Dendrochronological Sampling and Investigations in the Cairngorm Mountains during 2008 and 2009

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Introduction

This report details dendrochronological (tree-ring) investigations in the Cairngorm region undertaken in 2008 and 2009. Most of the living tree core samples were taken for a variety of student projects but are all fundamentally part of the larger "Scottish Pine Project".

http://www.st-andrews.ac.uk/~rjsw/ScottishPine/

This project's aims are:

1. To develop and update tree-ring chronologies from ALL semi-natural pine woodlands in the Scottish Highlands.

2. To extend living chronologies using extant, historical or sub-fossil tree-ring material.

3. To model the environmental (climatic, ecological or management) influences on Scots pine tree growth with a view to improved understanding of the future response of the native pinewoods, and to assist in their management.

4. To extend the application of native pine dendrochronology for cultural heritage research, including dating and provenancing native Scottish pine timbers in buildings and archaeological sites and in revealing the history of exploitation and management of the native pinewoods to inform their future conservation and interpretation.

5. To reconstruct, using physical and chemical methods, the environmental (climatic) history of the region for the last 1000 years and possibly back 8000 years.

The project, led by Rob Wilson (St. Andrews) who's interests lie in reconstructing past climate, is collaborative and includes:

1. Coralie Mills (affiliated with St. Andrews) and Anne Crone (AOC Archaeology) who are interested in the development of a reference network of pine chronologies to allow the dendrochronological dating of historical material as well as reconstructing the exploitation and management history of the woodlands;

2. Colin Edwards (Forest Research) who's main interests are with forest ecology and stand dynamics.

3. Neil Loader (University of Swansea) who is interested in studying past climate from the measurement of stable isotopes.

This report describes the location and age structure of all living sites sampled in the Cairngorms over the last two years as well as detailing preliminary results from the sampling of preserved sub-fossil pine material from lochs in the NW Cairngorms.

Fieldwork in 2008 and 2009

Living trees

Although some pine woodlands had been sampled in the Cairngorms through earlier studies (Hughes et al. 1984; Grace and Norton 1990; Fish et al. 2010), most of the resultant chronologies ended in the 1970s or 1990s and to assess the response of pine woodlands to current climate change, it was important to update old and sample new sites to present.

Figure 1 shows the locations of all sampled pinewoods in the Scottish Highlands. The higher density of sampled sites from the last few years' work in the Cairngorms region is clear compared to other locations in Scotland. Much of the living pinewood sampling in the Cairngorms is now essentially complete (see however "Proposed Future Field Work"). Figures 2a and 2b show in more detail the locations of the sampled woodlands in the Northern and Southern Cairngorms. The density of the sampled Cairngorm sites will allow for a rich data-set to ascertain the differing influences of climate, site ecology and management effects on tree growth in the region.

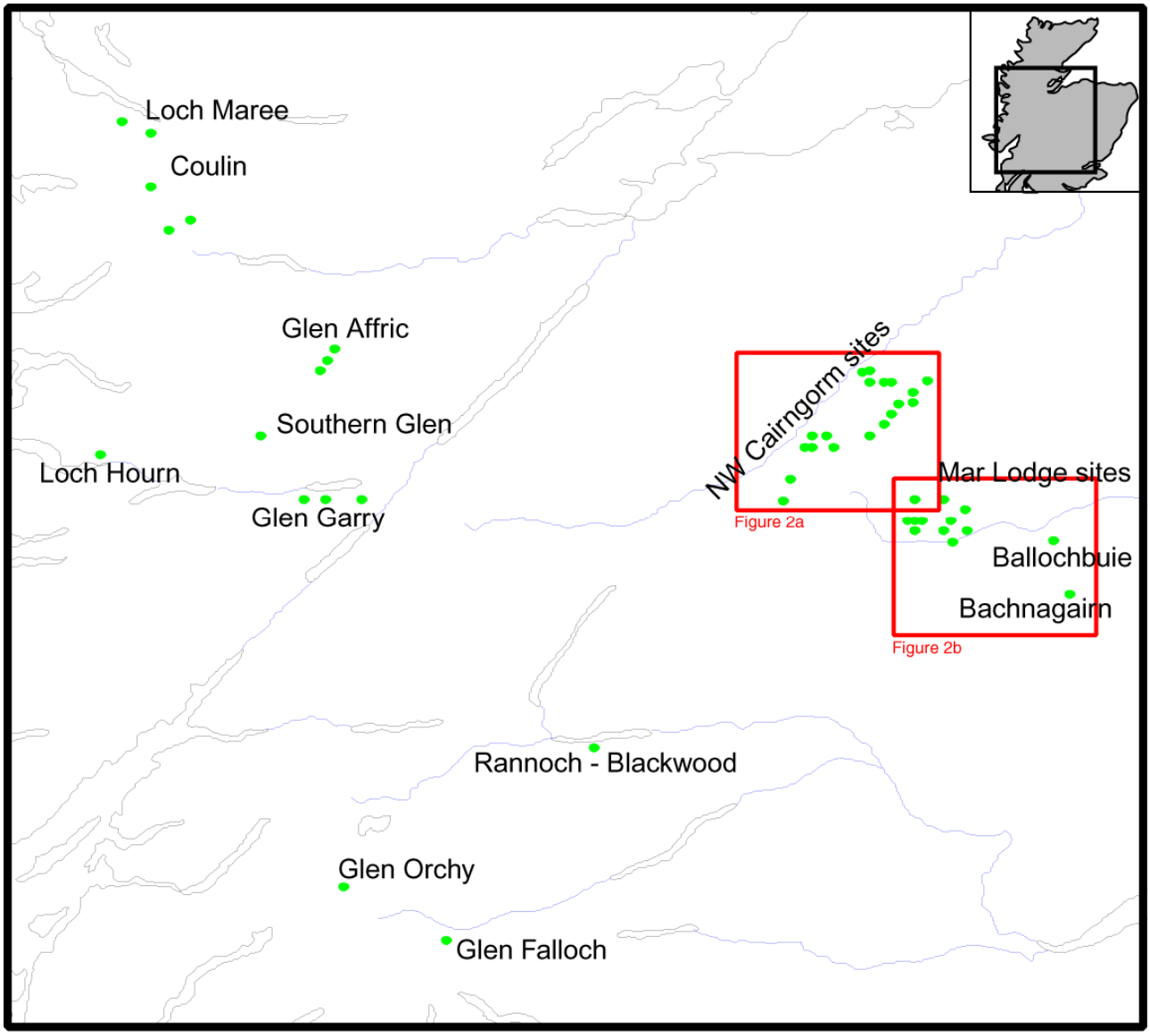

Figure 1: Location map of all sampled pinewoods in the Scottish Highlands

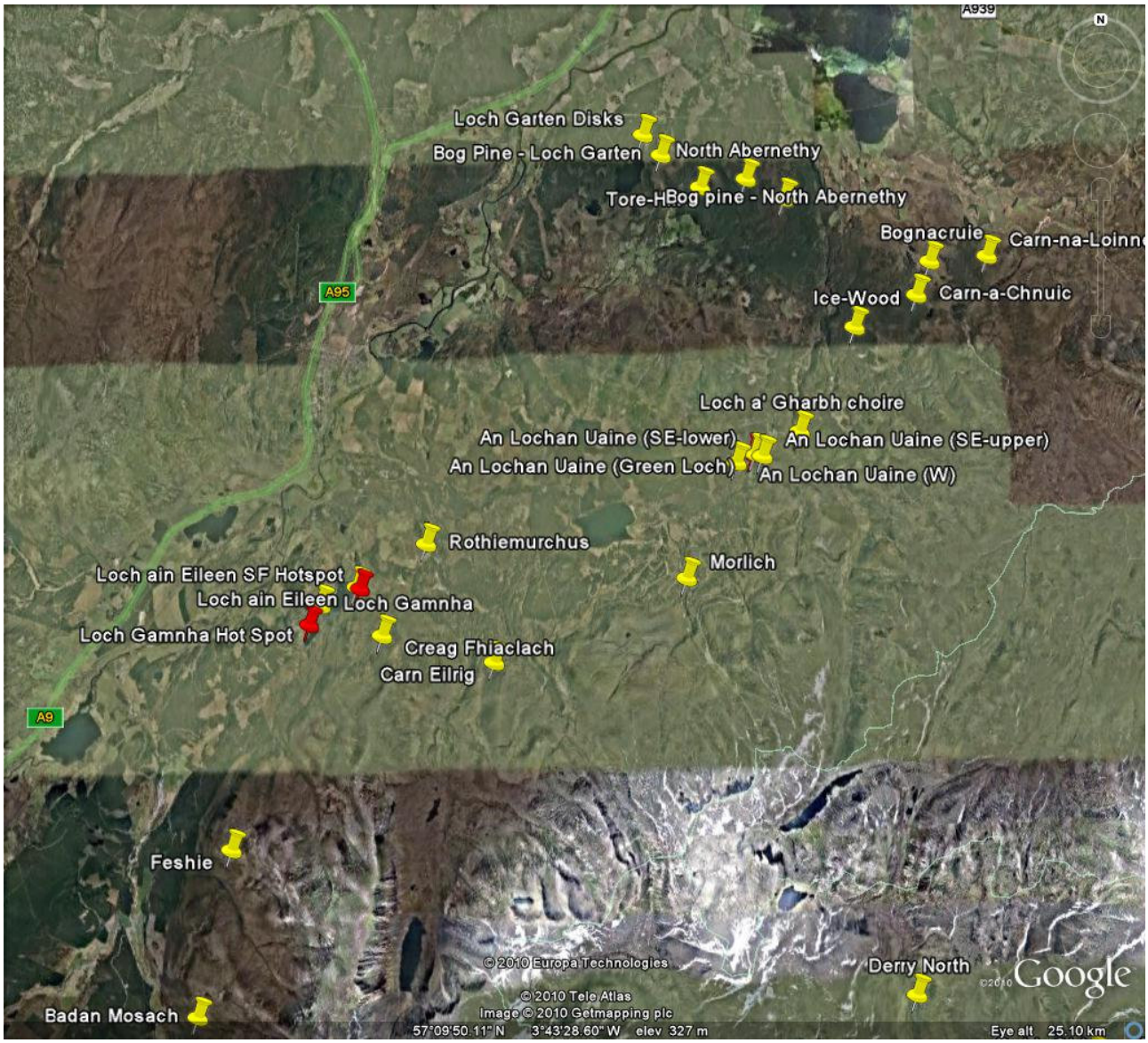

Figure 2a: Google map of all sampled pinewoods in the Northern Cairngorms. Yellow markers denote living pine site while red markers denote lochs from where sub-fossil samples have been extracted from lake sediments.

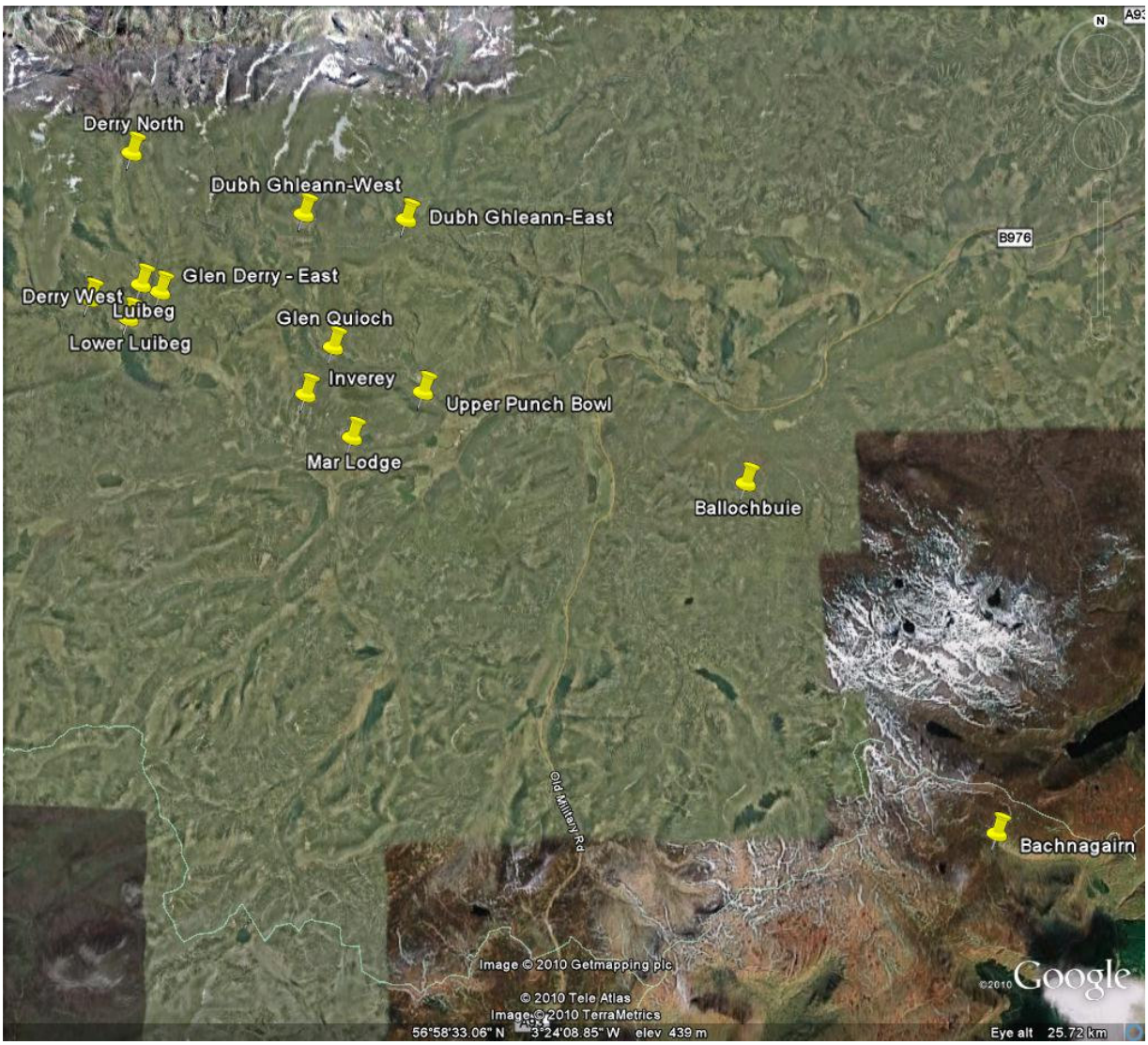

Figure 2b: Google map of all sampled pinewoods in the Southern Cairngorms.

Table 1 provides summary information (location, elevation, number of trees (series) measured, period covered by chronology etc) for each site. More detailed information for each site is provided in Appendix B. The oldest site is located on the Mar Lodge Estate (North Derry) with one tree going back to 1477 (Mills 2009). Currently, the Southern Glens (Figure 1 – Glen Loyne) pinewood is officially the oldest in Scotland (Mills 2005), but by including the estimate of rings missed (so called pith-offset) when we cored the trees, the North Derry site is possibly a little older than Glen Loyne. The Ballochbuie woodland also has quite old trees (Mills 2006) and further sampling through the area, especially in the upper tree-line areas, could also extend this site chronology further back in time.

On the whole, the pine woodlands in the Northern Cairngorms are much younger which likely reflects the intense clear cutting history over the last few centuries. The old trees noted by Grace and Norton (1990) at Creag Fhiaclach in Rothiemurchus have not been found and unfortunately, the data and samples from this earlier study have been lost. Test coring around the Green Loch in Glenmore, however, has shown that some trees go back into the mid 17th century and this site will be sampled as part of an avalanche study this September.

Region	Site Name	Site Code	ITRDB code	Latitude	Longitude	Elevation	First Year	Last Year	No. of series	Period cover by >=10 series	Parameters	Sampled/Measured by
Abernethy	Loch a' Gharbh choire	UAB	na	57.11	3.38	410-420	1735	2009	26	1783-2009	RW	Wilson
	Bognacruie (RSPB)	BGN	na	57.13	3.35	340-350	1634	2000	11	1894-2000	RW	Summers, Wilson
	Bognacruie (FR)	ABNPT	na	57.13	3.35	340-350	1734	2002	9	na	RW	Edwards, Wilson
	Carn-a-Chnuic	CRC	na	57.12	3.35	440-450	1741	2000	21	1889-2000	RW	Summers, Wilson
	Carn-na-Loinne	CNL	na	57.14	3.33	400-450	1885	2000	16	1895-2000	RW	Summers, Wilson
	Ice-Wood	ICE	na	57.12	3.37	370-380	1865	2000	25	1884-2000	RW	Summers, Wilson
	North-Abernethy	ABN	na	57.14	3.39	250-300	1937	2000	26	1945-2000	RW	Summers, Wilson
	Bog Pine - North Abernethy	BOGN	na	57.14	3.38	260	1805	2001	10	1899-1935	RW	Summers, Wilson
	Tore-Hill	TOR	na	57.14	3.41	330-340	1938	2000	21	1942-2000	RW	Summers, Wilson
	Loch Garten Disks	ABN-D	na	57.15	3.42	240	1859	1998	23	1863-1997	RW	Summers, Wilson
	Bog Pine - Loch Garten	BOGLG	na	57.15	3.41	220-230	1859	2001	7	na	RW	Summers, Wilson
NW Cairngorms	Morlich	MOR	na	57.09	3.41	410-450	1740	2006	17	1788-2006	RW	Wilson/Fish
	Carn Eilrig	CRNE	na	57.08	3.46	480-540	1735	2008	21	1828-2008	RW	Wilson/Frith/Patton
	Rothiemurchus	ROTHIE	na	57.09	3.47	290-330	1841	2006	17	1853-2006	RW	Wilson/Fish
	Loch an Eilein	EILEEN	na	57.09	3.49	260	1755	2008	53	1850-2008	RW/BI	Wilson/Loader
	Loch Gamnha	GAMNHA	na	57.08	3.50	270	1777	2008	26	1930-2008	RW	Wilson/Loader
	Creag Fhiaclach	CRF	na	57.08	3.49	500-550	1736	2008	16	1849-2008	RW/BI	Wilson/Frith/Patton
	Feshie	FESHIE	na	57.05	3.52	480-540	1811	2006	24	1849-2006	RW	Wilson/Fish
	Badan Mosach	BAM	na	57.03	3.53	370-420	1763	2008	18	1845-2008	RW/BI	Wilson/Frith/Patton
Mar Lodge	Derry East	DERE	Brit020	57.01	3.34	480-530	1629	2008	53	1745-2008	RW/MXD	Hughes/Wilson/Frith/Patton/Edwards/Fish
	Derry North	DERRYN	na	57.03	3.35	530-600	1477	2008	17	1665-2005	RW	Wilson/Loader/Mills
	Derry West	GDW	na	57.01	3.35	450-520	1723	2008	18	1773-2008	RW	Wilson/Frith/Patton
	Luibeg	MLLUIBEG	na	57.01	3.36	460-540	1657	2008	31	1711-2008	RW	Edwards/Wilson/Frith/Patton
	GhleannWest	MLGHLEAN	na	57.03	3.31	480-550	1744	2008	24	1764-2008	RW	Edwards
	GhleannEast	GLE	na	57.02	3.28	490-540	1697	2008	31	1760-2008	RW	Wilson/Frith/Patton
	Quoich	MLQUOICH	na	57.01	3.30	430-500	1680	2008	24	1733-2008	RW	Edwards/Wilson/Frith/Patton
	Inverey	INV	Brit015	57.00	3.31	500-550	1706	2008	37	1731-2008	RW/MXD/BI	Hughes/Schweingruber/Wilson/Frith/Patton
	Upper Punch Bowl	BNP	na	57.00	3.28	450-550	1681	2008	22	1839-2008	RW	Wilson/Frith/Patton
	Mar Lodge	MAL	na	56.59	3.30	350	1831	2008	20	1841-2008	RW/BI	Wilson/Frith/Patton
	Mar Dead	MLDEAD	na	na	na	na	1662	2004	12	1744-1867	RW	Wilson/Fish
S. Cairngorms	Ballochbuie	BALL	Brit017	56.58	3.19	300-500	1589	2003	48	1688-2003	RW/MXD	Hughes/Schweingruber/Crone/Mills
	Bachnagairn	BAG	na	56.54	3.14	500-560	1833	2008	20	1847-2008	RW	Wilson/Frith/Patton

Table 1: Summary site information. Parameter codes: RW = ring-width; MXD = maximum density; BI = Blue Intensity.

Figures 3a-3c show the establishment history for the Abernethy, Northwest and Southern Cairngorm sampled pinewoods respectively. The establishment and woodland dynamics history for Abernethy has already been detailed by Summers (2008). From Figure 3a, and in agreement with Summers (2008), the older trees are found at the higher elevations in the Abernethy region. The oldest trees were found at the Bognacruie, Carn a Chnuic and Loch a Gharbh Choire sites. The trees at this latter site (see cover page photo) were sampled as this loch and other lochs in the Upper Abernethy region provide a potential invaluable source of preserved sub-fossil material preserved in the loch sediments.

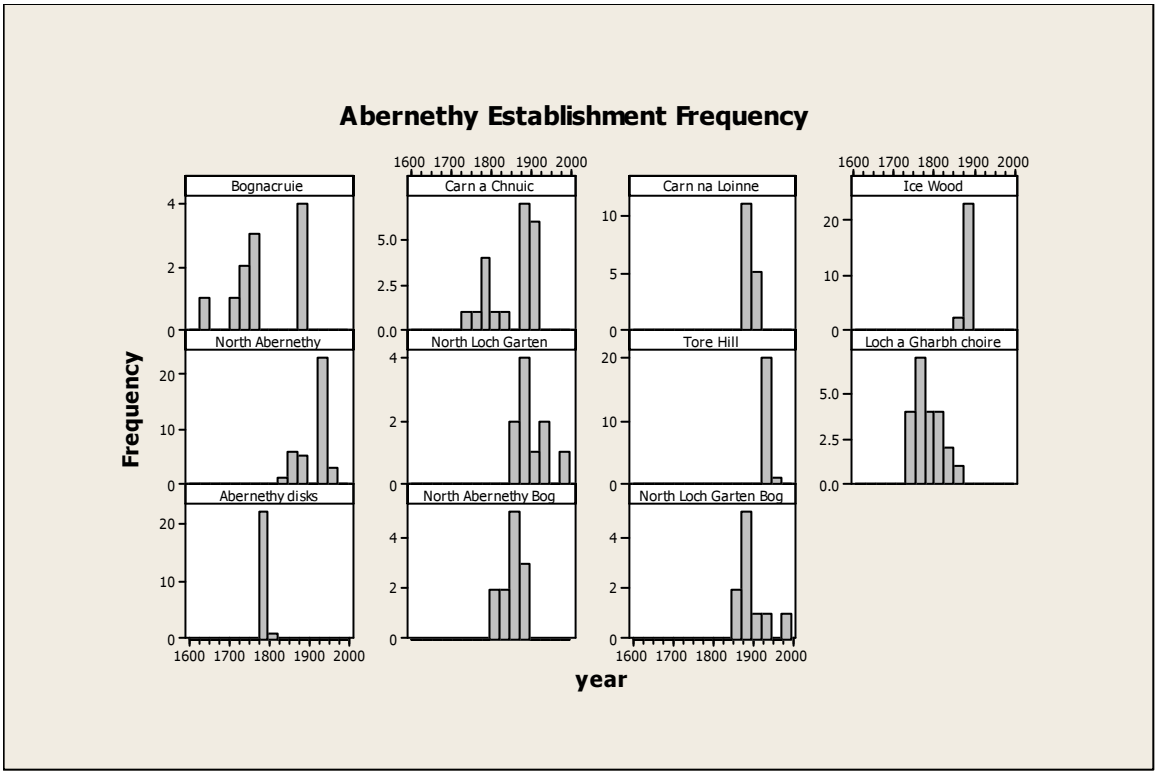

Figure 3a: Establishment history for Abernethy sampled pine sites. NB. Establishment is here defined as the estimated first year of growth at sampling (chest) height.

As mentioned earlier, the NW Cairngorm sites are generally younger than other pine woodlands in the Cairngorms. There seems to be a generally consistent pattern of tree recruitment at many of these sites with most sites (Figure 3b - Badan Mosach, Feshie, Loch en Eilein, Creag Fhiaclach and Rothiemurchus) showing a peak in establishment in the mid 19th century – presumably re-growth since the last major clear cutting in these regions. Earlier 18th century recruitment is noted for the Creag Fhiaclach and Morlich sites. Although there are some older trees around Loch Gamnha, the bulk of the trees are relatively young and started growing between the 1st and 2nd world wars.

There is a more varied frequency of establishment in the Southern Cairngorm sites (Figure 3c). Again, intense recruitment seems to have occurred at many sites during the 18th century (Derry East (late 18th), Derry West, Ghleann East and West, Inverey, Luibeg and Quioch and Ballochbuie (early 18th). At Bachnagairn, Mar Lodge and Upper Punch Bowl, most tree establishment occurred during the early 19th century. Establishment at the North Derry old site appears to have mostly occurred from the late 16th to late 18th century period with a peak around the early 17th century.

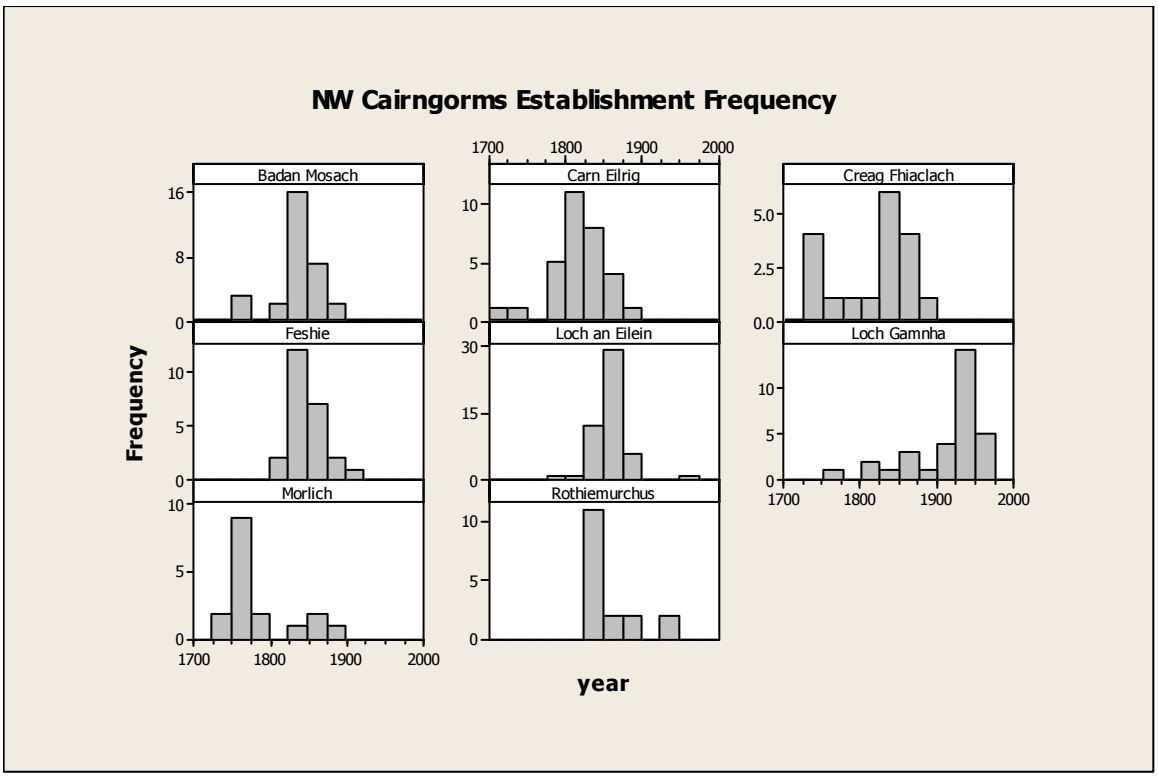

Figure 3b: As 3a bit for the North-western Cairngorm pine woodlands.

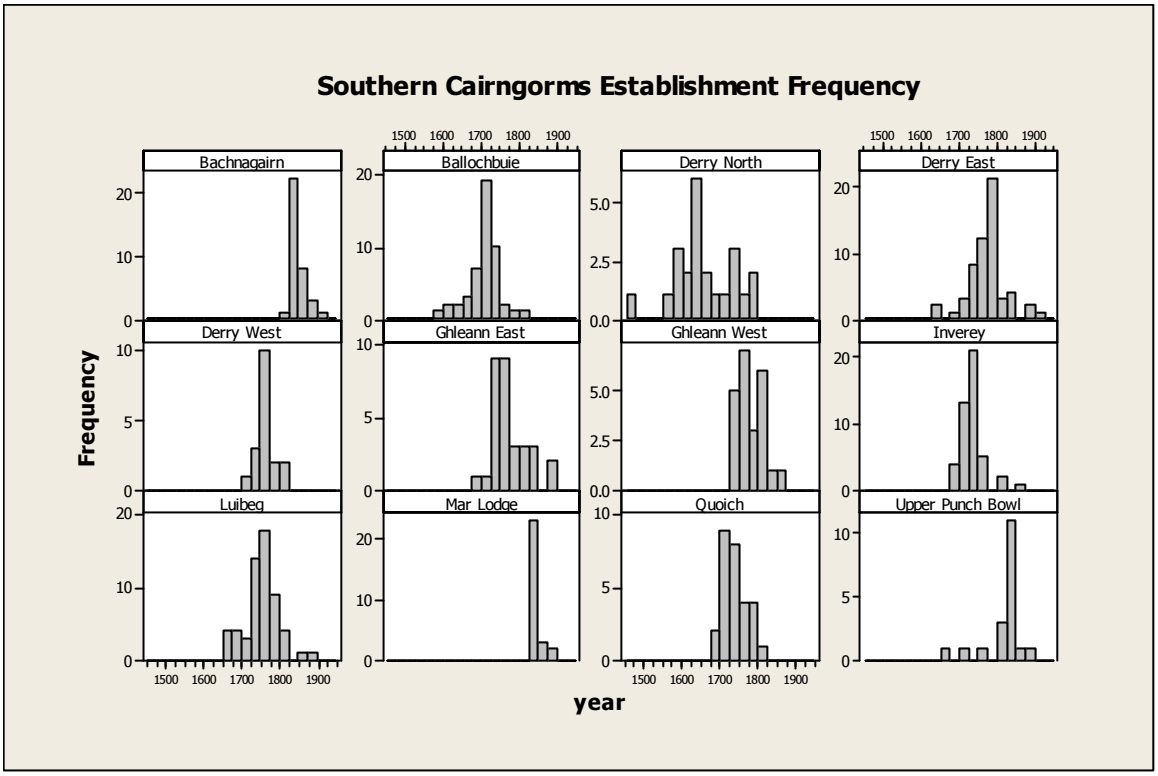

Figure 3c: As for 3a but for the Southern Cairngorm pine woodlands.

Sub-fossil loch material

One of the elusive aims for working with pine in Scotland is extending the living pine chronologies back in time, as has been conducted on oak (Crone and Mills 2002). ^{14}C dating of sub-fossil pine material preserved in peat bogs has, however, been used to provide information on the spatial and temporal distribution of pine in Scotland over the last ~8000 years (Dubois and Ferguson 1985; Ward et al. 1987;

Pears 1988; Bridge et al. 1990; Gear and Huntley, 1991; Moir et al. 2010). However, dendrochronological techniques could rarely be applied to the samples in these studies due to decay and the fact that the samples were often taken from the root stock where the rings are distorted. Scots pine trees growing on bogs have also never been shown to portray a valid climate signal compared to trees growing on drier mineral soil sites (Linderholm et al. 2002).

The key to extending the Scottish living pine chronologies for dendroclimatic purposes therefore lies NOT in using incomplete, distorted pine samples from peat bogs, but finding sources of complete stems where clearly-defined, long TR sequences can be found. In Fennoscandia, very long (> 5000 years) pine RW chronologies have been developed using sub-fossil wood preserved in the sediments of lakes (Eronen et al. 2002; Gunnarson and Linderholm 2002; Grudd et al. 2002; Linderholm and Gunnarson 2005; Grudd 2008). To date, no equivalent attempt has been made in Scotland to find macro-fossil pine material from lakes.

Palynological analysis has shown that Scots pine has grown continuously for the last ~ 8000 years in some areas of the Glen Affric and Cairngorm regions of the Scottish Highlands (O'Sullivan 1974a, 1976; Bennett 1995; Shaw and Tipping 2006; Froyd and Bennett 2006). These regions are therefore important critical areas for locating sub-fossil pine remains to derive a continuous pine chronology for most of the Holocene period.

In spring 2008, a survey was made in the North-West Cairngorm region to identify lakes with sub-fossil pine material preserved in their sediments (Wilson 2008). A few sub-fossil pine stems were found in many small lakes - even above the present tree-line. However, a particularly abundant amount of material was noted in two lochs (Loch an Eilein and Loch Gamnha) in the Rothiemurchus Estate and the Green Loch (An Lochan Uaine) in Glenmore Forest Park (Figure 4). A preliminary reconnaissance sampling field trip was undertaken in September 2008 to acquire samples from Loch an Eilein and Loch Gamnha for carbon dating to ascertain the rough time frame that the material represents. Figure 5 compares the results of the ^{14}C dating of this lake material, against dates of pine material extracted from peat bogs around Scotland. Of the initial 25 samples taken for analysis, the time frame covered by this material is from 200 to 8000 years BP. The dating of the samples, however, is clustered, with seven samples grouping to ~7800 years BP, a few samples between 2000-3000 years BP and the rest cover the last 1200 years. What is perhaps particularly intriguing is that no samples were dated to the traditional period (~5000 year BP) of maximal forest coverage in Scotland. This large temporal gap may simply reflect the small number of initial samples taken however.

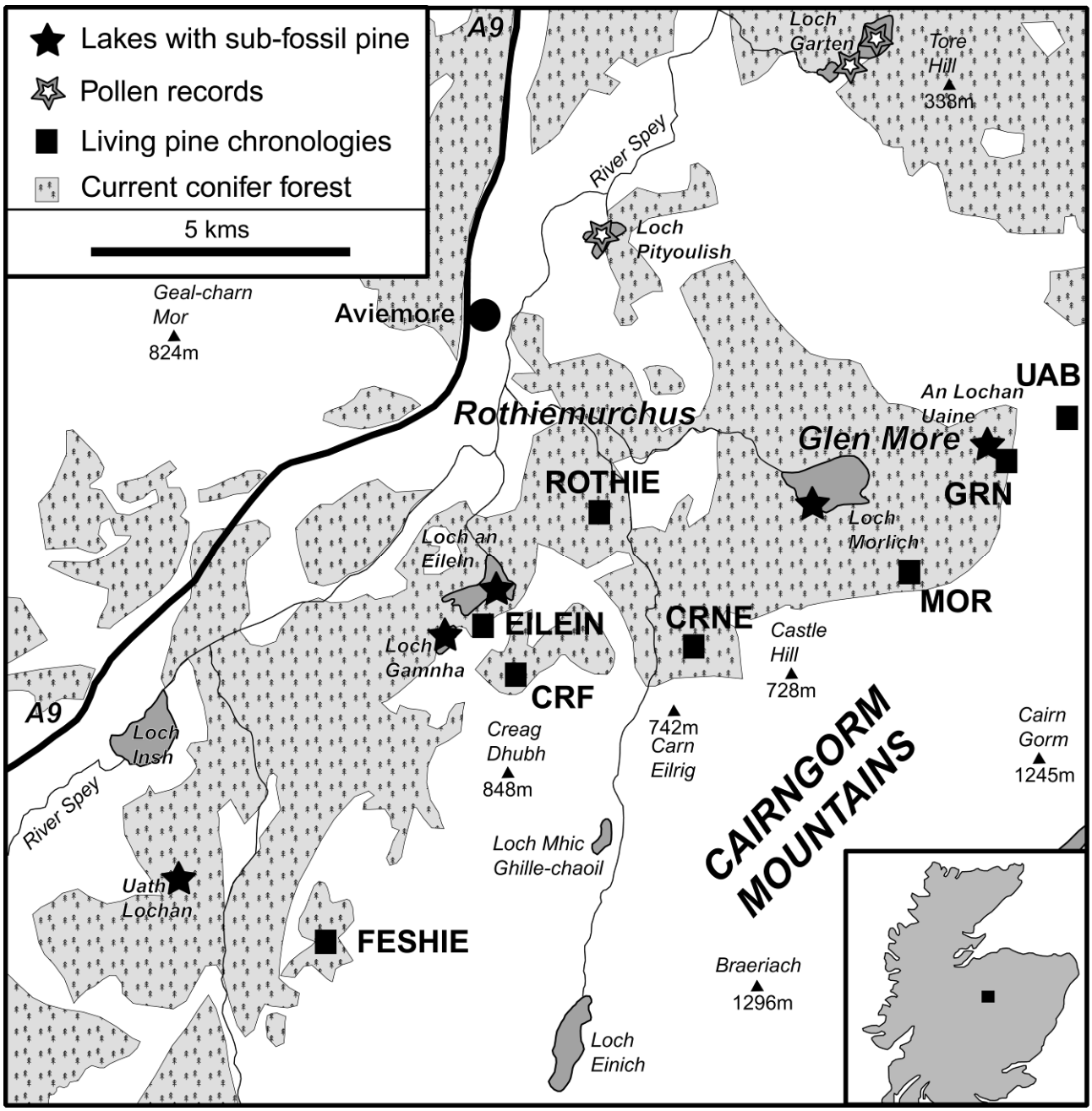

Figure 4: Location map of the current main study area in the North-West Cairngorms.

The initial radiocarbon dating results (Figure 5) clearly show the presence of extant well preserved pine macrofossil material covering different periods over the last 8000 years which highlights the possibility of developing a long pine chronology for this region. An intriguing cluster of 6 trees are dated to ~7800 years BP. These trees did not fall into the lake, but rather the base of the trunks are still rooted (but with the stems now tilted almost horizontally towards the shoreline) in situ ~2m below the present lake level. These trees most likely died therefore in the early Holocene when the level of the lake rose and killed the trees in situ.

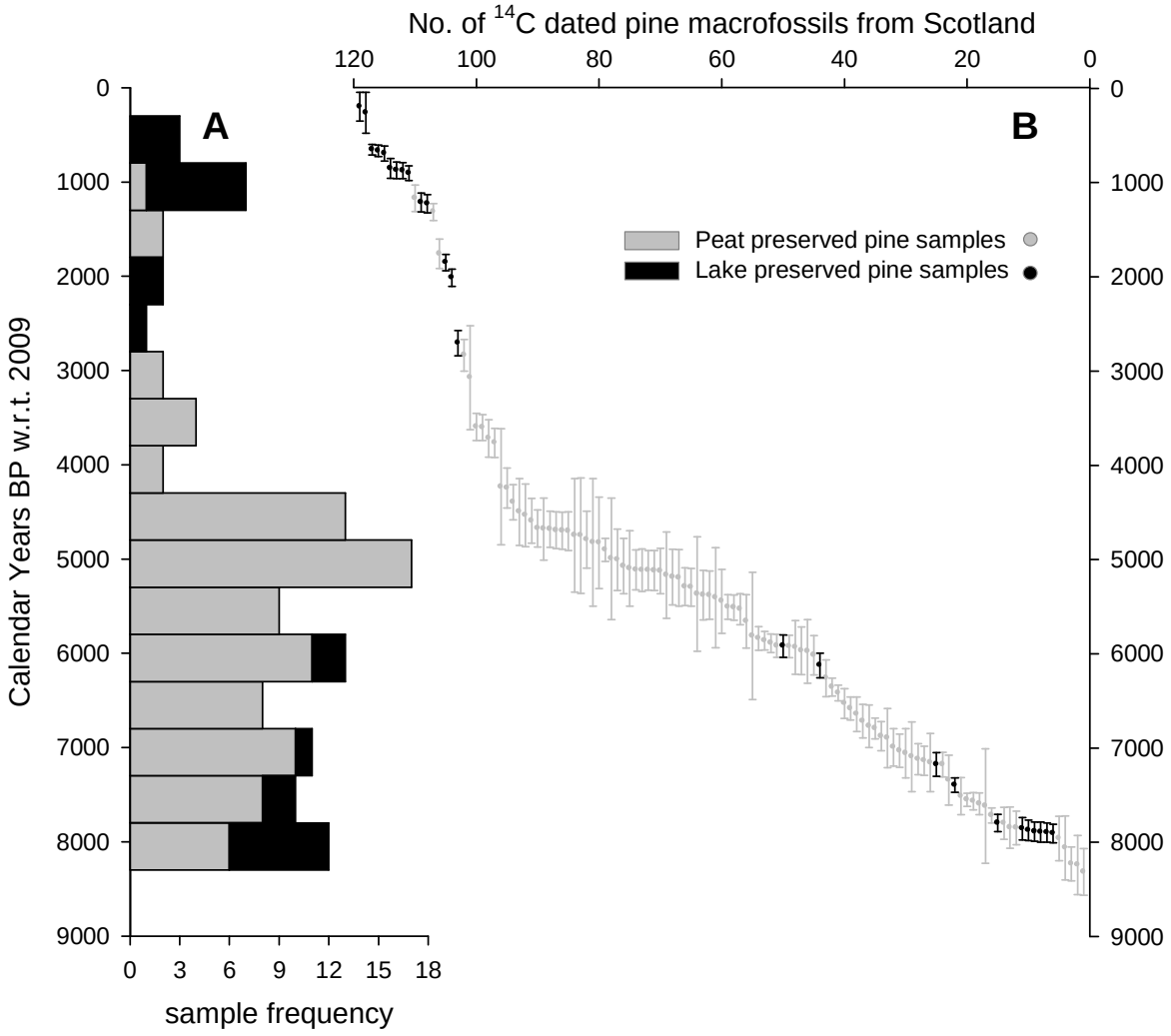

Figure 5: ^{14}C age comparison of pine macrofossils preserved within peat (▫) (data taken from Bridge et al. 1990 (and references therein) and Gear and Huntley (1991) and lakes (■) within the Scottish highlands, showing (**A**) the number of samples for 500 yr periods and (**B**) the ages (1 sigma error) of individual samples.

In 2009, a further ~50 samples were taken from Loch an Eilein (Figure 6) and the Green Loch to provide further "proof of concept" evidence for the development of a long Scottish pine chronology. Using the original sub-fossil samples from 2008 and the new data table 2 summaries preliminary dating results using both between sample crossdating (See Appendix A) and carbon dates. Despite the relatively low number of samples collected, these initial results already show that a near complete millennial long chronology has been derived using material from Loch an Eilein. At this time, the dating of each of the clusters have been constrained using ^{14}C dating (with associated errors), but we hypothesis that a complete dendrochronological dated millennial long record will be developed for this region very soon as further sampling continues. Crossdating using a continuous reference chronology will be much easier than the current "jigsaw" situation where samples may currently not date as they are temporally located during "gap" periods.

Figure 6: Winching method used to extract preserved sub-fossil pine stems from lake sediments.

Calendar Date	series	trees	Years	C14 Dates
1335-1483	12	6	149	3
1129-1336	8	4	208	2
1086-1189	3	2	104	2
723-905	3	3	183	2
-5956 to -5808	12	7	149	6
unknown	7	3	239	0
1755-2008	53	53	254	0

Table 2: Preliminary cluster crossdating results. Lower row are for the living trees around Loch an Eilein. NB. Many samples remain undated.

Conclusion

This report has detailed dendrochronological fieldwork and research over the last two years at the University of St. Andrews, and collaborating laboratories, that aims to develop a millennial length, and possibly longer, climate sensitive TR proxy record for Scotland. Extending the living pine chronologies will be a huge challenge. Many samples – likely thousands – will be needed before a robust near Holocene length chronology can be developed. However, preliminary results (Table 2) using both radio carbon dating and between sample crossdating has identified preliminary clusters of samples which indicate that a millennial length pine chronology from the NW Cairngorm region is a feasible and realistic objective. As well as sub-fossil material, we hope to also utilise samples from historic structures from the Scottish Highlands and some success has already been made on the Mar Lodge Estate in this regard.

Proposed Future Field Work in the Cairngorms

To realise the main aims of the Scottish Pine project will take many years of work. However, over the next few years, there are a few key areas of continued sampling in the Cairngorms that will be important for the success of the project:

1. ***Continued sampling of living trees:*** Although much sampling has been made over the last few years in the Cairngorms, the network is not quite complete:
    a. Due to the importance of Loch an Eilein and Loch Gamnha for the sub-fossil work, careful sampling along the slopes of Creag Fhiaclach would be useful to find and sample the older trees that are known to exist in this region from earlier research (Grace and Norton 1990). Such trees will be useful to overlap with the material coming out of the lakes to aid crossdating.
    b. The current samples taken from the old North Derry site were essentially taken through a reconnaissance fieldtrip in 2008. A return to this site will allow more trees to be sampled, and importantly a detailed map of the site will be made to ensure the identification and location of the oldest trees in the stand.
    c. The North Derry site highlights the importance of talus slope sites for finding old growth stands. Presumably these stands may never have been logged due to difficult access and the non-ideal tree growth forms. Potential talus slopes sites with associated pines have been identified in Abernethy, above the Green Loch in Glenmore, the upper reaches of Glen Feshie and Ballochbuie.
2. ***Continued extraction of preserved pine stems from Loch an Eilein, Loch Gamnha, the Green loch and Loch Morlich:*** Hopefully, for understanding past climate, forest stand dynamics and woodland exploitation, the importance of building a long pine chronology for the NW Cairngorms region cannot be discounted. There appears to be a profuse amount of preserved woody material in the lochs in the NW Cairngorm region and currently we have only touched the tip of the iceberg. A proposed detailed sonar survey of Loch an Eilein this July will hopefully be able to identify how much preserved woody material is in the loch which will also facilitate more focused sampling in the future. If the Loch an Eilein survey is successful, then permission will be sought to undertake similar surveys in other candidate lochs with good access (e.g. Loch Morlich).

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Appendix A

Dendrochronology and Dendroclimatology

At the simplest level, dendrochronology is the science of dating tree rings and interpreting the information within them. The crucial term is ‘dating’. Unlike many other palaeoclimate disciplines, dendrochronology allows the correct identification of each growth ring to an exact calendar year through the process of pattern matching sequences of wide and narrow rings. This process is known as crossdating and is schematically shown in Figure A1. Initially a chronology is derived from living trees (where the year of sampling is known) and then through careful comparison (visually and statistically) of the ring-width sequences, the living chronology can be extended using preserved material from either buildings (e.g. beams) or sub-fossil material (i.e. material preserved in sediments).

Dendroclimatology is concerned with identifying relationships between climate and measured parameters from annual rings (e.g. ring-width, maximum density, stable isotopes etc) and so allowing the development of tree-ring based palaeoclimatic reconstructions. A statistical model is derived using the overlap between the tree-ring and climate data and the temporal stability of this model is assumed to hold through time and is used to reconstruct past climate prior to the period covered by the instrumental data.

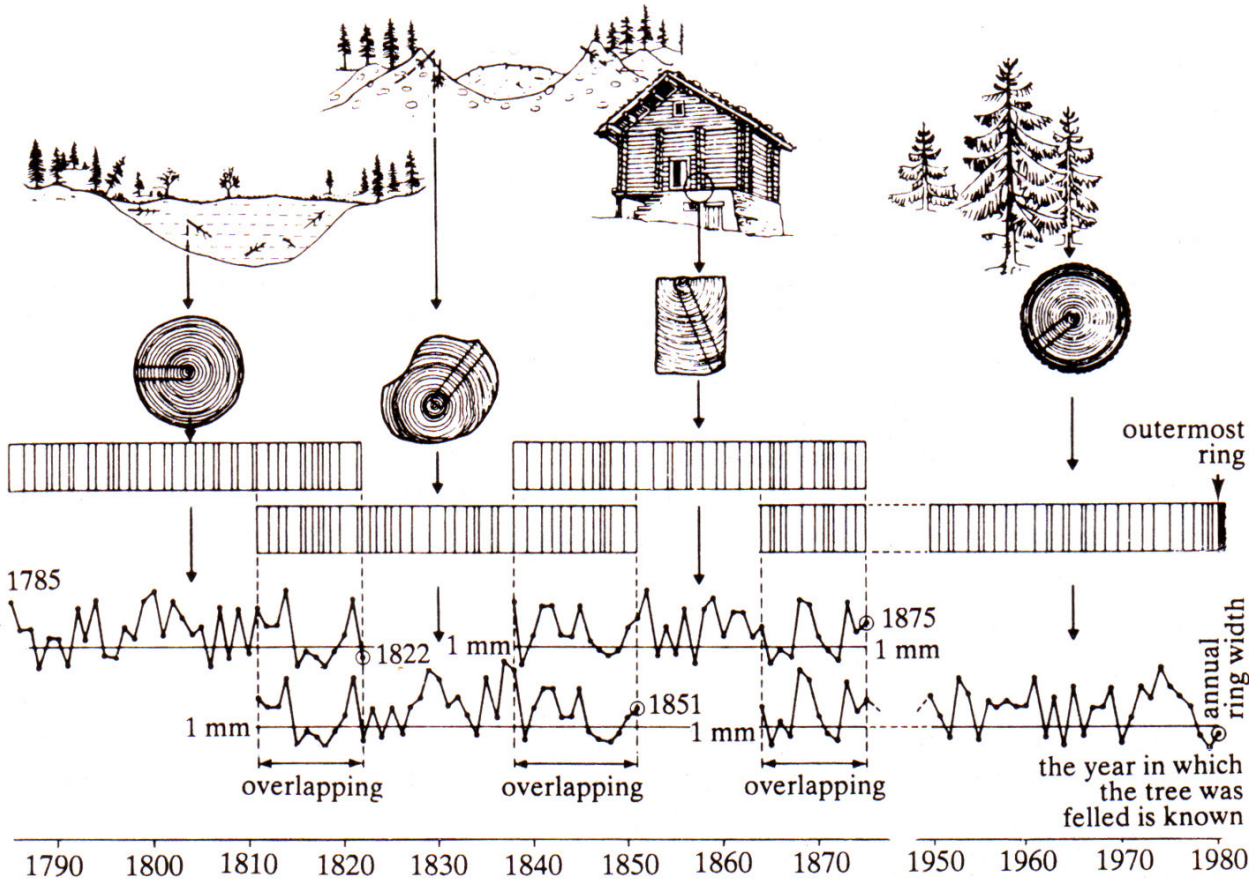

Figure A1: *Schematic representation of the procedure of crossdating.*

Appendix B – Individual site summary meta data

Abernethy

Upper Abernethy - Loch a' Gharbh choire

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
UAB01	1749	2009	261	16	98	1733	RW
UAB02	1862	2009	148	N/A	73		RW
UAB03	1866	2009	144	50+?	110	1816	RW
UAB05B	1789	2009	221	N/A	93		RW
UAB06	1871	2006	136	N/A	103		RW
UAB07	1735	1826	92	8	0	1727	RW
UAB08	1810	2009	200	29	86	1781	RW
UAB09	1778	2007	230	7	74	1771	RW
UAB10	1837	2009	173	17	78	1820	RW
UAB11	1858	2009	152	26	72	1832	RW
UAB12	1762	2009	248	N/A	87		RW
UAB13	1863	2009	147	23	55	1840	RW
UAB14	1861	2009	149	48?	85	1813	RW
UAB15	1826	2009	184	N/A	91		RW
UAB16	1783	2009	227	10	92	1773	RW
UAB17	1808	2008	201	22	89	1786	RW
UAB18	1770	2009	240	1	91	1769	RW
UAB19	1836	2009	174	N/A	83		RW
UAB20	1767	2009	231	16	102	1751	RW
UAB21	1835	2009	175	16	76	1819	RW
UAB22	1807	1866	60	32	0	1775	RW
UAB23	1751	2009	259	25	124	1726	RW
UAB24	1775	2009	235	20	63	1755	RW
UAB25	1806	2009	204	12	70	1794	RW
UAB27	1744	2009	266	2	96	1742	RW
UAB31	1878	2007	130	20	93	1858	RW
problems							
UAB04	1750	2009	260	N/A	89		RW
UAB05	1764	2009	246	3	44	1761	RW
UAB30	1779	2009	231	12	82	1767	RW

Bognacruie

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-011-04181	1894	2000	107	1	60	1893	RW
ABN-011-04182	1892	2000	109	0	46	1892	RW
ABN-013-04109	1731	2000	270	12	87	1719	RW
ABN-013-04110	1732	2000	269	0	70	1732	RW
ABN-014-04111	1634	2000	367	0	118	1634	RW
ABN-014-04112	1734	2000	267	3	110	1731	RW
ABN-015-04113	1893	2000	108	2	67	1891	RW
ABN-015-04114	1901	2000	100	2	46	1899	RW
ABN-016-04115	1766	2000	235	2	100	1764	RW
ABN-016-04116	1767	2000	234	1	160	1766	RW
ABN-017-04591	1760	2000	241	1	78	1759	RW

Bognacruie - Forest Research Plot

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
P05T60	1746	2002	257	25+?	86	1721	RW
P05T61	1742	2001	260	2	81	1740	RW
P09T134	1894	2002	109	3	58	1891	RW
P10T149	1902	2002	101	0	49	1902	RW
P19T276	1734	2002	269	3	73	1731	RW
P20T284	1747	2002	256	17	96	1730	RW
P20T288	1800	2002	203	N/A	95		RW
P20T292A	1753	2001	249	25?	60	1728	RW
P20T292B	1846	2002	157	??	82		RW

NB. Data not include in Figure 3a.

Carn-a-Chnuic

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-019-04593	1879	2000	122	0	48	1879	RW
ABN-019-04594	1891	2000	110	0	74	1891	RW
ABN-022-04119	1911	2000	90	3	60	1908	RW
ABN-022-04119A	1907	2001	95	5	60	1902	RW
ABN-022-04119B	1900	2001	102	1	62	1899	RW
ABN-022-04120	1900	2000	101	0	50	1900	RW
ABN-023-04145	1911	2000	90	2	50	1909	RW
ABN-023-04146	1904	2000	97	2	49	1902	RW
ABN-024-04157	1905	2000	96	2	70	1903	RW
ABN-024-04158	1895	2000	106	1	64	1894	RW
ABN-025-04169	1899	2000	102	1	64	1898	RW
ABN-025-04170	1889	2000	112	0	66	1889	RW
ABN-119-04361	1759	2000	242	4	92	1755	RW
ABN-116-04598	1892	2000	109	1	58	1891	RW
ABN-117-04355	1778	2000	223	1	92	1777	RW
ABN-118-04357	1741	2000	260	12	120	1729	RW
ABN-118-04358A	1812	2000	189	7	79	1805	RW
ABN-118-04358B	1803	2000	198	5?	78	1798	RW
ABN-119-04362	1851	2000	150	11?	66	1840	RW
ABN-120-04359	1790	2000	211	1	114	1789	RW
ABN-120-04360	1870	2000	131	80?	63	1790	RW

Carn-na-Loinne

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-001-01484	1890	2000	111	0	57	1890	RW
ABN-002-01487	1917	2000	84	15	63	1902	RW
ABN-002-01488	1903	2000	98	4	59	1899	RW
ABN-003-01489	1894	1998	105	3	70	1891	RW
ABN-003-01490	1891	2000	110	0	60	1891	RW
ABN-004-01497	1896	2000	105	3	68	1893	RW
ABN-004-01498	1889	2000	112	0	61	1889	RW
ABN-005-01499	1904	2000	97	0	54	1904	RW
ABN-005-01500	1904	2000	97	0	46	1904	RW
ABN-007-04229	1904	2000	97	10	55	1894	RW
ABN-008-04193	1885	2000	116	2	73	1883	RW
ABN-008-04194	1887	2000	114	3	66	1884	RW
ABN-009-04205	1892	2000	109	6	73	1886	RW
ABN-009-04206	1894	2000	107	4	55	1890	RW
ABN-010-04217	1908	2000	93	2	37	1906	RW
ABN-010-04218	1909	2000	92	2	50	1907	RW

Ice-Wood

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-026-04121	1879	2000	122	3	65	1876	RW
ABN-026-04122	1896	2000	105	3	61	1893	RW
ABN-027-04133	1884	2000	117	5	62	1879	RW
ABN-027-04134	1891	2000	110	0	65	1891	RW
ABN-027-04134	1902	2000	99	4	62	1898	RW
ABN-028-01492	1889	2000	112	2	84	1887	RW
ABN-029-04241	1894	2000	107	7	86	1887	RW
ABN-029-04242	1878	2001	124	2	80	1876	RW
ABN-030-04253	1878	2000	123	3	76	1875	RW
ABN-030-04254	1894	2001	108	7	56	1887	RW
ABN-031-04265	1865	2000	136	0	82	1865	RW
ABN-031-04266	1877	2000	124	0	62	1877	RW
ABN-032-04277	1893	2000	108	2	69	1891	RW
ABN-032-04278	1881	2000	120	1	67	1880	RW
ABN-033-04289	1891	2000	110	1	59	1890	RW
ABN-033-04290	1901	2000	100	2	57	1899	RW
ABN-076-01630	1884	2000	117	6	62	1878	RW
ABN-077-01637	1876	2000	125	2	75	1874	RW
ABN-077-01638	1900	2000	101	1	48	1899	RW
ABN-096-04507	1895	2000	106	1	58	1894	RW
ABN-096-04508	1876	2000	125	0	72	1876	RW
ABN-097-04509	1891	2000	110	0	57	1891	RW
ABN-097-04510	1894	2000	107	2	62	1892	RW
ABN-098-04521	1892	2000	109	1	67	1891	RW
ABN-098-04522	1899	2000	102	2	68	1897	RW

North-Abernethy

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-034-04379	1942	2000	59	0	41	1942	RW
ABN-034-04380	1945	2000	56	0	38	1945	RW
ABN-035-04375	1937	2000	64	0	46	1937	RW
ABN-035-04376	1940	2000	61	1	37	1939	RW
ABN-036-04377	1938	2000	63	0	39	1938	RW
ABN-036-04378	1937	2000	64	1	39	1936	RW
ABN-037-01591	1950	2000	51	1	79	1949	RW
ABN-037-01592	1948	2000	53	3	43	1945	RW
ABN-038-04381	1943	2000	58	3	45	1940	RW
ABN-038-04382	1945	2000	56	7	44	1938	RW
ABN-039-01593	1950	1998	49	3	40	1947	RW
ABN-039-01594	1949	2000	52	7	43	1942	RW
ABN-040-04383	1947	2000	54	0	34	1947	RW
ABN-040-04384	1949	2000	52	2	41	1947	RW
ABN-041-04385	1946	2000	55	0	40	1946	RW
ABN-041-04386	1948	2000	53	2	33	1946	RW
ABN-062-04387	1954	2000	47	1	36	1953	RW
ABN-062-04388	1951	2000	50	0	37	1951	RW
ABN-063-04389	1944	2000	57	1	42	1943	RW
ABN-063-04390	1947	2000	54	1	39	1946	RW
ABN-064-04391	1948	2000	53	2	40	1946	RW
ABN-064-04392	1947	2000	54	1	42	1946	RW
ABN-065-04393	1942	2000	59	1	42	1941	RW
ABN-065-04394	1948	2000	53	0	41	1948	RW
ABN-066-04395	1950	2000	51	0	34	1950	RW
ABN-066-04396	1947	2000	54	1	39	1946	RW
ABN-184-01710	1849	2000	152	2	62	1847	RW
ABN-185-01703	1875	2000	126	0	54	1875	RW
ABN-185-01704A	1899	2000	102	7??	72	1892	RW
ABN-185-01704B	1879	2000	122	0	78	1879	RW
ABN-186-01793L	1871	2001	131	0	54	1871	RW
ABN-186-01793	1891	2001	111	6	54	1885	RW
ABN-186-01794A	1871	2001	131	0	75	1871	RW
ABN-186-01794B	1888	2001	114	17	85	1871	RW
ABN-187-01791L	1854	2001	148	0	88	1854	RW
ABN-187-01791U	1873	2001	129	3	73	1870	RW
ABN-187-01792L	1878	2001	124	1	93	1877	RW
ABN-187-01792	1868	2001	134	10??	94	1858	RW

North Abernethy & North Loch Garten - bog

	Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
BOGN	**North Abernethy**							
	ABN-184-01710	1849	2000	143	2	62	1847	RW
	ABN-185-01704A	1899	2000	109	7??	72	1892	RW
	ABN-185-01704B	1879	2000	103	0	78	1879	RW
	ABN-186-01793	1855	1969	122	6	54	1849	RW
	ABN-186-01794A	1805	1935	124	0	75	1805	RW
	ABN-186-01794B	1828	1944	53	17	85	1811	RW
	ABN-187-01791L	1853	2000	152	0	88	1853	RW
	ABN-187-01791U	1872	2000	102	3	73	1869	RW
	ABN-187-01792L	1874	2000	122	1	93	1873	RW
	ABN-187-01792	1868	2001	115	10??	94	1858	RW
	problems							
	ABN-185-01703	1876	2001	126	0	54	1876	RW
	ABN-186-01793L	1871	2001	131	0	54	1871	RW
BOGLG	**North Loch Garten**							
	ABN-177-04021	1859	2001	143	0	78	1859	RW
	ABN-178-04033	1892	2000	109	9?	74	1883	RW
	ABN-180-04057L	1898	2000	103	3	75	1895	RW
	ABN-180-04058	1879	2000	122	1	88	1878	RW
	ABN-181-04069	1878	2001	124	0	80	1878	RW
	ABN-181-04070	1949	2001	53	0	44	1949	RW
	ABN-181-04070B	1887	1958	72	5	70	1882	RW
	problems							
	ABN-178-04034	1864	2000	137	5	92	1859	RW
	ABN-179-04045	1986	2001	16	5	16	1981	RW
	ABN-180-04057U	1902	2001	100	1	65	1901	RW

Tore-Hill

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
ABN-078-04397	1944	2000	57	0	39	1944	RW
ABN-078-04398	1941	2000	60	1	35	1940	RW
ABN-079-01486	1941	2000	60	1	47	1940	RW
ABN-080-04399	1946	2000	55	0	39	1946	RW
ABN-080-04400	1946	2000	55	0	35	1946	RW
ABN-081-04491	1945	2000	56	0	42	1945	RW
ABN-081-04492	1950	2000	51	0	38	1950	RW
ABN-108-04493	1944	2000	57	0	38	1944	RW
ABN-108-04494	1942	2000	59	0	42	1942	RW
ABN-109-04495	1942	2001	60	0	39	1942	RW
ABN-109-04496	1940	2001	62	0	42	1940	RW
ABN-110-04497	1948	2000	53	1	34	1947	RW
ABN-110-04498	1944	2000	57	1	39	1943	RW
ABN-111-04499	1941	2000	60	0	38	1941	RW
ABN-111-04500	1941	2000	60	0	36	1941	RW
ABN-112-04501	1949	2000	52	1	31	1948	RW
ABN-112-04502	1945	2000	56	0	41	1945	RW
ABN-113-04503	1941	2000	60	1	33	1940	RW
ABN-113-04504	1942	2000	59	1	44	1941	RW
ABN-114-04505	1945	2000	56	1	37	1944	RW
ABN-114-04506	1949	2000	52	1	33	1948	RW

Loch Garten - Abernethy Disks - infosheet

Sample Code	Start	End	Years	Pith-offset	sapwood count	Establishment	Measured parameter
05129	1796	1928	133	0	51	1796	RW
05130	1798	1928	131	2	72	1796	RW
05131	1798	1929	132	2	91	1796	RW
05132	1801	1928	128	4	60	1797	RW
05134	1799	1928	130	3	60	1796	RW
05135	1791	1929	139	0	84	1791	RW
05136	1793	1923	131	0	52	1793	RW
05137	1790	1913	124	0	50	1790	RW
05138	1793	1929	137	0	63	1793	RW
05139	1797	1932	136	0	68	1797	RW
05140	1791	1929	139	0	72	1791	RW
05141	1792	1929	138	0	85	1792	RW
05142	1793	1928	136	0	90	1793	RW
05143	1792	1928	137	1	65	1791	RW
05144	1794	1928	135	2	60	1792	RW
05145	1795	1928	134	0	66	1795	RW
05146	1794	1928	135	0	53	1794	RW
05147	1794	1929	136	0	76	1794	RW
05148	1797	1928	132	0	64	1797	RW
05149	1794	1929	136	0	66	1794	RW
05196	1805	1928	124	0	77	1805	RW
nocode1	1800	1929	130	2	58	1798	RW
noname2	1798	1927	130	0	63	1798	RW

Northwest Cairngorms

Morlich

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
GLM01A	1766	2006	241	4	1762	RW
GLM02A	1764	2006	243	6	1758	RW
GLM03A	1802	2006	205	4	1798	RW
GLM04A	1788	2006	219	15	1773	RW
GLM05A	1775	2006	232	7	1768	RW
GLM06A	1740	2006	267	0	1740	RW
GLM07A	1775	2003	229	11	1764	RW
GLM08A	1763	2006	244	0	1763	RW
GLM09A	1833	2006	174	0	1833	RW
GLM10A	1749	2006	258	8	1741	RW
GLM11A	1887	2006	120	14	1873	RW
GLM12A	1780	2006	227	22	1758	RW
GLM13A	1802	2006	205	14	1788	RW
GLM14A	1808	2006	199	43	1765	RW
GLM15A	1898	2006	109	15	1883	RW
GLM16A	1775	2006	232	15	1760	RW
GLM17A	1874	2006	133	13	1861	RW

Carn Eilrig

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
CE2a	1849	2008	160	7	1842	RW
CE2b	1844	2008	165	3	1841	RW
CE3	1882	2008	127	28	1854	RW
CE4a	1807	2008	202	9	1798	RW
CE4b	1807	1999	193	9	1798	RW
CE7	1808	2008	201	16	1792	RW
CE8	1821	2008	188	1	1820	RW
CE9	1869	2008	140	12	1857	RW
CE10a	1847	2008	162	0	1847	RW
CE10b	1851	2008	158	0	1851	RW
CE11	1828	2008	181	5	1823	RW
CE12	1901	2008	108	60	1841	RW
CE13	1836	2008	173	25	1811	RW
CE15	1831	2008	178	9	1822	RW
CE16	1811	2008	198	7	1804	RW
CE17	1837	2008	172	5	1832	RW
CE18a	1837	2008	172	19	1818	RW
CE18b	1837	2004	168	19	1818	RW
CE19a	1824	2008	185	19	1805	RW
CE19b	1824	2008	185	19	1805	RW
CE21	1828	2008	181	1	1827	RW
CE22	1820	2008	189	N/A	N/A	RW
CE25	1903	2008	106	7	1896	RW
CE26	1735	2008	274	6	1729	RW
CE29	1830	2008	179	14	1816	RW

Rothiemurchus

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
RTM01A	1898	2006	109	0	1898	RW
RTM02A	1845	2006	162	1	1844	RW
RTM03A	1859	2006	148	0	1859	RW
RTM04A	1854	2006	153	11	1843	RW
RTM05A	1850	2006	157	7	1843	RW
RTM06A	1937	2006	70	8	1929	RW
RTM07A	1879	2006	128	0	1879	RW
RTM08A	1940	2006	67	9	1931	RW
RTM09A	1853	2006	154	7	1846	RW
RTM10A	1852	2006	155	13	1839	RW
RTM11A	1841	2006	166	5	1836	RW
RTM12A	1852	2006	155	0	1852	RW
RTM13A	1849	2006	158	5	1844	RW
RTM14A	1841	2006	166	6	1835	RW
RTM15A	1852	2006	155	11	1841	RW
RTM16A	1845	2006	162	6	1839	RW
RTM17A	1860	2006	147	14	1846	RW

Loch an Eileen

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
LES1	1858	2008	151	11	1847	RW
LES2	1853	2008	156	10	1843	RW
LES3	1878	2008	131	17	1861	RW
LES4	1880	2008	129	50	1830	RW
LES5	1973	2008	36	3	1970	RW
LES12	1877	2008	132	12	1865	RW
LES13	1874	2007	134	4	1870	RW
LES14	1875	2008	134	5	1870	RW
LES15	1876	2008	133	2	1874	RW
LES11	1875	2008	134	15	1860	RW
LES21	1896	2008	113	40+	1856	RW
LES22	1887	2008	122	20	1867	RW
LES23	1867	2008	142	16	1851	RW
LES24	1854	2008	155	15	1839	RW
LES25	1880	2008	129	27	1853	RW
LES60	1851	2008	158	3	1848	RW
LES61	1838	2008	171	10	1828	RW
LES62	1868	2008	141	8	1860	RW

LES63	1866	2008	143		1866	RW
LES64	1879	2008	130	13	1866	RW
LES76	1777	2008	232	N/A		RW
LES77	1853	2008	156	2	1851	RW
LES78	1873	2008	136	18	1855	RW
LES79	1880	2008	129	25	1855	RW
LES80	1848	2008	161		1848	RW
LEL6	1888	2004	117		1888	RW
LEL7	1898	2008	111	7	1891	RW
LEL8	1876	2008	133	4	1872	RW
LEL9	1865	2008	144	3	1862	RW
LEL10	1869	2008	140	2	1867	RW
LEL16	1905	2008	104	6	1899	RW
LEL17	1932	2008	77	N/A		RW
LEL18	1853	2008	156	8	1845	RW
LEL19	1847	2008	162	4	1843	RW
LEL20	1866	2008	143		1866	RW
LEL26	1864	2008	145		1864	RW
LEL27	1841	2006	166	3	1838	RW
LEL28	1870	2008	139	6	1864	RW
LEL29	1864	2008	145	3	1861	RW
LEL30	1869	2008	140		1869	RW
LEL31	1860	2008	149	9	1851	RW
LEL32	1900	2008	109	25	1875	RW
LEL65	1808	2008	201	N/A		RW
LEL66	1819	2008	190	12	1807	RW
LEL67	1894	2008	115	14?	1880	RW
LEL68	1755	2008	254	N/A		RW
LEL71	1844	2008	165	11	1833	RW
LEL72	1903	2008	106	N/A		RW
LEL73	1881	2008	128	15	1866	RW
LEL74	1871	2008	138	15	1856	RW
LEL80	1881	2008	128	9	1872	RW
LEL81	1893	2008	116	14	1879	RW
LEL82	1850	2008	159	18	1832	RW

Loch Gamnha

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
LGS1	1936	2008	73	2	1934	RW
LGS2	1941	2008	68	9	1932	RW
LGS4	1965	2008	44	12	1953	RW
LGS16	1964	2008	45	10	1954	RW
LGS17	1953	2008	56	4	1949	RW
LGS18	1927	2008	82	7	1920	RW
LGS19	1946	2008	63	4	1942	RW
LGS20	1936	2008	73	9	1927	RW
LGS21	1898	2008	111	7	1891	RW
LGS22	1930	2003	74	8	1922	RW
LGS23	1930	2008	79	7	1923	RW
LGS24	1936	2008	73	5	1931	RW
LGS25	1940	2008	69	9	1931	RW
LGS102	1946	2008	63	5	1941	RW
LGS104	1822	2007	186	12	1810	RW
problems						
LGS3	1933	2008	76	5	1928	RW
LGS5	1945	2008	64	11	1934	RW
LGS103	1940	2008	69	19	1921	RW
LGL7	1941	2008	68	6	1935	RW
LGL8	1963	2008	46	7	1956	RW
LGL9	1967	2008	42	1	1966	RW
LGL10	1867	2008	142	25	1842	RW
LGL11	1947	2008	62	10	1937	RW
LGL12	1944	2008	65	1	1943	RW
LGL13	1970	2008	39	7	1963	RW
LGL14	1869	2008	140	11	1858	RW
LGL15	1876	2008	133	12	1864	RW
LGL26	1875	2008	134	21	1854	RW
LGL101	1777	2008	232	17	1760	RW
LGL105	1827	2008	182	20?	1807	RW
problems						
LGL6	1948	2008	61	5	1943	RW

Creag Fhiaclach

Sample Code	Start	End	Years	Pith-offset	Germination	Measured parameter
CF01	1849	2007	159	12	1837	RW
CF02	1865	2008	144	13	1852	RW/BI
CF03	1911	2008	98	23	1888	RW/BI
CF04	1845	2008	164	6	1839	RW/BI
CF05	1840	2007	168	5	1835	RW/BI
CF06	1801	2008	208	27	1774	RW
CF07	1849	2008	160	9	1840	RW/BI
CF08	1751	2008	258	4	1747	RW/BI
CF09	1860	2008	149	2	1858	RW/BI
CF10	1780	1991	212	N/A		RW
CF11	1778	1959	182	30	1748	RW
CF12	1844	2008	165	4	1840	RW
CF14	1844	2008	165	25	1819	RW
CF15	1736	2008	273	9	1727	RW/BI
CF16	1748	2008	261	15	1733	RW
CF17	1874	2008	135	20	1854	RW/BI
CF18	1851	2008	158	4	1847	RW
CF19	1879	2008	130	25	1854	RW

Feshie

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
FSH01A	1811	2006	196	4	1807	RW
FSH02A	1841	2004	164	15	1826	RW
FSH03A	1875	2004	130	7	1868	RW
FSH04A	1842	2006	165	11	1831	RW
FSH05A	1916	2006	91	12	1904	RW
FSH06A	1851	2006	156	14	1837	RW
FSH07A	1853	2006	154	9	1844	RW
FSH08A	1833	2006	174	0	1833	RW
FSH09A	1853	2006	154	5	1848	RW
FSH10A	1873	2001	129	14	1859	RW
FSH11A	1888	2006	119	11	1877	RW
FSH12A	1858	2006	149	5	1853	RW
FSH13A	1867	2006	140	4	1863	RW
FSH14A	1900	2006	107	15	1885	RW
FSH15A	1861	2004	144	10	1851	RW
FSH16A	1848	2006	159	10	1838	RW
FSH17A	1854	2006	153	1	1853	RW
FSH18A	1874	2006	133	0	1874	RW
FSH21A	1822	2006	185	15	1807	RW
FSH22A	1849	2006	158	0	1849	RW
FSH23A	1839	2006	168	0	1839	RW
FSH24A	1844	2006	163	0	1844	RW
FSH25A	1854	2006	153	8	1846	RW
FSH26A	1847	2006	160	0	1847	RW

Badan Mosach

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
FBM01	1851	2008	158	3	1848	RW-BI
FBM02	1852	2008	157	2	1850	RW
FBM02a	1878	2008	131	17	1861	RW
FBM03	1848	2008	161	9	1839	RW
FBM03?	1847	2008	162	3	1844	RW
FBM05	1859	2008	150	10	1849	RW-BI
FBM07	1833	2008	176	4	1829	RW-BI
FBM09	1830	2008	179	8	1822	RW
FBM11	1763	2008	246	5	1758	RW
FBM12	1872	2008	137	16	1856	RW
FBM12A	1866	2008	143	13	1853	RW
FBM13ai	1840	2008	169	N/A	N/A	RW
FBM13aii	1840	2008	169	2	1838	RW-BI
FBM13b	1880	2008	129	N/A	N/A	RW-BI
FBM13c	1835	2008	174	N/A	N/A	RW-BI
FBM16	1845	2008	164	6	1839	RW-BI
FBM16a	1836	2008	173	13	1823	RW-BI
FBM16b	1851	2008	158	N/A	N/A	RW
FBM17	1840	2008	169	5	1835	RW-BI
FBM18	1833	2008	176	1	1832	RW-BI
FBM19	1852	2008	157	4	1848	RW-BI
FBM19a	1851	2008	158	9	1842	RW
FBM21	1867	2008	142	17	1850	RW
FBM41	1864	2008	145	8	1856	RW-BI
FBM44	1854	2008	155	1	1853	RW
FBM46	1849	2008	160	3	1846	RW
FBM47	1839	2008	170	0	1839	RW

Mar Lodge

Derry East

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
569011	1814	1978	165	55	1759	RW
569012	1773	1978	206	14	1759	RW
569021	1779	1978	200	9	1770	RW
569022	1809	1978	170	29	1780	RW
569031	1779	1978	200	29	1750	RW
569032	1806	1978	173	56	1750	RW
569041	1823	1978	156	30	1793	RW
569042	1820	1978	159	23	1797	RW
569051	1811	1978	168	33	1778	RW
569052	1784	1978	195	6	1778	RW
569061	1838	1978	141	63	1775	RW
569062	1796	1978	183	21	1775	RW
569071	1817	1978	162	38	1779	RW
569072	1790	1978	189	11	1779	RW
569081	1864	1978	115	65	1799	RW
569082	1810	1978	169	11	1799	RW
569091	1833	1978	146	13	1820	RW
569092	1833	1978	146	13	1820	RW
568101	1846	1978	133	65	1781	RW
568102	1808	1978	171	27	1781	RW
568111	1786	1978	193	24	1762	RW
568112	1773	1906	134	11	1762	RW
568121	1810	1978	169	40	1770	RW
568122	1801	1978	178	31	1770	RW
572131	1878	1978	101	41	1837	RW
572132	1856	1978	123	19	1837	RW
GD01A	1629	1992	364	0	1629	RW
GD02A	1661	1988	328	13	1648	RW
GD05A	1722	1992	271	2	1720	RW
GD10A	1733	1992	260	14	1719	RW
GD20A	1762	1992	231	0	1762	RW
GD22A	1734	1988	255	6	1728	RW
GD32A	1741	1980	240	5	1736	RW
GD34A	1750	1992	243	9	1741	RW
GD35A	1745	1992	248	3	1742	RW
GD36A	1739	1992	254	3	1736	RW
GDE01A	1906	2008	103	23	1883	RW
GDE01R	1737	2008	272	N/A	N/A	RW

GDE02A	1808	2008	201	22	1786	RW
GDE02R	1727	2008	282	50?	1677	RW
GDE04A	1889	2008	120	2	1887	RW
GDE05B	1823	1990	168	N/A	N/A	RW
GDE06A	1799	2008	210	15	1784	RW
GDE07A	1794	1939	146	17	1777	RW
GDE08A	1746	2008	263	N/A	N/A	RW
GDE10A	1802	2008	207	20	1782	RW
GDE11A	1778	2008	231	N/A	N/A	RW
GDE11B	1821	2008	188	30	1791	RW
GDE12R	1745	2008	264	18	1727	RW
GDE14R	1919	2008	90	19	1900	RW
GDE16R	1804	2008	205	50	1754	RW
GDE17R	1804	2005	202	28	1776	RW
GDE18R	1727	2008	283	10	1717	RW
GDE19R	1761	2008	248	18	1743	RW

Glen Derry North

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
GDN01	1700	2008	309	13	110	1687	RW
GDN02A	1692	1809	118	37	??	1655	RW
GDN02B	1894	2007	114	N/A	??		RW
GDN03	1737	2008	272	6?	92	1731	RW
GDN04	1746	1962	217	5	74	1741	RW
GDN05	1769	2008	240	15	115	1754	RW
GDN06AR	1628	2008	381	40??	124	1588	RW
GDN06BR	1569	2008	440	N/A	138		RW
GDN07A	1688	2008	321	N/A	100		RW
GDN07B	1665	2005	341	25	148	1640	RW
GDN08	1802	2008	207	26	121	1776	RW
GDN09A	1690	2000	311	N/A	79		RW
GDN09B	1712	2008	297	N/A	89		RW
GDN09C	1642	1751	110	13	0	1629	RW
GDN09D	1643	1694	52	9	0	1634	RW
GDN10A	1604	2008	405	22	97	1582	RW
GDN10B	1656	2008	353	20+?	123	1636	RW
GDN11A	1706	2008	303	N/A	137		RW
GDN11B	1754	2008	255	30	118	1724	RW
GDN12A	1815	2008	194	40+?	96	1775	RW
GDN12B	1711	1909	199	N/A	106		RW
GDN13A	1620	2008	389	N/A	170		RW
GDN13B	1612	2008	397	25?	113	1587	RW
GDN14A	1658	2008	351	17	138	1641	RW
GDN14B	1477	1955	479	20	117	1457	RW
GDN15A	1783	2008	226	N/A	146		RW
GDN15B	1583	2006	424	15???	173	1568	RW
GDN16A	1756	2008	253	N/A	106		RW
GDN16B	1788	2008	221	N/A	77		RW
GDN17	1761	2008	248	22	107	1739	RW
GDN18	1648	2008	361	21	106	1627	RW
GDN19R	1640	2008	369	24	79	1616	RW
GDN20	1630	2008	379	17	118	1613	RW
GDNDead1	1694	1818	125	N/A	0		RW
GDNDead2	1575	1725	151	N/A	0		RW
GDNdead3	1849	1981	60++	50	47	1799	RW
GDNdead4	1690	1863	174	21	0	1669	RW

Glen Derry West

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
GDW01	1739	2008	270	1	104	1738	RW
GDW2	1746	2008	263	2	101	1744	RW
GDW03	1827	2008	182	12	77	1815	RW
GDW04	1780	2008	229	3	116	1777	RW
GDW05	1798	2008	211	14	116	1784	RW
GDW06	1782	2008	227	32??	96	1750	RW
GDW07	1776	2008	233	11-30??	116	1756	RW
GDW08	1769	2008	240	18?	123	1751	RW
GDW09	1816	2008	193	10	79	1806	RW
GDW12	1791	2008	218	20	94	1771	RW
GDW13	1760	2008	249	2	88	1758	RW
GDW14	1792	2008	217	34??	104	1758	RW
GDW15	1764	1946	183	6	68	1758	RW
GDW16	1768	2008	241	6	96	1762	RW
GDW17	1763	2008	246	3	93	1760	RW
GDW18	1723	2008	286	0	126	1723	RW
GDW19	1773	2008	236	20??	91	1753	RW
GDW20	1759	2008	250	19	115	1740	RW

Luibeg

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
GL52A	1699	1992	294	7	1692	RW
GL53A	1702	1992	291	11	1691	RW
GL56A	1669	1992	324	0	1669	RW
GL57A	1707	1992	286	4	1703	RW
GL59A	1711	1992	282	2	1709	RW
GL61A	1680	1992	313	5	1675	RW
GL62A	1672	1992	321	14	1658	RW
GL64A	1683	1978	296	6	1677	RW
GL66A	1665	1992	328	14	1651	RW
GL67A	1657	1961	305	5	1652	RW
GLB01b	1781	2008	228	11	1770	RW
GLB03	1860	2008	149	7	1853	RW
GLB04b	1821	2008	188	19	1802	RW
GLB09	1769	2008	240	20	1749	RW
GLB12a	1765	2008	244	18	1747	RW
GLB16a	1762	2008	247	9	1753	RW
GLB16b	1772	2008	237	14	1758	RW
GLB17	1732	2008	277	11	1721	RW
GLB25a	1778	2008	231	9	1769	RW
GLB26	1764	2008	245	13	1751	RW
GLB27a	1772	2008	237	0	1772	RW
GLB29	1762	2008	247	20	1742	RW
GLB30	1737	2007	271	2	1735	RW
GLB41	1769	2008	240	5	1764	RW
GLB46	1758	2008	251	3	1755	RW
GLB47	1808	2008	201	14	1794	RW
GLB47i	1736	2008	273	4	1732	RW
GLB48	1793	2008	216	33	1760	RW
GLB49	1778	2008	231	12	1766	RW
GLB50	1800	2008	209	25	1775	RW
GLBD01	1740	1948	209	7	1733	RW

Ghleann West

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
GW01	1760	2008	249	0	102	1760	RW
GW02	1825	1920	96	28	0	1797	RW
GW07	1851	2008	158	25	71	1826	RW
GW08	1823	2008	186	6	91	1817	RW
GW09	1799	1967	169	13	66	1786	RW
GW10	1827	2008	182	17	105	1810	RW
GW12	1879	2008	130	9	51	1870	RW
GW14	1807	2008	202	2	79	1805	RW
GW16	1823	2008	186	15??	72	1808	RW
GW17	1818	2000	183	1	109	1817	RW
GW18	1808	2008	201	14??	102	1794	RW
GW19	1841	1990	150	22	56	1819	RW
GW20	1837	2008	172	N/A	70	N/A	RW
GW21	1774	2008	235	5	117	1769	RW
DG110A	1763	1992	230	2		1761	RW
DG113A	1764	1992	229	5		1759	RW
DG116A	1752	1992	241	4		1748	RW
DG117A	1744	1930	187	4		1740	RW
DG119A	1754	1992	239	8		1746	RW
DG120A	1753	1950	198	5		1748	RW
DG126A	1756	1992	237	0		1756	RW
DG128A	1759	1992	234	0		1759	RW
DG130A	1767	1977	211	5		1762	RW
DG132A	1751	1980	230	4		1747	RW

Ghleann East

Sample Code	Start	End	Years	Pith-offset	Sapwood count	Establishment	Measured parameter
GE01	1776	2008	233	14?	104	1762	RW
GE02	1741	2008	268	16?	111	1725	RW
GE03	1751	2008	258	12	94	1739	RW
GE04	1797	2008	212	24	111	1773	RW
GE05	1811	2008	198	10	103	1801	RW
GE06	1818	2008	191	27	84	1791	RW
GE07	1697	1992	296	4	70	1693	RW
GE08	1738	2008	271	4	94	1734	RW
GE09	1835	2008	174	13	70	1822	RW
GE10	1848	2008	161	19	88	1829	RW
GE11	1833	2008	176	16	77	1817	RW
GE12	1785	2008	224	30	97	1755	RW
GE13	1798	2008	211	19	70	1779	RW
GE14	1734	2008	275	6	102	1728	RW
GE15	1785	2008	224	25?	74	1760	RW
GE16	1902	2008	107	19	65	1883	RW
GE17	1729	2008	280	3	68	1726	RW
GE18	1810	2008	199	28	63	1782	RW
GE19	1770	2008	239	40+??	88	1730	RW
GE20	1884	2008	125	9	63	1875	RW
GE21	1786	2008	223	40+??	75	1746	RW
GE22	1760	2008	249	6	121	1754	RW
GE23	1859	2006	148	14	88	1845	RW
GE24	1749	1996	248	2	80	1747	RW
GE25	1714	2008	295	5	99	1709	RW
GE26	1789	2008	220	35??	140	1754	RW
GE30	1859	2008	150	15	67	1844	RW
GE31	1811	2008	198	43?	91	1768	RW
GE32	1735	2008	274	6	120	1729	RW
GE33	1766	2008	243	5??	90	1761	RW
GE34	1817	2008	192	50+???	91	1767	RW

Quoich

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
Q4	1763	2008	246	N/A	N/A	RW
Q5	1782	2008	227	13	1769	RW
Q7	1737	2008	272	14	1723	RW
Q9	1764	2008	245	17	1747	RW
Q10	1711	2008	298	4	1707	RW
Q11	1796	2008	213	14	1782	RW
Q13	1733	2008	276	17	1716	RW
Q16	1765	2008	244	17	1748	RW
Q18	1748	2008	261	N/A	N/A	RW
Q19	1768	2008	241	5	1763	RW
Q20	1751	2008	258	N/A	N/A	RW
Q21	1734	2008	275	12	1722	RW
Q22	1776	2008	233	12	1764	RW
Q23	1760	2008	249	13	1747	RW
GQ198A	1728	1992	265	13	1715	RW
GQ197A	1707	1992	286	7	1700	RW
GQ180A	1750	1992	243	0	1750	RW
GQ164A	1727	1987	261	0	1727	RW
GQ158A	1716	1992	277	0	1716	RW
GQ193A	1680	1992	313	0	1680	RW
GQ189A	1790	1992	203	0	1790	RW
GQ171A	1687	1992	306	5	1682	RW
GQ163A	1700	1992	293	0	1700	RW
GQ175A	1725	1992	268	0	1725	RW

Inverey

Sample Code	Start	End	Years	Pith-offset	Germination	Measured parameter
IU01	1840	2008	169	16	1824	RW-BI
IU02	1727	2008	282	14	1713	RW
IU04	1745	2008	264	8	1737	RW-BI
IU05	1742	2008	267	13	1729	RW-BI
IU06	1869	2008	140	16	1853	RW-BI
IU07	1771	2008	238	8	1763	RW
IU08a	1742	2008	267	25	1717	RW-BI
IU08b	1752	2008	257	8	1744	RW-BI
IU09a	1744	2008	265	9	1735	RW-BI
IU10	1761	2008	248	17	1744	RW
IU11	1757	2008	252	13	1744	RW
IU12	1736	2008	273	9	1727	RW
IU14	1727	2008	282	2	1725	RW-BI
IU15	1759	2006	248	11	1748	RW
IU16	1765	2008	244	18	1747	RW-BI
IU18	1735	2008	274	7	1728	RW
IU19	1819	2008	190	14	1805	RW-BI
380011	1717	1976	260	14	1703	RW
380012	1731	1976	246	28	1703	RW
380021	1706	1976	271	17	1689	RW
380022	1720	1976	257	31	1689	RW
380031	1754	1976	223	22	1732	RW
380032	1792	1976	185	68	1724	RW
380041	1754	1976	223	26	1728	RW
380042	1738	1848	111	10	1728	RW
380051	1744	1976	233	35	1709	RW
381052	1731	1976	246	22	1709	RW
381061	1809	1976	168	86	1723	RW
381062	1750	1976	227	27	1723	RW
381071	1754	1976	223	10	1744	RW
381072	1775	1976	202	31	1744	RW
381081	1731	1975	245	25	1706	RW
381082	1721	1976	256	15	1706	RW
381091	1724	1976	253	11	1713	RW
381092	1724	1976	253	11	1713	RW
382101	1716	1976	261	31	1685	RW
382102	1763	1976	214	68	1695	RW
382111	1793	1976	184	39	1754	RW
382112	1769	1976	208	15	1754	RW
382121	1784	1976	193	19	1765	RW
382122	1783	1976	194	18	1765	RW

Punchbowl

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
PB1	1833	2008	176	5	1828	RW
PB2	1876	2008	133	N/A	N/A	RW
PB3	1852	2008	157	8	1844	RW
PB4	1713	2008	296	9	1704	RW
PB5	1769	2008	240	12	1757	RW
PB8	1764	2002	239	N/A	N/A	RW
PB9	1844	2008	165	20	1824	RW
PB10	1845	2008	164	15	1830	RW
PB11	1857	2008	152	8	1849	RW
PB12	1845	2008	164	7	1838	RW
PB13A	1855	2008	154	26	1829	RW
PB13B	1855	2008	154	(sample not found)		RW
PB14A	1839	2008	170	5	1834	RW
PB14B	1839	2008	170	(sample not found)		RW
PB15A	1880	2006	127	21	1859	RW
PB15B	1878	1996	119	(sample not found)		RW
PB16	1829	2008	180	6	1823	RW
PB17	1827	2008	182	20	1807	RW
PB19	1681	2008	328	18	1663	RW
PB20	1892	2008	117	5	1887	RW
PB21	1860	2008	149	18	1842	RW
PB22	1837	2008	172	0	1837	RW

Mar Lodge

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
ML01	1838	2008	171	1	1837	RW
ML02	1838	2008	171	4	1834	RW-BI
ML03	1864	2007	144	N/A	N/A	RW-BI
ML04	1841	2008	168	6	1835	RW-BI
ML05	1831	1988	158	1	1830	RW
ML06	1834	2007	174	3	1831	RW
ML07	1839	2007	169	7	1832	RW-BI
ML08	1837	2008	172	5	1832	RW
ML10	1845	2008	164	4	1841	RW
ML11	1843	2008	166	11	1832	RW-BI
ML12	1832	2008	177	1	1831	RW
ML13	1842	2008	167	2	1840	RW-BI
ML14	1830	1998	169	1	1829	RW
ML15	1833	2008	176	1	1832	RW
ML16	1834	2008	175	5	1829	RW
ML17	1828	2007	180	0	1828	RW-BI
ML18	1831	2008	178	2	1829	RW
ML19	1842	2008	167	3	1839	RW
ML20	1858	2008	151	8	1850	RW-BI
ML21	1857	2008	152	7	1850	RW
ML24	1916	2008	93	40	1876	RW
ML25	1855	2008	154	11	1844	RW-BI
ML26	1841	2007	167	11	1830	RW
ML27	1847	2008	162	9	1838	RW
ML28	1841	2008	168	5	1836	RW
ML29	1842	2008	167	12	1830	RW-BI

Ballochbuie

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
568012	1747	1862	116	16	1731	RW
568021	1712	1978	267	8	1704	RW
568022	1737	1978	242	33	1704	RW
568031	1782	1978	197	49	1733	RW
568032	1740	1978	239	7	1733	RW
568041	1728	1978	251	9	1719	RW
568042	1729	1978	250	10	1719	RW
568051	1770	1978	209	12	1758	RW
568052	1798	1978	181	40	1758	RW
568061	1762	1978	217	54	1708	RW
568062	1724	1978	255	16	1708	RW
568071	1729	1978	250	14	1715	RW
568072	1740	1978	239	25	1715	RW
568081	1855	1978	124	41	1814	RW
568082	1720	1978	259	6	1714	RW
568091	1780	1948	169	41	1739	RW
568092	1761	1978	218	22	1739	RW
568101	1732	1978	247	18	1714	RW
568102	1780	1978	199	66	1714	RW
568111	1769	1978	210	28	1741	RW
568112	1762	1978	217	21	1741	RW
B012	1701	2002	302	15	1686	RW
B110	1715	2003	289	7	1708	RW
B228	1619	2003	385	10	1609	RW
B122	1663	1996	334	0	1663	RW
B008	1654	2002	349	0	1654	RW
B233	1630	2003	374	6	1624	RW
B115	1663	2003	341	0	1663	RW
B551	1688	2001	314	8	1680	RW
B604	1722	2003	282	8	1714	RW
B605	1693	2003	311	6	1687	RW
B009	1738	2003	266	0	1738	RW
B022	1703	2003	301	7	1696	RW
B108	1645	1997	353	10	1635	RW
B153	1807	2003	197	13	1794	RW
B217	1699	1998	300	4	1695	RW
B218	1677	2003	327	2	1675	RW
B226	1643	2003	361	3	1640	RW
B234	1715	2003	289	0	1715	RW
B239	1724	2003	280	2	1722	RW

B241	1744	2003	260	0	1744	RW
B242	1717	2003	287	0	1717	RW
B243	1688	2003	316	0	1688	RW
B244	1723	2003	281	8	1715	RW
B277	1589	2003	415	8	1581	RW
B278	1709	1999	291	3	1706	RW
B279	1704	2003	300	0	1704	RW
B545	1741	2003	263	0	1741	RW

Bachnagairn

Sample Code	Start	End	Years	Pith-offset	Establishment	Measured parameter
BG1	1864	2008	145	35	1829	RW
BG3	1836	2008	173	8	1828	RW
BG4	1868	2007	140	6	1862	RW
BG5	1849	2008	160	12	1837	RW
BG5B	1849	2008	160	12	1837	RW
BG7	1833	2008	176	0	1833	RW
BG8	1833	2008	176	0	1833	RW
BG10	1888	2008	121	3	1885	RW
BG14	1889	2008	120	18	1871	RW
BG15	1893	2008	116	19	1874	RW
BG19	1934	2008	75	11	1923	RW
BG20A	1834	2008	175	0	1834	RW
BG20B	1834	2008	175	0	1834	RW
BG23	1838	2008	171	20	1818	RW
BG24	1847	2008	162	3	1844	RW
BG27A	1862	2008	147	21	1841	RW
BG27B	1862	2008	147	21	1841	RW
BG28	1838	2008	171	3	1835	RW
BG29	1838	2008	171	4	1834	RW
BG31	1836	2008	173	3	1833	RW