MG2
Arrhenatherum elatius-Filipendula ulmaria tall-herb grassland
Filipendulo-Arrhenatheretum elatioris Shimwell 1968*a*

Synonymy
Polemonium caeruleum stands Pigott 1958; Tall-herb grassland Grime & Blythe 1969; Habitat Study 51 Elkingkton 1969; Species-rich *Arrhenatherum* grassland B_b Lloyd 1972.

Constant species
Angelica sylvestris, *Arrhenatherum elatius*, *Cruciata laevipes*, *Dactylis glomerata*, *Dryopteris filix-mas*, *Epilobium montanum*, *Festuca rubra*, *Filipendula ulmaria*, *Geum rivale*, *Heracleum sphondylium*, *Mercurialis perennis*, *Poa trivialis*, *Silene dioica*, *Urtica dioica*, *Valeriana officinalis*, *Eurhynchium swartzii*, *Plagiomnium undulatum*, *Plagiothecium denticulatum*, *Lophocolea bidentata s.l.*

Rare species
Polemonium caeruleum.

Physiognomy
The *Filipendulo-Arrhenatheretum* is a luxuriant vegetation type dominated by large tussock grasses, notably *Arrhenatherum elatius* and *Festuca rubra* with smaller amounts of *Dactylis glomerata*, and tall hemicryptophyte dicotyledons, especially *Filipendula ulmaria* with some *Heracleum sphondylium*, *Urtica dioica*, *Valeriana officinalis* and *Angelica sylvestris*. These form an uneven canopy which may be more than 1 m high and beneath them is a thick understorey of shorter species of which *Mercurialis perennis*, *Geum rivale*, *Cruciata laevipes*, *Epilobium montanum*, *Silene dioica*, *Poa trivialis* and *Dryopteris filix-mas* are the most conspicuous. Frequent associates, some of which may attain local abundance, are *Trisetum flavescens*, *Veronica chamaedrys*, *Vicia sepium*, *Rumex acetosa*, *Hypericum hirsutum*, *Campanula rotundifolia*, *Scrophularia nodosa*, *Anthriscus sylvestris* and *Saxifraga hypnoides*. There is a marked seasonality in the vegetation with rapid early summer growth of the dicotyledons and complete winter die-back.

Bryophytes are always present and may form a lush, varied and extensive ground cover. The most frequent species are *Plagiothecium denticulatum*, *Eurhynchium swartzii*, *Plagiomnium undulatum*, *P. affine*, *Calliergon cuspidatum*, *Brachythecium rutabulum*, *Rhytidiadelphus squarrosus*, *Hylocomium splendens* and *Lophocolea bidentata s.l.*

Numerous other flowering plants and bryophytes occur at low frequency to make this one of the richest mesotrophic grasslands. There may also be occasional records for saplings of *Fraxinus excelsior*, *Ulmus glabra*, *Prunus padus* and *Corylus avellana* which reflect the frequent spatial association of the community with open or fragmentary woodland. The disposition of the vegetation over steep rocky slopes and ledges may introduce an additional element of physiognomic complexity.

Sub-communities
A provisional distinction is made here between two sub-communities, based partly on the presence or absence of the national rarity *Polemonium caeruleum*. The samples with *P. caereuleum* are numerous but from a relatively small number of sites (Pigott 1958, Shimwell 1968*a*, *b*) and some of their distinctiveness may be related to deliberate selection of stands and a more thorough searching of the vegetation, especially for the smaller bryophytes. Further data are needed from stands lacking *P. caeruleum* to substantiate the, at present, rather slim distinction between the two sub-communities.

***Filipendula ulmaria* sub-community:** *Filipendulo-Arrhenatheretum typicum* Shimwell 1968; Tall-herb grassland Grime & Blythe 1969 *p.p.*; Species-rich *Arrhenatherum* grassland B_b Lloyd 1972. A number of the community constants are less conspicuous than in the *Polemonium* sub-community, notably *F. rubra* which is never abundant here. *Arrhenatherum* and *F. ulmaria* tend to be co-dominant among the taller species with *Trisetum flavescens*, *Angelica sylvestris*, *Sanguisorba officinalis*, *Avenula pubescens*, *Senecio jacobaea*, *Poa pratensis* and *Origanum vulgare* preferentially frequent.

***Polemonium caeruleum* sub-community:** *Polemonium caeruleum* stands Pigott 1958; *Filipendulo-Arrhenatheretum polemonietosum* Shimwell 1968; Tall-herb grassland Grime & Blythe 1969 *p.p.*; Habitat Study 51 Elkington 1969. Here the vegetation is generally dominated by mixtures of *Arrhenatherum*, *F. rubra* and *P. caeruleum* with *F. ulmaria* less abundant. Particularly noticeable among the preferentials are species characteristic of moist and shaded vegetation such as *Oxalis acetosella*, *Stellaria holostea* and *Ranunculus ficaria*. Other species such as *Geranium robertianum*, *Cystopteris fragilis* and *Draba muralis* reflect the occurrence of more open rocky areas within stands of complex physiognomy. Bryophytes are particularly conspicuous in this sub-community with *Plagiomnium affine* and *Plagiochila asplenoides* (usually the var. *major*) good preferentials.

Habitat

The *Filipendulo-Arrhenatheretum* is strictly confined to steep or precipitous slopes (generally 30–50°), usually of northerly aspect, on the upland fringes (mostly 210–340 m) of northern England. It occurs almost exclusively on rendziniform soils over Carboniferous Limestone. It is ungrazed by large mammals and frequently occurs in assocation with fragmentary woodland.

The regional climate within the range of the community is cool, cloudy and wet (Pigott 1958). Temperatures are low throughout the year and most localities have less than 1300 hours of sunshine annually with frequent hill mists. The annual rainfall is between 900 and 1650 mm with usually more than 180 wet days per year. The particular topographic conditions under which the community is found accentuate the climatic effects. The sites from which Pigott (1958) described his *Polemonium* stands showed reduced air and soil temperature maxima in relation to standard meteorological observations for the region and the vegetation was, in some localities, shaded at noon and in the early afternoon even in midsummer. Such features combined to keep transpiration and soil-water evaporation low and maintain a cool and damp microclimate. Although these data refer to the *Polemonium* sub-community, such conditions probably apply to the community as a whole. It should be noted, however, that in the harsher climate towards the north of the range of the community, stands of both sub-communities are less markedly confined to north-facing slopes.

Apart from a single locality with a brown earth soil over Devonian andesite lava in the Cheviots, the community occurs on proto-rendzinas, rendzinas and mull rendzinas developed over Carboniferous Limestone, though sometimes partly from superficials. The soils from Pigott's *Polemonium* stands had a pH of generally 7 or more, free and sometimes plentiful calcium carbonate, organic matter usually in excess of 40% (i.e. humic rendzina *sensu* Avery 1980) and a moisture content which, though fluctuating markedly throughout the year, rarely fell below 50% dry weight, even in summer droughts. However, though moist, the soils were well aerated and there was a large annual nutrient turnover with rapid incorporation of the abundant litter by the following summer. The few soil data that are available for the *Filipendula* sub-community suggest that it may be more characteristic of rendziniform soils which approach brown calcareous earths, still moist but with a lower pH and with smaller amounts of free calcium carbonate.

Many of the species of the *Filipendulo-Arrhenatheretum* are highly palatable to stock and the vegetation will probably not withstand heavy grazing, especially by sheep or deer (Pigott 1958). Some stands are naturally inaccessible and this may have played a major part in their survival. The cool, damp conditions in which the community thrives also favour certain grazing molluscs, e.g. the snail *Arianta arbustorum*, which are vulnerable to dessication. Grime & Blythe (1969) showed that, at the Winnats Pass, Derbyshire, this species was locally abundant in stands of this community, sheltering by day amongst the moist bryophyte mat and talus substrate and grazing nocturnally on *Urtica dioica* and *Mercurialis perennis*. On nearby south-facing slopes which carried calcicolous grassland, *A. arbustorum* was replaced by *Cepaea nemoralis*, a species resistant to desiccation.

Zonation and succession

Spatial transitions between the *Filipendulo-Arrhenatheretum* and other vegetation types are partly controlled by the sharpness of local topographic discontinuities. Stands are often small and fragmentary and confined to ledges and embayments, giving way abruptly on less sheltered, sunnier slopes to the local form of calcicolous grassland. Where the vegetation is open to stock, grazing may blur the zonation.

There is sometimes a gradation to mixed deciduous woodland of the *Fraxinus-Acer-Mercurialis* or *Fraxinus-Sorbus-Mecurialis* types. However, although many sites may formerly have had a more extensive local woodland cover, the broken terrain on which the community is typically found could never have been densely wooded (Pigott 1958). The *Filipendulo-Arrhenatheretum* should therefore be regarded as a persistent woodland margin community rather than a seral precursor. The occasional association of the community with old mixed hedgerows is interesting in this respect.

Distribution

The community is confined to scattered localities in northern England, almost exclusively on the Carboniferous Limestone of Derbyshire and Craven with a single site in the Cheviots. The *Polemonium* sub-

community occurs at about 20 localities within this range. *P. caeruleum* itself is also sometimes found in the inundation communities of riverside sand and shingle downstream from stands of *Filipendulo-Arrhenatheretum*. Garden forms of the species also occur in this habitat but these are usually morphologically distinct (Pigott 1958).

Affinities

Although the *Filipendulo-Arrhenatheretum* shares many species with other coarse mesotrophic grasslands, it represents the nearest approach within the Arrhenatherion to the Northern Montane tall-herb communities of the Cicerbition alpini. Similar vegetation with *P. caeruleum* has been reported from Slovakia (Braun-Blanquet 1930), Scandinavia (Nordhagen 1943) and the Alps (Lüdi in Pigott 1958) and, in Europe, such communities are sometimes managed as hay-meadows. As with other vegetation types of this kind, one floristic element shows affinities with woodland field layers, in this case with the Alno-Ulmion.

Floristic table MG2

	a	b	2
Arrhenatherum elatius	V (1–8)	V (3–9)	V (1–9)
Heracleum sphondylium	IV (1–2)	V (1–4)	V (1–4)
Mercurialis perennis	IV (1–5)	V (1–8)	V (1–8)
Lophocolea bidentata s.l.	IV (1–4)	V (1–5)	V (1–5)
Festuca rubra	III (1–4)	V (1–10)	V (1–10)
Filipendula ulmaria	V (2–7)	IV (1–6)	IV (1–7)
Urtica dioica	V (1–4)	IV (1–5)	IV (1–5)
Valeriana officinalis	V (1–4)	IV (1–5)	IV (1–5)
Dactylis glomerata	IV (1–5)	IV (1–8)	IV (1–8)
Plagiomnium undulatum	IV (1–4)	IV (1–4)	IV (1–4)
Geum rivale	IV (1–5)	IV (1–5)	IV (1–5)
Cruciata laevipes	IV (1–5)	IV (1–5)	IV (1–5)
Dryopteris filix-mas	IV (1–5)	IV (1–6)	IV (1–6)
Epilobium montanum	IV (1–3)	IV (1–4)	IV (1–4)
Plagiothecium denticulatum	III (1–2)	IV (1–4)	IV (1–4)
Silene dioica	III (1–3)	IV (1–6)	IV (1–6)
Poa trivialis	III (1–3)	IV (1–6)	IV (1–6)
Eurhynchium swartzii	III (1–6)	IV (1–7)	IV (1–7)
Angelica sylvestris	V (1–3)	III (1–3)	IV (1–3)
Trisetum flavescens	V (1–4)	III (1–8)	III (1–8)
Sanguisorba officinalis	III (1–5)	I (1–3)	II (1–5)
Avenula pubescens	III (1–3)	I (1–5)	II (1–5)
Senecio jacobaea	III (1)	I (1–3)	I (1–3)
Poa pratensis	III (1)	I (1–2)	I (1–2)
Origanum vulgare	III (1–3)	I (1–3)	I (1–3)
Alchemilla glabra	II (1–4)	I (1)	I (1–4)
Stachys betonica	II (1–5)	I (1)	I (1–5)
Potentilla erecta	II (1–3)		I (1–3)
Festuca pratensis	I (2–3)		I (2–3)
Rosa villosa agg.	I (4–7)		I (4–7)
Lophocolea heterophylla	I (1–2)		I (1–2)
Parnassia palustris	I (1–2)		I (1–2)
Polemonium caeruleum		V (3–8)	III (3–8)
Plagiochila asplenoides	I (1–4)	IV (1–3)	III (1–4)
Plagiomnium affine	III (1–4)	IV (1–4)	III (1–4)

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Floristic table MG2 (*cont.*)

	a	b	2
Calliergon cuspidatum	III (1–5)	IV (1–5)	III (1–5)
Stellaria holostea	I (1–3)	III (1–4)	II (1–4)
Oxalis acetosella	I (1–2)	III (1–4)	II (1–4)
Geranium robertianum	I (1–2)	II (1–4)	II (1–4)
Thuidium tamariscinum	I (1–4)	II (1–5)	II (1–5)
Galium aparine	I (1)	II (1–4)	II (1–4)
Ranunculus ficaria		II (1–4)	I (1–4)
Pleurozium schreberi		II (1–4)	I (1–4)
Fraxinus excelsior sapling		I (1)	I (1)
Bromus ramosus		I (1–2)	I (1–2)
Primula vulgaris		I (4)	I (4)
Scabiosa columbaria		I (1–5)	I (1–5)
Clinopodium vulgare		I (1–4)	I (1–4)
Luzula sylvatica		I (1–6)	I (1–6)
Tritomaria quinquedentata		I (1)	I (1)
Cystopteris fragilis		I (1–4)	I (1–4)
Draba muralis		I (1–4)	I (1–4)
Climacium dendroides		I (1–5)	I (1–5)
Galium sterneri		I (1–2)	I (1–2)
Hypnum cupressiforme s.l.		I (1–2)	I (1–2)
Leontodon hispidus		I (3–5)	I (3–5)
Dicranum majus		I (5–6)	I (5–6)
Plagiothecium undulatum		I (1–3)	I (1–3)
Cochlearia alpina		I (2–4)	I (2–4)
Chrysosplenium alternifolium		I (1)	I (1)
Drepanocladus uncinnatus		I (1)	I (1)
Peltigera praetextata		I (1–2)	I (1–2)
Peltigera horizontalis		I (1–2)	I (1–2)
Veronica chamaedrys	III (1–3)	III (1–5)	III (1–5)
Vicia sepium	III (1–3)	III (1–5)	III (1–5)
Brachythecium rutabulum	III (1–4)	III (1–4)	III (1–4)
Rumex acetosa	III (1–2)	III (1–6)	III (1–6)
Hypericum hirsutum	III (1–2)	III (1–4)	III (1–4)
Campanula rotundifolia	III (1–3)	II (1–4)	III (1–4)
Scrophularia nodosa	III (1)	II (1–2)	III (1–2)
Rhytidiadelphus squarrosus	II (1–5)	III (1–5)	III (1–5)
Anthriscus sylvestris	II (1–2)	III (1–4)	III (1–4)
Saxifraga hypnoides	II (1–3)	III (1–7)	III (1–7)
Hylocomium splendens	II (1–5)	III (1–4)	III (1–5)
Deschampsia cespitosa	III (1–7)	II (1–5)	II (1–7)
Holcus lanatus	III (2–7)	II (1–5)	II (1–7)
Anthoxanthum odoratum	II (1–3)	II (1–3)	II (1–3)
Cerastium fontanum	II (1)	II (1–4)	II (1–4)
Cirsium palustre	II (1–3)	II (1–2)	II (1–3)
Myosotis arvensis	II (1)	II (1–3)	II (1–3)
Succisa pratensis	II (1–4)	II (1–5)	II (1–5)

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Pimpinella major	II (1–7)	I (3–5)	II (1–7)
Ranunculus acris	I (1)	II (1–4)	II (1–4)
Lathyrus pratensis	II (1–2)	I (2)	I (1–2)
Prunella vulgaris	I (1)	II (1)	I (1)
Pseudoscleropodium purum	I (1–3)	I (1–3)	I (1–3)
Eurhynchium praelongum	I (4)	I (1–2)	I (1–4)
Holcus mollis	I (7)	I (1)	I (1–7)
Centaurea nigra	I (2–3)	I (2)	I (2–3)
Alchemilla xanthochlora	I (1–2)	I (2)	I (1–2)
Stachys sylvatica	I (5)	I (3–5)	I (3–5)
Viola riviniana	I (1–3)	I (1–2)	I (1–3)
Briza media	I (1)	I (1)	I (1)
Galium verum	I (1–2)	I (1)	I (1–2)
Festuca ovina	I (1)	I (2–5)	I (1–5)
Eurhynchium striatum	I (2–3)	I (3)	I (2–3)
Teucrium scorodonia	I (1)	I (1–4)	I (1–4)
Mnium hornum	I (1–2)	I (1–2)	I (1–2)
Dicranum scoparium	I (1)	I (1–4)	I (1–4)
Sesleria albicans	I (1)	I (8)	I (1–8)
Rhytidiadelphus loreus	I (1)	I (3)	I (1–3)
Geranium sylvaticum	I (1)	I (2–5)	I (1–5)
Number of samples	12	27	39
Number of species/sample	33 (17–38)	33 (23–48)	33 (17–48)

a *Filipendula ulmaria* sub-community
b *Polemonium caeruleum* sub-community
2 *Filipendulo-Arrhenatheretum elatioris* (total)

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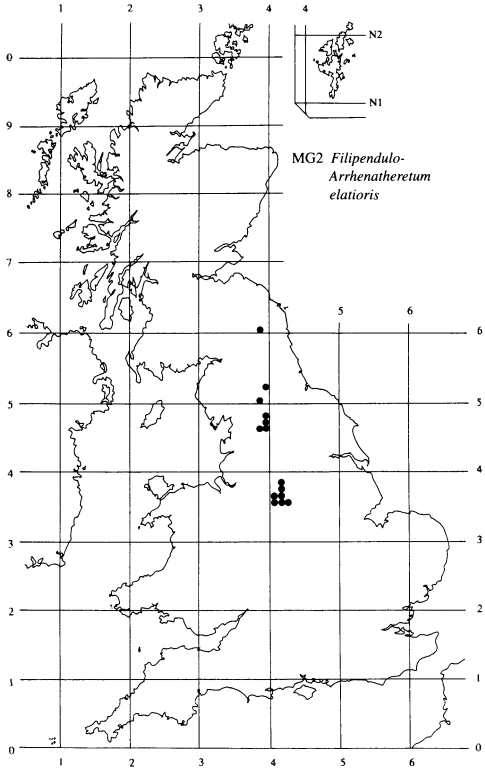

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