

CSI REPORT NO 83

THE PRESENT POSITION OF THE SCOTS PINE SEEDLING STUDIES 1975/76.
INTERIM REPORT. 1976. 9 leaves, figures. [Contract Title:
Survey of Native Pinewoods in Scotland: Contractor: ITE (R.G.H.
Bunce); NCC Research Contract: F3/03/27]
Key-Words: PINUS-S'LVESTRIS; REGENERATION

This Report is an official document prepared under contract between the Nature Conservancy Council and the Natural Environment Research Council. It should not be quoted without permission from both the Institute of Terrestrial Ecology and the Nature Conservancy Council.

INTERIM REPORT ON THE PRESENT POSITION OF SCOTS PINE SEEDLING STUDIES

The simplest way of breaking down the report is as follows:-

1. Timetables of events
2. Summary produced by John Hambrey
3. Tables of results to date, with comments
4. Outline of future work

The main problems have been in the time required for cutting the sections and ageing the seedlings, and in the data preparation.

1. Timetable

1975 Survey of seven pinewood sites. Stratified random plots with sample number dependent upon forest size. Ground flora, soil, tree, and regeneration data collected, representative samples of seedlings harvested and soil samples taken. Several measurements were made on the seedlings, including height, the number of leaders (live and dead), and weights of stem and needles. The age of some of the seedlings was also determined.

October 1974 to February 1975

John Hambrey completed the seedling ages and started working up some of the data (see below).

February - March 1975

Nick Thompson produced stock maps of all the forests surveyed using the tree plot data.

September - November 1975

Colin Barr subsampled birch and rowan - 30 samples/species/wood. These were aged and measured.

January - February 1976

Data punched (both laboratory and field).

2. Summary produced by John Harding (on Scots pine seedlings only)

a) Ageing of seedlings

Small segments were taken from the base of the seedling stem and preserved in formalin. Sections were then cut using a microtome. Several were taken from each sample, and where there was doubt as to the age, an average reading was taken. Phloroglucinol (1 per cent in 70 per cent alcohol), with conc. HCl (equal volumes) was found to be best for most sections. Where this was unsatisfactory, malachite and methylene blue was used. This occasionally produced better results than phloroglucinol. Some seedlings were, however, extremely difficult to age.

b) Analysis of data

Histograms were constructed (Fig. 1) of the frequency of different age classes for each of the major sites. Two points are important when interpreting these histograms.

- a) Many very young seedlings would be missed in the field where there is dense heather or other vegetation.
- b) Some of the trees will have grown out of the field category for seedlings (< 1.4 m high). It is hoped to find out, as nearly as possible, what this age is at some later date.

Taking these into account, the following deductions may be tentatively made.

Lock Marae There seems to be a very stable population structure here with gradually decreasing age class frequencies right up to age 14. Recruitment appears to be regular and quite high, and loss in the following years low. 50 per cent of the sampled plots contained seedlings.

Shieldair Here again, the population structure seems fairly stable, but there are relatively heavy losses of very young seedlings. Recruitment to the mature population is therefore lower. 50 per cent of plots contained seedlings.

Tynarum Here there is a rapid tailing off with age suggesting high mortality at an early age. Very few seedlings of age ten or over are present. 44 per cent of plots sampled contained seedlings.

Abermethy This shows a good population structure although young seedlings (4 years) seem under-represented. This suggests that recruitment has been lower during the last few years, or that the vegetation is such that sample bias against young seedlings is particularly important at this site. Only 26 per cent of plots sampled contained seedlings.

Glen Affric The pattern is similar to Abermethy with peaks in age class frequencies at 6 and 10 and to a lesser extent at 2 and 14. This may reflect particularly favourable conditions for recruitment two, six, ten and fourteen years ago. 39 per cent of plots contained seedlings.

Barisdale No seedlings at this site were over the age of four. This suggests rapid mortality during the first few years. Only 24 per cent of plots contained seedlings.

Lar Only two seedlings were found at this site, aged 12 and 14. Figure 2 summarises the relationships between forests. The high degree of variability emphasizes the importance of local factors, which require further study.

Distribution

The distribution of plots in which regeneration is occurring has been mapped, and the number and mean age of seedlings at each plot noted. Most sites have definite "zones of regeneration". Histograms of seedling age structures for these areas have been constructed. Some of these areas show different age structures with considerable variation in the amount of recruitment in recent years. Possible variations in sample bias against young trees must be remembered here, however.

Index of regeneration

It was decided to produce a measure of regeneration in terms of several important factors. This was to take into account:-

- (a) stability of population structure
- (b) a measure of growth in terms of :
 - 1. height
 - 2. dry weight
- (c) a measure of seedling density

The following equation gives such an index:

$$IR = \frac{MGPA \text{ (height)} \times MGPA \text{ (weight)} \times MSF \text{ per plot}}{\text{Standard deviation of age class frequencies}} \\ (3 - 10)$$

where MGPA is mean growth per annum

MSF is mean seedling frequency

3. Tables of results

Table 1. Total number of seedlings recorded and measured in each forest.
(The figures in brackets refer to the average number of seedlings/plot).

Table 2. Total number of seedlings over age 15, and average/plot (Scots pine only).

Table 3. Proportions of plots with different species of seedlings.

Table 4. Frequency of plots with different seedling numbers (unchecked data).

Table 5. Average age of seedlings.

Table 1. Total number of seedlings recorded and measured in each forest
(Figures in brackets refer to the average number of sampled seedlings per plot)

	Loch Marac	Glen Affric	Aber- nethy	Dundrum	Shieldnaig	Mar	Barris- dale	TOTALS
Scots pine	244 (8)	308 (4)	596 (5)	134 (5)	105 (6)	2	42 (1)	1329 (2)
Birch	26 (1)	278 (4)	278 (2)	508 (11)	53 (2)	111 (2)	88 (3)	1295 (2)
Rowan	50 (2)	327 (4)	327 (2)	130 (5)	63 (2)	57 (1)	65 (2)	985 (1)
Willow	-	20	20	27 (1)	-	1	-	89
Cherry	-	-	1	-	-	-	-	1
Aspen	-	-	3	-	-	-	-	3
Oak	-	-	-	-	1	-	-	1
Number of plots	31	75	161	37	30	53	34	(609)
Percentage with no seedlings at all	16	16	42	7	3	62	24	

Table 2. Total number of seedlings over age 15, and average/plot
(Scots pine only)

Loch Maree	14	.45
Glen Affric	16	.22
Abernethy	45	.28
Tyndrum	1	.04
Shieldaig	14	.47
Mar	0	0
Barrisdale	0	0

The above data reflect observable differences between the forests, with Loch Maree and Shieldaig not only having more, but also older, seedlings. Tyndrum has many seedlings but few survive whereas Affric and Abernethy are comparable in both columns. Some of the older seedlings could well be absent, since they have entered the sapling class (i.e. over 1.4 m). Data are being extracted for these.

Table 3. Proportions of plots with different species of seedlings

	% of plots with seedlings	% of max. possible no. (100% = 25) of seedlings			
		Pine	Birch	Rowan	Others
Abernethy	58	12	13	9	1
Affric	84	21	19	22	1
Barrisdale	76	6	13	10	0
Loch Maree	84	39	4	8	0
Mar	38	0	10	5	0
Shieldaig	97	33	9	11	0
Tyndrum	93	25	57	24	5

Abernethy - just over half the plots had seedlings and these were few in number comprised fairly evenly of pine, birch and rowan.

Affric - most plots had seedlings which were fairly numerous and again consisted of pine, birch and rowan in even numbers.

Barrisdale - most plots had some seedlings but they were few in number of which the least number were pine.

- Loch Maree - most plots had seedlings and nearly all of these had large numbers of pine with hardly any birch and only a few rowan.
- Mar - only a third of the plots had any seedlings. There were no pine seedlings, some birch, and a few rowan.
- Shieldaig - nearly all the plots had seedlings. There were large numbers of pine, several birch and rowan.
- Tyndrum - nearly all plots had seedlings. There were numerous birch seedlings in these plots with plenty of pine and rowan and also a good number of willow.

Table 4. Number of plots in 5 classes of seedling numbers
(unchecked data)

	0	1-6	7-12	13-16	> 19
Shieldaig	14	3	3	4	5
Loch Maree	16	3	-	4	7
Tyndrum	15	6	1	2	3
Barrisdale	16	6	1	-	2
Abernethy	121	21	9	7	4
Glen Affrid	48	11	9	1	4

Despite, in several cases, a low total number of plots with seedlings, there is a surprisingly high number of plots with many seedlings - suggesting that there is a considerable degree of patchiness of seedling distribution, and that, where conditions are favourable, a large number of seedlings occur. Study of these areas could well be rewarding.

Table 5. Average age of seedlings

	Scots pine	birch	rowan
Abernethy	10.2	6.0	5.7
Mar	-	7.4	7.9
Loch Maree	8.7	6.9	6.2
Shieldaig	8.1	11.0	9.0
Harrisdale	1.8	2.0	3.2
Lyndrum	4.0	5.4	4.4
Glen Affric	8.4	7.7	6.3

The figures given in Table 5 show the wide differences between forests but the data from Table 4 indicate that the wide variations within forests require a breakdown into zones where conditions can be examined in detail.

4. Outline of future work

Now that the data have been punched on to paper tape, two basic series of calculations will be carried out:-

1. A detailed comparison of the plots containing seedlings with those without seedlings, both within and between forests. Preliminary studies have already been carried out which show major differences. The main factors which will be compared are:-

- Height of vegetation
- pH
- Predominant ground flora species
- Pine versus birch versus rowan
- Soil characters

These procedures are based on those suggested by H. W. Shaw in his studies of oak seedlings.

2. Correlation analysis. These analyses will involve the calculation of correlations between the growth rate of seedlings and the following types of variables:-

- Grazing pressure
- pH
- Predominant ground flora species cover
- Soil characters

It is also intended to compare the growth patterns shown by pine, birch and rowan. The data also need to be broken down to a plot level as well as in zones in the forest.

It is hoped that the interpretation of these results can suggest future lines of experimental studies that can complement the previous published work, largely by McLean.

R. S. H. Sence

10 March 1973

Fig. 1. Numbers and ages of seedlings in seven sites.

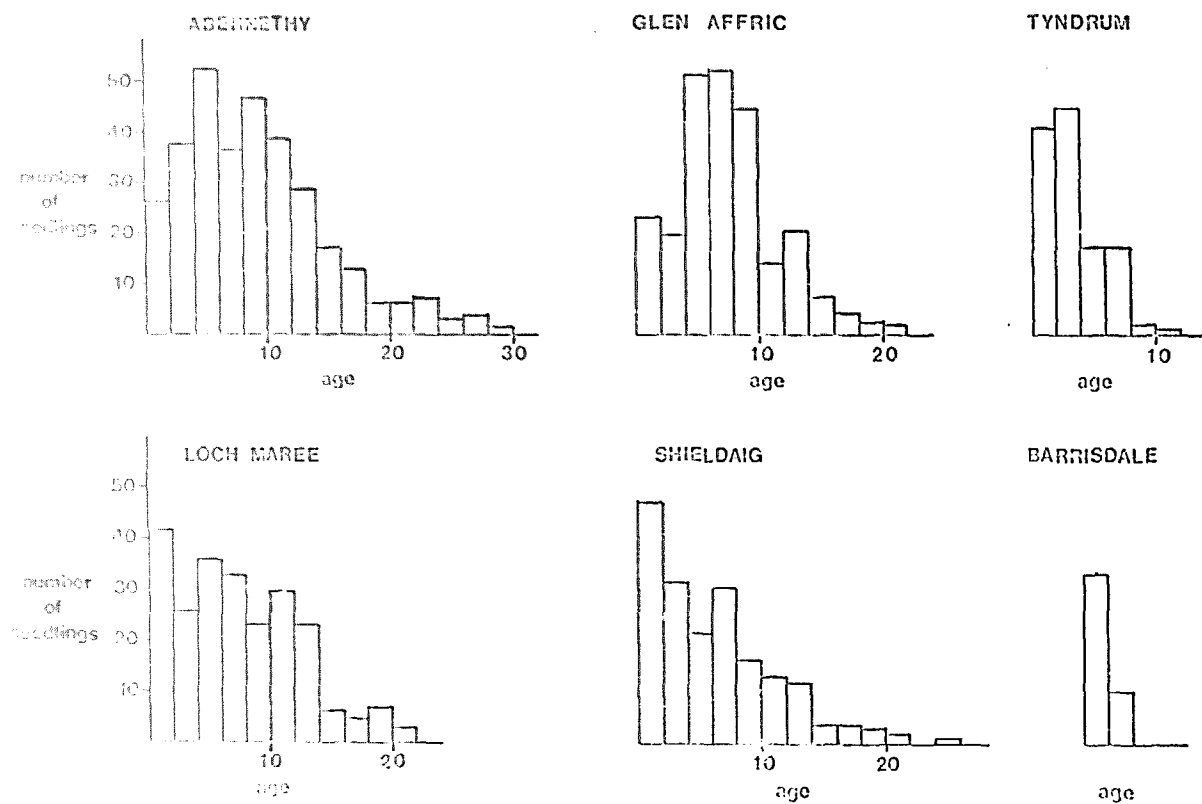


Fig. 2. Comparison between sites. Average diam/Average age.

