East Nethershiels soil survey

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Executive summary

East Nethershiels largely consists of “improved” agricultural soils which appear to have been significantly modified with cultivation, drainage, and additional nutrients over time. As there are no natural vegetation boundaries with which to stratify the site, the Hutton 25k soils layer provides an accurate basis for planning species and cultivation. Discreet areas of peat over 50cm have been identified, although their value as peatland is debatable given their past modification.

Survey and objectives

A walk over site survey was carried out involving taking soil samples on loose transects to verify the accuracy of existing Hutton 25k soils data. Peat probing was carried out to identify areas of peat >50cm depth initially on a set grid but then “freestyle” to establish the edge of peat areas. This information will allow local management to make more detailed species and cultivation prescriptions.

Climatic conditions (derived from Ecological Site Classification)

Climatic conditions vary across the site with areas of local topographic shelter / lower elevation having the most influence. Generally speaking, ESC describes the local climate as “Cool, highly exposed and wet” represented by accumulated temperature values of c.1150, DAMS scores of 16-18 and moisture deficit scores of c.80. This is somewhat acvcuaret although does not fully account for the beneficial impact of local landscape features such as woodlands and hedgerows which will improve both temperature and exposure conditions for young woodland.

Soils & Cultviation

Parent Materials (derived from BGS)

In the Soutern block and the bulk of the northern block, bedrock is primarily Clyde Plateau Volcanic Formation - Basalt and hawaiite. Igneous bedrock formed between 346.7 and 330.9 million years ago during the Carboniferous period. In the east of the northern block there are also sections of Coal Formation - Sedimentary rock cycles, clackmannan group type. Sedimentary bedrock formed between 329 and 328 million years ago during the Carboniferous period and Midland Valley Carboniferous To Early Permian Alkaline Basic Sill Suite - Microgabbro. Igneous bedrock formed between 358.9 and 272.3 million years ago during the Carboniferous and Permian periods.

However the great majority of the site is overlain with superifical deposits of Devensian till. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

Brown earths

These soils are characterized by uniform brown horizons and limited surface organic matter indicative of free drainage and relatively high biological activity. They mainly occurred on steeper slopes on coarser grained parent material. In all circumstances soil moisture regime was “fresh” although it is anticipated that the imperfectly drained variant types (1ug) in intergrading sutations with gley soils may tend towards “moist” for parts of the year. Soil nutrient regime is likely to currently sit around “medium” but can perhaps be expect to eventually default to “poor” the longer time since agricultural input elapses.

The primary constraint of these soils in terms of cultivation is the potential weed burden as free drainage is already present and fertility adequate for a range or species, so avoiding excessive soil disturbance which may exacerbate the situation i.e. linear strip or complete cultivation should be avoided. If mechanical cultivation is desired, invert mounding would be an ideal if relatively slow and expensive method. Continuous mounding may be preferred from a practical point of view but raised positions will create a higher drought risk in dry spring / summer conditions and depressions left by hinge mounds may affect future operations. There may be a place for subsoiling on repeatedly tilled soils to break up compaction and improve rooting depth although accepting that this may provide limited surface cultivation and thus require combined herbicide treatment. If mechanical cultivation is undesirable, chemical screefing may offer a possible alternative. Avoiding significant exposure of mineral soil is likely to reduce the impact of drought compared with a mound (especially hinge mounds) but this will have to be balanced with the increased risk of frost damage from reduced soil warming.

Brown earth exhibiting uniform brown horizons indicative of free drainage throughout profile

Gleys

These soils are characterised by varying degrees of waterlogging and thus high soil moisture regimes and poor aeration. They mainly occurred on flatter or water collecting topography or anywhere the parent material limited free vertical drainage. The majority of gley soils encountered conformed with the type 7c (cultivated surface water gley) where previous cultivation had given rise to an better aerated brown topsoil with mottling returning below the depth of past cultivation.

On more favourable types such as the cultivated gleys SMR could be ”moist – very moist” whereas on wetter types such as the cultivated peaty gley (6c found near the boundaries of peatland areas or in poorly drained basins it was “very moist-wet”

For the most challenging sites i.e. the peaty and very poorly aerated mineral gleys, creation of a raised planting position such as a mound will be beneficial to initial establishment. However, given the difficult / undesireable to drain locations where this soils occur such as basins, the raised position will only provide temporary drainage and choosing species which are naturally tolerant of high SMR will be more important long term.

Evidence of mottling indicating poor aeration

Accuracy of Hutton layer

Generally, the Hutton layer represents a reasonably good foundation on which to base species / cultivation prescriptions but given the level of past modification, prescriptions will need to be somewhat flexible to adjust for variations at unmappable scale. Likewise, the precautionary principle would suggest that assuming soil fertility will default to less fertile classes and drainage regimes to wetter moisture regimes once nutrient inputs cease and existing tile drainage fails / silts up should avoid choices proving unsuitable in the future.

species suitability / flexibility

A range of sample points were chosen to represent the range of soil types and elevations present on site. See attached ESC analyses for details. Exposure frequently appears as a limiting factor for a range of species; however, this seems overly pessimistic given the condition of existing woodlands in the locality. considered use of more wind tolerant species e.g. Scots pine, Birch, Sycamore, Beech on the periphery of planted areas will create a more suitable environment more tender species e.g. sessile oak. As trees of all species grow, they will provide shelter and improved conditions for one another. On moister soils such as the wetter gleys, clearly soil moisture regime becomes limiting for species which require good root aeration such as sessile oak and silver birch. In such situations, species like aspen, alder and the willows become much more suitable.