

SD9

Ammophila arenaria-*Arrhenatherum elatius* dune grassland

Synonymy

Dune grassland Gimmingham 1964a.

Constant species

Achillea millefolium, *Ammophila arenaria*, *Arrhenatherum elatius*, *Festuca rubra*, *Poa pratensis*.

Rare species

Acaena novae-zelandiae, *Astragalus danicus*.

Physiognomy

The *Ammophila arenaria*-*Arrhenatherum elatius* grassland includes rank, tussocky swards in which both *Festuca rubra* and *Ammophila* remain very common, the former especially being often abundant, indeed the most frequent dominant overall, the latter rather more patchily represented, but plentiful and vigorous in some stands. Compared with other dune grasslands, however, a noticeable difference here is the common occurrence of *Arrhenatherum elatius*, often growing in some abundance and quite frequently co-dominant. Other grasses figure, too, though their contribution to the cover is generally small. *Poa pratensis* agg. (probably *P. subcaerulea* in many cases) is constant in small amounts, for example, and *Dactylis glomerata* is often found, though only exceptionally with any abundance. More occasionally, there can be some *Holcus lanatus*, *Trisetum flavescens*, *Elymus pycnanthus*, *E. farctus* and *E. repens*, but smaller species like *Koeleria macrantha*, *Agrostis capillaris* and *Anthoxanthum odoratum* tend to be very scarce. *Carex arenaria* is only moderately common, and *Luzula campestris* rather infrequent.

Quite a variety of dicotyledonous herbs occur in the community, the commonest able to grow up tall through the grasses or form a loose, bushy understorey in more open parts of the sward. Most frequent among these plants are *Heracleum sphondylium*, *Achillea millefolium*, *Veronica chamaedrys*, *Galium verum*, *Ononis repens* and *Plantago lanceolata*, with *Cirsium arvense*, *Senecio jacobaea* and *Geranium sanguineum* preferential to particular

sub-communities. Less often, there can be some *Lotus corniculatus*, *Trifolium repens*, *Cerastium fontanum*, *Taraxacum officinale* agg. *Campanula rotundifolia*, *Centaurea nigra*, *Cruciata laevipes*, *Primula veris* and *Thalictrum minus* with occasional *Hypochoeris radicata* and *Hieracium pilosella* where the herbage is less rank. Among rarer plants, *Astragalus danicus* and the introduced *Acaena novae-zelandiae* have been recorded here.

In the denser swards, bryophytes are usually few and of patchy cover, but *Pseudoscleropodium purum* and *Brachythecium rutabulum* occur occasionally and *Rhytidiadelphus triquetrus*, *R. squarrosus* and *Hypnum cupressiforme* s.l. more rarely though sometimes with local abundance. Mosses like *Tortula ruralis* ssp. *ruraliformis* and *Homalothecium lutescens* are rare.

Sub-communities

Typical sub-community. Mixtures of *Arrhenatherum*, *F. rubra* and *Ammophila* form the bulk of the cover here, with *P. pratensis* generally very subordinate, *Dactylis*, *H. lanatus* and *C. arenaria* only occasional and locally abundant and *E. pycnanthus* very sparse. Among bigger associates, *Cirsium arvense* and *Senecio jacobaea* often accompany *Heracleum* giving a somewhat weedy appearance to the swards, but other distinctive features are few. *Achillea* remains frequent and there is occasional *V. chamaedrys*, *G. verum*, *O. repens* and *P. lanceolata*, with *Myosotis arvensis* and *Crepis capillaris* recorded rarely. Bryophytes are generally very sparse, but *P. purum* and *R. triquetrus* can be locally abundant, with occasional *B. rutabulum*.

Geranium sanguineum sub-community. *F. rubra* is the usual dominant in this sub-community, with *Arrhenatherum* and *Ammophila* somewhat less frequent and only patchily abundant. Along with *P. pratensis* and occasional *H. lanatus*, there is also very often some *Dactylis* and, less commonly, *Trisetum*, with *Koeleria* and *Carex flacca* occurring sparsely in more open areas. More

striking, though, is the constancy of *Geranium sanguineum*, sometimes growing in a procumbent form, though occasionally abundant and very eye-catching in summer with its red-purple flowers. Then, together with frequent *A. millefolium*, *V. chamaedrys*, *G. verum*, *O. repens* and *Heracleum*, there is often some *L. corniculatus*, *T. repens*, *P. veris* and *L. pratensis*, with occasional *C. fontanum*, *T. officinale*, *C. rotundifolia* and *T. minus*. Also preferential at low frequency are *Thymus praecox*, *Pimpinella saxifraga*, *Ranunculus bulbosus* and *Sanguisorba minor*, while at some sites this vegetation provides a locus for the rare *Astragalus danicus*. Occasionally, low bushes of *Rosa pimpinellifolia* can be found scattered through the rank sward. Bryophytes are again often sparse, but patches of *T. ruralis* ssp. *ruraliformis* sometimes occur with the occasional *P. purum*.

Habitat

The *Ammophila*-*Arrhenatherum* grassland is typically confined to less heavily grazed stretches of more fixed, calcareous coastal sands, occurring rather locally on dune systems all around Britain, though much more commonly along the seaboard of north-east England.

Like the *Festuca-Galium* grassland and the more well established *Ammophila*-*Festuca* swards, this is a vegetation type of wind-blown sands that have become more or less stabilised on sheltered slopes of coastal dunes, older ridges or tracts of sand-plain set back some distance from the shore. With accretion reduced to near negligible levels, *Ammophila* is past the peak of its vegetative and reproductive vigour here (Gimingham 1964a, Huiskes 1977a, b, 1979), though it often retains a quite strongly tussocky form in the community, rather than being reduced to the scattered tufts of debilitated shoots in which state it usually lingers on in the pastures of fixed dunes. Free of its overwhelmingly dominant influence, however, the smaller rhizomatous grasses *F. rubra* and *P. pratensis*, which begin to colonise less mobile sands, can make a more substantial contribution while, on the stabilising surface, there is opportunity for the appearance of such other herbs as can tolerate the base-rich and probably still quite impoverished and droughty conditions. For this is a vegetation type of more calcareous sands, where shell fragments often comprise a high proportion of the dune sediments or where leaching has not yet had a marked impact, superficial pH generally remaining between 6 and 8. And, though edaphic changes are in train with the more extensive colonisation of the fixed sand surface, there is perhaps but little accumulation yet of organic matter or nutrients in the substrate, and a still poor retention of moisture (Willis *et al.* 1959a, Willis 1985b). Such features thus probably continue to have a limiting effect on the composition and luxuriance of the associated flora.

Equally important with this vegetation, however, is

the absence or at least the low intensity of grazing, something which much restricts the distribution of the community on fixed dunes around our coasts, and has a variety of effects on the floristics and structure of those stands which can develop in the rather scarce localities where there is little or no predation by either stock or wild herbivores. In the first place, there is the prominence here, along with the usual perennial grasses of more stable coastal sands, of *Arrhenatherum*, a plant of wide distribution around most of the British coast, one tolerant of some quite harsh edaphic environments, but rare in grazed swards, including those on dunes, because of its great palatability. To a lesser extent, the increased frequency of *Dactylis* in this community, as compared with fixed dune pastures, probably reflects this same factor, and there are some dicotyledons here too, notably *Ononis repens* and *Geranium sanguineum*, which fare much better in ungrazed swards.

The second influence is felt through the generally rank growth which the grasses in particular are able to make in this vegetation with freedom from grazing, for this greatly increases competition for the available water and nutrients and also, very importantly, for light. The commonest associates are thus those plants which can maintain growth among the tussocky dominants, by putting up elongated leaves or tall shoots from rosettes, as with *Heracleum*, *A. millefolium*, *P. lanceolata*, *S. jacobaea* or *C. arvensis*, or producing more straggling masses of shoots among the herbage, like *V. chamaedrys*, *G. verum*, *L. corniculatus* and *G. sanguineum*. By contrast, *A. arenaria* and small tussock grasses, more diminutive hemi-cryptophyte dicotyledons and chamaephytes, which can maintain themselves in some variety in close-cropped *Festuca-Galium* swards, find little place here except where the bulkier perennials are not so dense. There is also very little opportunity for small ephemerals or bryophytes to make any consistent contribution on the sand surface.

Particular treatment histories, with local neglect of grazing on dunes, or vagaries in wild herbivore predation, as after the myxomatosis epidemic in the 1950s, may play some part in the marked concentration of the *Ammophila*-*Arrhenatherum* community along the Northumberland coast and around the Humber. However, although this kind of vegetation can be found on other ungrazed dune systems elsewhere in Britain, there are many places where it has not developed, despite low numbers of stock or rabbits. It is possible, therefore, that some other factors also influence its development, perhaps a requirement for sands that are not quite so droughty or impoverished as usual, or a dependence on certain climatic conditions. Interestingly, *Arrhenatherum* becomes prominent in cliff grasslands down the north-east coast of England where, with prevailing off-shore winds, salt-spray deposition is that much reduced

compared with similar situations on western cliffs, and, further south, around parts of East Anglia, *Arrhenatherum-Silene* swards are a distinctive feature at the top of some shingle beaches. A measure of protection from such maritime influence may thus be essential for the vigorous development of *Ammophila-Arrhenatherum* grassland even on ungrazed tracts of stabilised dunes.

Climate also certainly affects this vegetation on a smaller scale in the association of the *Geranium* sub-community with warmer dune slopes. This kind of *Ammophila-Arrhenatherum* grassland is more local than the Typical form and is usually found on south-facing slopes, often quite steep, where insolation is at its maximum, benefiting the thermophilous *G. sanguineum*.

Zonation and succession

The *Ammophila-Arrhenatherum* grassland is usually found as a local replacement for other swards on more stabilised calcareous dunes, occurring in zonations and mosaics which are presumably influenced, at least in part, by variations in grazing intensity. In many places, the community could probably progress very readily to scrub with the invasion of shrubs and trees, or to bracken, and stands are sometimes found among these kinds of vegetation.

In the generalised sequence of communities on British dunes, the *Ammophila-Arrhenatherum* grassland generally occurs where more mature *Ammophila-Festuca* swards or *Festuca-Galium* vegetation would otherwise be found and, on more varied systems, it often grades to these. Compared with the former community, the most obvious differences can be the abundance of *Arrhenatherum* and, particularly with the shift to younger dune ridges, Typical *Ammophila-Arrhenatherum* grassland may pass quite gradually to the *Ononis* sub-community of *Ammophila-Festuca* vegetation with changes in dominance of the grasses. Commonly, however, neighbouring *Ammophila-Festuca* swards on more fixed sands have a greater variety and abundance of smaller herbs and bryophytes, with species such as *Hypochoeris radicata*, *Taraxacum officinale* agg., *Leontodon taraxacoides*, *Hieracium pilosella*, *Brachythecium albicans*, *Tortula ruralis* ssp. *ruraliformis* and *Hypnum cupressiforme* becoming important. With the move to more heavily grazed stretches of stabilised dunes, some of these same plants make a frequent appearance where the *Ammophila-Arrhenatherum* grassland gives way to *Festuca-Galium* vegetation. In transitions to the *Luzula* sub-community of that kind of grassland, for example, a common vegetation type on Northumbrian dunes, the decline in *Arrhenatherum* is accompanied by a rise in their frequency along with small tussock grasses like

Koeleria, *Agrostis capillaris*, *Anthoxanthum* and *Festuca ovina* among the grazed down *F. rubra*, *P. pratensis*, *C. arenaria* and *L. campestris*. Where more acidic sands occur, this zonation can continue into stands of *Carex-Festuca-Agrostis* grassland.

Alternatively, the *Ammophila-Arrhenatherum* community can pass to Typical *Festuca-Galium* vegetation where the occasional occurrence of *Arrhenatherum*, *Dactylis*, *Heracleum* and *Cirsium arvense*, with frequent *Achillea* and *S. jacobaea* in sometimes rough *F. rubra*-dominated swards, can give a greater measure of continuity to the zonation. Mixtures of these two communities can also be found among patches of scrubby vegetation on less heavily grazed dunes. There, the *Ammophila-Arrhenatherum* grassland can give way to clumps of *Rubus-Holcus* underscrub, the grassy margins of which, with rank *H. lanatus*, *Arrhenatherum* and *Dactylis*, umbellifers and tall weedy herbs, have much in common with the surrounding dune swards (Figure 14). Or, where bracken invades along with the bramble, there may be transitions to *Pteridium-Rubus* underscrub. In other cases, particularly on some of the Humber dune systems, *Hippophae rhamnoides* scrub can be found among *Ammophila-Arrhenatherum* grassland, *Festuca rubra* and *Ammophila* tending to persist most prominently in the Typical sub-community, *Arrhenatherum* remaining common, often among nitrophilous weeds, in the *Urtica-Galium* sub-community. Or there can be zonations to *Ligustrum vulgare*-dominated stands of the *Crataegus-Hedera* scrub or grassy *Prunus-Rubus* scrub.

Distribution

The *Ammophila-Arrhenatherum* grassland can be found locally on suitably stable dunes around many parts of the British coast, but it is much commoner in north-east England, with the *Geranium* sub-community in particular strongly concentrated in Northumberland.

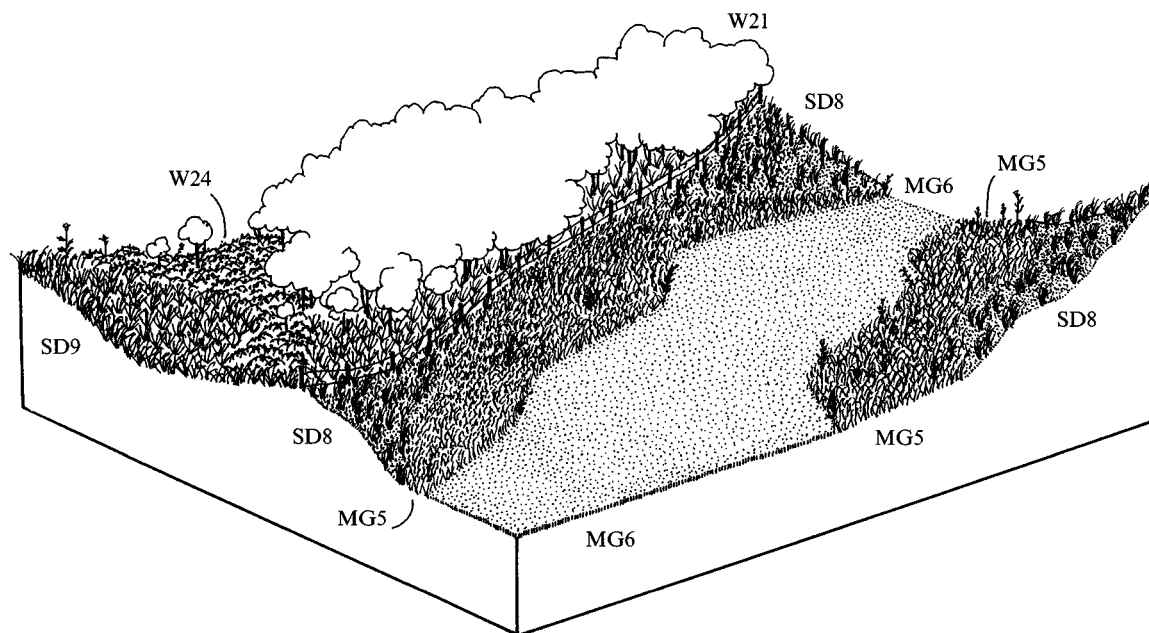
Affinities

Arrhenatherum figures hardly at all in descriptions of British dune vegetation (Tansley 1939, Gimingham 1964a, Birse 1980) and no account of this sort of grassland has previously been given. In phytosociological terms, it is probably best placed among the *Ammophilion* communities, rather than with the inland *Arrhenatherion* swards, although plants like *G. sanguineum* and *R. pimpinellifolia* also provide a link with *Geranion* scrubby grasslands. The *Geranium* sub-community thus comes close to the cliff *Geranietum* described by Malloch (1970, 1971) from sunny, sheltered places with base-rich soils on the Lizard peninsula.

Figure 14. Zonation of vegetation types on a dune hinterland with withdrawal of grazing and management for golf.

In the foreground, landscaping, fertilising and frequent mowing have transformed the grassland of the fixed dune sands to some type of MG6 *Lolio-Cynosuretum*, with periodically cut MG5 *Centaureo-Cynosuretum*

forming stretches of rough and SD8 *Festuca-Galium* grassland surviving on the remnants of the original dune ridges. Beyond the fence, elimination of grazing by stock and rabbits has encouraged the development of SD9 *Ammophila-Arrhenatherum* grassland, W24 *Rubus-Holcus* underscrub and W21 *Craetagus-Hedera* scrub.



Floristic table SD9

	a	b	9
<i>Festuca rubra</i>	V (3–9)	V (4–9)	V (3–9)
<i>Poa pratensis</i>	V (1–7)	V (1–7)	V (1–7)
<i>Ammophila arenaria</i>	V (2–9)	IV (1–8)	V (1–9)
<i>Achillea millefolium</i>	IV (1–5)	IV (1–4)	IV (1–5)
<i>Arrhenatherum elatius</i>	V (3–9)	III (1–8)	IV (1–9)
<i>Cirsium arvense</i>	III (1–3)	I (1–3)	II (1–3)
<i>Senecio jacobaea</i>	II (1–3)	I (1–3)	I (1–3)
<i>Elymus pycnanthus</i>	I (3–7)		I (3–7)
<i>Myosotis arvensis</i>	I (1–3)		I (1–3)
<i>Crepis capillaris</i>	I (2–3)		I (2–3)
<i>Leymus arenarius</i>	I (1)		I (1)
<i>Dactylis glomerata</i>	III (1–7)	IV (1–8)	III (1–8)
<i>Plantago lanceolata</i>	II (1–3)	IV (1–4)	III (1–4)
<i>Geranium sanguineum</i>	I (1–3)	V (2–8)	III (1–8)
<i>Lotus corniculatus</i>	I (1–3)	III (1–4)	II (1–4)
<i>Trifolium repens</i>	I (3)	II (1–7)	II (1–7)
<i>Trisetum flavescens</i>	I (3–4)	II (1–5)	II (1–5)
<i>Primula veris</i>	I (1–3)	II (1–4)	II (1–4)

Floristic table SD9 (cont.)

	a	b	9
<i>Rosa pimpinellifolia</i>	I (3)	II (1–7)	I (1–7)
<i>Lathyrus pratensis</i>	I (1–5)	II (1–4)	I (1–5)
<i>Carex flacca</i>		I (1–4)	I (1–4)
<i>Koeleria macrantha</i>		I (3–5)	I (3–5)
<i>Astragalus danicus</i>		I (1–4)	I (1–4)
<i>Tortula ruralis ruraliformis</i>		I (2–7)	I (2–7)
<i>Thymus praecox</i>		I (3–5)	I (3–5)
<i>Rumex acetosa</i>		I (1–3)	I (1–3)
<i>Pimpinella saxifraga</i>		I (1–3)	I (1–3)
<i>Ranunculus bulbosus</i>		I (1–2)	I (1–2)
<i>Sanguisorba minor</i>		I (4–6)	I (4–6)
<i>Bellis perennis</i>		I (1–4)	I (1–4)
<i>Veronica chamaedrys</i>	II (1–4)	III (1–3)	III (1–4)
<i>Heracleum sphondylium</i>	III (1–4)	II (1–4)	II (1–4)
<i>Galium verum</i>	II (1–5)	III (1–6)	II (1–6)
<i>Ononis repens</i>	II (1–6)	III (1–7)	II (1–7)
<i>Holcus lanatus</i>	II (1–8)	II (2–7)	II (2–7)
<i>Carex arenaria</i>	II (2–6)	II (1–4)	II (1–6)
<i>Pseudoscleropodium purum</i>	II (3–7)	II (2–7)	II (2–7)
<i>Cerastium fontanum</i>	I (1–3)	II (1–3)	II (1–3)
<i>Taraxacum officinale</i> agg.	I (1–3)	II (1–3)	II (1–3)
<i>Campanula rotundifolia</i>	I (2–3)	II (1–3)	II (1–3)
<i>Thalictrum minus</i>	I (1–7)	II (1–7)	II (1–7)
<i>Luzula campestris</i>	I (2–4)	II (1–4)	I (1–4)
<i>Hypochoeris radicata</i>	I (1–3)	I (1–3)	I (1–3)
<i>Brachythecium rutabulum</i>	I (1–4)	I (2–4)	I (1–4)
<i>Centaurea nigra</i>	I (2–7)	I (1–6)	I (1–7)
<i>Vicia sativa</i>	I (1–3)	I (1–3)	I (1–3)
<i>Cruciata laevipes</i>	I (1–5)	I (1–3)	I (1–5)
<i>Hieracium pilosella</i>	I (2–3)	I (2–6)	I (2–6)
<i>Equisetum arvense</i>	I (1–3)	I (2–4)	I (1–4)
<i>Viola riviniana</i>	I (2–3)	I (1–3)	I (1–3)
<i>Silene alba</i>	I (1–3)	I (1–3)	I (1–3)
<i>Rhytidiadelphus triquetrus</i>	I (5–8)	I (1)	I (1–8)
<i>Potentilla reptans</i>	I (2–4)	I (3)	I (2–4)
<i>Elymus farctus</i>	I (1–4)	I (1)	I (1–4)
<i>Leontodon hispidus</i>	I (3–4)	I (1–4)	I (1–4)
<i>Anthoxanthum odoratum</i>	I (4)	I (2–7)	I (2–7)
<i>Rhytidiadelphus squarrosus</i>	I (6)	I (1–5)	I (1–6)
<i>Agrostis capillaris</i>	I (5)	I (1–5)	I (1–5)
<i>Elymus repens</i>	I (2)	I (2–5)	I (2–5)
<i>Hypnum cupressiforme</i>	I (1)	I (2–7)	I (1–7)
<i>Pteridium aquilinum</i>	I (3–6)	I (1–3)	I (1–6)
<i>Fragaria vesca</i>	I (1)	I (1–3)	I (1–3)
<i>Torilis japonica</i>	I (1)	I (1–4)	I (1–4)

Number of samples	42	52	94
Number of species/sample	12 (7–26)	18 (9–29)	15 (7–29)
Slope (°)	3 (0–20)	11 (0–45)	8 (0–45)
Soil pH	7.6 (5.2–8.8)	7.7 (5.4–9.0)	7.7 (5.2–9.0)

- a Typical sub-community
- b *Geranium sanguineum* sub-community
- 9 *Ammophila arenaria*-*Arrhenatherum elatius* dune grassland (total)