

Symposium Proceedings

ROAD VERGES IN SCOTLAND

THEIR FUNCTION AND MANAGEMENT

Edited by,

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David Hume Tower,
Edinburgh.

Friday 3rd April 1970

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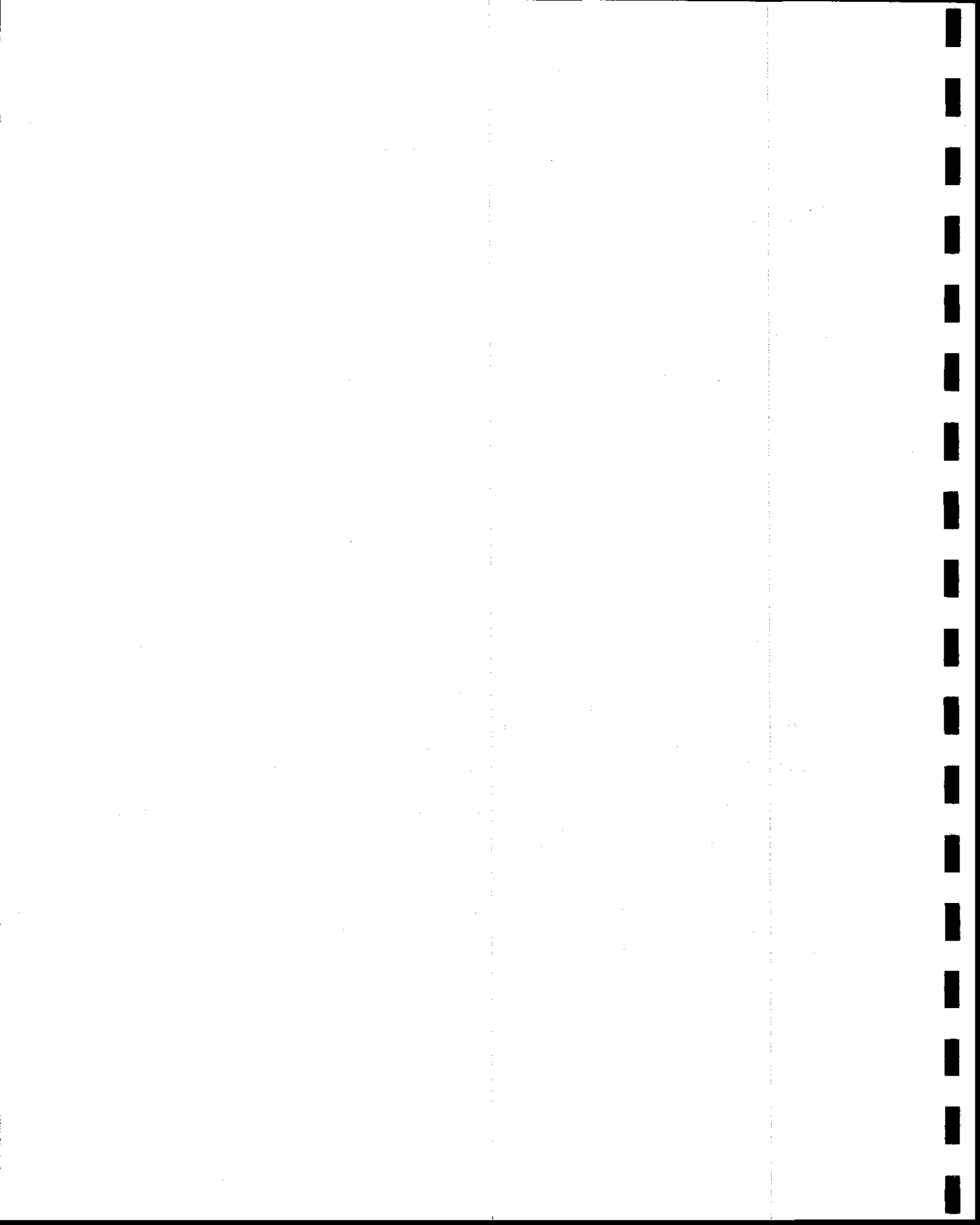


TABLE OF CONTENTS

Chairman

SIR CHARLES CONNELL

Morning Session

Opening address

SIR CHARLES CONNELL

"Further Observations on the Management of
Road Verges for Amenity and Wildlife"

J. M. WAY page 1

"Conservation of Roadside Verges in Scotland"

B. GILCHRIST page 14

"The Farmer on Roadside Verges"

H. WALLACE MANN page 19

"The Use of Chemicals in the Management of
Roadside Vegetation: long term studies of
the effects of spray treatment"

A. J. WILLIS page 23

DISCUSSION

Afternoon Session

"The Importance of Road Verges in a Rural County"

F. B. DRYBURGH page 35

"Grass Verges in Built-up Areas"

R. J. B. THOMSON page 44

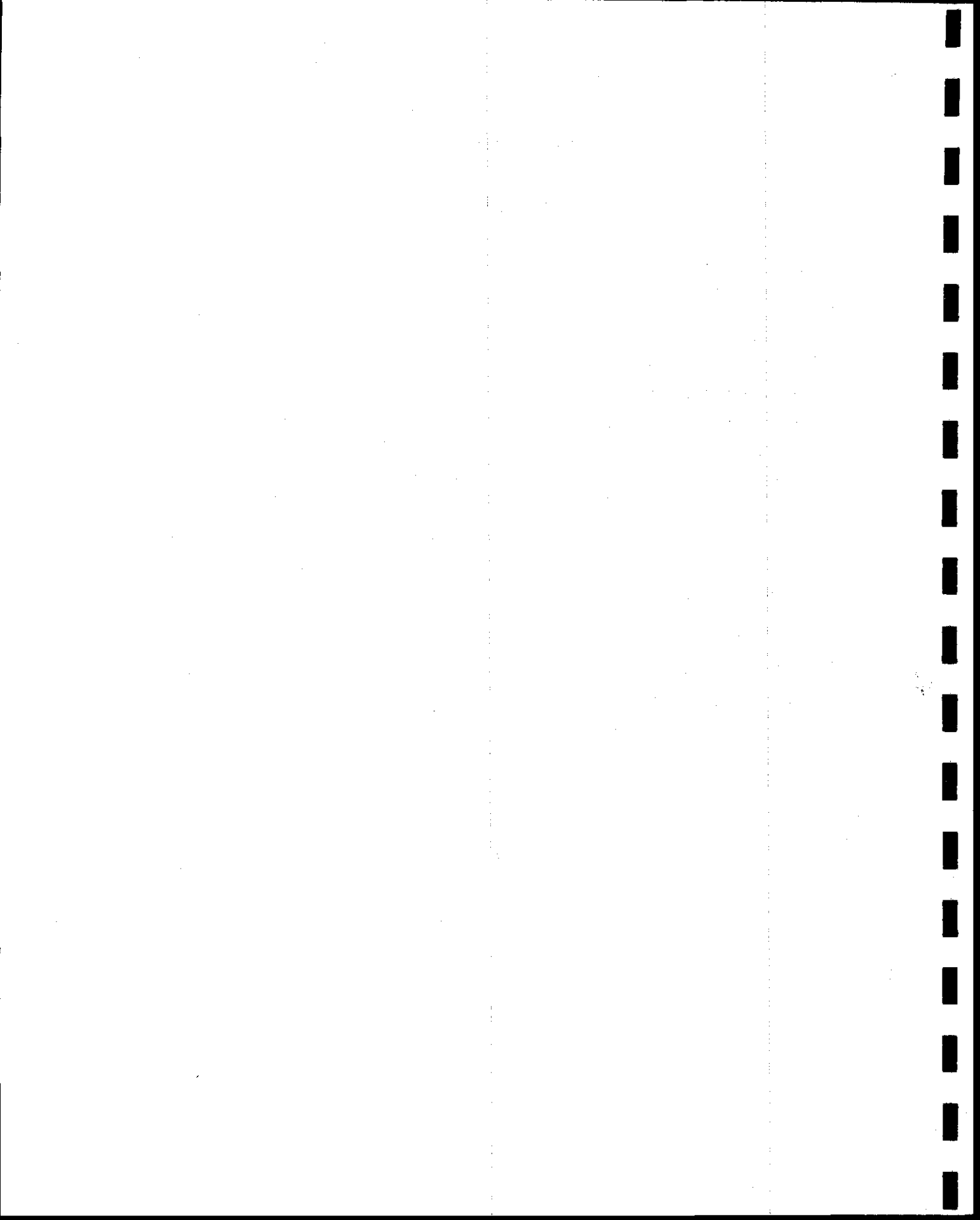
"On the Verge of some Problems or the Problems
of some Verges"

T. HUXLEY page 49

DISCUSSION

SUMMING UP

F. INGLIS ESQ.



FURTHER OBSERVATIONS ON THE MANAGEMENT OF ROAD VERGES FOR AMENITY AND WILDLIFE.

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The reasons why wildlife conservationists are concerned about roadside verges was probably sufficiently expressed at the London Symposium (Way, 1969), especially in the papers by Perring and Streeter, not to need repeating here. However, it has been suggested that the London Symposium was only really relevant to the lowland parts of England and that the situation in Scotland and Northern England might be rather different so far as wildlife was concerned.

As a generalisation this may be so and the reasons for any difference, apart from latitude and climate, would be of adjacent land use, of animal grazing and specifically of whether or not the highway was enclosed.

Now most of the highways in lowland Britain, except in some wooded areas or other special places such as commons, are enclosed or where the boundary hedges are being removed in arable areas, are not accessible to large wild or domestic herbivores. This would be as true for Wales and Scotland as for England so that in lowland parts of Scotland there is no reason to suppose that road verges are of any less actual or potential value as a wildlife habitat than in Southern England. In fact, in Scotland, because many species of plants may be nearing the norther limit of their range, the value could often be greater, particularly as the greatest density of roads is in just those lowland districts where these plants might be found. However, in upland regions of Britain, many roads are unenclosed and are grazed, mainly by sheep and deer. The proportion of these roads in Scotland is greater than in England. Thus, because a large part of Scotland is upland country where there are fewer roads, many of which are unenclosed, the overall conservation importance of the verges is different.

In upland, unenclosed, areas the growth of roadside vegetation rarely poses a problem to the highway authority, either because the plants themselves do not grow to an objectionable height, or because the verge is grazed. It is worth noting that whilst this holds good for verges that have not been disturbed by roadworks over a long period of time (where stable communities of mainly local, native plants have developed), in areas of newly established verges a regime of management of the sown grasses may be required. However, because of the enormous acreage of natural vegetation all around, it must be concluded from a wildlife point of view that the contribution of unenclosed road verges in upland areas to conservation will be very small. Any management for other than engineering or safety reasons is more likely to be for amenity, often on

an opportunity basis.

In both upland and lowland areas where the highway is enclosed, there will be a qualitative difference in the vegetation of the road verge compared to that of adjacent land. Furthermore, because the verges are not generally grazed, some form of management will be necessary. In order to maintain the characteristic wildlife habitat of grass verges, it is as important to manage them as it is for engineering reasons. No one would claim that all grass verges in isolation have any particular conservation value but as in England, because road verges are continuous and because of the difference in management from adjacent land, they do in aggregate have a considerable importance as a wildlife habitat and communications system. Some individual verges, where rare plants grow or where there is a particularly rich diversity of plants, do in themselves have importance. The interest of these verges is often a result of traditional forms of management over long periods of time, with the consequent development of more or less stable closed sward communities. In terms of numbers of different species of plants (diversity) in a given area, continuity of a particular form of management is usually necessary. This continuity of management allows the gradual build up of the many species that are in fact adapted to the particular conditions being created but most of which were not present in the beginning. Over a long period stable situations are sometimes, not always, established where there is a resistance to successional changes, as for instance from grassland to scrub. On the other hand, widely changing methods and intensity of management in a short period often lead to rapid successional changes because no one plant community has an opportunity to develop; a concomitant result of this is often poor diversity of species and low grade wildlife habitat. However, there is much to be said for having different management regimes in neighbouring places - thus on one verge a flail might be used once in the season, on another a cutter bar several times, on another a chemical growth retarder such as Maleic Hydrazide. In this way in adjacent areas a range of plant communities differing in detail might be built up over a period of time. In the less intensively managed parts of road verges (and other similar areas of land of 'secondary economic importance') there are also the successional plant communities characteristic of rotational forms of management such as scrub control, coppicing and so on. These in their place are equally desirable.

With new areas, such as motorway banks, a schedule of management regimes has to be evolved to take care of the rapid changes in the first few years after establishment from the sown species and the weedy species of disturbed ground to a more permanent community. There are great opportunities in these areas for a sequence of sowing and management programmes designed to encourage plant communities, that, once developed, can be relatively simply managed over a period of time to provide stable and diverse wildlife habitats which are acceptable in other ways to the land-owner, authority or undertaking immediately concerned.

The use of chemicals to control vegetation in situations such as road verges has been viewed by plant and animal ecologists with a good deal of suspicion. This is largely based on the fact that the herbicides which are used, selectively kill plants or alter their competitive ability in a quite unnatural manner usually leading to a species poor community. Now all forms of management affect the competitive ability of plant species in a community but cutting (as a management tool) is in many ways similar to grazing. A whole range of plants are adapted to grazing, and come together in time under this form of management to form the characteristic flora of pasture land. Similar communities develop in grassland subjected to cutting. Herbicides such as 2,4-D selectively kill broad-leaved plants and also appear to affect the growth of some grasses (see below and also Willis, this symposium) after some years of application, tending to produce a simple, species poor community in which herbs are generally absent. This is of course what herbicides are designed to do in agriculture, but in non-agricultural land this result would be considered bad by most ecologists and all conservationists. Nevertheless, in particular areas, usually of recently disturbed ground, where significant stands of injurious weeds (as defined by the Weeds Act 1959) are present adjacent to agricultural land, the use of a suitable selective herbicide to control them would be quite justified. A distinction must be made here between herbicides and the more specialised group of compounds known as Growth Inhibitors or Growth Retarders, of which Maleic Hydrazide (MH) is the only one generally available. MH affects the competitive ability of plants in a selective way, inhibits flowering and is especially effective on grasses. It does not, at the dose rates used, normally kill plants directly and because of its inhibiting effect on grass growth, often encourages the growth of herbs. Although the resulting swards do not always appear entirely natural, they can be species rich.

A great deal is written and said about weeds on road verges and highway authorities are under constant pressure to control them. Two classes of plants may be considered as weeds on road verges: (a) those that affect the highway and (b) those that affect the adjacent landowner, especially if he is a farmer. Generally speaking, plants in the first class are not agricultural weeds but are usually tall growing biennial or perennial plants that affect visibility and safety. Where these plants grow on straight roads, on the outside of bends, or in other places where they do not cause an obstruction, they can scarcely be classed as weeds and there is no justification on this count for their destruction. Many of them, especially the Umbellifers such as Cow Parsley (Anthriscus sylvestris), Cow Parsnip or Hogweed (Heracleum sphondylium) and Sweet Cicely (Myrrhis odorata), and the Composites, Hardheads (Centaurea nigra) and Field Scabious (Knautia arvensis) are extremely valuable for wild insects and the birds that feed on them. Agricultural weeds can be basically divided into those aggressive annual species of plants which together with a number of rhizomatous grasses make up the bulk of the weeds of cultivated ground, or into plants of natural grassland which,

when they occur in pastures, become weeds. On the whole, well managed leys are substantially weed free, because the grass sward is sufficiently tight to exclude casual introduction of weedy plants. So far as pastures are concerned, management is paramount in weed control. No amount of destruction of weed species in neighbouring areas (such as road verges) will affect the degree of infestation of a pasture that is inherently weedy because of the level of weed seeds in the soil; or a pasture that is overgrazed, or under fertilised, or even one that is badly undergrazed. Weeds of cultivated ground (e.g. frequently disturbed ground) are not characteristic plants of closed community grass swards on undisturbed ground, such as road verges may generally be considered to be. The test of this is to go and look at any established road verge and see how many of the weeds occurring in adjacent cultivated ground also occur on the verge. If there are any, to consider how many of the weedy plants there are in the verge compared to the field, and the significance of the seed being dropped in the soil of the field by the weeds already there compared to any that might be transported from the verge. Couch grass (Agropyron repens) is a special case often specifically mentioned. The plant occurs on road verges and seeds there, but the seed is heavy and not windborne; it seems unlikely that it would be eaten and pass undigested through the gut of the birds to be spread in that way. The principle method of spread by this plant is in any case by the well known underground rhizomes, but no amount of cutting will prevent their spread although it does appear (see below) that some cutting treatment will reduce the density of above ground shoots. In general the management techniques practicable on the majority of road verges will not prevent the plant from spreading so there is no reason to apply management to control it specifically. Wild oat (Avena fatua) is rarely found on road verges and when it is, can be assumed to have spread there from a neighbouring field. It is true that when verges have been newly established, or disturbed by roadworks or farm machinery, or in some other way, they will so long as they are disturbed, support a flora containing populations of weedy plants. There is no doubt these should be controlled; if necessary by the use of herbicides, if a real danger of spread into adjacent clean land seems likely. In general, although farmers' concern for the presence of plants on verges as potential sources of weeds on their land really is appreciated, it is probable that this concern is often out of all proportion to the actual hazard. In many instances, the plants complained of are not agricultural weeds of economic status and in some instances do not occur in cultivated land at all.

MANAGEMENT EXPERIMENTS

Country Roads

The two experiments in Huntingdonshire and Cambridgeshire reported on at the London Symposium (Way, 1969A) were continued in 1969 for the fifth year in succession. The treatments are shown in Table 1, where it should be noted that treatment 19 was sprayed with MH (as treatment 3) for the first time, and that treatment 20 was sprayed with MH and subsequently cut in June (as treatment 4) for the first time in 1969. These

TABLE 1

Treatments applied to experimental plots on road verges in
Cambridgeshire and Huntingdonshire.

		Operation in third week of:					
		April	May	June	July	August	September
1.	Untreated						
2.	Untreated						
3.	Maleic hydrazide	spray					
4.	Maleic hydrazide and cut later	spray		cut			
5.	Maleic hydrazide and 2,4-D	spray					
6.	Maleic hydrazide and 2,4-D; cut later	spray		cut			
7.	2,4-D	spray					
8.	2,4-D and cut later	spray		cut			
9.	Flail twice		cut			cut	
10.	Flail five times		cut	cut	cut	cut	cut
11.	Haymower twice, cuttings raked		cut			cut	
12.	Haymower 5 times, cuttings raked		cut	cut	cut	cut	cut
13.	Haymower twice, cuttings NOT raked		cut			cut	
14.	Haymower five times, cuttings NOT raked		cut	cut	cut	cut	cut
15.	Rotary mower twice		cut			cut	
16.	Rotary mower five times		cut	cut	cut	cut	cut
17.	Haymower once			cut			
18.	Haymower once				cut		
19.	Maleic hydrazide	spray					
20.	Maleic hydrazide and cut later	spray		cut			

two treatments are thus not comparable with the others in terms of age. In treatments 3, 4, 19 and 20, and also in treatments 5 and 6, MH was applied at 5 lb/ac a.i. as Regulox 36 W; in treatments 7 and 8, 2,4-D was applied at 5 lb/ac a.e. as Vergemaster but in the combined spray treatments (5 and 6) at 3.5 lb/ac a.e. In all cases the sprays were applied at 80 gallons per acre and 30 p.s.i. The flail mowers were in both cases side mounted Lupat machines; the rotary mower was a small hand propelled garden machine and the haymowers were of the conventional tractor mounted reciprocating cutter bar type.

The height of the vegetation was measured at monthly intervals from May to September, colour photographs of the plots were taken and records were made of the plants in flower on each occasion in each plot. Presence/absence records of plants in forty 15 cm quadrants per plot were made in July/August.

The numbers of species of plants that flowered in each treatment are shown in Table 2.

In terms of diversity (i.e. numbers of species of different plants) the only clear cut effect was that of 2,4-D which reduced it. However, it is of interest that there was probably a greater reduction from 2,4-D at 5 lb/ac (7 and 8) at Keyston (Huntingdonshire), and possibly also at Ickleton (Cambridgeshire), than from 2,4-D at 3.5 lb/ac when mixed with MH (5 and 6). This Table only tells part of the story as it is based on any record of a plant in flower, whilst in fact one plot might be a mass of inflorescences of a given species and another plot might have one flower only. A similar analysis of the total number of species recorded per treatment, regardless of whether they flowered or not, did not show any consistent pattern of effect except where 2,4-D had been used and there was a reduction in the number of species.

Results of the quadrat counts are beginning to show some patterns of effect on individual species but these are still too variable to describe in detail. The effects of MH on vegetation over a period of years are described by Willis (this Symposium) for a site in Gloucestershire and essentially similar results are being recorded in my trials. With 2,4-D and the mixed spray of the two compounds, differences in detail are also apparent, both in relation to time (i.e. changes reported by Willis in his trial to have occurred in 4 seasons, are still not consistently apparent after 5 seasons in trials here) and to effects on species composition, attributable to site differences. Of the three machines, the haymower produces a less even cut and does not cut so close as the other two machines, which in the hands of an unskilled or tired operator can damage the sward. Both of these machines (flail and rotary cutter) should be fitted with jockey wheels or rollers to prevent them from cutting too close to the ground. In general terms the effects of cutting in May and September (treatments 9, 11, 13 and 15) or in June (treatment 17) are on

TABLE 2

Total number of species of plants flowering during 1969 for each treatment in experiments in Cambridgeshire and Huntingdonshire

Treatment number	Treatment	ICKLETON Cambridgeshire Site			KEYSTON Huntingdonshire Site		
		Herbs	Grasses	Total	Herbs	Grasses	Total
1	Untreated	29	9	38	19	13	32
2	Untreated	29	8	37	22	11	33
3	MH	29	6	35	26	10	36
4	MH + Cut	28	7	35	24	7	31
5	MH + 2,4-D	17	6	23	21	11	32
6	MH + 2,4-D + Cut	12	6	18	16	8	24
7	2,4-D	8	9	17	4	13	17
8	2,4-D + Cut	12	7	19	5	11	16
9	Flail x 2	28	8	36	26	10	36
10	Flail x 5	30	7	37	19	11	30
11	Haymower x 2 Raked	31	9	40	24	13	37
12	Haymower x 5 Raked	30	6	36	27	8	35
13	Haymower x 2 not raked	27	9	36	23	12	35
14	Haymower x 5 not raked	30	7	37	25	10	35
15	Rotary mower x 2	31	9	40	19	12	31
16	Rotary mower x 5	24	8	32	25	10	35
17	June only	27	8	35	21	8	29
18	July only	33	10	43	19	13	32
19	MH	30	11	41	25	7	32
20	MH + Cut	25	7	32	26	12	38

the one hand to allow the later summer flowering plants to develop and on the other, to allow spring flowering plants. A further advantage of the June cut is to allow ground nesting birds such as Duck, Partridge, Pheasant, Yellow Hammer, Reed Bunting and others to get their first brood off. However, if the first cut is delayed until June, a somewhat coarser vegetation does develop than if the first cut is in May and the cuttings left by the machine are heavier, in themselves tending to suppress smaller plants and favour the more vigorous. If the first cut is delayed until July (treatment 18) a generally much coarser vegetation develops. Frequent cutting (treatments 10, 12, 14, 16) leads to a finer vegetation, with gradual disappearance of Couch (Agropyron repens) and False Oat (Arrhenatherum elatius) but not apparently Cocksfoot (Dactylis glomerata). Increases in Bent grass (Agrostis stolonifera) have been recorded in these plots together with a number of low growing herbs such as Creeping Buttercup (Ranunculus repens), Birdsfoot Trefoil (Lotus corniculatus), White Clover (Trifolium repens), Hop Trefoil (Trifolium campestre) and Germander Speedwell (Veronica chamaedrys). The plots that have been uncut for 5 years (treatments 1 and 2) have developed a coarse vegetation of tall growing grasses and herbs, though not necessarily of weedy species, and also occasional shrubs mainly hawthorn.

The mean height of vegetation in selected treatments at intervals during 1969 are shown in figures 1 and 2.

From these some practical generalisation can be made remembering that the results are from the east Midlands of England.

- a) Cutting 5 times at monthly intervals with any of the machines will maintain vegetation below a height of 12 in.. It is probable that this could be achieved by two, or at the most three cuts, at monthly intervals beginning in May (see also fig. 3).
- b) If the vegetation has to be less than 6 in., more frequent cutting will be necessary, probably beginning in April and continuing at 3 weekly intervals into June, after which longer intervals may be possible (see also fig. 4).
- c) Cutting once in June or July will prevent the vegetation generally exceeding 10 in., for the remainder of the season but for a period from the end of May to the time of cut, increasingly tall vegetation will have to be tolerated.
- d) A single cut in May with a haymower will have the same effect as a single application of MH in April, the average height of the vegetation in July reaching 12 - 14 in., (figs. 1 and 2).
- e) A combination spray of MH and 2,4-D in April may lead to a

Fig. 1 Mean height of vegetation in selected treatments sprayed with MH, 2,4-d or a combination, on 3rd May, with and without a later cut in June. Cambridgeshire 1969.

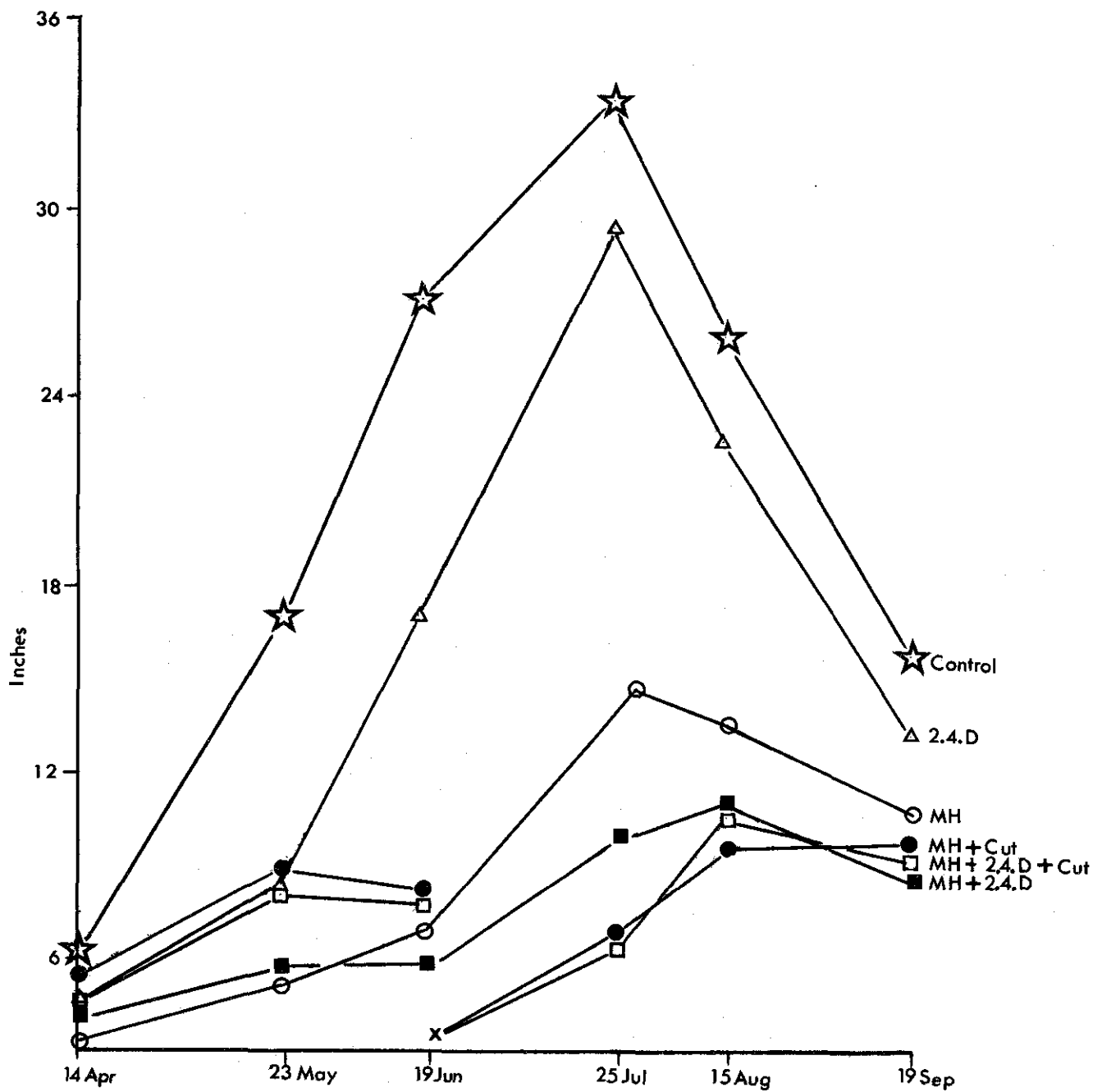
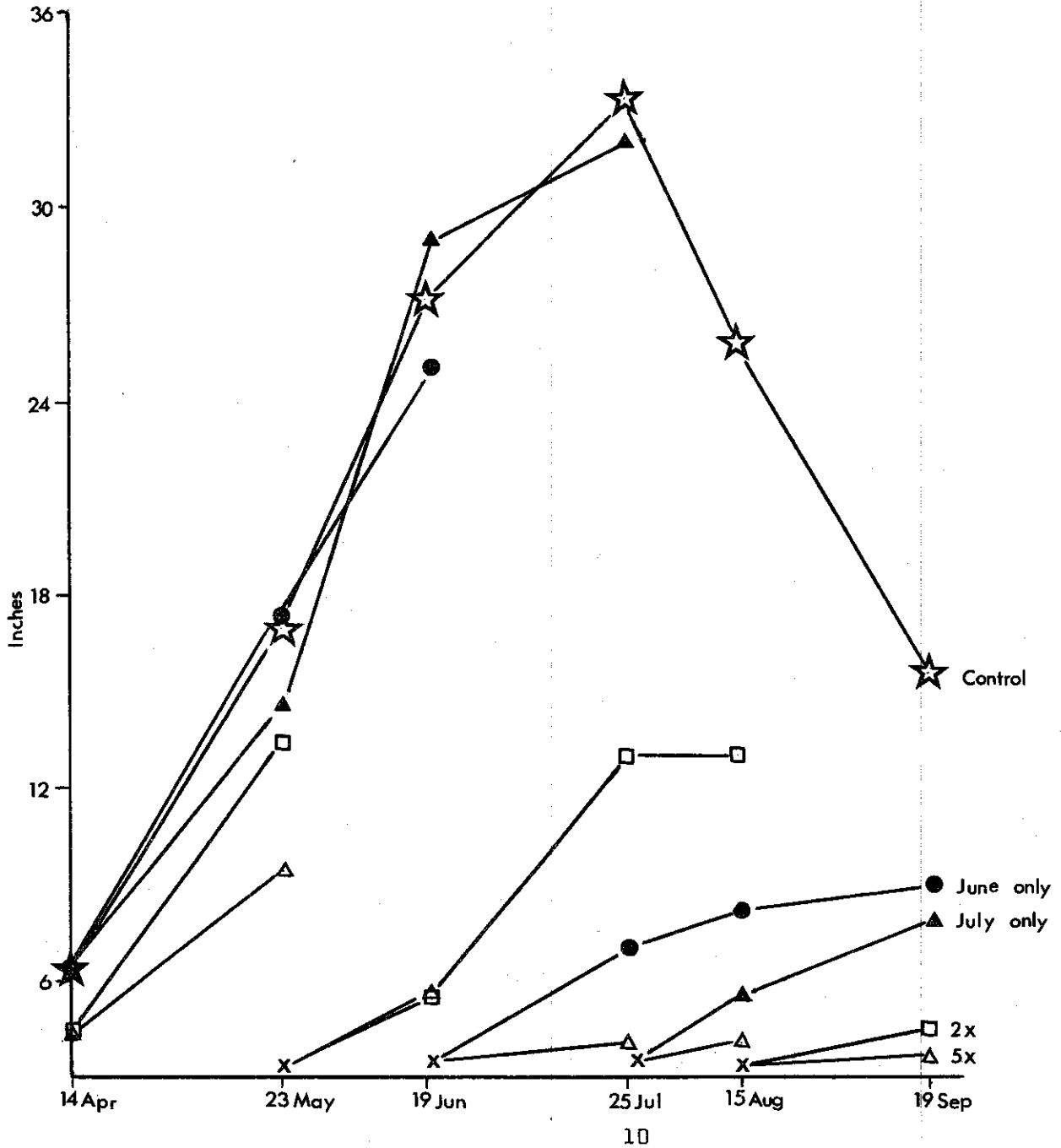


Fig. 2 Mean height of vegetation in selected treatments cut with a haymower and the cuttings raked off. Cambridgeshire 1969.



shorter vegetation than this with an average height of 10 - 11 in., in July. This would be analogous to two cuts with a haymower, one in May and the other in June (figs. 1 and 3).

- f) A single spray with 2,4-D in April may reduce the height of vegetation compared to uncut plots in July but not apparently before or after. The advantage of this is dubious and some of the ecological drawbacks of the use of 2,4-D have been pointed out earlier in this paper.
- g) Cutting plots six to eight weeks after spraying with MH or MH + 2,4-D will maintain vegetation at an average height of less than 12 in., through the season and is essentially comparable to two cuts, one in May and the other in June.
- h) Cutting plots six to eight weeks after spraying with 2,4-D will give a pattern of rather tall vegetation up to the time of cut, and thereafter similar effects on height to a single cut in June.

Motorways

As mentioned above, there are very considerable opportunities for creating wildlife habitats, protected from the public, on the verges, banks and cuttings of motorways. A preliminary experiment to see what management schedules might be appropriate was described at the London Symposium (Way, op. cit) and was continued in 1969 for the second year. It is too early in the life of this experiment yet to give any detailed results on the vegetation except in relation to height. The results of measurements of height in two of the treatments (cutting in May and June, and cutting in April, May, June, July and September) are shown in figs. 3 and 4. The essential conclusions from these have been discussed above.

General

It has been a common policy with many Councils in the past year or so, to maintain the front of the verge next to the road to a higher standard than the back of the verge. From a wildlife point of view this is excellent as it leads to a range of different habitats and encourages diversity of plant and animal species. In this respect the interests of wildlife conservationists and of Highway Authorities may well be the same, although for different reasons. In fact, in very broad verges it is hoped that a 'multi-zone' system of management could be applied by County Authorities with the intensity of management falling off in zones as one goes further back from the road itself.

From a botanical standpoint it is worth noting that the tall growth of grasses comes from the flowering stem (or culm) and that once this is

Fig. 3 Mean height of vegetation cut in May and June.
M.1 Motorway 1969.

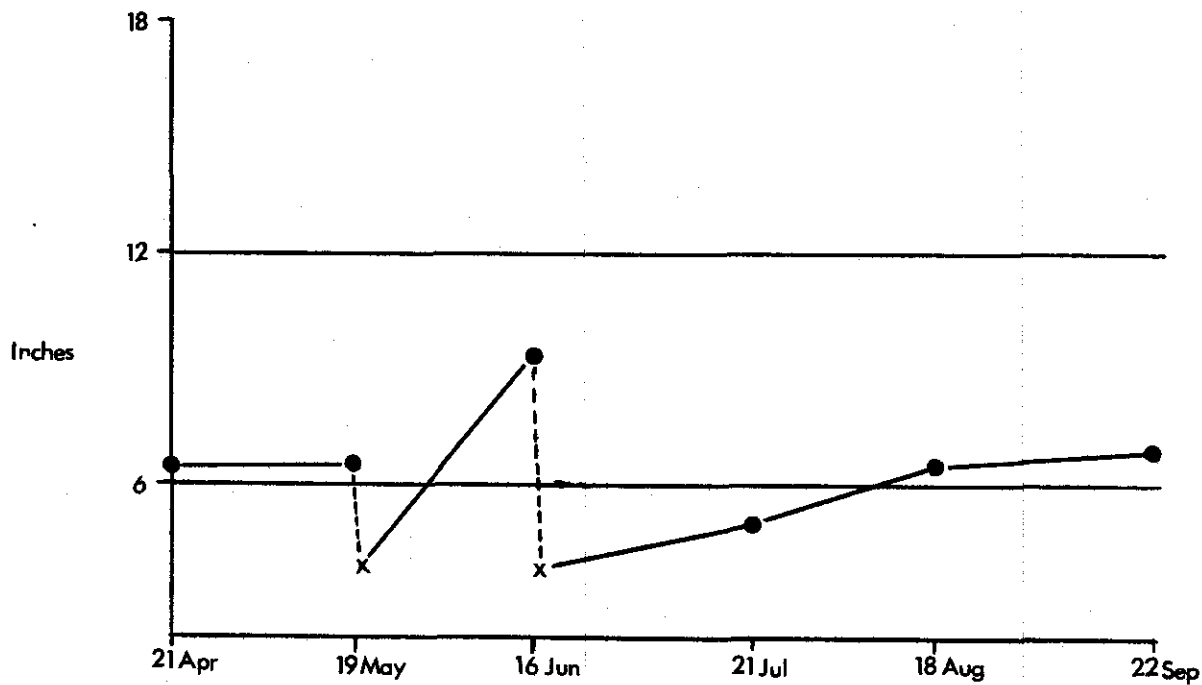
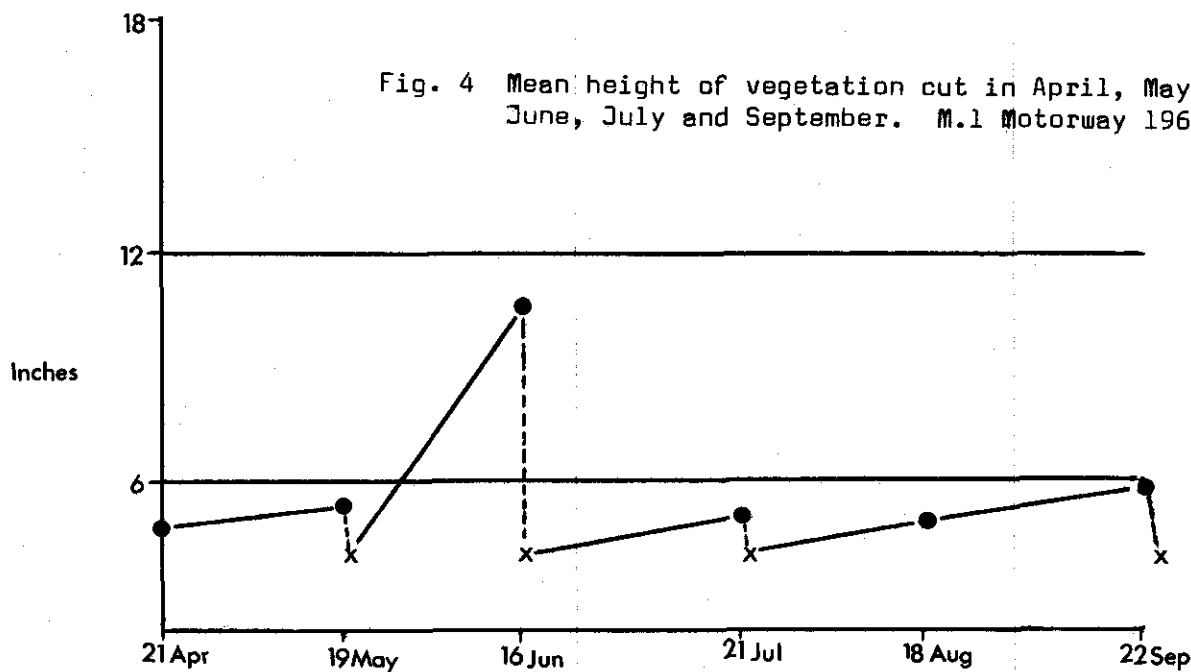


Fig. 4 Mean height of vegetation cut in April, May, June, July and September.
M.1 Motorway 1969



cut off after a certain period of the year it is not normally replaced. The part of the plant left is almost entirely leaf produced from organs of the plant at soil level and only in a few grasses are the leaves longer than 12 in., although a number of roadside grasses do have leaves longer than this. The choice of an acceptable height of vegetation is therefore fairly critical, because, if it is possible to control the culm growth either by use of MH or by cutting, subsequent growth of leaves of the majority of grasses is unlikely to provide a road hazard. However, if a height of 6 in., is prescribed, then not only must the culm growth be controlled but also growth of leaves.

Conclusion

In the low lying land of Scotland, where the highways are enclosed, the importance of road verges as a habitat for wildlife may often be as great as in the comparable parts of southern England. With the intensification of agriculture and particularly with an increase in the use of herbicides in grassland, road verges have an importance as relict areas of natural grassland. Enclosed highway verges rarely nowadays have any economic value for hay or grazing and in fact their maintenance is a continual unproductive drain on general highway funds. Their conservation value for wildlife is not assessable in money terms and does not often reside in individual stretches. However, it can be assumed that in the aggregate, they do have an importance, and in many instances forms of management that will favour diversity of species and structure of habitat for wildlife will be less rather than more expensive to the Highway Authority.

ACKNOWLEDGEMENTS

It is again a pleasure to acknowledge the interest and help of the Cambridge and Isle of Ely, the Huntingdon and Peterborough and the Leicestershire County Councils, together with the Ministry of Transport, with whose co-operation the experiments referred to in this paper are being made. Also Mr. V.F. Woodham of Burt, Boulton and Haywood, Limited, through whom the chemicals were supplied and by whom they were applied.

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CONSERVATION OF ROADSIDE VERGES IN SCOTLAND

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For the Symposium on "Road Verges - Their Function and Management", held in London in March, 1969, Mr. D.T. Streeter produced a paper entitled "Road Verges - A Local Responsibility for Conservation" (Streeter, 1969), in which he cited the County Nature Conservation Trusts as suitable bodies to undertake the care and conservation of road verges and gave many instances to show how the Trusts were indeed thoroughly involved. The place in nature conservation filled by the County Trusts in England and Wales is occupied in Scotland by the Scottish Wildlife Trust which is similar in constitution and in its mode of operation but national in scope. A series of papers on road verges in Scotland would not be complete without a report on the work and experience in this field of the Scottish Wildlife Trust, which this present paper will offer. Mr. Streeter did in fact note the work of the Scottish Wildlife Trust in his original paper but the mention was naturally a brief one.

The Scottish Wildlife Trust became concerned with roadside verges in 1967, when a paper was submitted to the County Surveyors' Society (Scottish Branch) by the author of this present paper in his capacity of Trust Secretary. The lines of this first approach to the conservation of roadside verges in Scotland benefited from experience gained by County Trusts in England and Wales. This was made freely available by the County Trusts through the County Naturalists' Trusts Committee of the Society for the Promotion of Nature Reserves. This help is gratefully acknowledged by the Scottish Wildlife Trust. However, despite the importation of experience, there were important differences encountered in implementation and these are brought out in the present paper for consideration by the Symposium in Scotland.

The paper produced in 1967 was accepted by the County Surveyors' Society whose Hon. Secretary reported a general agreement by members of the Society that "if the Trust would designate particular stretches of roadside verge for special treatment they would co-operate to the best of their ability". In discussion between the Society and the Trust, it was however made known that County Surveyors in Scotland were working under the provisions of an old enactment, the Roads and Bridges (Scotland) Act 1878, which laid apparently heavy responsibilities on road authorities. Thus, under Section 106 of the Act, it was stated that "the trustees of every turnpike road shall cut or shall cause to be cut all weeds growing on the same or sides thereof, when enclosed, at a proper season of the year, in order to prevent such weeds coming into seed" Unfortunately the legislation lacked any definition of "weed" and the

possibility of very many species of plants earning this designation in the eyes of one body or another made the obligation look possibly an open ended one. It was pointed out by the Trust that the sections of verge which carried plants of interest to the Trust would usually be long-established ones and they were unlikely to contain the common weeds which were characteristic of recently disturbed ground. It was agreed that the Trust would be responsible for meeting with third parties who were concerned about the possible spreading of weed species from designated verges and this responsibility was subsequently conveyed to the Branches of the Trust.

The Trust in Scotland operates through regional Branches which are semi-autonomous though guided and advised by the Trust. This situation compares closely with England and Wales where the County Trusts are fully autonomous but are advised and guided by the Society for the Promotion of Nature Reserves. The Branches were encouraged to set up programmes for verge conservation, according to their resources and other commitments, and within the provisions of the agreement reached with the County Surveyors' Society. Four, out of eight Branches, started programmes and by the end of 1969, 5 counties had been dealt with, though one of them, Perthshire, was only half completed. The following information therefore represents only a beginning to verge conservation on a national scale. Nevertheless some useful experience has been gained. Particularly is it interesting to see how the botanists within the Branches have interpreted the instruction from the Trust "to safeguard uncommon or interesting plants or interesting communities of plants occurring in the verges of roads of all categories."

Some 50 verge sections have been designated - 13 in Berwickshire, 16 in the three Lothian Counties, 16 in Perthshire and 4 in Orkney, but further sections are likely to be added in all these counties. More than 40 sections protected single species, of which 21 were either rare in Scotland or locally uncommon and 12 were naturalised or had been introduced to Scotland and were at the same time rare; the remaining few sections covered relatively common species which were occurring in conspicuous masses. Among the rare species are Sambucus ebulus (Danewort) in Perthshire and Silvaum silaus (Pepper Saxifrage) in East Lothian; locally uncommon species are Geranium pratense (Meadow Cranesbill) in East Lothian and Plantago media (Hoary Plantain) in Berwickshire. Naturalised and introduced species include Geranium phaeum (Dusky Cranesbill) in East Lothian and Rumex alpinus and Geum macrophyllum in Perthshire. In Orkney, where the floristic range is much reduced, Ononis repens (Rest Harrow), Stellaria holostea (Greater Stitchwort) and Galium mollugo ssp. mollugo (Great Hedge Bedstraw), have been selected for safeguarding.

The instruction to select uncommon species has clearly been applied

in the field, while the pursuit of interest has been an added reason for the inclusion of a number of naturalisations and introductions. Some additional information supporting the claim to interest is offered, as an example, for Rumex alpinus (Monk's Rhubarb) which was introduced to Perthshire from East Central Europe, probably by monks; its leaves were used for wrapping butter. The presence of non-indigenous species does suggest that roadside verges containing them have been disturbed in the recent past and are not truly ancient.

Dr. F.H. Perring, writing on "The Botanical Importance of Roadside Verges" for the earlier Symposium (Perring, 1969), stressed the importance of road verges as relics of native grassland. Communities of plants have been safeguarded in 7 sections of verge under the present programme in Scotland, and in each case an example of a natural community is represented. In most instances the communities occupy a base-rich site. Examples are a grassland/herb community, comprising Potentilla argentea (Hoary Cinquefoil), Dianthus deltoides (Maiden Pink), Trifolium striatum (Soft Trefoil) and Saxifraga granulata (Meadow Saxifrage) in East Lothian, and Epipactis helleborine (Broad Helleborine) with short grasses, in Perthshire.

Amenity has been well served by these programmes as all but a few of the safeguarded species are attractive and most are distinctly showy, though only in 6 instances were verges primarily selected for a showy plant which was appreciated to be common. The counties which have attracted programmes have all been lowland and the programmes have even there concentrated on the agriculturally most developed portions. In such portions the lack of plants of the same species in farmland away from the verge has made the verge sections uniquely important. Extending this experience to other parts of Scotland, it is unlikely that moorland regions will call for much attention under the verge conservation scheme since verges and adjacent moorland, often in the absence of any dividing fence or barrier, are subjected to the same influences and the same plants are likely to occur overall.

Questions raised by farmers in Perthshire were resolved by discussion between the county Branch of the Trust and the Perthshire committee of the National Farmers Union, so that the roadside verge programme proceeded with the blessing of agricultural interests.

Branches have accepted responsibility for designation, recording, notification and demarcation of verge sections. Sections are first described and then marked on two copies of a 1" road map. One copy is handed to the County Surveyor in the spring of the year and recovered in the autumn for revision. It is also the function of the Trust to mark verge sections on the ground. Wooden posts, painted white and marked with distinctive initials, are placed at each end of a section.

One County Surveyor has kindly supplied posts but normally they have been provided by the Trust. Posts are 4' 6" long and have a cross-section of $1\frac{1}{2}$ inches square. Driven into the ground as far as they will penetrate, by means of a mallet, they are unfortunately too easily removed by passers by. Such losses are serious because much time and effort, given by experts, is negated and re-location requires special journeys.

There has been too little time for management of verges to have become sophisticated. A rule of thumb has been established which delays cutting of vegetation till after August but clearly this will not suffice for all verges except as an interim measure; some species of plants might benefit from the mowing of verges during the growing season if this would check the development of more aggressive species. It is unlikely in the long term that any common management policy will suit all verges; not only do the requirements of species vary but roads attended by verges include all categories from the A9 Trunk Road to unclassified roads and road safety requirements vary with the category. It has been arranged that verge marking posts are placed close to the rear boundary of all verges and not less than 4 feet from the edge of the carriageway, thus facilitating the taking of a 3 feet wide cut when this becomes necessary. Verges selected at the current density have given rise to conflict between conservation and road safety in only two cases, both in East Lothian, during the last 2 years. In one case the verge was seriously but unavoidably damaged during road widening at an intersection but a similar operation at the second site was carried through without loss of plants, these having been marked off with temporary ropes throughout the operation. In this case the fact that an interest in the plants of the verge had been established, was all-important. The occasional failure of an employee to notice a safeguarded verge, which has resulted in the verge being mown at the wrong time, has been reported but not on any occasion has herbicide been applied to a designated verge.

Some recommendations are made for consideration for the future:-

- (i) County Surveyors' staff should become more closely involved in the safeguarding of verges. Local members of staff should "take-over" the verges after they have been designated and should "hand-over" information about them to their successors.
- (ii) A more permanent marker than the wooden post is desirable. A concrete pillar would be preferable. County Surveyors are asked to consider making such pillars available and to be responsible for putting them in position.
- (iii) Trust members should work out and recommend the appropriate form of management for each safeguarded section.

- (iv) The safeguarded verge programme might be applied more widely to cover also verges containing plants which are primarily attractive and secondarily of scientific interest, thus safeguarding also amenity.

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THE FARMER AND THE ROADSIDE VERGE

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From the Arable Farmers' point of view roadside verges and hedges are a complete nuisance, being a harbour for weeds and dirt in all forms, including couch grass or rack (as it is called in Scotland), the bane of modern farming.

Rack and much else is spread outwards into the fields, by the practice of ploughing out the hedge-backs.

Stock farmers are, apparently, no more enamoured of the roadside verge either! Busy roads have put an end, largely, to stock grazing the verges, or the "long meadow", as the Irish call it, and, in fact, where roads are unfenced and verges are re-seeded, the fresh grass attracts animals, causing many of them to be killed and creating a road hazard to motorists.

So, from the purely agricultural view point, most farmers (assuming they are being entirely businesslike) would wish to see fenced roads, hedges removed, and a "scorched earth" policy employed on the verges.

However, it is recognised that other interests are involved, and coupled with cost factors we are not likely to reach the ideal state outlined above.

Nevertheless, a statement of the problems involved, particularly when we have the ear of the Local Authorities may help to "clear the air" and help towards the creation of roadside verges acceptable to all parties involved.

Information on this topic was asked for and received from the National Farmers' Union Area Secretaries all over Scotland. Their replies revealed quite a variety of opinions and problems.

Firstly, there is the obvious problem of weed control, the uncut or untreated verge. In fairness it must be said that a few Areas are broadly quite satisfied with existing arrangements. The Local Authorities apparently co-operate well, and they state they have few problems. Weed control here, takes the form of cutting the verge with a reaper or a flail-mower.

Some N.F.U. Areas are unhappy about the cutting. They consider it is done too late, when the weeds have flowered, and also an uncut strip is left near the hedge.

This raises the questions:-

- (a) who owns or is responsible for this part?
- (b) does the Highway Authority only have an obligation to cut enough of the verge to ensure good visibility, and thus reduce a road hazard?

One Area considered uncut verges were causing accidents, while a number of others considered weed control was inadequate.

Secondly, there is the problem of road drainage, which is a two-fold one, as far as the farmer is concerned. Namely:-

- (a) The draining of surplus road water into adjoining fields and
- (b) the lack of maintenance of roadside ditches.

It is realised that under the Roads and Bridges Act (1878), the Local Authorities are entitled to run drain water into nearby fields, and it may be, though I am not able to verify this at the moment, that farmers are responsible for open drains and ditches.

Here, I think, a revision of this Act is overdue. Some of its provisions must be rendered obsolete by the growth of modern traffic.

One Area has pointed out that hidden drains and overgrown ditches have caused major accidents, which on level verges might have been relatively minor. It ought to be the responsibility of the Local Authority to pipe and close these ditches as this benefits the road using public and not the farmer. With regard to surface water, it should be made statutory for the Road Authority to ensure that it is properly led into the nearest field drain.

Many Areas express anxiety on this drainage problem, particularly with regard to made-up or re-aligned roads which increase the catchment areas.

Finally, there is the problem of the width of roadside verges.

With regard to unfenced roads, Stirling Area brought up the point that the Roads and Bridges Act 1878 stipulates that a margin of 12 ft. be retained, unploughed, between the field and the Public Highway, where the fields are unfenced. It is felt that this margin is drastic, under modern conditions, and ought to be amended.

On the stock side, as mentioned at the beginning of the paper, two upland Areas stress the danger of reseeded verges attracting animals and often resulting in their deaths. They feel that at least, trunk road fencing ought to be considered.

On the point concerning width of roadside verges, some Areas felt that there was much waste of land here, particularly new verges at road junctions.

A contrary view was expressed by one Area, who felt wider verges were of benefit, as snow clearance did not then tend to damage the fence.

Another Area put the view that although land was wasted, it was felt that it was better for the ground to be taken at one time rather than that it should be taken in small parts, each time further widening of the roads became necessary.

In conclusion I would like to make some general points.

Firstly, I think the Roads and Bridges Act 1878 is in need of overhaul along the lines suggested.

Secondly, it is evident that much has been and could be achieved, with a closer co-operation between N.F.U. Areas and Local Authorities. Some Areas express their appreciation of efforts by their Local Authorities and seem to be satisfied with the results.

Nevertheless, many genuine points have been raised, which will require to be looked at, if a satisfactory working arrangement is to be achieved.

Thirdly, there is the reconciliation of the Wild life interests. I do not wish to trespass into the domain of the next paper, but a reading of the London Symposium papers impressed upon me the possibilities of sprays. I was particularly interested in the use of growth inhibitors coupled with selective weed killers, which seemed to produce a short grassy sward, fairly free of weeds.

Again, of course, cost is a paramount consideration, but it may well be a most promising method of controlling the verges, without greatly affecting wildlife.

I would disagree that only a 6 ft. wide strip need be done, there is still the problem strip next the fence or hedge. I would contend that the Local Authorities have some obligation towards keeping the whole verge tidy.

Under the Civic Amenities Act they are charged with the task of cleaning up the countryside as far as the dumping of rubbish is concerned!

It is surely only a logical extension of Government thinking on this matter to ask that road verges be kept trim and tidy.

THE LAW ON INJURIOUS WEEDS

Legislation on injurious weeds dates from the Corn Production Acts of 1917 and 1920 and further provisions were introduced under a number of subsequent Acts. In July 1959 the previous enactments were repealed and all the provisions consolidated in the Weeds Act, 1959. The injurious weeds to which the Weeds Act applies are:

<u>Cirsium vulgare</u>	(spear thistle)
<u>Cirsium arvense</u>	(creeping or field thistle)
<u>Rumex crispus</u>	(curled dock)
<u>Rumex obtusifolius</u>	(broad-leaved dock)
<u>Senecio jacobaea</u>	(ragwort)

and additional weeds may be prescribed by regulations.

The Minister has power under the Act to serve notice on an occupier of land requiring him, within the time specified in the notice, to take such action as may be necessary to prevent the injurious weeds from spreading. An occupier who unreasonably fails to comply with the requirements of such a notice is liable, on summary conviction, to a fine not exceeding £75, or for a second or subsequent offence, not exceeding £150; the Minister may also enter on the land and take the necessary action to prevent the weeds from spreading, recovering the cost of doing so from the occupier.

Since 1939, there have been changes in the delegation of the Minister's powers. At present the councils of county boroughs exercise the delegated powers on non-agricultural land within their areas, the Minister's divisional executive officers the powers on non-agricultural land outside the county boroughs, and the county agricultural executive committees on agricultural land within their areas.

From the WEED CONTROL HANDBOOK, 5th edition 1968, Eds. J. D. Fryer & S. A. Evans, Volume 1 (Principles). Blackwell Scientific Publications, Oxford and Edinburgh. With acknowledgments.

THE USE OF CHEMICALS IN THE MANAGEMENT OF VEGETATION: LONG-TERM STUDIES OF THE EFFECTS OF SPRAY TREATMENTS

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INTRODUCTION

Two major aspects of the management of roadside verges concern the control of height and of the composition of the vegetation. The unimpeded visibility required by the road-user necessitates a short sward, especially immediately adjacent to the road, and it is desirable to eliminate weed species, particularly those troublesome in agriculture. Amenity considerations and the requirements of the motorist point to the need for an attractive but short roadside vegetation.

Chemical methods of control are now available which take the place of traditional cutting procedures; the work of the lengthsman can now be effectively and economically achieved by chemical spray techniques. The height of vegetation can be controlled by means of growth retarders or regulators and its composition altered by the use of herbicides. A combination of the growth retarder maleic hydrazide (MH) and the well-known selective herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) is proving especially valuable in the management of the vegetation of roadside verges; a single application of the mixed spray (MH + 2,4-D) annually in spring leads to the production of a grassy sward which is largely free from weeds and which remains conveniently short throughout the year.

While much is known about the effects of spraying over short periods, little information is available concerning the effects on vegetation when applications are continued over a substantial number of years. The ecological importance of the initial effects of the spray and more especially of the sequence of gradual changes which may result from spray application over a long period is far-reaching; a different community structure may develop highly contrasting with that of the semi-natural vegetation present initially. The roadside verge, with its range of conditions including those of the ditch and hedge, is a diverse habitat, supporting a great variety of plant life, both native and introduced, and it includes a substantial proportion of rare species (Perring, 1969). Modification of the structure of this vegetation by any method of management consequently raises issues of nature conservation. Information is needed concerning the degree of permanence of new community structures generated by spraying, and the extent to which re-establishment of the original type of vegetation (reversion) can occur on cessation of spray treatments.