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Scots Pine Forest Management Case Study 2:

Seafield Estate - Cullen, Scotland

HIGHLAND BIRCHWOODS Coille Beithe na Gàidhealtachd
skog+landskap
METLA
SKOGSSTYRELSEN
NORTH KARELIA POLYTECHNIC
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Introduction

Seafield Estate is composed of two main holdings in the north of Scotland, Cullen in Banffshire and Strathspey in Speyside (Figure 1a). At Cullen the estate extends to 12250ha of which 3500ha is woodland, whilst the total estate area at Strathspey is just under 22000 ha, of which 7300ha is woodland. This case study is focused on the Cullen component of Seafield Estate (Figure 1b).

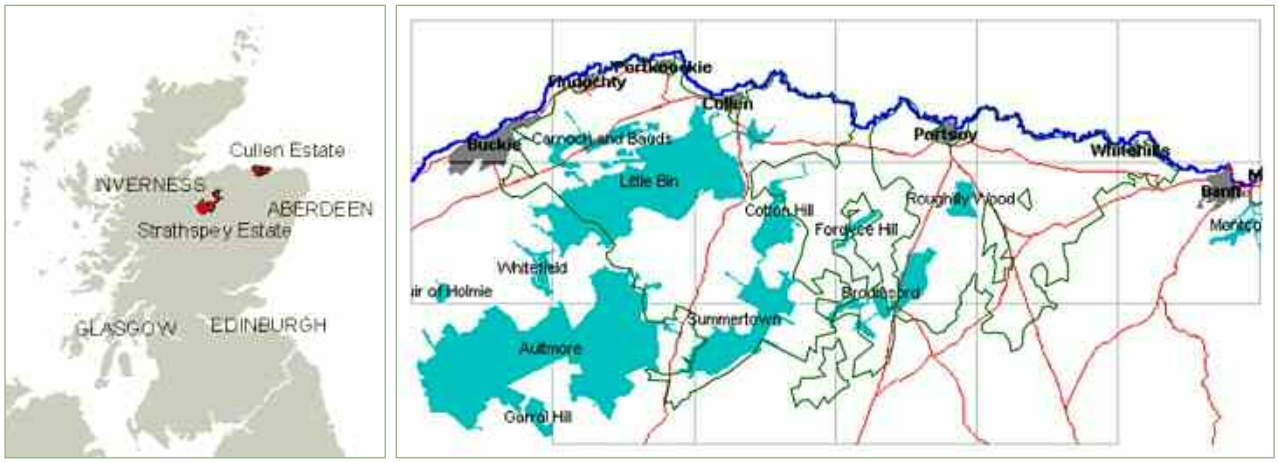

Figure 1: (a) Location of Seafield Estate holdings at Cullen and Strathspey **(b) Cullen Estate** ***(Maps courtesy of Seafield Estates)***

The strategic objectives of forest management at Cullen Estate, as set out in the Seafield and Strathspey Estates' Forest Management Plan, are:

- *To secure the maximum sustainable financial return and enhancement of the capital value.*
- *To practise sound silviculture and business management with due regard to landscape, conservation and amenity factors.*
- *To contribute to optimal land resource usage consistent with wider estate objectives.*
- *To secure management excellence, complying with the UKWAS standard.*

There are no areas covered by **statutory designations** for conservation interest within the woodlands at Cullen Estate and there are few formal recreation facilities, although there are ample opportunities for informal access (Figure 2).

Figure 2: Informal recreation at Cullen Estate

Within the context of the **"Developing the Scots Pine Resource"** project, Cullen represents an example of forest management where realising economic value through timber production is a primary objective, and where there are fewer external constraints on management when compared to areas of high conservation or amenity interest, such as Rothiemurchus Estate (the subject of another case study within this project).

Climate

The altitude of Cullen Estate ranges from sea level to 305m, while site wind exposure, as measured by DAMS score (Quine and White, 1994), is generally in the range of 10-14. The average annual rainfall is 775mm and there are an average of 41 days of frost per year. Pyatt et al. (2001) describe seven climatic zones for Great Britain, based on a combination of site values for AT5 (accumulated temperature – degree days above 5ºC) and moisture deficit (reflecting the balance between potential evaporation and rainfall). According to this system most of Cullen Estate is classified as cool moist, with some areas cool wet.

Silviculture and Timber Production

Scots pine comprises about 25% of the 3500 ha of forest area at Cullen, whilst the predominant species is Sitka spruce, which accounts for 40% of the area, (Figure 3). Scots pine was traditionally the main commercial species on Cullen Estate and it was planted extensively on a range of site types during the first half of the 20th Century. From the 1950s onwards, however, there was a move to plant faster growing, more productive species, mainly Sitka spruce which was well suited to many of the available sites and which has made up the majority of planting over the last 50 years, resulting in the current age class and species structure (Figure 4).

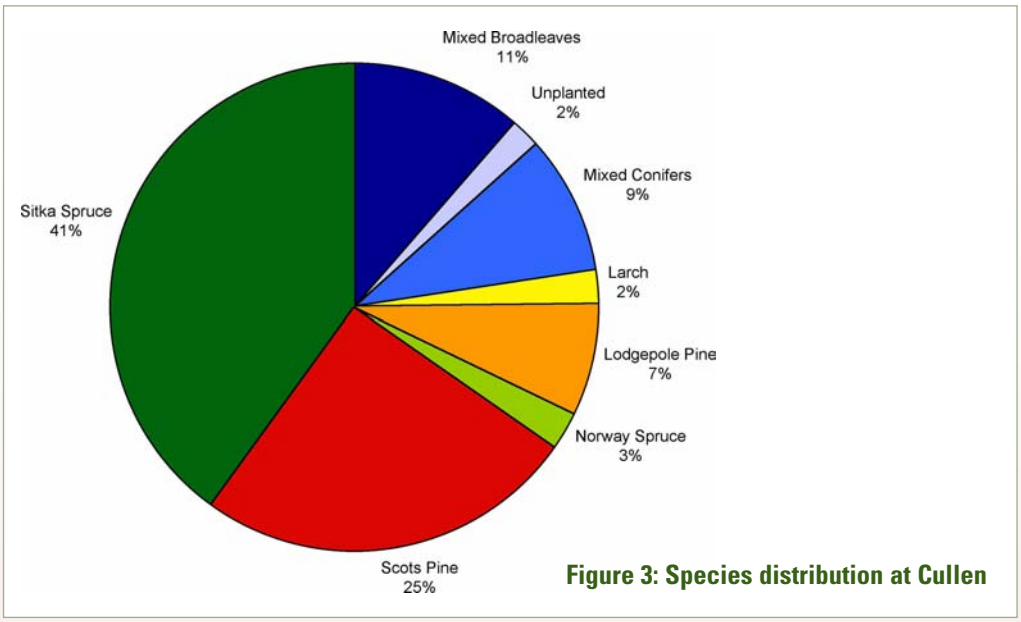

Figure 3: Species distribution at Cullen

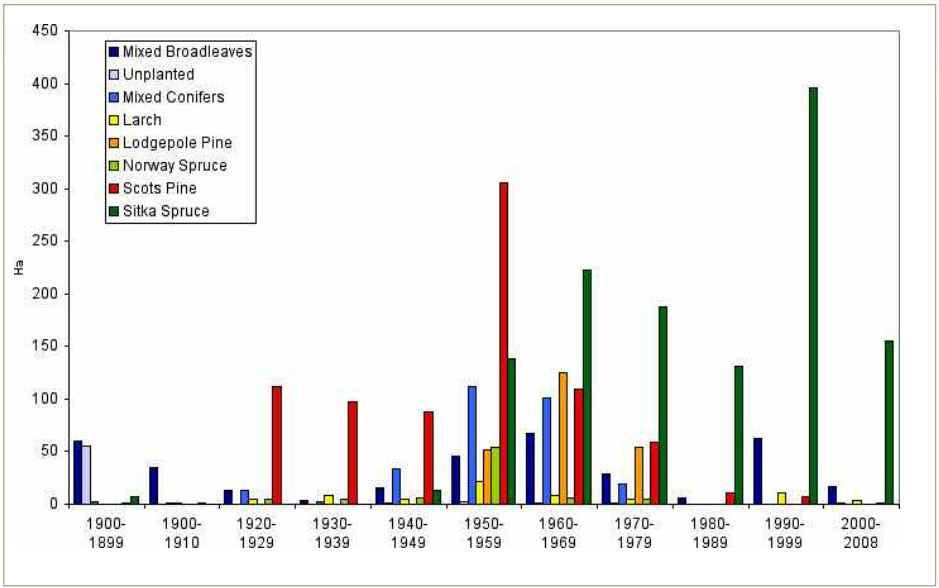

Figure 4: Age class distribution by species

Selective thinning of Scots pine stands at Cullen Estate generally starts at around 28 years of age and is carried out on an 8-10 year cycle, with the aim being to produce a final crop of high quality sawlogs. Rotation lengths are normally in the range of 70 – 90 years. The majority of the Scots pine in the current resource at Cullen is relatively mature and is in the late thinning or final felling phase. There is some concern that the current mature crop of Scots pine is at risk from a number of biotic threats, specifically resin-top disease (*Peridermium pini*) and Red Band Needle Blight, RBNB (*Dothistroma septisporum)*. Timely and regular thinning will continue in pine stands as a recommended means of limiting the incidence RBNB by avoiding the development of dense stands with high levels of humidity (Brown and Webber, 2008). During thinning trees that are infected with *P. pini* are also removed.

On more fertile sites Scots pine is being replaced with Sitka spruce or other more productive species, according to site conditions. On these sites, where a change of species will take place, the Scots pine will be clearfelled and the site replanted with the desired species. Where the aim is to retain Scots pine there is a general move away from clearfelling and replanting towards natural regeneration techniques, the aim being to retain the presence of Scots pine in the landscape and to minimise restocking costs.

An example of the type of seeding felling carried out with the aim of achieving natural regeneration is shown in Figure 5. Approximately 100 seed trees per hectare, with well developed crowns, were left standing and some scarification of the site was completed using harvesting machinery during the timber extraction operations. 4 years after felling there is some Scots pine regeneration on site, together with quite a lot of birch and western hemlock seedlings (Figure 6). As this site is relatively fertile there is vigorous competing vegetation which might make it difficult for an adequate stocking of Scots pine seedlings to be achieved. The forest manager is monitoring the site and will use either more aggressive scarification coupled with a reduction in stem density to 50 stems/ha or supplementary planting in order to achieve the desired stocking.

Figure 5: Seeding felling of mature Scots pine stand

Respacing of regeneration is usually left until the first thinning stage, but if very dense stocking is achieved consideration will be given to an earlier intervention, possibly linked to emerging biomass markets.

The majority of timber from the estate is sold standing through negotiation on a long term contract to local sawmilling company James Jones and Sons Ltd. This approach ensures continuity and the regular use of experienced contractors for selective thinning operations (Figure 7).

Figure 6: Natural regeneration

Most sawlogs are processed at James Jones' sawmill at Mosstodloch, about 15 miles from Cullen, which produces predominantly carcassing, fencing and pallet wood together with some decking and other garden products. Small roundwood is generally processed into OSB at Norbord's plant at Dalcross near Inverness, about 50 miles from Cullen. In 2009/10 Cullen Estate harvested around 17000 tonnes of timber in total, of which 6300 tonnes was Scots pine which all came from thinnings.

Figure 7: Harvesting Scots pine timber at Cullen Estate

Scots pine timber quality at Cullen Estate

In a recent survey of Scots pine timber quality across north Scotland, non-destructive assessments of log quality and mechanical properties were made on over 7000 trees in 87 stands (Macdonald et al., 2010). Visual assessments of stem straightness and of the height of the lowest dead branch in a stem can be used to estimate the out-turn of higher value green logs, whilst stress wave velocity measurements, made using portable acoustic tools, are good predictors of the mechanical properties of sawn timber (Macdonald et al., 2009). The survey included six stands at Cullen (Table 1).

Table 1: *Summary of timber quality data for 6 stands at Cullen Estate*

Stand	Planting Year	Age	Yield Class	Stocking (stems/ha)	Standmean DBH(cm)	Mean height of lowest dead branch (m)	Median Stand Stem Straightness Score[1] (and Stem Straightness Grade[2])	Stress Wave Velocity	DAMS Score	Elevation (m)	AT5 (degree days above 5°C)
1	1954	54	10	475	31.0	2.0	3 (C)	4.82	10	80	1157
2	1932	76	8	250	40.5	2.9	6 (A)	4.59	10	120	1121
3	1929	79	6	338	32.1	3.5	6 (A)	3.9	12	170	1065
4	1949	59	6	588	22.4	1.0	4 (B)	3.6	14	125	1117
5	1950	58	4	544	31.0	0.8	1 (E)	4.14	12	240	987
6	1970	58	4	1113	15.4	0.3	1 (E)	2.9	11	250	967

[1] Based on a visual assessment of stem straightness in the lower 6m of the stem, from 1 (worst) to 7 (best).

[2] Based on distribution of straightness scores in a stand, A (best) – E (worst).

The stands evaluated represent a broad range of the age and growing conditions for Scots pine at Cullen Estate, from 38 to 79 years and from 80m to 250m elevation. All of the stands had been thinned with the exception of Stand 6, the youngest. The two oldest stands (2 & 3), which were close to maturity for the silviculture practised at Cullen, both scored well for stem straightness and lowest dead branch heights, indicating that they are likely to produce a high proportion of green logs (Figure 8). In terms of log quality the two poorest stands were stands 5 and 6, which were growing slowly on very exposed sites at an elevation of around 250m (Figure 9). These stands are being managed primarily for biodiversity in recognition of the site limitations. Analysis of results from the overall north Scotland survey showed that log quality could be predicted from models that use age and stocking density as inputs, with older stands with lower stocking density producing a higher proportion of better quality logs, reflecting the outcome of selective thinning. The stands at Cullen broadly reflect this result.

Figure 8: Timber quality sample stand 3

Figure 9: Timber quality sample stand 6

The stress wave velocity measurement made using portable acoustic tools show that trees which have the best log quality attributes do not necessarily have the best mechanical properties (Figure 10). Sample stand 2 combines excellent stem straightness and branching attributes with high values of stress wave velocity, whereas sample stand 3 has slightly lower values of stress wave velocity, so although it is likely to produce a similar proportion of good logs as stand 2, the sawn timber cut from it is likely to have lower timber stiffness. Sample stand 5 has very similar values of stress wave velocity to sample stand 3, but the poor stem straightness and heavy branching of the trees in stand 5 will prevent the production of any significant quantity of green logs, so the mechanical properties are unlikely to be of practical importance.

Analysis of the acoustic measurement results from all stands in the north Scotland survey found that accumulated temperature was positively correlated with stand mean stress wave velocity, with warmer sites having higher values. The results from the Cullen stands reflect this general trend.

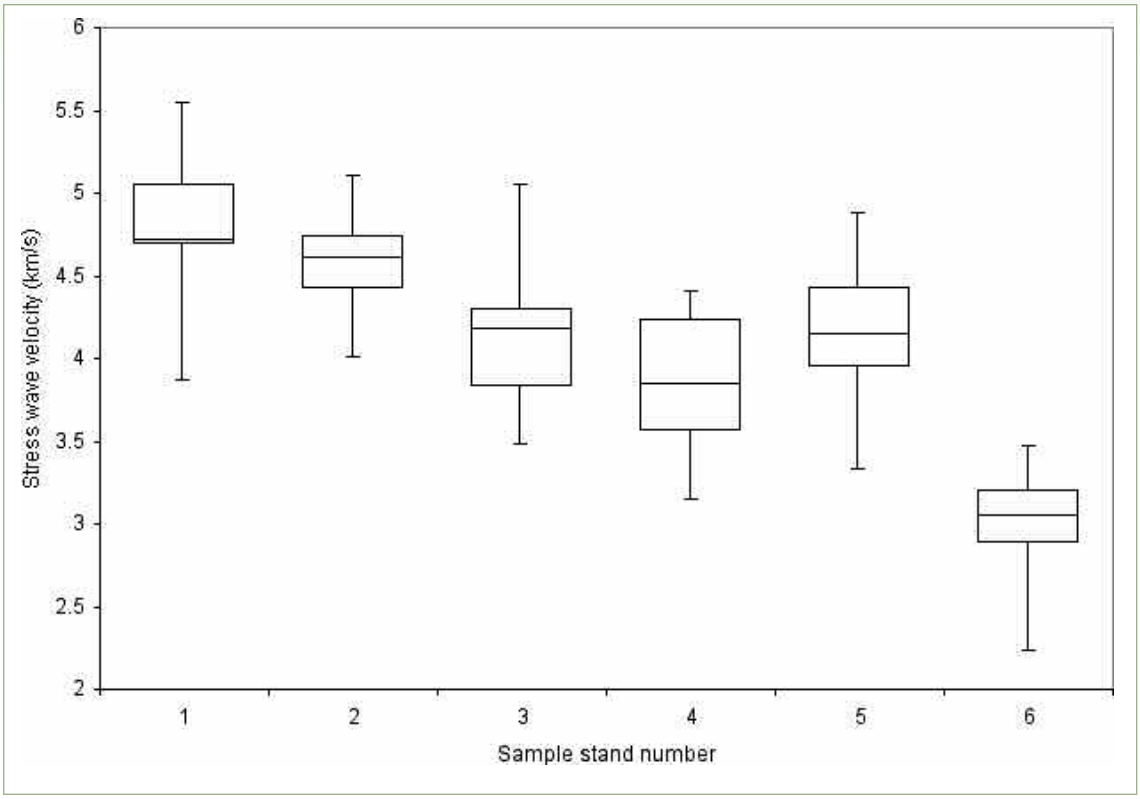

Figure 10: Boxplot showing the minimum, median, maximum and inter-quartile range of stress wave velocity values for each sample stand.

Conclusions

At Cullen Estate there is a tradition of producing good quality Scots pine logs from silviculture that is based on regular selective thinning and relatively long rotations. In order to meet management objectives of maximising financial return, enhancing capital value and making optimal use of available land, Scots pine has gradually been replaced on more fertile sites with Sitka spruce. This will continue as appropriate, although species choice is likely to be influenced in the future by changes in species suitability that have been predicted to occur as a result of climate change, with some sites in north east Scotland becoming less suitable for Sitka spruce as a result of forecast increases in moisture deficit.

There will always be some sites that are well suited to Scots pine, and here the aim is to use natural regeneration where possible to achieve acceptable stocking levels for timber production, i.e. 2500 – 3000 stems/ha.

Acknowledgements

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References

Brown, A., and Webber, J. 2008. Red band needle blight of conifers in Britain. Forestry Commission Research Note 2. Forestry Commission. Edinburgh.

Macdonald, E., Connolly, T. and Gardiner, B. 2010. A Survey of Scots pine timber quality in the Northern Periphery Programme area of Scotland. Proceedings of the 6th International Symposium Wood Structure and Properties 2010. Podbanské, High Tatras, Slovakia. Arbora Publishers, Zvolen, Slovakia.

Macdonald, E., Moore, J., Connolly, T., Gardiner, B. (2009a). Developing methods for assessing Scots pine timber quality. Forestry Commission Research Note 5. Forestry Commission, Edinburgh.

Pyatt, D.G., Ray, D., Fletcher, J. (2001) An Ecological Site Classification for Forestry in Great Britain. Forestry Commission Bulletin 124. Forestry Commission, Edinburgh.

Ray, D. (2008). Impacts of climate change on forestry in Scotland – a synopsis of spatial modelling research. Forestry Commission Research Note 101. Forestry Commission, Edinburgh.

Quine, C. P. and White, I. M. S. (1994). Using the relationship between rate of tatter and topographic variables to predict site windiness in upland Britain. Forestry, 67(3), 245-256