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A FEASIBILITY STUDY OF THE USE OF CHEMICALS FOR RURAL AMENITY AREAS
Sponsored by the Countryside Commission

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CONTENTS LIST

CONTENTS LIST

## LIST OF EXPERIMENTS

# LIST OF TABLES

## LIST OF FIGURES

# A FEASIBILITY STUDY OF THE USE OF CHEMICALS FOR RURAL AMENITY AREAS

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SUMMARY

Amenity land in Britain amounts to over 1.5 million ha, including 847,000 ha of "amenity grassland" which can be defined as that having "recreational, functional or aesthetic value, and of which agricultural productivity is not the primary aim". Informal recreation areas in the counryside amount to well over 20,000 ha. Most land, but especially amenity areas, requires management, otherwise undesirable vegetation will develop. Increasing costs of maintenance of picnic areas and country parks have resulted in a re-examination of standards and often a reduction in management. Interest in alternative techniques of management has also increased.

Chemicals have proved to be effective and labour- and cost-saving in agriculture, horticulture and forestry and might be further exploited in amenity situations. Herbicides are already used for controlling vegetation in some amenity sites, notably around planted trees and for total control on paths, parking areas and around buildings. More sophisticated manipulation of vegetation might be achieved using chemicals, for example by applying low doses at particular times of year, or applied in particular ways.

A feasibility study of the use of chemicals for rural amenity area management has been carried out at the Weed Research Organization sponsored by the Countryside Commission. The objectives have been to find chemicals which reduce sward height (and hence mowing), which selectively control coarse grasses leaving finer species and which encourage short-growing common flowers. At the same time treatments need to maintain an acceptable sward appearance. Techniques for controlling problem species in grass, e.g. docks, have not been investigated as information on control is available from agriculture (e.g. ADAS Booklet 2056 *Weed control in grassland, herbage legumes and grass seed crops* 1981-1982). Three scrub control experiments and one trial introducing wild flowers have been conducted, but the study has concentrated on manipulating swards with herbicides and grass growth retardants.

Initial trials were set out at many sites on different grass swards. A logarithmic-sprayer was used to spray a range of herbicides and growth retardants in spring, summer and autumn. The amount of applied chemical is reduced along the plot, allowing a rapid assesssment of the effects over a range of doses. Trials with herbicides have indicated that autumn treatments are probably the most appropriate, both from the biological viewpoint and the aesthetic. Any discolouration of the sward occurs during winter and spring, when there are fewest visitors to amenity sites and natural senescence is taking place. At this time, most desirable herbs have died back and are not affected by sprays, while the coarse grasses are still active. The grass-specific herbicide dalapon, and the broad spectrum herbicides paraquat and glyphosate appeared most promising in initial trials. Aminotriazole and propyzamide also had some potential. Selectivity between grass species was only observed on *Holcus lanatus* (Yorkshire fog), which could be controlled by asulam and linuron

in mixed swards. Logarithmic-sprayed trials of available growth retardants indicated spring applications give best results. The compounds maleic hydrazide, mefluidide and PP333 (paclobutrazol) all showed useful activity.

More detailed experiments have been designed using herbicides and growth retardants applied at finite doses. Herbicide trials gave varied results. Dalapon, paraquat and glyphosate gave best effects. The compounds aminotriazole and propyzamide did not show the useful effects indicated in initial studies. It was shown that herbicides alone will not create short swards or stop the accumulation of standing dead vegetation. The composition of treated swards was a major factor in the results; tall undesirable dicotyledons, such as docks and thistles, could be encouraged by checking the grasses, just as short-growing species could be encouraged. In rough grass areas the trials indicated that some useful effects could be created with herbicides, notably paraquat. In shorter grass, further work on the integration of mowing and herbicide treatments are required.

Trials with growth retardants have shown that they provide the best potential use of chemicals in amenity areas at present. The foliage-acting compounds maleic hydrazide and mefluidide give best results for rural amenity situations. These compounds give good inhibition of flowering in grasses, a useful attribute for amenity use, accompanied by growth suppression for six to eight weeks and acceptably short swards for longer. Mefluidide is faster acting than maleic hydrazide and gives better retardation and suppression of flowering. The soil-acting PP333, while retarding for longer than the other compounds, does not inhibit flowering. Trials of repeated annual applications of these growth retardants indicate that finer grasses, notably *Festuca rubra* (red fescue), are encouraged by the foliar retardants and discouraged by the soil active retardant. Coarse, deep-rooted grasses are largely unaffected by PP333. Data on dicotyledons indicate that species numbers were only maintained on mefluidide and control plots. Where dicotyledons need to be controlled, it was shown that 2,4-D could be mixed with maleic hydrazide and mefluidide.

Scrub control trials indicated that there are alternatives to 2,4,5-T. Hawthorn and birch could be eliminated using glyphosate applied to foliage or cut stumps. The herbicide fosamine also controlled these species, and triclopyr was effective against birch if overall coverage was achieved. Pines were highly susceptible to soil applications of tebuthiuron. Hazel stumps were killed by 2,4,5-T and were adversely affected by triclopyr.

An experiment in which wild flower seeds were introduced into a ryegrass sward using a tractor-mounted slot-seeder, indicated there is some potential for the technique. Wild flowers could be seeded into botanically uninteresting amenity swards using a slot-seeder, without undue disruption of the grass.

This feasibility study has examined herbicides and growth retardants for manipulating amenity swards, chemical control of scrub and direct seed introduction. As a feasibility study the results have demonstrated the potentials in these areas. Practical treatments which could be taken up by the amenity land manager without further work are those for grass growth retardation and scrub control. Further work on herbicides for sward composition manipulation and on wildflower introduction is required.

# 1. INTRODUCTION

This report presents the results of a three year Countryside Commission-sponsored study on the feasibility of using chemicals to manage rural amenity areas. The project arose after the Countryside Commission had identified potential financial and ecological benefits from using chemicals in amenity areas. In such areas as picnic sites and country parks the rising costs of maintenance are tending to result in less cared-for sites with rank vegetation. Attractive common flowers have beem lost as a result. Chemicals have successfully taken the place of manual and mechanical techniques in agriculture, and might be used in amenity situations as alternatives to grazing or mowing.

As the title of the project suggests the work has been broadly based, considering herbicides and plant growth regulators for use in picnic areas, country parks and other rural open spaces in public ownership. The project has been concerned with informal recreation areas in the countryside, not with urban parks, lawns or sports turf where the expectations of the public for standards of management are more stringent. Nevertheless, the results of the study may be relevant to such situations, and to others like road verges, field margins and farm tracks.

The initial objectives of the project were to assess the potential of chemicals for reducing maintenance or its cost, and for encouraging greater amounts of attractive common flowers.

## 1.1. The extent of amenity land in Britain.

A land-use classification of the United Kingdom gives 1,622,500 ha of rural uncultivated land which is not water, woodland or rough grazing (Callaghan et al., 1980). A further 522,000 ha of amenity land are found in urban situations.

The extent of "amenity grassland" in Britain has been estimated as 847,000 ha which amounts to 3% of Britain's land area (NERC, 1977). This total comprises all grass "with recreational, functional or aesthetic value, and of which agricultural productivity is not the primary aim". The range of functional categories and sites of amenity grassland assessed in the NERC study are given in Table 1.

Table 1

Functional and habitat categories of amenity grassland. (from NERC, 1977)

Intensively managed areas
- Bowling greens
- Golf greens
- Ornamental lawns
- Tennis courts
- Cricket squares
- Cricket outfields
- Golf tees
- Field sports stadia
- Football, rugby & hockey pitches
- Golf fairways
- Horse race tracks
- Greyhound tracks
- School playing fields

Trampled open spaces

Man-made
- Domestic lawns
- Urban parks
- Urban road verges
- Car parks

Semi-natural
- Golf rough
- Archaeological sites
- Rural road verges
- Waterway banks
- Picnic areas
- Forestry recreation areas
- Nature trails
- Camp and caravan sites
- Country parks
- Country estates, private
- National trust land
- Common land
- Nature reserves, open

Untrampled open spaces
- Cemeteries
- Military airfields
- Civil airports
- Railway embankments
- Motorway embankments
- Dam faces

Derelict land

Many of these situations are not countryside amenity areas, and it is the semi-natural open spaces with which this project has been concerned. Rural situations which are under the jurisdiction of local authorities, notably picnic areas and country parks, have been particularly studied. The area of various types of amenity grassland are summarised in Table 2.

Table 2.
Types of amenity grassland (from NERC, 1977).

| Type of grassland | Area (ha) |
|---|---|
| Bowling and golf greens | 2000 |
| Urban parks, cricket outfields, golf tees, school playing fields, Armed Services sports grounds | 202000 |
| Cricket squares, Armed Services ornamental lawns | 2000 |
| Golf fairways | 35000 |
| Domestic lawns | 90000 |
| Armed Services outfields and airfields | 45000 |
| Civil airfields | 11000 |
| Golf rough | 50000 |
| Road verges - District Councils | 25000 |
| Road verges, other areas - County Councils | 131000 |
| Caravan sites | 6000 |
| National Trust land | 92000 |
| Motorways verges | 6000 |
| Country parks and Nature Reserves | 69000 |
| Common land | 53000 |
| Railway embankments | 20000 |

A total of 400,000 ha of rural amenity grassland are relevant to this study, though road verges and common land have not been directy investigated. It should be stressed that these are areas of grass only, and do not represent the total areas which include woodland, water etc.

Data from the Countryside Commission show that in 1980 157 country parks, covering 19,200 ha were registered and had received grant aid. By 1982 the number had risen to 169 adding a further 500 ha or more. Grant-aided picnic areas have increased from 112 sites covering 623 ha in 1974, to 213 in 1982 covering over 1140 ha. Considerable numbers of such areas are not registered with the Countryside Commission as they have not received grant aid. Further land administered by County Councils and given under "other areas" in Table 2 is estimated as 30,000 ha (NERC, 1977). Part of this area includes Local Nature Reserves declared to the Nature Conservancy Council (NCC) amounting to over 11,800 ha. National Nature Reserves established by the NCC cover over 129,000 ha, a proportion of which are maintained under agreements with the landowners. Local Naturalist Trusts are responsible for increasing numbers of reserves and there are more than 1500 notified Sites of Special Scientific Interest (SSSI), mostly on private land. Such areas are not immediately relevant to this report, though the findings may prove useful to them.

To summarize, the report is concerned with upwards of 50,000 ha of amenity land; the results may be relevant to considerably larger areas of at least 400,000 ha if road verges, field margins, nature reserves, common land, even orchards, are included.

## 1.2. Amenity vegetation management.

### 1.2.1 Current management techniques for rural amenity areas.

Managers have to rely on the traditional methods of grassland management for most amenity situations. These techniques of cutting and grazing, and in a very few cases burning, have been reviewed by Wells (1980) and Green (1981).

Grazing animals, sheep, cattle and horses, have been traditionally stocked on grass areas in the countryside. The use of stock as grass management agents has increased over recent years, and different breeds of sheep have been investigated for use in Nature Reserves (Large & King, 1978). Welsh Beulah sheep are currently used by the Nature Conservancy Council on some chalk grassland reserves (Pers.comm. A Roberts). Management agreements with local farmers are often negotiated under terms the local authority can set. Grazing will keep the grass short, and in the case of sheep young scrub plants and undesirable speies such as ragwort (*Senecio jacobea*) will be browsed. However, the effects depend on which animals are stocked and at what stocking rate they are present. Horses, for example, are notoriously selective grazers. Low stocking rates may allow undesirable plants to establish. In the agricultural context Jones (1933) showed that stocking rate could affect the botanical composition of the sward. There are other problems with grazing; stockproof fencing is required, the animals need a water supply and they can interfere with or be interfered by the public in amenity areas. In many small amenity sites which are often open onto trunk roads, grazing is impractical and the authority is obliged to use other methods.

Mowing is the commonest maintenance technique. There are many types of cutters in use; managers have considerable choice in their use and rate of use. Manual methods using scythes are uncommon but many mechanical flail, rotary and cylinder cutters are available. The significant factors affecting choice are the standards that are required and the available resources, notably financial. The cheapest method of managing extensive grass areas is to gang-mow (Parker, 1982). Methods of cutting with smaller machines are progressively more expensive.

Burning is used rarely, as it is inherently dangerous and the aesthetic aspects in amenity areas are obvious. Nevertheless, the technique is useful for maintaining new heather growth in heathland, and Lloyd (1966) has noted its effect on maintaining species diversity and reducing scrub in limestone grassland. Chalk grassland which has become dominated by tor grass (*Brachypodium pinnatum*) can be burnt to reduce vegetative litter and encourage flowers (Green, 1980).

### 1.2.2 Problems facing amenity land managers.

In order to assess the major problems facing managers of amenity areas, informal meetings have been held with interested parties, correspondence with local authorities has continued, and a range of amenity sites have been visited. The discussions have identified the following areas:

- the costs of mowing small remote sites
- mowing banks and other areas where large machines cannot be used
- improving the botanical interest of grass, especially sown swards
- controlling rank vegetation and scrub

Site visits have confirmed these general areas as common problems.

Managers have been under increasing financial pressure, and as a result techniques and standards of maintenance have been re-examined. Standards of grass maintenance are variable; in urban situations lawn-like grass is expected; on road verges, sight lines must be clear; in heavily-used areas

grass must be short but vigorous enough to tolerate wear. There has been a tendency to mow less often in rural situations. On road verges a total cessation of cutting allows scrub species to appear. In amenity areas, tall-growing competitive species may dominate under relaxed maintenance and common flowers may be lost.

The role of standards of grass management in affecting the choice of techniques is illustrated by two country parks in Yorkshire. Canon Hall Park, Barnsley and Bretton Park, Wakefield are of a similar size and layout. Canon Hall is gang-mown while Bretton is grazed. The appearance of the grassland is different, though the costs involved may be similar. It could be argued that the rougher grazed grass is more appropriate for the countryside. Under park-like conditions most common flowers do not set seed and the trend towards botanically uninteresting grass has begun. Nevertheless, it can be argued that gang-mowing is cheap and the grassland fulfils its function of providing a green area for walkers, picnicers, footballers etc.

While improvements in technique for maintaining extensive grass areas are needed, the major problems identified were with smaller grass situations and the control of problem plants.

### 1.2.3. Amenity grassland management objectives.

In order to try to define the objectives of amenity grassland managers, a questionnaire was drawn up (Appendix I) inviting recipients to rank attributes of amenity swards and their management. A response relating to heavy wear areas, as well as moderate wear situations like picnic areas was requested. Information on the use of chemicals was also sought. The questionnaire was sent out in 1980 to 52 local authorities in England and Wales, and completed forms were received from 31 (60%) authorities. A total of 49 questionnaires were returned (several were sent to each council). Twenty-three authorities use chemicals for vegetation management (74% of authorities replying), and 8 of the 31 (26%) use chemicals on grassland, usually for control of docks and other broad-leaved weeds.

The questionnaires were returned from several sources, including Planning Departments, Surveyors Departments, Estates and Valuation Departments, and individual amenity areas, reflecting both official and personal views. The total response is summarised in Table 3. A summary of the official views of 25 counties (Table 4) was also drawn up. In a small number of counties, official replies were received from more than one department. In such situations official responses referring to country parks, as opposed to roadside verges, have been included in Table 4. Answers from individual site managers are shown in Table 5.

Analyses of questionnaires rely on many assumptions, and the results presented here should be interpreted with care. The median and mean rank scores for each attribute drawn from all replies, 25 official replies and 13 site replies are shown in Table 6. In heavy wear areas, managers unsurprisingly require wear tolerance above all else. A low maintenance requirement and low cost, together with a sward with no bare patches are given lower priority though replies indicated a range of views is held on their importance (Table 4).

In intermediate wear areas, managers hold a greater diversity of opinion on the listed attributes than in heavy wear areas. In lower wear areas high priority is given to low maintenance requirements, low cost and a lack of bare patches in the sward. The desirability of wear tolerance and a short sward is variable, wide views being held (Tables 3 & 4). The presence of common flowers, and the lack of rank weeds also received variable priority. The absences of coarse grasses and of grass flowering heads have low priority.

Table 3. Summary of all questionnaire replies on objectives of amenity grass management

Numbers of rank scores received for each attribute. (1 = most desirable, 10 = least desirable)

| | Attributes on heavy wear areas | | | | | | | | | | Attributes on moderate wear areas | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | A | B | C | D | E | F | G | H | I | J | A | B | C | D | E | F | G | H | I | J |
| 1 | - | 7 | 2 | 8 | 5 | - | - | 2 | 24 | 1 | - | 7 | 6 | 7 | 8 | 3 | - | 4 | 11 | 3 |
| 2 | - | 11 | 3 | 12 | 11 | 5 | - | - | 9 | 1 | - | 11 | 5 | 10 | 10 | 3 | - | 1 | 7 | 2 |
| 3 | - | 8 | 5 | 12 | 11 | 3 | - | 1 | 6 | 2 | - | 5 | 6 | 11 | 5 | 9 | - | 7 | 5 | 1 |
| 4 | - | 6 | 10 | 10 | 9 | 8 | 1 | 2 | 1 | 1 | - | 9 | 7 | 7 | 9 | 2 | 1 | 6 | 7 | 1 |
| 5 | 2 | 3 | 10 | 3 | 7 | 8 | 2 | 8 | 3 | 3 | 1 | 7 | 3 | 5 | 6 | 10 | 1 | 5 | 6 | 5 |
| 6 | 3 | 6 | 4 | 2 | 4 | 10 | 1 | 8 | 3 | 8 | 3 | 3 | 5 | 7 | 3 | 11 | 3 | 5 | 7 | 2 |
| 7 | 7 | 3 | 8 | 1 | - | 8 | 2 | 11 | 2 | 10 | 5 | 4 | 6 | 1 | 5 | 5 | 7 | 6 | 4 | 9 |
| 8 | 8 | 4 | 4 | - | 1 | 3 | 15 | 8 | 1 | 4 | 4 | 1 | 5 | - | 2 | 4 | 12 | 5 | - | 13 |
| 9 | 9 | 1 | 2 | - | - | 3 | 22 | 5 | - | 5 | 10 | 2 | 3 | - | 1 | - | 20 | 6 | 1 | 4 |
| 10 | 20 | - | 1 | 1 | 1 | 1 | 6 | 4 | - | 14 | 26 | - | 3 | 1 | - | 2 | 5 | 4 | 1 | 9 |
| Median rank | 9 | 3 | 5 | 3 | 3 | 6 | 9 | 7 | 2 | 7 | 10 | 4 | 5 | 3 | 4 | 5 | 9 | 6 | 4 | 8 |
| Mean rank | 8.6 | 3.9 | 5.2 | 3.1 | 3.5 | 5.5 | 8.4 | 6.7 | 2.0 | 7.4 | 9.0 | 3.8 | 5.0 | 3.5 | 3.8 | 5.0 | 8.2 | 5.8 | 3.7 | 7.0 |

Code of attributes:

A : Few flowering heads of grasses
B : No bare patches in the sward
C : Short sward
D : Low maintenance requirement
E : Low cost of maintenance
F : Lack of rank weeds
G : Lack of coarse grasses
H : Presence of common flowers
I : Tolerance to wear
J : Absence of yellowing on vegetation

Table 4. Summary of 25 official questionnaire replies

Numbers of rank scores for each attribute

| | Attributes on heavy wear areas | | | | | | | | | | Attributes on moderate wear areas | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | A | B | C | D | E | F | G | H | I | J | A | B | C | D | E | F | G | H | I | J |
| 1 | - | 4 | 1 | 5 | 3 | - | - | - | 11 | 1 | - | 3 | 3 | 6 | 6 | 1 | - | 1 | 2 | 3 |
| 2 | - | 7 | 2 | 6 | 6 | 2 | - | - | 5 | - | - | 6 | 1 | 7 | 6 | 1 | - | 1 | 2 | 1 |
| 3 | - | 3 | 3 | 3 | 6 | 3 | - | - | 4 | 2 | - | 3 | 2 | 4 | 4 | 6 | - | 4 | 1 | 1 |
| 4 | - | 2 | 4 | 8 | 4 | 2 | 1 | 1 | 1 | 1 | - | 4 | 4 | 3 | 4 | 1 | 1 | 2 | 6 | - |
| 5 | - | 3 | 5 | 1 | 4 | 4 | 1 | 4 | 2 | 1 | - | 3 | - | 2 | 2 | 6 | - | 3 | 6 | 3 |
| 6 | 1 | 3 | 4 | 1 | 2 | 7 | - | 3 | 1 | 3 | - | 2 | 2 | 2 | 2 | 5 | 2 | 5 | 4 | 1 |
| 7 | 3 | 1 | 4 | - | - | 3 | 2 | 9 | 1 | 5 | 3 | 2 | 5 | - | 1 | 2 | 6 | 3 | 3 | 3 |
| 8 | 4 | 2 | 1 | - | - | 2 | 11 | 3 | - | 1 | 2 | 2 | 2 | - | - | 1 | 7 | 2 | - | 7 |
| 9 | 5 | - | 1 | - | - | 1 | 9 | 4 | - | 3 | 6 | - | 3 | - | - | - | 8 | 2 | 1 | 2 |
| 10 | 12 | - | - | 1 | - | 1 | 1 | 1 | - | 8 | 14 | - | 3 | 1 | - | 2 | 1 | 2 | - | 4 |
| Median rank | 10 | 3 | 5 | 3 | 3 | 6 | 8 | 7 | 2 | 7 | 10 | 4 | 7 | 2 | 3 | 5 | 8 | 6 | 5 | 8 |
| Mean rank | 9.0 | 3.6 | 5.0 | 3.2 | 3.2 | 5.6 | 8.1 | 7.0 | 2.4 | 7.4 | 9.2 | 3.9 | 5.9 | 3.0 | 3.0 | 5.1 | 7.8 | 5.7 | 4.7 | 6.6 |

(Rank 1 = most desirable, 10 = least desirable).

Table 5. Summary of questionnaire replies from 13 amenity areas

Numbers of rank scores for each attribute

| | Attributes on heavy wear areas | | | | | | | | | | Attributes on moderate wear areas | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | A | B | C | D | E | F | G | H | I | J | A | B | C | D | E | F | G | H | I | J |
| 1 | - | - | 1 | 1 | 1 | - | - | 2 | 8 | - | - | - | 1 | - | 1 | 1 | - | 3 | 7 | - |
| 2 | - | 1 | 1 | 6 | 2 | 2 | - | - | 1 | - | - | 2 | 3 | 2 | 1 | 2 | - | - | 3 | - |
| 3 | - | 3 | 2 | 2 | 5 | - | - | - | 1 | - | - | 2 | 2 | 3 | 1 | 1 | - | 2 | 2 | - |
| 4 | - | 3 | 2 | 2 | 2 | 4 | - | - | - | - | - | 5 | 1 | 3 | 3 | - | - | - | - | 1 |
| 5 | 2 | - | 2 | 1 | 1 | 2 | - | 4 | - | 1 | - | 3 | 2 | 1 | 3 | 2 | 1 | - | - | 1 |
| 6 | - | 3 | - | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 4 | - | 5 | - | - | - | - |
| 7 | 3 | 2 | 1 | - | - | 1 | - | 1 | 1 | 4 | 2 | - | - | - | 4 | - | 1 | 1 | 1 | 4 |
| 8 | 3 | 1 | 2 | - | 1 | - | 2 | 3 | 1 | - | 1 | - | 2 | - | - | 2 | 2 | 3 | - | 3 |
| 9 | 2 | - | 1 | - | - | 2 | 6 | - | - | 2 | 3 | - | - | - | - | - | 7 | 2 | - | 1 |
| 10 | 3 | - | 1 | - | - | - | 4 | 2 | - | 3 | 6 | - | - | - | - | - | 2 | 2 | - | 3 |
| Median rank | 8 | 4 | 5 | 2 | 3 | 5 | 9 | 6 | 1 | 7 | 9 | 4 | 4 | 4 | 5 | 6 | 9 | 8 | 1 | 8 |
| Mean rank | 7.8 | 4.6 | 4.3 | 3.3 | 3.9 | 5.5 | 8.9 | 6.3 | 2.4 | 8.0 | 8.5 | 4.1 | 3.6 | 3.6 | 4.4 | 5.5 | 8.5 | 6.3 | 2.3 | 8.2 |

(Rank 1 = most desirable, 10 = least desirable)

Table 6. Questionnaire results.

| | Attributes on heavy wear areas | | | | | | | | | | Attributes on moderate wear areas | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Few grass heads | No bare patches | Short sward | Low maintenance | Low cost of maintenance | Lack of rank weeds | Lack of coarse grasses | Presence of common flowers | Tolerance to wear | No yellowing on sward | Few grass heads | No bare patches | Short sward | Low maintenance | Low cost of maintenance | Lack of rank weeds | Lack of coarse grasses | Presence of common flowers | Tolerance to wear | No yellowing on sward |
| **MEDIAN RANK** | | | | | | | | | | | | | | | | | | | | |
| All replies (49) | 9 | 3 | 5 | 3 | 3 | 6 | 9 | 7 | 2 | 7 | 10 | 4 | 5 | 3 | 4 | 5 | 9 | 6 | 4 | 8 |
| Official County replies (25) | 10 | 3 | 5 | 3 | 3 | 6 | 8 | 7 | 2 | 7 | 10 | 4 | 7 | 2 | 3 | 5 | 8 | 6 | 5 | 8 |
| Site replies (13) | 8 | 4 | 5 | 2 | 3 | 5 | 9 | 6 | 1 | 7 | 9 | 4 | 4 | 4 | 5 | 6 | 9 | 8 | 1 | 8 |
| **MEAN RANK** | | | | | | | | | | | | | | | | | | | | |
| All replies (49) | 8.6 | 3.9 | 5.2 | 3.1 | 3.5 | 5.5 | 8.4 | 6.7 | 2.0 | 7.4 | 9.0 | 3.8 | 5.0 | 3.5 | 3.8 | 5.0 | 8.2 | 5.8 | 3.7 | 7.0 |
| Official County replies (25) | 9.0 | 3.6 | 5.0 | 3.2 | 3.2 | 5.6 | 8.1 | 7.0 | 2.4 | 7.4 | 9.2 | 3.9 | 5,9 | 3.0 | 3.0 | 5.1 | 7.8 | 5.7 | 4.7 | 6.6 |
| Site replies (13) | 7.8 | 4.6 | 4.3 | 3.3 | 3.9 | 5.5 | 8.9 | 6.3 | 2.4 | 8.0 | 8.5 | 4.1 | 3.6 | 3.6 | 4.4 | 5.5 | 8.5 | 6.3 | 2.3 | 8.2 |

It had been intended that the questionnaire would also give some insight into the acceptability or otherwise of the effects of particular chemical treatments. Unfortunately the design of the questionnaire has not elicited this information. For example, bare patches are reported as undesirable. Nevertheless, gaps in swards may be necessary for the survival of particular species (Grubb; 1976). Would certain types of gap be acceptable? Lack of yellowing on the vegetation, lack of coarse grasses, and lack of grass flowering heads are given low priority. Using this questionnaire it is not possible to decide if such attributes are of no importance, or simply of slight importance in comparison to cost. It is therefore unfortunate that, for example, the desirability of grass head suppression, which has been observed to encourage good sward appearance in late season with no cutting, cannot be guaged. Nevertheless, several points are well illustrated by the questionnaire.

1. There is considerable interest amongst local authorities in grassland management. 60% of authorities returned questionnaires.
2. Current financial considerations are all-important. Low cost and low maintenance requirements are consistently given high priority.
3. Site appearance is important. Vegetation cover and wear tolerance are given high priority.
4. Most local authorities (74%) use chemicals for some form of vegetation control.
5. Some authorities use chemicals for grass weed control, and are therefore already equipped for sward spraying.

The objectives of amenity land managers in picnic areas are to provide ground cover at low cost, requiring little maintenance. Useful techiques would have to reduce the amount and cost of management, while causing minimal damage to the appearance of the area. The promotion of a short sward made up of finer grass species and containing short flowering herbs might achieve these aims.

## 1.3. The ecology of amenity areas.

Amenity sites occur on a variety of soils and in many situations across the UK. Country parks on acid moorland, lowland farmland and on limestone and chalk can be found. The vegetation that these sites support is markedly different, but some generalisations about their ecology are useful. Rural recreation areas are by definition open to the public and are usually grassland or open heath and woodland. Overgrown areas are undesirable, unless designed as wild areas, so rank grasses and herbs, brambles and scrub need to be controlled. If land is left unmanaged, it will not remain as it is. The vegetation will change, from open grass to scrub and in Britain to ecologically stable woodland and forest. This process is termed succession; the stages of succession are termed seres and final vegetation is called climax. In most of Britain the climax vegetation is deciduous forest. The progress and final outcome of succession is dependent on many factors, such as soil type, nutrient status, availability of invading species etc. The processes are predictable in a limited sense, and may be fast or slow. For example, succession may be delayed if total vegetation cover is maintained (Ward, 1979). A classic example of succession is the development of scrub, notably hawthorn, on chalk grasslands after the rabbit population was decimated by myxamatosis in the 1930's. As a general principle, vegetation succession needs to be controlled in order to maintain open areas.

Grassland in semi-natural areas is a plagioclimax; that is, succession has been halted in some way. In the case of chalk grassland, it was the combination of sheep and rabbit gazing which maintained a short diverse sward. It is the role of management to halt succession and create new ecological balances; different management regimes will create different systems. It may be sufficient to control the arrival of succeeding (undesirable) species in some situations. However, there may also be changes in the physical and chemical

environment with time, which create opportunities for other plants.

The species composition of amenity areas is determined by many factors, including environmental and soil variables, previous history (e.g. seed mixture), management and wear. Soil pH and nutrient status are important determining factors. High or low soil pH values are correlated with low nutrient status, and often with high numbers of plant species (though extremes allow only a few species to survive). Neutral soils are typically productive environments where species capable of rapid growth can dominate. Many amenity sites fall into this category and managers are aware that the grass grows rapidly. If maintenance is relaxed, those tall, rapidly-growing coarse species such as tall oat grass (*Arrenatherum elatius*) can take over. Nutrient-rich amenity sites are typically dominated by a small number of competitive plant species.

Low nutrients create a stressed environment for plants (Grime, 1979). Rapidly growing species are not able to survive, while shorter, slow-growing (more desirable, for amenity purposes) species are present. Such stressed environments tend to be more heterogeneous, e.g. having variable soil depths, and this may create opportunities for greater numbers of species to occur. The botanically most diverse ecosystem in Britain is chalk or limestone grassland. Many species may survive in the sward through their ability to exploit particular circumstances, e.g. gaps created by hooves, and dung or urine patches, (Grubb,1977). A cessation of grazing such areas results in coarse grasses growing and subsequent invasion by scrub. Once the scrub is present, its removal without other management will not allow the reappearance of the typical flora. Green (1972) argues that as succession proceeds, nutrients accumulate by deposition, nitrogen fixation and weathering. In the chalk situation, sheep grazing may not only have disturbed the sward, creating gaps for species to exploit, but may have maintained low nutrient status by exporting nutrients from the downs to the lowland.

Another botanically diverse situation (now rarely found) is the traditional hay meadow. Meadows were allowed to grow on into late summer before cutting. The hay was taken off the fields and the late growth (or aftermath) was grazed, usually by cattle. In this situation as well, there is a net export of material from the land, though such meadows were fertilised with farmyard manure, perhaps every three years.

It would appear that nutrient removal may be a useful management aim. This might be achieved by grazing or by cutting and removing the clippings. However, this may not work in practice. Wells (1980) examined the effects of removing or returning cuttings from a chalk sward over eight years. Grass was analysed for major nutrients, but there was only a significant decline for phosphorus and magnesium. The practice of removing grass cuttings is found on road verges in the Netherlands. Where the swards already contain a meadow flora, management maintains it. The removal of cuttings as a remedial treatment has achieved reduced production, but not encouraged a herb-rich flora (Pers.com. J. van Groenendael). The lack of sufficient propagules of desirable species may be one of the limiting factors, and further work is continuing.

Nutrient removal may also be effected by burning, though reports indicate that only nitrogen is lost to the atmosphere. Arianatsou & Margaris (1981) noted that the bulk of phosphorous and potassium remained after burning a Meditteranean habitat. Another benefit of burning is the removal of vegetative litter. The removal of tor grass (*Brachypodium pinnatum*) litter by burning can allow other desirable chalk grassland species to regenerate (Green, 1980).

The direct ecological effects of various management techniques have been alluded to above. Grazing is more selective and diversifying than cutting. Animals pull the grass while grazing, and leave hoof marks, dung and urine. The

effects of animals are dependent on species (horses, cattle, sheep, deer), stocking rate and the time of year they are present. Cutting is less selective, as all the material above the blades is severed. There is no deposition of dung and there is a different form of trampling. Nevertheless, scrub species can be kept at bay by both grazing and cutting. The effects of different sorts of cutting machine on the sward are not well known. Work on road verges has indicated that different cutters do not cause significantly different changes in the flora (Way, 1970). However, different frequencies and the timing of the first cut affect the sward. Jones (1939) has also shown that cutting frequency can affect agricultural sward composition; infrequent mowing can favour cocksfoot (*Dactylis glomerata*).

To summarize an ecological perspective of amenity site management it may be stated:

- maintenance must halt succession
- low nutrient status, slow growth rates and high botanical interest go together
- high nutrient status encourages rapid sward growth and dominance.

The improvement of the botanical diversity of amenity swards is a legitimate aim of management. But it must be recognised that wear tolerance is a factor to consider. Wear-tolerant species and varieties tend to be rapid-growing plants which require high nutrient inputs. If such plants are untrodden or undermanaged they become untidy. However, any amenity site is a mosaic of areas receiving different use. It is probable that heavy wear areas can be identified and managed to withstand trampling, while other areas can be managed to promote short interesting swards. If reduced maintenance is the aim of amenity land managers, then it would seem apropriate to aim for short, slow-growing swards, and some form of nutrient removal system might achieve this. Remedial treatments such as continued cutting and grass removal, may involve more maintenance than currently received in many nutrient-rich sites. In others, the development of traditional meadow culture may be enough. In some extensively gang-mown sites, a relaxation to cutting for hay in late summer may allow the development of attractive swards. The potential role of chemicals in managing these sites is explored in the following section.

## 1.4. The potential use of chemicals to manage rural amenity sites.

Herbicides and growth regulators are widely used in agriculture, horticulture, forestry and to some extent in aquatic situations. Effective weed control can be achieved using chemicals, and the techniques are labour - and therefore cost-saving. Recommendations for the control of herbaceous vegetation in non-agricultural land also exist (Fryer & Makepeace, 1978) though these usually refer to total vegetation control or selective weed elimination only. Interest in more novel uses of chemicals for amenity areas is increasing (e.g. Haggar, 1980). Chemicals are already used by many local authorities for weed control (Section 1.2.3.), but usually only for total weed control on paths and around buildings, though chemical control of broad-leaved weeds in turf is also reported.

The chemicals which are currently cleared by the Pesticide Safety Precaution Scheme, and approved by the Agricultural Chemicals Approval Scheme for use in agriculture now number 208, of which 84 are herbicides, growth regulators and soil sterilants (MAFF, 1982). The two former types of chemical are relevant to this report. Such compounds may be active against plants either through the foliage, through the roots, or by a combination of uptake by shoots and roots. The spectrum of plant species which are affected by a herbicide may be narrow or broad. Some compounds, e.g. glyphosate, are effective against most plant species. Others may be active against grasses only, e.g. dalapon, or inactive on grasses, e.g. 2,4-D and mecoprop. The activity of these compounds may be affected by environmental conditions (Caseley, 1980). The selectivity of

these compounds under agricultural conditions are fairly well understood and narrow selectivities have been developed, e.g. wild oat herbicides. However, the effects of chemicals on non-agricultural, and agriculturally unimportant plant species are not well known.

Herbicides can be applied in a number of different ways. Conventional sprayers with hydraulic nozzles apply liquid at between 100 and 1000 l $ha^{-1}$; on the farm a rate of 200 l $ha^{-1}$ is common. Tractor-mounted multi-nozzle boom sprayers cover the weeds and the crop, be it grass, cereals etc. There are hand-held knapsack sprayers which can be used for limited areas, or for spraying discrete patches (of weeds). Soil-active compounds can be sprayed onto the soil surface, or if necessary they may be incorporated below the surface. Developments of controlled droplet application (CDA) where the spray is made up of uniform size drops, has led to both mechanically-mounted and hand held applicators capable of low volume spray rates (c. 10 l $ha^{-1}$). Further developments for spraying, which are still at the experimental and trials stage, include various methods of electrically charging the spray drops. Various techniques for applying chemicals selectively, i.e. to those target weeds, and not the desirable or crop plants, have been produced (Lutman, 1980). The commonest rely on wiping the chemical onto the plant. Tractor-mounted rope-wick applicators and rollers are available, and there are also small hand-held rope-wick applicators on the market.

In the amenity context chemicals may be useful for maintaining sites and also for remedial treatments of areas. In the first instance chemicals can be used for straight forward weed control. Examples include control of brambles, nettles, thistles and woody scrub species. It should be noted that occupiers of land are required to avoid the spread of specified injurious weeds under the Weeds Act, 1959. The five listed species are creeping thistle (*Cirsium arvense*), spear thistle (*C.vulgare*), curled dock (*Rumex crispus*), broad-leaved dock (*R.obtusifolius*) and common ragwort (*Senecio jacobaea*). In practice, the powers given to the Ministry of Agriculture for the containment of these species are rarely invoked and only when agricultural land is directly threatened.

Chemicals might also be used as a maintenance technique in place of mowing, for example, or for the manipulation of species composition towards desirable ends. Using the retardant maleic hydrazide, Willis (1972) reported changes in roadside swards to finer grass species with the suppression of tall species.

Selective elimination of dominant plant species should encourage diversity at a new equilibrium of species. This might be achieved by application of a selective chemical, or by applying a generally-active compound, just to those plants which require elimination. A check on sward growth might result from applications of low doses of generally-active chemicals, or this might be achieved by growth retardants. A reduction in amounts of grasses might encourage the growth of common flowers, and so improve the appearance of sown swards. Sward manipulation and weed control are usually dependent on selectivity between target plants and desirable ones. Selectivity can be achieved by using compounds inherently ineffective on desirable species and which are applied overall. Alternatively, compounds might be applied only to the target plants. In practice, the spectrum of plants that are susceptible to chemicals is dependent on dose, growth stage and time of year. Different selectivities might be exploited by changing the dose applied, or the time of year applications are made.

Single applications of a herbicide or growth retardant will usually cause only temporary effects on a sward. Species which are directly affected will usually recover to their previous equilibrium. The entire population of a suseptible species is never eliminated by a single spray; for example, young plants may be protected in the sward canopy. The species can often recolonise a treated area, either from within from unaffected propagules, or from adjacent

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