

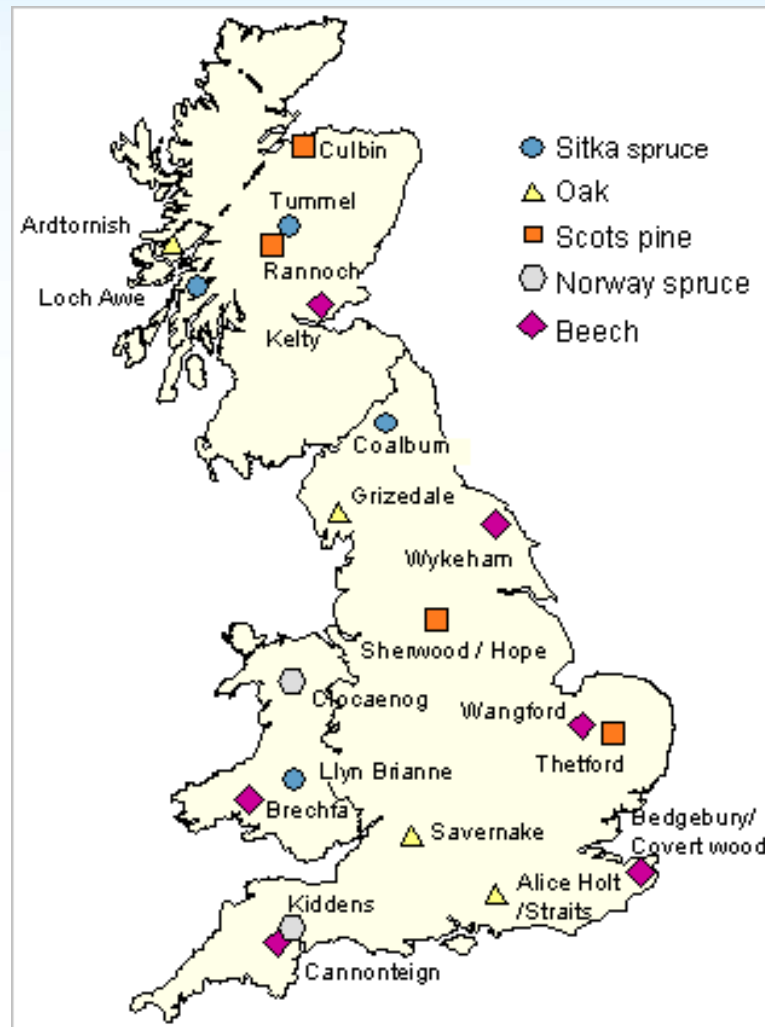
# Long term trend analysis on UK Level II data

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# Level II sites in the UK

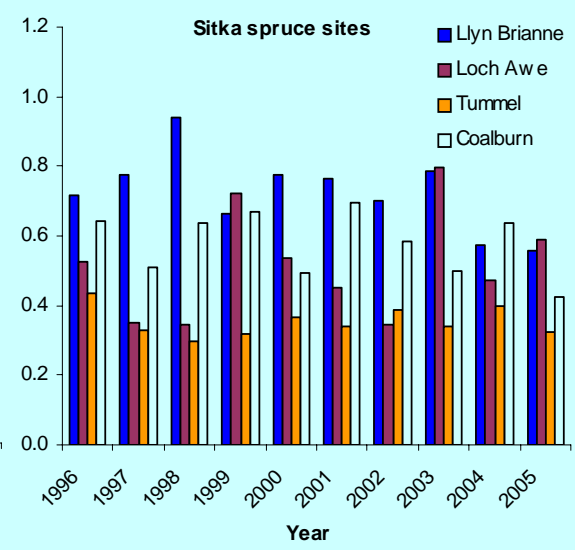
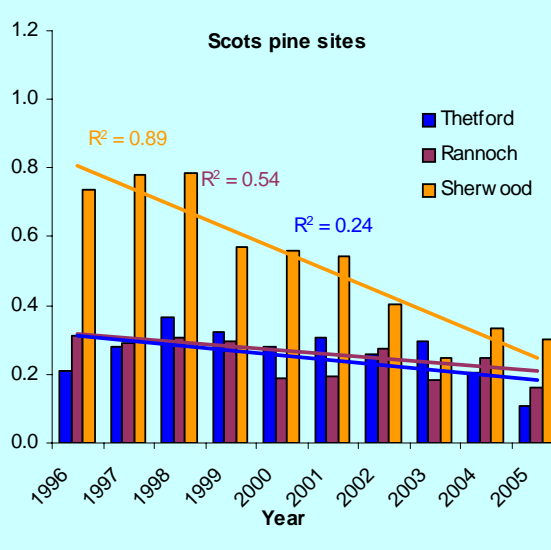
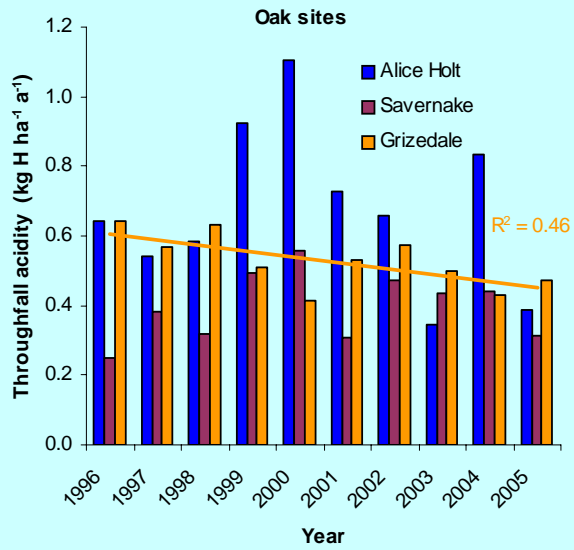
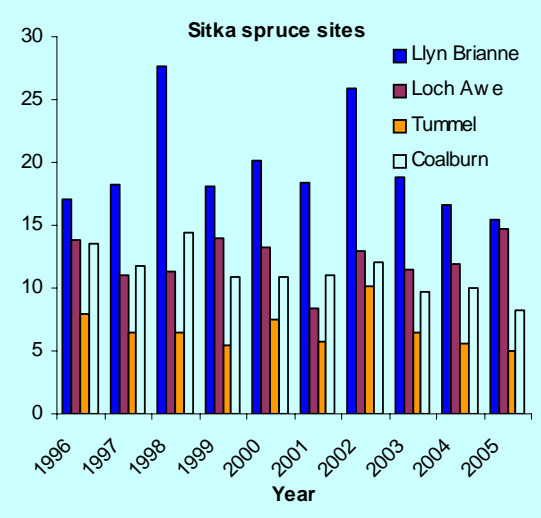
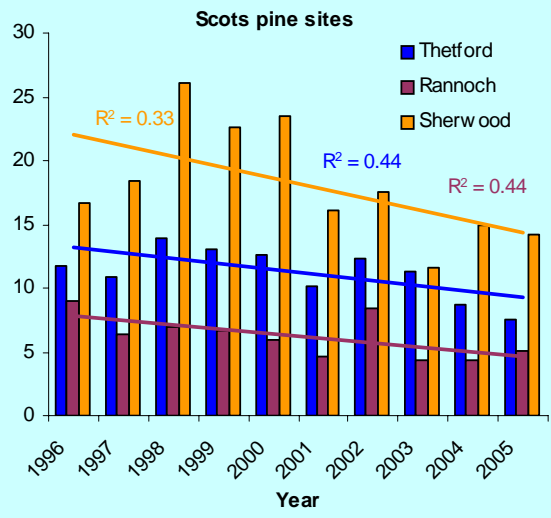
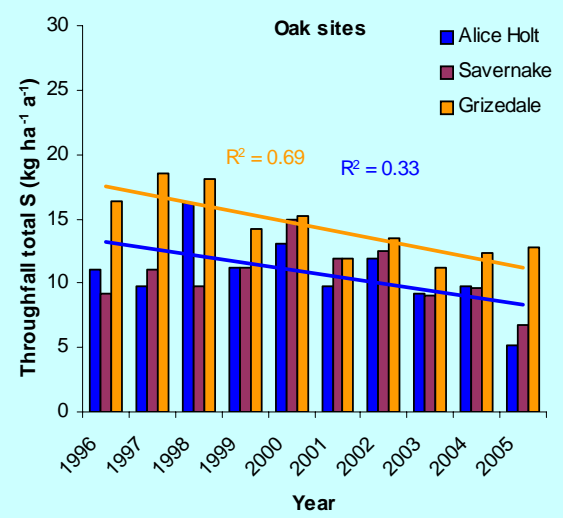


# Policy Relevance

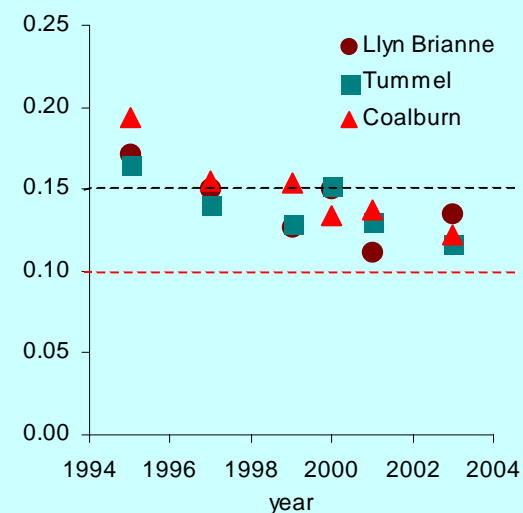
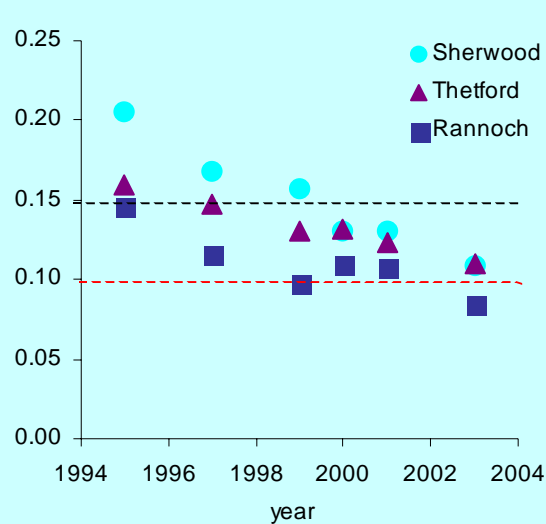
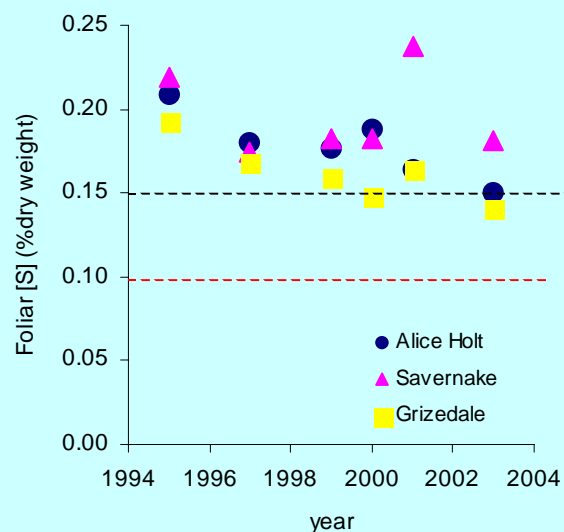
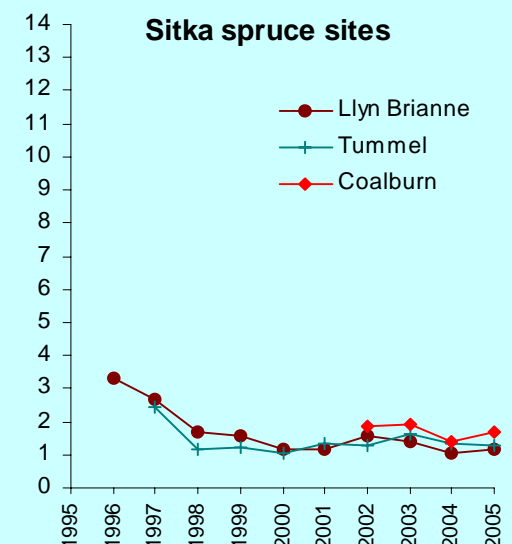
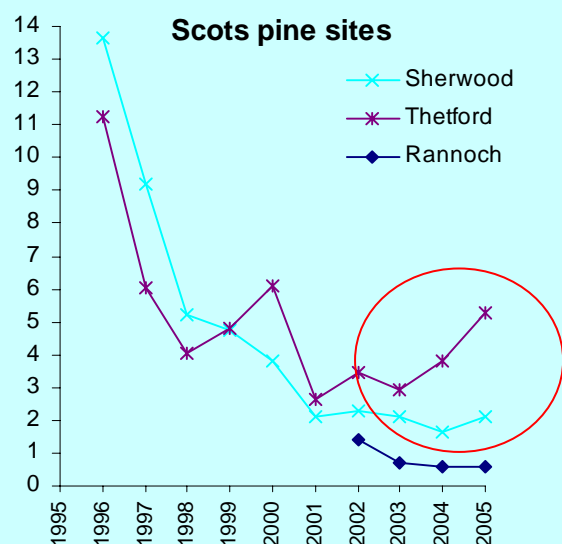
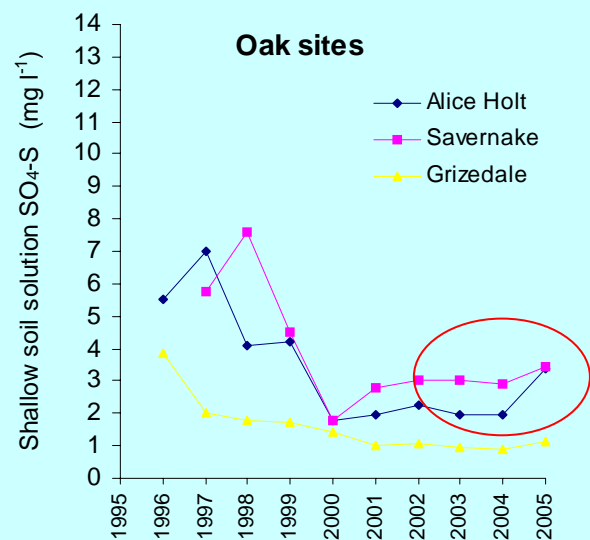
- Level II data-sets provide an assessment of ecosystem recovery.
- Excess N deposition and ozone pollution have come to the fore alongside climate change – Level II network is an invaluable source of information on forest condition and interaction with the wider environment.
- Wide number of variables measured - long term trends were assessed and interactions between different variables



# Sulphur and acidity in deposition shows a downward trend on the lowland and most previously polluted sites

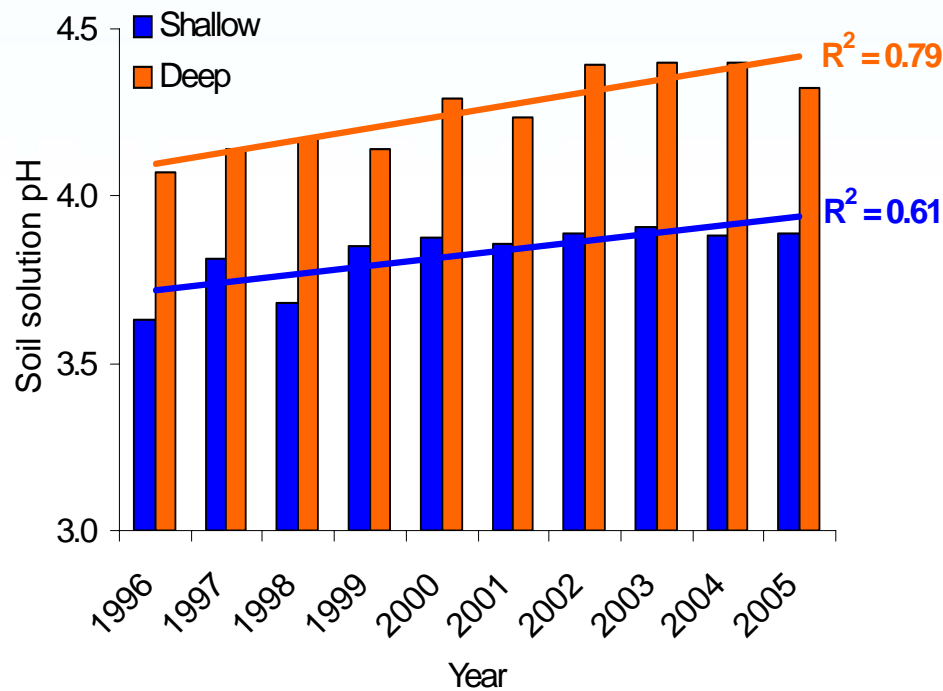


# Sulphur in soil solution for 2005 is higher than previous years at almost all of the plots

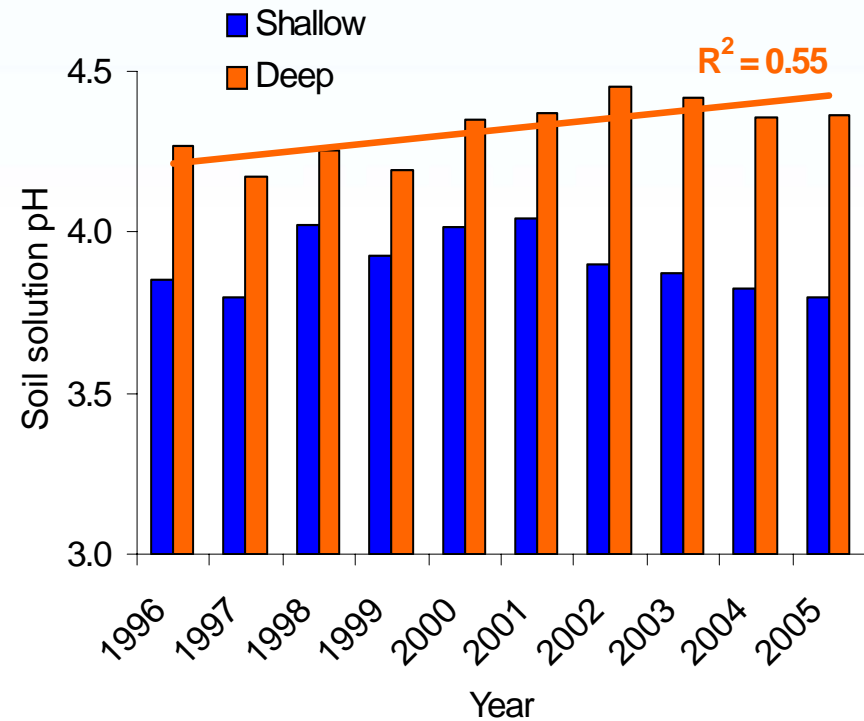


# Recovery of soil solution continued at Sherwood but now also evident at Llyn Brianne

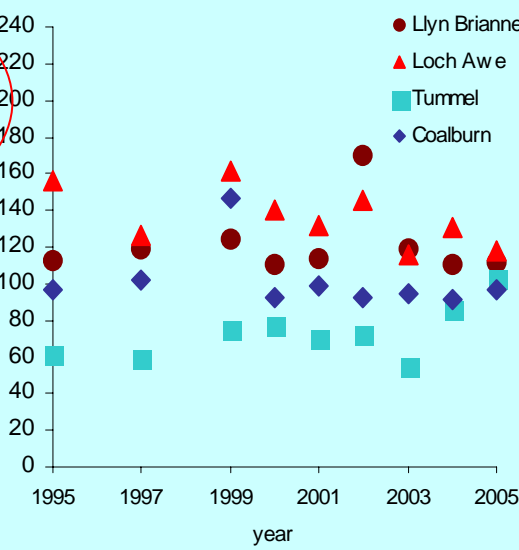
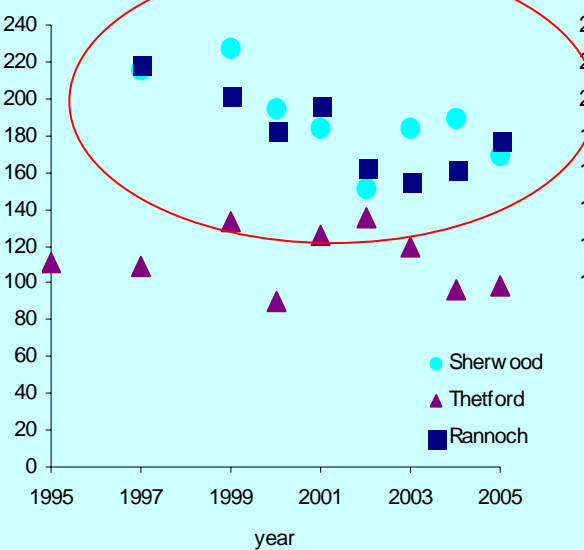
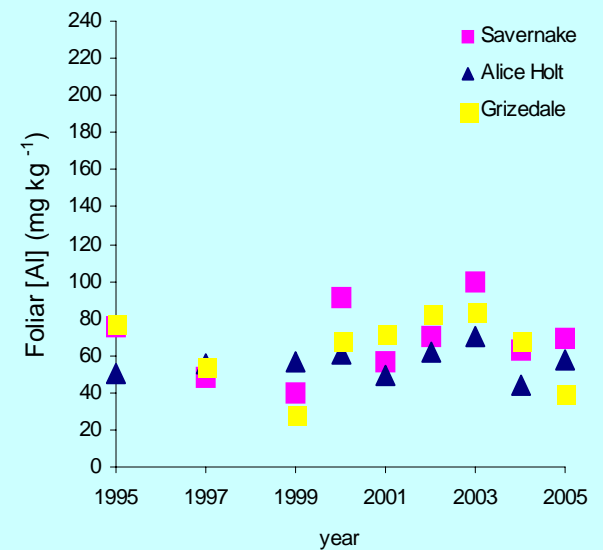
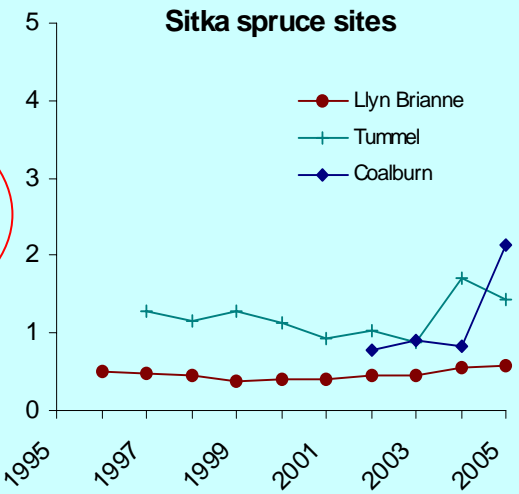
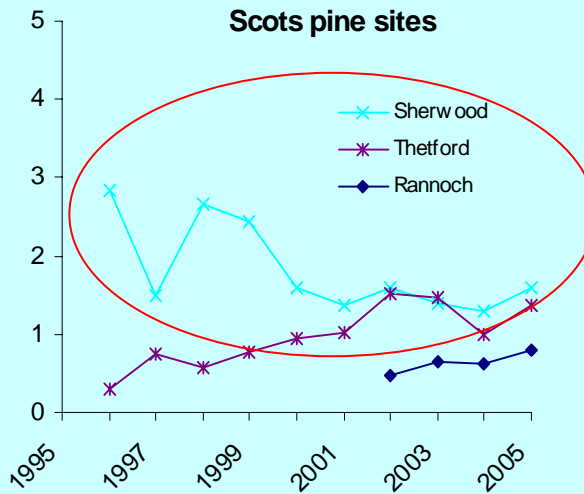
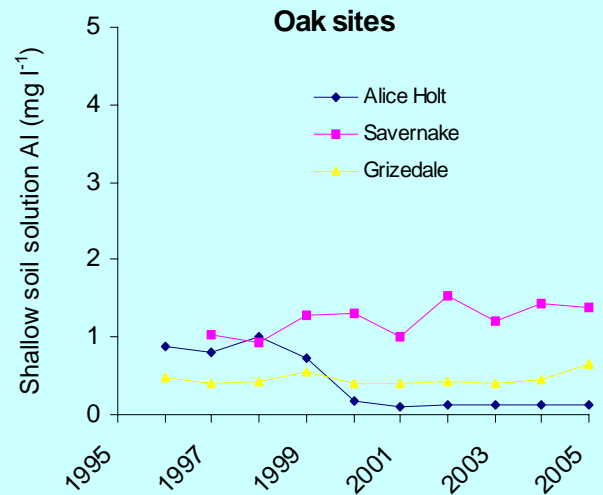
## Sherwood



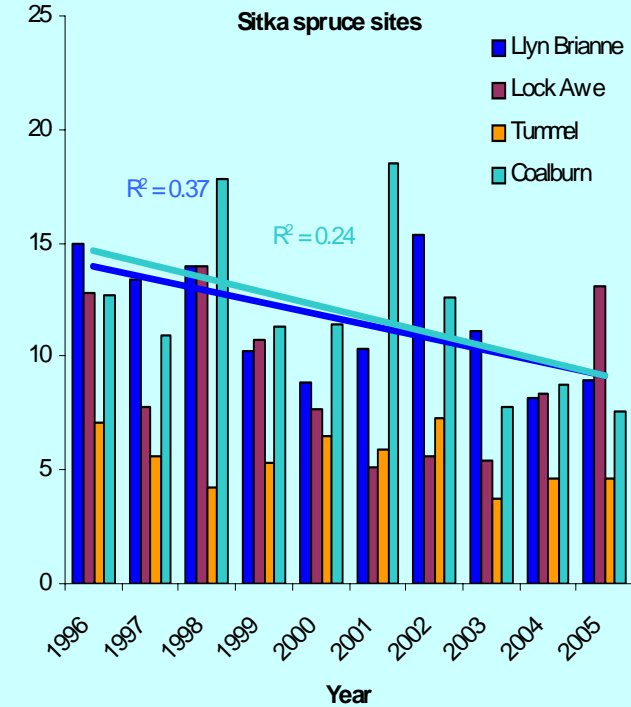
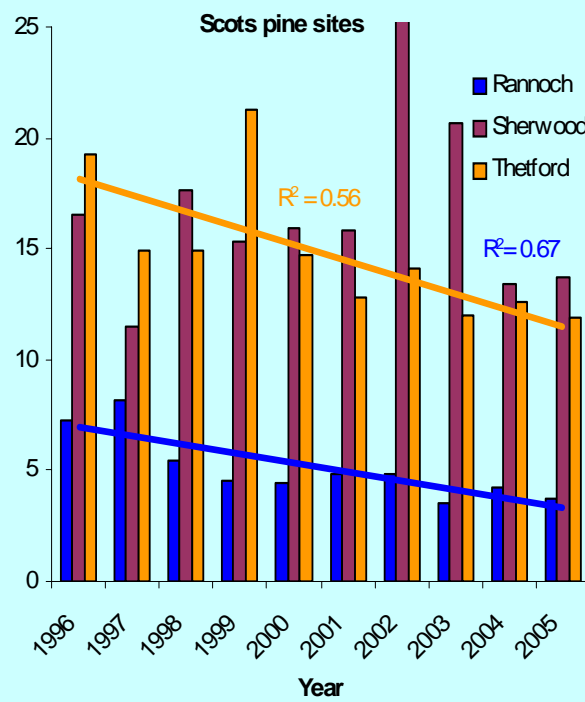
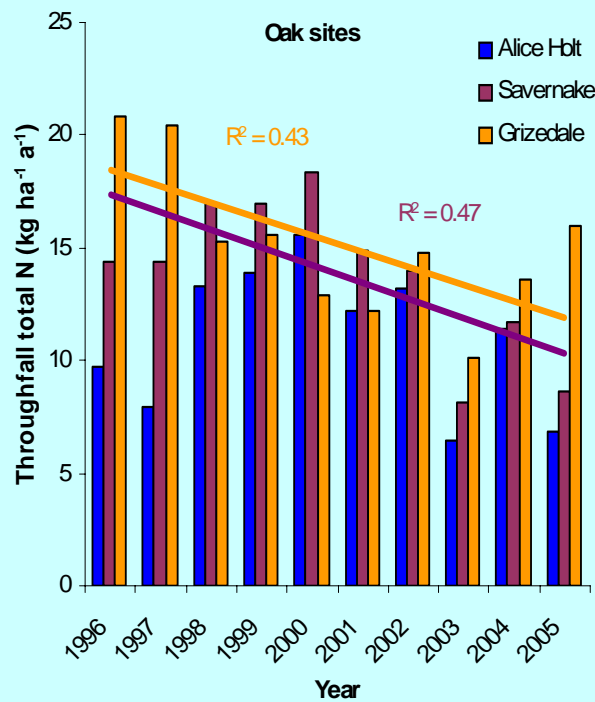
## Llyn Brianne



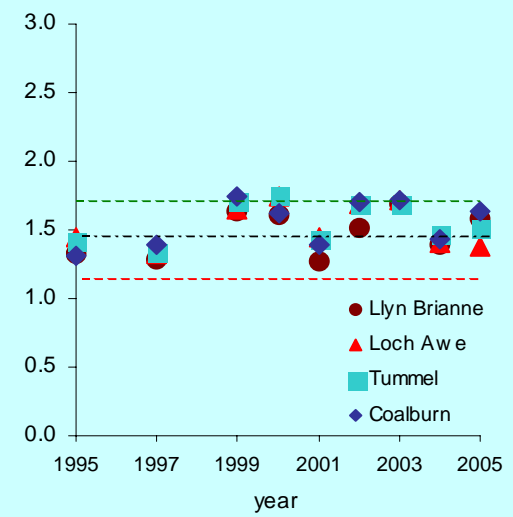
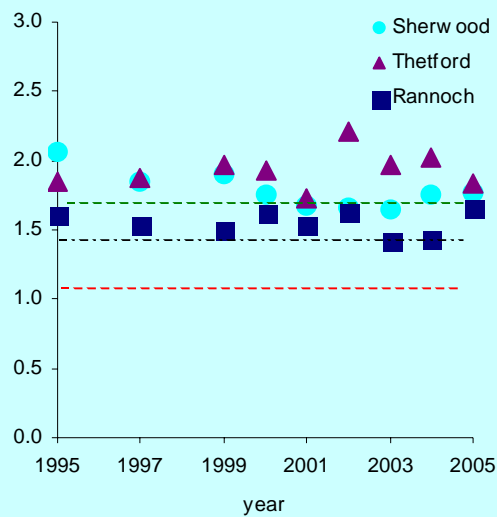
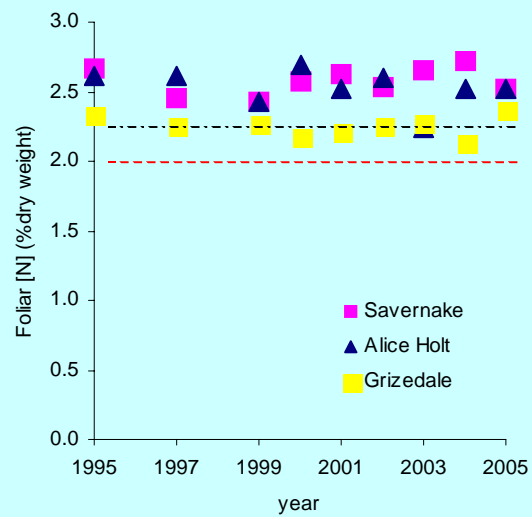
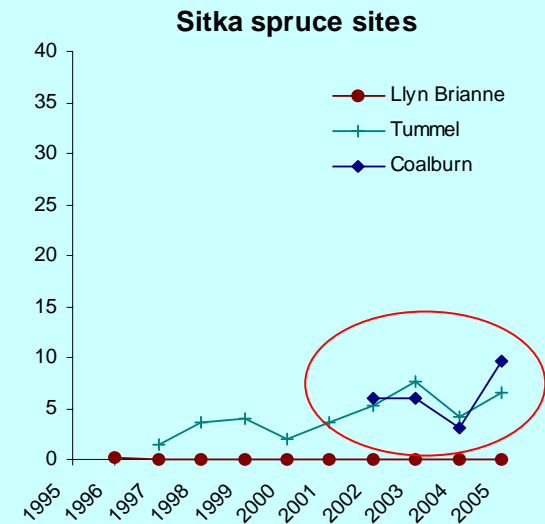
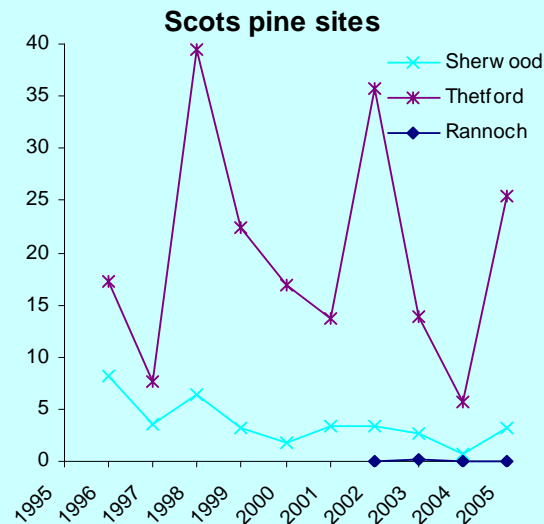
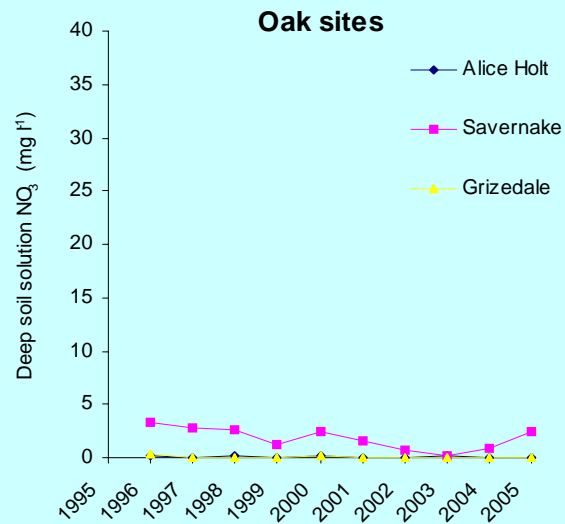
# Aluminium in soil solution and tree foliage confirms the recovery processes



# Total nitrogen deposition shows downwards trend in most of the sites

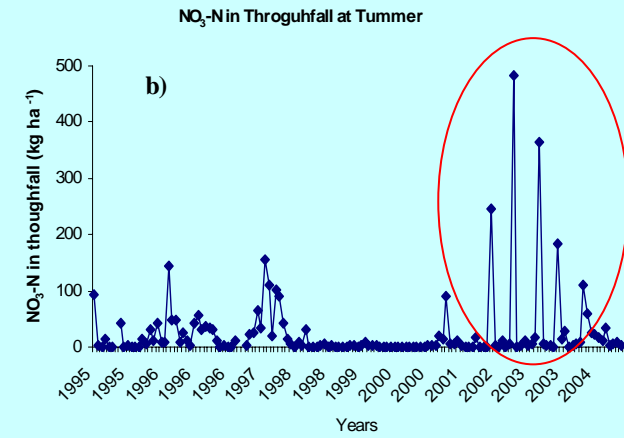
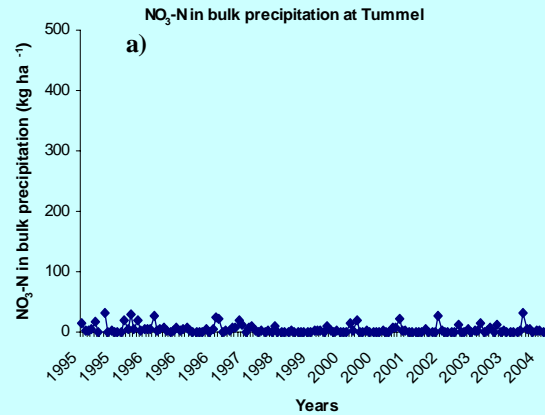
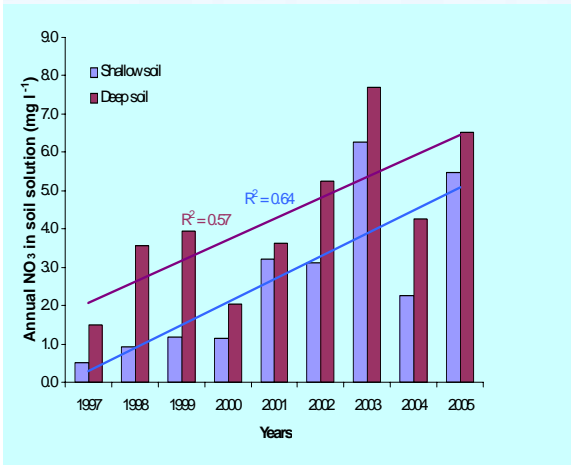


# Nitrogen in soil solution is variable with a steep increase at Tummel and Coalburn

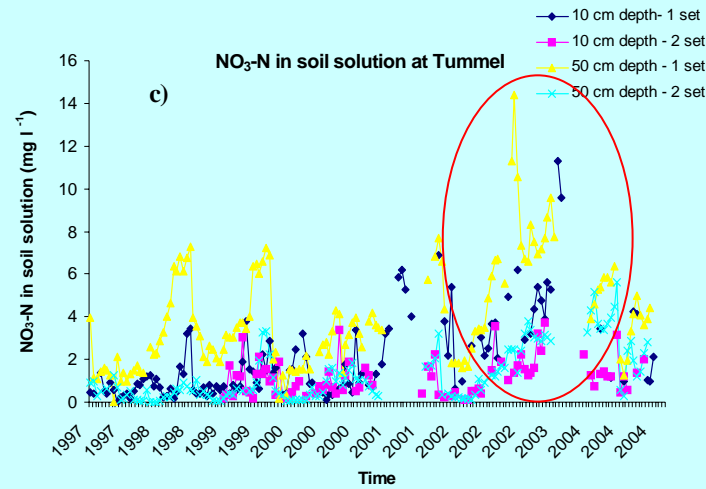
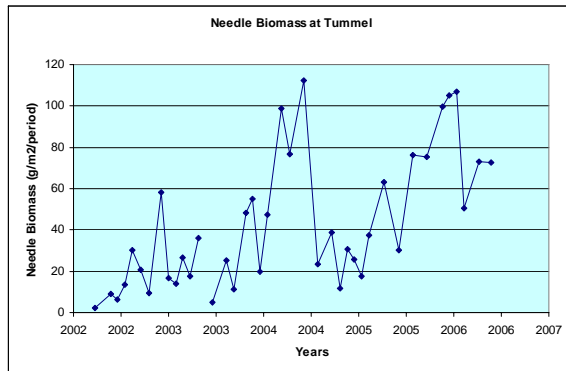


# Nitrogen increase in Tummel can not be explained with chemical processes but with biological influence

## Soil solution N-NO<sub>3</sub>



## Needle Biomass



# Mann-Kendall test results

Table 1. Summary Table of long term trends in throughfall and rainfall chemistry of ten Level II sites

Variable	H	S-SO4	N-NO3	NH4	total N	DOC	K	Ca	Mg	Na	Cl
Site	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value
512 Throughfall	0.008	0.007	0.084	0.005	0.608	0.602	0.471	0.046	0.029	0.111	0.154
512 Rainfall	0.087	0.135	0.606	0.075	0.259	0.146	0.646	0.121	0.261	0.413	0.806
516 Throughfall	0.796	0.038	0.875	0.126	0.784	0.355	0.222	0.683	0.550	0.268	0.394
516 Rainfall	0.087	0.117	0.916	0.129	0.596	0.443	0.352	0.773	0.779	0.155	0.265
517 Throughfall	0.002	0.054	0.142	0.735	0.036	0.729	0.018	0.206	0.138	0.065	0.051
517 Rainfall	0.040	0.022	0.269	0.460	0.115	0.474	0.255	0.945	0.462	0.082	0.128
715 Throughfall	0.061	0.027	0.637	0.262	0.520	0.225	0.928	0.367	0.651	0.347	0.739
715 Rainfall	0.176	0.216	0.724	0.164	0.898	0.770	0.681	0.686	0.422	0.494	0.665
716 Throughfall	0.003	0.017	0.900	0.377	0.103	0.078	0.199	0.248	0.943	0.071	0.188
716 Rainfall	0.009	0.193	0.978	0.594	0.171	0.559	0.061	0.358	0.309	0.039	0.165
717 Throughfall	0.189	0.238	0.210	0.090	0.077	0.348	0.193	0.951	0.351	0.034	0.058
717 Rainfall	0.084	0.095	0.251	0.016	0.116	0.083	0.082	0.666	0.370	0.061	0.111
919 Throughfall	0.006	0.003	0.253	0.035	0.072	0.107	0.425	0.125	0.256	0.121	0.228
919 Rainfall	0.010	0.016	0.097	0.039	0.289	0.567	0.491	0.448	0.190	0.790	0.988
920 Throughfall	0.238	0.034	0.697	0.612	0.057	0.032	0.680	0.501	0.244	0.094	0.109
920 Rainfall	0.012	0.018	0.856	0.051	0.122	0.228	0.405	0.071	0.254	0.250	0.655
921 Throughfall	0.795	0.104	0.571	0.116	0.875	0.860	0.204	0.875	0.098	0.010	0.035
921 Rainfall	0.088	0.139	0.007	0.008	0.045	0.384	0.774	0.168	0.948	0.169	0.284

# Possible drivers

- Significant decline in acidity and sulphate in rainfall and throughfall in most of the sites – likely due to reduction in sulphur emissions
- Ammonium in rainfall and throughfall is significantly declines in some sites (Alice Holt, Rannoch and all Sitka spruce sites)- a confirmation that emission reduction policies to take an effect.
- Throughfall and sometimes rainfall Na and Cl increased significantly at Rannoch, Tummel and especially pronounced at Loch Awe and Llyn Brianne. Since Na and Cl are assumed to be derived mainly from the sea, these results are most likely to show/record the increased number of storm events occurring at these sites.
- Increase in K, DON and DOC at some sites – links with insect attacks (e.g. caterpillar attacks in Grizedale, aphid attacks at Tummel and Llyn Brianne and saw flies at Rannoch).

# Mann-Kendall test results

<b>Combined Tests</b>		
K	MK-Stat	p-value
All	<b>2.366872</b>	<b>0.017939</b>



<b>Univariate Tests</b>		
K	MK-Stat	p-value
1	2.880446	0.003971
2	-1.47915	0.139101
3	0.856349	0.391805
4	<b>1.645741</b>	<b>0.099817</b>
5	<b>2.194322</b>	<b>0.028212</b>
6	<b>2.057176</b>	<b>0.039669</b>
7	-1.09716	0.272571
8	<b>1.645741</b>	<b>0.099817</b>
9	<b>1.645741</b>	<b>0.099817</b>
10	-0.41144	0.680753
11	-0.27429	0.783862
12	2.331467	0.019729



**Thank you for your attention**

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