Trees Beyond the Wood

An exploration of concepts of woods, forests and trees

Conference proceedings

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Young Wood: a woodland beyond the edge

Andrew Weatherall, Naomi van der Velden, Carrie Wallace, Roger Atkins

National School of Forestry, University of Cumbria

Abstract

Young Wood, near Mungrisedale, in the Lake District National Park is the highest Atlantic oakwood in England. This makes Young Wood the current upper altitudinal limit for semi-natural, ancient woodland in England. This iconic woodland was fenced by Natural England in autumn 2008 to remove grazing sheep in order to conserve and enhance biodiversity, for example by enabling natural regeneration of trees. It is hypothesised that management of semi-natural habitats to conserve and enhance biodiversity may also protect, and possibly increase, carbon storage in the landscape. However, very little research has specifically tested this in long-term field studies. The fencing of Young Wood provides a good opportunity to improve the evidence base. Immediately prior to fencing soil samples were taken to provide baseline carbon and nitrogen concentrations. Soil bulk density samples were also taken to enable an estimation of soil carbon content. Data from this initial soil survey were analysed to compare current soil concentration and content under different types of vegetation. The potential implications of the results for future carbon storage are discussed. Future repeat surveys will determine how carbon storage is actually affected by the removal of grazing sheep. To begin to monitor changes in biodiversity, a ground vegetation survey was undertaken in summer 2009 and a baseline lichen survey was undertaken in 2010. Data from these baseline surveys are briefly described. A follow up ground vegetation survey was undertaken in 2011. Data are compared to the baseline 2009 survey. The possible implications of early changes in ground vegetation composition are discussed. The aim of this paper is to provide a reference to the baseline survey work undertaken at Young Wood. It is hoped that further surveys of soil, ground vegetation and lichens will be undertaken in future, but also that surveys of other measures of biodiversity, and of carbon stocks and fluxes, can be commenced.

Keywords: oak, natural regeneration, biodiversity, carbon storage, ground vegetation, lichen, soil.

Introduction

> *'The most important Cumbrian woodlands in the national context are the high-altitude woods of the Lake District, the highest woodlands in England and Wales. Keskadale and Birkrigg woods lie between 400 m and 500 m above the Newlands Valley... They are predominantly oak woods, low grown and windswept… it is their altitudinal position which is important. Another site, which is not so well known, is at Mungrizedale and lies between 490 m and 520 m'* (Bunce, 1989).

Young Wood (NY350307) on Bowscale Fell, part of the Skiddaw Massif, near Mungrisedale at the northern border of the Lake District National Park is the highest Atlantic oakwood in England. Atlantic oakwoods are our 'temperate rainforest' and are as nationally important as the rather better known Caledonian pinewoods (Baarda, 2005). Atlantic oakwoods have international significance, only found in north-western Europe, predominantly in Britain and Ireland, they are '*an extreme oceanic element among a range of oak woodlands that extend into the heartland of the Continent and south to the Mediterranean*' (Rodwell, 2005). If Atlantic oakwoods are woodlands at the edge (Rodwell, 2005), then Young Wood, which is very small, fragmented and vulnerable, is beyond that edge. Natural England took an important step towards conserving this potentially iconic woodland by fencing, to remove grazing sheep, in autumn 2008. This presented an opportunity for research to increase our understanding of how to enhance this woodland which is so far beyond the edge that it does not appear on the maps or habitat inventories of England; although this is arguably the most monitored and designated landscape of any country in the world. Young Wood has often been overlooked as little more than an awkward remnant of shrubby sessile oak (*Quercus petraea*) trees on a steep inaccessible slope of Bowscale Fell, this may be precisely why it is important. In England, trees grow where people have not prevented them (Rackham, 2006).

Young Wood is a type of ancient semi-natural woodland described by Peterken (1991, in Peterken, 1993) as 'Upland birch – sessile oakwood, Sub-type 6Ab'. Birch (*Betula* spp.) is totally absent, but Peterken (1993) acknowledged this possibility (perhaps this could be described as sub-type 6A). It could also be categorised by the National Vegetation Classification system of British Plant Communities as a W17 *Quercus petraea-Betula pubescens-Dicranum* woodland (Rodwell, 1991), again with the birch absent. It has been suggested that:

> *'Some stands of Quercus-Betula-Dicranum woodland on steep, rocky hillsides and in steep ravines may never have been felled and may be survivors of the original natural woodland'* (Averis *et al.*, 2004).

Although sheep grazing, pollution and human induced climate change have undoubtedly affected Young Wood, and observation suggests there may have been some coppicing too, it can be described as primary woodland as it is extremely unlikely the site has ever been ploughed or cultivated (Watkins, 1990). Leach (1922) thought Keskadale and Birk Rigg could '*probably lay claim to be as nearly virgin in nature as any others in Great Britain'*, Young Wood could challenge them for the title of most untouched woodland in England.

The upper edge of Young Wood is the current altitudinal limit for semi-natural ancient woodland in England. According to recent measurements with the altimeter from a global positioning system (GPS) unit, Young Wood is between 465 m and 485 m above sea level (asl), whereas according to Pankhurst (2008), Keskadale is 300 m to 460 m asl. The individual tree line in England is higher for isolated pioneer species such as common juniper (*Juniperus communis*), birch and rowan (*Sorbus aucuparia*) in amongst the heather (*Calluna vulgaris*) and up sheltered gills, but looking down from the top of Young Wood, it is possible to say that everything below this point was once the wildwood of England (Figure 1). Whether the wildwood was a continuous tree canopy as proposed by Tansley (1939), a patchwork of grass and trees as hypothesised by Vera (2000), or something in between is discussed elsewhere (e.g. Rackham, 2006, Rotherham, 2012).

Figure 1. Looking across and down from Young Wood, the highest Atlantic oakwood in England; a view of the wildwood?

This paper reports on the current status of Young Wood and how recent management and research is intended to conserve it and, if possible, bring it back from beyond the edge.

Current status

Although this small, fragmented, vulnerable wood is known from a few reports and papers, it does not appear on the current Ordnance Survey map (Figure 2) or on the oldest found historical map (Figure 3).

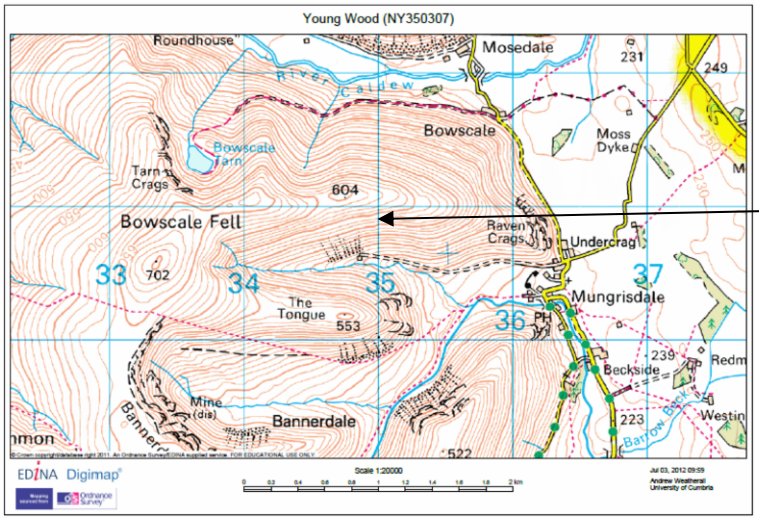

Figure 2. Absence of Young Wood (NY350307) from current Ordnance Survey map (Edina Digimap 3rd July 2012). The broad yellow strip (top right hand corner) is the Lake District National Park Boundary (Bowscale Fell is on the inside).

Figure 3. Absence of Young Wood from oldest historic Ordnance Survey map of Bowscale Fell in 1860s (Edina Digimap 3rd July 2012).

Nor is Young Wood itself listed in the current record of Habitat inventories (Figure 4). The Ancient Woodland Habitat Inventory is derived from the 'Cumbria Inventory of Ancient Woodland' (Whitbread, 1985). This includes Keskadale and both sections of Birk Rigg, but may have omitted Young Wood as it concentrated on '*individual, discrete woods or woodland blocks of 2 hectares or more*' and prior to fencing Young Wood was described as 1.9 ha (Vatcher & Johnston, 2007), although individual oak trees beyond the main canopy are actually spread over a larger area than this.

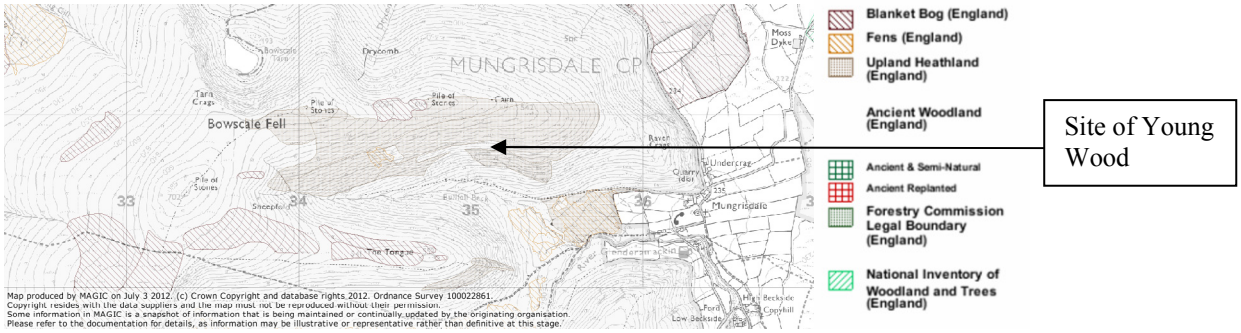

Figure 4. Map of Bowscale Fell. Young Wood (NY350307) is not shown on the maps of Habitat inventory layers for Bowscale Fell (MAGIC Defra 3rd July 2012). Legend shows habitats recorded on map and the woodland types that might have shown Young Wood.

The Forestry Commission Land Information Search (FCLIS) map (Figure 5) which shows that the entire area on the Skiddaw Massif is a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC), does not have Young Wood marked.

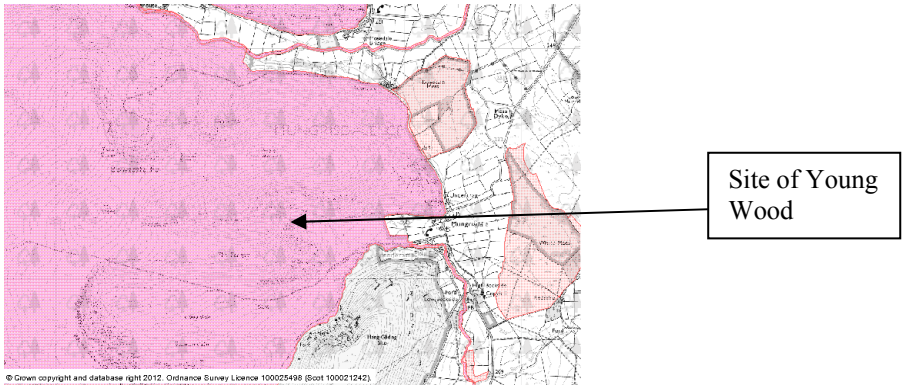

Figure 5. Forestry Commission Land Information Search map of Bowscale Fell showing land designation as Special Area of Conservation (pink shading) and as Site of Special Scientific Interest (pink and red shading). Young Wood is not marked.

When all else fails, the normal last source of maps for researchers working in the Lake District National Park is Alfred Wainwright's 'Pictorial Guide to the Lakeland Fells'. In Book 5 The Northern Fells (Wainwright, 1962), he deals specifically with the Skiddaw Massif, but even Wainwright fails to note the presence of Young Wood or any oaks among the bracken (*Pteridium aquilinum*), gorse (*Ulex europaeus*) and heather (Figure 6). Although to be fair, the main path to the top of Bowscale Fell goes the other side of The Tongue so he may not have come close enough to observe the wood.

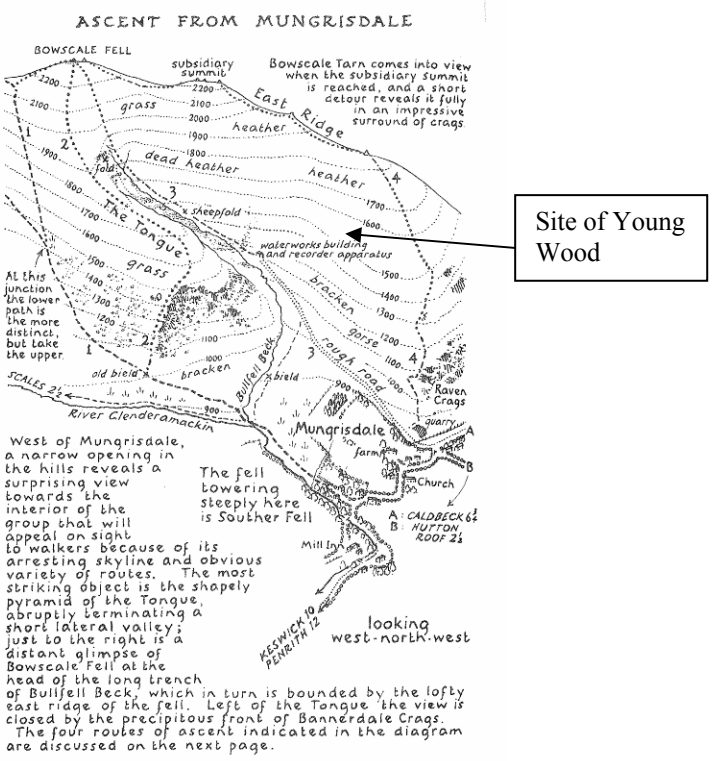

Figure 6. Bowscale Fell from Mungrisedale (Wainwright, 1962). Young Wood not shown.

One more map source was available because Bowscale Fell is close to Low Beckside Farm at Mungrisedale, which is the hill farm belonging to Newton Rigg College Estate. As the sheep from the hill farm have traditionally been heafed on the common land at Bowscale Fell, it was included in a survey 'Climate, Soils and Land Use at Low Beckside Farm, Mungrisedale, Cumbria' (Bendelow, Rousell & Humphries, 1998). The area where Young Wood is situated is described as '*where outcropping and surface rock debris is sometimes a common feature on the south facing slopes. Such areas are colonised by oak, gorse, bilberry and crowberry*'. On the map itself, this area is more simply described as 'Rock' (Figure 7). This is not an unreasonable description from a farming perspective given the inaccessibility of the site and the habit of foresters to describe a wide spectrum of agriculture land containing diverse habitats all together simply as "farmland".

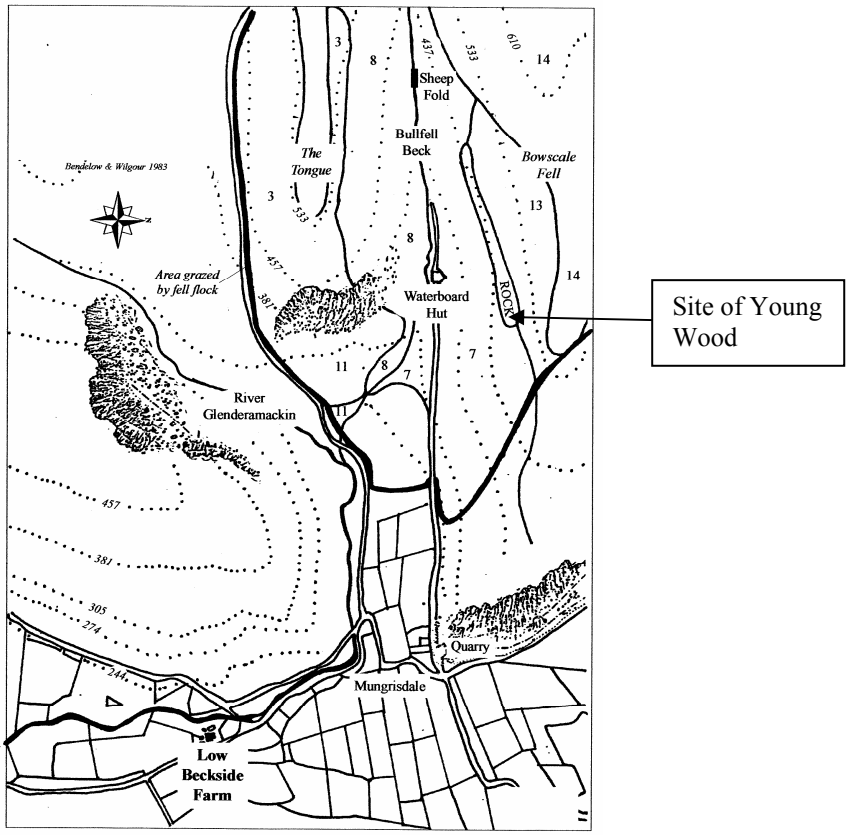

Figure 7. Bowscale Fell. Fell Grazing for the Fell Flock (Bendelow & Wilgour, 1983 in Bendelow, Rousell & Humphries, 1998). Area labelled 'Rock' is where Young Wood lies on the fellside.

Consequently, despite having a name, Young Wood has been considered, if at all, as a collection of trees not really a wood, when actually it is a wood beyond the map. As Figure 8 clearly shows, there is a wood here, however small in area, it is something more than just an area colonised by oak, a definite canopy, however stunted. There are single trees up to 200 metres (m) beyond the main canopy, perhaps indicating a larger area was once part of the wood. There are also shrubby areas of oak, no more than 1 m high, possibly an example of krummholz woodland, or maybe a growth form resulting from constant high grazing pressure.

Figure 8. Quadrat (1 m x 1 m) for vegetation survey under the canopy in Young Wood (photo by Roger Atkins).

The National Inventory of Woodland and Trees (2002) states:

> *In the United Kingdom woodland is defined as land with a minimum area of 0.1 ha under stands of trees with, or the potential to achieve tree crown cover of more than 20%. Areas of open space integral to the woodland are also included* (National Inventory of Woodland and Trees, 2002).

As Figure 8 illustrates, by this criteria Young Wood deserves to be named as woodland, even though it is not recognised as such on any known maps, including those of the Forestry Commission.

How then is Young Wood known, if not from maps? It is referred to in some publications and reports on woodlands in Cumbria, such as Bunce (1989) (see epigraph) and Pankhurst (2008). However, it is not mentioned in older references on upland oakwoods in Cumbria such as Leach (1922) or Whitbread (1985). Most importantly, it is known to Natural England, marked on their maps and referred to in their management reports (Figure 9, Vatcher & Johnston, 2007).

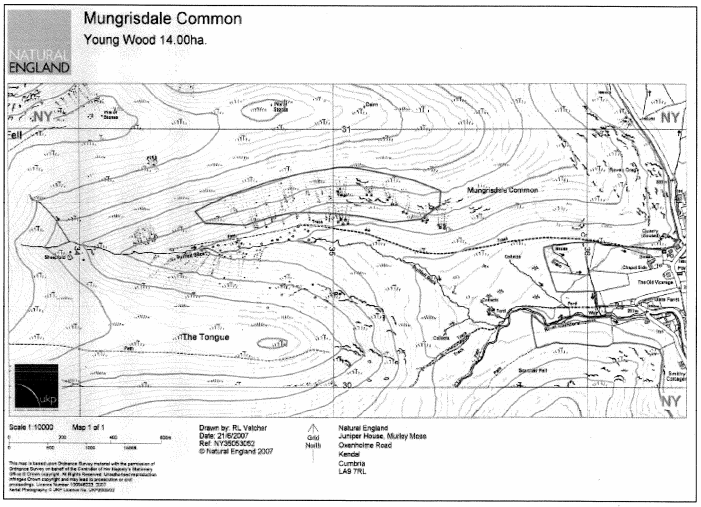

Figure 9. Mungrisdale Common: Young Wood 14.00 ha (from Vatcher and Johnston, 2007).

Recent management

In fact the area enclosed by Natural England (Figure 9) is not all Young Wood, which is only about 1.9 hectares, but comprises an area of 13-14 hectares around the wood which it obtained permission to fence as part of a Higher Level Stewardship agreement with The Commons Association at Mungrisedale (Vatcher and Johnston, 2007). The final position of the fenceline may be slightly higher up the slope than shown in Figure 9 (Vatcher, pers. comm.).

The fence was intended to exclude grazing sheep (Figure 10). The aim of this was to conserve and enhance Young Wood, specifically by enabling the natural regeneration of trees at the edges of the current small wooded area (Vatcher and Johnston, 2007).

Figure 10. Fencing of Young Wood to exclude grazing sheep (photo by Naomi van der Velden).

Young Wood was last assessed by Natural England in December 2010 and listed as '*Unfavourable Recovering*' (Johnston, 2012). This is the second best of six reportable condition categories suggesting that

> '*….all the necessary management measures are in place. Provided that the recovery work is sustained, the SSSI will reach favourable condition in time'* (Natural England, no date).

This is true, with grazing removed the heathland should revert to woodland in time, the only question is 'what sort of woodland'. As recognised in the report:

> *'……there is no evidence as yet of regeneration from the oaks in the residual woodland, although there is good epicormic growth present. The oaks are producing acorns, however, so hopefully it will only be a matter of time before young oaks appear'* (Johnston, 2012).

Also, that:

> '*There is some regeneration of exotic species within the exclosure, eg larch and spruce, also Scots pine – so, a close watch will need to be maintained to ensure these species do not get out of hand*' (Johnston, 2012).

Partly to consider these issues a range of research studies has followed fencing to learn more about how to conserve and enhance vulnerable woodlands such as this.

Research

A range of different research studies have been commenced at Young Wood (Table 1). These studies have tended to reflect the research interests and skills of the available staff rather than a planned coherent approach to investigating the most relevant research questions at the site. In this section, preliminary findings from each of the studies are reported briefly. It should be noted that most of them are small initial baseline surveys and the results will only become clear with follow up surveys over time. However, in some case interesting trends are apparent from analysis of the initial data collection.

Table 1. Summary of studies undertaken at Young Wood to date

Year (1st study)	Year (follow up study)	Subject	Main researcher (lead investigator if different)	Organisations involved (funding or in kind contribution)
1999	2008	Heather grazing by sheep	Lois Mansfield	University of Central Lancashire University of Cumbria
1999	2008	Earthworms	Kevin Butt	University of Central Lancashire University of Cumbria
2008		Soil carbon and nitrogen	Andrew Weatherall	University of Cumbria
2009	2011	Vegetation	2009. Naomi van der Velden 2011. Roger Atkins (Naomi van der Velden	University of Cumbria
2009		Oak leaf morphology	Harriet Wood (Andrew Weatherall)	University of Cumbria
2009		Oak genetics	Lenka Mejzrova (Billy Sinclair and Maurice Pankhurst)	National Trust University of Cumbria
2009		Pollen	Helen Shaw	University of Cumbria
2010		Lichens	Carrie Wallace	University of Cumbria

A couple of studies began in 1999 when sheep stocking numbers were reduced. Soil samples, with permanent sample plot stake markers, were established immediately prior to fencing to completely exclude grazing sheep in 2008. The other studies started as soon after fencing as possible.

Earthworms

Very low levels of earthworm diversity and abundance were recorded at and around Young Wood on Bowscale Fell, but the greatest abundance appeared to be close to the edge or under the woodland canopy (Butt, 2008).

Heather grazing by sheep

The highest levels of sheep grazing in 1999 were immediately below Young Wood (Mansfield *et al.*, 1999). As this area was included in the fence it will be interesting to see if any tree regeneration below occurs below the wood. Data from the 2008 study are awaiting analysis.

Soil carbon and nitrogen

A soil survey was completed as the fence was completed and grazing sheep were excluded in autumn 2008. The aim of the survey was to determine the percentage total carbon and total nitrogen in the 0-10 cm and 10-20 cm layers in the soil, plus bulk density measurements. These data would enable total nitrogen and carbon in the top O -20 cm layer to be quantified. Samples were analysed by the Forest Research soil analysis service (Forest Research, no date). The aim was to establish baseline data for future comparisons (e.g.10 years after fencing) to determine whether management for biodiversity also had any carbon mitigation benefits. To make this possible the soil samples were undertaken at 25 stakes establishing permanent sample plots on an approximate transect across the slope at the current elevation of the main woodland and where it was predicted that most of any natural regeneration was likely to occur.

Although this was established as a long term time-series experiment focussing on changes per stake, initial data analysis was possible to compare current soil carbon and nitrogen under different vegetation types. The data analysis focussed on the presence and absence of oaks at the stakes as the purpose of fencing was to conserve and enhance the oakwood. Of the 25 stakes, 10 were closely associated with oaks, while the other 15 were in more open heathland vegetation dominated by heather, bilberry (*Vaccinium myrtillus*), gorse and bracken. The greatest difference between plots with oak and those without was in the 10 -20 cm soil layer. Insufficient samples were available to observe significant differences, but a trend towards higher carbon and nitrogen levels under oak was observed, possibly connected to tree root turnover at this depth (Figure 11).

Unexpected differences in bulk density between soils under oak trees and soils under other vegetation reduced these differences when total soil nitrogen and carbon content were quantified Table 2). Further sampling of bulk density will be undertaken in future to analyse these differences. Nonetheless, some interesting differences were observed. Furthermore, as soil carbon content at Young Wood was half the amount recorded in some lower elevation oakwoods in Cumbria (Brooks, 2011), there is the potential for increased carbon storage if fencing enables the oakwood to regenerate.

Table 2. Soil carbon (C) and nitrogen (N) concentrations, bulk density and soil C and N content in the presence and absences of oak trees at Young Wood.

Baseline soil survey in 2008	%C (0 – 20 cm)	% N (0 – 20 cm)	Bulk density (kg l^{-1})	tC ha^{-1} (0 – 20 cm)	tN ha^{-1} (0 – 20 cm)
Oak (n = 10)	10.14	0.61	0.40	80.17	4.80
Other (n = 15)	9.29	0.54	0.43	78.45	4.53
% difference (oak / other)	+ 9%	+ 16%	-8%	2%	6%

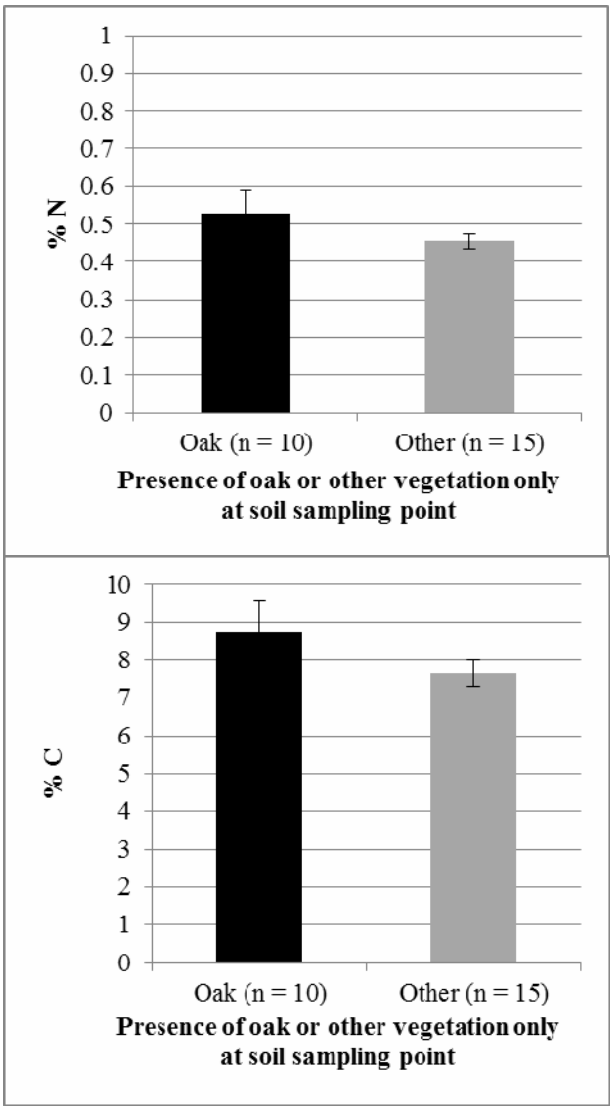

Figure 11. Mean percentage carbon (C) and nitrogen (N) in soil samples at Young Wood immediately prior to fencing in autumn 2008.

Vegetation

The vegetation surveys in 2009 and 2011 had slightly differing methodologies, so any apparent trend in vegetation change must be treated cautiously. Nonetheless, as part of the vegetation survey in each year a 1 m x 1 m quadrat was placed exactly 1 metre away from the stake marking the centre of each permanent sample plot established for soil sampling. In the 2009 survey, these quadrats were placed with the nearest corner exactly 1 metre from the permanent stake, but the compass point at which each one was orientated in relation to the stake was randomised. In the 2011 survey, the centre of the nearest side was directly up the slope (i.e. between north- northwest and north- northeast) (Atkins, 2012). This meant that in 2011 the centre of the quadrat was 1.5 metres from the stake and the same quadrat can be surveyed in future. It can be stated however that the vegetation surveys around each stake in both 2009 and 2011 were measured in a 1 m x 1 m quadrat within the same 4 m x 4 m area. Each survey included more vegetation sampling, but only the data from these areas are discussed further here. All 25 stakes were used in 2011, but only 24 stakes were located during the 2009 survey, so data are presented for quadrats around the 24 stakes used during both surveys (Figure 12). As some ground flora species were not completely identified (particularly grasses and mosses) data are only reported for trees and shrubs, plus the single grass and both herbaceous species identified as 'very common' in NVC W17 communities (Harmer, Kerr & Thompson, 2010).

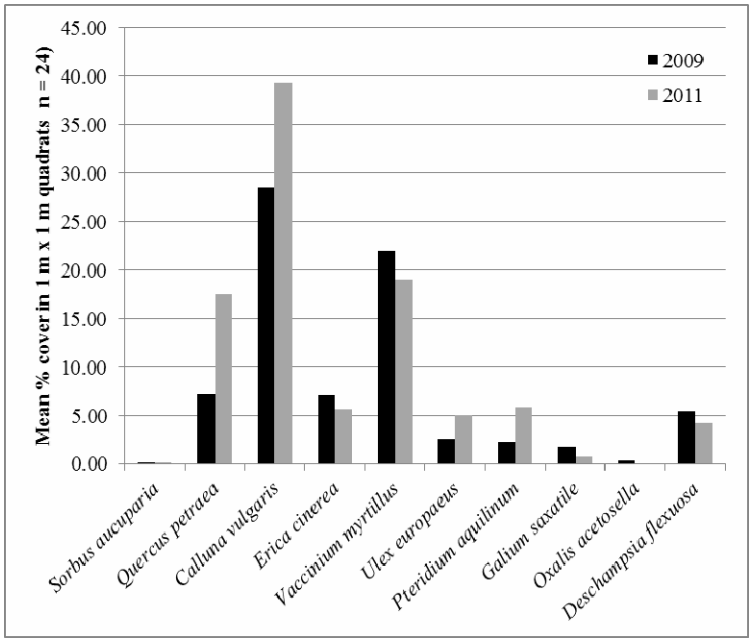

Figure 12. Comparison of tree and shrub species, plus one grass and one herb recorded in 1 m x 1 m quadrats in 2009 and 2011 (n = 24). Quadrats were not permanent, but within the same 4 m x 4 m area. 2011 data from Atkins (2012).

Despite the caveats applied to the data collection, some interesting potential trends can be noted. Firstly, the apparent increase in oak, heather, gorse and bracken between 2009 and

2011. For oak, this is due to increased size of foliage from trees within plots, rather than natural regeneration on new oak seedlings. Secondly, the apparent decrease in bilberry, bell heather (*Erica cinerea*) and wavy hair grass (*Deschampsia flexuosa*), and also, although at lower percentage cover, of heath bedstraw (*Galium saxatile*) and wood sorrel (*Oxalis acetosella*) during the same period. The data suggesting an increase in heather, gorse and bracken since fencing are supported by qualitative visual assessments by researchers on repeat visits to the site over time.

Oak leaf morphology

The methodology for assessing oak leaf morphology developed by Potter (1994) was used to attempt to distinguish sessile oak from pedunculate oak and hybrids comparing the three upland Atlantic oakwoods (Young Wood, Keskadale and Birk Rigg) with three lower level Atlantic oakwoods (Great Wood, Brandlehow and Johnny Wood) in the Borrowdale valley in Cumbria. Leaf morphology indicated that all three upland woods were probably purer sessile oak than the Borrowdale valley oakwoods, although only genetic analysis could provide definitive proof of this.

Oak genetics

Unfortunately, the study of oak genetics across the same six woodlands has so far been inconclusive. Analysis is continuing.

Pollen

The study into understanding the pollen-vegetation relationship in this upland oak woodland is also continuing.

Lichens

Initial results from the lichen flora study at Young Wood (Wallace, 2012) indicated that like Keskadale (Pankhurst, 2008) it is impoverished (Table 3).

Table 3. Lichen flora recorded at Keskadale (Day, 2008 in Pankhurst, 2008) and Young Wood (Wallace, 2012). New names from Coppins (2006). Conservation status from Woods and Coppins 2012).

Species	Type	Keskadale 1976 (14 species identified)	Keskadale 2007 (24 species identified)	Young Wood 2010 (25 different species, but only the 7 current definite identifications + 3 possible identifications to date included here)	Conservation Status
Arthonia didyma	C		✓		LC
Arthonia radiata	C	✓		✓	LC
Arthopyrenia lapponina now *Arthopyrenia analepta (*F*)*	C	✓			LC
*Athropyrenia punctiformis (*F*)*	C		✓	*	LC
Calicium viride	C		✓		LC
Catinaria atropurpurea	C		✓		LC
Cladonia chlorophaea (s. lat or *s. str.)*	FR	✓			LC
Cladonia coniocraea	FR		✓		LC
Cladonia fimbriata	FR		✓		LC
Cladonia macilenta	FR	✓			LC
Evernia prunastri	FR		✓	✓	LC
Graphis elegans	C	✓			LC
Graphis scripta	C			✓	LC
Hypogymnia physodes	FR		✓	✓	LC
Lecanora chlarotera	C		✓	*	LC
Lecanora conizaeoides (f. canizaeoides or f. variola)	C		✓		LC or NE
Lecanora expallens	C	✓			LC
Lecidella eleachroma (f. eleachroma or f. soralifera)	C		✓		LC or LC
Lepraria incana	L		✓		LC
Lepraria lobificans	L			✓	LC

Micarea prasina s. str.	C	✓			LC, NS
Mycoblastus sanguinarius (f. leprosus or f. sanguinarius)	C	✓			LC, NR or LC
Normandina pulchella	SQ		✓		LC
Ochrolechia androgyna	C		✓		LC
Ochrolechia subviridis	C	✓			LC
Ochrolechia tartarea	C		✓		LC
Opegrapha vulgata	C	✓			LC
Parmelia caperata now *Flavoparmelia caperata*	FO		✓		LC
Parmelia exasperata or *Menlanohalea exasperata* or *Melanilia exasperata*	FO	✓			LC
Parmelia glabratula NOW *Parmelia glabratula* subsp. *fuliginosa* (Fr. ex Duby) J.R. Laundon = *Melanelia fuliginosa* subsp. *fuliginosa* *Parmelia glabratula* var. *fuliginosa* (Fr. ex Duby) Grummann = *Melanelia fuliginosa* subsp. *fuliginosa* *Parmelia glabratula* (Lamy) Nyl. subsp. *glabratula* = *Melanelia fuliginosa* subsp. *glabratula*	FO		✓		LC
Parmelia revoluta NOW *Parmelia revoluta* Flörke = *Hypotrachyna revolute* *Parmelia revoluta* var. *concentrica* (Arnold) Cromb. = *Hypotrachyna revolute* *Parmelia revoluta* var. *erratica* (Linds.) Zahlbr. = *Hypotrachyna revolute* *Parmelia revoluta* var. *rugosa* Cromb. = *Hypotrachyna taylorensis*	FO		✓		LC (unless *H. taylorensis*, then, IR)

Parmelia saxatalis	FO		✓		LC
Parmelia subaurifera NOW *Melanelia subaurifera*	FO	✓			LC
Parmelia subrudecta NOW *Punctelia subrudecta*	FO		✓		LC
Parmelia sulcata	FO	✓			LC
Pertusaria pertusa	C		✓		LC
Platismatia glauca	FO		✓	✓	LC
Scoliciosporum chlorococcum	C	✓			LC
*Tomasellia gelatinosa (*F*)*	C		✓	*	LC
*Usnea subfloridena (*or for Young Wood might be *Usnea fragilescens var. mollis*)	FR		✓	✓	LC or LC

Acronyms: C=crustose, FR=fruticose, FO=foliose, L= leprose (a sub-category of crustose), SQ=squamulose (a sub-category of foliose), ✓=present, *=possible but further identification required (other samples still need to be identified). International Union for the Conservation of Nature
(IUCN) threat categories **(**LC - Least Concern, NE - Not Evaluated), other protection status levels referred to: IR - International Responsibility (i.e. British populations identified by the symbol "IR" may be of international, NR - Nationally Rare, NS - Nationally Scarce (these are indications of rarity, based on post-1960 records held by the BLS Mapping Scheme Database, F - Fungus that is probably non-lichenized, but has traditionally been treated as a lichen (see Coppins, 2006 for fuller explanation).

Conclusions

Pankhurst (2008) described Keskadale as one of a series of small, fragmented oak woodlands; an oakwood on the edge. Thus, Young Wood, the smallest and most isolated of these fragments, is a woodland beyond the edge, in critical need of management and research to conserve and enhance it. Although the lichen survey indicates that the biodiversity of this site is relatively impoverished, more surveys of other taxa are required. Nonetheless, it can be argued in this case that the very existence of this wood at this altitude and remoteness in England is what makes it worthy of conservation, rather than any rare species within it. Natural England began the management by fencing to exclude grazing sheep in 2008, it is hoped that the research described here, beginning to study the biodiversity and carbon value of this iconic woodland can help to increase our understanding of its value and contribute to its long-term protection, and that of other vulnerable upland Atlantic oakwoods.

At present, the signs at Young Wood are encouraging. Almost four years after fencing considerable tree regeneration has been observed (although this has unfortunately not been

picked up in the vegetation surveys to date). Tree regeneration so far is ninety-nine percent rowan, rather than oak (Figure 10). A survey of this regeneration to establish density per hectare is being planned at present. Rowan is a natural component of W17 oak woodland, so this is a natural compositional change rather than the threat from exotic conifers that Natural England expressed concern about (Johnston, 2012). This tree regeneration is predominantly occurring above the current woodland line, this was not expected as it was thought that the woodland was at its altitudinal limit (Vatcher & Johnston, 2007). This is why it has not been recorded in the vegetation surveys to date, which concentrated on areas where vegetation change was most expected. The movement up the hill may be due to anthropogenic climate change, which is allegedly bringing warmer and definitely bringing even wetter weather to Cumbria. However, it would require extensive further study to ascertain whether this is the main cause. Nonetheless, it is possible that if the pioneer rowan seedlings, some of which are already saplings, reach maturity, other species may then regenerate beneath them and the woodland could 'walk' up the hill. The highest Atlantic oakwood in England may be getting higher.

Figure 10. Rowan regeneration in 2012 just below (inside) top edge of fence (photo by Roger Atkins).

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References

Atkins, R. (2012) *Effects of a stock fence on plant composition of Young Wood.* Unpublished BSc thesis, University of Cumbria, Carlisle.

Averis, A., Averis, B., Birks, J., Horsfield, D., Thompson, D., & Yeo, M. (2004) *An Illustrated Guide to British Upland Vegetation*. Joint Nature Conservation Committee, UK.

Baarda, P. (2005) Atlantic Oakwoods in Great Britain: Factors Influencing their Definition, Distribution and Occurrence. *Botanical Journal of Scotland*, **57**, 1-20.

Bendelow, C., Rousell, I. & Humphries, A. (1998) *Climate Soils and Land Use at Low Beckside Farm, Mungrisdale, Cumbria*. Resources for Learning No.4, Newton Rigg College, University of Central Lancashire, Penrith.

Brooks, S.P. (2011) *An investigation into the soil carbon stocks present under four woodlands with differing management objectives.* Unpublished MSc thesis, University of Cumbria, Carlisle.

Bunce, R.G.H. (1989) *The composition of woodlands in Cumbria.* In Adamson, J.K. *Cumbria woodlands – past, present and future.* Adamson, J.K. (ed.) Institute of Terrestrial Ecology, Natural Environment Research Council, HMSO, London.

Butt, K.R. (2008) Earthworms at Young Wood SSSI. Report to University of Cumbria (UC08), Carlisle.

Coppins, B.J. (2006) *Synonyms of British Lichens.* British Lichen Society. Page last accessed 23rd July 2012 at: http://www.thebls.org.uk/content/synlist.html.

Forest Research (no date) *Soil Analysis Service.* Page last accessed on 20th July 2012 at: http://www.forestry.gov.uk/fr/INFD-79MDEX.

Harmer, R., Kerr, G. & Thompson, R. (2010) *Managing native broadleaved woodland.* The Stationary Office, Edinburgh.

Johnston, J. Natural England, Sites of Special Scientific Interest , SSSI Unit Information, Skiddaw Group – Unit 3838. Page last accessed 18th July 2012 at: http://www.sssi.naturalengland.org.uk/special/sssi/unit_details.cfm?situnt_id=1024846

Leach, W. (1922) Two relict upland oak woods in Cumberland. *Journal of Ecology*, **13**, 289-300.

Mansfield, L., Know, C., Butt, K. & Cotton R. (1999) Baseline Survey of Extensification Scheme Bowscales Fell, Mungrisedale. Unpublished report, University of Cumbria, Carlisle.

National Inventory of Woodland and Trees (2002) *England; County Report for Cumbria.* Forestry Commission, UK.

Natural England (no date) SSSI Glossary; explanation of terms used in managing and protecting SSSIs. Page last accessed on 20th July 2012 at: http://www.naturalengland.org.uk/ourwork/conservation/designatedareas/sssi/glossary.aspx

Pankhurst, M. (2008) Keskadale – an oakwood on the edge. *British Wildlife*, **19**, 187-192.

Peterken, G.F. (1993) *Woodland Conservation and Management.* 2nd edn. Chapman & Hall, London.

Potter, S. (1994) Practical methods for distinguishing the two native British oaks and their intermediates. *Quarterly Journal of Forestry*, **88**, 27-34.

Rackham (2006) *Woodlands.* Collins, London.

Rodwell, J.S. (ed.) (1991) *British Plant Communities. Volume 1. Woodlands and Scrub.* Cambridge University Press, Cambridge.

Rodwell, J.S. (2005) Woodlands at the edge: a European perspective on the Atlantic oakwood plant communities. *Botanical Journal of Scotland*, **57** 121-133.

Rotherham, I.D. (2011b) *Animals, Man & Treescapes – perceptions of the past in the present*. In: Rotherham, I.D. & Handley, C. (eds.) (2011) *Animals, Man and Treescapes: The interactions between grazing animals, people and wooded landscapes*. Wildtrack Publishing, Sheffield, 1-32.

Tansley, A.G. (1939) *The British Islands and their vegetation.* Cambridge University Press, London.

Vatcher, R. and Johnston, J. (2007) *Woodland and scrub project proposal for Mungrisdale Common.* Natural England report Agreement Ref: AG00250343

Vera, F. (2000) *Grazing Ecology and Forest History*. CABI, Oxon.

Wainwright, A. (1962) *A Pictorial Guide to the Lakeland Fells. Book Five: The Northern Fells.* Henry Marshall, Kendal.

Wallace, C. (2012) *An investigation of epiphytic lichen diversity at Young Wood.* Unpublished BSc thesis, University of Cumbria, Carlisle.

Watkins, C. (1990) *Britain's ancient woodland: woodland management and conservation.* Nature Conservancy Council, Peterborough.

Whitbread, A. (1985) *Cumbria: inventory of ancient woodland (provisional)*. Nature Conservancy Council, Peterborough.

Woods, R.G. & Coppins, B.J. (2012) *A Conservation Evaluation of British Lichens and Lichenicolous Fungi.* Joint Nature Conservation Committee, Peterborough.