

Dinkling Green



Soil Science Field Trip

To identify soil plant and landscape dynamics in the
Bowland Fells

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- Aims:
 - To investigate the relationship between soils, topography, vegetation and land use on Totteridge Fell in the Forest of Bowland
 - To identify key soil characteristics at different height levels on the fell. Texture, depth O.M. content, and pH
 - To identify changing flora (species) and population dynamics associated with changing soil types
 - To consider the impact of past, present and future land management on the nature of soils and plants on the fell.
 - To consider the wider nature of the local landscape in association with geology, land use, climate and topography
- Background
 - Dinkling Green is a 300Ha hill farm comprising improved lowland and in bye pasture and open fell rising to 350m asl
 - Land use is limited by climatic and soil conditions and is focused on sheep production utilising the improved and unimproved pasture
 - Intensification of production in the period 1970 – 2000 has given way to a more extensive approach and a greater focus on bio-diversity and ecological / environmental issues
 - The open fell is managed and used to promote populations of Red Grouse used for shooting purposes.
 - Improved fields in the lower lying areas of the farm and closer to the main farm buildings are known as “in bye”. Dinkling Green has a relatively high proportion of “in bye” compared to open (unimproved fell)

Totteridge Fell

- The arrow indicates line of samples/ survey – starting at @100m asl and ending at @ 350m asl
- At approximately 50m (height) intervals soils, vegetation and land use were considered



Soil profiles created by excavations or landslip
can often reveal the nature of the underlying soil
In this case glacial till overlying sandstone.



Open fell –
unimproved
soil /
vegetation


This is the main
transport slope down
which most soil
material moves under
the influence of water
and gravity

Fell wall –
above
which soil
has not
been
improved

This field is on the “toe
slope” and receives soil
and water from the upper
slope. Soils are deep but
gleyed







Rushes (*Juncas* sp.) are a clear indication of the waterlogged and gleyed nature of this soil and without management are now coming to dominate this field

With improved drainage, cultivations, re-seeding, liming and fertiliser – followed by similar on-going management and intensive grazing this field was highly productive in the last 30 years
But this was only sustainable with Government subsidy.

Changes in agricultural policy now mean that such “intensification” is not economic- indeed farmers on such land are now “subsidised” to extensify their production – reduce inputs and “enhance” the ecology / bio-diversity of such sites

Grass species such as Yorkshire fog (*Holcus lanatus*) and Bent grasses (*Agrostis* sp) remain productive where they are not dominated by *Juncas*.



This silty clay loam binds together well and feels smooth and silky – but take care of the high (>15%) O.M content.

This profile core indicates the deep nature of the soil in the “in bye” field. There is some evidence of gleying in the lower part of the core. The texture of this soil is a silty clay loam

Slight gleying seen in the lower core




With a pH of @ 6 the soil in the in bye field is fertile and productive – though rather poorly drained. With intense management it could produce a high quality sward. But such management comes at both a financial and ecological cost – typically reduced bio-diversity.

Above the fell wall looking up the main transport slope



Un improved soil / pasture above the fell wall is dominated by coarse unproductive and unpalatable grasses Sheep's fescue (*Festuca ovina*) Common bent (*Agrostis tenuis*) and Mat grass (*Nardus stricta*) The dense surface litter layer is increasingly filled with moss and the wetter areas prone to domination by rushes.

Productivity is low and now grazing on the open fell is at a minimum



“Flushes” such as this area represent “springs” where through-flow water in the fell is forced to the surface by underlying impermeable strata. They enhance the habitat diversity on the fell.

The dense mat of poorly decomposed plant litter is a consequence of low pH and high soil water content

Wavy hair grass (*Deschampsia flexuosa*) is typical of many upland grassland areas and its "tufted / tussock" habit is ideal for small mammals in which to nest and graze. This in turn attracts birds of prey such as owls and the Hen harrier (*Circus cyaneus*) an example of which was seen on this occasion





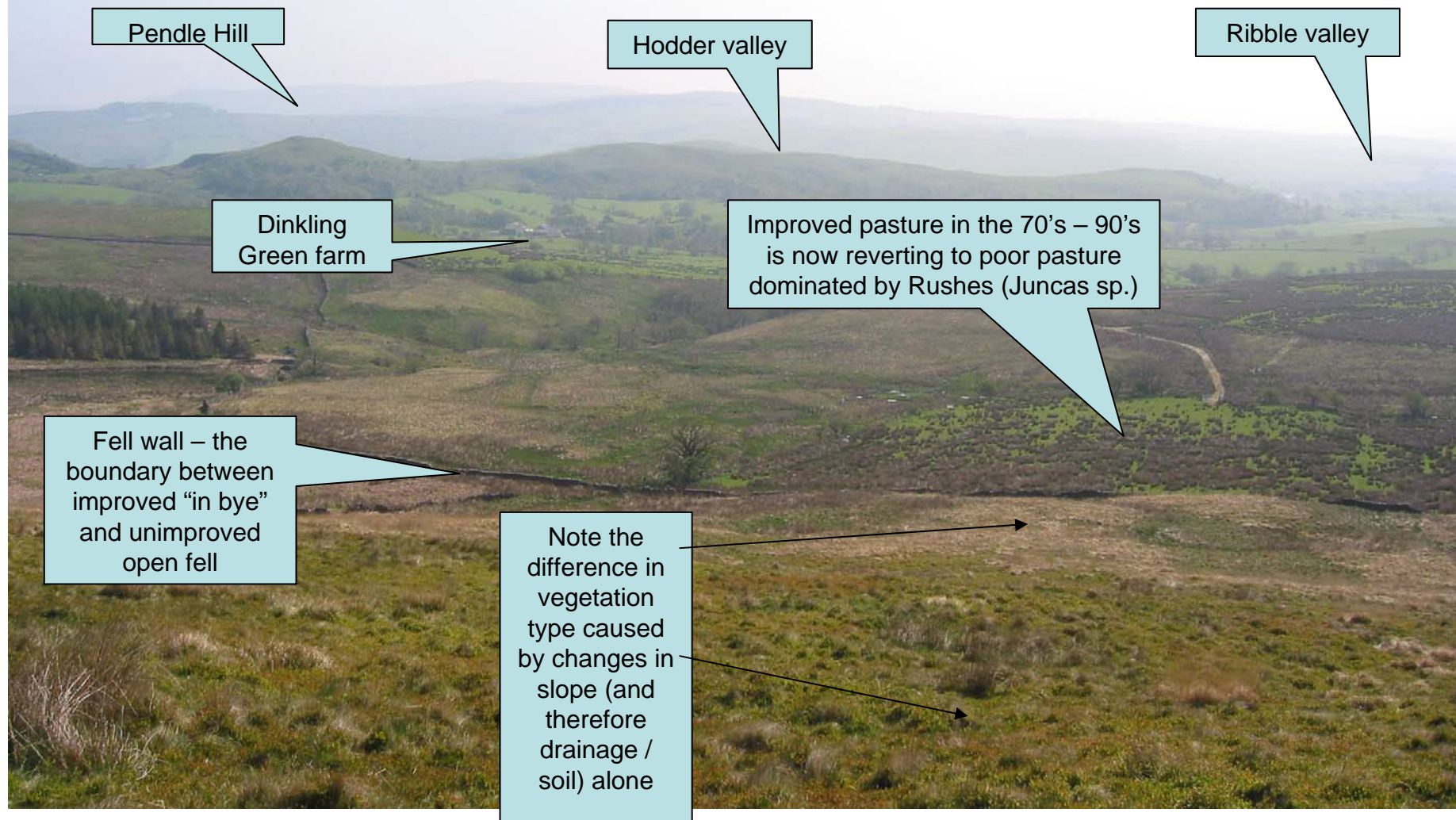
Wavy hair grass
(*Deschampsia
flexuosa*) – dried
remnants of
previous years
growth

In the drier soils on the main
transport slope Bilberry
(*Vaccinium myrtillus*) is
increasingly dominant in the
sward as a consequence of
reduced grazing

Bent
(*Agrostis
sp.*)
grasses
are
typified
by their
slender
“spear
shaped”
leaves

Mat grass – (*nardus
stricta*) – a “rank”
unpalatable grass
typical of upland soils
– especially dry /
damp acid areas

Looking S.East from mid way point on Totteridge Fell. Despite the hazy conditions the topography of the land south of the Bowland Fells is apparent. Undulating hills intersected by rivers (Hodder, Ribble, *et al*). Geologically hard sandstone tops with underlying shales have been undercut by the action of these rivers to leave rounded protruding hills such as the Beacon, Longridge and Pendle fells. An exception to this is the low lying ridge in the mid / fore ground which is a limestone outcrop – an outlier from the more extensive limestone country of the Yorkshire Dales



Looking due south – Longridge fell on the horizon (right). At one time the fields below the fell wall were all brought into relatively intense production through improvements to soil drainage and fertility. Without intensive (and expensive inputs) they are reverting to dominance by Rushes (*Juncas sp.*) Nevertheless such areas are relatively bio-diverse and as such are a valuable contribution to the ecology of the area. Indicator species such as the Golden plover and Curlew are testament to this.



Golden plover (*Pluvialis apricaria*)
Another summer inhabitant of the uplands

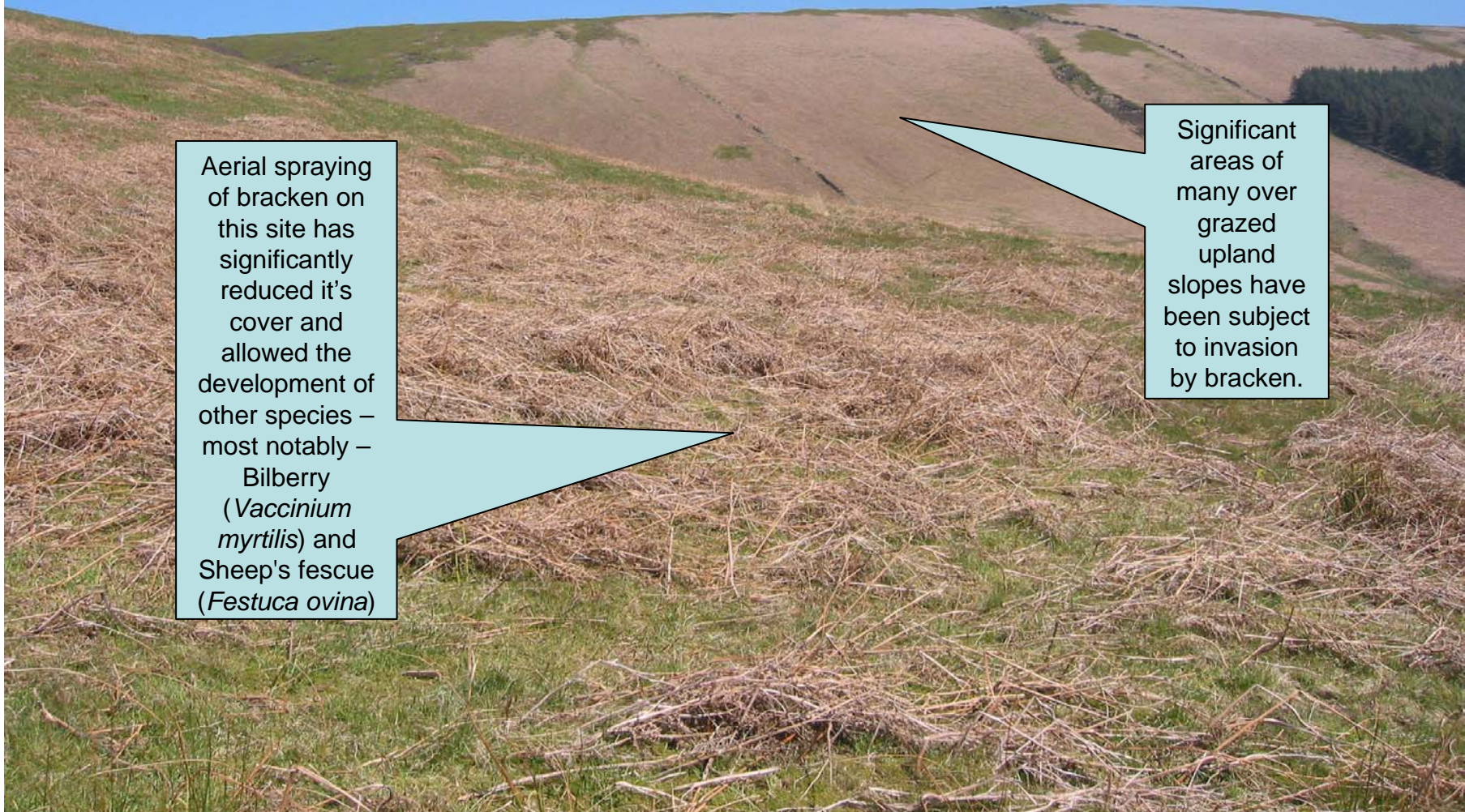


Curlew (*Numenius arquata*)
migrates from the Ribble and other nearby estuaries to spend the summer months on the uplands

The upper areas of the main transport slope are subject to high rainfall @ > 1200mm pa but the steepness of the slope results in rapid run off and subsequent movement of soil material down slope. Consequently soils are relatively dry and in many parts very shallow @ < 10cms. Bracken (*Pteridium aquilinum*) has come to dominate these slopes – possibly as a consequence of over grazing in times of more intensive sheep production. Bracken is highly invasive – spreading by vegetative (rhizomes) means and by sporulation. Highly unpalatable once established it dominates the site by excluding light to other sward species.

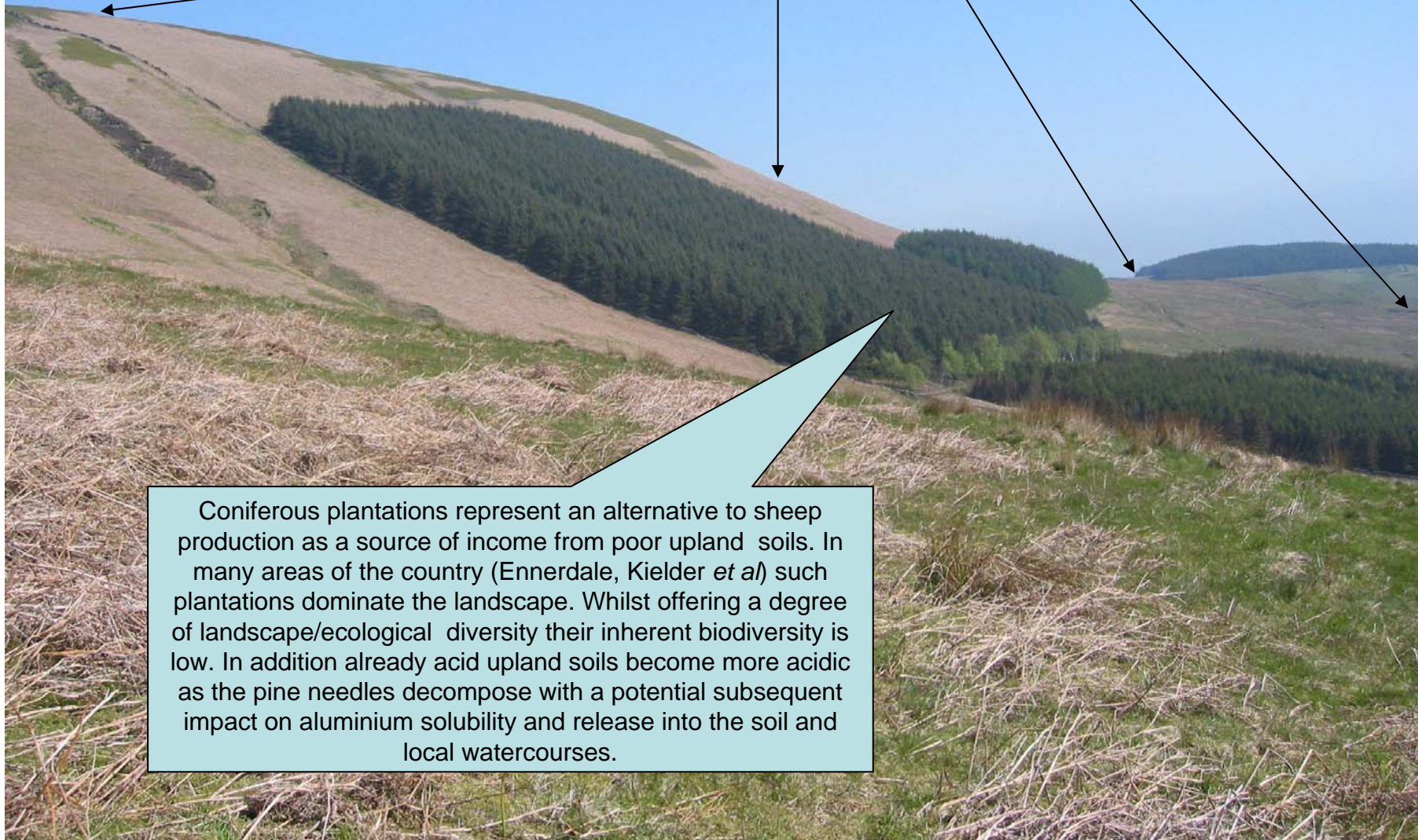
Aerial spraying of bracken on this site has significantly reduced it's cover and allowed the development of other species – most notably – Bilberry (*Vaccinium myrtillis*) and Sheep's fescue (*Festuca ovina*)

Significant areas of many over grazed upland slopes have been subject to invasion by bracken.

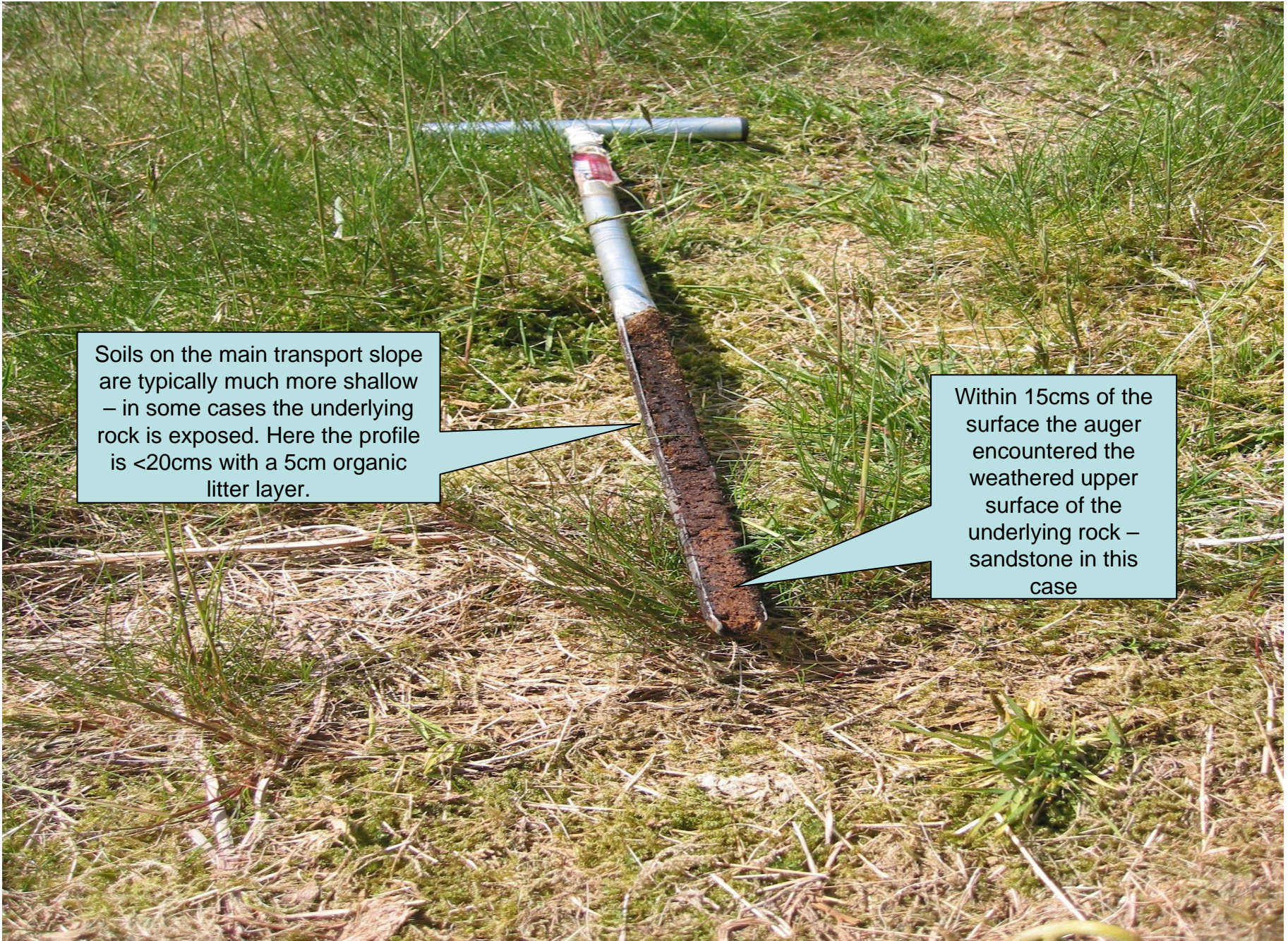


This profile shot of the fell clearly indicates the different elements of the slope from;

Transition slope to transport slope, foot slope and toe slope.



Coniferous plantations represent an alternative to sheep production as a source of income from poor upland soils. In many areas of the country (Ennerdale, Kielder *et al*) such plantations dominate the landscape. Whilst offering a degree of landscape/ecological diversity their inherent biodiversity is low. In addition already acid upland soils become more acidic as the pine needles decompose with a potential subsequent impact on aluminium solubility and release into the soil and local watercourses.



Soils on the main transport slope are typically much more shallow – in some cases the underlying rock is exposed. Here the profile is <20cms with a 5cm organic litter layer.

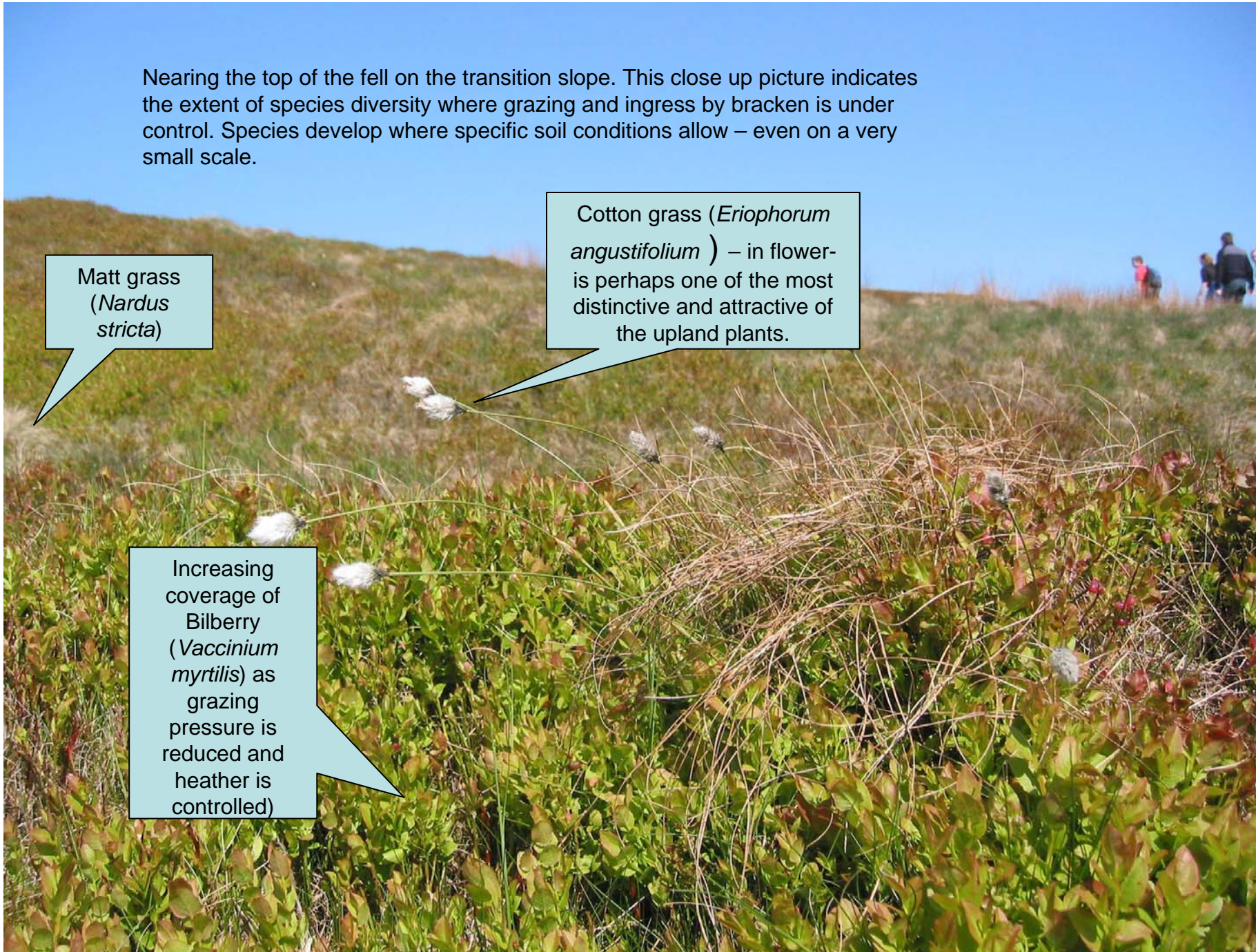
Within 15cms of the surface the auger encountered the weathered upper surface of the underlying rock – sandstone in this case

Nearing the top of the fell on the transition slope. This close up picture indicates the extent of species diversity where grazing and ingress by bracken is under control. Species develop where specific soil conditions allow – even on a very small scale.

Matt grass
(*Nardus stricta*)

Cotton grass (*Eriophorum angustifolium*) – in flower – is perhaps one of the most distinctive and attractive of the upland plants.

Increasing coverage of Bilberry (*Vaccinium myrtillus*) as grazing pressure is reduced and heather is controlled)



The Bowland Fells represent a high (@ > 400m asl) sandstone plateau deeply intersected by rivers (Wyre , Hodder, *et al*) The plateau is characterised by high rainfall (@ > 1200mm pa) and underlying sandstone rock. Consequently soils on the plateau are waterlogged for much of the year and are very acidic (@ < pH4.5) This gives rise to the accumulation of deep deposits of “blanket” peat – which may extend to 3 metres in depth.

Erosion and oxidation of peat results in the development of exposed peat outcrops known as peat “hags”

This inset picture gives some idea of the scale / depth of the peat accumulations



On the plateau extensive erosion has exposed not only peat "hags" but in some areas the underlying sandstone rock – note the extent to which it is bleached by the prevailing acidic environment

On a worldwide scale (including the tundra) peat accumulations represent a significant carbon sink. As global temperatures rise and the oxidation rate of such deposits increases such sinks may well become a major source of CO₂ release and contribute to a positive feedback loop leading to increased global temperatures



Looking N.West across the Bowland Fell plateau. This extensive (>30000 ha) upland area (typically > 350 metres asl) is typified by blanket peat soils overlying acidic sandstone rock with rainfall > 1200mm pa.

The area is managed as a heather moor land to encourage the population of Red Grouse used for shooting. Extensive coverage of Common Heather (*Caluna vulgaris*) and to a lesser extent Bell Heather (*Erica tetralix*) is promoted by extensified grazing (fewer sheep per area – even zero grazing in some areas) and by sequential burning of heather to develop a diverse range of young, adolescent and mature heather stands to offer feeding and shelter / protection to the grouse population.

This managed landscape not only promotes the grouse but in so doing populations of other species are encouraged ranging from insect and other invertebrates to mammals and top predators such as the fox, hen harrier, kestrel and other birds of prey.

