SD4
Elymus farctus ssp. *boreali-atlanticus* foredune community

Synonymy
Agropyretum juncei Moss 1906, Tansley 1911, 1939; *Agropyretum boreo-atlanticum* (Warming 1909) Br.-Bl. & De Leeuw 1936; *Elymo-Agropyretum junceiforme* Tx. 1955; *Agropyron junceiforme* stands Gimingham 1964*a*; *Elymo-Agropyretum boreo-atlanticum* Tx. (1937) 1967; Sociation à *Agropyron junceiforme* Géhu & Géhu 1969.

Constant species
Elymus farctus ssp. *boreali-atlanticus*.

Rare species
Euphorbia paralias.

Physiognomy
The *Elymus farctus* community comprises generally open, though often locally dense, vegetation in stretches of wind-blown sand, in which the dominant is the perennial grass long familiar as *Agropyron junceiforme*, but now known as *Elymus farctus* ssp. *boreali-atlanticus*. It is a rhizomatous plant, growing in the early stages after colonisation as small rosettes of shoots, often appressed to the surface, but then spreading outwards by means of its long and wiry underground stems and putting up vertical sympodial branches which by repeated tillering can keep pace with rapid though quite modest accumulation of sand (Nicholson 1952). Young colonies of the grass often have little more than small, low domes of sand around them but, where accretion progresses, distinct dunes, sometimes 1 m or more high, can develop. The grass shoots grow 20–60 cm tall and may be closely massed where the plants are especially vigorous, the glaucous foliage contrasting sharply with the bright yellow of the mobile sand.

In some stands, particularly around our northern coasts, *Leymus arenarius* invades together with or subsequent to *E. farctus*, its robust shoots often attaining more than a metre in height, but its cover here is always subordinate and, where it begins to dominate, the vegetation should be considered part of the *Leymus* foredune community. Other species are no more than occasional overall, though some can be locally frequent and abundant. *Honkenya peploides*, for example, is quite common and, provided sand accumulation is not too rapid, it will persist for some time among developing dunes and readily regenerate its patches of low shoots where beach-top stands are inundated by exceptional tides or the sand eroded in gales. Then, there can be scattered plants of a number of annuals characteristic of strandline vegetation, such as *Cakile maritima*, *Salsola kali*, *Atriplex prostrata*, *A. glabriuscula* and, more locally, *A. laciniata*, with very occasional *Matricaria maritima* and coarse weedy species like *Senecio jacobaea*, *S. squalidus*, *Cirsium arvense* and *Sonchus arvensis*. Around our more southerly coasts, there are sparse records in the community for *Chamomilla recutita* and the Oceanic Southern *Eryngium maritimum* and nationally rare *Euphorbia paralias*.

Where more substantial foredunes raise the level of the beach, *Ammophila arenaria* can invade the *Elymus farctus* community, and there is a continuous floristic transition between such vegetation and the *Ammophila* dune community where marram dominates.

Habitat
The *Elymus farctus* community is a pioneer vegetation type of wind-blown sand on foreshores around most of the British coast, developing along and above the strandline or among distinct foredunes.

E. farctus is well adapted to survival in raw sand soils close to the tidal limit, but its initial establishment in more exposed situations can be a somewhat precarious affair. It can colonise by both seed and rhizome fragments washed or blown on to the small patches of sand that accumulate around living strandline plants and their dead remains, or where slight irregularities along the beach top encourage accretion. Where there is less shelter from very high tides and wind erosion, however, and particularly through the more disturbed autumn

and winter months, its persistence may depend on repeated invasion from already established stands nearby, as on foredunes behind (Harris & Davy 1986*a*). Burial of propagules under shifting beach material can also be a problem, their depth when growth starts being critical for successful shoot emergence. Both seedlings and single-noded pieces of rhizome, for example, have been shown to survive burial beneath 13 cm or so of sand, but to succumb under 18 cm (Harris & Davy 1986*b*). Multi-node fragments survive better and from greater depths, probably because of their larger reserves of accumulated nutrients and because the dormancy of subordinate buds makes more resources available for the dominant shoot, while retaining some flexibility of response should this apex be lost or overwhelmed. Even then, though, there is considerable variation in the regenerative ability of such propagules, perhaps because of fluctuations in nitrogen and carbohydrate reserves in the parent plants from which they break (Harris & Davy 1986*b*), the former nutrient being of especial importance in a habitat where exogenous supplies are unpredictable and patchily distributed (Lee *et al.* 1983). Tiller apices of *E. farctus* also have a vernalisation requirement and do not normally initiate flowers until their second year, so the poor survival of plants in the pioneer strandline stands inevitably results in low seed production. Rabbit-grazing can be a further important factor limiting inflorescence production, both in the more vulnerable colonising zone and among the foredune stands that can keep it supplied with seed (White 1961, Harris & Davy 1986*a*).

If these hazards are overcome, the young plants are able to consolidate their hold by putting out rhizome branches and roots into the underlying sand and even into the shingle that often forms a base to beaches (Tansley 1939, Nicholson 1952). *E. farctus* is also tolerant of periodic, brief immersion in sea-water (Gimingham 1964*a*, Chapman 1976) so, provided plants are strongly anchored, they are not damaged by any occasional extreme high tides that subsequently wash over the strandline, something which gives this species an important advantage over *Ammophila* in the colonising zone. Quite quickly, too, the plants themselves are able to help offset any loss of beach material through sea and wind erosion by encouraging accretion of sand among the virtually prostrate early shoots (Nicholson 1952). Where there is a net gain in material, *E. farctus* can keep pace to some extent by horizontal and vertical growth of the rhizome and shoot system, actually stimulating the formation of, first, low mounds of sand, then, if the process continues without any drastic erosive setback, small dunes. In such circumstances, growth of the plant can be very vigorous: at Blakeney, for example, Oliver (1929) reported that a single seedling gave rise to a dune more than 1 m high and 6 m across after just a few years, and especially where adjacent colonies coalesce shoots can become densely crowded.

Some of the characteristic associates of the *Elymus farctus* community are survivors of the strandline assemblages among which the grass gains a hold and eventually comes to dominate, the perennial *Honkenya* able to grow through more shallow coverings of sand, annuals like *Cakile*, *Salsola* and *Atriplex* spp. continuing to invade afresh in spring and summer where the substrate remains sufficiently stable, and particularly where patches of drift detritus thrown high up on to the beach top give a firmer footing and a flush of nutrients. Where the sand is accreting quickly, though, these species can soon be reduced to a very sparse element in the vegetation, and few other dicotyledonous herbs invade along with the *E. farctus* to maintain any richness in the community. In the warmer south of the country, however, where mean annual maxima around our coasts are in excess of 25 °C (Conolly & Dahl 1970), the occasional appearance of more thermophilous dune perennials like *Eryngium maritimum* and *Euphorbia paralias*, which can keep a hold in quite mobile sand, brings some stands close to the more diverse foreshore assemblages found along the French Atlantic coast (Géhu & Géhu 1969).

More characteristic of this kind of vegetation around the cooler seaboard of north-west Europe and particularly well seen with us on beaches in northern England and Scotland, is the presence of *Leymus arenarius*. The natural southern boundary of the range of this Oceanic Northern grass is uncertain (Bond 1952) but probably related to temperature and, in congenial climatic conditions, it can invade the strandline along with *E. farctus*. It has been variously suggested, however, that it does not penetrate so close to the tidal limit as *E. farctus* (Turner 1977), that its taller shoots are more susceptible to wind damage (Bond 1952) and that it favours sands richer in organic matter (Géhu & Géhu 1969), each or all of which might play some part in restricting its role here as opposed to the *Leymus* foreshore community where it is dominant.

The contribution of *Ammophila* to the *Elymus farctus* vegetation, on the other hand, is often clearly limited by its greater susceptibility to tidal flooding, this grass appearing as an occasional here only where foredunes have raised the general level of the beach above the limit of inundation. Then, it may further encourage accretion beyond the limit of tolerance of *Elymus* itself, the original pioneer grass losing vigour and persisting with reduced cover.

Zonation and succession

The *Elymus farctus* community typically occupies a distinct zone on the foreshore, occurring above the strandline vegetation and fronting such other dune assemblages as are present. Along more exposed

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stretches of beach, perhaps in most of our dune systems now, it functions as a repeatedly renewed pioneer assemblage, but theoretically it can initiate a dune succession.

Very often, the *Elymus farctus* community occurs in close association with the *Honkenya-Cakile* vegetation and, quite commonly, the two form an ill-defined linear mosaic of vegetation strung out along and just above strandlines subject to varying periods of erosion and accretion. The two assemblages intergrade continuously, being distinguished according to whether dominance lies with *Honkenya* and the strandline annuals on the one hand or with *E. farctus* on the other, this reflecting the balance between continuing disturbance by sea and wind along and just above the tidal limit and progressive accumulation of sand. In other places, where accretion has been able to continue unchecked, a better-defined and wider zone of *Elymus farctus* vegetation can be seen above the strandline, distributed over gently undulating stretches of sand or on distinct dunes, these sometimes very few and irregularly distributed, in other places numerous, rising in height towards the beach top and developed in lines parallel to the shore. Particularly along the coasts of north-east England and in Scotland, this simple pattern can be complicated by transitions between *Elymus* vegetation and foreshore *Leymus* stands.

Along some coasts, such may be the limit of dune vegetation, the sequence of communities being abruptly terminated inland by a switch to agricultural enclosures or golf-course rough and greens on reclaimed and improved soils or to settlements and industrial developments. More extensive sequences occur quite widely, however, and here the *Elymus* community typically occurs on foredunes which front larger yellow dunes with sometimes, behind these, immobile dunes and stretches of undulating sandy ground. Usually, in such situations, the *Elymus* vegetation passes to *Ammophila* dune stands, *E. farctus* and, to a lesser extent, plants such as *Honkenya*, *Cakile* and *Atriplex* spp. retaining some representation in the transitional zone. Patterns of this kind can be seen all around the coasts of England and Wales, with *Leymus* vegetation and intermediate stands also figuring in the zonations along the coasts of Northumberland and at some sites in Lincolnshire. In its turn, the *Ammophila* community may give way to *Ammophila-Festuca* vegetation with *Festuca-Galium* assemblages becoming important in northern Britain.

The studies of Harris & Davy (1968*a*, *b*) along the north Norfolk coast have demonstrated very clearly that strandline stands of *Elymus farctus* are maintained in more disturbed situations only by continual replenishment from such vegetation on foredunes behind and suggested that the classic seral progression might not occur very readily.

Obviously, this has happened in past times, when it is likely that *Elymus* foredunes have been succeeded by *Ammophila* dunes and these in their turn by more stable tracts of vegetated sand. Along the outer fringes of our dune systems at the present time, however, the *Elymus* community may persist widely as a pioneer vegetation that is continually set back by more disturbed periods of wind and wave erosion.

Distribution

The community is found around most of the British coastline on suitably sandy beaches.

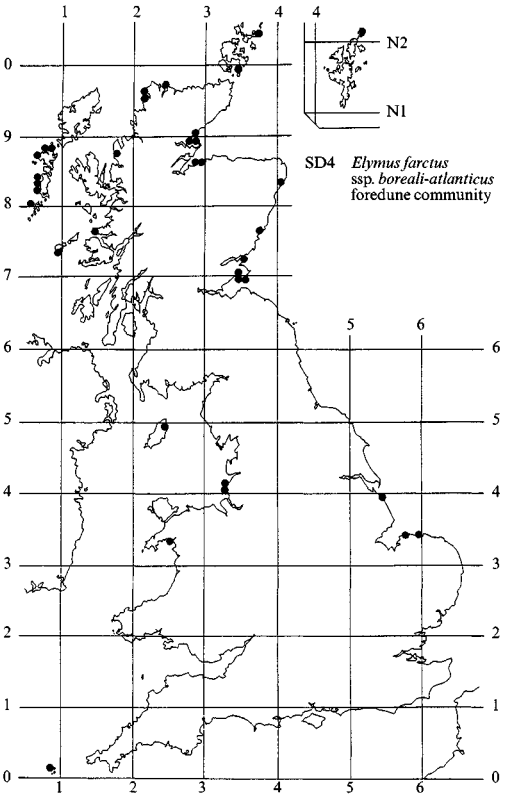
Affinities

The distinctive place of *E. farctus* among British foreshore vegetation was acknowledge in early studies (Moss 1906, Tansley 1911, 1939) by the characterisation of assemblages defined by its dominance, and an essentially similar approach has been adopted in more recent accounts, both descriptive (Gimingham 1964*a*) and phytosociological (Birse 1980, 1984). Here, too, the separation of the *Elymus farctus* community from other strandline and dune vegetation is by the cover contribution of the plant, but this is a reasonable diagnostic feature in view of its important ecological role on the foreshore.

Phytosociologically, our *E. farctus* vegetation is part of what was early defined as an *Agropyretum boreo-atlanticum* (Braun-Blanquet & de Leeuw 1936). More recent schemes have reserved this name (Westhoff & den Held 1969, White & Doyle 1982) or *Elymo-Agropyretum junceiformis* (Géhu & Géhu 1969, Birse 1980, 1984) to describe *E. farctus* stands from more northerly parts of Europe in which *Leymus arenarius* is a common feature, as with much of our vegetation of this kind. Along the warmer Atlantic coast of France, this community is seen as being replaced by a *Euphorbio-Agropyretum junceiformis* in which such species as *Eryngium maritimum*, *Euphorbia paralias* and *Calystegia soldanella* become constant (Géhu & Géhu 1969). These plants are generally no more than occasional among British stands, but locally high frequencies may bring the composition close to the *Euphorbio-Agropyretum* and Braun-Blanquet & Tüxen (1952) and Schouten & Nooren (1977) allocated some Irish dune vegetation to this association. Géhu & Géhu (1969) also characterised an *E. farctus* sociation comprising impoverished stands derived from either of the richer communities, but in this scheme these are simply subsumed. Traditionally, assemblages dominated by *E. farctus* have been grouped among the dune vegetation of the Ammophiletalia in an Elymo-Honkenion (Braun-Blanquet & Tüxen 1952), although Géhu & Géhu (1969) proposed redefining this alliance as what they termed an Agropyrion boreo-atlanticum, so as to avoid confusion with strandline *Honkenya* vegetation of the Salsolo-Honkenion.

Floristic table SD4

Elymus farctus	V (5–9)
Leymus arenarius	II (1–7)
Honkenya peploides	II (1–4)
Ammophila arenaria	II (2–5)
Cakile maritima	II (1–5)
Atriplex prostrata	I (1–3)
Atriplex glabriuscula	I (1–2)
Atriplex laciniata	I (1–4)
Cirsium arvense	I (2–5)
Eryngium maritimum	I (1–4)
Hypochoeris radicata	I (2–4)
Sonchus arvensis	I (1–5)
Elymus pycnanthus	I (3–7)
Festuca rubra	I (3–6)
Rumex crispus	I (2–4)
Senecio squalidus	I (2–5)
Matricaria maritima	I (1–4)
Taraxacum officinale	I (1–2)
Agrostis stolonifera	I (1–5)
Cirsium vulgare	I (1–4)
Chamomilla recutita	I (4–5)
Salsola kali	I (3–5)
Senecio jacobaea	I (1–2)
Senecio vulgaris	I (1–4)
Sonchus asper	I (1–2)
Cerastium diffusum diffusum	I (2–3)
Euphorbia paralias	I (1)
Polygonum oxyspermum	I (2)
Artemisia maritima	I (3)
Number of samples	51
Number of species/sample	4 (1–11)



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