U2
Deschampsia flexuosa grassland

Synonymy
Graminetum arenosum Tansley 1911 *p.p.*; *Nardus-Deschampsia* grassland Adamson 1918 *p.p.*; Grass-heath Tansley 1939, Pearsall 1968 *p.p.*; *Deschampsia flexuosa* grassland Tansley 1939.

Constant species
Calluna vulgaris, *Deschampsia flexuosa*.

Physiognomy
The *Deschampsia flexuosa* grassland comprises swards in which *D. flexuosa* is an obvious dominant, being particularly striking where the vegetation goes ungrazed in early summer, when an abundance of the tall silvery-purple inflorescences can colour whole stands. In fact, the cover of the grass is rarely complete, and the height of its herbage is usually only around 2 dm, but its strongly tussocky habit and its ability to spread rhizomatously mean that it characteristically exerts a controlling effect on the distribution of many of the other species. This is visible, first, in the generally impoverished nature of the vegetation, in which there is but one other constant, hardly any other associates occurring commonly throughout and rather sparse preferential floras in the two sub-communities. And, second, although even occasionals of the community can sometimes show local prominence, there are no consistent patterns of co- or sub-dominance.

In particular, other grasses and sub-shrubs are typically subordinate. *Calluna vulgaris* is the only other plant that occurs commonly overall, but it is characteristically found as sparse shoots and is sometimes absent altogether. And, although *Vaccinium myrtillus* and *Empetrum nigrum* ssp. *nigrum* are recorded fairly frequently, they are very much confined to one type of *Deschampsia* grassland and even there are of low cover. So, though the community is often seen in close association with a variety of heaths throughout its range and grades into them structurally, the balance of dominance in typical stands helps distinguish the vegetation types. The separation from calcifuge scrub is usually clear, too, although *Ulex europaeus* and *Rubus fruticosus* agg. can both occur occasionally in small amounts.

As for grasses, the most frequent associates are those which form the basis of other fine calcifuge swards, with *Festuca ovina* and *Agrostis capillaris* both common, *Anthoxanthum odoratum*, *Agrostis canina*, *A. stolonifera* and *Festuca rubra* occurring more occasionally. But, again, these are rather unevenly distributed throughout the community and, although the first two in particular can be patchily abundant, they never rival the dominance of *D. flexuosa* except very locally. Likewise, *Molinia caerulea* is sometimes found but only as scattered tussocks and, although *Nardus stricta* is also seen in some stands, almost all the kinds of mixed swards which Adamson (1918) and later authors (Tansley 1939) put in *Nardus-Deschampsia* vegetation are best placed in the *Nardus-Galium* grassland.

Small dicotyledons are few in number and usually sparse. *Galium saxatile* is the commonest of the group and it can form quite large patches between the grass tussocks, but with *Potentilla erecta* it is more often seen as scattered individuals. *Rumex acetosella* can also find a place in more open areas but the rich ephemeral flora of the *Festuca-Agrostis-Rumex* grassland is not characteristic here. Other, more conspicuous, plants which can add diversity to the community are *Eriophorum vaginatum*, though its tussocks are never more than a subordinate or waning element in the flora, *Juncus squarrosus* and *J. effusus*, both only occasional but the latter sometimes locally prominent, and *Pteridium aquilinum*, found as sparse shoots or in small patches. Saplings of *Betula pendula* and oak, usually with at least some *Q. robur* characters, are also sometimes seen where seedlings germinating on more open ground have been able to get away.

Bryophytes and lichens are not usually a conspicuous component of the vegetation, with only very occasional *Hypnum cupressiforme s.l.*, *Plagiothecium undulatum*, *Pohlia nutans* and *Rhytidiadelphus squarrosus* occurring

through the community. But some stands have local enrichment from acrocarpous mosses and *Cladonia* spp. while in others bulky pleurocarps or even Sphagna can make a prominent contribution.

Sub-communities

***Festuca ovina-Agrostis capillaris* sub-community:** *Graminetum arenosum* Tansley 1911 *p.p.*; Grass-heath Tansley 1939 *p.p.* Although this kind of *Deschampsia* grassland is commonly found among sub-shrub vegetation, it is the less heathy of the sub-communities with only small amounts of *Calluna* occurring through the sward. But the grass cover is a little more diverse than usual with *F. ovina* and *A. capillaris* both common and among these are the preferential herbs *Galium saxatile*, *Potentilla erecta* and *Rumex acetosella*. *R. acetosa* and *Digitalis purpurea* also occur very occasionally and there can be clumps of *Epilobium angustifolium*. *Pteridium aquilinum* is commoner here than in the other sub-community and some stands have birch or oak saplings or patches of *Ulex europaeus* and bramble.

Acrocarpous mosses are fairly frequent between the grass tussocks, though only exceptionally abundant, with *Polytrichum piliferum*, *Dicranum scoparium* and, less commonly, *Campylopus pyriformis* and *Orthodontium lineare*. In some stands, too, *Cladonia gracilis*, *C. pyxidata*, *C. uncialis* and *C. impexa* can be found on patches of bare ground.

***Vaccinium myrtillus* sub-community:** *Nardus-Deschampsia* grassland Adamson 1918 *p.p.*; Grass-heath Pearsall 1968 *p.p.*; *Deschampsia flexuosa* grassland Tansley 1939. *D. flexuosa* remains dominant here, but *Calluna* is typically accompanied by scattered sprigs of *Vaccinium myrtillus* and *Empetrum nigrum* ssp. *nigrum*, which together can give the vegetation a distinctly heathy aspect. Some stands have scattered tussocks of *Eriophorum vaginatum*, while occasional plants of *Molinia*, *J. squarrosus* or *J. effusus* can also occur through the sward. In other situations, small amounts of *Anthoxanthum*, *Agrostis canina*, *Festuca rubra* and *Carex nigra* are recorded and here *Galium saxatile* and *Potentilla erecta* can occur, though they are not generally characteristic of this vegetation.

Small acrocarps and lichens are uncommon here too, though *Pleurozium schreberi* is frequent and locally abundant and there can be small patches of *Polytrichum commune* and very occasional tufts of *Sphagnum compactum*, *S. subnitens* or *S. recurvum*.

Habitat

The *Deschampsia* grassland is characteristic of base-poor soils, free-draining though not parched and sometimes quite moist, through the upland fringes and moderately oceanic parts of the lowlands. Grazing is often important in maintaining the community and most stands have probably been derived secondarily from woodlands, heaths and even mires.

D. flexuosa is an important constituent of a number of widespread kinds of calcifuge grassland, but it is only really able to attain the kind of prominence that it shows here when certain rather particular conditions are fulfilled. In the first place, the climate needs to be at least moderately moist. *D. flexuosa* has become locally prominent on some of the Breckland grass-heaths with the demise of grazing (Watt 1971*a*, Ratcliffe 1977), but the *Deschampsia* grassland itself is not common in those parts of Britain where the annual rainfall drops below 600 mm (*Climatological Atlas* 1952) or where the number of rain days yr^{-1} is less than 120 (Ratcliffe 1968), a zone which includes most of East Anglia, much of the East Midlands and the Vale of York. In these areas, spring and early summer in particular are dry and, with the rise in temperature thereafter to high levels, with mean annual maxima above 29 °C (Conolly & Dahl 1970), the tendency for a soil water deficit is very marked, particularly on permeable profiles (Smith 1976, Chandler & Gregory 1976). Here, then, the community is usually replaced on such soils by the *Festuca-Agrostis-Rumex* grassland, where parching contributes to keeping the turf open and allowing a rich representation of ephemerals and lichens. With less droughty conditions, grass-dominance and consequent impoverishment of the swards in these elements are more pronounced in the *Deschampsia* grassland, though the two vegetation types can come quite close in the *Festuca-Agrostis* sub-community. This is characteristic of the drier part of the range of the *Deschampsia* grassland, occurring across lowland England up to altitudes of around 200 m, where it grades continuously in locally-parched patches to the *Galium-Potentilla* sub-community of the *Festuca-Agrostis-Rumex* grassland.

The opposite extreme is seen in the *Vaccinium* sub-community which replaces the other kind of *Deschampsia* grassland through the upland fringes of the west and north of the country, at altitudes between 300 and 500 m, where the annual rainfall approaches 1000 mm (*Climatological Atlas* 1952) with 140–160 wet days yr^{-1} (Ratcliffe 1968), and where mean annual maxima are less than 27 °C (Conolly & Dahl 1970). Indicative of this shift to cooler, moister conditions are the appearance of the broadly montane *V. myrtillus* and *E. nigrum* ssp. *nigrum*, the greatly increased frequency of *Pleurozium schreberi* and the general change in the character of the vegetation from a Thero-Airion sward towards a Nardo-Galion grassland. Indeed, in these parts of Britain, the community can extend into habitats transitional to various kinds of mire, as over the drying surfaces of blanket bog or in the surrounds to grassy poor fens.

Throughout its range, however, and this is the second feature of importance in its distribution, the *Deschampsia* grassland is consistently associated with base-poor soils that, though sometimes quite moist, are free-draining, being typically derived from pervious siliceous bedrocks or sometimes coarse-textured superficials. For the most part, the extensive aeolian sands and sandy drifts of East Anglia, together with the Pliocene and Pleistocene Crag, lie beyond the climatic limit of vigorous growth of *D. flexuosa* but, with the move into the somewhat wetter Midlands, coarse glacio-fluvial deposits and river-terrace drift, together with patches of wind-blown sand, provide suitable substrates in parts of the Shropshire–Cheshire Plain. There, too, down through Staffordshire, and up into the Nottinghamshire lowlands, there are Permo-Triassic sandstones and conglomerates making up the low, flat-topped hills of Cannock Chase, and Delamere and Sherwood forests, over which the community is locally abundant. To the south, it is the Lower Greensand cropping out through Bedfordshire and, more extensively, around The Weald, that provides the most important parent material beneath the *Deschampsia* grassland, with the more pervious of the Hastings Beds underlying stands in the High Weald.

Through this lowland part of the range of the *Deschampsia* grassland, where the *Festuca-Agrostis* sub-community is the usual type, such deposits weather to a variety of acidic impoverished profiles. In the Midlands, deep brown sands of the Bridgnorth, Newport and Cuckney series are widespread (Furness 1978, *Soil Survey* 1983, Ragg *et al.* 1984), though the lightness of these profiles has meant that they have often been reclaimed for agriculture, leaving only fragments with more semi-natural vegetation. More often, though, the *Festuca-Agrostis* sub-community is found on humo-ferric podzols, like those of the Goldstone Series in Delamere and Cannock (Furness 1978, Ragg *et al.* 1984) and the Shirrell Heath soils in Surrey and Sussex or, where there is a little more fine material in the profile, on the palaeo-argillic podzols of the Southampton Series in Ashdown Forest (*Soil Survey* 1983, Jarvis *et al.* 1984). The more sharply draining of these soils can show some tendency to droughtiness in especially hot summers but, even where permeability is not so extreme, there is no tendency to drainage impedence, as characterises so many base-poor soils in southern England, particularly with the shift westwards into the zone of more oceanic climate. Any marked tendency to the development of a hard argillic B horizon or B_{Fe} pan or to seasonal waterlogging by ground water in gley podzols curtails the vigour of *D. flexuosa* and, down through the South-West Peninsula and south Wales, it typically cedes dominance on such moister soils to *Agrostis curtisii*.

With the move to the wetter climate at somewhat higher altitudes around the upland fringes, the *Deschampsia* grassland is able to maintain a hold on base-poor soils provided drainage remains sharp, and here it tends to be associated with somewhat steeper ground, quite often on scarps or stepped valley sides. Around the Pennines, the resistant sandstones of the Millstone Grit and Coal Measures are particularly important with Devonian Old Red Sandstone supporting stands in the hills of south-east Scotland and south Wales, and granite in Dartmoor. In some such situations, around free faces or over detritus, the soils can be rock-dominant rankers, often very sandy below, but podzols are again commonly found beneath the community, notably Anglezarke humo-ferric podzols and Belmont and Lydcot stagnopodzols (Carroll *et al.* 1979, *Soil Survey* 1983). Here, it is the *Vaccinium* sub-community that is characteristic, with *D. flexuosa* contributing to what is often a much more substantial layer of mor than is seen under the *Festuca-Agrostis* sub-community: the litter often accumulates as compact laminae, with seemingly slow incorporation (Scurfield 1954). Sometimes, where the ground has become drier, by natural climatic change or through draining operations, this kind of *Deschampsia* grassland extends on to distinctly peaty topsoils, as over stagnopodzol intergrades and on raw peats proper over raised and blanket mires. It is then that elements of mire floras can be found as remnants among the *D. flexuosa*, species such as *J. effusus*, *A. canina* and *C. nigra* showing affinities with poor fens, *E. vaginatum* often indicating the prior existence of ombrogenous bog vegetation. In such situations as these, other grasses are likely to become important as possible rivals to *D. flexuosa*, *Nardus stricta* taking over as a dominant on ground where drainage is poor (e.g. Adamson 1918), *Molinia* on free-draining but wetter peats.

Towards the edaphic limits of the *Deschampsia* grassland on moister soils, treatments such as burning and grazing may play a crucial role in extending the dominance of *D. flexuosa* further than might otherwise be expected. Indeed, throughout its range, these activities have probably helped establish and maintain the community over the complete range of soils, constituting a third important environmental factor governing its distribution. In the climax forest type of base-poor soils in lowland Britain, the *Quercus-Betula-Deschampsia* woodland, *D. flexuosa* is a constant and often abundant member of the field layer and, with clearance of the canopy, it can show an increase in both vegetative vigour and rate of flowering (Scurfield 1954). Similarly, when the dry sub-shrub vegetation of the moderately oceanic lowlands of Britain, the *Calluna-Ulex* minor and *Calluna-Deschampsia* heaths, are burned, it is often *D. flexuosa* that spreads to achieve dominance in the herbaceous phase of the post-fire regrowth (e.g. Fritsch

& Salisbury 1915). Where grazing supervenes in such situations, this dominance is likely to be prolonged except on those soils more strongly susceptible to drought or impedence because, although *D. flexuosa* is eaten by sheep and rabbits, it can withstand grazing for very lengthy periods. Indeed, very heavy grazing may actually push back quite advanced recolonisation by sub-shrubs and tree saplings, leaving *D. flexuosa* in possession of most of the ground. And since the grass tends to form a thick, tussocky sward in this kind of vegetation, a reduction or even withdrawal of grazing may not produce any quick resumption of succession: except perhaps for oak (Jones 1959), woody plants are not readily able to get a hold where the grassland has become quite closed.

Zonation and succession

The *Deschampsia* grassland is most often found with sub-shrub vegetation, woodland, scrub and bracken in mosaics which reflect complex histories of land use, particularly forest clearance, burning and grazing, and on lowland heaths it now often makes but a small contribution to remnants of semi-natural vegetation where neglect is the major controlling factor in community distribution. Soil-related sequences can sometimes still be discerned beneath the seral patterns, with the *Deschampsia* grassland occupying a transitional position between wet heath and ephemeral-rich grassland. Around the upland fringes, the patterns are essentially the same, though the particular vegetation types involved can be different and here, too, the grassland can occur in close association with mire communities.

In The Weald, in such places as Iping Common in Sussex, Thursley, Hankley and Chobham Commons in Surrey (Ratcliffe 1977) and over some of the remaining open spaces around London, the *Deschampsia* grassland forms an integral part of the patchwork of communities that has developed over the more free-draining base-poor soils with the abandonment of burning, grazing and other traditional treatments like the cutting of bracken and gorse. Much of the ground is now occupied by what was early referred to as 'oak-birch heath' (Tansley 1911, 1939, Wooldridge & Goldring 1953), that is, open, immature *Quercus-Betula-Deschampsia* woodland with local dominance by a variety of invading trees. Birch, usually *B. pendula*, oak, mostly *Q. robur* but with *Q. petraea* locally abundant, and pine, particularly *P. sylvestris* but with other species seeding in from planted stock, are all important. And, on some Surrey sites, the naturalised alien *Amelanchier lamarkii* has gained a hold in such mosaics. In certain places, as on Holmbury and Leith Hill, dead heather and gorse among the woodland litter shows that such vegetation has succeeded heath over the past 40 years or so, while elsewhere trees have invaded more open ground directly after burning episodes. In other sites, there is overgrown *Calluna-Ulex minor* heath, dense bracken or, where there has been some disturbance and enrichment of the soils, *Ulex-Rubus* scrub. Among these mosaics, the *Deschampsia* grassland is sometimes limited to the margins of well-worn paths or remnants of more open ground where woody plants have not yet got a hold in the rank sward, and periodic fires can help re-instate the community in such situations. Sometimes, the stands are a little more extensive, but throughout there is always a strong floristic continuity among the various vegetation types represented, *D. flexuosa* itself running on under more open canopies of sub-shrubs and trees, together with herbs like *Potentilla erecta* and *Galium saxatile*, and the boundaries between the communities being often dependent upon the extent of the cover of woody plants.

Frequently, now, the extent of this regrowth is sufficient to blur any soil-related patterns in which the *Deschampsia* grassland is involved, but it can sometimes be seen as a partial replacement for the *Calluna-Ulex* heath in the sequences of communities over soils that are increasingly impeded. Then it gives way, where there is any strong tendency to gleying, to the *Ericetum tetralicis* wet-heath on periodically waterlogged peaty profiles. Such conditions are inimical to the survival of *D. flexuosa*, although where the surrounds of valley mires in this part of Britain have become dry and been burned the community can extend a little further than usual on to such ground. However, where there is any tendency for grass-dominance to develop in such situations westwards of The Weald, *Agrostis curtisii* usually has the edge on *D. flexuosa*, and the *Deschampsia* grassland fades in importance in the extreme oceanic zone. Shifting in the other direction in these edaphic sequences, on to base-poor soils that show a stronger tendency to parching than is usual under the *Deschampsia* grassland, there can be a local transition to the *Festuca-Agrostis-Rumex* grassland, usually, in The Weald, of the *Potentilla-Galium* sub-community. In the past, severe rabbit-grazing helped accentuate the contribution from this vegetation over scuffed patches and around burrows.

Essentially similar mosaics of grassland, heath and woodland such as characterise The Weald can be found locally through the Midlands in such sites as Sherwood and Delamere Forests and over the higher ground in Cannock Chase, though here the sub-shrub vegetation is represented by the *Calluna-Deschampsia* heath, a community which shows an even greater floristic continuity with the *Deschampsia* grassland than does the *Calluna-Ulex minor* heath. Birch, oak and pine remain the major colonisers of the more open vegetation with *Quercus-Betula-Deschampsia* woodland eventually establishing itself as the climax forest.

With the shift to the upland fringes, some further

changes can be seen in this basic pattern. The *Festuca-Agrostis* sub-community of the *Deschampsia* grassland is replaced by the *Vaccinium* sub-community, and there are similar shifts in both the associated heath and woodland types, with bilberry-rich sub-communities becoming the norm, thus giving a somewhat montane character to the entire sequence of vegetation types. Usually these are disposed over the scarps and valley sides that mark the first substantial rise to the Pennine uplands, the mosaic of communities being again largely dependent on the history of treatments, with a widespread continuance of grazing helping to maintain extensive tracts of the *Deschampsia* grassland against the spread of sub-shrubs and trees. Patches of grassland and heath can recur at quite high altitudes on the grit edges, though wherever there is a lessening of slope with the shift on to the great shelving dips, poor drainage and the accumulation of ombrogenous peat curtail the extent of these communities. A common pattern is for the *Deschampsia* grassland to give way to *Nardus-Galium* grassland on the stagnopodzol intergrades, a zonation which can be interrupted by the occurrence of flushed areas with poor-fen vegetation like grassy *Carex-Sphagnum* mire, and then for there to be a switch to *Calluna-Eriophorum* bog. *D. flexuosa* can run throughout such sequences and, indeed, where blanket peats have been drained, the *Deschampsia* grassland itself can become established on the drier fringes and ramparts, with a local spread of *V. myrtillus* where grazing is withdrawn or of the unpalatable *E. nigrum* ssp. *nigrum*. The *Deschampsia* grassland can also figure over the drying surfaces of raised mires with the *Eriophorum* bog, though with the shift into more oceanic areas it is *Molinia* which usually assumes dominance with the loss of waterlogging on the bog surface.

Distribution

The *Deschampsia* grassland has a fairly widespread but local distribution through the moderately oceanic lowlands, becoming more common towards the upland fringes of northern England.

Affinities

Although *D. flexuosa* has long been acknowledged as a major component of heaths throughout much of the lowland zone, this grassland has figured little in descriptions, except as part of a compendious 'grass heath'. And its phytosociological status is unclear. It shows floristic affinities, in the more open stands of the *Festuca-Agrostis* sub-community, with the *Festuca-Agrostis-Rumex* grassland, though clearly it cannot itself be considered as a Thero-Airion community. A better solution, while acknowledging that it can have a variety of remnant associated floras depending on its origin, is to locate it among the Nardo-Galion swards which stresses its close floristic and ecological relationships with a range of sub-shrub communities.

Floristic table U2

	a	b	2
Deschampsia flexuosa	V (4–9)	V (4–9)	V (4–9)
Calluna vulgaris	IV (1–4)	IV (1–5)	IV (1–5)
Galium saxatile	III (1–5)	II (1–3)	III (1–5)
Potentilla erecta	III (1–3)	II (1–4)	III (1–4)
Festuca ovina	III (2–6)	I (4)	II (2–6)
Pteridium aquilinum	III (1–8)		II (1–8)
Agrostis capillaris	III (1–5)		II (1–5)
Polytrichum piliferum	III (1–5)		II (1–5)
Rumex acetosella	III (1–6)		II (1–6)
Dicranum scoparium	II (1–5)	I (1–3)	II (1–5)
Rumex acetosa	II (4–5)	I (1)	I (1–5)
Betula pendula sapling	II (1–4)		I (1–4)
Epilobium angustifolium	II (1–3)		I (1–3)
Rubus fruticosus agg.	II (1–3)		I (1–3)
Campylopus pyriformis	I (1–3)		I (1–3)
Orthodontium lineare	I (1–3)		I (1–3)
Holcus mollis	I (1–3)		I (1–3)
Quercus hybrid sapling	I (1–3)		I (1–3)

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Floristic table U2 (*cont.*)

	a	b	2
Betula pendula seedling	I (1–2)		I (1–2)
Quercus sp. seedling	I (1–3)		I (1–3)
Poa annua	I (3–4)		I (3–4)
Cladonia gracilis	I (3–5)		I (3–5)
Ulex europaeus	I (2–4)		I (2–4)
Vaccinium myrtillus		V (1–4)	II (1–4)
Pleurozium schreberi	I (4)	IV (1–5)	II (1–5)
Empetrum nigrum nigrum		III (1–5)	II (1–5)
Eriophorum vaginatum		III (1–5)	I (1–5)
Molinia caerulea	I (2–4)	II (1–4)	I (1–4)
Juncus squarrosus	I (5)	II (1–3)	I (1–5)
Juncus effusus	I (1)	II (1–6)	I (1–6)
Polytrichum commune		II (1–4)	I (1–4)
Agrostis canina		II (1–4)	I (1–4)
Anthoxanthum odoratum		II (1–4)	I (1–4)
Carex nigra		II (1–3)	I (1–3)
Festuca rubra		I (4–5)	I (4–5)
Nardus stricta		I (1–3)	I (1–3)
Barbilophozia floerkii		I (1–4)	I (1–4)
Luzula multiflora		I (1–3)	I (1–3)
Hypnum cupressiforme s.l.	II (1–4)	II (1–6)	II (1–6)
Plagiothecium undulatum	I (1)	I (1–3)	I (1–3)
Rhytidiadelphus squarrosus	I (1)	I (1–4)	I (1–4)
Pohlia nutans	I (1–2)	I (1–2)	I (1–2)
Number of samples	19	11	30
Number of species/sample	9 (3–16)	11 (6–15)	9 (3–16)
Herb/shrub height (cm)	21 (4–60)	20 (15–30)	21 (4–60)
Herb/shrub cover (%)	87 (50–100)	86 (30–100)	87 (50–100)
Ground layer height (mm)	14 (10–30)	42 (10–100)	21 (10–100)
Ground layer cover (%)	19 (0–80)	7 (0–15)	17 (0–80)
Altitude (m)	110 (20–168)	449 (305–539)	254 (20–539)
Slope (°)	4 (0–20)	7 (0–20)	5 (0–20)

a *Festuca ovina-Agrostis capillaris* sub-community
b *Vaccinium myrtillus* sub-community
2 *Deschampsia flexuosa* grassland (total)

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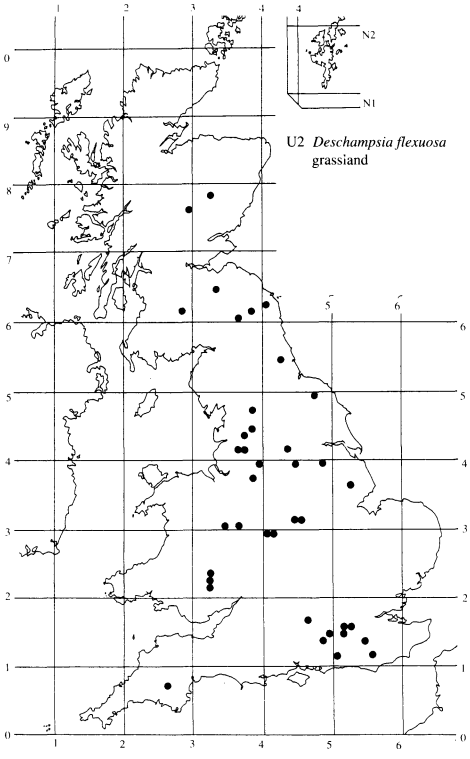

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