Water table trends and the recent history of Birch colonisation on Lindholme Old Moor, South Yorkshire

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Introduction:

1960s: Dr Peter Skidmore, late of Doncaster Museum remembered visiting the Lindholme Old Moor (SE7006) site during the mid 1960s and recalled a habitat of Heather, Cross-leaved Heath, Cotton-grasses, isolated Scots Pines and open peat pools.

A lowering of the water table in preparation for mechanised peat extraction on adjacent compartments of Hatfield Moors (Kilham West, Kilham and Kilham East) appears to have taken place around 1964. This has coincided with the loss of open water habitats, appears to have triggered the ubiquitous Birch colonisation, the advance of Bracken and has led to the current dry heath/wet heath habitat structure, dominated by Birch canopy.

1970s: Between July 1978 and September 1979 Brian Eversham and Mark Lynes surveyed the vegetation of Hatfield Moors (Eversham & Lynes 1980-81). On Lindholme Old Moor (their site 4) they describe 10m tall open Birch woodland on sandy soils bordering the farmland (the 'Ten acre') of the Lindholme moraine to the southwest and a population of Pedunculate Oak and Birch. adjacent to Sandy Lane to the southeast. On the peat substrate they describe that a "moderately dense 3m Birch scrub prevails" on the western portion of the site, while on the eastern portion "3m Birch undergrow 7m trees". Throughout the site the field layer beneath the scrub Birch was characterised by Heather (dominant) and Cross-leaved Heath and that Hare's-tail Cotton-grass (frequent to abundant) was ubiquitous.

1980s: A more aggressive lowering of the water table in preparation for peat milling/rotavation was commenced during the 1980s. Clearly the site continued to desiccate from 1979 to 1992 since Bracken, described as "weak" in woodland (Eversham & Lynes 1980-81), had become dominant on rides

between the Moraine and the central access riding. Also Heather, Cross-leaved Heath and Hare's-tail Cotton-grass were reduced to being only locally abundant and were by no means ubiquitous.

1990s: From 1992 to 2003, under a Section 39 Agreement between the Local Authority and the Lyon family, considerable efforts were made to increase and retain ground water on site, the performance of the water table was monitored (see Oliver & Howes 2006 and Figure 4), and the surviving heath/mire invertebrate faunas were monitored (Skidmore 2006).

The effect of the drainage on the vegetation was echoed by the catastrophic decline in the Hatfield Moor population of the Large Heath Butterfly. First noticed here in the 1860s local lepidopterists knew it in good numbers here from the 1920s to the 1980s where its larvae fed on waterlogged Cottongrasses and White-beaked Sedge, George E. Hyde referring to "magnificent colonies at Hatfield" (Rimington 1992). In the early 1980s counts of 40-50 were possible, by the end of the decade numbers had halved and it vanished during the 1990s (Rimington 1992).

Future Habitat Management:

In order to restore the un-cut peat areas of Lindholme Old Moor to functioning lowland raised mire, the proposed habitat management is to maintain a raised water table. This is to be achieved by

- Inserting and maintaining dams on the grid of drains across the site.
- Raising the water levels in the Old Moor perimeter drains.
- Removing up to 50% of Birch *Betula pendula* and *B. pubescens* canopy in order to reduce summer water loss through excess transpiration.

It is also anticipated that the reduction of tree canopy will encourage the restoration of the characteristic peat bog flora, currently suppressed by excessive tree shading. The primary means of achieving the 50% Birch canopy removal will be through

- Removing Birch scrub and overhanging canopy from the overgrown network of access rides.
- Creating or re-opening Nightjar *Caprimulgus europaeus* glades, again by the removal areas of Birch scrub. It is also assumed that a raised water table will in itself suppress future Birch growth.

Methods: In order to investigate the assumed relationship between water table and Birch suppression, mean girth measurements of Birch populations in damp and dry areas of the moor were compared. Where available, the ground water performance at tree sampling sites was examined, using data from Oliver and Howes (2006) and from the archive of dip-well measurements monitored by them on 57 dates from 1992 to 2003*.

On 19 June 2013 during a visit by the Doncaster Naturalists' Society 84 Birch tree girths were measured at chest height at five sites. Site one was in the triangular area of open wood-pasture to the south east of Sandy Lane. Sites two to five were along the Dip-well Riding which forms a southwest to northeast transect across Lindholme Old Moor (the former Section 39 Agreement area).

Results: The numbers of girths sampled and the resultant maximum, minimum and mean girth measurements at each sampling site are given in Table 1 and represented graphically in Figure 1. The dominant associated plant taxa are also given in Table 1.

Table 1:

Birch Girths (inches)	**Associated vegetation**
Site 1: Mean 31.37 Range 8 to 65 (n = 24)	*Ceratocapnos claviculata, Digitalis purpurea*, *Pteridium aquilinum*, *Rubus* sp.& *Silene dioica*
Site 2: Mean 17.64 Range 9 to 28 (n = 14)	*Ceratocapnos claviculata* & *Deschampsia flexuosa, Digitalis purpurea*, *Galium saxatile, Pteridium aquilinum* & *Rubus* sp.
Site 3: Mean 16.66 Range 7 to 30 (n = 15)	*Ceratocapnos claviculata, Deschampsia flexuosa, Digitalis purpurea*, *Pteridium aquilinum* & *Rubus* sp.

Site 4: Mean 11.05 Range 5 to 22 (n = 20)	*Ceratocapnos claviculata*, *Deschampsia flexuosa, Pteridium aquilinum* & *Rubus* sp.
Site 5: Mean 7.09 Range 4 to 10 (n = 11)	*Calluna vulgaris* (to 36"), *Eriophorum angustifolium*, *E. vaginatum, Erica tetralix, Pinus sylvestris* saplings, *Polytrichum commune* & *Sphagnum* sp.

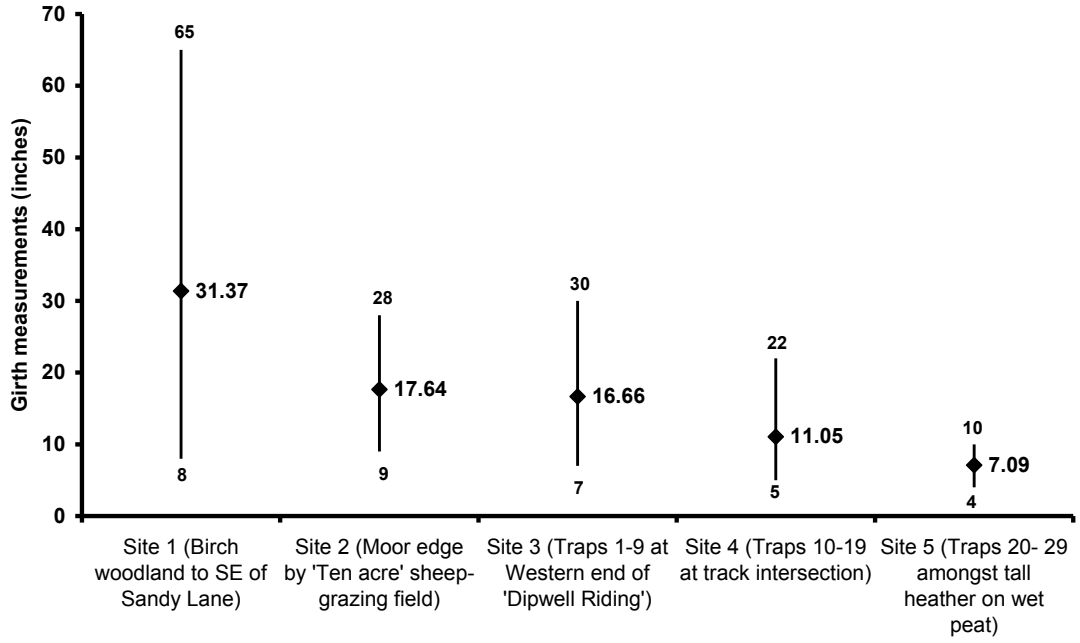

Figure 1: Girth measurements (inches) of 84 Birches (max., min., and mean) at five sampling sites on Lindholme Old Moor 19 June 2013.

The largest trees, with girths up to 65 inches were encountered in the wood-pasture on sand/gravel soils to the south east of Sandy Lane. Here the tree population seems not to have been affected by fire or felling in living memory and since the perimeter ditch along Sandy Lane seldom if ever holds standing water, this site would seem to have a relatively low (though un-measured) water table.

The sampled tree populations along the Dip-well Riding show a progressive decline in mean girth size from southwest to northeast, the largest (mean girth 17.64 inches) being on sand/gravel soils adjacent to the slightly elevated ‘Ten-acre’ field of Lindholme Island and the smallest (mean girth 7.09 inches) being the scrub birch population on the damp peat approximately 250m in from the moor edge.

Figure 2 compares the mean Birch girth measurements of the four Dip-well Riding populations with the underlying mean water table readings (1992 to 2003) and indicates a correlation between the increasing height of the water table and progressively lower mean tree girths.

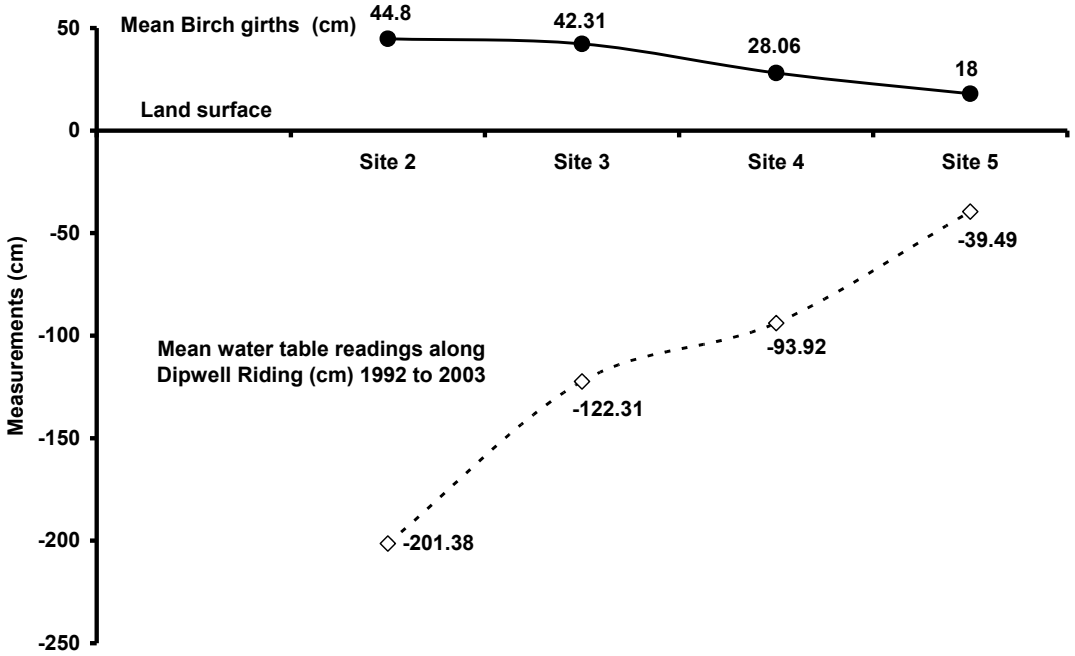

Figure 2: Mean Birch girth and mean water table (1992 to 2003) (all in cm) at four sites along the Lindholme Old Moor Dip-well Riding from the dry moor edge (site 2) to the damp peat area (site 5) 250 metres along the riding.

Conclusions and discussion: Figure 3 provides a more critical examination of the correlation between the tree girth and water table, suggesting a statistically significant relationship (R^2 coefficient correlation = 0.8332). However although Birch growth may indeed be checked by a particularly high water table (standing water) the current tree girth results are more likely to be a reflection of progressive desiccation over the past fifty years rather than reflecting recent conservation efforts.

Evidently the managed drop in ground water across the commercial peat workings of Hatfield Moors also resulted in a catastrophic loss of surface water and a significant drop in the water table on the Lindholme Old Moor site, triggering a major Birch colonisation of the peat body during the 1970s. The

desiccating peat surface and the absence of open water appears also to have left the site vulnerable to fire, as many of the multi-stemmed birch shrubs on the peat furthest away from the 'Ten-acre' field and Sandy Lane revealed the remains of burned central stumps. Although it is not positively known which fire event this represented, a likely burn may have occurred during the record drought of 1975-76 (Cox 1978). [For comparative purposes, according to press reports and photographic evidence o the T&HMC Forum website, fires on the similarly managed Thorne Moors took place in June 1982, August and September 1989, September 1995 and August 2010]. Thus, irrespective of the current water table effect, it is likely that a history of recent (post 1960s) colonisation and fire culling has resulted in a younger/smaller population of Birches occurring in the core of the Old Moor site, the older, broader-girth populations being associated with the more elevated mineral soils of Lindholme Island.

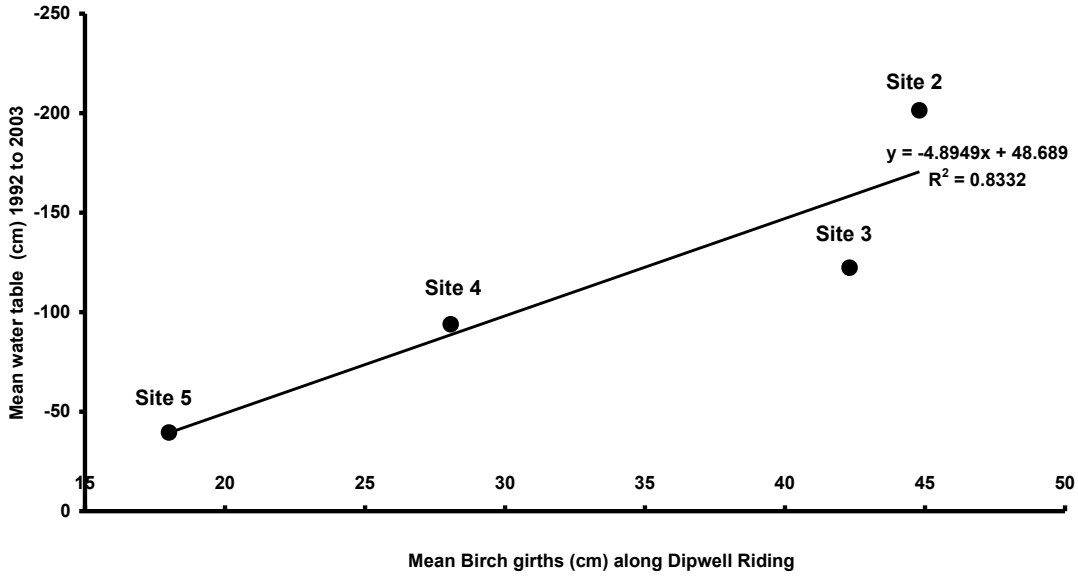

Figure 3: Apparent relationship between mean birch girth (cm) and proximity of the water table (cm) calculated from 57 dates 1992 to 2003 at four sites along the Dip-well Riding.

It is worth recording here that in 1992, prior to Natural England's re wetting of the old peat workings (milling fields), the mean water table reading across Lindholme Old Moor (the Section 39 agreement area) was -95.11cm (range -

242cm to -4cm) but after the flooding of the northern and eastern perimeter drains by Natural England and the discovery and progressive damming of the surface drains across the site by MO and Ian Mcdonald, the mean water table reading had risen to -37.03cm (range -187cm to -2cm) in 2003. The progress of the mean annual water table readings 1992 to 2003, with comments on prevailing weather trends, is shown in Figure 4.

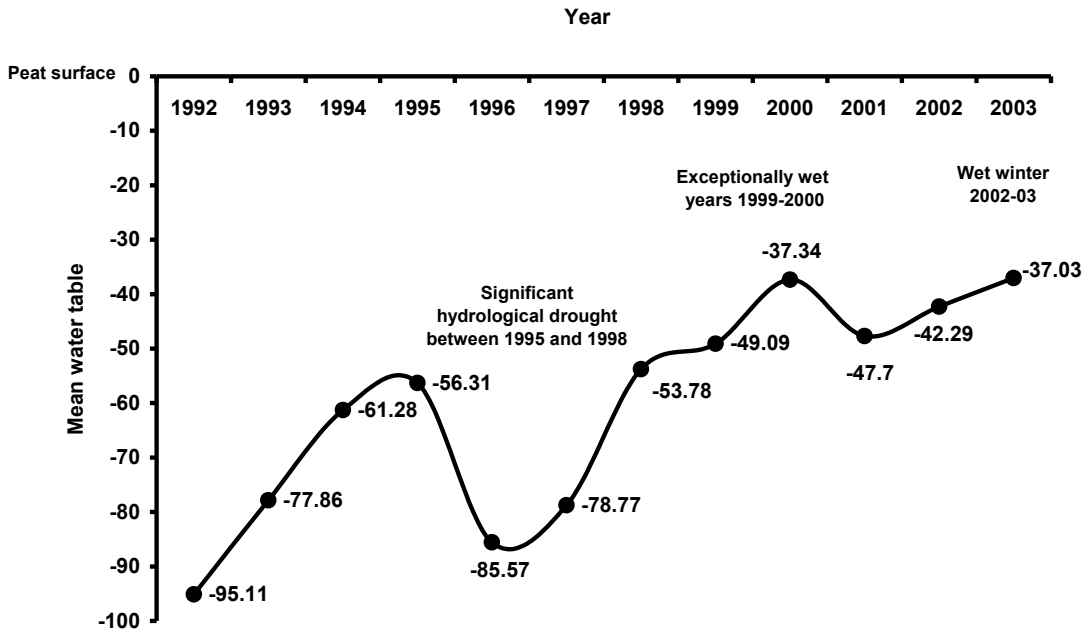

Figure 4: Mean water table readings from all the dip-well pipes along Dip-well Riding 1992 to 2003.

References

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* After the loss of the Environmental Records Officer and Natural Sciences Collections Officer posts at Doncaster Museum, the 1,500+ dip-well measurements maintained there on a Microsoft EXCEL spreadsheet were inadvertently disposed of. The calculations in this study have been made possible after the painstaking re assembly of data from a miscellany of surviving paper records.

Appendix 1: Taxa referred to in text

Betula pendula Silver Birch
Betula pubescens Downy Birch
Calluna vulgaris Heather
Caprimulgus europaeus Nightjar
Ceratocapnos claviculata Climbing Corydalis
Coenonympha tullia Large Heath Butterfly
Deschampsia flexuosa Wavy Hair-grass
Digitalis purpurea Foxglove
Erica tetralix Cross-leaved Heath
Eriophorum angustifolium Common Cotton-grass
Eriophorum vaginatum Hare's tail Cotton-grass
Galium saxatile Heath Bedstraw
Pinus sylvestris Scots Pine
Polytrichum commune
Pteridium aquilinum Bracken
Rhynchospora alba White-beaked Sedge
Rubus sp. Bramble
Silene dioica Red Campion
Sphagnum sp.