

The Flora of the Oxford Ring Road

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Summary

This paper presents the results of a large-scale snapshot survey of the flora of the Oxford Ring Road verges. It argues for their value as a resource for public acquaintance with a variety of higher plants. Although it is often supposed that verges contain only what are publicly perceived as weeds, and although such species are well represented in the survey, I demonstrate that the majority of the plants represent a wide range of settled habitat communities. The richness of the verge flora depends on the continuing presence of relict woodland, grassland and even wetland sites, in spite of the pressures generated by the construction and management of a major road. The survey was undertaken in 1990; it is updated by comments on the changes in the dynamic verge system.

Introduction

The Verge Survey Group of the Ashmolean Natural History Society of Oxfordshire has been surveying local verge flora for twenty-five years. However, up to 1990 we had no data on the Oxford Ring Road, and one attempt at a group survey made it obvious that this was not viable as a social project because of noise and road hazards. Most of the Ring Road, though, is readily accessible in part to both pedestrians and cyclists, so a survey was feasible.

The rationale for the Group is the belief that verges are where wild flowers are most publicly visible; many people see them only here. While carrying out surveys one is often approached by members of the public curious about one's interest in 'weeds', but in fact the majority of plants observed are not 'weeds' in the sense of ruderal species with powers of widespread dispersal and rapid colonisation. In a symposium in 1969 Perring claims that 'roadside verges are the richest single habitat for wild plant species in the country', though in the same volume Streeter points out that 'the biological interest of roadside verges often differs very markedly from county to county and also within the same administrative area' (Way 1969). The purposes of the survey discussed here are to revisit these assumptions after a lengthy period of time and contribute to a continuing debate by recording the species present and by establishing the degree of variation in plant communities on one major site, the Oxford Ring Road, and thus demonstrate the botanical richness of a site subject to large-scale initial and continuing human disruption and interference.

Background

The original surface geology includes clay and other alluvial soils (river gravels, sand) and Corallian limestone. As well as passing through built-up areas, the road borders or even cuts across several interesting habitats, such as ancient woodland at Brasenose and Open Magdalen Woods (SP5505) and unimproved wet meadowland at Iffley Mead (SP5203) and Pixey Mead (SP4810). However, various factors inherent in the construction of large roads militate against the retention of the original plant communities. These include the physical clearance of plants, the removal of topsoil and its replacement with soil (often subsoil) from other sources, soil compaction during workings and ancillary construction such as workmen's huts, and alteration of

the height and aspect of the area, and of the hydrology, since roads require good drainage (Dowdeswell 1987). Verges may be seeded with standard seed mixes which take little account of the original vegetation (Horton 1978).

These general points can be illustrated by specific records of the process of construction held by Oxfordshire County Council. For example, fill for the original northern by-pass in the 1930s was obtained from material dredged from the Thames. The earthworks for the southern and western route in 1960 amounted to about a third of the total cost and involved about 75,000 cubic yards (57,340 m³) of cut and return fill 'in material varying from clay to gravel, but predominantly clay'. However, 'for distances of 50 ft. [15m] and 100 ft. [30m] on either side of the River Thames bridge where its depth exceeds 10 ft. the marsh clay [was] removed and replaced with gravel' (Oxfordshire County Council: County Surveyor's File 2372/0/2). Large amounts of gravel from the Seacourt Stream northwards to Wolvercote were used, as was higher quality gravel from the fledgling reservoir site at Farmoor. Where the Ring Road met the Henley Road the natural water table was only 8 feet (2.4m) down, and the proposed cutting was 25 feet (7.5m). Plans for cuttings and embankment verges in the southern section specify a topsoil depth of 4 to 8 inches (10-20 cm) but 'as it was impossible for vehicles to traverse the low-lying marshy areas, no top-soil was stripped' and instead stone quarry waste was tipped. At this point (in the 1960s) a quarter of a million tons (254,000 tonnes) of gravel from Farmoor was used for fill, together with 380,000 cubic yards (290,500 m³) of clay from Rose Hill. Thus, although the base of the road and its surrounds were created from relatively local material, there is no sense in which the original surface geology was retained. Banks and verges in the 1960s were sown with an unspecified seed mix (probably the standard Department of Transport one: see below) and trees were planted (Oxfordshire County Council file O490).

The Oxford Ring Road was constructed in two main stages, in the 1930s and late 1950s/early 1960s. This account follows Hall's 'History of the Oxford Ring Road' and other typescript documents belonging to Oxfordshire County Council. The Northern By-pass was started in 1930, with the Headington to Wolvercote section opening in 1934. Meanwhile (1931-32) the Southern section from Botley to South Hinksey was being built. The eastern and western sections followed nearly thirty years later; that from Headington to Rose Hill dates from 1957-59, and that from Botley to Pear Tree, 'although not a motorway [was] being constructed to motorway standards' between 1959 and 1961. The final links between South Hinksey and Heyford Hill, and then Rose Hill, opened in 1965 and 1966. However, this was not the end of the story. The southern and northern sections were dualled between 1971 and 1974, and large-scale works such as the flyover at Garsington Road (1994) continue to take place. Verge widths and compositions do not remain constant after construction. For example, in 1959 the eastern sections of the road had a central reservation 15 feet (4.5 m) wide and a 7-foot (2.1 m) verge separating the carriageway from the two-way cycle track and footpath (Oxfordshire County Council file O.398/6) but the verge next to the road is much narrower now. Work on the northern section in the summer of 2000 has reduced the grass section of verge there in some places. There is little detailed specification of verge design or changes available for consultation; I am advised that, not surprisingly, even if such records had originally been made, they are not routinely retained in an accessible form, if at all, after seventy or even forty years (Assistant Highway Records Manager, verbally 24.8.2000). However, it is known that the new Cumnor by-pass was seeded with quite an

elaborate mix involving wild flowers, notably Chicory (*Cichorium intybus*), around 1975 (J. Osborne, verbally 29.8.2000).

After the initial construction, the actual operation of a large road brings about other stresses such as impaction from traffic straying from the carriageway, the physical effects of wind shear, rain wash and salt wash, and pollution from a wide variety of substances, including salt, lead (at the time of the survey) and ethylene, which inhibits plant growth (Dowdeswell 1987, Thompson 1978, Williamson 1978). Also, the verges are managed with the prime objective of road safety and a subsidiary one of tidiness (Crofts and Jefferson 1994, Dowdeswell 1987). Only in rare instances are they managed for their conservation interest, and this is usually plant conservation, as with the sixteen roadside nature reserves set up by Oxfordshire County Council in 1992 after input from naturalists around the county, including the Verge Survey Group. (None of these reserves is on the Ring Road, although the County Council keeps a sympathetic eye on the Pyramidal Orchid [*Anacamptis pyramidalis*] colony on one of the roundabouts and is open to additions to the list.)

The building of the southern and western parts of the road was within the remit of Berkshire County Council, as agents for the then Ministry of Transport, while the Oxfordshire sections were handled by the Oxfordshire County Council and the City authority. A similar pattern of mixed responsibilities is found today; the verge management involves three authorities: Oxford City Council, for small sections in residential areas of the city (where 'tidiness' is of greater concern), Oxfordshire County Council for the non-trunk road sections (Headington roundabout to Heyford Hill) and the Department of Transport and the Environment because of the function of the Ring Road as a trunk road on the south, west and north of Oxford, from Heyford Hill to Headington. A further complication is that the actual mowing and pruning is usually carried out by contractors. Typical verge seeding and management practices for the 1960s are described in the Nature Conservancy's 1969 *Road Verges: their Function and Management*. Detailed year-on-year verge management practices specific to the Oxford Ring Road do not appear to be available. Since the 1960s, the use of herbicides has been largely discontinued and mowing reduced. The notional cutting regime has remained fairly standard from the time of the original survey. This is: cutting in rural areas twice a year, and five times a year (or more) in urban areas. Where safety demands, cuts may be made more frequently and right back to the highway boundary; otherwise the cut is a single swathe (i.e. machine width) only. This leaves some areas uncut, but 'in order to prevent woody growth becoming established and to reduce the chance of roadside fires in the summer, these areas are cut every third year' (Oxfordshire County Council pamphlet, 'Highway Maintenance'). Although nature conservation implications are not considered within the remit of the Area Engineer, the effect of this policy is to maintain biodiversity by keeping verges open for grassland and woodland edge species. Messrs Kennedy and Donkin took over some cutting management from Oxfordshire County Council in 1997 and advise me that they are maintaining a similar but somewhat reduced regime of annual single swathe cutting, usually in May or June, and visibility cuts according to need. They do cut the central reservation, even where it is straight, to allow for a weekly visual inspection of the safety barrier from a vehicle (Richard Tift, verbally 25.8.2000). (Such a cut may be unnecessary, since it is difficult to envisage any incident affecting the strength of the central crash barrier that would leave no obvious mark on the vegetation, especially in the early part of the season. Indeed, the vegetation could be used as a much quicker indicator of any incident likely to

compromise the strength of the barrier; thus, a cut would not be needed until plants dried off after flowering.) In areas adjacent to fields, Kennedy and Donkin also pull by hand Common Ragwort (*Senecio jacobea*) since this noxious weed is poisonous to stock.

The actual management practice is dependent on unpredictable features such as the timing of growth and the amount of rain. Frequency and timing of cutting thus varies, making a full analysis of the relation between management and plant communities impossible. However, the frequently-mown sections, such as that by the traffic lights at Risinghurst, display a lawn-like appearance and only low-growing species such as Common Bird's-foot-trefoil (*Lotus corniculatus*) manage to flower. Throughout, cut herbaceous material is routinely left on site, thus generating a physical barrier to the germination and growth of smaller plants and maintaining a high nutrient level favouring the more vigorous species such as Cocksfoot (*Dactylis glomerata*) and Hogweed (*Heracleum sphondylium*). Although it would be highly desirable from a conservation point of view to remove this material (and recycle it as compost) in the present financial climate this is not feasible. Even the designated Verge Nature Reserves suffer as a result of cost cutting, which results in less flexibility in the timing of mowing (C. Blackwell, County Ecologist, *in litt.* 1992).

Methods

The base survey was carried out between 20 May and 22 June 1990. This time of year was selected as a) the earliest at which the determination of most grasses is possible, b) early enough to include at least the remains of most winter and spring annuals and ephemeral visible species (e.g. Whitlow Grass, *Erophila verna*, and Lesser Celandine, *Ranunculus ficaria*) and c) having the advantage of long day length to enable completion of survey sections before traffic build-up. (Pedestrian access to major roundabouts and some sections of verge becomes hazardous during later hours of daylight).

The circular route of c. 24.7 kilometres was divided into six sections of roughly equal length based on major permanent man-made landmarks, namely: (1) the A40 Headington roundabout (SP556075) to Cowley roundabout (SP552038), 4 km; then (2) to the A34 Hinksey roundabout at SP513035, 4.3 km; then (3) to the A420 Botley roundabout at SP487066, 4.2 km; thence (4) to the bridge over one arm of the Thames at SP486100, 3.7 km; thence (5) to the Cherwell bridge at SP515099, 3.7 km; and (6) back to the A40 Headington roundabout, 4.8 km. Each section contains a variety of verge layouts, though none includes the full range, which varies from effectively nothing on flyover sections to the complexity of edges to pedestrian path, cycle path, main carriageways, central reservation, with ditches and hedges, outlined in Figure 1.

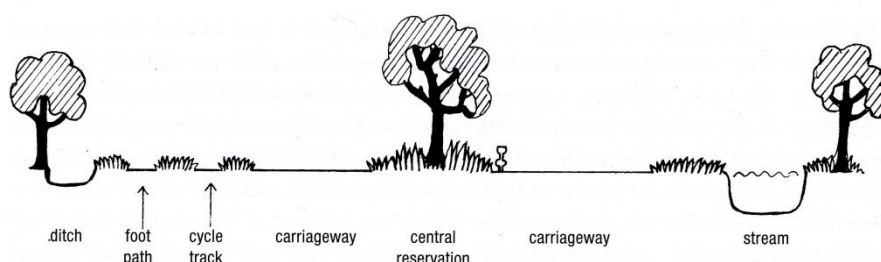


Figure 1: The most complex verge contour: in Section 6, near Marston

The author walked or cycled every section at least once in each direction. Observations were made from the fence or mid-line of hedge on the inside edge of the road to that on the opposite side. The central reservation was initially surveyed through binoculars, at frequent intervals, and checked on foot where appropriate. Flowering plants and ferns were recorded on a presence/absence basis on a standard South West recording card RP4 provided by Oxfordshire County Council Biological Records Centre, though scientific names have as far as possible been standardized for this article according to C. Stace, 1997 *New Flora of the British Isles*. Records are at species level only. The survey takes no account of what appear to be deliberate exotic and decorative municipal plantings, mostly at or near roundabouts. As far as they could be identified, it does include crop relics, garden escapes and other probable plantings where the species involved appeared to be established and/or, in the case of non-woody plants, reproducing. When a species was insufficiently developed to be identified during the main survey period (e.g. melilots, *Melilotus* spp.) its identity was confirmed by later visits.

Results and Discussion

There was no clear correlation between the length of the section and the number of species recorded. While the longest section (6) had the highest number of species (216) it also had some of the most complex verge structures, including a ditch and stream. Section 5 which had the next highest total (206) was one of the shortest, and included arid sections of flyover. Section 1 had 182 species, Section 2, 186, Section 3, 199, and Section 4, 191.

The species total was 355, of which 82 occurred in every section, 41 in 5 sections, 35 in four, 44 in three, 59 in two, and 94 in only one. 41 of the species recorded were alien relics of recent horticulture or agriculture, including four crop plants, Broad Bean, (*Vicia faba*), a wheat (*Triticum aestivum*), a barley (*Hordeum distichon*) and a flax (*Linum usitatissimum*). Of the rest, 69 were species which would be likely to be recognized as modern 'weeds' because of either their abundance or their habits of growth or distribution, and this includes all six of the willowherbs recorded (*Epilobium* spp.) and four ragworts (*Senecio* spp.) not all of which usually attain 'weed' proportions. Another 40 are colonizers of bare ground, both wet and dry. Some, such as Field Pennycress (*Thlaspi arvensis*) or Fumitory (*Fumaria officinalis*) or poppies (*Papaver dubium*, *P. rhoeas*), used to be considered field weeds, but modern farming practice has reduced their abundance and economic threat.

Of the species found in all 6 sections, only 27 (just under a third) were 'weeds', e.g. Common Nettle (*Urtica dioica*), Coltsfoot (*Tussilago farfara*), Creeping Thistle (*Cirsium arvense*) and Groundsel (*Senecio vulgaris*). The other species were representative of woodland or hedgerows and grassland. They included trees Ash, (*Fraxinus excelsior*), Elder, (*Sambucus nigra*), Hawthorn, (*Crateagus monogyna*), hedgerow shrubs e.g. Dog Rose, (*Rosa canina* agg.) and herbs e.g. Ground Ivy, (*Glechoma hederacea*). A large number of the most widely distributed were grassland species, e.g. Common Knapweed (*Centaurea nigra*), Wild Carrot (*Daucus carota*), Red Fescue (*Festuca rubra*), Cut-leaved Crane's-bill (*Geranium dissectum*), Perforate St John's-Wort (*Hypericum perforatum*), Meadow Vetchling (*Lathyrus pratensis*), Oxeye Daisy (*Leucanthemum vulgare*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Wild Parsnip (*Pastinaca sativa*), Selfheal (*Prunella vulgaris*), Lesser Trefoil (*Trifolium dubium*), Tufted Vetch (*Vicia cracca*). Such species represent a wide range of grassland types, as outlined in the *Flora of Oxfordshire* (Killick, Perry

& Woodell, 1998). Three out of the five species used in standard 1963 Ministry of Transport seed mix (Chadwick, in Way 1969) were found in all six sections (Red Fescue (*Festuca rubra*), Perennial Rye-grass, (*Lolium perenne*), White Clover, (*Trifolium repens*)) and the other two in five sections (Crested Dog's-tail, (*Cynosurus cristatus*), Smooth Meadow-grass, (*Poa pratensis*)). On a county-wide basis, these are found in, respectively, 570, 595, 596, 528, and 586 tetrads. Though, of course, their widespread occurrence may be partly due to this seed mix, the mix itself is made up of common, hardy and versatile species.

Many of the 'weeds' were not found in all sections. This correlates with Chancellor's findings that 'important arable weeds ... although often common on newly-sown roadside verges and for one or two seasons after sowing, are infrequent on undisturbed well-established ones' (Way 1969). Even Hedge Bindweed (*Calystegia sepium*), Shepherd's Purse (*Capsella bursa-pastoris*) and Fat Hen (*Chenopodium album*) were only seen in five sections. Couch Grass (*Elytrigia repens*) and Sun Spurge (*Euphorbia helioscopia*) were noted in four sections, Broad-leaved Willowherb (*Epilobium montanum*) in two, and Hoary Cress (*Lepidium draba*) and Annual Mercury (*Mercurialis annua*) in one. However, 12 of the 82 species found in every section were composites with wind-blown seeds, and 4 of the others (three trees and a willowherb) also have wind-dispersed seeds.

It was more surprising to record some of the species at all than to have recorded them only once. Because of their mycorrhizal associations, orchids are very susceptible to disturbance, and only two species were recorded, both in one section only. Common Spotted Orchid (*Dactylorhiza fuchsii*), a robust coloniser, as orchids go, occurred in section 3, and Pyramidal Orchid (*Anacamptis pyramidalis*) grows in quantity on the A 34 roundabout at South Hinksey. Other scarce species are scarce in the county generally. Grass Vetchling (*Lathyrus nissolia*) was also found near South Hinksey but is only recorded in 25 of the 596 tetrads of the recent *Flora of Oxfordshire* (all tetrad records are derived from Killick, Perry, & Woodell, 1998, hereafter KPW). Field Bugloss (*Anchusa arvensis*), a formerly widespread arable weed, occurred in Section 6; it has been recorded in 74 Oxfordshire tetrads.

Habitat requirements are the obvious constraint on many of the species found in only one section. Thus Wood Spurge (*Euphorbia amygdaloides*) 'associated with ancient woodlands', found in 148 Oxfordshire tetrads (KPW), occurred only in the vicinity of Brasenose Wood in Section 1. Also only in Section 1, Pellitory-of-the-Wall (*Parietaria judaica*) needs 'old walls' (KPW; 108 tetrads). A denizen of 'permanent hay meadows' (KPW; 199 tetrads), Yellow Rattle (*Rhinanthus minor*) occurred only near to Pixey Mead, one of the country's best-preserved ancient hay meadows.

24 of these species are associated with water, which is in short supply near major roads in any useful form except where there is a ditch, and 18 of these were only found once. Common Duckweed (*Lemna minor*) must have open water; on the other hand, Greater Meadow-rue (*Thalictrum flavum*: 87 tetrads) just needs damp meadowland. Other limitations include soil PH and texture.

Gorse (*Ulex europaeus*) which prefers acid soils and is therefore only patchily distributed in a largely alkaline county (279 tetrads) was only found in Sections 1 and 2. Calcicole species such as Chicory (*Cichorium intybus*: 100 tetrads) and Traveller's Joy (*Clematis vitalba*) occur in three and four sections respectively. The Chicory forms conspicuous stands in some places, particularly near the A420 roundabout, and is the subject of many enquiries from interested members of the public. Its

distribution probably reflects its introduction at the time of the building of the Cumnor by-pass, but it is obviously thriving and expanding its range.

The most unusual of the niches required by any of the plants recorded here is that of salt-laden ground. This is the result of winter de-icing regimes and is colonized by Danish Scurvygrass (*Cochlearia danica*). In the 1990 survey it was dominant over ribbon-like stretches (about 20 cm. wide) at the edges of the central reservation in Section 1. The spread of halophytes (salt-loving plants) along major roads has been well documented (for Oxfordshire, see KPW). Since it first appeared in Oxfordshire along the A 40, and since this road runs to its natural habitat in South Wales, it seems possible that the origins of our ring-road plants lie in Dyfed.

It is impossible to draw up hard-and-fast exclusive categories of plants; Hedge Bindweed, for example, might be seen as a hedgerow species and Field Bindweed (*Convolvulus arvensis*) is a grassland species, though I have counted them both as 'weeds' since that is where most (gardening) non-botanists would place them. Moreover, there are some species that can cope with a wide range of habitats, such as Amphibious Bistort (*Persicaria amphibia*), which has floating leaves in aquatic situations but can also live as a ruderal on quite dry waysides. Leaving aside these more versatile species and the 'weeds', the survey found some 58 trees, shrubs and herbaceous woodland or hedgerow plants, and 82 grassland plants. Some of these are the subject of regular public and conservation interest, particularly the Cowslip (*Primula veris*) which occurred in five sections. Other conspicuous grassland species not already mentioned include Greater Knapweed (*Centaurea scabiosa*), Meadow Crane's-bill (*Geranium pratense*), Field Scabious (*Knautia arvensis*) and Common Toadflax (*Linaria vulgaris*). The scarce Great Burnet (*Sanguisorba officinalis*; 143 tetrads) is associated with unimproved grassland and mentioned by Shakespeare as one of the components of a prime hay meadow (*Henry V*, V, 2). This does well on the verges, being present on 5 out of 6, and determinedly second-flowering if mown off.

Woodland and hedgerow plants include Greater Stitchwort (*Stellaria holostea*) and Yellow Archangel (*Lamium galeobdolon*) and a variety of climbers: three roses (*Rosa canina*, *R. arvensis*, *R. rubiginosa*), both bryonies (*Bryonia dioica*, *Tamus communis*) and Honeysuckle (*Lonicera periclymenum*). Most notable is the presence in two sections of the Narrow-leaved Everlasting-pea (*Lathyrus sylvestris*), quite a scarce plant county and country wide (34 tetrads in Oxfordshire) and associated with ancient woodland (KPW). This is illustrated as Figure 2. Even ancient field weeds crop up occasionally; Corn Buttercup (*Ranunculus arvensis*) was found in two sections, if one stretches the concept of 'verge' to include beds recently planted in new developments bordering the road. Corn Buttercup is a UK BAP species of conservation concern; see Kay in this volume. KPW notes, p100, "c 50 tetrads in 1970 and almost none since then".



Figure 2: Narrow-leaved Everlasting-pea

Relative frequencies in distribution contained a few surprises. Thus, Hoary Ragwort (*Senecio erucifolius*) appeared in all sections and was relatively abundant, whereas there were only odd plants of Common Ragwort (*Senecio jacobaea*) although it appeared in five sections. Over the whole county the latter is much commoner (527 tetrads as opposed to 347) but Hoary Ragwort, which is said to be an indicator of ancient grassland, has a preference for clay soils, which dominate the original soils of the road route (KPW). It is possible that the hand-pulling of *S. jacobaea* has decreased its abundance, but Chancellor reported that it was uncommon on a variety of roadsides in Oxfordshire and Essex (*Road Verges* 1969). Similarly, Round-leaved Crane's-bill (*Geranium rotundifolium*; Figure 3) in all sections was much commoner than Dove's-foot Crane's-bill (*Geranium molle*) in five sections, although noticeably rarer in the country as a whole and in the county (141:462 tetrads; KPW). It is often found on bare ground, and even in the cracks at the bottom of walls, so it appears to be the more adaptable species; Dove's-foot Crane's-bill prefers more stable grassland sites.

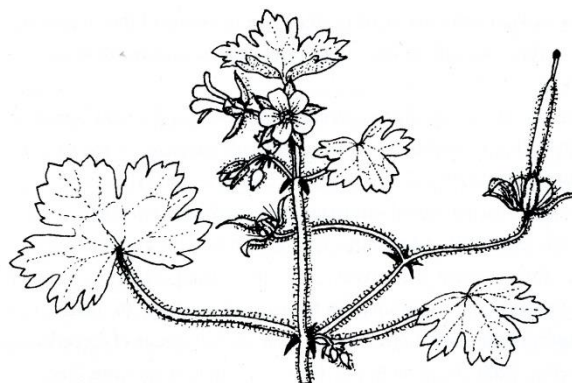


Figure 3: Round-leaved Crane's-bill

The seed mix used on the Cumnor by-pass in the 1970s seems to have had one spectacular effect on the Ring Road flora: the creation of a large population of

Chicory which may not have been present before, or not so widely. However, only three species occur solely in the nearest sections of the road to this work (3 and 4). One is a tree, Pear (*Pyrus communis*). The herbs are Burnet Saxifrage (*Pimpinella saxifraga*) and Square-stalked St John's-wort (*Hypericum tetrapterum*). Both are common grassland plants (414 and 357 tetrads). The species that occur solely in either section 3 or section 4 would appear to be limited by habitat, for example Common Duckweed, or to be improbable candidates for introduction in even the most imaginative seed mix, for example, Lesser Swine-cress (*Coronopus didymus*). Thus, as far as we can tell, the effects of deliberate wild-flower sowing are small in the context of the whole Ring Road. Targeted control, as with Common Ragwort, may have some effect, but only on this species. Chance introduction through soil or in mud on vehicles or boots seems a more likely source for many species. Where the habitat requirements are limiting and the habitat exists next to the road, the presumption must be that the occurrence of scarcer species is due to the survival of the original flora.

Changes since 1990

The survey has not been repeated but continued *ad hoc* observations confirm the dynamic nature of the verge environment. Paradoxically, part of its richness depends on apparently destructive human interference, especially where annuals such as poppies are involved. Thus, since 1990, the Flax has disappeared; 1991 saw only a few straggly plants, and there have been none since except for one or two where the original site has been turned over for some reason. Extensive roadwork in 1999/2000 may produce another mass flowering. Creeping Yellow-cress (*Rorippa sylvestris*) is a scarce perennial (96 tetrads) only recorded from one patch near the traffic lights at Risinghurst. It is out-competed by robust grasses, and also suffers from Oxford City Council's close-mowing regime at this point. However, it reappears annually in the wheel ruts of articulated lorries clipping the verge and after disturbance this year (2000) produced a fine flowering on the opposite side of the road from the original site, until mown halfway through flowering.

After roadworks in 1992, the verge near Summertown was bright with the large lilac flowers, and, later, yellow fruits, of the solanaceous alien Apple-of-Peru (*Nicandra physaloides*). This annual is susceptible to winter cold and cannot compete with established grass sward, so there were only a few plants in 1993 and none the next year. I was told by one of the workmen at the site that the topsoil had been imported from a site in Kidlington that had been a market garden fifty years ago, so future disturbance on the site may cause its reappearance, and that of several other aliens that appeared (and disappeared) at the same time, such as Beard Grass (*Polypogon monspeliensis*).

The Danish Scurvygrass has now spread considerably and can be found as dominant in strips all round the ring road in places. It should continue to do well in its man-made niche unless we cease to salt the road in winter.

On the minus side, constant summer mowing has eliminated what was a fine stand of Woolly Thistle (*Cirsium eriophorum*) in the central reservation near Cowley. It is still possible to find young rosettes, but this imposing (up to 150 cm.) biennial needs to be lucky enough to avoid cutting to survive. Other thistles do better by being either shorter or perennial or both. The Grass Vetchling has disappeared as its site has been shaded out by dense Ash and Hawthorn scrub. The Corn Buttercup has also gone as its locations have matured, and the one site for Rat's-tail Fescue (*Vulpia myuros*; 70

tetrads) at Cowley has been demolished for the new intersection at the Garsington Road.

Conclusions

Verges can never be a substitute for more sympathetically managed areas. In the usual sense of the word (offering a passage to suitable habitat) they are not wildlife corridors for the more demanding and less mobile *plant* species, whatever they may be for animal taxa (Andrews 1993). An ancient woodland species cannot establish itself for an interim period on dry sand, nor can a water-dependent species move easily beyond the immediate confines of its damp ditch. More varied, conservation-minded, and costly, verge management could improve the verge flora, but only up to a point. In any case, part of the attraction of verge monitoring is recording the changes in a dynamic system.

Nevertheless, the often urban and highly artificial road system of the Oxford Ring Road still permits the survival of a wide range of wild plant species in appropriate habitat reservoirs. Public access to most of these is safe, if unpleasantly noisy, via footpath and cycle track provision. The Ring Road is rich in ruderal and introduced species, as might be expected, but also in grassland and woodland edge plants. Though nature reserves carry a richer suite of scarcer plants, they cannot usually compete in terms of variety (partly because they are smaller). Thus Pixey Mead, which comes very close to the road, is one of the best examples of unimproved hay meadows in Europe; it may have up to 60 species in a 5 metre-square quadrat (AW McDonald, verbally 2000) but its higher-plant species total is 141. The Oxford Ring Road achieves its variety by crossing a number of different geological substrates and relict habitats. We should use it, enjoy it, and defend its best patches. Watch this space.

Acknowledgements

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Appendix

Species	section 1	section 2	section 3	section 4	section 5	section 6	Total
<i>Acer campestre</i>		1	1	1	1	1	5
<i>Acer platanoides</i>	1		1			1	3
<i>Acer pseudoplatanus</i>	1	1	1	1	1	1	6
<i>Achillea millefolium</i>	1	1	1	1	1	1	6
<i>Aegopodium podagraria</i>			1		1	1	3
<i>Aesculus hippocastanum</i>	1	1	1		1	1	5
<i>Aethusa cynapium</i>					1	1	2
<i>Agrimonia eupatoria</i>	1	1	1		1	1	5
<i>Agrostis canina</i>						1	1
<i>Agrostis capillaris</i>	1	1			1	1	4
<i>Agrostis stolonifera</i>	1	1	1	1	1		5
<i>Ajuga reptans</i>			1		1		2
<i>Alisma plantago-aquatica</i>				1			1
<i>Alliaria petiolata</i>	1	1	1	1	1	1	6
<i>Allium vineale</i>		1	1	1		1	4
<i>Alnus glutinosa</i>					1		1
<i>Alopecurus myosuroides</i>		1	1	1	1	1	5
<i>Alopecurus pratensis</i>				1	1		2
<i>Anacamptis pyramidalis</i>		1					1
<i>Anagallis arvensis</i>	1				1		2
<i>Anchusa arvensis</i>						1	1
<i>Angelica sylvestris</i>		1	1	1	1		4
<i>Anisantha sterilis</i>			1	1	1	1	4
<i>Anthemis cotula</i>					1	1	2
<i>Anthriscus sylvestris</i>	1	1	1	1	1	1	6
<i>Apium nodosum</i>			1				1
<i>Arctium lappa</i>			1	1	1	1	4
<i>Arctium minor</i>	1	1		1			3
<i>Arctium vulgare</i>				1			1
<i>Arenaria serpyllifolia</i>	1						1
<i>Armoracia rusticana</i>	1	1	1	1	1	1	6
<i>Arrhenatherum elatius</i>		1	1	1	1	1	5
<i>Artemisia absinthium</i>			1			1	2
<i>Artemisia vulgaris</i>	1	1	1	1	1	1	6
<i>Arum maculatum</i>			1			1	2
<i>Aster novi-belgii</i> agg.	1	1			1	1	4
<i>Atriplex prostrata</i>				1	1		2
<i>Avena fatua</i>					1	1	2
<i>Ballota nigra</i>	1	1	1	1	1	1	6
<i>Barbarea vulgaris</i>		1	1			1	3
<i>Bellis perennis</i>	1	1	1		1	1	5
<i>Beta vulgaris</i>			1				1
<i>Betula pendula</i>		1		1		1	3
<i>Brachypodium sylvaticum</i>		1				1	2
<i>Brassica napus</i>	1	1	1	1	1	1	6
<i>Brassica nigra</i>			1	1	1		3
<i>Bromopsis erecta</i>	1	1	1	1	1	1	6

<i>Bromus hordeaceus</i>	1	1	1	1	1	1	6
<i>Bryonia dioica</i>			1	1	1	1	4
<i>Buddleja davidii</i>			1			1	2
<i>Caltha palustris</i>				1			1
<i>Calystegia sepium</i>		1	1	1	1	1	5
<i>Calystegia silvatica</i>		1					1
<i>Campanula rapunculoides</i>			1				1
<i>Capsella bursa-pastoris</i>	1	1	1		1	1	5
<i>Cardamine hirsuta</i>	1	1		1		1	4
<i>Carduus crispus</i>				1	1	1	3
<i>Carduus nutans</i>		1					1
<i>Carex hirta</i>	1	1	1	1	1	1	6
<i>Carex otrubae</i>		1					1
<i>Carex pendula</i>			1				1
<i>Carex riparia</i>	1						1
<i>Carpinus betulus</i>	1					1	2
<i>Centaurea nigra</i>	1	1	1	1	1	1	6
<i>Centaurea scabiosa</i>	1	1				1	3
<i>Centaureum erythraea</i>	1	1	1				3
<i>Cerastium fontanum</i>	1	1	1	1	1	1	6
<i>Cerastium tomentosum</i>		1		1			2
<i>Chaerophyllum temulum</i>			1	1	1	1	4
<i>Chamerion angustifolium</i>	1	1	1	1		1	5
<i>Chenopodium album</i>	1		1	1	1	1	5
<i>Cichorium intybus</i>			1	1	1		3
<i>Cirsium arvense</i>	1	1	1	1	1	1	6
<i>Cirsium eriophorum</i>	1			1	1		3
<i>Cirsium palustre</i>		1		1			2
<i>Cirsium vulgare</i>	1	1	1	1	1	1	6
<i>Clematis vitalba</i>	1	1		1	1		4
<i>Clinopodium vulgare</i>				1			1
<i>Cochlearia danica</i>	1	1		1		1	4
<i>Conium maculatum</i>			1	1	1	1	4
<i>Conyza canadensis</i>	1	1				1	3
<i>Convolvulus arvensis</i>	1	1	1	1	1	1	6
<i>Cornus sanguinea</i>	1	1	1			1	4
<i>Coronopus didymus</i>			1				1
<i>Coronopus squamatus</i>					1		1
<i>Corylus avellana</i>	1	1		1	1	1	5
<i>Cotoneaster sp.</i>						1	1
<i>Crataegus monogyna</i>	1	1	1	1	1	1	6
<i>Crepis capillaris</i>	1	1	1	1	1	1	6
<i>Crepis vesicaria</i>	1	1	1	1	1	1	6
<i>Cynosurus cristatus</i>	1	1	1	1	1		5
<i>Dactylis glomerata</i>	1	1	1	1	1	1	6
<i>Dactylorhiza fuchsii</i>			1				1
<i>Daucus carota</i>	1	1	1	1	1	1	6
<i>Deschampsia cespitosa</i>	1	1	1	1	1	1	6
<i>Dipsacus fullonum</i>	1	1	1	1	1	1	6
<i>Dryopteris filix-mas</i>				1			1

<i>Elytrigia repens</i>	1		1	1	1		4
<i>Epilobium ciliatum</i>					1		1
<i>Epilobium hirsutum</i>	1	1	1	1	1	1	6
<i>Epilobium montanum</i>					1	1	2
<i>Epilobium obscurum</i>				1			1
<i>Epilobium parviflorum</i>	1						1
<i>Epilobium tetragonum</i>	1	1	1		1	1	5
<i>Equisetum arvense</i>	1	1	1	1	1	1	6
<i>Equisetum telmateia</i>	1	1	1	1			4
<i>Erigeron acer</i>				1			1
<i>Erophila verna</i> agg.	1		1			1	3
<i>Euonymus europaeus</i>	1	1	1			1	4
<i>Eupatorium cannabinum</i>		1	1	1		1	4
<i>Euphorbia amygdaloides</i>	1						1
<i>Euphorbia exigua</i>				1			1
<i>Euphorbia helioscopia</i>	1		1		1	1	4
<i>Euphorbia peplus</i>	1						1
<i>Fallopia convolvulus</i>			1		1		2
<i>Fallopia japonica</i>			1		1		2
<i>Fallopia sachalinensis</i>						1	1
<i>Festuca arundinacea</i>	1				1		2
<i>Festuca pratensis</i>	1		1	1			3
<i>Festuca rubra</i> agg.	1	1	1	1	1	1	6
<i>Filipendula ulmaria</i>		1		1	1	1	4
<i>Fraxinus excelsior</i>	1	1	1	1	1	1	6
<i>Fumaria officinalis</i>	1		1		1	1	4
<i>Galium aparine</i>	1	1	1	1	1	1	6
<i>Galium mollugo</i>		1		1	1	1	4
<i>Galium palustre</i>				1			1
<i>Galium verum</i>	1			1	1		3
<i>Geranium dissectum</i>	1	1	1	1	1	1	6
<i>Geranium molle</i>	1	1	1		1	1	5
<i>Geranium pratense</i>	1					1	2
<i>Geranium pyrenaicum</i>	1	1	1	1	1	1	6
<i>Geranium robertianum</i>	1	1	1	1	1	1	6
<i>Geranium rotundifolium</i>	1	1	1	1	1	1	6
<i>Geum urbanum</i>	1				1	1	3
<i>Glechoma hederacea</i>	1	1	1	1	1	1	6
<i>Glyceria maxima</i>				1	1		2
<i>Hedera helix</i>	1	1	1	1	1	1	6
<i>Helictotrichon pratense</i>				1			1
<i>Heracleum sphondylium</i>	1	1	1	1	1	1	6
<i>Hesperis matronalis</i>						1	1
<i>Hieracium</i> sp.					1		1
<i>Hippophae rhamnoides</i>	1						1
<i>Holcus lanatus</i>		1	1	1	1	1	5
<i>Hordeum distichon</i>		1	1	1	1	1	5
<i>Hordeum murinum</i>	1	1	1	1	1	1	6
<i>Hordeum secalinum</i>	1			1	1		3
<i>Humulus lupulus</i>				1	1	1	3

<i>Hyacinthoides hispanica</i>	1	1		1		1	4
<i>Hypericum hirsutum</i>		1					1
<i>Hypericum perforatum</i>	1	1	1	1	1	1	6
<i>Hypericum tetrapterum</i>			1	1			2
<i>Hypochaeris radicata</i>		1	1			1	3
<i>Ilex aquifolium</i>			1			1	2
<i>Inula conyzae</i>		1	1	1			3
<i>Iris pseudacorus</i>				1			1
<i>Juglans regia</i>						1	1
<i>Juncus acutiflorus</i>					1		1
<i>Juncus conglomeratus</i>	1		1				2
<i>Juncus inflexus</i>	1	1	1	1	1	1	6
<i>Knautia arvensis</i>	1	1	1			1	4
<i>Laburnum sp.</i>			1		1	1	3
<i>Lactuca serriola</i>		1	1	1	1	1	5
<i>Lamiastrum galeobdolon</i>	1						1
<i>Lamium album</i>	1	1	1	1	1	1	6
<i>Lamium amplexicaule</i>	1						1
<i>Lamium purpureum</i>	1						1
<i>Lapsana communis</i>	1	1	1	1	1	1	6
<i>Lathyrus latifolius</i>		1					1
<i>Lathyrus nissolia</i>			1				1
<i>Lathyrus pratensis</i>	1	1	1	1	1	1	6
<i>Lathyrus sylvestris</i>	1	1					2
<i>Lemna minor</i>			1				1
<i>Leontodon autumnalis</i>	1	1	1	1	1	1	6
<i>Leontodon hispidus</i>		1			1		2
<i>Lepidium draba</i>		1					1
<i>Leucanthemum vulgare</i>	1	1	1	1	1	1	6
<i>Ligustrum vulgare</i>	1	1	1			1	4
<i>Linaria purpurea</i>					1		1
<i>Linaria vulgaris</i>	1		1	1	1	1	5
<i>Linum usitatissimum</i>				1	1		2
<i>Lolium multiflorum</i>					1		1
<i>Lolium perenne</i>	1	1	1	1	1	1	6
<i>Lonicera periclymenum</i>						1	1
<i>Lotus corniculatus</i>	1	1	1	1	1	1	6
<i>Lunaria annua</i>	1		1			1	3
<i>Lychnis flos-cuculi</i>		1	1				2
<i>Lysimachia vulgaris</i>				1			1
<i>Malus sylvestris</i>	1		1				2
<i>Malus domestica</i>		1	1	1	1	1	5
<i>Malva neglecta</i>	1						1
<i>Malva sylvestris</i>	1	1	1	1	1	1	6
<i>Matricaria discoidea</i>	1	1	1	1	1	1	6
<i>Matricaria recutita</i>	1						1
<i>Medicago lupulina</i>	1	1	1	1	1	1	6
<i>Medicago sativa</i>		1			1	1	3
<i>Melilotus albus</i>				1			1
<i>Melilotus altissimus</i>	1	1	1	1			4

<i>Melilotus officinalis</i>		1				1	2
<i>Mentha aquatica</i>		1	1				2
<i>Mercurialis annua</i>	1						1
<i>Mercurialis perennis</i>						1	1
<i>Muscari armeniacum</i>						1	1
<i>Myosotis arvensis</i>		1	1		1		3
<i>Myosotis scorpioides</i>				1			1
<i>Narcissus sp.</i>	1	1		1	1		4
<i>Narcissus poeticus</i>						1	1
<i>Odontites verna</i>	1						1
<i>Oenanthe crocata</i>				1			1
<i>Papaver dubium</i>	1	1			1	1	4
<i>Papaver rhoeas</i>		1	1	1	1	1	5
<i>Papaver somniferum</i>	1				1		2
<i>Parietaria judaica</i>	1						1
<i>Pastinaca sativa</i>	1	1	1	1	1	1	6
<i>Pentaglottis sempervirens</i>		1					1
<i>Persicaria amphibia</i>	1	1	1	1	1	1	6
<i>Persicaria lapathifolia</i>					1		1
<i>Persicaria maculosa</i>					1		1
<i>Phalaris arundinacea</i>					1		1
<i>Phleum bertolonii</i>	1	1			1	1	4
<i>Phleum pratense</i>					1	1	2
<i>Phragmites australis</i>		1	1	1			3
<i>Picris echioides</i>			1	1	1	1	4
<i>Pimpinella saxifraga</i>			1	1			2
<i>Plantago lanceolata</i>	1	1	1	1	1	1	6
<i>Plantago major</i>	1	1	1	1	1	1	6
<i>Plantago media</i>	1		1		1		3
<i>Poa annua</i>	1	1		1	1	1	5
<i>Poa compressa</i>						1	1
<i>Poa pratensis</i>	1	1	1	1	1		5
<i>Poa trivialis</i>	1	1	1	1	1	1	6
<i>Polygonum aviculare</i>	1	1	1	1	1	1	6
<i>Polygonum rurivagum</i>					1		1
<i>Populus alba</i>		1			1	1	3
<i>Populus canescens</i>		1					1
<i>Populus nigra var. italica</i>				1	1	1	3
<i>Populus tremula</i>	1						1
<i>Potentilla anserina</i>			1	1		1	3
<i>Potentilla reptans</i>	1	1	1	1	1	1	6
<i>Primula veris</i>	1		1	1	1	1	5
<i>Prunella vulgaris</i>	1	1	1	1	1	1	6
<i>Prunus avium</i>	1	1	1	1	1	1	6
<i>Prunus domestica</i>			1			1	2
<i>Prunus spinosa</i>	1	1		1	1	1	5
<i>Pteridium aquilinum</i>	1						1
<i>Pulicaria dysenterica</i>	1	1	1	1	1		5
<i>Pyrus communis</i>			1	1			2
<i>Quercus cerris</i>						1	1

<i>Quercus robur</i>	1	1	1	1		1	5
<i>Ranunculus acris</i>	1	1	1		1	1	5
<i>Ranunculus arvensis</i>			1		1		2
<i>Ranunculus bulbosus</i>	1	1				1	3
<i>Ranunculus ficaria</i>						1	1
<i>Ranunculus repens</i>	1	1	1	1	1	1	6
<i>Ranunculus sceleratus</i>					1		1
<i>Raphanus raphanistrum</i>	1	1			1		3
<i>Reseda lutea</i>				1		1	2
<i>Reseda luteola</i>	1	1			1		3
<i>Rhamnus catharticus</i>					1	1	2
<i>Rhinanthus minor</i>					1		1
<i>Ribes rubrum</i>					1		1
<i>Rorippa nasturtium-aquaticum</i>						1	1
<i>Rorippa sylvestris</i>	1						1
<i>Rosa arvensis</i>	1	1				1	3
<i>Rosa canina</i>	1	1	1	1	1	1	6
<i>Rosa rubiginosa</i>						1	1
<i>Rubus caesius</i>		1	1	1	1	1	5
<i>Rubus fruticosus</i>	1	1	1	1	1	1	6
<i>Rubus idaeus</i>		1	1				2
<i>Rumex acetosa</i>	1	1	1	1	1	1	6
<i>Rumex conglomeratus</i>	1		1				2
<i>Rumex crispus</i>	1	1	1	1	1	1	6
<i>Rumex obtusifolius</i>	1	1	1	1	1	1	6
<i>Rumex sanguineus</i>					1	1	2
<i>Sagina apetala</i>			1				1
<i>Sagina procumbens</i>	1					1	2
<i>Salix alba</i>		1	1	1	1	1	5
<i>Salix caprea</i>					1	1	2
<i>Salix cinerea</i>	1	1	1	1	1	1	6
<i>Salix fragilis</i>		1	1	1	1	1	5
<i>Salix viminalis</i>					1	1	2
<i>Sambucus nigra</i>	1	1	1	1	1	1	6
<i>Sanguisorba officinalis</i>	1	1		1	1	1	5
<i>Saponaria officinalis</i>						1	1
<i>Scrophularia auriculata</i>			1		1	1	3
<i>Scutellaria galericulata</i>				1			1
<i>Sedum acre</i>			1				1
<i>Sedum album</i>		1					1
<i>Sedum reflexum</i>		1					1
<i>Senecio canadensis</i>		1	1			1	3
<i>Senecio erucifolius</i>	1	1	1	1	1	1	6
<i>Senecio jacobaea</i>		1	1	1	1	1	5
<i>Senecio squalidus</i>	1	1		1	1	1	5
<i>Senecio vulgaris</i>	1	1	1	1	1	1	6
<i>Silaum silaus</i>					1	1	2
<i>Silene dioica</i>		1	1	1		1	4
<i>Silene latifolia</i>	1	1	1		1	1	5
<i>Silene vulgaris</i>	1	1	1		1	1	5

<i>Sinapis alba</i>				1			1
<i>Sinapis arvensis</i>	1	1	1	1	1	1	6
<i>Sison amomum</i>					1	1	2
<i>Sisymbrium officinale</i>	1	1	1	1	1	1	6
<i>Solanum dulcamara</i>		1	1	1	1	1	5
<i>Sonchus arvensis</i>	1		1		1		3
<i>Sonchus asper</i>	1		1	1	1	1	5
<i>Sonchus oleraceus</i>	1	1	1	1	1	1	6
<i>Sorbus aucuparia</i>		1	1			1	3
<i>Sparganium erectum</i>						1	1
<i>Stachys sylvatica</i>	1	1	1	1	1	1	6
<i>Stellaria graminea</i>	1		1	1	1		4
<i>Stellaria holostea</i>	1					1	2
<i>Stellaria media</i>	1	1	1	1	1	1	6
<i>Symphytum officinale</i>			1	1		1	3
<i>Symphoricarpos albus</i>						1	1
<i>Syringa vulgaris</i>	1						1
<i>Tamus communis</i>			1		1	1	3
<i>Taraxacum officinale agg.</i>	1	1	1	1	1	1	6
<i>Thalictrum flavum</i>				1			1
<i>Thlaspi arvense</i>	1				1	1	3
<i>Tilia x europaea</i>		1	1		1		3
<i>Torilis japonica</i>	1		1	1		1	4
<i>Tragopogon pratensis</i>	1	1	1	1	1	1	6
<i>Trifolium campestre</i>	1		1	1			3
<i>Trifolium dubium</i>	1	1	1	1	1	1	6
<i>Trifolium hybridum</i>		1		1	1	1	4
<i>Trifolium pratense</i>	1	1	1	1	1	1	6
<i>Trifolium repens</i>	1	1	1	1	1	1	6
<i>Tripleurospermum maritimum</i>	1	1	1		1	1	5
<i>Trisetum flavescens</i>	1	1	1	1			4
<i>Triticum aestivum</i>		1	1	1	1	1	5
<i>Tussilago farfara</i>	1	1	1	1	1	1	6
<i>Typha latifolia</i>			1	1	1	1	4
<i>Ulex europaeus</i>	1	1					2
<i>Ulmus glabra</i>			1			1	2
<i>Ulmus procera</i>		1	1	1	1	1	5
<i>Urtica dioica</i>	1	1	1	1	1	1	6
<i>Valeriana officinalis</i>				1			1
<i>Valerianella locusta</i>	1		1				2
<i>Verbascum thapsus</i>		1			1		2
<i>Veronica arvensis</i>	1			1			2
<i>Veronica beccabunga</i>				1		1	2
<i>Veronica chamaedrys</i>				1	1		2
<i>Veronica hederifolia</i>			1		1		2
<i>Veronica persica</i>	1	1	1	1	1	1	6
<i>Viburnum lantana</i>	1	1					2
<i>Viburnum opulus</i>						1	1
<i>Vicia cracca</i>	1	1	1	1	1	1	6
<i>Vicia faba</i>			1	1	1		3

<i>Vicia hirsuta</i>		1	1	1			3
<i>Vicia sativa</i>	1	1	1	1	1	1	6
<i>Vicia sepium</i>		1		1			2
<i>Vicia tetrasperma</i>			1			1	2
<i>Vinca major</i>				1			1
<i>Viola arvensis</i>				1	1		2
<i>Viola riviniana</i>	1						1
<i>Vulpia myuros</i>	1						1
Totals	183	186	199	191	206	216	1181

Species Occurred in	Sections
94	1
59	2
44	3
35	4
41	5
82	6
355	all