



Forest Research

The Research Agency of the Forestry Commission

Alice Holt Lodge

Farnham
Surrey
GU10 4LH

Kieron.doick@forestry.gsi.gov.uk
Tel: +44(0)1420 526177
Fax: +44(0)1420 520180

Project Leader
Kieron J. Doick

Report: site visit to Tullos Hill landfill site, Aberdeen
24th November 2008

A visit was made to Grampian Conservancy's Aberdeen Office on the 24th November, 2008. The visit had two main aims. The first aim was to visit the Tullos Hill landfill site and the woodland grant scheme (WGS) planting thereon to ascertain:

- a. Why the WGS had not established successfully?
- b. Is the site indeed suitable for tree planting?
- c. Identify 'issues' and potential causes of issues related to tree planting at this site.

The second aim was to liaise with Colin Forshaw (Operations Manager – Aberdeen, SITA UK) and Ian Talboys (Head of Ranger Services, Aberdeen City Council) and to discuss plans for reclamation works on the Ness Farm area of the site and which abuts Tullos Hill. The Ness Farm area is also a previous landfill site. The discussions were to provide guidance on the successful establishment of trees in land reclamation, in support of trees being considered in the final design.

Following debrief at the Conservancy's Doig Scott office the site visit was made. The weather was generally overcast, with occasional sun and scattered light drizzle. Much of the site had a thin layer of snow that had fallen in the preceding few days. The air temperature was ca. 3°C. Steven Webley, Dan Cadle and Gavin Legge of the FC were also in attendance. The site visit involved a walk-over and the excavation of small trial pits, by hand.

Aim 1: the Tullos Hill area

The Tullos Hill landfill is understood to have opened in the 1940's with largely unregulated municipal solid waste landfilling occurring until the 1990's. Colin Forshaw advised that the waste is considered non-hazardous and that clinker and other wastes from household coal fires are known to comprise a large proportion of the waste. On-site monitoring by SITA suggests that landfill gas generation is low and 'tailing-off'. Grampian Conservancy have previously grant aided the city council to establish trees at Tullos Hill. The original WGS was planted in 1996 and covers a total planting area of ca. 37 ha (primarily broadleaf). The Conservancy wished to establish the long term safety of the WGS plantations, which they believed to be under threat from proposed reclamation works. But, also, to ascertain possible reasons for the unsuccessful establishment of much of the original planting; estimates made during the site visit suggest that losses may be as high as 40%. Colin Forshaw stated during the walk-over of Tullos Hill that, to the best of his knowledge, no further reclamation works were planned for the Tullos Hill area, although he would confirm this to the Conservancy.

Protecting and expanding Britain's forests and woodlands, and increasing their value to society
and the environment, through research and the application of scientific knowledge

www.forestresearch.gov.uk



INVESTOR IN PEOPLE

Causes of unsuccessful establishment

- Soil condition

A number of small trial pits were dug and the results are presented in the table below.

Soil pit number	Total depth of excavation (cm)	Approximate rootable depth (cm)	Comments
1	30	20	Grass area; loose matrix of soil and rubbish until very compact and stony layer at 30 cm; very wet
2	60	20	Grass area; whips in tree shelters; loose matrix of soil and rubbish; wet
3	70-80	15	Grass area; loose matrix of soil and rubbish; very wet; slight greying/ greenish colour to soil; no strong landfill or anaerobic condition type odours
4	20	15	In amongst 5 Elder trees of good size relative to other trees in vicinity. Very high levels of rubbish, including fibrous materials that constrained digging.
5	20	15	In amongst 5 Ash trees of relative good size. Very high levels of rubbish, including fibrous materials that constrained digging. Large roots at shallow depth. Nettles present.
6	45	10	Control site – not landfill area. Previously gorse area, now extensively cleared. Soil notably drier; very peaty. Loose. Shallow rooting.

At all soil pit locations, except the control, the soil matrix was 'made ground', thus natural soil profiles were not discernable. The composition of the made-ground varied little, visually, at the depths investigated. Waste from land-filling therefore extended to within a few centimetres of the surface. The made-ground, whilst providing a loose medium that was rootable in physical terms, was poorly consolidated and low density, which leaves trees prone to premature wind-throw, as evidenced by one partially toppled Elder (exposing waste at its roots). Whilst generally wet, the made-ground was not saturated in soil pits 1-5. There was evidence indicative of anaerobicity at one location (pit 3), although this was not reinforced with the characteristic smell of 'bad eggs' (hydrogen sulphide) nor with the pungent smells of methane rich landfill gas. Overall, there were no signs or indications for landfill gas as a cause of poor vegetation establishment observed during the site walkover, supporting the previously mentioned claim by SITA that landfill gas measurements are low in monitoring wells.

- Compaction

The two biggest threats to successful tree establishment at brownfield sites are generally considered to be compaction of the soil (or made ground) and weed control (see below). Compaction was not observed to be an issue away from paths and tracks, except at soil pit 1 where severe compaction was noted at 30 cm depth. Therefore, cultivation or ripping to alleviate compaction is not required at the soil depths investigated.

- Weed control

Weed control would appear to have been minimal during tree establishment across all the areas of Tullos Hill visited. Weeds compete with seedling trees for light, water and nutrients and therefore weed suppression is recommended for the first three years after planting – normally by herbicide spraying.



- Deer browsing

Deer browsing is known to be significant on site and is hampering tree establishment. Protection against deer browsing has been inadequate across Tullos Hill. Where tree guards have been used they are insufficient in height (90 cm rather than 120 cm guards are in use). Whilst some tree guards had been knocked over, the majority were still in position making it easy to locate trees and identify the extent of browsing.

- Fire

The site is known to have suffered from bouts of arson, plus gorse clearance by fire. Consequently, there has been some damage to seedling and sapling trees by fire.

Recommendations

- Chemical analyses are not a component of a site walk-over study. Therefore the pH, nutrient status and contamination status of the soils/made ground was not investigated. Whilst the soils appeared to be organic rich, the nutrient balance may not be conducive to tree growth. Surveying would be expedient for the identification of nutrient deficiencies and also elevated concentrations of potentially toxic elements. Supporting evidence for potential nutrient deficiency at Tullos Hill comes from the observation that where nettles were found the trees were notably larger than in other areas. Nettles are an indicator of nitrogen-rich soils.

- Tree establishment at Tullos Hill is likely to be strongly supported by improved protection against deer browsing. Investments in improving protection are strongly recommended.

- A strict regime of weed control for a period of 2-3 years will strongly facilitate tree establishment at Tullos Hill. As trees become established, they will help address the local imbalance, by providing shading and competition for nutrients.

- Guidelines for the successful reclamation of brownfield sites for woodland have been published including by the Land Regeneration and Urban Greening team at Forest Research entitled "Best Practice Guidance for Land Regeneration" - a copy was provided to FC staff during the visit on the 24th. Of particular note for Tullos Hill include those on 'Weed control' and 'Animal browsing' (see below). Other recommended literature was notified to the FC prior to the visit, via email.

Additional notes

It is noteworthy that the establishment of large mature trees on many parts of Tullos Hill is unlikely. The rootable material is unlikely to be able to provide adequate anchorage, increasing the risk of wind-throw, especially given the exposed, coastal location. Furthermore, root depth was limited to the surface ~20 cm in the soil pits investigated, suggesting that root penetration to depth may be hampered, for example by anaerobic conditions. Shallow rooting will further increase the risk of wind throw. These unfavourable conditions, however, need not discourage attempts to establish trees at this site. Those trees that grow and topple and decay will help to initiate a local balanced nutrient cycle. Furthermore, as roots begin to penetrate to greater depth they will facilitate aeration, and thus decomposition at depth and a gradual change in the soil matrix. The timescales for these processes are protracted (many tens of years). However, if they are acceptable to the land managers then the previous comments on facilitating tree establishment should be adopted.

Aim 2: the Ness Farm area

From very early on in the discussions it was quite clear that there is still some confusion between the three parties as to the extent, position and future of future reclamation works at Ness Farm and, therefore, the potential [supporting] roles that third parties like the Forestry Commission can play. It is understood that extensive works are planned for the Ness farm area, including landform, capping (lining and overburden), establishment of vegetation. Furthermore, these works will be progressed over a number of years.

The Forestry Commission could seek to encourage the establishment of some trees as part of the reclamation works. For example, blanket coverage of ~ 1 metre of soil cover seems to be proposed following capping. Best Practice Guidance advises that ~ 30 cm soil depth is sufficient for the planting of grass species, 60-70 cm for arable crops and small shrubs, and 120-150 cm depth for trees. Appropriate design of the new site with complimentary mixes of grassland, scrub land and tree/wooded areas would allow for the establishment of trees within the current provision and constraints of soil. I.e. soil is placed in thinner layers where grass and shrubs are to be planted so that the excess can be used to increase soil depth in areas of tree planting. Guidelines and other publications have been provided in support of these objectives. In particular, attention is drawn to the following:-

- a) Physical and chemical analysis of imported soils (for nutrient and contaminants) (BPG 2)
- b) Loose tipping and soil placement (BPGs 4 and 5)
- c) Application of sewage sludge and composts (BPG 6)
- d) Tree species selection (BPG 8)
- e) Weed control (BPG 11)
- f) Protection of trees from mammal damage (BPG 12)

Final comments

Guidelines for the successful reclamation of brownfield sites for woodland have been published and are thus recommended for both the future reclamation works planned for the Ness Farm area, but also in support of the trees planted across Tullis Hill in order to encourage their establishment. Useful guidance on the subject has been published by the Land Regeneration and Urban Greening team at Forest Research entitled "Best Practice Guidance for Land Regeneration" and a copy was provided to FC staff during the visit. A short list of associated reading is given below. Other recommended literature was notified to the FC prior to the visit, via email.

If you have any queries please do not hesitate to get in touch.

Yours sincerely,

Kieron J. Doick
(by email)

Land Regeneration and Urban Greening Research Group
Environmental and Human Sciences Division
Forest Research
kieron.doick@forestry.gsi.gov.uk

Associated reading

Moffat, A.J. and J.D. McNeill, Reclaiming disturbed land for forestry. Forestry Commission Bulletin 110. (1994) HMSO, London.

Bending, N.A.D., S.G. McRae, and A.J. Moffat, Soil-forming materials: Their Use in Land Reclamation. (1999) DETR, The Stationery Office, London.