

Flora and vegetation

Margaret E Bradshaw

The flora of Upper Teesdale is probably more widely known than that of any other area in Britain, and yet perhaps only a few of the thousands who visit the Dale each year realise the extent to which the vegetation and flora contribute to the essence of its character. In the valley, the meadows in the small walled fields extend, in the lower part, far up the south-facing slope, and, until 1957 to almost 570m at Grass Hill, then the highest farm in England. On the north face, the ascent of the meadows is abruptly cut off from the higher, browner fells by the Whin Sill cliff, marked by a line of quarries.

Below High Force, the floor of the valley has a general wooded appearance which is provided by the small copses and the many isolated trees growing along the walls and bordering the river. Above High Force is a broader, barer valley which merges with the expansive fells leading up to the characteristic skyline of Great Dun Fell, Little Dun Fell and Cross Fell.



Pennine skyline above Calcareous grassland and wet bog, Red Sike Moss © Margaret E Bradshaw



Spring gentian © Geoff Herbert

Within this region of fairly typical North Pennine vegetation is a comparatively small area which contains many species of flowering plants, ferns, mosses, liverworts and lichens which can be justifiably described as rare. The best known is, of course, the spring gentian (*Gentiana verna*), but this is only one of a remarkable collection of plants of outstanding scientific value. For generations of British naturalists, Upper Teesdale has been hallowed ground, and many still come each year to 'pay their respects' to the relics of an earlier, more widespread flora. For those on more serious business, the unique plant communities are of major scientific importance and provide abundant opportunities for ecological and taxonomic research.

The account that follows is divided into two parts. The first deals, broadly, with the valleys and lower lying regions of the Dale (up to about 460m) and the second with the vegetation of the higher ground. The line between the two is not very sharply drawn; where there is some overlap, cross-references are given.

Space has not allowed us to describe or name all the plants, but we have tried to include both the most common and the most characteristic. Normally, when a plant is first mentioned, both its English and Latin names are given, and subsequently its English name only. Exceptions are made for some of the more familiar plants, where English names are used throughout. Bryophytes (liverworts, mosses) and lichens have Latin names only.

Plant community types are shown according to the National Vegetation Classification scheme, for example as (NVC MG3). For more details see Averis (2013) and Averis et al. (2004).

Flora and vegetation of lower ground

Meadows and pastures

In the last 60 years, there have been great changes in the farming practices in the Dale. These have affected the management of the meadows and pastures, particularly in the valley floor. Tractors and herds of suckler-cows have replaced horses and dairy cows, and the production of cross-bred ewes and lambs and butcher-ready lambs has become common. The application of artificial fertiliser has increased to boost the growth of the grass to be made into silage or haylage, though sheep farmers like to make some 'soft hay' for the sheep. These changes have resulted in fewer herb-rich meadows of the old type, described below, and more uniformly green fields, rich in buttercups and reddish-brown soury-dock and fewer of the other colourful flowering plants eg. wood crane's-bill ([Geranium sylvaticum](#)). In the upper part of the Dale the meadows are now being grazed for longer periods in the year and some are becoming pastures, because modern transport allows other fodder — silage, straw and hay — to be brought in. The agricultural support introduced some 20–35 years ago to encourage more environmentally friendly lower stocking and fertiliser application was only partially successful in restoring a more bio-diverse landscape. Let's hope that a new 'farmer selected' system produces better results.

Meadows

The plants of the meadows and the roadside verges attract attention by the rich variety of their colour. In early May the common dandelions burst forth in a blaze of golden yellow, and the creamy-white sweet cicely ([Myrrhis odorata](#)) lines some road and riverbanks. Throughout the summer, except when the meadows are newly cut for hay, a succession of colours attract the eye because of an unusually large proportion of colourful flowering plants amongst the grasses. Such meadows are known locally as 'herbie meadows' and by the botanists as 'herb-rich'. Almost a hundred different kinds of flowering plants have been recorded in them, but the composition of individual meadows varies considerably with such factors as altitude, aspect, soil, drainage and farming methods. Whilst grasses form the basis, wood crane's-bill, now much scarcer, earthnut ([Conopodium majus](#)), meadow buttercup ([Ranunculus acris](#)) and sorrel ([Rumex acetosa](#)), locally known as 'soury dock', are mainly responsible for their pink-purple, white, yellow and reddish appearance in the summer. At least eight kinds of grasses are usually present, and of these the most constant are sweet vernal ([Anthoxanthum odoratum](#)), sheep's fescue ([Festuca ovina](#)), crested dog's-tail ([Cynosurus cristatus](#)) and cock's-foot ([Dactylis glomerata](#)). Many other flowering plants are present, such as red and white clover, ribwort plantain, dandelion and later in the year another dandelion-like plant, the rough hawkbit ([Leontodon hispidus](#)).



Herb-rich meadow, Tattyfield, Baldersdale 2007. © John O'Reilly

One group of plants of particular interest to the more knowledgeable is the Lady's mantle ([Alchemilla vulgaris agg.](#)). This will be familiar enough with its attractive fan-like leaves and masses of small yellow-green flowers. In Teesdale there are nine species, of which three are almost confined to Teesdale and three more are only thinly scattered in the North Pennines and three are frequent. Here and there are patches of bistort ([Polygonum bistorta](#)). Meadows such as these were usually found on the better-drained slopes where the soil is a fine, crumbly loam, often enriched by the lime-rich water which seeps from the bands of limestone rocks in the hillsides. Today, such floriferous meadows are much less frequent, but in recent years the less-rich have been enhanced by the spreading of 'green hay' from neighbouring richer fields, in the hope that seed will germinate and become established plants.

In the wetter parts, the more marsh-like vegetation contains other interesting species. Most striking is the majestic melancholy thistle ([Cirsium heterophyllum](#)), known locally as 'shaving brushes', with its tall, stiff stems and solitary purple heads. Here, too, are water avens, ragged robin, marsh valerian ([Valeriana dioica](#)), meadow sweet and marsh hawk's-beard ([Crepis paludosa](#)) which is another plant with flowers like a small dandelion. Somewhat hidden amongst this tall vegetation are the marsh orchids, which hold a fascination for almost every plant hunter.

Records made in 1967 of the occurrences of globeflower ([Trollius europaeus](#)), wood crane's-bill and melancholy thistle in Forest-in-Teesdale, around Newbiggin and Holwick, and Mickleton showed different distribution patterns for each species in each area. In a 2000 repeat survey (Bradshaw, 2001) the declines were greater in the Newbiggin/Holwick than in Forest-in-Teesdale meadows.

The meadows of the higher Dale show certain differences. In spring, some of these are dominated by shades of yellow: first marsh marigold, then buttercups and the paler globeflower. (NVC MG8) Globe flowers are more frequent here but much rarer than in former times; they have the delightfully apt local name of 'double dumplings'. Wood anemones grow in the open fields and it is not surprising that a local child wondered why they were called wood anemones. Another not uncommon woodland plant is goldilocks ([Ranunculus auricomus](#)), though nowhere do bluebells grow in the open as they do in Swaledale. These three are all 'woodland plants'. Here also is the mountain pansy ([Viola lutea](#)) — purple, purple and white, purple and yellow, but rarely the wholly yellow flower so common in Swaledale and Craven. Wood crane's-bill does not seem to like the exposed conditions and is only found occasionally in sheltered places such as amongst the willows near Cronkley Farm, although its leaves can be found in the turf on Widdybank Fell at 525 m. In the higher Dale some of the fields, especially those near the becks and with limestone outcrops, contain more uncommon species such as alpine bistort ([Polygonum viviparum](#)), northern bedstraw ([Galium boreale](#)), shady horsetail ([Equisetum pratense](#)), mountain eyebright ([Euphrasia officinalis ssp. monticola](#)) and two small and peculiar ferns, moonwort ([Botrichium vulgaria](#)) and adder's tongue ([Ophioglossum vulgare](#)).



Cronkley meadow in the 1960s before it was 'improved'
© Margaret E Bradshaw

In a few places there still persist two ancient introductions. One is northern dock ([*Rumex longifolius*](#)), the other is masterwort ([*Imperatoria ostruthium*](#)) — a herb which was used as a cow medicine in the upper Dale — whilst lower down, green hellebore ([*Helleborus viridis*](#)) was used for the same purpose and still survives near Cotherstone below Middleton. It is also possible that the three lady's mantles peculiar to the Teesdale area were introduced as medicinal herbs from Central Europe or Scandinavia.



Crested Dog's-tail — Marsh Marigold community (MG8) and inset Marsh Marigold
© Dave Mitchell



Ash — Rowan — Dog's Mercury woodland.
Inset top left Wood Sorrell, bottom left Dog's Mercury and right Wood False-brome.
© Dave Mitchell

It is almost certain that the meadows in Teesdale have been directly derived from the former more extensive woodlands. Several of the meadow plants — wood anemone, goldilocks and wood crane's-bill — are essentially woodland species (*NVC W9, W16*). A fine example of a transition from herb-rich, birch-willow woodland to meadow can be seen near Force Garth. There is great similarity between these hay-meadows and the park-meadows in mid-Sweden. Although the Swedish meadows contain many more species, almost all of the Teesdale plants are there. In Sweden the meadows are found in clearings in the herb-rich, open birch and spruce woodlands, and the high fertility of the soil is maintained by natural flushing of the soils with mineral-rich spring water and shed leaves of the birch.

Pastures

In the Forest-in-Teesdale and lower Harwood area, the floor of the valley is covered by a series of drumlins — low lying hillocks of glacial till (boulder clay) — and rocks left by the melting glaciers. This landscape can be seen clearly from the road from Cow Green to Langdon Beck and its composition at places where the Tees has eroded the drumlins near Widdybank Farm and near Cronkley Bridge. Here, meadows give way to a larger number of permanent pastures and the vegetation loses its more obvious summer-time brilliance; but some of these fields are far from being botanically dull.

Where the Whin Sill is near the surface, the pastures are poor and are covered by an acid turf of matgrass ([Nardus stricta](#)) with tormentil ([Potentilla erecta](#)) and heath bedstraw ([Galium saxatile](#)) (NVC U5). Locally there are patches of deergrass ([Trichophorum germanicum](#)), bilberry and species of bog-moss ([Sphagnum spp.](#)). This plant community is better represented in the upland region and is described below.

That a few of the hollows are water-logged is indicated by the dominance of the vegetation by rushes, mainly the soft rush ([Juncus effusus](#)) and sharp flowered rush ([J. acutiflorus](#)) (NVC MG8). Growing with these are such plants as ragged robin and sneezewort ([Achillea ptarmica](#)), a relative of the common yarrow, which was formerly dried, ground and used as snuff.

Further west and on the lower slopes of Widdybank Fell, plant hunters quicken their pace making for the broken turfy pastures, a problem to the farmer but a botanist's delight. These 'turfy marshes', (NVC M10, M11) have been described in some detail by Pigott (1956). They have developed where the springs or seepage water ooze out of the drumlins and till-covered hillsides. Their general appearance ranges from a slightly broken, 'boggy' pasture to a patchwork of hummocks, more or less isolated from one another by an expanse of calcareous, muddy gravel.



Bird's-eye Primrose
© Dave Mitchell

They carry some of the richest plant communities in Teesdale. At the right time of the year they are covered with a haze of pink caused by the masses of bird's-eye primroses ([Primula farinosa](#)); and in a few places one could have been forgiven for thinking that alpine bartsia is a common plant, but not so now. Other showy species include spring gentian, northern marsh orchid ([Dactylorhiza purpurella](#)), early marsh orchid ([D. incarnata](#)) and grass of Parnassus ([Parnassia palustris](#)). Among the less obvious plants of great scientific importance that grow here are two sedges: hair sedge ([Carex capillaris](#)) and false sedge ([Kobresia simpliciuscula](#)), the rushes, northern deergrass ([Trichophorum cespitosum](#)), variegated horsetail ([Equisetum variegatum](#)) and sea plantain ([Plantago maritima](#)).

The open, broken nature of these habitats is largely due to trampling by grazing animals; in former times by red deer and even aurochs, and more recently by domesticated animals, especially cattle. In the extreme cases, active springs wash away much of the exposed silt and clay, leaving hummocks of vegetation on an almost bare gentle slope of calcareous mud. These hummocks support an intriguing mixture of very common and rare plants; for example, alpine bartsia and false sedge share the tops with daisy and dandelion; and butterwort (*Pinguicula vulgaris*), grass of Parnassus and yellow mountain saxifrage ([Saxifraga aizoides](#)) grow on the sides. There are few grasses on these hummocks but they do include the strange combination of blue moor-grass ([Sesleria caerulea](#)), usually a plant of dry places, and purple moor-grass ([Molinia caerulea](#)), usually a plant of wet places. Many sedges and some rushes are present as well as a rich bryophyte flora. Between the hummocks, the few species include marsh marigold, lesser spearwort ([Ranunculus flammula](#)) and marsh arrowgrass ([Triglochin palustris](#)).

Earlier this century the introduced heavier cattle churned up the soft substrate, impeding the free movement of the water and hoof-holes created small stagnant pools. Ten years later the swift flow of the water along the man-created channel has recreated the silty base and many of the original plants are there; but the hoof-holed substrate of the low-sedge-marsh vegetation through which the water used to seep has not recovered. This century the gradual spread of rushes has entered most of these communities.

In the adjacent meadows where cattle-trampling is less frequent, there is an almost closed turf with much purple moor-grass, clumps of globeflower and wood crane's-bill. Although bird's-eye primrose, spring gentian and even alpine bartsia may occur here, most of the other smaller rare species are absent.

By the riverside, a rather similar unstable open community is maintained by natural forces (*NVC M10, M11*). Here, at Cetry Bank, on the outside of a curve, the Tees cuts into the base of a moraine. Seepage and springs keep the calcareous till permanently wet and after rain, or when the snow thaws, the whole mass becomes semi-fluid. Under these conditions tussocks of turf dominated by purple moor-grass and blue moor-grass build up, and become the home of the less vigorous species such as alpine bartsia, spring gentian, bird's-eye primrose, wild thyme, Scottish asphodel ([Tofieldia pusilla](#)), hair sedge, alpine rush ([Juncus alpino-articulatus](#)) and lesser club-moss ([Selaqinella selaqinoides](#)). Here too are cushions of two mosses, [Tortella tortuosa](#) and [Ctenidium molluscum](#). Nothing is stable for long, and eventually the ridge of plants becomes too large and either slides down the slope or rolls over. The pockets of wet mud and gravel are occupied by such plants as yellow mountain saxifrage, yellow sedge ([Carex lepidocarpa](#)), false sedge and the moss [Drepanocladus revolvens](#).

On this unstable bank the continued existence of this species-rich flora would appear to depend upon a balance between the slow build-up of vegetation and its breakdown due to erosion of the bank. The periodic removal of the accumulated boulders and clayey mess from the base, when the river is in spate, may be a vital factor. A little further down the river, but separated from it by an alluvial flat, is another moraine slope covered with stable, bent-fescue turf, a little heather and a few springs and flushes, indicator of a former course of the Tees. In contrast is Hag Hill, a steep-faced moraine where the Tees actively scours the base at all times; much of the vegetation has gone completely because the rapid and continuous erosion has created an over-steepened and hence unstable slope. Since the completion of the Cow Green dam in 1971 and the regulation of water flow in the Tees, the slope has become more vegetated. Some open habitats remain with such rare plants as field gentian ([Gentianella campestris](#)).

Thus, a limited amount of erosion by the river seems to be desirable, but to maintain the rare flora the undisturbed periods when the river is low may also be of importance.

In other parts of the Dale there are more till hillocks, where the internal water table is high and seepage occurs out of the sides. Here, a less extreme form of soil creep takes place. Miniature terraces develop and provide sufficient instability to form a habitat for some of the smaller plants, such as spring gentian, lesser club-moss and moonwort amongst fescue and bent.

Where the smaller tributaries of the Tees (the sikes) meander through the flatter ground, alluvial flats have arisen. These are frequently flushed with silt and calcareous material which maintains a high base-status. Here is a flora very similar to that of the 'turfy marshes' but perhaps especially noteworthy for the high density of bird's-eye primroses.

Woodlands

The fragments of more or less natural (not planted) woodland which survive scarcely provide a representative picture of this once widespread vegetation. Sizeable relics occur only by the river above and below High Force and at Park End near Holwick; elsewhere the woods consist of rather scrubby patches on the cliff faces and by the streams.

Most of the woodland on the better drained soils has been replaced by meadows, but a little does remain, such as Sun Wood above High Force. (NVC W9). Here are birch (*Betula pubescens*), ash, hazel, bird-cherry, rowan and the common sallow (*Salix cinerea ssp. atrocinnerea*). The ground flora contains many typical woodland plants, such as wood anemone, common violet (*Viola riviniana*), wood-sorrel (*Oxalis acetosella*) and bitter vetch (*Lathyrus linifolius*); globeflower, earth nut, wood crane's-bill, and lady's mantle are also found. Woods of this kind must have been the first to be cleared, for the rich brown earth soil is similar to that in the meadows. In the wetter places by streams and springs, and a few water-logged hollows, alder and several willows are frequent. Though the common sallow is the most frequent, four other willows are often found; eared willow (*Salix aurita*), dark leaved willow (*S. myrsinifolia*) — now very rare, tea leaved willow (*S. phylicifolia*), and creeping willow (*S. repens*) which flowers and seeds happily under the annual mowing in at least one meadow. In these places the herbs are those of a fen or marsh as, for example, marsh marigold, marsh thistle, marsh hawk's-beard, meadowsweet, water avens, ragged robin, globeflower, heath spotted orchid (*Dactylorhiza maculata ssp. ericetorum*) and several rushes. The similarity between these communities and the wetter meadows is readily seen; near Cronkley Farm the much-nibbled remains of willow bushes illustrate the process by which this valley has come to be virtually treeless.

A somewhat different birch woodland (NVC W11) occurs at Park End. Here the birches are 10 m to 12 m high and at least 30 cm in diameter, indicating considerable age; like most of the other woods it is open to grazing and so doomed to extinction unless regeneration can be encouraged. This wood is on Whin Sill, where the soil is more acidic, and bluebells and bracken are common. Both are characteristic of oak woodlands in other parts of the Pennines. It is of considerable interest to note that some of the birches are of a northern race (*Betula pubescens ssp. tortuosa*), which can be recognised by the pungent resinous smell of its small leaves after wetting by rain.

On the south side of the river, in the National Nature Reserve, the north-facing hillside is covered with another kind of relict woodland (NVC W19). This is dominated by juniper, a low-growing evergreen native conifer which grows in a fantastic mixture of columnar and bushy shapes, and locally forms impenetrable thickets.



Juniper, 2011 © Dave Mitchell

The juniper occurs over an extensive area by both sides of the Tees from Keedholm Scar to the summit of Cronkley Fell; in a few places where grazing is limited some regeneration is taking place, but for the most part only the resistant old trees survive. Formerly this 'juniper' was gathered for firewood. In 2012 a deadly, water-borne pathogen was found to be killing the bushes. These are being cut down and burnt in situ but alas, five years later the pathogen continues to spread.

Here and near Holwick Head Bridge a dozen or so different kinds of fern can be found; amongst these are lemon-scented fern ([*Oreopteris limbosperma*](#)) which is covered with small yellow glandular hairs and smells of lemons, the handsome male fern ([*Dryopteris borreeri*](#)) and two smaller and more delicate ferns with tree names, oak fern ([*Gymnocarpium dryopteris*](#)) and beech fern ([*Phegopteris connectilis*](#)).

Juniper woodland in Teesdale is extensive, and isolated bushes, often of low growth, are scattered far over the slopes of Mickle Fell. Isolated trees of birch and aspen on Cronkley Scar and Falcon Clints, together with the more widespread willow scrub which extends into Harwood Dale, all indicate that this now bare part of the Dale must have enjoyed the shelter of at least a sparse covering of trees and bushes within historic times. Protected from grazing, the mutilated remnants would recover to provide windbreaks and reduce the present bleakness.

Riversides

The riverside communities are amongst the most interesting in the Dale. Unlike the meadows and woodlands, the plant communities have bare or 'open' areas. The most important process in the maintenance of this open condition is a large fluctuation in the flow of the river. Even after the construction of Cow Green reservoir very high spates do occur when the reservoir is overflowing and/or Maize Beck is in flood. The Tees has many tributaries and there is evidence that it has changed its course in many places, so open vegetation by the river will have always existed and been available to support the many rare species including: very rare hawkweeds, shrubby cinquefoil, globe flowers, shady and variegated horsetails, flat rush, alpine (viviparous) bistort, northern bedstraw and more.

The margins of the wide stony bed of the Tees provide a habitat for those species which can withstand the force of the river in spate, after heavy rain or when the winter snow melts. That some of the rarer plants of the area can do so no doubt explains, at least in part, their survival to this day. Most characteristic of this habitat is the shrubby cinquefoil ([*Potentilla fruticosa*](#)), a small bush which becomes covered with a fine display of yellow, rose-like flowers for many weeks in the summer. This plant grows in dense stands in several places or is scattered singly by the river from Falcon Clints to below Middleton. Its deep roots and tough stems enable it to survive the pressure of the flood water even when almost completely submerged and it is of interest to know that it occupies very similar riverside habitats in the Ural mountains in Russia. Formerly a large colony existed at the margin of a former course of the Tees several hundred metres from the present course of the Tees and separated from it by heather heath.

Plants in the fine gravel and silt amongst the stones include sea plantain and scurvy-grass ([Cochleria pyrenaica](#)), two maritime plants not uncommon in some inland mountain areas, as well as northern bedstraw, bird's-eye primrose, blue moor-grass, alpine bistort, stone bramble ([Rubus saxatilis](#)); grass of Parnassus and salad burnet. On the more stable banks, where the soil is deeper, the flora is essentially that of the herb-rich woodland and hay meadows already described. (MG3, W9, W11). These are at their best where the riverside path has been fenced off from the adjacent fields thus excluding grazing animals but not rabbits.

The broken border of trees, mainly willow, alder, bird-cherry and ash, give some protection to the herbs from river erosion, but not from trampling and picking. Additional species not commonly found in the meadows include the meadow, the wood and the variegated horsetail, early purple and fragrant orchid, twayblade ([Listera ovata](#)), giant bellflower ([Campanula latifolia](#)), and three of the rarer Lady's mantles ([Alchemilla monticola](#), [A. wichurae](#) and [A. glomerulans](#)). Also present is saw-wort ([Serratula tinctoria](#)), a species at the northern end of its range.

Where the Whin Sill rocks form islands in the river, as at Wynch Bridge, a number of base-loving plants have a precarious hold in the joints of the rock. These include cat's foot ([Antennaria dioica](#)), alpine cinquefoil ([Potentilla crantzii](#)), alpine pennycress ([Thlaspi caerulescens](#)) and dwarf golden-rod ([Solidago virgaurea ssp. minuta](#)). In this region also is rock whitebeam ([Sorbus rupicola](#)), a relation of the rowan with simple white-backed leaves and large fruits.

In the gorge below High Force, the waterfall maintains, for most of the time, a humid atmosphere. Here is a rich bryophyte flora, especially on the shaded north-facing slope. Above the waterfall, on the south-facing rock, a lush growth of the woodland herb community contains wood crane's-bill, meadow-sweet, water avens, greater woodrush ([Luzula sylvatica](#)) and two sedges: pale sedge ([Carex pallescens](#)) and wood sedge ([C. sylvatica](#)).

Since the erection of the fence by the Pennine Way that excluded grazing from the Tees bank, and the reduction in the high spates of the Tees, many open sites have become closed, the meadow-type vegetation ranker, the scrub denser and bracken more frequent. Though in this part of the National Nature Reserve, between Wynch Bridge and Holwick Head Bridge, conservation work is attempting to maintain the three communities of meadow, scrub and woodland.

Whin Sill Scars

The Whin Sill cliffs of Falcon Clints and Cronkley Scar are prominent features of the Forest-in-Teesdale area; less well known are Dine Holm Scar and the cliffs near Holwick.

The well-jointed facies, block scree and rock slopes are well drained and though little peat develops on the more stable slopes, lime-loving plants tend to be absent. The vegetation resembles that of the 'bilberry edges' of the South Pennines. The most abundant species are heather, bilberry, cowberry ([Vaccinium vitis-idaea](#)), crowberry ([Empetrum nigrum](#)) and wavy hair-grass ([Deschampsia flexuosa](#)), but locally bearberry ([Arctostaphylos va-ursi](#)) is co-dominant with these species, (possibly a remnant of NVC H13). On the drier sunnier aspects, bell-heather ([Erica cinerea](#)) is common, and it is on these screes that the locally rare parsley fern ([Cryptogramma crispa](#)) can be found. Formerly, the little arctic-alpine fern oblong woodsia ([Woodsia ilvensis](#)) grew on the Whin Sill cliffs near Cauldron Snout, but it appears to have suffered from the avidity of collectors (plants grown from a mixture of spores from Wales and Scotland have been introduced at sites on both sides of the Tees). Green and maidenhair spleenworts ([Asplenium viride](#) and [A. trichomanes](#)) and the holly fern ([Polystichum lonchitis](#)) still occur sparingly on Falcon Clints. The moss flora contains several woodland species; and locally, in damp hollows, patches of bryophytes (including bog moss) and lichens characteristic of acid rocks are present.

Indications of an earlier woody vegetation on these scars are provided by the isolated plants of birch, aspen, rowan and juniper; and by the occurrence on south-facing ledges of a tall-herb community with greater woodrush, stinging nettle, dog's mercury, red campion, rosebay willow-herb and orpine ([Sedum telephium](#)).

The Whin Sill cliffs at High Cup Nick are outside our area, but it is worth noting that they have a number of mountain plants not found in Teesdale, such as the rose-root ([Sedum rosea](#)) and Alpine saxifrage ([Saxifraga nivalis](#)).

Flora and vegetation of higher ground

The more upland areas of Upper Teesdale are characterised by four principal types of vegetation, namely, blanket bog, dwarf shrub heath, grass heath and flush vegetation.

Blanket Bog

Much of upland Teesdale up to 600 m lies buried beneath a blanket of acid peat, varying in thickness from 30cm to 4m; the peat is characteristic of the flatter and gently sloping areas. Most of it is of a type which depends for its formation on acid conditions, an adequate supply of rain and a topography which tends to retard water run-off. Under these conditions, the bog moss (Sphagnum), which is the chief peat former, becomes established; and once established, it continues to grow. As the older parts below die, they fail to decay due to the water-logging of the acid environment; and ultimately the dead bog moss becomes compressed to form peat. Pollen analysis has revealed that peat development in Teesdale, as elsewhere in the uplands of England and Scotland, commenced towards the end of the Boreal Period, and spread rapidly between about 7,000 and 5,000 years ago during the wetter Atlantic period. At the base of this peat, remains of trees, mainly pine, birch, willow and juniper, can be seen in many places where exposed by erosion and stand witness to the former extent of woodland. Remains of the common reed ([Phragmites australis](#)), of species of Equisetum and of the now rare British moss [Paludella squarrosa](#) are also locally abundant in the lower peat and it seems that they must have been constituents of the ground vegetation in wet, shaded parts of the original woodland.



Heather — Hare's-tail Cotton grass community (Blanket mire) (M19).

Inset left to right, Hare's-tail Cotton grass, *Hylocomium splendens*, *Rhytidiadelphus loreus* and Cloudberry.

© Dave Mitchell

The present-day vegetation of these bogs depends largely on the extent to which they have been burned, drained or grazed. Where relatively undisturbed (*NVC M17, N18*), a good cover of bog moss is still to be found supporting on its surface such plants as the sundew ([Drosera rotundifolia](#)) and the bog asphodel ([Narthecium ossifragum](#)). Growing through the carpet are heather, cross leaved-heath ([Erica tetralix](#)), tussocks of the tufted hare's-tail cotton-grass ([Eriophorum vaginatum](#)), shoots of the common cotton-grass ([E. angustifolium](#)) and deergrass.

Decaying animal matter on the wet bog surface provides the habitat for the mosses [Splachnum sphaericum](#) and [Tetraplodon mnioides](#) and for the very rare moss [Aploqon wormskieldii](#), known elsewhere only on Ben Lawers in Scotland. A patch of this moss, almost 2 m in length, was observed growing on what must have been the carcass of a sheep submerged in a peat pool.

The rediscovery in 1965, on the blanket bog on Widdybank Fell, of the dwarf birch ([Betula nana](#)) provided not only an important addition to the arctic- alpine element of the Upper Teesdale flora but also the first recent living record in England. On bogs which have been subjected to man's interference (*NVC M19*), the bog moss with its associated species is poorly represented and the heather and hare's-tail cotton-grass tend to become dominant; in drained bogs, the cloudberry ([Rubus chamaemorus](#)), the cowberry and the fir club-moss ([Huperzia selago](#)) may be present.

In many parts of upland Teesdale, rapid erosion of peat has resulted in exposure of the mineral soil below. Wind, water and frost are the chief agents of erosion, but the initiating causes are not yet fully understood. In recent decades revegetation has taken place naturally and also aided by the blocking of the drainage 'grips' created after World War Two.

Dwarf Shrub Heath

The principal dwarf shrub heath community of the Teesdale area is that dominated by heather ([Calluna vulgaris](#)), and its presence indicates an oceanic tendency in the otherwise sub-arctic climate of the region. The community is found wherever better drained, leached and acid soils occur. Thus, the heather moor (heath) (*NVC H9, H12*) is characteristic of the steeper slopes and the well-drained flatter areas; impeded drainage results in the development of blanket bog. The heath soils are overlaid by a shallow layer of acid humus — peat. It is now generally agreed that heather moor communities lying within the potential forest zone are largely man-made, resulting initially from the early clearance of the open forest and subsequently maintained as heath in the last two centuries by the practice of moor-burning and grazing.

In Teesdale, as elsewhere, heather provides valuable grazing for grouse and sheep, and the periodic burning of the heather is to ensure a succession of young heather shoots. The maintenance of heather moorland is thus of considerable economic importance for the farmers and sporting interests in the area.

The floristic composition of heather moor varies considerably depending mainly on the intensity of burning and grazing. Frequent burning produces dense even-aged stands of heather with little else present except an under-storey of bryophytes and lichens. Where the community is more open, common constituents are bilberry, cowberry, bell-heather, crowberry, tormentil, heath bedstraw, wavy hair-grass and sheep's fescue; in wetter areas cross-leaved heath is also often present (*NVC H10*).



Heather, bilberry
© Dave Mitchell

In undisturbed areas, lesser twayblade ([Listera cordata](#)) can still be found, often growing in a patch of moss. It seems likely that the juniper was formerly a constituent of some of the heather communities on the less acid soils, but today only scattered bushes remain. Heather with good juniper does still occur on the Whin Sill outcrop near High Force.

Grass Heath

The grass heath communities of the higher ground and fell tops are also a product of man's activities. Some of this grassland on the better soils — the fescue-bent- thyme and fescue-bent-heath bedstraw grasslands (*NVC CG10, U4*) — has been produced directly from former forest or scrub as a consequence of long-sustained grazing, latterly mainly by sheep. This prevented, in the first place, regeneration of the woodland by the eating of the seedling trees and secondly, favoured the grasses of the field layer at the expense of the other herbs. In grasses, the growing point is at the base of the shoot and is not damaged by grazing unless very intensive; in contrast, in many herbs, though not all, the growing point lies well above ground level and is, therefore, much more liable to damage. In this way, grassland directly replaced forest in the uplands.

On the other hand, some of the grass heath is secondary in origin, having been derived again as a result of grazing but this time from heather moor which, in its turn, was produced from forest. Ratcliffe (1959, 1962), has shown that for North Wales, the Southern Uplands and the Highlands of Scotland, the sub-montane heather communities have been, and are still being, replaced by bilberry communities, bent- fescue grassland and mat-grass communities as a result of repeated heather burning combined with intensive sheep grazing; and this is probably happening in Teesdale too. These man-made communities, like the heather moor, are again of economic importance to the farmers and sporting interests of the Dale.

At the highest levels on Mickle Fell and Crossfell, some grass heath unmodified by man may exist (*NVC U10*). This view is strengthened by the occurrence in these poor grasslands of species like the stiff sedge ([Carex bigelowii](#)) and the alpine club-moss ([Diphasiastrum alpinum](#)) and by the presence of several characteristic lichens and mosses for example [Polytrichum alpinum](#) (*NVC U7*).

Although no detailed ecological investigation of the Teesdale grass heath as a whole has been carried out, it can be shown, following the work of McVean and Ratcliffe (1962) for the Highlands of Scotland, that types of grass heath represented in Upper Teesdale depend, in addition to the grazing factor, on the soil-moisture regime and the base-status of the soil. In soils of high base-status, lime is present together with salts of magnesium, potassium, ammonium and sodium and such soils are usually fertile; in soils of low base-status, free lime is usually absent, and the other bases are present only in small quantities; these soils are usually infertile.

In Upper Teesdale there are three main kinds of grassland on soils of low base-status; they are dominated by bent and fescue, mat-grass and purple moor-grass respectively and they are all species-poor. There are also limestone grasslands, dominated by a variety of grasses and herbs, which are species-rich.

The grasslands will be described briefly in this order.

Bent-Fescue grassland (species-poor)

This grassland (NVC U4), in which the bent grasses, ([Agrostis capillaris](#) and [A. vinealis](#)) and the sheep's fescue are the dominants, is characteristic of the less acid and more fertile soils, provided that drainage is reasonably free. Other characteristic plants of the community are sweet vernal-grass, tormentil, heath bedstraw, common dog-violet, field woodrush and the mosses [Rhytidiadelphus squarrosus](#) and [Hylocomium splendens](#). The lovely mountain pansy is also often present. This type of grassland, together with the limestone pastures, provides the mainstay of the grazing animal in Upper Teesdale.

Mat-grass grassland

Floristically this is very similar to bent-fescue grassland except that the mat-grass replaces the other two grasses as dominant (NVC U5). The soils are acid and tend to be wetter, particularly during the winter months. The wetter conditions result in the dominance of mat-grass, especially where grazing pressure is high; it is more unpalatable to sheep than the other grasses though in the early summer its young leaves are eaten. The moss layer tends to be better developed and the heath rush ([Juncus squarrosus](#)), the pill sedge ([Carex pilulifera](#)) and the wavy hair-grass are other characteristic species (NVC U6). The presence of dwarf heather and bilberry, and more rarely the wood anemone, indicates not only the possible origin of this grassland type but also what it would develop into if the grazing pressure were reduced.

Purple moor grass ([Molinia](#)) grassland

Purple moor grass prefers still wetter soils, but not usually waterlogged. Consequently, it is characteristic of the heavier soils with impeded drainage and of soils where lateral movement of water takes place as in flush sites (NVC M25). In these soils anaerobic conditions prevail and iron salts occur in the ferrous condition, imparting a blue-grey colour to the soil. Such soils are described as 'gleyed' and are often overlaid by an accumulation of amorphous peat. In addition to the purple moor grass, most of the other grasses already mentioned (except the wavy hair-grass) and heath rush are present in varying quantities. The wetter conditions also favour the presence of a number of sedges, such as carnation sedge ([Carex panicea](#)), glaucous sedge ([C. flacca](#)), star sedge ([C. echinata](#)), pill sedge, dioecious sedge ([C. dioica](#)) and common sedge ([C. nigra](#)). The number of other flowering plants present depends on the base-status of the soil, and from the more fertile soils the list can be extensive. Pure stands of purple moor grass are uncommon in Teesdale and the one near Cronkley Farm has been drained.

In the flushed sites where spring or other water (frequently calcareous) flows laterally through the soil, jointed rush ([Juncus articulatus](#)) often becomes co-dominant with the purple moor grass. The calcareous flushes provide some of the most species-rich habitats in Upper Teesdale. The description above of the 'turfy marshes' applies equally to these higher flushes and need not be repeated here.

Grasslands on limestone (species-rich)

This type of grassland is best described under the two headings of sugar-limestone grassland and unaltered limestone grassland.

Sugar Limestone Grassland Blue moor-grass – mountain bedstraw grassland

This remarkable grassland type (*NVC CG9*), has been studied by Professor Pigott and the late Mr Kenneth Park; the following account draws largely on the published work (Pigott, 1956). Like the vegetation it supports, sugar limestone is a unique type of rock, possessing a coarsely crystalline structure. Good outcrops are to be found on the top of Cronkley Fell and again on the west- south-west slope of Widdybank Fell; these outcrops overlies the Whin Sill.



Sugar limestone exposure, calcareous grassland
© Margaret E Bradshaw

On weathering, this metamorphic limestone breaks down to form separate crystals, producing a white limestone sand which closely resembles coarse granulated sugar. The highly calcareous soils which are produced are usually shallow, averaging some 20 cm in depth, but differ from normal limestone soils in the very high proportion of calcite crystals present and in the virtual absence of siliceous material. Where close turf has developed on top, in the more sheltered areas, black soot-like humus is incorporated in the soil, giving it a brown or blackish colour, and the whole profile is saturated with bases.

Below this soil, the underlying sugar limestone is often weathered and stained pale yellow and this zone can be penetrated by roots. This is probably particularly important in relation to the survival of shrubby plants, such as the rock-roses, mountain avens and thyme, which form important constituents of the turf. The presence of buried turf horizons in these soils indicates successive and often progressive burial by fresh wind-blown deposits of limestone sand derived from erosion areas nearby, and this will be mentioned again below.

As already mentioned, these soils occur only in the more sheltered regions and characteristically support a smooth closed turf in which several of the rare species show their greatest vigour.



Blue-moorgrass — Mountain Bedstraw community (*CG9*), with Blue-moorgrass heads silhouetted.
Inset Mountain Bedstraw. © Dave Mitchell

Floristically, the turf is very rich, with as many as 40 to 50 species in a four square metre quadrat. Sheep's fescue is dominant with an abundance of the two lime-loving grasses, blue moor grass (*Sesleria caerulea*) and crested hair-grass (*Koeleria macrantha*); meadow oat grass (*Helictotrichon pratensis*) and very dwarfed quaking-grass (*Briza media*) are also usually present (NVC CG9). Other characteristic flowering plants present in some quantity are the sedges: spring sedge (*Carex caryophylleii*), rare spring sedge (*Carex ericetorum*), hair sedge, limestone bedstraw (*Galium sternerii*), felwort (*Gentianella amarella*), common rock-rose (*Helianthemum nummularium*), purging flax (*Linum catharticum*), spring sandwort (*Minuartia verna*), common dog-violet, wild thyme, harebell, ribwort plantain and sea plantain. This century glaucous sedge has become more abundant. Of species generally regarded as rare or local in the British Isles, hoary rock-rose (*Helianthemum oelandicum ssp. laevigatum*) occurs only on Cronkley Fell and the rock violet (*Viola rupestris*) only on Widdybank Fell. Holly fern is also known from one or two localities.



Teesdale (rock) violet © Margaret E Bradshaw

Three factors contribute to the richness of the vegetation, viz: the chemical nature of the soil, the slow accretion of limestone sand from adjacent erosion- areas, and the relatively high grazing intensity (by sheep and rabbits), which reduces the competitive power of the grasses to the advantage of shrubby, rhizomatous and rosette plants. These conditions also prove beneficial to many bryophytes such as *Ditrichum flexicuale*, *Encalypta streptocarpa*, *Rhytidium rugosum* (only on Widdybank Fell in Teesdale), *Tortula ruralis*, *Rhacomitrium canescens*, *Scapania aspera* and also to many lichens. Any attempt at conservation of the sugar limestone grassland must take into account the grazing factor because most of these rarities are termed 'light- demanders' and cannot tolerate being shaded by neighbours as in under-grazed situations

Somewhat surprisingly there is an extensive area overlaying the sugar-limestone on Widdybank Fell which is dominated by short heather, in which such calcicole species as blue moor-grass, spring gentian, alpine bistort and northern bedstraw are frequent and, locally, crowberry is also present. Here the molehills are composed of soil which is rich with fragments of sugar limestone rock. Analysis of this soil reveals, among other things, higher clay and quartz sand fractions as compared to normal sugar limestone soil; an explanation of this difference is that the soil in question has been derived from thin glacial drift deposited on top of the sugar limestone outcrop. In contrast to the usual immature sugar limestone soil, these drift-derived soils tend to remain moister during the summer. Where the depth of the overlying drift is greatest, taller heather becomes dominant, forming dry heath communities as already described.

Mention has already been made of the fact that these sugar limestone soils are very liable to erosion when exposed to wind and particularly so when the soil is disturbed by the rubbing of sheep or the scuffling of rabbits. Mole activity too, on the deeper soils, may have contributed to the initial weakening of the turf leading to subsequent erosion.

Pigott (1956) describes various stages of erosion leading to the ultimate exposure of bare sugar limestone rock. An initial stage consists of only partial disruption of the turf producing a mosaic of small bare hollows and grass tussocks. Annual species occur in the hollows which soon however become recolonised by seedlings of the spring sandwort, by runners of the wild thyme and by seedlings and persistent fragments of sheep's fescue. More rapid erosion on exposed west-facing slopes results in the progressive undercutting of the turf along numerous edges, bringing about the death of the grasses. Deeper rooted woody plants like the rock-roses and thyme become isolated and may survive for a number of years but ultimately they too are killed. The patch of mountain avens (*Dryas octopetala*), in the same habitat suffered severely. Large areas of the weathered limestone are laid bare by erosion and are only very slowly re-colonised by plants like fescue and sandwort.

A very characteristic plant of these exposed surfaces is the moss *Tortella toruosa*. Eventually, a patchy turf develops, and the slow process of soil building starts again. Pigott has aptly described this sugar limestone habitat as not unlike calcareous dunes in miniature. Although, from what has been said, it is obvious that some degree of erosion is beneficial for many of the rare plants, the evidence points to more rapid erosion in recent years and further research is required to devise methods to control this.

In the meantime, large areas of the sugar limestone on Cronkley Fell have been fenced to exclude grazing animals, but this can create the new problem of too little grazing. Getting the balance right is being worked out; the amount of grazing by the sheep can be controlled but keeping out the rabbits requires constant effort.

Another consequence of erosion is the development below the outcrops of deeper, moister, dark-brown soils which consist largely of an admixture of blown limestone particles and peat. Alpine meadow rue and false-sedge occur very abundantly in these soils amongst more frequent species.

Unaltered limestone grassland

Apart from the presence of the sugar limestone, the limestone topography of Upper Teesdale differs from that of the Craven area in the relative absence of limestone pavement with clints and grikes. The thick horizontal beds of limestone form low cliffs and although well-jointed are for the most part covered with soils of varying thickness. On some of the outcrops the clint and grike pattern can be seen in the present-day covering of turf. If, as is thought by some, the limestone pavements of Craven are due to loss of an original covering of soil down the grikes, the question arises as to why the soil covering has been preserved in Teesdale? Obviously, whatever the explanation for the different limestone topography of the two areas, there is a problem here for further investigation.



Common Bent - Red Fescue - Heath Bedstraw community (U4) © Dave Mitchell



Common Bent - Sheep's Fescue - Wild Thyme community (CG10) © Dave Mitchell

The vegetation of the shallower soils derived directly from the weathering of limestone resembles very much that of the sugar limestone with fescues (*NVC CG10*), blue moor grass and crested hair-grass (*Koeleria macrantha*) as the principal grasses associated with harebell, thyme, vernal sandwort and spring gentian. On the deeper soils leaching has started and here bent and fescue are the dominants, associated this time with a corresponding reduction of the lime-loving species; scattered patches of heavily grazed heather and bilberry may also be present. Another very beautiful plant in the turf of these slightly leached soils is the mountain pansy.

Pigott records an interesting variant of this turf from 670 m on Mickle Fell, where the soil derived from down-washed drift is flushed by calcareous water. In the close-grazed turf on this soil the lovely alpine forget-me-not (*Myosotis alpestris*) is plentiful, as also are spring gentian, mossy saxifrage (*Saxifraga hypnoides*) and mountain everlasting (*Antennaria dioica*).

To conclude this section on the grass heath of Teesdale, it must be emphasised that the types described represent, as it were, reference points in an almost continuous range of variation. Many intermediate communities could be described. As we have seen the direction of variation is controlled on the one hand largely by the moisture regime of the soils and on the other by the base-status of the soils. Superimposed on both of these is the grazing factor.

Flush Vegetation

Gravelly and stony flushes

On the sugar limestone area of Widdybank and Cronkley Fells, open, gravelly and stony flushes exist either as sharply defined patches in the surrounding drier vegetation or in an association with a transition through dwarf-sedge marsh to the drier areas. A typical feature of these flushed sites is the occurrence of numerous small knobbly or large dark-green hummocks of the mosses *Hymenostylium recurvirostrum* and *Catascopium nigratum*; some of these can measure almost 1 m in diameter and may reach a height of 30 cm. In the vicinity of some calcareous streams the hummocks, with the exception of the top 2–3 cm, become encrusted and fused into a porous rock (tufa) by the deposition of calcium carbonate; certain blue-green algae would appear to be active in this deposition. In more exposed situations the normal hummocks assume a crescent shape and against the concave surfaces to the windward, windblown detritus accumulates forming a small inclined bank. Cushions may also be formed by two other mosses *Palastriella commutata* var. *falcata* and *Drepanocladus revolvens*.



Fruits of Three-flowered Rush
© Margaret E Bradshaw

These wet gravel patches on Widdybank Fell provide the only known habitat in the British Isles for bog sandwort ([Minuartia stricta](#)) and fortunately for its survival it is an inconspicuous, small plant; other rare and interesting species include the three-flowered rush ([Juncus triqlumis](#)), yellow saxifrage, alpine meadow-rue, Scottish asphodel, alpine rush and variegated horsetail. butterwort and the yellow sedge, ([Carex lepidocarpa](#)), are very characteristic species, too; and the rare British mosses [Amblyodon dealbatus](#), [Catascopium nigratum](#) and [Meesia uliginosa](#) also contribute to the floristic interest of the gravelly flushes.

Brophyte flushes

Where the drainage water is more highly localised within the blanket bogs of the area and the higher slopes of the Dun Fells, Mickle Fell and Dufton Fell, nutrient-poor flushes are mostly dominated by the mosses typical of the flush bogs, forming bright-green or reddish-brown spongy carpets (NVC M37). Where the water has a slightly higher mineral content, bog-mosses give way to a variety of other mosses and liverworts such as [Philonotis fontana](#), [Dicranella palustris](#), [Warnstorfyae exannulata](#) and [Calliergon sarmentosum](#). These, also, form spongy cushions, but they are associated with a greater variety of vascular plants, including blinks ([Montia fontana](#)), bog stitchwort ([Stellaria uliginosa](#)), opposite-leaved golder-saxifrage ([Chysosplenium opositifolium](#)), chickweed willowherb ([Epilobium alsinifolium](#)) and various grasses and sedges.



Philonotis fontana — Saxifrage stellaris (Star Saxifrage) community (M32). Inset *Philonotis fontana* and Star Saxifrage. © Dave Mitchell

The most outstanding plant of these flushes is the rare, yellow marsh saxifrage ([Saxifraga hirculus](#)). This arctic-alpine is centred in Lunedale, Teesdale and Weardale in north England, and has a few records in the Pennines and Scotland and a cluster in Ireland. Other arctic alpine in these flushes are alpine willowherb ([Epilobium anaqallidifolium](#)), stary saxifrage ([Saxifraga stellaris](#)) and hairy stonecrop ([Sedum illosum](#)).

To conclude, the vegetation of Upper Teesdale comprises a very large variety of plant communities, where the juxtaposition of the common and the rare makes the scientific importance of the area far greater than the sum of the number of the individual types.

It is a truly unique area. Interest in this flora lies not only in its variety but also because its members belong to diverse geographical elements.

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