North East Mountain Trust

Increased Woodland[1] in the Cairngorm Glens

K J Thomson, 21 December 2020

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[1]. In UK forestry statistics, the term "woodland" is land under stands of trees with a canopy cover of at least 20% or able to achieve this, including open spaces under 0.5 ha, and felled areas awaiting restocking (Forest Research website). In this paper, more isolated trees are also of interest, whether surviving from once denser woodland, existing in small areas, or growing in places with reduced grazing and/or more favourable climatic conditions (e.g. river gorges). The word "more" reflects both the increasing the density of existing woodlands and establishing new ones, whether by planting or regeneration.

Increased Woodland in the Cairngorm Glens

K J Thomson for NEMT

Summary

1. This paper expands my short NEMT Council note "Trees in the Cairngorms" in spring 2020, and is intended to inform further steps that the Trust might take over the issue of increased tree cover in the glens and their shoulders of the core Cairngorms ("the area") -- roughly, Wild Land Area 15 (WLA15) including Glens Tilt, Tromie/Gaick and Feshie, and Rothiemurchus. As for WLA15, the Lochnagar and Laggan areas are excluded, though similar considerations may well apply there too.

2. As in Scotland as a whole, the policy background – and to some extent practice – is clearly in favour of increased woodland in this area. This could be established by planting for commercial or other reasons, and/or by natural regeneration; both methods would require fencing and/or deer culling. Considerable funding is available, but progress has been slow except in Glen Feshie and parts of the Mar Lodge Estate, and the southern glens are particularly bare except for Sitka and other plantations.

3. Arguments for and against increased tree cover in the area are considered here under eight headings: it is recognised that these are often interconnected, and to some extent overlap (or may leave some gaps). Moreover, existing, or alternative, land covers should be considered, and the timescales involved may differ considerably. These arguments, and the conclusions reached in this paper for more trees in the relevant areas, are:

    i) *Commercial*: not justified – especially for Scots pine and birch plantations – by long-term and risky financial returns after costs, even assuming high timber prices and lower farm subsidies

    ii) *Economic*: local employment of some but not major concern in the Braemar and Aviemore areas, and import substitution (of softwood) of negligible significance

    iii) *Biological*: diversity of habitats and associated species almost certainly improved by more tree cover, especially natural regeneration, though possibly less habitat for eagles, grouse, etc.

    iv) *Hydrological*: water off-flows and quality (e.g. for salmon) almost certainly improved by more tree cover, especially naturally regenerated

    v) *Climate Change*: no clear carbon capture benefits if soil effects (peat disturbance) and timber usage (if any) taken into account; other aspects (e.g. tree disease) need to be considered

    vi) *Landscape*: probably slightly negative effects as trees obstruct views, and create a more enclosed and less "wild" landscape

    vii) *Recreation*: more diversity a positive benefit, e.g. from increased shelter, though some obstruction both physical (fencing) and visual (views); implications for orienteering, deer shooting, etc.

    viii) *Cultural*: considerable scope for controversy over historic/pre-historic land cover; perhaps loss – a least visually – of built heritage

4. In addition to the "further steps" in 1. above, which might include more information, relevant lectures, and campaigning, NEMT might also push for improvements in terms of e.g.:

    • better forestry management, e.g. less biomass wastage at felling, more brash removal, less ditching/gouging, old fencing removal, tidying-up, less destructive machinery
    • better/more extensive access arrangements, e.g. stiles, parking places, restored or new paths.

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1. Introduction

1.1. This paper is an expanded version of my short note "Trees in the Cairngorms", written for the NEMT Council meeting of 21 April 2020, when it was briefly discussed, and further steps for the rest of the year were considered, for future decision. It follows roughly the same structure as that earlier note.

1.2. In expanding the April note, I have been helped by criticism and suggestions from the NEMT Chair Dave Windle and others, some at second hand. However, I alone am responsible for the information and opinions in this paper, and it does not represent current NEMT policy, which to date has not directly covered this topic (see next section).

1.3. The "further steps" mentioned above included (a) investigation of current (and if possible future) planting plans; (b) an invitation to an expert in this topic to speak to NEMT next autumn[2]; (c) a possible survey of NEMT members some time in 2021, the form and timing of that survey to be determined later, e.g. at the NEMT AGM or Council meeting in January 2021.

2. NEMT Relevance

2.1. The current "purpose" of the Trust is[3] "*to protect from potentially damaging developments, and to enhance, the upland, coastal and rural environments of Scotland, and in particular the hills and mountains of North East Scotland, for the benefit of those taking responsible non-motorized recreation there*". Thus, whether more trees in the Cairngorms would "damage" or "enhance" the upland environment (see paragraph 2.4 for a definition and justification of the area covered by this paper), and so change its recreational "benefit" for better or worse, the issue would seem to fall squarely within the Trust's "purpose". More trees in non-upland "rural" and even "coastal" areas of North East Scotland might also be of interest, but these issues are likely to be different in nature or at least in degree, and are ignored here.

2.2. The current (2020/21) NEMT Council Work Plan does not specifically mention trees or woodland, but includes "campaigning" and "monitoring" in respect of:

- moorland and deer management
- public access
- consultations undertaken by the Scottish Government (SG), and statutory bodies
- developments on Cairngorm Mountain,

all of which have overlaps, of various types, with woodland areas and their management. A future Work Plan might of course include woodland explicitly mentioned.

2.3. The idea of further trees in the Scottish and UK landscape has been controversial for many years. In the post-war decades, conifer plantations established in the uplands to replace earlier losses encroached on agricultural land (thus provoking farmer resistance), and had dubious strategic and economic

[2] This was done at the NEMT Lecture "Big targets, big ambitions – unpicking the pros and cons of woodland expansion in Scotland", delivered via Zoom on 4 November 2020 by Alison Hester and Ruth Mitchell of the James Hutton Institute in Aberdeen.

[3] http://www.nemt.org.uk/about/NEMT-constitution.pdf.

rationales[4]. Macdonald (1993)[5] suggested that the "*crofting version of the natural heritage debate is regarded as counter-hegemonic to dominant discourses of conservation and the sporting estate*", while Robbins and Fraser (2003)[6] refer to the "*postmodern form of ecological capitalism*" as a framework for the "schizophrenic" promotion of both commercial coniferisation and the establishment and repair of "native" or "consumption forests" as on Speyside. More recently, more environmental factors have come into play, such as water flows, species habitats and carbon flows. Many of these argument areas are reflected below.

2.4. The geographical area of primary interest for the purpose of this paper is assumed to be the upper stretches and shoulders of the glens leading into the high core of the Cairngorm mountains, all within the Cairngorms National Park (CNP). These glens include the Dee (and its tributaries Clunie, Ey, Geldie, Lui/Derry, Quoich and Gairn), Don, Avon, Spey (Tromie/Gaick, Feshie, Einich, More) and Garry (Tilt, Bruar). Areas to the west of the A9, e.g. the Monadhliaths, and the hills on either side of Loch Ericht, are ignored, though similar considerations may apply in a few places there (see Annex); the same may be said of Glen Muick, and in Glen Doll. The lower parts of the Park, e.g. alongside the A9, the A93 between Dinnet and Braemar, and the A939 between Ballater and Grantown, often with standard plantation forestry as well as roadside scrub etc., are not considered.

2.5. The above area, along with the ground above the glens, roughly corresponds with that delineated by Murray[7] as an "area of outstanding beauty". He includes Rothiemurchus and Glenmore, despite the hillsides near Loch Morlich being "*ugly, not yet fully cleared or planted*" after fire damage, and the "*ugly scar*" of the (then new) access road to the ski-tow and chairlift. The lower stretch of Glen Feshie (above and below Achlean) is excluded as having "*become a scene of devastation like a World War I battlefield"* due to Forestry Commission ploughing, and so is Glen Tilt*,* which "*has high claim for inclusion by virtue of its live river, and well-grown woods …* [but] *is narrowly enclosed for its long length, the flanking mountains are not well seen, and their visible slopes seem without sufficient di*stinction". In fact, Murray does not include any area south of the tree-line above the Linn of Dee, south or west of the Geldie and Feshie (including the Laggan area), or north of the Avon, e.g. Strathnethy. Balmoral Forest is considered a separate area of beauty, bounded by the Dee, Glen Muick (almost from Ballater), Broad Cairn, and Glen Callater.

2.6. Frank Fraser Darling[8] describes the Cairngorm region, and its "*ancient pine forests at their eastern and north-western foot*" of the mountains, as "*of special interest to ornithologists*" and entomologists, though he describes the deer forests of Drumochter and Gaick as "*the most depressing part of the Highlands",* where *"trees are few and far between".* Around Loch Morlich, "*The old trees have suffered more heavily here and have been replaced by plantations of Scots pine, but Abernethy is still beautiful and the birch and juniper take away the grim formality of the solid stands of planted timber".* He records "*one of the best routes into the Cairngorms … up Glen Tilt from Blair Atholl, past the Falls of Tarf … until the Bynack Sheiling*", along a route with few trees except for plenty of small birches in the narrow side dens, and at Bynack he notes "*a few well grown spruces … out of which he frightened a capercaillie*."

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[4] See HM Treasury (1972) *Forestry in Great Britain: an Interdepartmental Cost/Benefit Study*. HMSO, London; and Price. C. (1997) Twenty-Five Years of Forestry Cost-Benefit Analysis in Britain, *Forestry*, 70(3), 171-189, https://academic.oup.com/forestry/article/70/3/171/543868.

[5] MacDonald, F. (1993) Viewing Highland Scotland: Ideology, Representation and the 'Natural Heritage', *Area*, 30(3) (Sep., 1998), 237-244. https://www.jstor.org/stable/20003900?seq=1

[6] See www.researchgate.net/publication/229522932_A_Forest_of_Contradictions_Producing_the_Landscapes_of_the_Scottish_Highlands.

[7] Murray, W. H. (1962) *Highland Landscape*, National Trust for Scotland.

[8] Fraser Darling (1947) *Natural History in the Highlands and Islands*, Collins New Naturalist series, London.

2.7. Darling[8] describes "*the destruction of the ancient forest – the great Wood of Caledon*"[9] as having "*happened within historic time, partly between A.D. 800 and 1100 and then from the 15th and 16th centuries till the end of the 18th*", corresponding mainly to the depredations of the Vikings and to the needs of the furnace and then the sheep, respectively. According to him, it "*consisted of oak at the lower levels, with alders along the rivers and in soft places, and pines and birches elsewhere*", and extended across the country "*from Glencoe eastwards to the Braes of Mar*". Later authorities[10] consider that 2000 years ago perhaps a quarter of the land of Scotland (not just the Highlands) would have been wooded, and that "*there may be fewer arguments from history than usually assumed, and none for restoring the fantastical Great Wood of Caledon"*[11]*.* Whatever the true proportion, Darling recommended (in 1947) that, "*if nature reserves ever become a reality in the Scottish Highlands (as something distinct from National Parks, which are lungs for the people and playgrounds), the authorities should go to a great deal of trouble to bring about regeneration of the true Scots pine which is a tree different in many ways from the sombre article commonly grown in plantations as Scots*." Bain[12] offers a "traveller's guide" – unfortunately without data such as area – of 38 "ancient pinewoods" in (mostly Highland) Scotland, including 11 in or near the Cairngorms region: 7 in Strathspey (Glen Avon, Dulnain, Abernethy, Glenmore, Rothiemurchus, Invereshie and Inveresk, and Glen Feshie) and 4 on Deeside (Mar, Ballochbuie, Glen Tanar, and Glen Ferrick and the Finlets up the Feugh), with none along the A9 corridor or at Laggan.

2.8. In considering "*use and delight*" in relation to Scottish natural resources, Smout[13] refers several times to historical developments in the woodlands in and around the Cairngorms. He considers the "original" woodlands about 4000 years ago to have been often scattered groups of various species, which were gradually degraded, in higher altitudes largely by a wetter and colder climate (hence the remnants found in many bogs), and then, especially in the eighteenth and nineteenth centuries, by over-grazing[14]. From 1500 inwards, there were markets for birch and pine at Inverness, Perth, Edzell and Kirriemuir, as well as local use for shelter, fuel and timber. After 1750, timber speculators operated in places, where "*their depredations were, indeed, at times extremely severe, especially when wars against the French gave a respite from Baltic competition … But often* [the woods] *recovered to occupy much or all of their former space, either by regenerating naturally from isolated trees and shed cones or by being planted up.*" As Smout points out, "*A pine wood likes, under natural conditions, to move its stance*" (p. 57), regenerating at the edges away from the shade of existing trees, and leaving the centres to decay.

2.9. Wild Land Areas (WLAs) have been defined by Scottish Natural Heritage (SNH, now NatureScot) on the basis of four attributes (perceived naturalness; terrain ruggedness; remoteness; visible lack of buildings,

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[9] Smout, T.C. (2000) *Nature Contested: Environmental History in Scotland and Northern England since 1600*, Edinburgh, says (p. 37) "Let us begin with the Great Wood of Caledon. It is, in every sense of the word, a myth", and (p. 44) "In its modern form, the Caledonian Forest is a product of German Romanticism, mediated through the excitable and fantasy-filled minds of the Sobieski Stuarts" – who in the mid-nineteenth century falsely claimed to be descendants of Bonnie Prince Charlie.

[10] Smout, T.C., MacDonald, A.R. and Watson, F. (2005) *A History of the Native Woodlands of Scotland, 1500-1920*, Edinburgh University Press (page 34).

[11] The 'Great Wood of Caledon' concept was promulgated in 1527 by Hector Boece when Principal of Aberdeen University, updating Roman ideas.

[12] Bain, C. (2013) *The Ancient Pinewoods of Scotland*, Sandstone Press, Dingwall.

[13] Smout, T.C. (2000) *Nature Contested: Environmental History in Scotland and Northern England since 1600*, Edinburgh.

[14] Unlike the Alps, Carpathians, etc., hills and mountains in Scotland (as in Ireland, Wales and North-West England) "suffer" from the Atlantic and its Gulf Stream, which make it possible to graze livestock outside all year round, rather than having to be housed over the winter. However, until the eighteenth century, due to lack of feed such as turnips, hay or potatoes, Highland cattle had to be exported to the south in the autumn, and sheep were generally over-wintered indoors (A. R. D Haldane, *The Drove Roads of Scotland*, 1952 and 1971, pp. 189-190).

roads, etc.). The designation confers no additional statutory protections or particular obligations, but WLAs are recognised by the policy and planning systems, and by some planning applicants. A SNH Policy Statement[15] says that "*for extensive areas under moorland vegetation, it is reasonable to predict that there could be much more woody vegetation than exists today. More natural woodland could be anticipated on the better quality lower ground, merging upwards through scrub and shrubbier moorland vegetation to the alpine heaths: elsewhere, open habitats would prevail*". WLA 15 (the "Cairngorms") also roughly corresponds with the area selected for this paper, although it also includes the highest areas such as the plateaux, where trees are highly unlikely, even with climatic change. WLA 15 excludes the main part of Glenmore with its roads and ski infrastructure, as well as lower Glen Feshie as far as Glenfeshie Lodge, Glen Tromie as far as Gaick Lodge, and the relative lowlands around Braemar (as far as White Bridge), Blair Atholl, etc.[16]

3. Policy background

3.1. For several reasons, more trees in this area are highly likely. Many pressure groups and agencies, e.g. the UK Committee on Climate Change (CCC) and Scottish Environment LINK, recommend an expansion of Scottish woodland cover[17]. The Scottish Government (SG) plans significant increases in forest and woodland cover in Scotland as a whole, and the CNP Authority (CNPA) in the Park (see below). Amongst the larger "private" land owners in the CNP, NTS efforts on Mar Lodge Estate, and the Cairngorms Connect[18] and River Dee[19] projects, amongst others, aim at increasing tree cover, mostly by natural regeneration encouraged by adequate deer culling, though with some fencing and/or planting.

3.2. Two executive agencies of the Scottish Government deliver forestry and land management functions:

- Scottish Forestry (SF) (previously Forestry Commission Scotland, FCS) is responsible for regulation, policy, support and grant-giving, the last mostly through the Forestry Grant Scheme (FGS)
- Forestry and Land Scotland (FLS) (previously Forest Enterprise Scotland, FES) is responsible for managing the Scottish Ministers' land known as the National Forest Estate; FLS receives funding directly, and is not eligible for FGS.

Planned SF and FLS spending increased from £43.3m and £15.7m (total £59m) in 2019-20 to £47.5m and £17.2m (total £65m) in 2020-21 respectively.

3.3. Table 3.1 shows recent woodland areas in Scotland and in North East Scotland (i.e. Aberdeenshire, Speyside, Moray), an area much larger than considered for this paper but the nearest SF region for which official all-woodland statistics are available:

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[15] SNH (2002) *Wildness in Scotland's Countryside*, Policy Statement no. 02/03, https://www.nature.scot/wildness-scotlands-countryside-policy-statement.

[16] https://www.nature.scot/sites/default/files/2017-11/Consultation-response-Description-of-Wild-Land-Cairngorm-January-2017-15.pdf.

[17] Under its "net-zero" deep emissions reduction scenario, the CCC recommends expanding woodland cover in Scotland – given its "unique opportunities" - from the current c.19% to 30% by 2045 (www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming). SE LINK wants a "*significant expansion in trees and woodland cover*" (www.scotlink.org/wp-content/uploads/2020/06/Woodland-principles-LINK-Woodland-Group-final-version.pdf).

[18] A partnership of RSPB, SNH, FLS (FCS/FES as was) and Wildland Ltd (Povlsen, Glenfeshie), aiming "*to restore woodland to its natural limit, including high altitude montane woodlands*" over its area of 60,000 ha. See http://cairngormsconnect.org.uk/. It excludes the skiing corries, Atholl, Invercauld, Balmoral, Mar Lodge, Mar, etc.

[19] See http://www.riverdee.org.uk/news/2020/a-million-trees-to-save-our-salmon and a photograph and BBC weblink at http://www.riverdee.org.uk/news/2020/million-trees-project-featured-on-landward. It is reported in spring 2020 that "*well over 200,000 trees are already in the ground and mostly growing well on the banks of the River Dee and tributaries*," including the Feardar catchment on Invercauld Estate.

Table 3.1: Woodland areas in Scotland and North-East Scotland, 2018

'000 ha (% of total area)	Total Land Area	National Forest Inventory (NFI) Woodland	Other Trees
Scotland	7791 (100%)	1,429 (18%)	84 (1%)
NE Scotland	1142 (100%)	237 (21%)	14 (1%)

Forestry Statistics 2017, Forestry Commission.

In Scotland as a whole, woodland owned by FLS represents 40% of the total, and all other woodland, whether owned by individuals, companies, trusts, charities (e.g. NTS) or local authorities the remaining 60%. Conifers occupy 74% of the total, and broadleaves 26%. The shares in NE Scotland are probably similar. Of the 1.43 million ha NFI total, 31% (442,611 ha) is classified as native woodland, more than previously thought (i.e. up 131,458 ha on the 2014 estimate), the majority being in North East and West Scotland.[20]

3.4. New planting (mostly private) in Scotland over 2000-2018 averaged about 6,500 ha per year, well below target (10,000 ha in 2018). In 2018/19, new planting (over 90% private, i.e. non-FLS) totalled 11,200 ha, including 3,900 ha of broadleaves[21], the first time of meeting the SG target. The 2019/2020 figure was 10,860 ha. The current annual planting target is 12,000 ha, rising to 15,000 ha by the mid-2020s. For native woodlands, the aims are: "*to Increase the amount in good condition; to create 3,000-5,000 hectares per year, and to restore approximately 10,000 ha of new native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans*".[22] [23]

3.5. The current (2016-2020) Forestry Grant Scheme (FGS) contains eight "support categories", two for the creation of new woodlands, and six for the management of existing woodlands. In the Woodland Creation category, there are nine "options": Conifer, Diverse Conifer, Broadleaves, Native Scots Pine, Native Upland Birch, Native Broadleaves, Native Low Density, Small or Farm Woodland, Northern and Western Isles.[24]

3.6. In "target" (as opposed to "standard") areas, the FGS Woodland Creation scheme pays £3600 per ha (£2070 initially, then £306 for each of 5 years) for Native Scots Pine, plus capital grants for operations such as establishing a "high cost" deer fence at £9.90/m[25].

3.7. Restocking (largely public; includes regeneration) averages about 10,000 ha per year[21]. Forests remove from the atmosphere about 9.5 Mt of CO2 [NB: not C] each year[26], averaging 6.65t/ha/yr. The FGS Sustainable Management of Forests – Native Woodland scheme aims to (i) maintain native woodland, (ii) bring native woodlands and designated woodland features into good ecological condition, and (iii)

[20] https://forestry.gov.scot/news-releases/new-report-reveals-scotland-has-more-native-woodland-than-was-thought.

[21] https://www.forestresearch.gov.uk/tools-and-resources/statistics/data-downloads/. Areas are probably underestimates.

[22] Scottish Government (2019) *Scottish Forestry Strategy 2019-29*. https://www.gov.scot/publications/scotlands-forestry-strategy-20192029/. There is some uncertainty over the target year; the Deer Working Group report (para 69) gives 2024, not 2029.

[23] *The Management of Wild Deer in Scotland*, Report of the Deer Working Group (December 2019), para. 69. https://www.gov.scot/publications/management-wild-deer-scotland/.

[24] https://www.ruralpayments.org/topics/all-schemes/forestry-grant-scheme/.

[25] https://www.ruralpayments.org/topics/all-schemes/forestry-grant-scheme/woodland-creation/.

[26] https://forestry.gov.scot/news-releases/tree-planting-targets-smashed-say-ewing, June 2019. For a simple (but somewhat dated, and rather sceptical) text on forestry and C sequestration, see Cannell. M.G.R. (1999), *Forestry*, 72(3). To convert from CO2 to C, divide by 3.62. Given CNP figures, and ignoring species etc., this suggests that CNP trees absorb about 125 Kt of C per year, the equivalent of the emissions of about 300 cars (*to be checked)*.

restore Plantations on Ancient Woodland Sites[27] to native woodland through deer control and natural regeneration. Under this scheme, any threats from non-native species or inappropriate levels of grazing and browsing must be controlled, so that natural regeneration is encouraged[28].

3.8. One valuation of trees as compared to open ground is indicated by two of the six "tiers" in the recently re-introduced system of sporting rates for "shootings and deer forests", i.e. £2 per hectare for Deer Forest/Hill/Moor, and £5 per hectare for Woodlands/Forestry.[29] However, the Deer Working Group report recommended that all reference to "deer forest" – currently defined for the purposes of rating as "areas of predominantly managed open hill and moorland which deer now inhabit and used for the exercise of the rights to shoot deer– be removed from ratings legislation.

3.9. In the Cairngorms National Park, the area of native woodland is 42,947 ha (28,970 ha Scots pine, 8,708 ha upland birch), which is 69% of the Park's total woodland area, or 9.5% of the total land area of the Park. 44% of this native woodland is 80-100% semi-natural, and 63% is in "good" biodiversity health, with a further 34% in the next best category (of 4). The Caledonian Pinewood Inventory records the following pinewood areas: core 7,445 ha; regeneration 9,658 ha, buffer 20,645 ha, total 37,748 ha. See Annex B for specific pinewood areas.

3.10. The Cairngorms National Park Forestry Strategy 2018-2023[30] aims at: "*restoring the largely missing montane woodland habitat*" (p. 6), where "*Dwarf birch habitat is extremely sparse and … montane willow scrub is virtually non-existent*" (p. 30). It also "*aims to strongly encourage landowners to consider more woodland creation and regeneration where it will enhance the landscape and wildland qualities and provide the most environmental, social and economic benefits*" (p.42). A map (p.43) shows extensive "potential areas (with known sensitivities)" for planting, and areas of "Potential Montane woodland" in most of the Cairngorms glens, with further "Preferred" areas in Glen Clunie and north of Blair Atholl. The Strategy notes that "*In some areas, deer fencing is required as a short term management tool … [but], especially [in] remote wild land areas, can impact negatively on landscape and access*" (p.26). In the Cairngorms Massif Special Protection area (SPA)[31] specifies "*Some potential for sensitive enhancement or small scale expansion of existing areas of native woodland, and … for small scale montane scrub/riparian habitat*" (Annex 2, p. 4).

3.11. The Cairngorms Special Area of Conservation (SAC) covers 57691 ha, and has two "priority features"[32]:

- "91C0 Caledonian forest", consisting of six individually large Caledonian forest areas, including Abernethy and North Rothiemurchus. It "represents the more 'continental' East Central biochemical region, typically with W18b *Pinus sylvestris – Hylocomium splendens* woodland, *Vaccinium* spp. sub-community. This complex of woodlands is the most extensive area of native pinewood in the UK and comprises almost half the total area of ancient Caledonian forest in Scotland. In common with the rest of Scotland, the upper limits of the pine woodland are mostly

[27] The term 'ancient woodland' was originated by Oliver Rackham in 1971 but was resisted by the Forestry Commission until it was persuaded to adopt the term in the 1990s.

[28] https://www.ruralpayments.org/topics/all-schemes/forestry-grant-scheme/sustainable-management-of-forests/native-woodland/

[29] *The Management of Wild Deer in Scotland*, Report of the Deer Working Group (December 2019), para. 48 and footnote 37. https://www.gov.scot/publications/management-wild-deer-scotland/. The arable and unimproved grassland tiers are each £4 per hectare.

[30] https://cairngorms.co.uk/working-together/publications/publication/464/.

[31] SPAs are protected areas for birds in the UK, classified under the Wildlife & Countryside Act 1981.

[32] https://sac.jncc.gov.uk/site/UK0016412.

artificially depressed by grazing, but a more natural tree-line occurs at 640 m on Creag Fhiachlach[33]. This is the highest altitudinal limit of woodland in the UK, and consists of bushy stunted growth of Scots pine *Pinus sylvestris* admixed with juniper *Juniperus communis* of a similar stature. The pine woodland shows transitions to a wide range of other vegetation, including 91D0 Bog woodland on the forest mires. There are areas of unusual herb-rich pine woodland at Mar Lodge, similar to those described at Ballochbuie. This type of forest is of very restricted distribution in Scotland. The forest contains nationally important populations of capercaillie *Tetrao urogallus*, Scottish crossbill *Loxia scotica* and the osprey *Pandion haliaetus*."

- 91D0 Bog woodland, lying on gently-undulating glacial deposits in the foothills of the Cairngorms. It "has developed within the forest because the irregular glacial topography has led to marked variations in geomorphology and drainage pattern. The drier slopes and knolls support mature pine woodland and in the hollows between, wet mires with abundant bog woodland have developed. These stands are composed of mire vegetation, either M18 *Erica tetralix – Sphagnum papillosum* mire or M19 *Calluna vulgaris – Eriophorum vaginatum* mire, with a scattering of stunted pine trees and saplings. A good intact example of this community occurs at Mineral Well within Rothiemurchus forest. … The bog woodland appears to be stable, and the trees, although stunted, continue to grow. Other areas, including Inshriach, have been influenced by past management for commercial forestry, and recent restoration work has created the conditions required for wet woodland restoration. In total the hollows form an extensive area representing the largest example of Bog woodland in Scotland."

3.12. Few specific tree planting plans are available for the area under consideration in this paper. FLS land management plans[34] for the public-sector National Forest Estate contain details of every area to be restocked or planted within a 10-year period, but are not collated in terms of commercial vs. native woodlands at a regional level[35]. In any case, the relevant FLS East Region is much larger than the Cairngorms area, and FLS manage only Glenmore Forest around Loch Morlich, and Glen Doll forest.

3.13. The Scottish Forestry Map Viewer[36] shows, in the "FGS Woodland Creation – Options" layer, a few small areas of riparian plantings of native broadleaves along small sections of the Geldie and the upper Dee, and larger areas at lower altitude of native broadleaves and conifers around Dorback Lodge and in Gleann Chomhraig between Glens Feshie and Tromie. The "FGS SMF (Sustainable Management of Forests) Native Woodlands" layer shows areas up the Lui, Derry and Quoich, and another in Rothiemurchus. If the latter is the area below Rothiemurchus Lodge, this illustrates huge variety in SMF: the Rothiemurchus area has been completely felled (presumably of mixed or exotic species), and is currently impassable on foot, while the Lui/Derry/Quoich woodlands are classic areas of "ancient" Caledonian Forest with few direct signs of active management (which presumably takes the form of severe deer culling).

3.14. The latest (2020) assessment[37] of Scotland's protected sites (SSSI, SAC, SPA and Ramsar sites) "in favourable condition" shows that protected Woodlands, which account for about 20% of all protected-site habitats, have the second lowest proportion (64.3%) in favourable condition (after marine mammals, at 57.1%; birds were third, at 67.8%). It should be noted that (i) not all these Woodlands are relatively high-altitude, as in the Cairngorms, (ii) "favourable condition" actually includes two "unfavourable" conditions, which account for about a fifth of the "favourable" total for all site types,

[33] In Invereshie and Inshriach NNR, east of Feshiebridge, with the most natural altitudinal tree-line in the UK.
[34] See https://forestryandland.gov.scot/what-we-do/planning for these plans, both active and under consultation.
[35] Pers. comm. 13 May 2020 to Dave Windle from Euan Stewart, Planning Forester, FLS East Region, Huntly.
[36] scottishforestry.maps.arcgis.com/apps/webappviewer/index.html?id=0d6125cfe892439ab0e5d0b74d9acc18.
[37] https://www.nature.scot/information-hub/official-statistics/official-statistics-protected-sites.

and “Grazing – Over-grazing” is the second main negative pressure (after invasive species) on natural features on protected sites. This suggests that less than half of existing “protected” woodlands in the Cairngorms are in good ecological condition.

4. Arguments For and Against

4.1. The pros and cons of more woodland in the Cairngorms can be grouped into a number of categories, each of which should be considered in arriving at an overall judgement, after giving appropriate – and inevitably personal – weight to each category. In each case, the literature provides a wide range of scientific and other evidence, which however can be reduced by considering the additional woodland cover as being primarily in the first three or four of the woodland establishment types below, rather than in the remaining ones. Thus the economic and non-economic arguments considered in this paper can be confined to native species growing on mainly non-agricultural land (and, if planted, not on deep peat), with no commercial exploitation involved: this greatly simplifies things, though evidence is still patchy and uncertain.

4.2. It is also necessary to consider alternative land covers (and uses, where appropriate), since a judgemental view on future conditions implies at least a potential choice. Even if a future trajectory is considered “inevitable”, comparison can be made with the current situation, rather than – as is more intellectually satisfactory – with what alternative decisions might lead to. Thus, if possible, comparison “with/without” is better than “before/after”.

4.3. A further aspect of judgement is assessment of developments over time (the well-known economic problem of discounting): how should undoubted benefits some way into the future, and perhaps enjoyed by future generations, be weighed against undeniable costs incurred in the near term? A particular factor to be considered here is the likely impact of climate change on forestry and its effects. Naturally, this is subject to considerable uncertainty, both about climate change itself, and about these impacts. It has been suggested[38] that climate change could increase tourism potential (as measured by ‘good days’ in summer) of Scottish forests, especially upland ones, “resulting in a high demand for forest recreation in Scotland”. On the other hand, carbon sequestration may decrease, even turning forests (as a whole) into carbon sources due to heat-waves, fires and windthrow. There are also likely to be changes in disease risk.

4.4. Possible woodland establishment types for consideration here – arranged in a rough spectrum from “natural” to “artificial” – are as follows:

a) natural regeneration, with no fencing
b) natural regeneration assisted by fencing (probably for two or three decades) and perhaps scarifying
c) planting of native species, with no fencing, plus perhaps scarifying
d) fenced planting of native species
e) fenced planting of mixed but mainly native species
f) fenced planting of mixed but mainly non-native species
g) fenced planting of non-native species, e.g. Sitka spruce[39].

4.5. In all cases, in the Cairngorms, local control of deer numbers is probably necessary and indeed desirable, to allow natural regeneration in cases a) and c) above, and in other cases to offset incursions of deer

[38] Petr, M., Boerboom, L G J, Ray, D and van der Veen, A. (2015) Adapting Scotland's forests to climate change using an action expiration chart, *Environmental Research Letters.* https://iopscience.iop.org/article/10.1088/1748-9326/10/10/105005.

[39] Current planting grant conditions usually insist on a proportion of native species, but of course planting without grant may take place.

into fenced areas, or to assist tree spread into surrounding areas. Similarly, culling (by felling emergent saplings) of exotic species introduced by wind-transferred seed or otherwise, may be necessary and is probably desirable in most cases.

4.6. According to the recent Deer Working Group report, "*losses of revenue caused by damage to trees by deer and expenditure on deer control through culling and fencing, have been major costs throughout the development of the NFE* [National Forest Estate] *and remain so. The main problem is damage by deer browsing young trees, which can prevent or delay sapling growth. Browsing can also deform trees, reducing their potential to produce commercial timber. Past studies have estimated, for example, that browsing of Sitka spruce can result in revenue losses of 3-4% and browsing of leading shoots in losses of 1-8% of revenue. Recent evidence also indicates that repeated browsing of Sitka spruce can result in a revenue loss of 3-4%. … Surveys on the NFE in 2013 showed that 15-20% of young trees on the NFE had been damaged by deer. It was also reported that on the NFE between 2011 and 2013, around 11-12% of leading shoots suffered deer damage each year. … FLS aims on NFE land for damage by deer to be less than 10% of leading shoots each year.*" The report cited "*anecdotal evidence [which] strongly suggests tree species choices are influenced by the potential impact deer could cause: less palatable species are planted in preference to palatable species where the potential for high losses or damage from deer impact is anticipated*". It also reported that "*the most resilient species against deer browsing is Sitka spruce, which already accounts for just under 60% of all coniferous woodland in Scotland.*"

4.7. The location of any new woodland is important for most of the categories below, since this affects the advantages and disadvantages involved, because of distance from e.g. existing woodland, viewpoints, "source" habitats, etc. Thus final judgements may vary about more woodland in different glens. Similarly, as with multiple wind farms, "cumulative impact" needs to be considered, whether negatively ("too much" woodland in the landscape) or positively (a small isolated plantation looks unnatural, and/or offers limited ecological benefits).

4.8. The following categories or argument are considered here, although by no means equally:

i) *Commercial*: high timber prices (and lower farm subsidies), but long-term/risky
ii) *Economic*: major UK imports of wood and wood products, rural employment
iii) *Biological*: generally increased diversity of habitats and associated species (but fewer eagles?)
iv) *Hydrological*: slower water off-flows, higher water quality for e.g. salmon
v) *Climate Change*: carbon capture, for periods depending on tree species, wood usage, etc.
vi) *Landscape*: different, either "improved" or "spoiled"
vii) *Recreation*: more diverse (e.g. shelter) or obstructed (fences, views)
viii) *Cultural*: restoration of historic/pre-historic land cover (but perhaps loss of built heritage)

5. Commercial Arguments

5.1. For a private landowner or investor concerned mainly with the monetary returns on investing in further woodland (or re-investing by felling and re-planting), the important factors are (i) yields, (ii) prices (costs and revenues, including taxes and subsidies), and (iii) risk.

5.2. In general, *yields* of Scots pine, with a mean class of 10 (m^3 per ha per year, over the rotation), are considerably lower those for Sitka spruce, at 16[40]. Moreover, the maximum annual volume increment for Scots pine occurs at 60-100 years, compared to around 55 years for Sitka. There is some evidence[41] that an increasing proportion of birch in mixed managed stands reduces yield, due to the effect of birch

[40] McLean, P. (2019) *Wood properties and uses of Scots pine in Britain*, Forestry Commission Research Report. https://www.forestresearch.gov.uk/documents/7106/FCRP029_YFdfInO.pdf.

[41] https://www.sciencedirect.com/science/article/abs/pii/S0378112711003586.

competition. The timber quality of these softwoods is similar, but knots are more of a problem in Scots pine timber than in Sitka spruce.

5.3. In the case of the woodland types and locations considered in this paper, the main relevant *costs* are (i) fencing and (ii) deer culling, both of which may be considerable unless deer numbers in the Cairngorms as a whole can be reduced significantly. Forest subsidies (see Section 3.6) are available, but are complicated to obtain, are time-limited

5.4. Commercial *revenues* can probably be ignored, although an enhanced environment might in time lead to more guided wildlife tours (even if the revenues from these are likely to go to other than the woodland owner/investor).

5.5. *Risks* exist for all of the above, i.e. for yields (e.g. windthrow, disease), costs (e.g. fence failures) and revenues (e.g. timber and fuelwood prices), as well as other factors likely to be of importance to commercial operators, e.g. changes in taxation/subsidisation of operations and/or assets, political security

5.6. Given all of the above, for the woodland types and locations considered in this paper, it is concluded that:

- *Commercial profitability is NOT a significant argument in favour of more trees in the Cairngorms, and indeed (given landscape and other damage likely to be caused), commercial operations are to be discouraged.*

6. Economic Arguments[42]

6.1. For the wider economy, a number of points may be made additional to the commercial ones above, including (i) rural employment and (ii) the national trade balance. These topics are of course affected by national macroeconomic circumstances, including the general level of employment, and monetary conditions such as the exchange rate, which are here ignored – i.e. assumed roughly similar to recent conditions.

6.2. Rural economic analysis in Scotland is usually carried out in terms of officially defined Remote Rural, Accessible Rural and Urban areas[43]. The first of these covers nearly all of northern Scotland, including the Cairngorms, whose main settlements (Aviemore, Braemar, etc.) lie in economic terms somewhere between "extreme" Remote Rural areas (e.g. in the far North West, or the Islands), and "semi-accessible" ones (e.g. Aboyne, Nairn).

6.3. A 2010 study[44] of the economy of the Cairngorms National Park (CNP) showed that Tourism added about £115m to the overall CNP economy, while Forestry accounted for £11m. In employment terms, Agriculture and Forestry, and the Wood sector, were highly "salient" (i.e. relatively important) in the Park, compared to the GB average. Detailed employment data for about 500 subsectors showed that the two highest-ranking were "Hunting, trapping and game propagation" and "Botanical and zoological gardens and nature reserve activities", while "Sawmilling and planing of wood, impregnation of wood",

[42] This discussion ignores the economic effects of the current Covid-19 crisis, which is likely to affect the tourism and hospitality sectors in both urban and rural areas, though in ways unclear in the medium and longer terms.

[43] https://www.gov.scot/publications/understanding-scottish-rural-economy.

[44] Cogentsi (2010) *The Economic and Social Health of the Cairngorms National Park*. https://cairngorms.co.uk/resource/docs/publications/14092010/CNPA.Paper.1633.The%20Economic%20and%20Social%20Health%20of%20the%20Cairngorms%20National%20Park%202010%20-%20complete%20document.pdf. Figures 38, 43 and 44, and Section 8.3 "Forest Cluster", pp. 68-73. Although this study concerns the whole of the Park, and is now somewhat dated, it provides useful background information for consideration of more trees in the upper glens of the area.

"Youth hostels and mountain refuges", "Hotels", "Camping sites, including caravan sites", "Forestry and logging related service activities" and "Forestry and logging" were respectively at ranks 6, 10 to 13, and 15[45]. A cluster analysis which allocated 'overlapping' employment such as forest tourism suggested that Tourism accounted for about a third of the "employment salience" of Forestry and Logging.

6.4. Forests were judged "*to play a very significant role in the Park, but not as great in relative terms as in other less mountainous areas such as Argyll and Galloway*" (p. 65). However, "*Forest planting in more recent years [1971 to 2007] … in general has provided better access so that the forests contribute substantially to the tourist offering of the Park*" (p. 69). "*One sector which is shown as particularly large in relative terms is forestry contractors registered in the Park, but in fact the number of people recorded as employed is not large (but unfortunately statistically confidential). This is an informal sector and businesses in it overlap with those in agricultural contracting. Forest operations employ a significant amount of labour-only subcontracting, and use is made of gang labour with nationally and internationally recruited teams. The informality tends to lead to the suspicion that it may play a larger part in the real economy than the statistics reveal*" (p. 71).

6.5. The same study reports measures of deprivation for the 25 datazones within the Park. For employment-related deprivation (based on evidence from the benefits system), Braemar had the lowest level of such deprivation of all such localities, and Aviemore East/Glenmore the ninth lowest, both better than the Scottish average. In terms of deprivation measured by skills and education, Braemar area was fourth best amongst the 25 datazones, and Aviemore East/Glenmore the fourth worst (slightly better and worse than the Scottish average, respectively). For both measures, Aviemore Central was the most deprived datazone, though around and slightly worse than the Scottish average respectively. Thus socio-economic deprivation in the Park seems not to be a general problem[46].

6.6. In the Cairngorms, 'Agriculture, forestry and fishing' is the largest source of private-sector jobs (15%)[47], but this excludes self-employment (in Remote Rural Areas, a third of all employed males, and a sixth of employed females) and jobs in very small businesses, as well as the public sector.

6.7. The UK is a major importer of wood products, with imports valued at about £8.3 billion in 2019 (about 50% pulp and paper, and sawnwood and pellets 15-20% each), compared to £1.7 billion of exports[48] (with paper more than 50%). Wood from the Cairngorms area is overwhelming softwood, and nearly all will be used for pulp or fuel. However, demand for domestically produced wood pellets has stabilised in recent years as subsidy incentives have been withdrawn (production of wood pellets has fallen in the UK as a whole since 2015), and imports and sawmill by-products have offered alternative sources. The longer-term future for fuelwood will depend on both government action (e.g. renewals regulation, and subsidies) and on the overall energy market, i.e. on oil and gas prices.

7. Biological Arguments

7.1. Compared to alternative land covers in upland areas (e.g. rough grassland, heather, rock and gravel, water), woodland offers a different set of habitats for living organisms. These habitats depend on the type of woodland, i.e. natural or man-made, managed or unmanaged, and whether composed of native or non-native species. It has long been noted that intensively managed plantations of Sitka spruce offer limited opportunities for other species of plants, animals and insects, while ancient semi-natural woodland offers many more, especially for rare native species. However, for maximum ecological value,

[45] Many other high-ranking subsectors related to farming and food.

[46] According to a recent (2018) study of economic deprivation, Remote Rural Scotland is slightly better than Accessible Rural, and Accessible Rural is slightly better than urban Scotland, although there may be issues around job quality or preferences.

[47] This includes the important public sector, and self-employment, and jobs in very small businesses.

[48] Forestry Commission (2020) *UK Wood Production and Trade: 2019 Provisional Figures*. May 2020.

a mixture of woodland and other habitats is probably best[49], since it offers a variety of niches, including edges.

7.2. Native pine woodland – distinguished by the abundance of Scots pine – is a UK BAP Priority Habitat [50], and has many (at least 50) species of special conservation status, including such Red Data list lichens and bryophytes (e.g. mosses), as well as more obvious species such as the capercaillie and crested tit. Less obviously, mountain woodlands in Scotland found to support over 250 species of ectomycorrhizal (ECM) fungi, at least 90 occurring only in arctic-alpine habitats[51]

7.3. Compared with the current unwooded cover of the land likely to be affected by more trees in the Cairngorm glens, more trees are almost certainly likely to increase the biological value and interest (to scientists and lay people) of the areas concerned, by providing for habitat for birds[52] and (especially if fenced) smaller shrubs which are usually browsed out by deer. However, certain species, such as golden eagles, grouse and hen harriers, might suffer from loss of open moorland, especially to commercial afforestation[53]. Nevertheless, since considerable areas are likely to remain unwooded, and land cover over the Cairngorms as a whole would become more mixed, biological value would most likely be seen as better.

7.4. Certain types of woodland can improve the well-being of deer, particularly in poor weather. Management of the higher uplands in Scotland over recent centuries has forced red deer to spend most of their time on open ground, but the species is "naturally" – and presumably historically – a woodland species. While the "Ancient Caledonian Forest" is primarily thought of in terms of Scots pine and birch, the variety of tree species found in the gullies inaccessible to the larger browsers shows that a wide range of tree (and so also other) species may be expected to emerge and return – especially if wetland and flowing water is included – if appropriate measures such as fencing or deer culling are taken.

8. Hydrological Arguments[54]

8.1. Afforestation, particularly along river banks ("riparian"), is frequently considered beneficial in terms of the "water environment"[55]. In upland areas, these benefits include reducing water flows off land after heavy rainfall and prolonging off-flow during droughts[56], improving quality by reducing soil-load

[49] The term "best" is of course contestable, since there is no generally accepted ordinal measure of "value" in biological or ecological terms. However, diversity, the inclusion of rare species, and "naturalness" are usually regarded positively.

[50] https://www.nature.scot/sites/default/files/2018-02/Priority%20Habitat%20-%20Native%20Pine%20Woodlands.pdf.

[51] Hesling, E. and Taylor, A. (2014?) Mountain woodlands in Scotland found to support a treasure trove of fungal diversity, Scrubbers' Bulletin no. 11, Mountain Scrub Action Group. https://treesforlife.org.uk/docs/079_403__scrubbersbulletin11_1465573498.pdf.

[52] Between 1994 and 2018, the "smoothed woodland bird index" (covering all woodlands in Scotland, not only high-altitude ones) increased by 58% (but declined by 12% between 2017 and 2018, probably due to the "Beast from the East" in spring 2018). Capercaillie showed the biggest long-term decrease (-51%); other monitored woodland species decreased by under 10%. The equivalent index for upland birds decreased by 15%, with dotterel, curlew, black grouse, hooded crow and common sandpiper declining by more than 50%. NatureScot website (2019), *Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2018*.

[53] Whitfield, D. P. *et al.* (2001) The Effects of Forestry on Golden Eagles on the Island of Mull, Western Scotland, *J. Appl. Ecol.*, 38(6), 1208-1220. https://www.jstor.org/stable/827293?seq=1.

[54] This section has benefitted greatly from references supplied by Roger Owen.

[55] The landscape and perhaps cultural aspects of this environment are more appropriately considered in different sections.

[56] For "soil water repellancy" in forests of Scots pine (in Poland), especially after wildfire, see Hewelke, E. *et al.* (2018) Intensity and Persistence of Soil Water Repellency in Pine Forest Soil in a Temperate Continental Climate under Drought Conditions, *Water*, 10, 1121. https://www.mdpi.com/2073-4441/10/9/1121/htm.

pollution (and its acidic content), increasing nutritional content for fish and other species through supplies of vegetation and insects, and maintaining better temperatures for e.g. salmon.[57] Naturally, these effects must be compared with what would otherwise exist as land cover over the same area, and considered in the light of the likelihood of fire, climate change, disease, etc. It is also necessary to consider the timescale of any benefits, and possible negative impacts from efforts to establish more trees, as from ditches formed in peaty ground.

8.2. In terms of controlling water flow, research suggests that

- "*the greatest attenuation potential occurs for the smaller events achieving predicted flood peak reductions approaching 60–70% as complete forest coverage is attained. The effects are less pronounced in the case of the larger events, where woodland coverage of c. 80% was reported to effect a 30% reduction in peak flow values*" [58];

and that

- "*Floodplain forest restoration can reduce peak discharge at the catchment outlet by a combination of the processes described in §§27–29. For an event with AEP of 3% (RPO: all but extreme high flows), peak discharge was reduced by up to 19% under mature forest. In areas where only 20–35% of the overall catchment area was restored to forest, peak discharge was reduced by 6%*"[59]

8.3. Non-native afforestation – presumably mainly for commercial reasons – is frequently thought to have adverse effects on water quantities and quality, partly due to establishment methods, and partly from the relative lack of natural undercover such as shrubs, which, like the roughness of the ground, may be as important as the effects of the trees themselves in holding water on leaves and on the ground.[60] Afforestation fencing seems likely to improve the hydrological benefits, by excluding deer and thus promoting vegetation cover of several types.

8.4. In the Cairngorm glens and hill shoulders, natural regeneration by Scots pine, birch and other native species seems highly likely to provide most of the above benefits, though the effect must be proportional to the area and riparian lengths involved; heavy downpours high upstream will not be much affected by lower-level tree establishment.[61]

9. Climate Change Arguments

9.1. A few basic points about climate change and greenhouse gases (GHGs) may be made:

- Climate change (warming, and perhaps more "extreme" events such as floods and gales) in the next few decades seems inevitable, given that the world (governments, producers, consumers) are not taking sufficient action to reduce GHG emissions.
- There are *various types* of GHGs, including water vapour (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), ozone (O3), and fluorinated gases (e.g. CFCs), each with different effects on atmospheric warming. For example, the mean half-life of methane is 9.1 years, while that of CO2 is around 100 years. This has led to the use of CO2 equivalent (CO2eq) as an overall measure, based on the "global warming potential" of each GHG.

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[57] *Opportunity mapping - woodland creation for water objectives*, Forest Research, Forestry Commission. https://www.forestresearch.gov.uk/research/forest-hydrology/opportunity-mapping-woodland-for-water/

[58] Iacob, O., Rowan, J. S., Brown, I. and Ellis, C. (2014) Evaluating wider benefits of natural flood management strategies: an ecosystem-based adaptation perspective. *Hydrology Research*, 45 (6): 774–787.

[59] Dadson, S., Hall, J. W. *et al.* (2017) A restatement of the natural science evidence concerning catchment-based 'natural' flood management in the UK, Proc. Roy. Soc. A. https://doi.org/10.1098/rspa.2016.0706.

[60] Calder, I. R., Harrison, J. A.; Nisbet, T. and Smithers R. (2008) *Woodland actions for biodiversity and their role in water management*. Lincolnshire: Woodlands Trust.

[61] Consider the washing away in 1956of the newly erected Lui bridge, and lower-level damage, by water descending from high up on Ben Macdhui.

- 1kg of CO2 contains 0.27kg of carbon (C), and this ratio, or its reciprocal 3.70, must be borne in mind when comparing statistics using different units of measurement or estimation.
- *Stocks* of carbon must be distinguished from *flows*, i.e. the rates at which carbon is emitted or sequestered from stocks. Thus, frequently cited estimates of how much carbon is stored in peatlands (e.g. 2500 Mt in Scotland, mainly in blanket bog[62]), are less important than the rate at which this carbon is released each year, now or in the future.
- Efforts at combating climate warming by changing land cover on a small area are of course highly *marginal* in global terms[63]; but this can also be said for Scotland or the UK as a whole, or even – given that there are many other GHG sources and sinks – for world land use change. This does not invalidate local efforts.
- Assessing a change in land cover, such as from moorland to trees, from the point of view of global climate change (as opposed to local micro-climate effects), involves several considerations, notably the *relative* performances of the two (or more) alternative land covers in terms of net GHG flows, taking into account not only vegetative cover but the effects of animals living in the area under either scenario, e.g. methane emissions by ruminants. If trees are planted, the effects of soil disturbance and machinery use at the initial stage should be taken into account, as also the likely behaviour of land cover and land use given longer-term expected climatic changes, e.g. atmospheric warming (with faster growth but less snow), higher wind speeds, more disease, etc.

9.2. The drive to tackle climatic change by reducing carbon emissions and increasing carbon sequestration has focussed much attention on the potential benefits of trees as a "natural" and often popular way of accelerating the latter process[64]. The rate at which trees absorb carbon (in the form of carbon dioxide, CO2) is of course crucial in this respect, and varies markedly by species, altitude, attitude (e.g. north-south), etc. However, the relationship of trees and climate (both local and global) is complex, and involves not only the well-known capture of carbon through photosynthesis, but also the emission by trees of methane, volatile organic compounds (VOCs) including the hydrocarbon isoprene, and terpenes[65], and a reduced albedo effect (less sunlight reflection, and hence greater warming). In the longer term, the eventual fate of timber grown in forests also matters; wood-burning after a relatively short growing period cycles carbon back into the atmosphere, while carbon locked up in construction use or in slow-growing species delays this effect for centuries.

9.3. Given the above complexities, the net effect of afforestation in general on global climate is thus uncertain even in sign (though probably positive), and certainly in magnitude. While focus on a particular species (e.g. Scots pine, or birch) and area (i.e. the Cairngorm glens) might suggest scope for some simplification and precision, only a limited amount of relevant research has been carried out within these constraints, thus offsetting the potential advantage of concentration.

9.4. Recent research[66] by scientists in Stirling and Aberdeen has recorded stocks and flows of carbon resulting from the planting of birch at four heather moorland sites in the Cairngorms (near Tomintoul)

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[62] Ferretto, A., Brooker, R. Aitkenhead, M., Matthews, R. and Smith, P. (2019) Potential carbon loss from Scottish peatlands under climate change, *Regional Environmental Change*, 19, 2101–2111. https://link.springer.com/article/10.1007/s10113-019-01550-3

[63] This could be said for almost all the areas of argument in this paper (economic, biodiversity, etc.).

[64] In recent elections, political parties have seemed to compete with ambitious planting targets in their manifestos, though usually alongside even more ambitious intentions as regards carbon capture storage (CCS), and relative silence on re-starting the fuel duty escalator.

[65] *Nature,* 15 January 2019: "How much can forests fight climate change?". https://www.nature.com/articles/d41586-019-00122-z#ref-CR1".

[66] Friggens, N. *et al.* (2020), Tree planting in organic soils does not result in net carbon sequestration on decadal timescales, *Global Change Biology*, https://www.stir.ac.uk/news/2020/july-2020/tree-planting-does-not-always-boost-ecosystem-carbon-stocks-study-finds/, and https://doi.org/10.1111/gcb.15229.

and elsewhere, and Scots pine at Ballogie on Deeside. They recorded a marked (e.g. 58%) reduction in soil organic carbon stocks (due to soil respiration, itself due to mycorrhizal activity) 12 years after planting, a decline not compensated for by the carbon gains in the growing trees. After 39 years, carbon sequestration in the birches had offset the soil losses, but with no net gain in the overall ecosystem carbon stocks. The Scots pine planting showed similar results after 12 years. The authors conclude that "*recommendations … that 34% of Scotland's land area may have potential for woodland expansion … risk jeopardising soil (and ecosystem) C stocks on the extensive heather moorlands and heathlands with organic horizons of <50 cm depth*". For the purposes of this paper, it should be borne in mind that (a) planting trees (and fencing against large herbivores) may have effects different from natural regeneration (whether assisted e.g. by scarifying or not), (b) the study sites are generally at lower altitudes than the sides of the Cairngorm glens contemplated here (e.g. 200m and 450m, compared to 650m), and (c) long-term (e.g. 39 years) results for Scots pine are not yet available.

9.5. The carbon cycle for Scots pine has been reported in several papers[67]. For upland Scots pine of yield class 8, with a normal rotation of 70 years, above-ground harvestable carbon content is reported to maximise at 74 t/ha at an age of 140 years[68], compared to 78 t/ha at 110 years for Sitka spruce and 61 t/ha for upland birch (and somewhat higher values for these and other species in lower locations). This implies accumulation at a rate of some 0.5t/ha/yr, and more if below-ground accumulation is added. The rate of net carbon sequestration by British forests in 1990 was estimated at around 2.25 Mt per year[69]. With about 2.75 Mha of UK woodland at that time[70], this implies an average sequestration rate of about 0.82 t/ha/year, across all tree types and sites.

9.6. While most concern over afforestation on peatland has focussed on deep peat such as in large-scale areas in the Flow Country and in the Borders, the arguments also apply to shallower peat areas and to mineral soils, as found in the Cairngorms. According to a recent (April 2020) position statement on "*Peatland and Trees*" from the IUCN UK Peatland Programme: "*The optimum solution for carbon and biodiversity is to maintain non-afforested peatlands, restore forested peatland to open habitat and secure new tree cover on non-peat soils or areas of benefit to peatlands … Recent studies have suggested that for organo-mineral soils this balance may be positive in the short term – the carbon gain in the trees outweighs any peaty soil losses, even longer term, into a second rotation. Whilst there is evidence that on some shallow peats that there is a net carbon gain from trees on the peat during the afforested stage the overall carbon balances are unclear taking into account the effect of initial soil preparation, planting, harvesting restocking and final clear-felling*." [71] Moreover, "*Forestry policy does divert new planting away from deep peat and allows for peatland restoration with many successful schemes but our position statement highlights that policy still allows for extensive restocking to occur on both deep and shallow peat*."[72]

9.7. A recent paper[73] on planting new woodlands in Scotland to meet national climate change commitments suggests that "*Extensive establishment of lower yielding trees on low-quality ground, with organo-*

[67] Wegiel, A. and Polowy, K. (2020) Aboveground Carbon Content and Storage in Mature Scots Pine Stands of Different Densities, *Forests*, 11, 240. https://www.mdpi.com/1999-4907/11/2/240/pdf

[68] Thompson, D. A. and Matthews, R. W. (1989) *The Storage of Carbon in Trees and Timber*, Research Information Note no. 160. Forestry Commission. https://www.forestresearch.gov.uk/documents/4749/RIN160.pdf

[69] Cannell, M.G.R. (1999), Growing Trees to Sequester Carbon in the UK: Answers to Some Common Questions, *Forestry*, 72(3), 237-247.

[70] https://www.forestresearch.gov.uk/documents/5471/Complete_FS2018_74CYDs1.pdf

[71] https://www.iucn-uk-peatlandprogramme.org/sites/default/files/2020-04/IUCN%20UK%20PP%20Peatlands%20and%20trees%20position%20statement%202020.pdf.

[72] https://www.iucn-uk-peatlandprogramme.org/news/peatland-trees-position-statement-released.

[73] Matthews, K.B. *et al.* (2020) Not seeing the carbon for the trees? Why area-based targets for establishing new woodlands can limit or underplay their climate change mitigation benefits, *Land Use Policy*, 97. https://doi.org/10.1016/j.landusepol.2020.104690.

mineral soils could … result in net emissions that persist for decades", and concludes that (the current) "*combination of land manager preferences, budgetary limitations, and the unintended consequences of other land use or agricultural policies can lead to the afforestation of less productive land, on soils with higher organic matter contents, that in the worst cases results in net emissions of carbon for decades*". The paper thus argues that 20-year goals require the use of "*supplementary carbon storage tonnage targets*" for lowland planting (which would favour short-rotation species such as Eucalypti, and "production" Douglas Fir and Sitka) rather than nation-wide area-based targets.

9.8. The above suggests that there is no strong argument based on climate change for active tree establishment in the Cairngorm glens. The scientific evidence based on holistic (ecosystem) studies suggests that the GHG effects are ambiguous but probably weak. Even natural regeneration may result in adverse soil effects which offset the absorption of carbon into the trees themselves. Moreover, warmer temperatures may alter carbon flow rates, and seem certain to increase disease risks. Finally, changes in human (and animal) behaviour, such as increased visitation rates, in an altered climate may have indirect GHG emission effects.

10. Landscape Arguments

10.1. More woodland obviously creates a different landscape, whether viewed from amongst the trees themselves, or from outside, e.g. on an approach up the glen, or from a higher viewpoint. As with most other aspects of argument, whether such a change is regarded as an improvement or not depends on personal judgement, as well as the type and location of the additional trees. Moreover, while "beauty is in the eye of the holder"[74], the brain is engaged in a number of ways, such as form, colour, memory of previous visits, and historical or scientific awareness (see other sections). While many aspects of landscape are perceived / experienced by sight, other senses may be involved, such as those involved in smell, tranquillity, noise, and exposure to wind, rain and snow) [75]. And of course, in Scotland, seasonal and indeed day-to-day or even hour-to-hour variation plays a huge part in forming the appearance, if not the basic shape, of the landscape at any one location.

10.2. Experiential factors relating to landscape can be grouped into aesthetic ones (such as scale, diversity, texture, colour, balance and movement), and perceptual ones (e.g. wildness, security, light quality, beauty and scenic attractiveness).

10.3. Aesthetic characteristics of forests in terms of attractiveness to the general public have been studied, with differing results, perhaps depending on methodology (e.g. on-site surveys or pictorial/photographic representation), forest type (e.g. young or old), etc. In Sweden, "the attractiveness of young forest, i.e. perceived aesthetic beauty, was mostly correlated with sense of easy access and safety. Thus, presence of deadwood, understory and high stand density were the most important factors towards negative attitude about the forest. … The results also indicated a correlation between aesthetic and ecological values within the group of respondents, who were not educated in forest ecology." [76]

10.4. Further, the loss of open moorland which is characteristic of much of the Cairngorms can be viewed in different ways. Famously, the ecologist Frank Fraser Darling considered such landscape as "*wet desert*", based on its lack of biodiversity. On the other hand, there is widespread admiration for its open views and changing colours, especially the purple of the autumn heather. In work to establish Wild Land

[74] See Murray (1962), *op. cit.*, pp. 9-10, where "criteria" for the "beauty of highland country" are briefly considered.

[75] Tudor, C. (2014) *An Approach to Landscape Character Assessment*, Natural England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691184/landscape-character-assessment.pdf.

[76] Golivets, M. (2011) *Aesthetic Values of Forest Landscapes*, MSc Thesis, Southern Swedish Forest Research Centre, Swedish University of Agricultural Sciences. https://www.researchgate.net/publication/259232123_Aesthetic_Values_of_Forest_Landscapes.

Areas, a survey of public perceptions[77] of landscape "attributes" was carried out, for the general public (the 'main sample'), for National Park residents, and for environmental organisation members. "Natural broadleaf or coniferous woodlands" scored positively for wildness, as did (to a lesser degree) "semi-natural woodland, bracken or shrubs", while "plantation forests (non-native conifers)" scored negatively. The top three attributes contributing to positive perceptions of wildness by the main and organisational sample respondents tended to mention "noticeable features" (not man-made), while residents included 'natural broadleaf or coniferous woodland'. However, "naturalness" was often associated with "open areas", and the general attitude towards large future areas of relatively young pinewood and birchwood is not entirely clear.

11.Recreational Arguments

11.1. Following the Land Reform (Scotland) Acts of 2003 and 2016, public access to land is now largely uncontentious, and is certainly accepted in nearly all the areas considered in this paper. The Scottish Outdoor Access Code explicitly says "You can exercise access rights in forests and woods" (page 93), and the only references to "trees" in the Code refer to temporary limitations on these rights due to tree felling and planting.

11.2. Whether trees are preferred by walkers and cyclists to open landscape as locations for recreational activity[78] is more contentious[79]. Folklore often represents forests as dark and dangerous places, associated with dangers such as disorientation, and attack from wild beasts or other humans[80]. On the other hand, they offer shelter from the elements, and potentially a richer perceptual experience than moorland. They are also being promoted as a site to promote mental as well as physical health, e.g. via "forest bathing"[81]. Most studies show that visual diversity is valued highly, both within stands (mixed species, different tree heights, etc.) and – from more open ground – between stands[82]. Also desired is a degree of "visual transparency", allowing geological and topographic features to be observed.

11.3. Fencing is obviously a consideration in terms of recreational access, with gates or stiles becoming necessary, both being particularly awkward for cyclists. Visual enjoyment may also be impaired, particularly if inappropriate colours are used, directional notices are posted, or anti-strike markers for birds are considered necessary.

11.4. If the visual presence of other visitors is considered negatively, then afforestation brings benefits by obscuring the sight of others in the area[83].

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[77] *Public Perception Survey of Wildness in Scotland* (2012) Report for Loch Lomond & The Trossachs National Park Authority, Cairngorms National Park Authority & Scottish Natural Heritage in association with Research Now. See https://www.nature.scot/public-perception-survey-wildness-scotland, Figures 5.7 and 5.8.

[78] Apart from mode of travel, the nature and purpose of such activity can of course vary widely. One Study distinguishes between Getaway, Sport/Recreation, Timber, Picnic, Walking, Wildlife and Tourism. Lee, T. (2001) *Perceptions, Attitudes and Preferences in Forests and Woodlands*, Forestry Commission Technical Paper no. 18. https://www.forestresearch.gov.uk/documents/6921/FCTP018.pdf.

[79] One argument against setting up National Parks in Scotland around 1950 was put by the Forestry Commission, whose Chairman, having read the 1945 Dower Report on National Parks in England and Wales (the Ramsay Report did a similar though less successful job for Scotland) feared that 'Mr Dower had entirely missed the point that there was much more of interest in walking through a wood than over a bare hillside' (Smout, 2000, p.160).

[80] The term "savage" derives from the Latin "sylva" i.e. forest or grove.

[81] See www.visitscotland.com/blog/nature-geography/forest-bathing/, for "11 beautiful places to go forest bathing in Scotland", including Abernethy and Glen Tanar. See also 3 sites on forestryandland.gov.scot/blog/forest-bathing-top-3.

[82] Filyushkina, A. *et al*. (2017) Preferences for Variation in Forest Characteristics: Does Diversity Between Stands Matter?, *Ecol. Econ.,* 140, 22-29. http://macroecointern.dk/pdf-reprints/Filyushkina_EE_2017.pdf.

[83] On the other hand, some may prefer such sightings, as reducing perceived forest risk (see a previous paragraph).

11.5. Some specialised recreational activities, such as orienteering, or even deer shooting, may suggest additional considerations as regards afforestation.

12. Cultural Arguments

12.1. In the ecosystem literature, the "services" provided to humans by the natural environment are conventionally categorised into supporting (e.g. nutrient cycling, soil formation), provisioning (e.g. of food, timber), regulating (e.g. carbon sequestration, water purification), and cultural services. Many of these services, as applied to areas currently consisting mostly of open grassland or moorland but available for planting or regenerating trees, have been analysed in previous sections. Cultural services can be classified in various ways, e.g. aesthetics, natural heritage, spiritual and religious values, recreation, educational and inspirational and sense of place[84]. In this paper, recreation is treated separately (see previous section), but the other aspects are considered here, collectively.

12.2. Preserving or restoring historical[85] land cover and use immediately raises the issue of which historical period(s) to consider. For a variety of reasons, including climate, the rural economy and government policy, land cover in Scotland has varied greatly over past centuries, from being largely wooded to almost completely lacking in trees a hundred years ago[8687]. And at any one time, conditions have varied greatly

[84] See e.g. http://www.teebweb.org/resources/ecosystem-services/ and https://www.millenniumassessment.org/documents/document.319.aspx.pdf.

[85] Present-day "culture", such as the use of land for recreational visits, is treated in a different section.

[86] See paragraph 2.7 above for two widely differing academic opinions.

[87] Oosthoek, K. Jan (2013) *Conquering the Highlands: a History of the Afforestation of the Scottish Uplands*, ANU E Press. http://library.oapen.org/bitstream/id/66bbaa04-1f6b-444c-8b41-e021cc3b81ac/459902.pdf.

from place to place[88]. Changes around the Cairngorms may have been more abrupt, and some more recent (e.g. wartime fellings), but are likely to have been similar in nature to those elsewhere, taking into account the effects of climate and altitude, e.g. more Scots pine and less oak. The larger landowners (e.g. the Dukes of Atholl, Gordon, Fife), and their factors, may have had a greater influence than in the west: Smout *et al.*[89] cite several episodes from Badenoch, Deeside, etc. involving tensions between the various landed interests of forestry, farming and sport. Perhaps, even with twentieth-century fellings (and fires, and plantings), the Cairngorms have seen rather less historical change than elsewhere: several old woods (parts of Rothiemurchus, Ballochbuie, Glentanar, Feshie, Abernethy) have been saved. However, even there the effects of excessive deer numbers became obvious until more enlightened land management, some by new conservation-minded owners, arrived in recent years.

12.3. There is also a distinction to be made between historic land cover and built cultural heritage. The latter mainly comprises buildings in various states of current repair, from well-maintained weatherproofed lodges and bothies to complete ruins almost indistinguishable from the surrounding ground, but it also includes bridges, dykes, drains, etc. Historically, of course, the two are connected:

[88] Thomas Pennant, in his *Tour of Scotland* (1771), observes, in relation to August 1769: On the Duke of Athol's estate, "the forests, or rather chases (for they are quite naked) are very extensive, and feed vast numbers of Stags". In Glen-Tilt, "The sides of many of these mountains is [sic] covered with fine verdure, and are excellent sheep-walks: but entirely woodless … Cross the Dee near its head. The rocks of *Brae-mar*, on the east, are exceedingly romantic, finely wooded with pine. The cliffs are very lofty, and their front most rugged and broken, with vast pines growing out of their fissures. On the North side of the river lies Dalmore [now the site of Mar Lodge], distinguished by the finest natural pines in Europe, both in respect to the size of the trees and the quality of the timber. Single trees have been sold out of it for six guineas [over £1000 in current terms]: they were from eighty to ninety feet high, without a collateral branch, and four feet and a half in diameter at the lower end. The wood is very resinous, of a dark red color [sic], and very weighty. It is preferable to any brought from Norway, and being sawn into plank on the spot, brings annually to the proprietor a large revenue. On the opposite side of the river is the estate of Inverey, noted also for its pines, but of a size inferior to those of Dalmore. When the river is swelled with rains, great floats of timber from both these estates are sent down into the Low Countries [i.e. the lower Dee, presumably]. The views from the skirts of the plain, near *Invercauld*, are very great; the hills that immediately bound it are cloathed with trees, particularly with birch, whose long and pendent boughs, waving a vast height above the head, surpass the beauties of the weeping willow. The Southern extremity is pre-eminently magnificent; the mountains form there a vast theatre, the bosom of which is covered with extensive forests of pines: above, the trees grow scarcer and scarcer, and then seem only to sprinkle the surface; after which vegetation ceases, and naked summits of a surprizing height succeed, many of them topped with perpetual snow; and, as a fine contrast to the scene, the great cataract of Garval-bourn [Garravalt], which seems at a distance to divide the whole, foams amidst the dark forest, rushing from rock to rock to a vast distance. … crossed the Dee on a good stone-bridge, built by the Government, and entered on excellent roads into a magnificent forest of pines of many miles extent. Some of the trees are of a vast size; I measured several that were ten, eleven, and even twelve feet in circumference, and near sixty feet high, forming a most beautiful column, with a fine verdant capital. These trees are of a great age, having, as is supposed, seen two centuries. Their value is considerable; Mr Farquharson informed me, that by sawing and retailing them, he has got for eight hundred trees five-and-twenty shillings each: they are sawed in an adjacent saw-mill, into plank ten feet long, eleven inches broad, and three thick, and sold for two shillings apiece." Pennant goes on to mention many species observable here, including "game" (which "abounds"), green plovers, whimbrels, snow-flecks (snow buntings, which "assemble in great flocks"), eagles, peregrine falcons, goshawks, foxes, rooks, and "the greater bulfinch" [the capercaillie]. More generally, Pennant remarks that "… in North Britain the pine forests are become very rare: I can enumerate only those on the banks of Loch-Rannoch, at Invercauld, and Brae-mar; at Coygach and Dirry-Monach [in Sutherland], an a few other places. And in 1772, Pennant recalls that John "*Taylor*, the water[man]-poet [1578-1653], speaks in high terms of those [i.e. pine trees] in *Brae-mar*, 'That there are as many as will serve to the end of the world, for all the shippes, carracks, hoyes, galleys, boates, drumlers [a type of yacht], barkes and water craftes, that are now in the world, or can be these forty years'". Would that it had been so!

[89] Smout, T.C., MacDonald, A.R. and Watson, F. (2005) *A History of the Native Woodlands of Scotland, 1500-1920*, Edinburgh University Press (e.g. pp. 143-147)

those who lived in these areas managed the land in terms of their agriculture, hunting and other pursuits.

12.4. Modern practice – as required in grant applications – requires the consideration of pre-existing built features in an area to be afforested, and usually their preservation by avoidance[90]. With grant-assisted planting, this would presumably continue via site-specified conditions, though occasional monitoring and perhaps enforcement would be needed. Natural regeneration would require occasional clearance of sites by removing saplings from buildings themselves, and close by, in order to ensure non-disturbance by roots.

12.5. As regards general land cover, there is obvious potential conflict, in terms of cultural appreciation, between open moorland such as "traditional" heather– largely a nineteenth-century "construct" – and semi-natural pinewood intended eventually to assume an "ancient" character. What type of wooded landscape is to be preferred depends of course on opinions and mind-sets which are formed by a wide variety of influences, from aesthetic tastes (as derived from e.g. educational sources such as schooling, books, films[91], etc.[92]) to political stances, e.g. over land ownership and rural sport.

13. Possible NEMT positions

13.1. This paper seeks to present information and arguments related to more woodland in the Cairngorms, and does not seek to set out in detail possible NEMT positions or actions in the area or elsewhere in the North-East. However, the following aspects might be considered:

i) The desirable extent of such woodland, both in general, and in specific areas
ii) The nature of such woodland, e.g. in terms of location (e.g. spacing), species, etc.
iii) Access arrangements to and into such woodlands, e.g. tracks, paths, fencing gates

13.2. NEMT might also push for improved woodland management, in terms of:

iv) better felling practices, e.g. less biomass wastage (e.g. stumps, roots or woodpiles), more brash removal (or treatment to encourage faster degradation), less ditching/gouging, old fencing removal, tidying-up/removal of old machinery, etc.
v) new management methods, e.g. less destructive machinery
vi) better/more extensive access arrangements, e.g. stiles, parking places, restored or new paths

13.3. It might also be useful to consider "case studies" for or against more cover in specified glens (Atholl, Geldie?), for more detailed consideration.

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[90] Consider the clearings left around old settlements below Bennachie, amongst trees originally planted for commercial purposes.

[S] See https://www.visitscotland.com/blog/films/iconic-film-locations-in-scotland/ for 8 landscapes including those used in the films *Skyfall*, *Braveheart* and *Harry Potter*, all with little woodland content.

[92] In https://www.visitscotland.com/see-do/landscapes-nature/iconic-scottish-views/, only two of the 12 "Iconic Scottish Views" involve trees: Scott's View (in the Borders), and the Queen's View, overlooking Loch Tummel. In https://thatadventurer.co.uk/37-beautiful-landscapes-scotland/, only 4 of the 37 – Scott's View again, Glen Affric, the Trossachs, Loch Maree – have trees as a major component, although a few others – Glens Shiel and Torridon – feature them more marginally. Postcards and wall calendars offer further guides to popular tastes, and may feature trees more frequently, the latter perhaps because (deciduous) foliage carries clear seasonal indications.

Annex: Trees in Cairngorms Glens

This annex lists woodlands in some of the main upper glens and their shoulders around the Cairngorms. Most glens harbour "refugee" birch, hazel, rowan, etc. in small gullies and on exposed rock faces, as well as deer-browsed seedlings in heather, and limited amounts of juniper, alder, etc. Other than from the Caledonian Pinewood Inventory (CPI)[93], data and grid references do not purport to be accurate. SNW = semi-natural woodland areas. (D)FP = relatively recent (de-)fenced plantation; FE = fenced exclosure (unplanted). Updates and corrections welcome!

Glen Ey (Mar): FP above Colonel's Bed (083868, ~2000); FEs at Piper's Wood (098856, 1987) and (around residual larch) Altanour (082823, 2015)

Glen Dee (Linn of Dee to Corrour, NTS): CPI areas (ha): DFPs at 060900 immediately N of the Linn, at 053892 S of the river, at 030895 (badly wind-thrown) halfway to White Bridge, and at 995895 (on slope W of river); SNWs at 050897 on Sgor Mor above and below WB track; new riparian fencing/planting at 000896; some (but not much?) natural regen outwith these areas.

Glen Geldie (White Bridge to Geldie and Bynack Lodges, NTS): DFPs at 005875 (Ruigh nanClach) W of river, and at 985878 halfway to Geldie Lodge; a very few remnant Scots pine (and beech?) at Bynack Lodge 000856; new riparian fencing/planting at 975875

Glen Lui (Linn – Derry Lodge – Robbers Copse, NTS): CPI areas (ha) 147, 420, 904, 1471. DFPs N of Linn car park, and alongside river below Black Bridge (BB), beside track and W of river beyond BB, near Derry Lodge, and at Robbers' Copse; SNWs at 072791 (Doire Bhraghad) on Creag Bhalg, at 060906 on Carn an 'Ic Duibhe, and above Luibeg Cottage to Robbers' Copse< Some regen elsewhere.

Glen Derry (Derry Lodge towards Coire Etchachan, NTS): CPI areas (ha) 235, 454, 1148, 1837: DFPs (1950s?) DFPs E and N of Lodge (~1950), and at 030975in mid-glen (late 1990s); SNWs E and W of river up to dam footbridge 030960. Some regen on Carn Crom up to about 800m.

Glen Quoich (NTS): CPI areas (ha) 418, 648, 1160, 2226: SNWs SW of river above Punchbowl, in Dubh Ghleann, and in mid-Glen (Am Beitheachan); DFPs SW of river towards Clash Fhearnaig (CF), in lower Dubh Ghleann, and NE of river from Punchbowl to opp. CF

Ballochbuie (Balmoral): CPI areas (ha) 775, 260, 990, 2025: DFPs immediately S of Invercauld Bridge (185905); SNWs in Glenbeg (190885)

Feshie (Povlsen): CPI areas (ha) 960, 1923, 3546, 6429: SNWs in upper glen as far as 882890

Rothiemurchus (around CC Footbridge 927079; Grant): CPI areas (ha) 1744, 1721, 1674, 5139: SNWs (incl. juniper, and riparian species) towards Lairig (927050); DFPs (incl. felled exotics) around R. Lodge (952068)

Glenmore (FLS): CPI areas (ha) 389, 651, 2850, 3890: DFPs in wide area around Lodge; some SNWs alongside road (945105); some regen below N corries

Abernethy (RSPB): CPI areas (ha) 2452, 3001, 4865, 10318: Mainly DFPs around Forest Lodge; some SNWs (and plantings?) on fringes

Glen Avon: CPI areas (ha) 5, 20, 304, 329. FPs W and N of Linn of Avon just above Inchrory; scrub birch in lower Glen Builg?

Other CPI areas: Glen Brown (above Bridge), Allt Cul (S of Culardoch), Glen Tromie

Notable glens with little woodland include: Glens Tilt, Loch, Gairn, Caenlochan, Einich.

[93] CPI areas: core, regen, buffer and total. See map and table in this Annex.

Map: Cairngorms Areas in Caledonian Pinewood Inventory

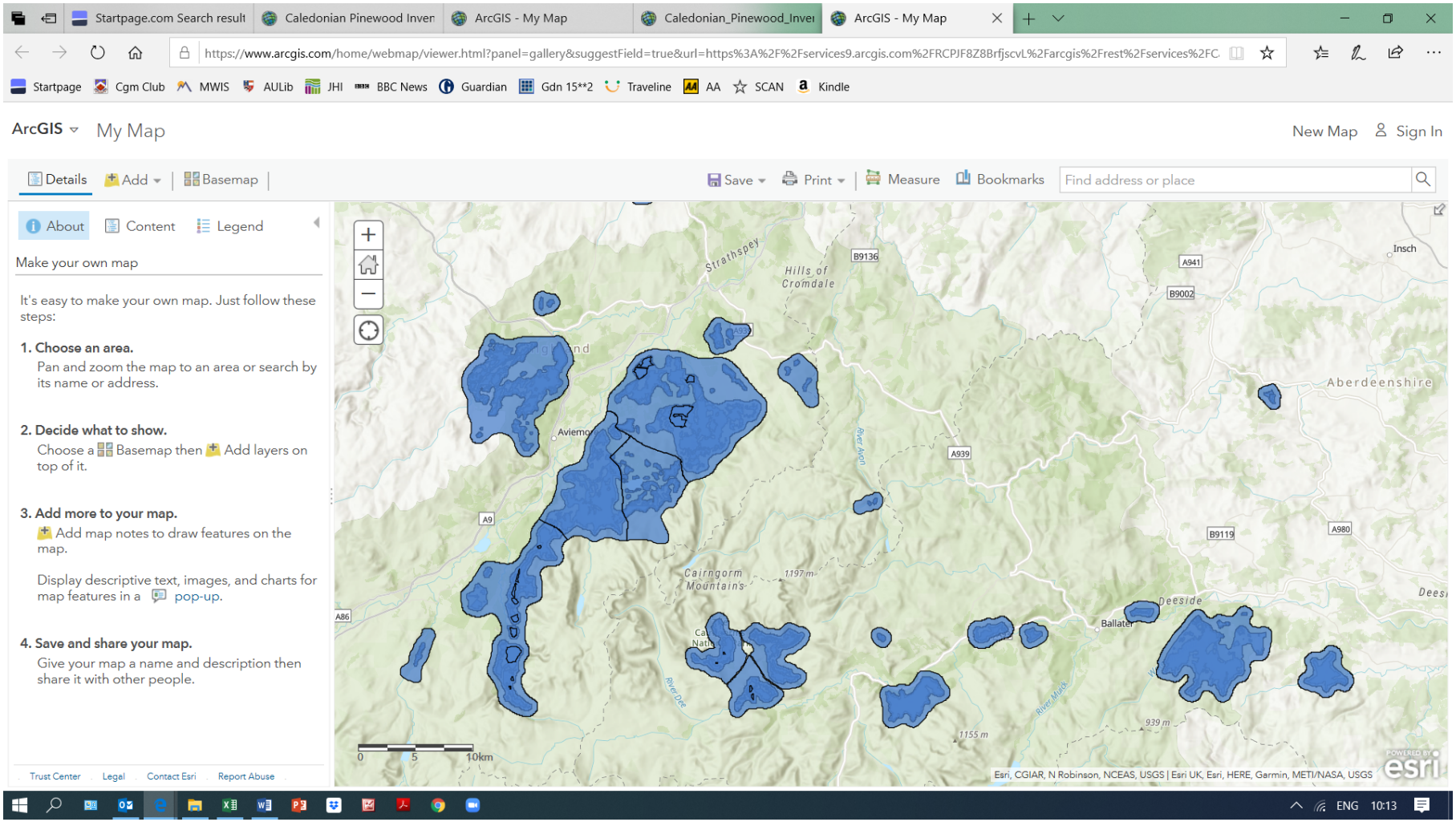

Table: Cairngorms Areas in Caledonian Pinewood Inventory

Map: Caledonian_Pinewood_Inventory: Cairngorms Areas																
PINENAME	Totals	Glen Derry	Glen Lui	Glen Quoich	Glen Feshie	Rothiemurchus	Glenmore	Abernethy	Carn Na Loinne	Glen Brown	Glen Avon	Allt Cul	Ballochbuie	Crathie	Creag Ghiubhais	Glen Tromie
NGR		NO040940	NO075905	NO095952	NN855990	NH930080	NH980090	NJ030140	NJ042225	NJ118177	NJ176072	NO180953	NO210900	NO270955	NO315955	NN770949
COREAREA	7445	235	147	418	960	1,744	389	2,452	100	9	5	13	775	135	40	23
REGENAREA	9658	454	420	648	1,923	1,721	651	3,001	116	78	20	25	260	200	86	55
BUFFER AREA	20645	1,148	904	1,160	3,546	1,674	2,850	4,865	641	939	304	199	990	480	305	640
TOTALAREA	37748	1,837	1,471	2,226	6,429	5,139	3,890	10,318	857	1,026	329	237	2,025	815	431	718
Source: https://www.arcgis.com/home/webmap/viewer.html?panel=gallery&suggestField=true&url=https%3A%2F%2Fservices9.arcgis.com%2FRCPJF8Z8BrfjscvL%2Farcgis%2Frest%2Fservices%2FCaledonian_Pinewood_Inventory%2FFeatureServer%2F0																