratensis	RO	F	R
Taraxicum officinale	R	R	R
Trifolium dubium	R	-	-
Trifolium pratense	R	O	O
Trifolium repens	R	RO	F
Vicia cracca	-	R	-
Viola palustris	-	VR	-
No of vascular plant species recorded	64	72	53

* DAFOR values in brackets are additional records from Simon Leach 6/8/91

+ present but not given a DAFOR rating

TABLE 35 PLOT C: FREQUENCY OF SPECIES

Sample date	04/07/90		12/08/91		30/06/92	
Recorders	CPB SJL		RFJ JHLA		RFJ	
Total no of quadrats	50		50		50	
	No	%	No	%	No	%
Trees & Shrubs						
Ulex europaeus	17	34	14	28	15	30
Grasses						
Agrostis canina	20	40	25	50	38	76
Agrostis capillaris	34	68	38	76	12	24
Agrostis stolonifera	0	0	2	4	0	0
Alopecurus genticulatus	2	4	0	0	0	0
Anthoxanthum odoratum	24	48	22	44	19	38
Cynosurus cristatus	1	2	15	30	8	16
Deschampsia cespitosa	0	0	0	0	2	4
Festuca ovina	8	16	0	0	0	0
Festuca rubra	5	10	26	52	36	72
Glyceria fluitans	0	0	1	2	0	0
Holcus lanatus	42	84	46	92	39	78
Lolium perenne	0	0	1	2	0	0
Molinia caerulea	1	2	2	4	1	2
Poa annua	8	16	0	0	0	0
Poa pratensis	5	10	4	8	0	0
Poa trivialis	0	0	3	6	1	2
Sedges						
Carex demissa	0	0	5	10	5	10
Carex flacca	2	4	0	0	8	16
Carex hostiana	0	0	0	0	1	2
Carex nigra	0	0	1	2	2	4
Carex panicea	4	8	10	20	10	20
Forbs						
Achillea ptarmica	2	4	4	8	0	0
Angelica sylvestris	2	4	1	2	2	4
Bellis perennis	1	2	1	2	0	0
Cardamine pratensis	1	2	0	0	0	0
Centaurea nigra	1	2	7	14	8	16
Cerastium fontanum	8	16	2	4	0	0
Cirsium palustre	2	4	4	8	0	0
Euphrasia sp	0	0	1	2	0	0
Filipendula ulmaria	0	0	0	0	1	2
Galium palustre	0	0	1	2	0	0
Galium saxatile	1	2	0	0	0	0
Hypericum sp	1	2	0	0	0	0
Hypochaeris radicata	8	16	23	46	10	20
Juncus acutiflorus	3	6	12	24	19	38
Juncus articulatus	0	0	1	2	0	0
Juncus bufonius/bulbosus	0	0	1	2	1	2
Juncus conglomeratus	0	0	3	6	13	26
Juncus effusus	0	0	1	2	1	2
Lathyrus pratensis	0	0	2	4	0	0
Leontodon autumnalis	4	8	5	10	5	10
Lotus corniculatus	2	4	2	4	4	8
Lotus uliginosus	4	8	6	12	5	10
Luzula campestris/multiflora	7	14	5	10	3	6
Plantago lanceolata	23	46	28	56	18	36
Polygonum persicaria	2	4	0	0	0	0
Potentilla erecta	23	46	25	50	19	38
Prunella vulgaris	1	2	4	8	0	0
Ranunculus acris	2	4	0	0	2	4
Ranunculus flammula	7	14	13	26	18	36

Plot C continued						
Sample date	04/07/90		12/08/91		30/06/92	
Recorders	CPB SJL		RFJ JHLA		RFJ	
Total no of quadrats	50		50		50	
	No	%	No	%	No	%
Ranunculus repens	7	14	13	26	4	8
Rumex acetosa	12	24	1	2	4	8
Sagina procumbens	1	2	0	0	0	0
Sonchus asper	1	2	0	0	0	0
Stachys palustre	0	0	1	2	0	0
Stellaria alsine	1	2	0	0	0	0
Succisa pratensis	2	4	1	2	1	2
Taraxicum officinale	1	2	1	2	1	2
Trifolium pratense	0	0	2	4	0	0
Trifolium repens	2	4	2	4	2	4
Bare ground					34	68

TABLE 36 PLOT C: SPECIES LOST BETWEEN 1990 AND 1992

Species	DAFOR in 1990	DAFOR in last year recorded	Last year recorded	Established strategy
Crataegus monogyna	VR	VR	1991	SC
Danthonia decumbens	R	R	1991	S
Phleum pratense	R	R	1990	CSR
Poa annua	RO-LF	VR	1991	R
Cardamine pratense	R	R	1990	R/CSR
Cerastium fontanum	RO	R	1991	R/CSR
Cirsium vulgare	VR	R	1991	CR
Galium saxatile	VR	R	1991	S
Hypericum sp.	VR	VR	1990	?
Juncus articulatus	VR	R	1991	CSR
Leucanthemum vulgare	R	R	1990	CR/CSR
Pedicularis sylvatica	R	OF	1991	SR
Polygonium lapathifolium	R	R	1990	R/CR
Polygonium persicaria	RO	R	1991	R
Rhinanthus minor	R	O	1991	R/SR
Rumex acetosella	+	+	1990	SR/CSR
Rumex crispus	VR	VR	1990	R/CR
Sonchus asper	R	R	1990	R/CR
Stellaria alsine	VR	VR	1991	CR/CSR
Trifolium dubium	R	R	1990	R/SR

TABLE 37 PLOT C: SPECIES WHICH HAVE SHOWN AN OVERALL DECREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Poa annua	16	0	0	*		*	R
Poa pratensis	10	8	0		*	*	CSR
Cerastium fontanum	16	4	0	*		*	R/CSR
Rumex acetosa	24	2	8	**		*	CSR

[1] Chi-square: significant decrease *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant increase)

TABLE 38 PLOT C: SPECIES GAINED BETWEEN 1990 AND 1992

Species	First year recorded	DAFOR in first year	DAFOR in 1992	Established strategy
Dactylis glomerata	1992	R	R	C/CSR
Glyceria fluitans	1991	RO	OF	CR
Poa trivialis	1991	O	F	CR/CSR
Carex binervis	1992	RO	RO	S
Carex hostiana	1992	VR	VR	S
Carex ovalis	1992	R	R	S
Carex pallescens	1992	R	R	S
Dactylorhiza fuchsii	1992	VR	VR	S/CSR
Equisetum arvense	1991	R	R	CR

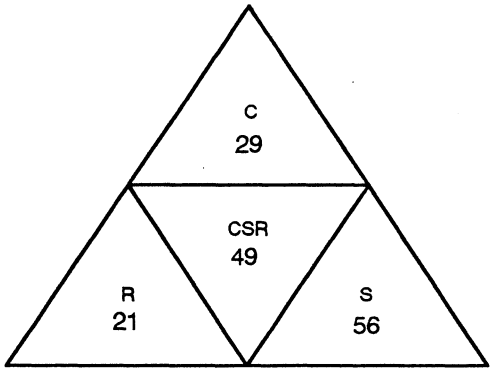
TABLE 39 PLOT C: SPECIES WHICH HAVE SHOWN AN OVERALL INCREASE IN FREQUENCY BETWEEN 1990 AND 1992

Species	% Frequency			Significance of frequency change between years [1]			Established strategy
	1990	1991	1992	90/91	91/92	90/92	
Cynosurus cristatus	2	30	16	***		*	CSR
Festuca rubra	10	52	72	***	*	***	CSR
Carex demissa	0	10	10	*		*	S
Carex flacca	4	0	16		*	*	S
Centaurea nigra	2	14	16	*		*	S/SC
Juncus acutiflorus	6	24	38	*		***	SC
Juncus conglomeratus	0	6	26		**	***	CS/CSR
Ranunculus flammula	14	26	36			*	CR/CSR

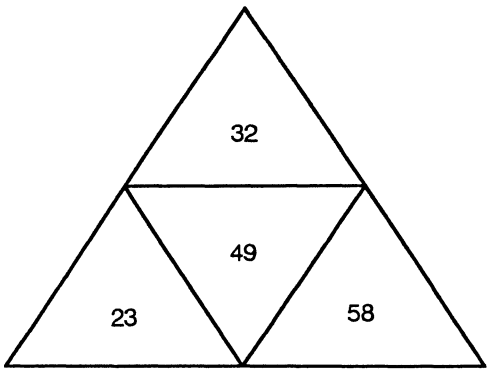
[1] Chi-square: significant increase *: P<0.05, **: P<0.01, ***: P<0.001 (brackets indicate a significant decrease)

FIGURES

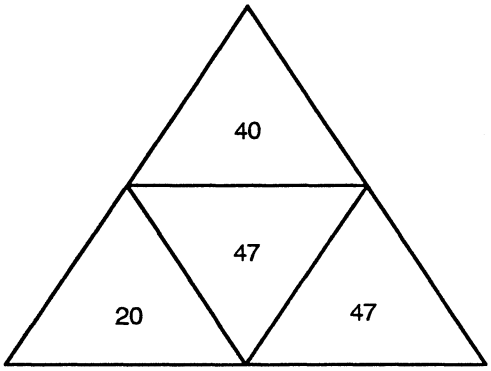
Figure 1 CSR analysis of vegetation change in the 90m x 30m plot



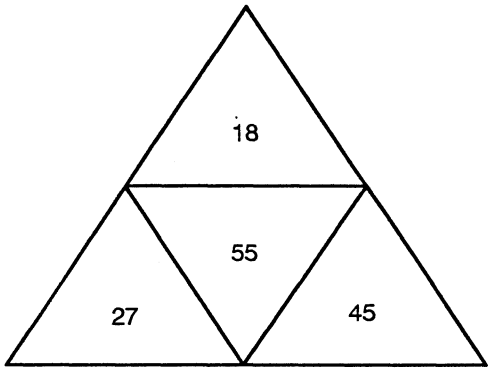
1a 1988 Total species complement n=68



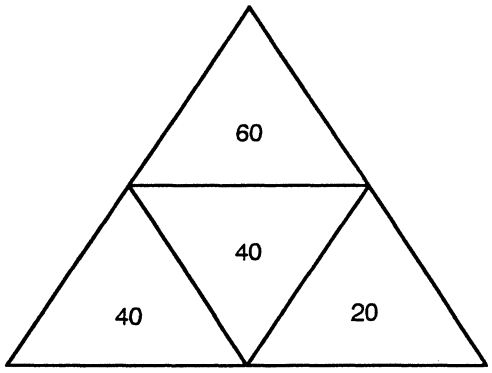
1b 1992 Total species complement n=57



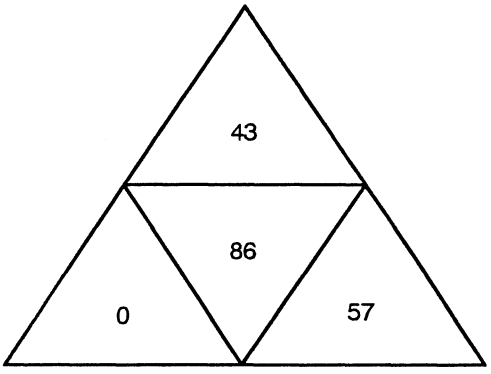
1c Species disappearing between 1988 & 1992 n=15



1d Species decreasing between 1988 & 1992 n=11



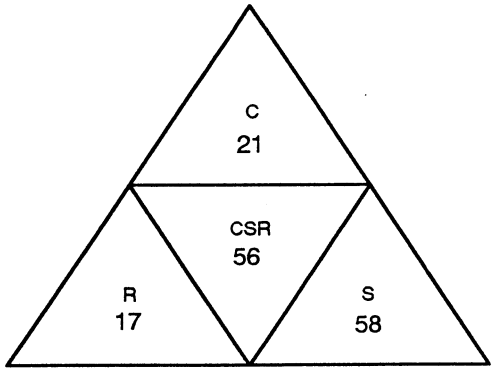
1e Species appearing between 1988 & 1992 n=5



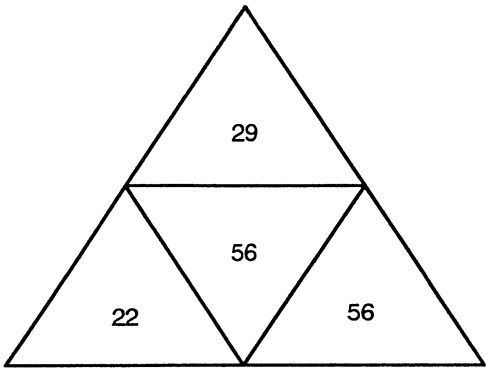
1f Species increasing between 1988 & 1992 n=7

All figures in triangles are percentages

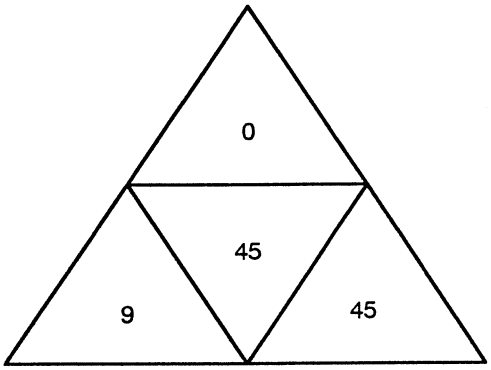
Figure 2 CSR analysis of vegetation change in the 30m x 30m plot



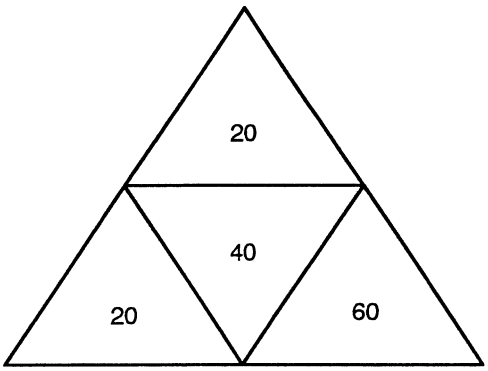
2a 1988 Total species complement n=52



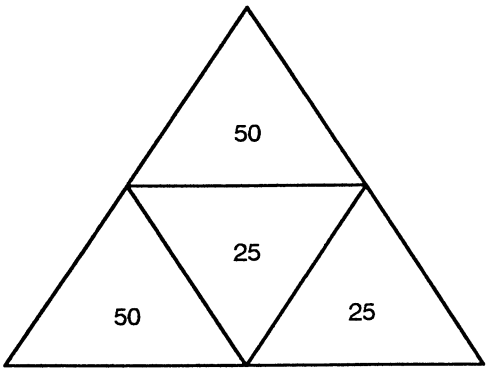
2b 1992 Total species complement n=45



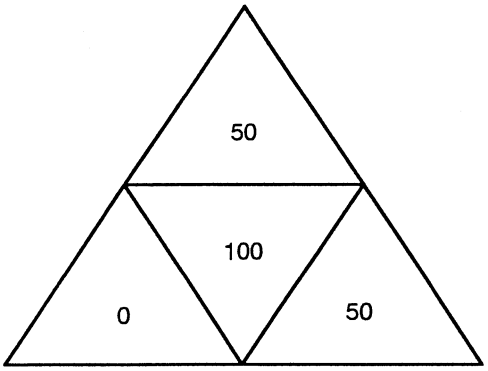
2c Species disappearing between 1988 & 1992 n=11



2d Species decreasing between 1988 & 1992 n=10



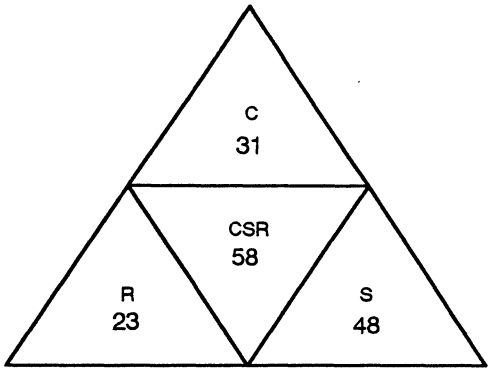
2e Species appearing between 1988 & 1992 n=4



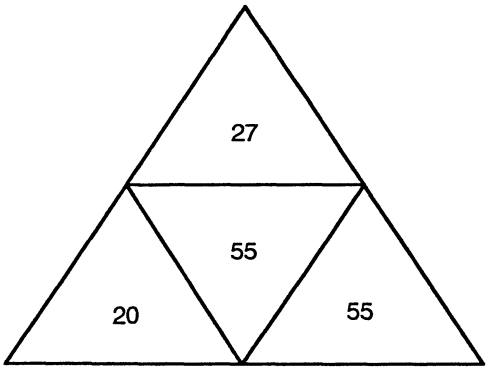
2f Species increasing between 1988 & 1992 n=4

All figures in triangles are percentages

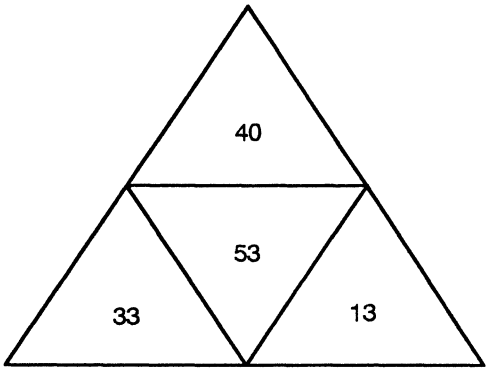
Figure 3 CSR analysis of vegetation change in the "Orchid" plot



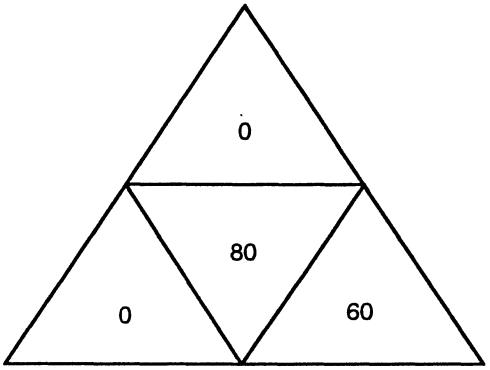
3a 1989 Total species complement n=64



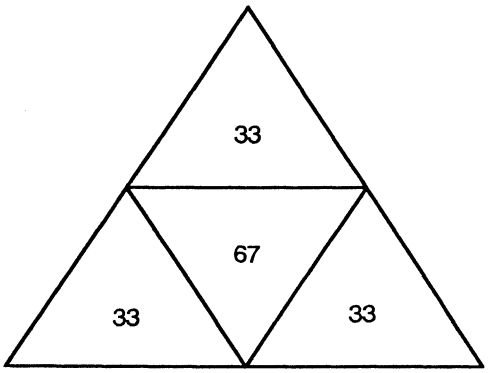
3b 1992 Total species complement n=55



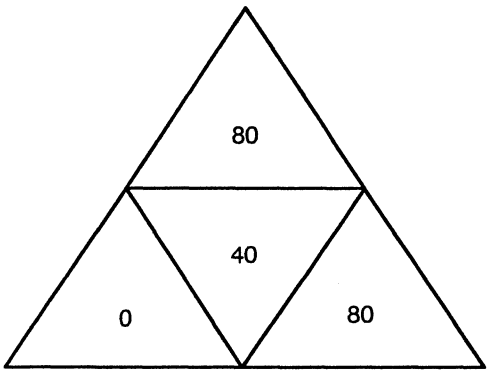
3c Species disappearing between 1989 & 1992 n=15



3d Species decreasing between 1989 & 1992 n=5



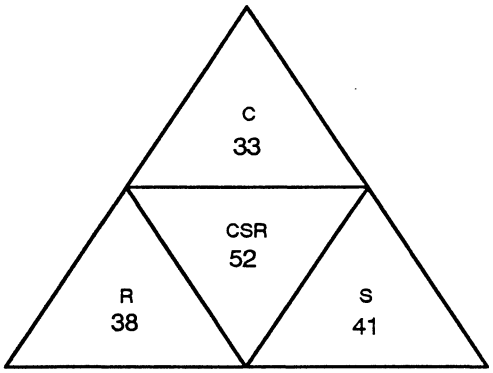
3e Species appearing between 1989 and 1992 n=3



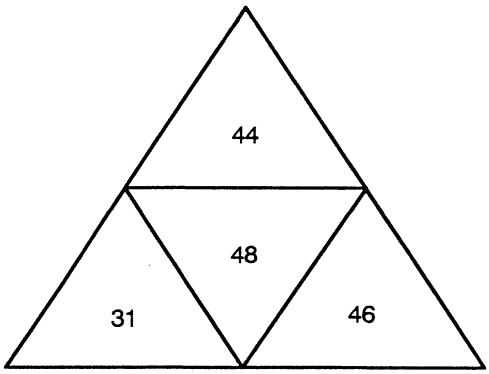
3f Species increasing between 1989 and 1992 n=5

All figures in triangles are percentages

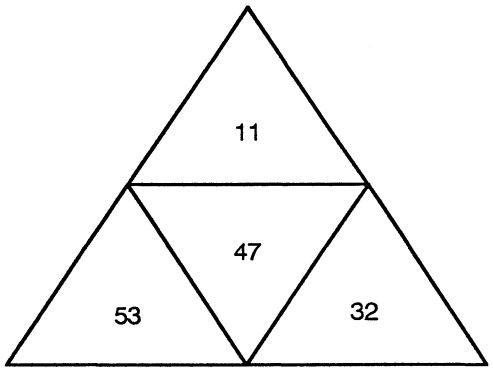
Figure 4 CSR analysis of vegetation change in Plot A



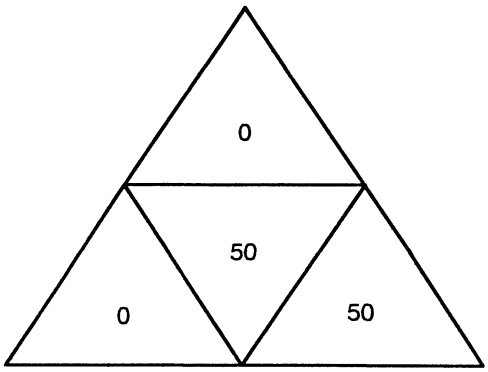
4a 1990 Total species complement n=61



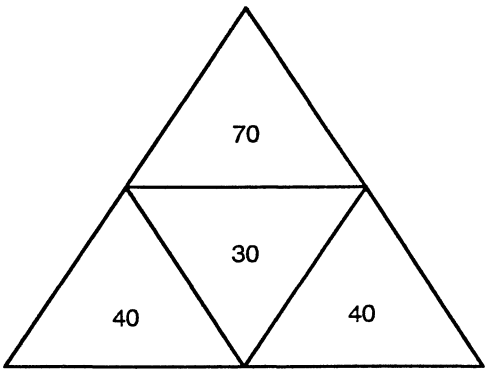
4b 1992 Total species complement n=54



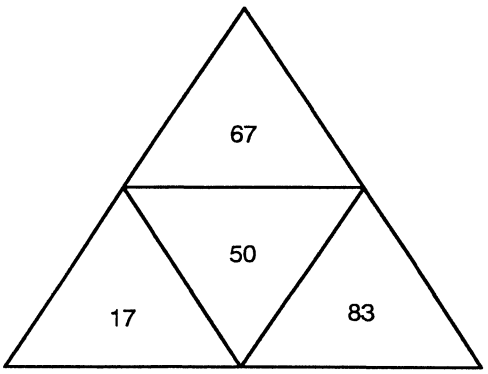
4c Species disappearing between 1990 & 1992 n=19



4d Species decreasing between 1990 & 1992 n=2



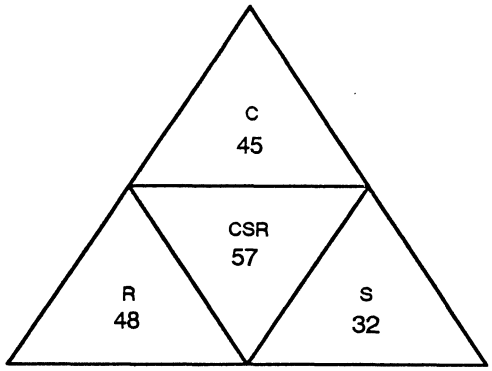
4e Species appearing between 1990 and 1992 n=10



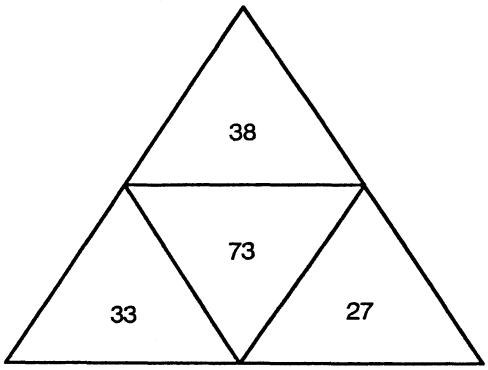
4f Species increasing between 1990 and 1992 n=6

All figures in triangles are percentages

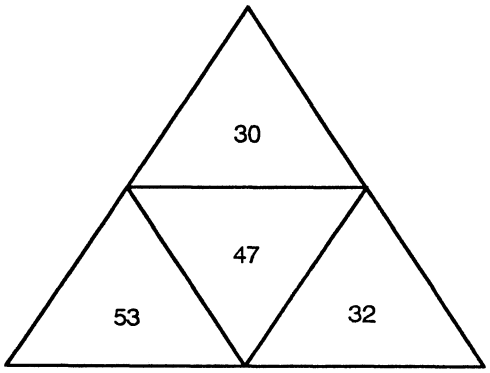
Figure 5 CSR analysis of vegetation change in Plot B



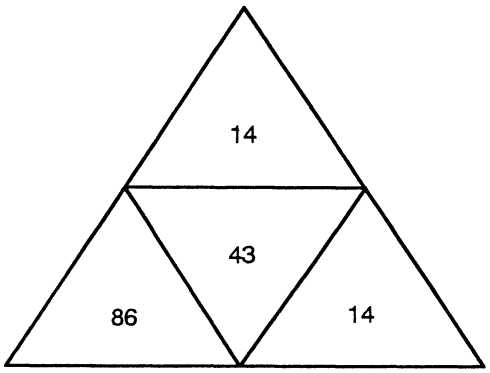
5a 1990 Total species complement n=44



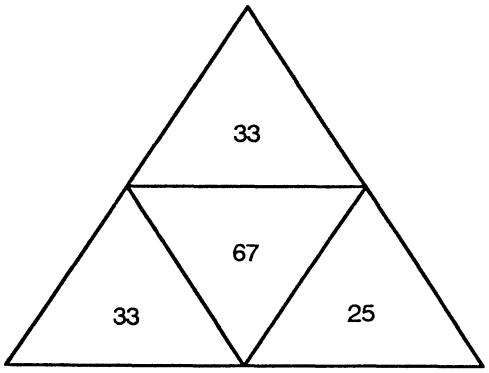
5b 1992 Total species complement n=45



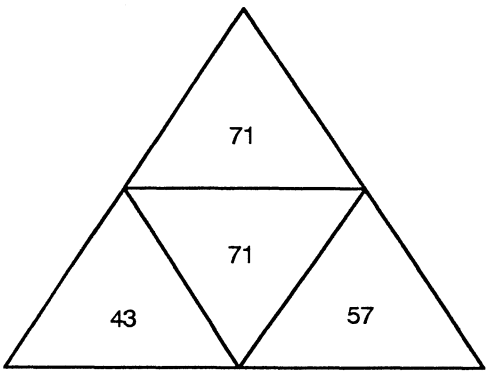
5c Species disappearing between 1990 & 1992 n=10



5d Species decreasing between 1990 & 1992 n=7



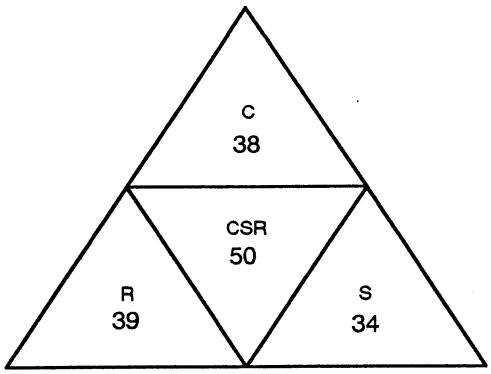
5e Species appearing between 1990 and 1992 n=12



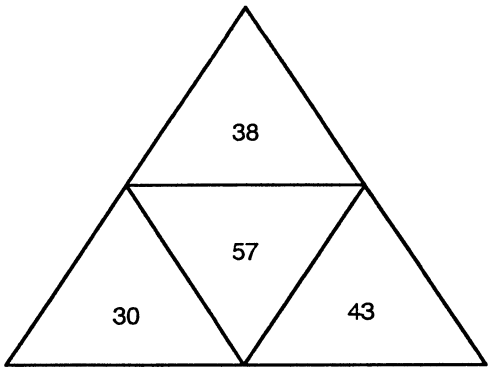
5f Species increasing between 1990 and 1992 n=7

All figures in triangles are percentages

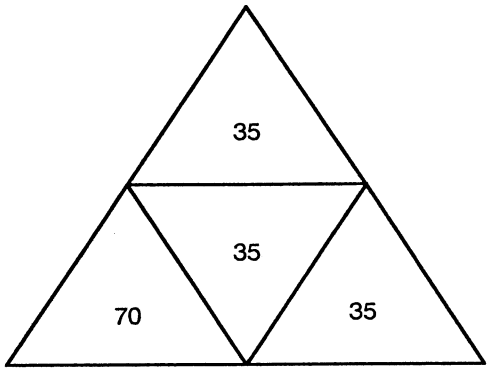
Figure 6 CSR analysis of vegetation change in Plot C



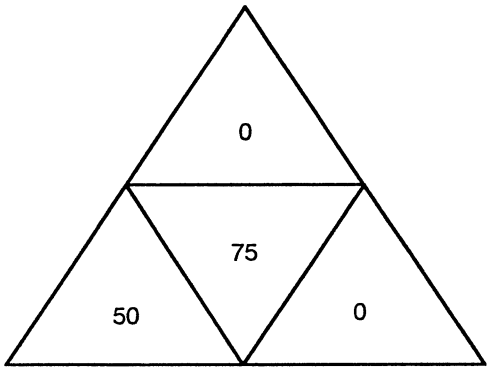
6a 1990 Total species complement n=64



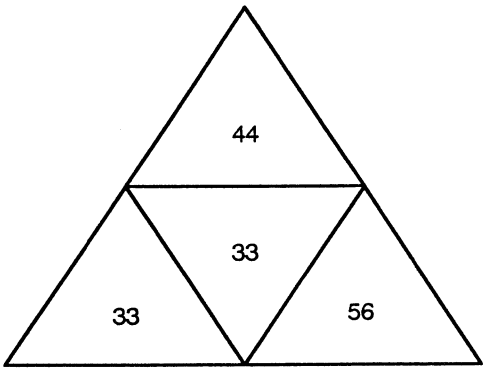
6b 1992 Total species complement n=53



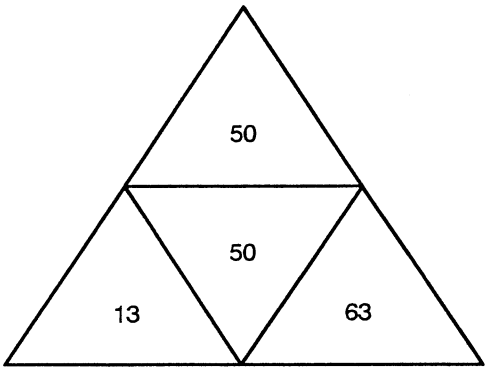
6c Species disappearing between 1990 & 1992 n=20



6d Species decreasing between 1990 & 1992 n=4



6e Species appearing between 1990 and 1992 n=9



6f Species increasing between 1990 and 1992 n=8

All figures in triangles are percentages

APPENDIX

Figures from Leach *et al.*1991

FIGURE 1 1:25,000 map showing location of donor site (including approximate positions of the 90x30m and 30x30m plots), receptor site for the turf transplants and receptor site for 'bladed' material

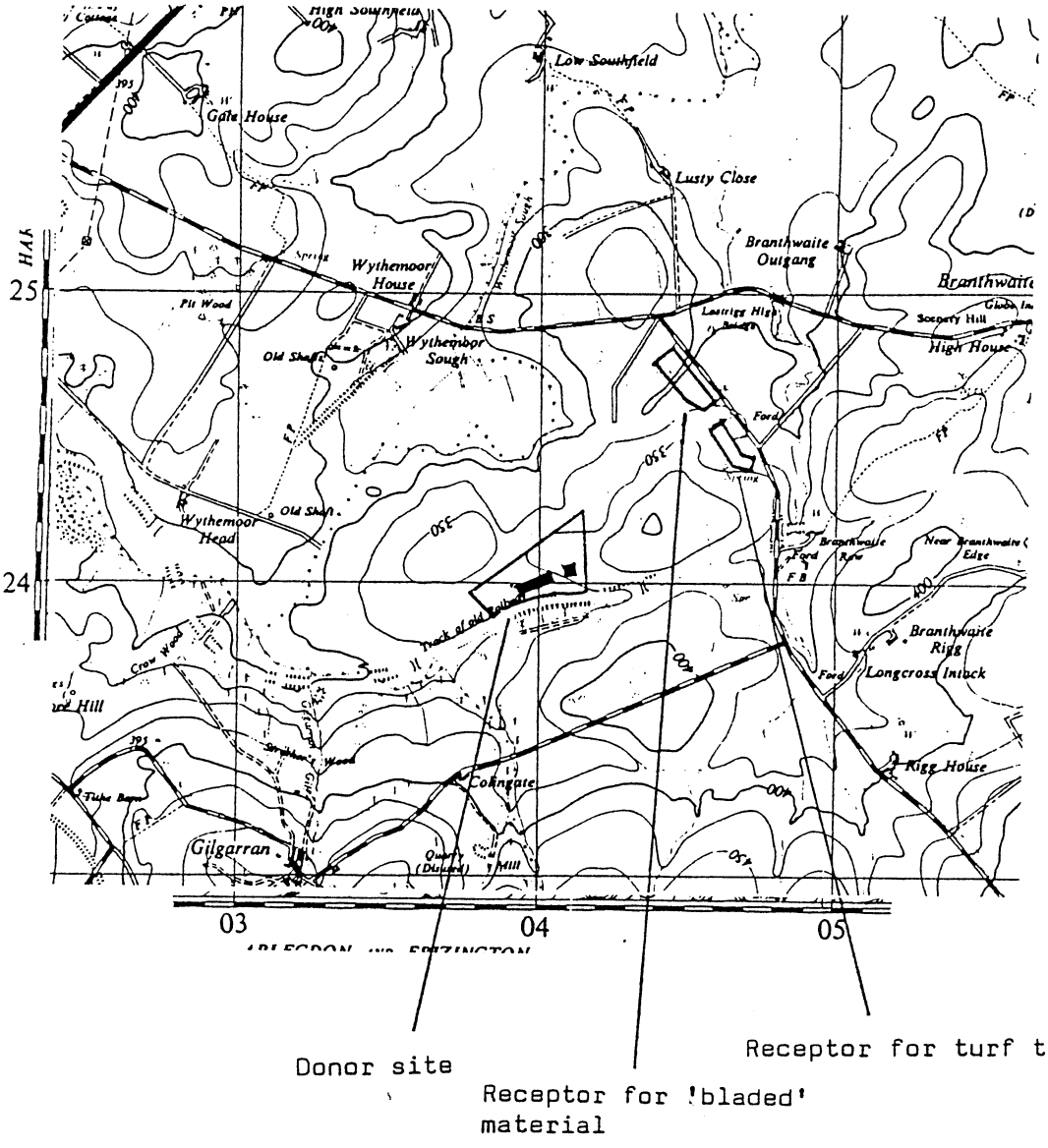
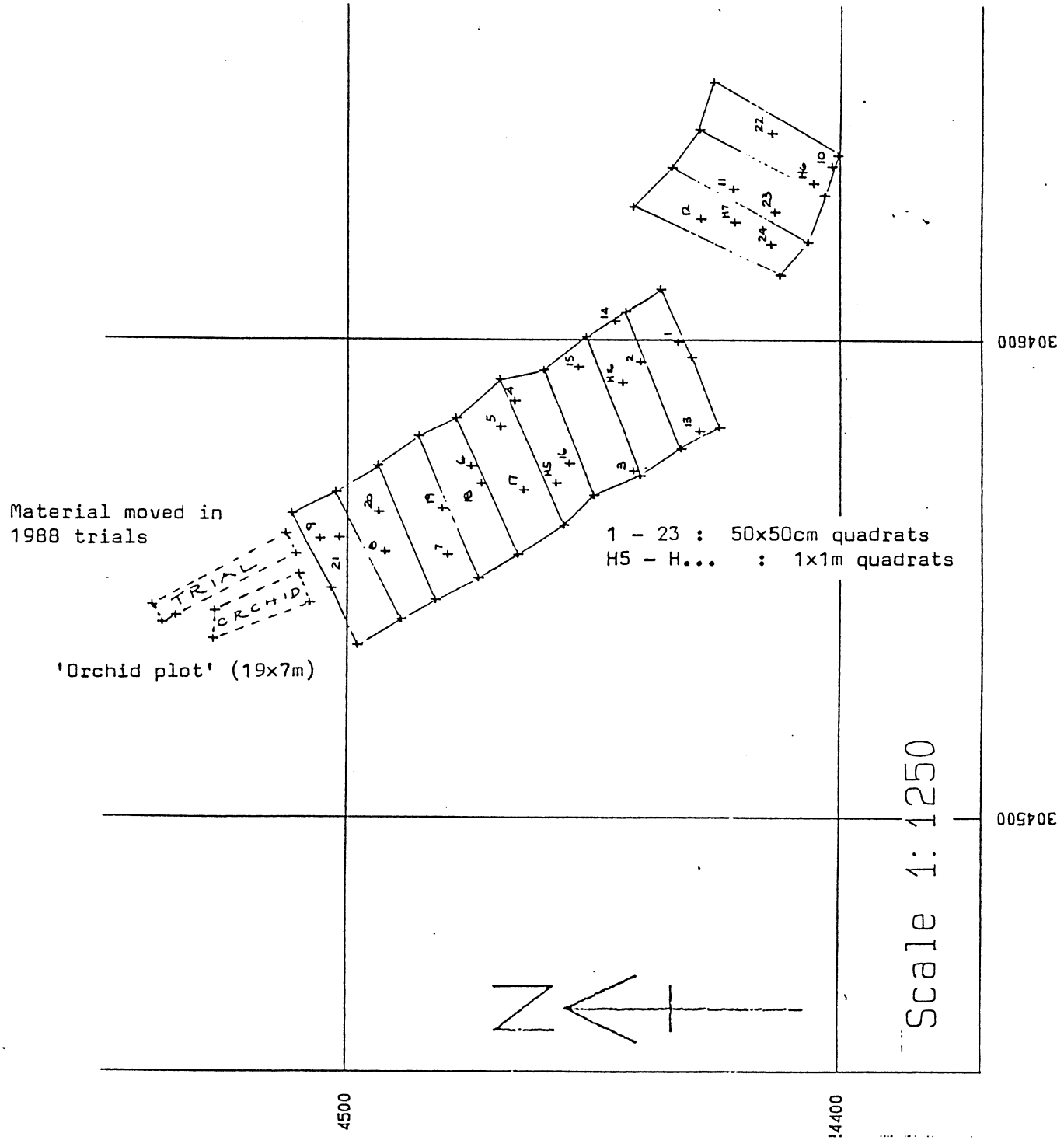


FIGURE 2 1:1,250 plan showing location of 90x30m and 30x30m plots, their subdivision into 10x30m strips, and locations of the 23 permanent 50x50cm quadrats and the four surviving permanent 1x1m quadrats established in 1987



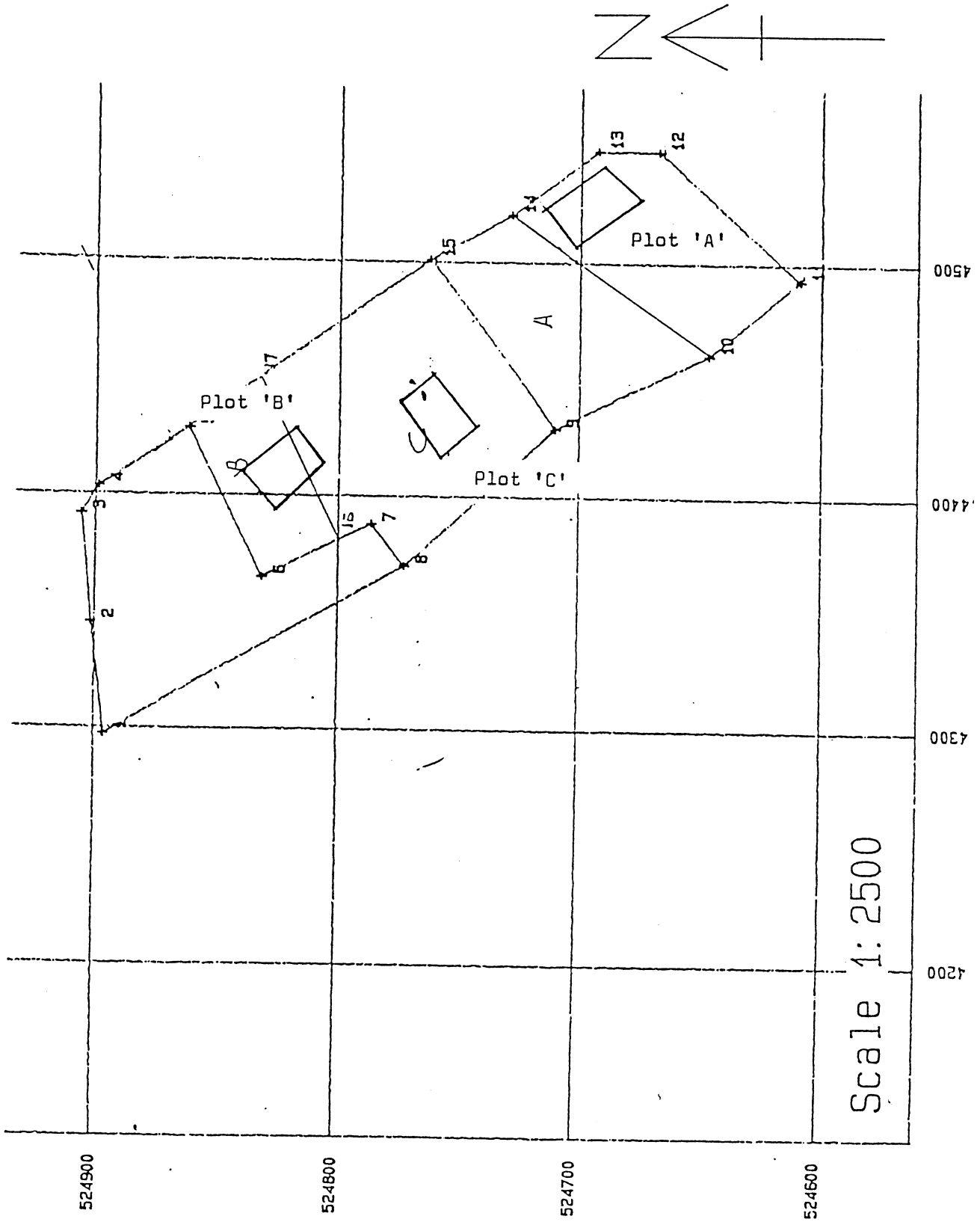
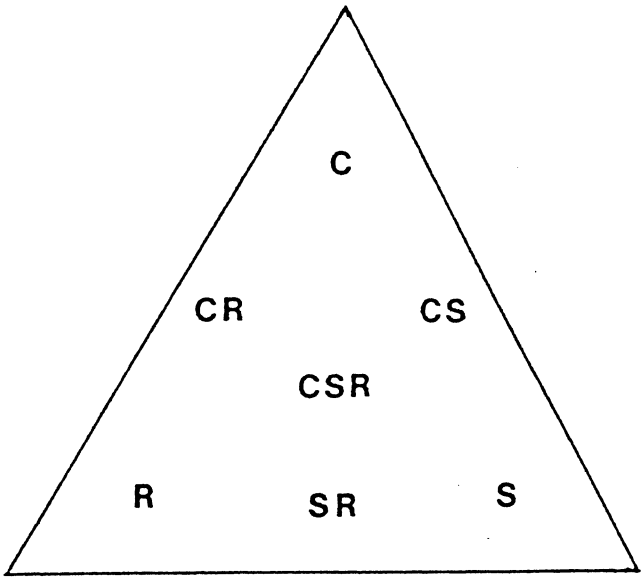


FIGURE 3 1:2500 plan showing location of 20x30m plots in area covered by 'bladed' material (plots 'A', 'B', 'C')



ABBREVIATIONS

C -- COMPETITOR

S -- STRESS-TOLERATOR

R -- RUDERAL

CR -- COMPETITIVE RUDERAL

CS -- STRESS-TOLERANT COMPETITOR

SR -- STRESS-TOLERANT RUDERAL

CSR -- CSR STRATEGIST

FIGURE 4 The triangular model of plant strategies (the 'Sheffield Triangle') and definitions of the various abbreviations

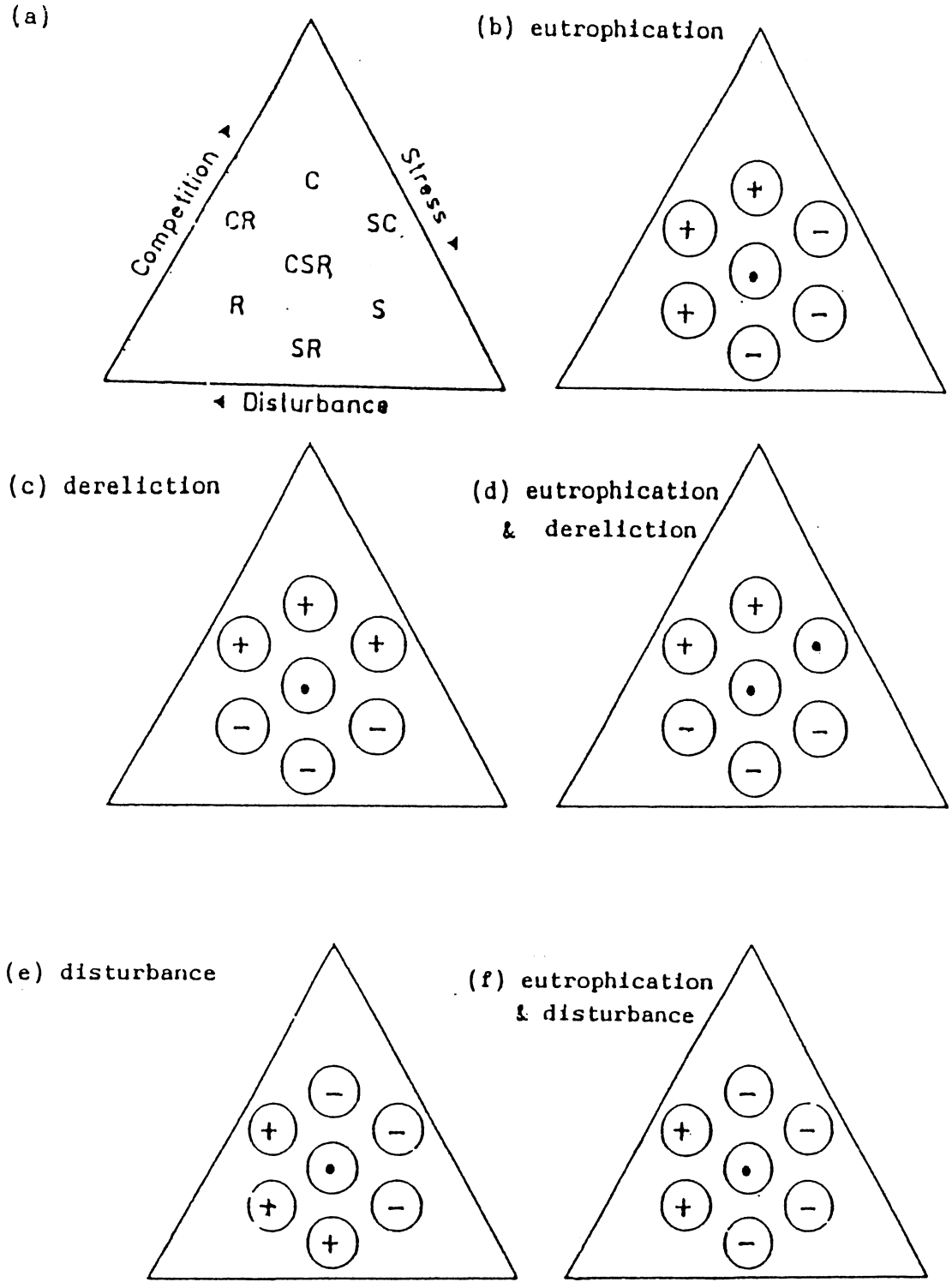


FIGURE 5 The plant strategies and their theoretically expected changes in response to various management changes (from J. Hodgson, pers. comm.)

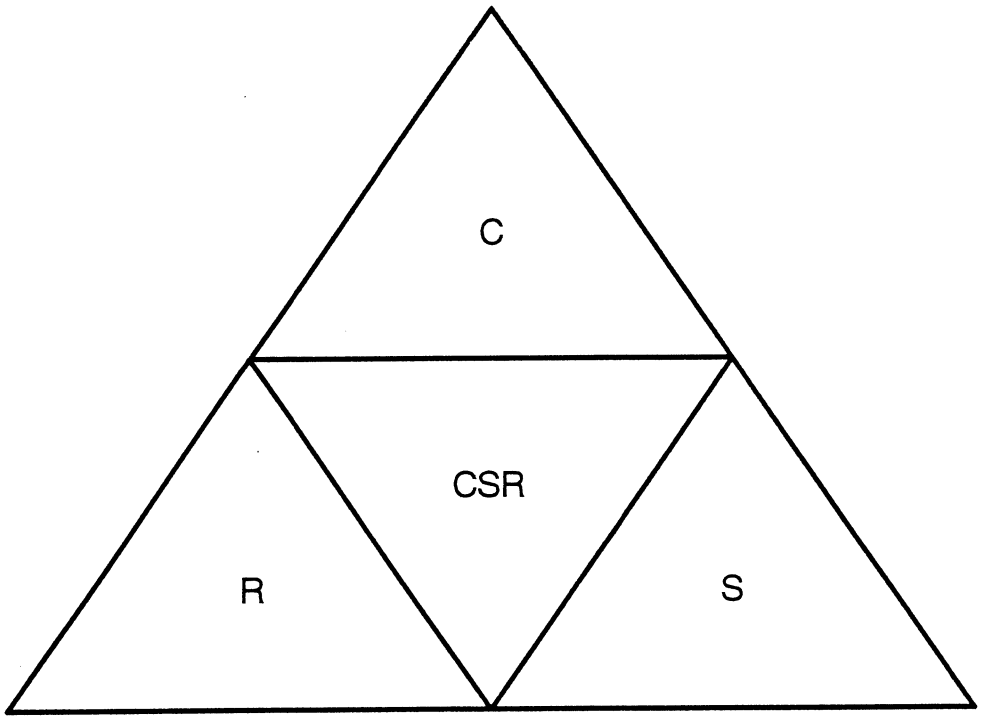


Figure 6 The four strategy sectors used in this analysis from the'Sheffield Triangle'