

## **Applicants' Guidance for Cultivation for upland productive woodland creation sites (Scottish Forestry)**

### **LONG-AWAITED SCOTTISH FORESTRY GUIDANCE ON FORESTRY CULTIVATION GETS A GOOD "A-"**

Two years ago FPG published a blog on forestry cultivation called "*Back to the 70's - Flared Trousers and Forestry Ploughing*" (link), proposing a rethink on cultivation practice. Since then, FPG has been busy researching the effects of forestry operations on soil carbon, and what might constitute best practice in an era when the climate emergency is centre stage. This work is funded by the Pebble Trust (<http://www.thepebbletrust.org>)<sup>1</sup>.

Others in the forestry profession have been busy with the same topic. A debate about the rights and wrongs of different types of cultivation has been in progress, including some within the commercial forestry sector marshalling arguments to support intensive cultivation techniques, including ploughing<sup>2</sup>. Some concerned communities<sup>3</sup> and farmers<sup>4</sup> have been waking up to the scale of new forestry schemes appearing in their neighbourhoods in which intensive cultivation techniques on peaty soils are sometimes apparent. Scottish Forestry has been busy grappling with how best to regulate forestry cultivation in response to both "net zero carbon" targets and government commitments on sustainable forest management. And after a tricky and prolonged gestation and labour, Scottish Forestry have produced an "Applicants' Guidance for Cultivation for upland productive woodland creation sites"; plus an interesting "Background Note"<sup>5</sup>; much of this based on work by Forest Research and Technical Development Branch<sup>6</sup>.

It seems that both FPG and Forest Research have been reviewing the same literature on how forestry practices and tree growth effect soil carbon. This makes clear that cultivation and drainage of peaty soils leads to the release of significant amounts of carbon; and where more intensive cultivation techniques are used, there is a high likelihood that more carbon dioxide will be emitted than absorbed by the trees for the next few decades. This means that those techniques would fall foul of Scotland's efforts to reach net zero carbon by 2045.

---

<sup>1</sup> Pebble Trusts objectives centre on: "a more sustainable, equal and low-carbon society, where constraints on fossil fuels lead to a more localised economy with stronger, more resilient, communities, and where human activities take account of climate change and the wider environment."

<sup>2</sup> Ploughing or mounding. Which is more environmentally friendly? Iain Kyle p46-47. Forestry and Timber News, October 2019 Issue 95.

<sup>3</sup> e.g. <https://www.facebook.com/groups/581843619140972>

<sup>4</sup> e.g. <https://www.pressandjournal.co.uk/fp/business/farming/2774509/christopher-nicholson-rethink-on-forestrys-failure-to-protect-peat/>

<sup>5</sup> Customers Representatives Group 17 March 2021 Cultivation for upland woodland creation sites – Applicant's Guidance

<sup>6</sup> Field Guide to Soil Cultivation Forest Research Technical Development TDJR193, 2019

FPG found that quantitative evidence that would allow nuanced comparisons between carbon emissions and absorption by growing trees is scarce, especially for shallow peats. In general, research evidence on soil carbon is challenging to draw detailed conclusions from - because of different research methodologies, the confounding effects of different site types and tree species, and the small number of robust long-term studies. Similarly, Forest Research reported that trying to establish carbon budgets for woodland creation on peaty soils yielded “variable and inconclusive results”. Using new modelling scenarios, Forest Research concludes that *“On soils with organic layers <20cm, it is likely that carbon losses arising from cultivation would be reabsorbed by the growing trees within 10-15 years, depending upon the growth rate of the trees; whereas on soils with organic layers > 30cm the time taken for the growing trees to reabsorb released carbon may be over 20 years...”*. On a typical upland planting site, organic horizons might vary in depth from a few cm to more than 50 cm over distances of a few metres, and tree growth rates will vary widely too. This makes even coarse estimates of carbon emissions and absorption hugely challenging. But this partial evidence is what is available to work with, and unfortunately the topic demands answers now.

Scottish Forestry’s new guidance sets out which cultivation techniques are acceptable on which soil types; and concludes *“that the most appropriate approach is to exclude the use of medium and high disturbance soil cultivation techniques on all organo-mineral soils with an organic layer over 10 cm in depth”*. That is FPG’s view too.

The key tables in the new guidance looks like this:

**Table 4 – Forest soils and ground preparation<sup>2</sup>**

Legend:  
 +++ ... recommended best practice  
 ++ ... possible alternative  
 + ... acceptable under certain circumstances, e.g. on small areas  
 \* ... manual screening only  
 \*\* ... clay soils only

		least intensive → most intensive										
		No cultivation	Subsoiling / Ripping	Inverted mounding	Patch scarification	Disc scarification (linear)	Mulching	Hinge mounding	Trench mounding	Shallow strip ploughing (linear)	Deep complete ploughing	
↑ heavy draining variable ↓ waterlogged	Brown earth	SNR Poor or Medium	++		+++	+++	++			+		
	Brown earth	SNR Rich or Very Rich	+++		+	+						
	Podzol		++	++	++	+++	+++	+		+		
	Ironpan	Pan poses no obstacle to rooting	++	++	+++	+	+	+		+		
	Ironpan	Pan limits root growth		+++	+++						+	
	Ironpan	Pan is out of reach		<b>Treat like gley / peaty gley depending on presence of organic layer</b>								
	Ranker		+++		+++							
	Gley	SNR Poor or Medium	++	+++*	+++	+		+	+			
	Gley	SNR Rich or Very Rich	+++	+++*	+	+			+	+		
	Peaty gley		+		+++			+				

<sup>2</sup> Table 4 courtesy of Jens Haufe, Forest Research. Table 4 is currently being reviewed by FR and may be subject to minor change by the time this guidance is published.

Table 4 from “Cultivation for upland productive woodland creation sites Scottish Forestry 2021”

**Table 5 – Caveats of use**

Technique	Environmental constraint			
	Soil Carbon Can be used on organo-mineral soils with a peat depth layer 10-50 cm?	Water Management		Forest Stability Can be used on sites with DAMS score ≥ 16?
		Can be used within UKFS buffer areas?	Can be used on moderate or steep slopes?	
Manual screening	Y	Y	Y	Y
Sub-soiling aka ripping or tining	Y	N	N*	Y
Patch scarification using excavator	Y	N	Y	Y
Inverted mounding	Y	Y	Y	Y
Hinge mounding	Y	Y	Y	Y
Patch scarification using scarifier aka continuous mounding	Y	N	Y	Y
Trench mounding	N**	N	Y	Y
Rotary (helix) ploughing	N	N	N*	N***
Line scarification using disc scarifier	N	N	N*	N***
Shallow ploughing	N	N	N*	N***
Deep ploughing	N	N	N	N

\* May be acceptable on moderate slopes where detailed analysis has established soil erosion risk is low and appropriate mitigation and controls are deployed.  
 \*\* Where an integrated drainage system is put in place drain spoil may be used for mound formation on condition drain intensity does not exceed the minimum level required for successful site establishment.  
 \*\*\* May be acceptable where additional mitigation measures are incorporated within forest design, see [Appendix 3 Guidance Rationale – Forest stability](#).

Table 5 from “Cultivation for upland productive woodland creation sites Scottish Forestry 2021”  
 Techniques in red are considered unacceptable.

Table 4 sets out recommended cultivation techniques on different soil types and many of the higher impact techniques (hinge mounding, trench mounding, and ploughing) are excluded or relegated to poor second-best alternatives. FPG would be happy to see the demise of these forms of cultivation and note that the Guidance still suggests that they are acceptable in “certain circumstances” and would like to see some details of what those “certain circumstances” might be, because we cannot think of any. In their place the Guidance promotes inverted mounding and disc scarification are the favoured techniques, which FPG fully endorses.

The guidance steers practitioner towards techniques that *meet the main objectives of cultivation whilst causing least impact*. Previous guidance exhorted practitioners to make this difficult judgement, but without providing enough information as to how exactly to do it; leaving a degree of confusion in its wake, and consequently providing scope for some operators to push the envelope of what is acceptable. The tables summarise what that balance looks like, and the accompanying guidance sets out both the logic and technical details in a concise and understandable way.

FPG thinks that Scottish Forestry have got this more or less right and we note that it addresses nearly all of the concerns we raised in our “flared trousers” blog. We like the strong support for inverted mounding, and the relegation of hinge mounding with its mini-tank traps to an “also ran”. We support the virtual abandonment of ploughing. On restock sites we agree that inverted mounding should replace the execrable trench mounding. It is good to see situations where “no cultivation” is feasible being highlighted. The Pebble Trust project is proceeding towards similar conclusions.

Part of the Pebble Trust project was to interview a range of practitioners about how they see the issues around forest operations and soil carbon. This demonstrated a wide range of opinion, from those fully in support of continuing with intensive ground preparation, to those desperate to see it reigned in. What was universal, however, was the call for clear and unequivocal guidance, which FPG believes we now have in hand.

What is needed is a shift in our professional mindset, from considering peaty soils as unpleasant substandard soils needing remedial action, to them being important large-scale stores of carbon that need to be carefully managed. The task at hand is to enhance their carbon storage potential by carefully adding trees, not to embark on their wholesale alteration in order to maximise the early growth of those trees. Sustainable forestry requires a little more patience and skill at the start of the rotation, using cultivation solutions that are more “nature based” and less in hock to forestry’s overly technocratic recent past.

However, another aspect of site preparation is crystallising in our minds as a result of the Pebble Trust project - the role of soil drainage (as distinct from cultivation) in carbon emissions. Where drainage leads to a lowering of the water table on peaty soils, as opposed to simply leading runoff off the site more rapidly, the consequent aeration of soil organic matter inevitably leads to carbon emissions. In addition, drainage water carries away dissolved carbon, causing problems in watercourses and water treatment plants, before

most of it eventually oxidises and converts to carbon dioxide. So, we have been puzzling over the sentence in the introduction to the new guidance that “Cultivation techniques should not be used to manage excess water, instead an integrated drainage system should be put in place at the same time or immediately after cultivation.” FPG view is that drainage systems will to a greater or lesser extent lower water tables, at least in the immediate vicinity, and logically should therefore be subject to the same strictures *to meet the objectives whilst causing least impact*. Having said that, is harder to envisage the purpose and appropriate design of drainage systems now that collecting water from linear cultivation furrows will no longer be needed. More thought is needed on a more limited role for drainage with this new limited suit of cultivation techniques.

FPG also notes that practitioners engaged in creating new native woodlands are steered by this new cultivation guidance towards FC Bulletin 112 “Creating New Native Woodlands, 1994”. Bulletin 112 never provided clear guidance on cultivation and is well out of date. For instance, it includes no mention of inverted mounding which must now fully replace the ubiquitous and unpleasant hinge mounding. FPG will be blogging on this topic shortly.

Looking to the longer-term future, two things are our minds:

1. The forestry profession needs to continue upping our game on soil identification and mapping in order to be fully able to implement this guidance.
2. There must be scope to deliver the favoured lower impact forms of cultivation with lighter and more fuel-efficient machinery than traditional forestry tractors and excavators, and using these, develop even better cultivation techniques.

FPG looks forward to the full adoption of this guidance and its incorporation into the UK Forest Standard. So, we mark the new guidance a very good A-.