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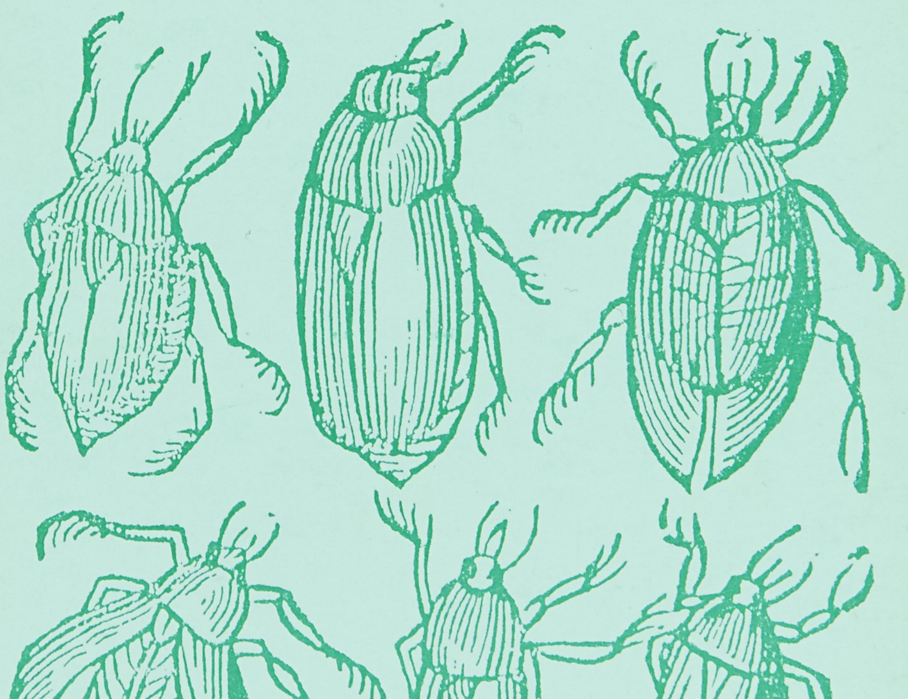

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ANNUAL CLIMATOLOGICAL BULLETIN No. 5, 1983

S. J. Harrison
University of Stirling

THE WEATHER OF 1983

This was a year of mixed fortunes for gardeners. A mild March after a very cold February promised us an early spring but an exceptionally cold and wet May checked early plants and rotted seeds in the ground. After that we had an exceptionally hot and dry summer. The most noteworthy feature of 1983 was, however, the autumn which lingered well into December. Leaves remained on the trees and there was little sign of any snow on even the highest ground.

January. Exceptionally mild but windy and wet.

A series of deep depressions and associated fronts moved rapidly eastwards across Scotland during the first eleven days. While pressure remained high to the south of Britain and generally low to the north, including Scandinavia, winds were from the west-southwest, and at times reached gale force. There was widespread gale damage on the 5th and 6th. 80.0mm of precipitation were recorded at Parkhead between the 1st and 8th (110.5mm at Carim). Precipitation on lower ground was mainly in the form of rain or sleet although extensive snow fell on the 7th when 10cm were recorded throughout central Scotland. On high ground however, there were blizzards and mountain rescue teams were kept busy. By the 12th pressure began to build to the west of Britain and on the 13th a ridge of high pressure brought a brief respite from the strong winds, but at the same time heralded much colder weather. By the 17th winds were in the north-west and temperatures fell sharply for a few days. As a cold front moved southwards across Scotland on the 18th, snow showers fell in a fresh north-westerly wind. By the 20th the anticyclone had begun to drift south-eastwards into France and exceptionally mild weather returned for much of the remainder of the month. Low cloud with some drizzle occurred on higher ground but it was the 23rd before more general rain affected Scotland. The weather pattern for the last eight days was similar to the first eleven days. Winds were frequently very strong and mainly mild south-westerly. Snowfall was rare on low ground but on higher ground there were blizzards. After a shallow ridge of high pressure crossed the country on the 30th, pressure began to fall steeply on the 31st. Storm force winds caused extensive structural damage and brought heavy snow followed by floods.

February. Very cold and dry.

As the deep depression moved eastwards into the North Sea on the 1st Scotland counted the cost of the overnight gales. Pressure rose rapidly during the day and remained high until the 4th. Away from the Forth valley, Carim was only slightly warmer at −5.4°C. A deep depression moved from Iceland into the North Sea between the 4th and 6th bringing milder but wetter weather. The 4th was the month's wettest day with 9.0mm at Parkhead, and 14.5mm at Carim. With high pressure to the north of Scotland, the country was affected by a cold north-easterly airstream between the 6th and 12th. Although the weather in the Stirling area remained little more than 'brisk' with occasional flurries of snow, much of Britain from Kent to Grampian experienced severe blizzards on the 7th and 8th. Roads to the north and south of Stirling were affected by drifting snow. Like the famous Black Isle, the Forth lowlands frequently escape the worst of the winter snow. High pressure dominated the weather map from the 12th to the 18th and temperatures in Scotland rose in the Stygian gloom, while they remained very low in England. Air temperatures reached the month's highest of 7.9°C at Parkhead on the 14th (Carim 4.6°C), which was a pleasantly sunny oasis in an otherwise dull and cold month. Skies began to clear on the 17th which gave three days of crisp clear weather. Pressure remained high but on the 21st to 25th the weather was cold and grey. Freezing fog occurred on the 24th and 25th. Pressure began to fall on the 25th as the anticyclone moved away eastwards into central Europe. Troughs moved eastwards across Britain on the 26th and 27th bringing rain in a freshening westerly wind. A ridge of high pressure approaching from the west resulted in a sunny fresh day on the 28th.

March. Mild and occasionally dull.

A ridge of high pressure extended over Britain on the 1st bringing calm but very dull weather. Pressure began to fall during the day and moderately heavy rain fell which continued into the 2nd. As high pressure began to develop over southern England and France after the 3rd Scotland was brought into a mild westerly airstream until the 10th. Although hill fog resulted in small amounts of precipitation at Carim weather station, none was recorded at Parkhead until the 10th when a cold front and associated band of rain began to move southwards across Scotland. By the 11th, temperatures had fallen quite sharply in a cold showery polar airstream. As high pressure retreated into continental Europe the weather became more unsettled and a succession of troughs moved across Scotland. Temperatures returned to levels registered earlier in the month but rain was recorded every day between the 10th and 23rd. A weak low to the west of Ireland produced the month's largest daily rainfall of 17.8mm at Parkhead and 19.5mm at Carim on the 18th. A vigorous low developed to the north-west of Scotland by the 19th and as its associated cold front moved south-eastwards on the 20th temperatures began to fall in a strengthening north-westerly wind. Heavy snow showers fell on the 21st. After the 22nd, which was bright and cold, a deepening low brought a return to rain on the 23rd. This was heavy at times. With high pressure to the west, northerly air affected Scotland until the 28th. Troughs brought heavy rain and sleet to low ground on the 25th and 27th and moderate accumulations of snow on high ground. A depression moved south-eastwards from Iceland after the 28th which brought rain on the 29th followed by snow showers.

April. Cold and continuing rather dull.

High pressure to the west of Britain maintained a cold northerly airflow across the country which brought hail and snow showers on the 1st and 2nd. An area of low pressure moved south-eastwards into Scotland on the 3rd becoming stationary and filling off the west coast by the 7th. The weather remained rather murky with occasional sunny intervals. As the low drifted away north-eastwards into Scandinavia on the 8th a deep depression approached Britain from the south-west. This brought gales and heavy rain to England on the 9th and 10th. Central Scotland experienced only a strong breeze and occasional snow showers. Only 0.6mm was recorded at Parkhead and none at Carim. Pressure began to rise on the 11th and for the next four days the weather was mild with a fresh westerly wind. As high pressure drifted eastwards by the 16th, the weather became more unsettled for the remainder of the month. Britain was affected by a series of complex lows which brought occasionally heavy rain and fresh winds. A deepening depression and associated fronts moved northwards across Ireland from 21st to 23rd retreating to the Bay of Biscay by the 27th. This produced the wettest day of the month on the 22nd when 9.8mm fell at Parkhead and 29.5mm at Carim. Above about 300m this fell as snow. Pressure remained relatively low until the end of the month. Visibility was poor in a mild easterly breeze. Central Scotland escaped the thunderstorms which affected other areas of Britain.

May. Cold and very wet.

A shallow low to the south-west of Britain brought dull and wet weather to all but north-west Scotland between 1st and 3rd. After a brief bright interval on the 4th, a depression to the west of Ireland trailed a slow moving front eastwards across Scotland. 22.3mm of rain were recorded at Parkhead on the 5th, 31.0mm at Carim. The weather then remained dull and wet until the 16th. A deep depression approached Scotland between the 8th and 11th resulting in rising easterly winds which reached gale force late on the 10th. Thunderstorms occured on the 11th and 12th which were associated with very heavy rain. On the 12th the automatic raingauge at Carim was unable to cope with the rainfall intensity and consequently jammed. Heavy showers persisted for the next four days but became less intense and less frequent.

By the 16th, there were long sunny periods between showers. As an area of low pressure became stationary over southern England, dull weather returned on the 17th although rainfall amounts were negligible. Localised heavy showers occurred until the 23rd when pressure slowly began to rise. Some of these showers were very heavy and again caused the failure of the Carim raingauge. Freak hailstorms were reported in southern England, some of the hailstones being 20mm in diameter. As a ridge of high pressure extended across Britain on the 23rd, the weather became warm and sunny until the 26th. The 25th was particularly warm although a weak front off the north-west coast made it a more cloudy day than in England. Temperatures at Parkhead reached the month's highest at 17.1 °C on the 25th (13.1 °C) at Carim. The ridge retreated northwards on the 27th to be replaced by a westwards moving depression from eastern Europe. The 27th, 28th and 29th were generally dull and wet with continuous light rain. Skies cleared briefly on the 30th to give a fine warm and sunny day but cloud and the promise of more rain returned on the 31st.

June. Cool at times, becoming dry.

While England suffered violent and often destructive thunderstorms, Scotland experienced cool but generally unsettled weather. Well over half of the month's rainfall fell in the first three days as weak fronts moved north-eastwards across Britain. Temperatures remained at or below 10°C at the University, which is exceptionally low for June. Pressure began to rise on the 4th and on the 5th and 6th an anticyclone was centred over Scotland. While Stirling enjoyed three days of relatively fine weather, violent thunderstorms in southern England produced hailstones as big as 30 to 40mm in diameter. As high pressure drifted eastwards temperatures rose rapidly in light south-easterly air. Between the 9th and 13th a series of Atlantic depressions and frontal troughs crossed Scotland but amounts of rain were relatively small in a cool fresh westerly wind. Moderately heavy rain fell on the 13th in strong winds. Pressure began to increase on the 14th as an anticyclone moved across Britain from the south-west. This dominated the weather pattern for the next seven days. A weak warm front moved across Scotland on the 16th resulting in a small amount of rain but after this the skies cleared and temperatures began to rise to levels more appropriate to early summer. On the 18th, 19th and 20th daytime temperatures exceeded 20°C, reaching 24.5°C at Parkhead on the 19th (21.4°C at Carim). The anticyclone moved north-eastwards on the 21st but pressure remained relatively high. Daytime temperatures fell to 13.5°C behind a weak cold front which moved slowly south-eastwards late on the 22nd. By the 25th, winds over Scotland had become north-westerly and weak fronts crossed south-eastwards. Although cloud amounts were often high, no rain fell until the 27th and 28th when a more active warm front crossed Scotland. Temperatures fell again on the 28th and 29th in a cold north-westerly wind. Pressure rose again on the 30th and the month finished on a warm but dull note.

July. Hot and dry.

Frontal troughs moved eastwards across northern Britain bringing rain on the 1st and 2nd. Maximum temperatures were well below the seasonal average. A ridge of high pressure extended north-eastwards across Britain on the 4th and 5th and although remaining cloudy daytime temperatures began to climb. The 6th was sunny and hot, temperatures reaching 25.5°C at Parkhead (22.2°C at Carim). Scotland escaped the severe thunderstorms which brought floods to central and southern England. An anticyclone became centred over the North Sea on the 8th and remained there until the 11th. Although winds were light, days were hot, cloudy and humid. Pressure remained high over the northern Atlantic and Scotland for much of the remainder of the month, but cloud amounts were generally quite high. Fronts crossing Scotland were generally weak and gave little or no rain. The temperature on the 12th reached a remarkable 29.8°C at Parkhead, and 26.0°C at Carim. Temperatures fell in a stiff north-westerly airstream behind a cold front on the 15th and 16th but soon recovered. High pressure briefly gave way to less stable weather patterns between the 22nd and 25th and a small amount of rain fell on the 24th around a weak frontal system. A ridge of high pressure extended eastwards towards Britain on the 26th and brought Scotland into a cool westerly airstream for the remainder of the month.

August. Very warm and relatively dry.

While pressure remained high to the south-west of Britain, Scotland experienced cool showery west to north-west winds until the 4th. A strong ridge of high pressure extended north-eastwards across Britain on the 5th to affect the weather until the 14th. Maximum temperatures topped 20°C throughout the 10 days, reaching the month's highest of 27.4°C at Parkhead (23.2°C at Carim) on the 10th. While a weak cold front lingered to the north-east of Scotland on the 8th and 9th skies were cloudy and during a brief westwards retreat of the ridge, winds on the 12th were fresh north-westerly. The weather pattern began to break late on the 14th and a series of troughs affected Scotland until the 16th. Slight rain fell in a fresh south-westerly breeze but maximum temperatures remained quite high. Pressure began to build from the continent on the 17th but slight rain fell from a weak frontal system which crossed central Scotland in the evening. A broad low over southern England brought thundery rain to this area but Scotland remained rainfree and warm on the 19th and 20th in a mild southerly breeze. As pressure began to increase on the 21st, the weather for the next week became very close with heavy mists. A warm front moved eastwards across Scotland on the 22nd and 23rd bringing heavy continuous rain and half of the month's total. Pressure remained high until the 29th and the weather calm and warm, but rather dull at times. As high pressure retreated eastwards a vigorous cold front moved in from the Atlantic to give rain later on the 31st.

September. Cool and very wet.

A deep depression moved eastwards across Scotland between the 1st and 3rd bringing strong winds and rain to most of Britain. South of the border there was widespread structural damage. Another depression moved in on the 4th bringing more rain and a fresh westerly wind. Pressure began to rise very sharply on the 5th as an anticyclone built from the south-west. As this drifted slowly eastwards the 6th and 7th were bright and sunny but rather cool. As a warm front moved in from the west late on the 7th, rain began to fall and the 8th was a dull wet day. With complex cyclonic conditions over Britain the weather became very unsettled on the 9th and 10th. Heavy rain fell for most of the day on the 9th, which was the month's wettest day with 27.3mm at Parkhead. A ridge of high pressure to the west of Ireland extended northwards on the 10th and temperatures in many parts of England were well below the seasonal average, in the cold north-westerly winds. Heavy rain and floods affected northern England and localised hailstorms occurred in the south. Central Scotland, however, remained dry and cool for three days. A series of deep depressions and associated fronts crossed Scotland between the 14th and 20th. Rain was recorded every day in this period. Winds were south-westerly and reached gale force on the 18th and 19th in many places. A depression tracked eastwards along the English Channel on the 21st bringing rain to southern England but in the 'col' to the north Scotland had a dry sunny day. An anticyclone moved near south-east England on the 22nd to continue the fine weather but retreated eastwards overnight allowing rainbearing fronts to move northwards across Scotland. Temperatures rose very quickly in warm southerly winds on the 23rd when a remarkable 18.0°C was reached at Parkhead (16.1°C at Carim). Pressure began to rise quickly on the 24th and the next few days were relatively more settled although rather dull. As high pressure began to retreat northwards, the 27th was an exceptionally warm day reaching 20.1°C at Parkhead. A front lay across Scotland on the 28th and 29th bringing moderate rain, and by the 30th a vigorous low was approaching from the west.

October. Mild and wet at first, becoming cooler and drier.

While pressure remained high to the south or south-east of Britain Scotland was visited by a seemingly endless sequence of fronts moving in from the Atlantic. Winds remained generally west to south-west and rain was recorded on all of the first nineteen days of the month. Winds became strong to gale force at times, in particular on the 5th and the 15th. Daily rainfall exceeded 10mm on the 3rd, 4th, 15th and 18th at Parkhead. The 18th with 12.3mm was the wettest day of the month. An anticyclone moved slowly eastwards across Britain between the 20th and 23rd bringing a welcome change to drier more settled weather. However, as skies cleared, night-time temperatures began to fall and the first air frost was recorded on the 21st (−2.5°C at Parkhead). A cold front with a band of rain moved south-eastwards on the 23rd as another anticyclone moved south-eastwards. The 24th was sunny and calm but while southern England experienced cool calm weather Scotland was brought into a brisk westerly airstream on the 25th and 26th. Yet another anticyclone drifted south-eastwards between the 27th and 30th, and its arrival over the country was preceded by a cold north-westerly airstream. Night frosts, severe in places, were widespread on the 29th. A vigorous depression to the north of Scotland on the 30th brought a rapid overnight change in the weather to strong westerly winds.

November. Mild and dull but little rain.

The first two weeks were exceptionally mild. Winds were south-westerly moving to easterly by the 10th. The weather throughout Britain was dominantly of low cloud, drizzle and fog. A deep depression to the north brought stong winds on the 1st but very little rain. As a depression approached from the south-west on the 5th Scotland was affected by a very mild southerly airstream and temperatures were well above the seasonal normal. Low pressure became stationary to the south-west of Ireland by the 8th and a large area of high pressure developed to the north. Winds became light and variable and temperatures remained high, reaching 14.9°C at Parkhead on the 10th. The weather remained murky but amounts of precipitation were generally very small. As the anticyclone moved eastwards into Scandinavia on the 11th daytime temperatures fell in a fresh easterly wind. On the 12th the anticyclone embraced Scotland and began to drift westwards. As the sky cleared and the drizzle died away night temperatures fell to give frost on the 14th (−1.3°C at Parkhead). As the high moved out into the Atlantic Britain was covered by a cold clear northerly airstream on the 15th and 16th. As it began to drift eastwards again on the 17th, the country was brought into a cold cloudy westerly airstream. As the high slipped south a depression to the north of Scotland and associated fronts brought rain in a strengthening westerly wind on the 19th. A ridge of high pressure extended southwards over Iceland on the 20th and a cold clear northerly airstream covered Britain. Snow showers affected north-east Scotland on the 21st, 22nd and 23rd. Night temperatures fell to −4.6°C on the 22nd and daytime temperatures reached only 2.8°C on the 23rd. High pressure moved eastwards to be replaced by low pressure systems by the 24th. Temperatures recovered quickly as general rain fell in a mild south-westerly wind between the 24th and 27th. The vigorous low which travelled up the English Channel on the 26th and 27th and which brought gales to southern England had little effect on Scottish weather. After a brief respite on the 28th which was clear and cold a ridge of high pressure extended across Britain on the 29th and 30th bringing cold grey weather with a return to night frosts.

December. Mild and wet.

Rain was recorded at Parkhead on 25 days during the month and wind speeds were generally high. As the anticyclone gradually drifted away eastwards during the first four days, Scotland was affected by a mild moist south-westerly airstream while south of the border the weather remained cold in a ridge of high pressure extending from eastern Europe. On the 5th this ridge began to join with an area of high pressure to the west of Britain and by the 6th the rain had cleared, to be replaced by cold weather with night frosts under clear skies. Light rain fell on the 7th and 8th but temperatures remained low. A depression moved eastwards across Ireland and into Wales on the 8th eventually drifting away into the Low Countries. Snow showers fell in strong northerly winds. A weak ridge of high pressure crossed the country on the 10th and 11th and was accompanied by cold northerly winds. Daytime temperatures at Parkhead rose to only 1.8°C on the 11th. A frontal trough moved in from the west later in the day bringing heavy overnight snow which accumulated to a depth of up to 10cms. A rainbearing warm front crossed central and northern Scotland in the late evening of the 12th bringing about a remarkable rise in temperature. Snow patches survived until early on the 13th but had disappeared by the end of the day. Cold wet weather persisted until the 16th. A cold front associated with a low to the south-west of Ireland drifted northwards during the 17th bringing heavy rain to central Scotland (16.6mm at Parkhead, 24.5mm at Carim). Rain was recorded on all the remaining days of the month but temperatures were in general above the seasonal average. Depressions moved north-eastwards into the Irish Sea between the 18th and 21st and were associated with heavy rain and strong to gale force winds on the 20th. Further depressions and associated fronts moved in from the west bringing more rain after the 21st. 22.0mm fell at Parkhead on the 24th, the wettest day of the month. With high pressure to the south and low to the north, the country experienced a strong meridional pressure gradient for much of the remainder of the month assuring us a wet and windy festive season. The west to south-west winds were occasionally strong and reached storm force at Hogmanay – most 'first foots' were distinctly soggy! The New Year was welcomed in with widespread floods.

For data see Tables 1 to 5 and Figures 1 to 4.

DATA SOURCES

Basic data is as given in the 1985 report.
All Stirling (Parkhead) monthly data are now on computer file.
The Carim station has been plagued by instrument failure during 1983. Percentage of days lost amount to 3% for air temperature, 7% for relative humidity and 25% for rainfall. This is due in part to the ageing of the equipment and an inability to maintain an adequate servicing schedule. Missing data has been estimated by cross-reference to

Parkhead.
The new Didcot Automatic Weather Station has been installed and is linked to a programmable CR21 solid state logger and memory unit. Laboratory and field tests have been carried out and a supply of reliable data came 'on stream' by mid-December. The equipment currently supplies hourly means of air temperature, relative humidity, net radiation, wind speed and wind direction. A raingauge is to be added during 1984. Evaporation will be calculated using a Penman-Monteith method.

RESEARCH NOTES

Effects of elevation (Figure 3)

During 1983 the average difference in maximum temperature between Carim and Parkhead was 3.1 °C which represents a lapse rate of 10.3°C per 1000m. As was the case in 1982, seasonal variation in this lapse rate was not particularly obvious but since the Carim station opened in 1980, a pattern is emerging of least severe elevation gradients in winter. The average difference in minimum temperature between the stations was − 1.1 °C. This represents a lapse rate of only 3.7°C per 1000m. In comparison to 1982, inversions of minimum temperature were relatively less frequent during 1983 which was characterised by more unstable cyclonic weather systems. Conditions for the development of the Forth valley frost hollow (Harrison and Wallace 1982) were rare, particularly later in the year. Difference in annual mean temperature between Carim and Parkhead was 2.1 °C which represents a rate of decrease of 7.0°C per 1000m.

Precipitation increase with elevation varies according to synoptic conditions but during 1983 the rate of increase in annual total was 1.74mm per metre increase in elevation. This is consistent with values derived for elsewhere in Britain (Ballantyne 1983) and suggests that a reasonable annual average rainfall for Carim would be of the order of 1400mm.

BALLANTYNE, C.K. 1983. Precipitation gradients in Wester Ross, North-West Scotland. *Weather* 38, 379-387.

HARRISON, S. J. and WALLACE, R.W. 1982. Frost in Forth Valley, Scotland. *Journal of Meteorology* 7, 84-86.

The Register of Weather Stations

A directory of weather stations outwith the Meteorological Office network was published in March 1983 jointly by the Royal Meteorological Society and the University of Stirling and demand for the first print run of 500 has been high. Universities, colleges, schools, local libraries, industry and research agencies have been the main customers. The information in the Register will be updated in regular supplements.

Harrison, S. J., Register of Weather Stations, Environmental Science Department, University of Stirling. £3 plus 50p postage and packing.

Climatic Trends (Figure 5)

Much has been heard of possible climatic trends – whether rainfall is increasing or decreasing, whether temperatures will continue to be inflated by atmospheric carbon dioxide, or whether we are approaching the next Ice Age. The validity of any conclusions reached depends in very large measure on the quality of the data which are used and the time interval over which data are analysed. Uncritical use of long records of weather, of which there are several in Britain, can lead to entirely false conclusions. Before carrying out analysis it is wise to check through the Meteorological Office 'Green Files' which give a reasonably complete record of site and instrument changes at a station. An example of this can be seen in Harrison (1983) where a long data series for Portsmouth comes from four separate sites all of different situation.

The danger of taking too short a time interval can best be illustrated by referring to the annual rainfall totals for Stirling (Parkhead) over the period 1972 to 1983. When plotted in graph form (Figure 5) there would appear to be a tendency towards increasing totals through time. Indeed, there is a significant linear correlation between rainfall total and year. Using a linear model would suggest that annual rainfall by AD2000 will be 50 per cent higher than it is now, which is meteorologically highly improbable. Analysis of longer rainfall data series usually reveal that rainfall variation through time is more likely to be in the form of a complex cyclical trend.

HARRISON, S.J. 1983. Climatological stations at coastal resorts, a cautionary note. *Journal of Meteorology* 8, 3-6.

Weather Station siting characteristics (Figure 6)

The topographic setting of a weather station, including aspect, slope, and shelter can introduce a strong local element into weather observations which makes them difficult to compare with observations from other stations. One method of assessing shelter and aspect is to measure the angle of inclination or declination of the horizon (including buildings) from the centre of the weather station. This can be carried out using a simple clinometer made from a protractor and ruler, or using more sophisticated surveying equipment. Angles are determined along the eight major points of compass, then plotted as a 'sheltergram' (Figure 6). The centre of the 'sheltergram' is $-5°$.

Once this has been drawn, the area enclosed may be determined using simple geometry in order to provide a shelter value for the site. An exposed station will have a shelter value less than 100, a very sheltered site more than 400.

Aspect may be determined by using VECTORS. The resultant direction indicates where the station is sheltered. Aspect is resultant $+180°$.

Forth Estuary Project

This has been completed and a final report sent to the Natural Environment Research Council. A synopsis of the heat flow aspects of the work appears in the IMRP Report series:

The temperature regime of a mudflat influenced by power station warm water discharge. G. J. Walters (Walthamstow, London). IMRP Report No. 6 1984.

Thermal properties of muddy intertidal sediments S. J. Harrison and A. P. Phizacklea (University of Stirling). IMRP Report No. 7 1984.

These reports are available for £1 each (plus p and p) from the Department of Environmental Science, University of Stirling. A full list of reports is available on request.

Undergraduate dissertations

Clark, J.	The urban cold island of Glasgow
Cooper, K.	The urban heat island of Stirling
Muirhead, D.	Wind speed under a woodland canopy

	Mean Maximum °C	Difference from Average	Highest Maximum	Lowest Maximum	Mean Minimum °C	Difference from Average	Highest Minimum	Lowest Minimum	Mean °C	No. of days < 0°C	Mean Soil Temp. °C
January	8·1	+1·9	12·4	2·4	2·4	+2·0	8·0	−2·0	5·2	11	3·9
February	4·9	−1·5	7·9	1·2	− 1·5	−2·1	2·2	−6·0	1·7	20	1·4
March	9·2	+0·5	12·3	5·2	2·9	+1·2	7·7	−3·1	6·1	5	5·2
April	9·7	−1·9	13·0	6·1	2·2	−0·8	7·2	−3·1	5·9	7	6·8
May	12·5	−2·4	14·8	6·5	6·0	+0·6	8·5	2·9	9·2	0	11·0
June	16·7	−0·7	24·5	10·0	8·2	+0·1	12·5	2·3	12·4	0	14·5
July	21·5	+1·7	29·8	15·3	12·1	+1·5	15·0	6·8	16·8	0	17·9
August	21·6	+2·3	27·4	16·3	11·6	+1·5	16·4	1·2	16·6	0	17·6
September	15·4	−0·6	21·6	11·2	8·4	0	13·7	1·4	11·9	0	13·8
October	12·4	−0·2	19·1	8·6	5·6	+0·2	14·6	−2·5	9·0	3	10·0
November	10·1	+1·2	14·9	2·8	3·7	+1·2	10·2	−4·6	6·9	6	7·4
December	8·5	+1·6	14·2	1·8	2·2	+1·0	9·1	−4·1	5·4	9	6·3
YEAR	12·6	+0·2	29·8	1·2	5·3	+0·5	16·4	−6·0	8·9	61	9·7

Table 1 Monthly temperatures (Stirling, Parkhead) 1983

	Mean Maximum °C	Difference Carim – Parkhead	Highest Maximum	Lowest Maximum	Mean Minimum °C	Difference Carim – Parkhead	Highest Minimum	Lowest Minimum	Mean	No. of days < 0°C
January	5·5	−2·6	10·1	0·4	1·2	−1·2	6·0	−2·5	3·3	12
February	1·9	−3·0	4·8	2·0	−2·2	−0·7	1·4	−6·2	−0·1	23
March	5·8	−3·4	9·0	0·0	1·5	−1·4	5·8	−2·8	3·7	13
April	6·6	−3·1	9·9	2·6	0·3	−1·9	4·2	−5·1	3·4	16
May	9·1	−3·4	13·1	5·0	4·3	−1·7	6·7	1·0	6·7	0
June	13·5	−3·2	21·4	6·7	6·7	−1·5	11·6	3·8	10·1	0
July	18·5	−3·0	24·6	12·6	10·5	−1·6	15·0	6·0	14·5	0
August	17·8	−3·8	23·2	11·8	10·3	−1·3	13·8	5·9	14·0	0
September	12·3	−3·1	16·4	8·2	7·6	−0·8	13·0	3·1	10·0	0
October	9·5	−2·9	14·5	4·7	5·2	−0·4	12·5	−1·4	7·4	2
November	7·3	−2·8	11·7	1·0	2·9	−0·8	9·4	−5·0	5·1	8
December	5·7	−2·8	10·4	0·0	1·9	−0·3	7·5	−2·0	3·8	9
YEAR	9·5	−3·1	24·6	2·0	4·2	−1·1	15·0	−6·2	6·8	83

Table 2 Monthly Temperatures (Carim) 1983

	Total Precipitation (mm)	Percentage of Average	Greatest fall in 24 hours		Number of Days			
			Amount (mm)	Date	Precipitation Recorded	0·2mm or more	1·0mm or more	5·0mm or more
January	145·4	145	20·4	2nd	24	23	20	11
February	20·3	34	9·0	4th	7	7	5	1
March	81·6	100	17·8	18th	21	20	18	6
April	34·6	97	9·8	22nd	16	14	10	2
May	108·8	177	22·3	5th	22	20	17	7
June	45·4	83	15·1	1st	13	12	8	3
July	16·6	32	10·7	1st	6	6	4	1
August	24·6	42	8·1	22nd	7	7	6	1
September	149·0	152	27·3	9th	20	20	18	10
October	122·6	139	12·3	18th	24	23	20	9
November	21·7	22	5·2	26th/27th	9	9	8	2
December	114·5	123	22·0	24th	25	25	18	8
YEAR	885·1	100	27·3	9th Sept.	194	186	152	61

Table 3 Monthly Precipitation (Stirling, Parkhead) 1983

		Total Precipitation (mm)	Greatest fall in 24 hours: Amount (mm)	Greatest fall in 24 hours: Date	Number of Days: 0·5mm or more	Number of Days: 1·0mm or more	Number of Days: 5·0mm or more
January		221·0	33·5	2nd	26	24	14
February		37·5	14·5	4th	10	7	3
March		132·5	19·5	18th	24	23	9
April		66·0	29·5	22nd	16	11	3
May	*	166·2	31·0	5th	24	18	12
June	*	76·2	21·9	1st	16	10	4
July		16·0	10·0	1st	6	5	1
August	*	32·5	11·0	22nd	8	5	3
September	*	171·4	20·0	9th	20	19	12
October	*	191·6	–	–	–	–	–
November	*	46·0	–	–	–	–	–
December	*	245·6	–	–	–	–	–
YEAR		1402·5	–	–	–	–	–

Table 4 Monthly precipitation (Carim) 1983

* Incomplete records

	Maximum Temperature °C	Minimum Temperature °C	Number of Days < 0°C	Soil Temperature (0·3m) (0900 GMT)	Total Precipitation (mm)	Number of Days with Precipitation
January	6·2	0·4	13	3·0	100·5	19
February	6·4	0·6	13	2·8	59·1	16
March	8·7	1·7	9	4·4	81·7	18
April	11·6	3·0	5	7·6	35·8	11
May	14·9	5·4	2	11·4	61·6	16
June	17·4	8·1	0	14·5	54·6	14
July	19·8	10·7	0	16·6	51·1	12
August	19·3	10·1	0	16·4	58·6	14
September	16·0	8·4	0	13·7	97·9	16
October	12·6	5·4	3	10·0	88·0	17
November	8·9	2·5	9	6·2	98·9	18
December	6·9	1·2	12	3·6	93·2	19
YEAR	12·4	4·8	66	9·2	881·0	190

Table 5 Climatological Averages for Stirling (Parkhead) 1971 – 1983

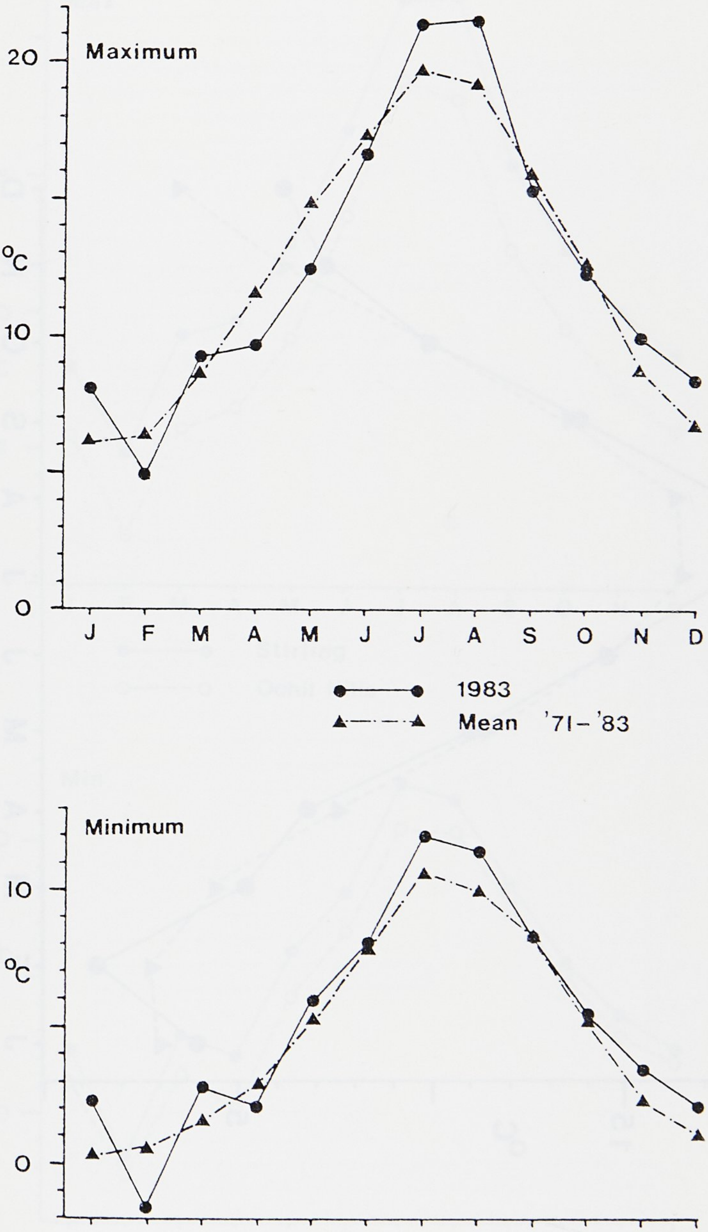

Figure 1 Monthly air temperatures Stirling (Parkhead) 1983

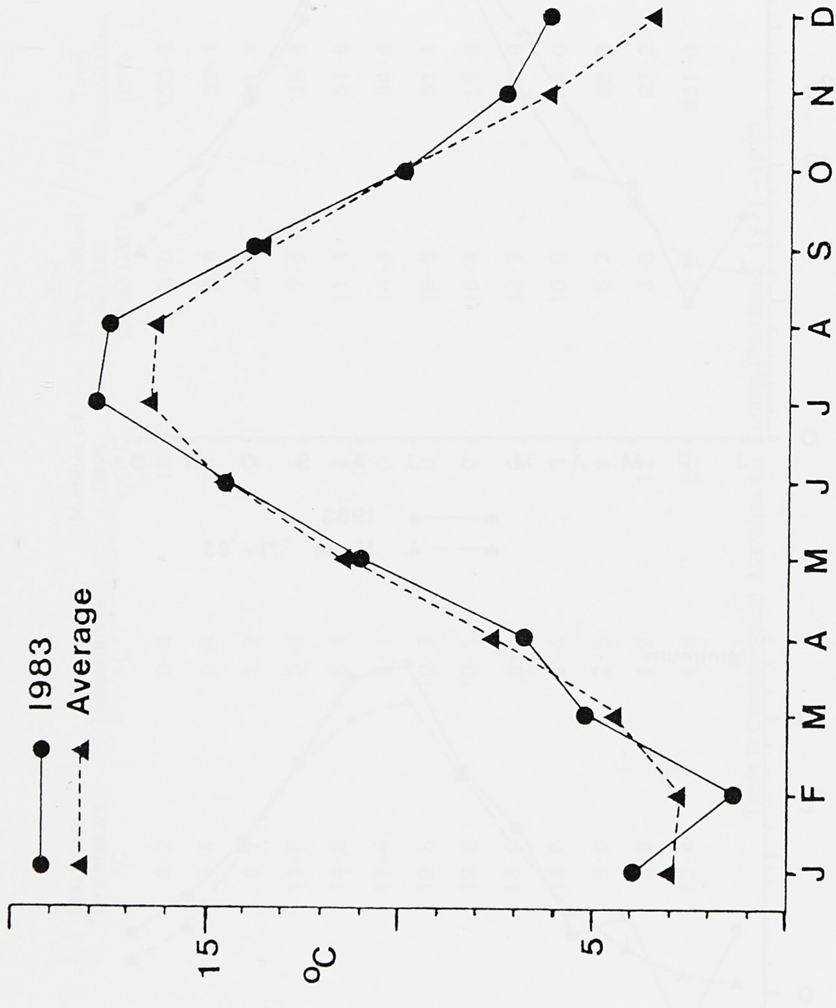

Figure 2 Soil temperatures (0·3m) Stirling (Parkhead) 1983

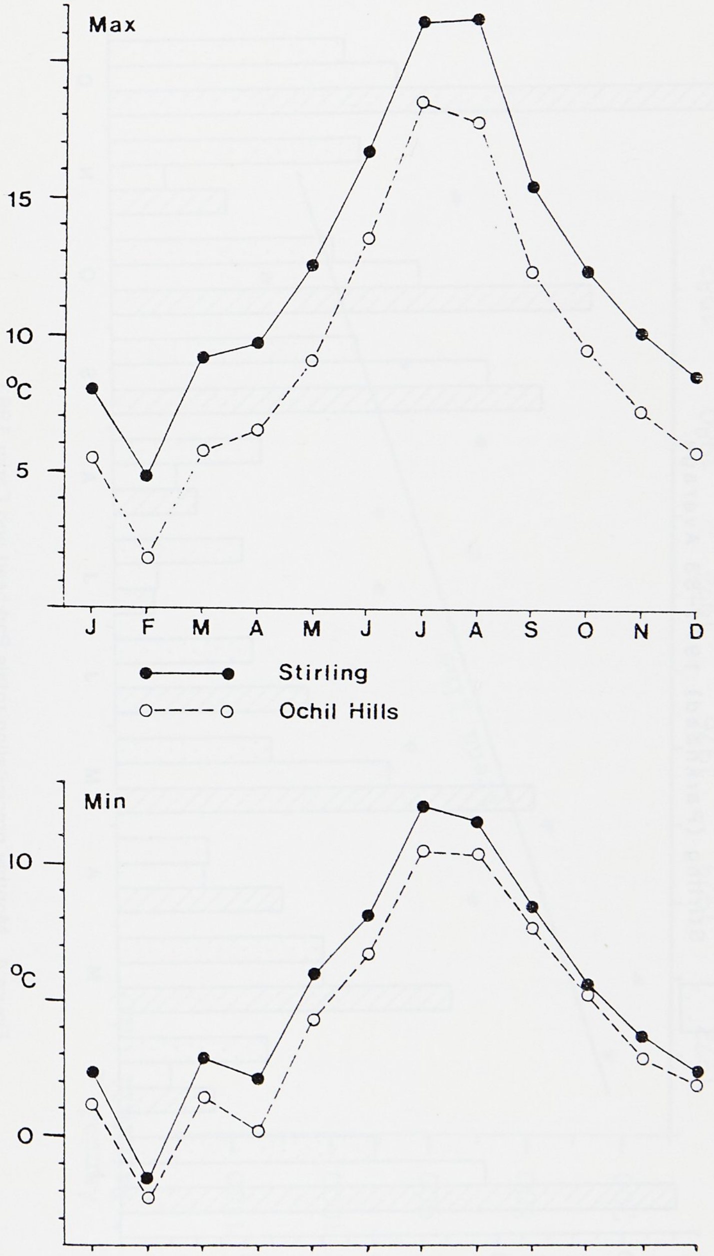

Figure 3 Effects of elevation – temperature differences between lowland and upland 1983

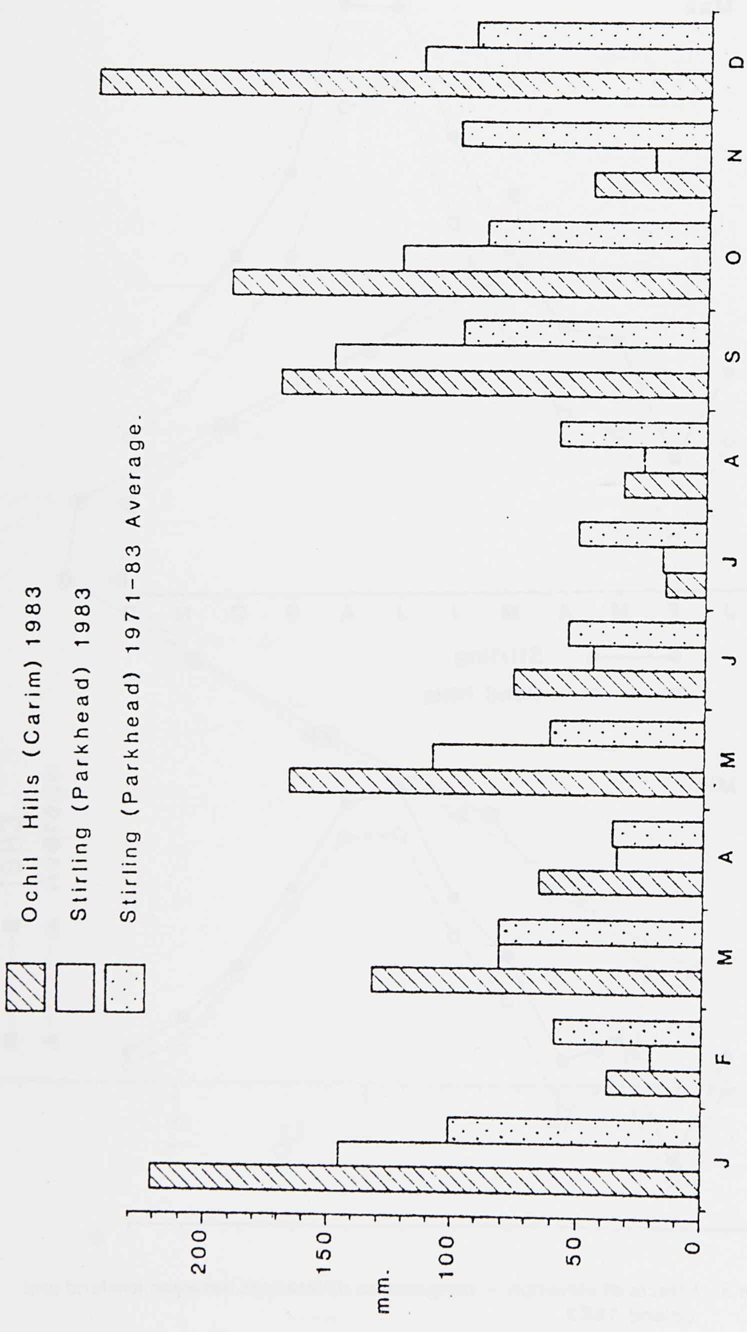

Figure 4 Monthly precipitation totals Parkhead and Carim 1983

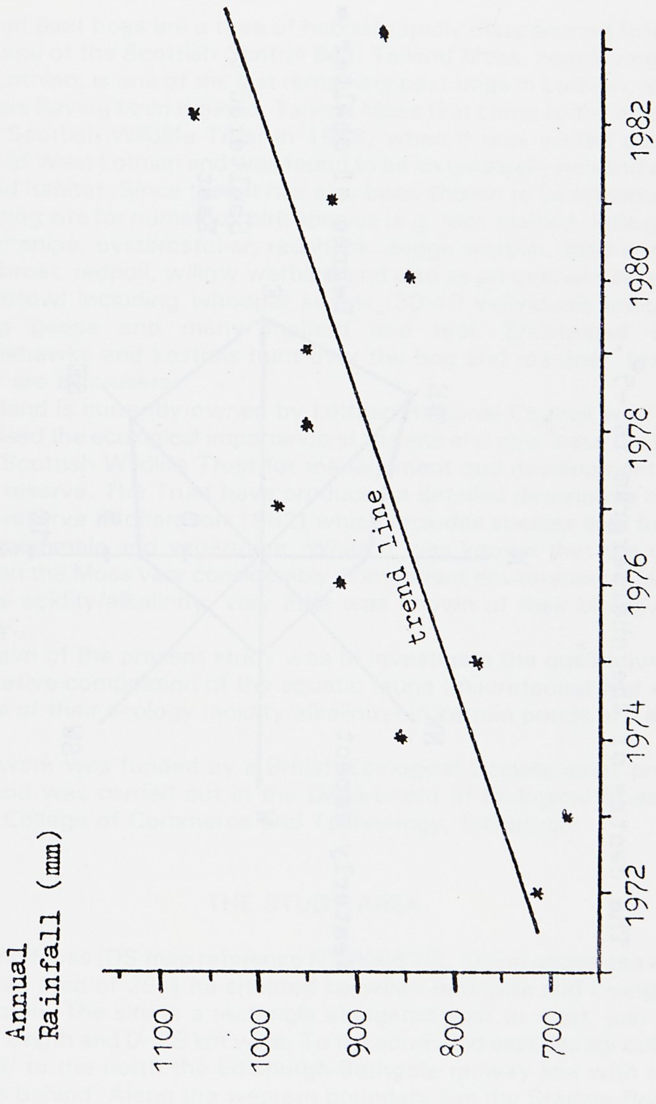

Figure 5 Annual rainfall for Stirling (Parkhead) 1972-1983

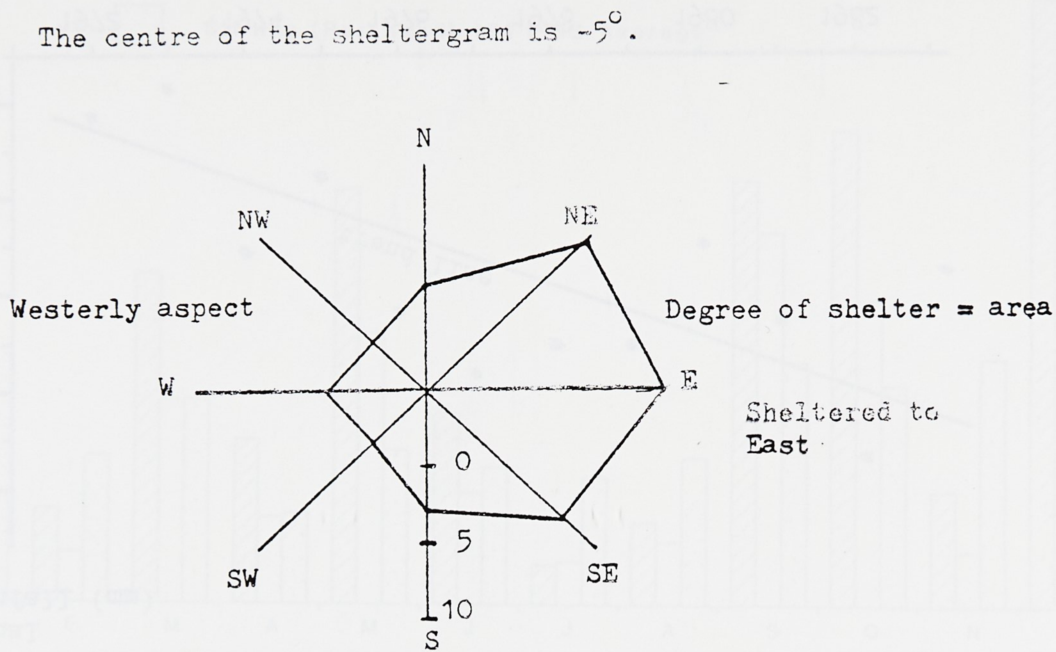

Figure 6 Weather station siting 'sheltergram'

POND ECOLOGY – TAILEND MOSS NATURE RESERVE, WEST LOTHIAN

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Raised peat bogs are a type of habitat rapidly disappearing from the landscape of the Scottish Central Belt. Tailend Moss, near Livingston, West Lothian, is one of the last remaining peat bogs in Lothian, almost all others having been drained. Tailend Moss first came to the attention of the Scottish Wildlife Trust in 1968, when it was visited during a survey of West Lothian and was found to be an unusually rich and varied wetland habitat. Since then it has also been shown to be important as a breeding site for numerous bird species (e.g. teal, mallard, little grebe, curlew, snipe, oystercatcher, redshank, sedge warbler, reed bunting, whitethroat, redpoll, willow warbler) and also as an overwintering site for wildfowl including whooper swans (30-40 individuals annually), greylag geese and many mallard and teal. Shorteared owls, sparrowhawks and kestrels hunt over the bog and roe-deer, fox and badger are also users.

The land is currently owned by Lothian Regional Council who have recognised the ecological importance of the site and now lease the Moss to the Scottish Wildlife Trust for management and development as a nature reserve. The Trust have produced a detailed descriptive report on the reserve (Richardson 1982) which includes species lists for the birds, mammals and vegetation. While it was known that the many ponds on the Moss vary considerably in important environmental factors such as acidity/alkalinity, very little was known of their biology and ecology.

The aim of the present study was to investigate the qualitative and quantitative compostion of the aquatic fauna (macrofauna) and some aspects of their ecology (acidity/alkalinity) in certain ponds of Tailend Moss.

The work was funded by a British Ecological Society small project grant and was carried out in the Department of Biological Sciences, Napier College of Commerce and Technology, Edinburgh.

THE STUDY AREA

Tailend Moss (OS map reference NT 006678), 166m above sea level, covers an area of 28.4 ha situated between Bathgate and Livingston New Town. The site is a rectangle elongated east to west, just over 1 km in length and 0·25 km wide. To the south and east lies agricultural land and to the north the Edinburgh-Bathgate railway line with shale mounds behind. Along the western boundary lies the Starlaw-Boghall road (B708) and the M8 Edinburgh-Glasgow motorway clips the north-west corner. Tailend Moss thus forms an island of raised bog surrounded

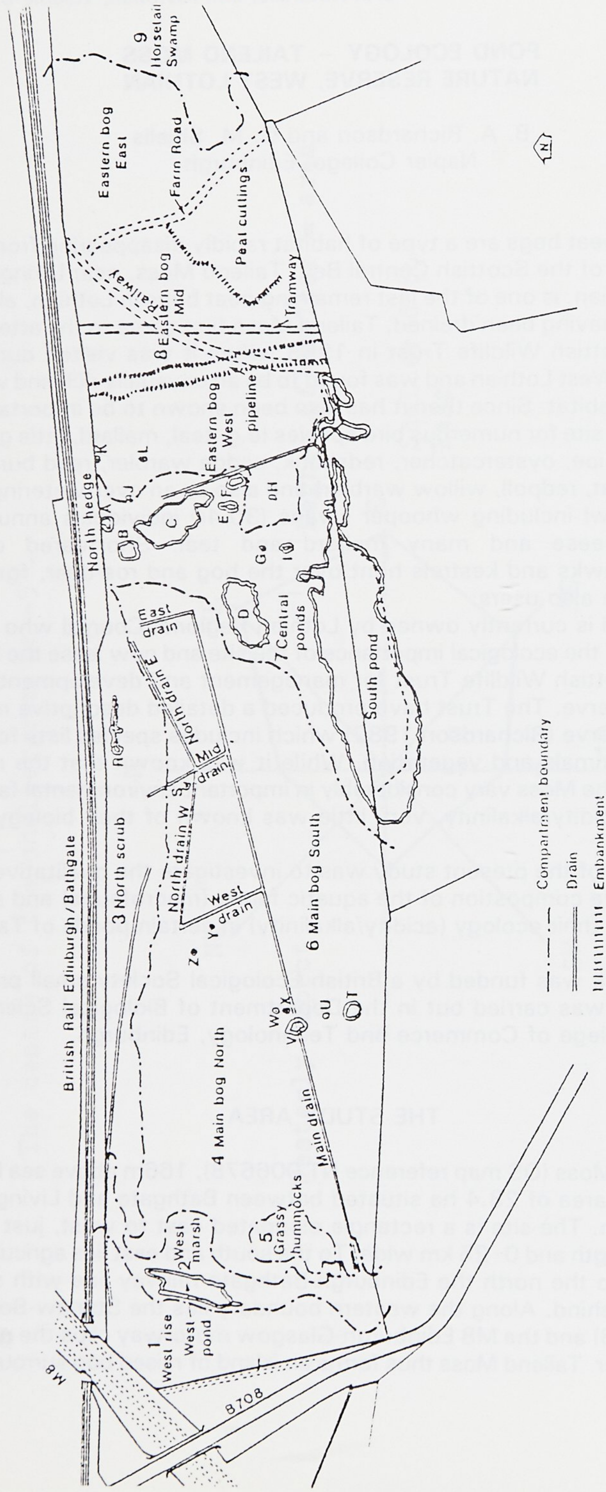

Figure 1 Tailend Moss reserve in detail showing main compartments.

by land which has undergone substantial change by industrialisation and agriculture.

It seems likely that the moss was once part of a much larger wetland system, as close by is Easter Inch Moss, now largely drained and place names such as Little Boghead and Moss-side Farm bear witness to a former wetland mentioned in old records – the Bathgate Bog. James IV is reputed to have hunted over this area and to have been presented with a bittern by a local fowler. The name Tailend in old Scots means 'a piece of land irregularly bounded, jutting out from a larger piece of land' (MacDonald 1941). Presumably Tailend Moss was the end of the bogland before reaching the higher ground of Livingston and Ladywell.

Previous land-use on the moss includes the siting of a railway line along the northern border; rough grazing, peat extraction, oil-shale mining in the area; and a pharmaceutical company is thought to have used part of the bog near the railway line as a dump for waste materials. Richardson (1982) should be consulted for further information on previous land-use.

The Reserve (Figure 1) has been divided into nine major compartments briefly described below. The two major ponds, twenty-one other ponds, the main drains, the three old tracks across the east end and the gas pipe have also been identified as features in their own right.

COMPARTMENTS

1 West Rise
East facing slope of mineral grassland in which some native trees have already been planted, topped by a hawthorn hedge.
2 West Marsh and associated West Pond
A shallow N-S depression where water drains from Tailend Farm fields through the West Pond and along the railway line. Associated marginal vegetation of sedges and rushes.
3 North Scrub
A low ridge running the full length of the north side of the Reserve, made up of hummocks of sand deposited by glaciation, covered by grass and scrub vegetation including willow, birch, hawthorn, gorse and broom.
4 Main Bog North
Area north of Main Drain from West Marsh to Central Ponds. Deep peat with associated bog vegetation of heather and sphagnum, particularly wet at western end.
5 Grassy Hummocks
A small area of acid grassland on hummocks of sand in south-west corner of Main Bog North.
6 Main Bog South
South of the Main Drain the Moss includes a large burnt heather area with *Molinia* and regenerating heather.
7 Central Ponds
A shallow depression running across the centre of the Moss. The southern edge is a herb rich marsh (South Marsh) which frequently

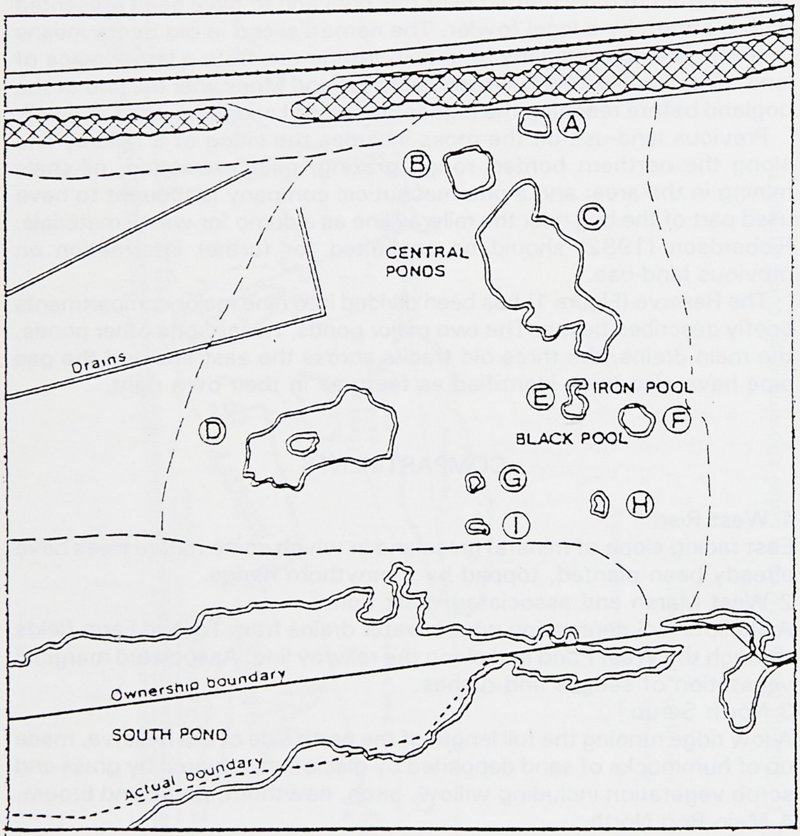

Figure 2 Tailend Moss, the Central Ponds compartment. The area shown by dotted lines is the focus of this study. In addition to the Central Ponds themselves it includes the ponds A-L. It also shows the adjacent South Pond.

floods to form an open water area (South Pond). This varies in extent throughout the year. It is very important for ducks, geese and swans during the winter. This compartment also includes ponds A - L.

8 Eastern Bog

The peat bog east of Central Ponds is divided into four main areas for recording purposes; by the old railway, the tramway, the farm road, and by the depression formed by the old peat workings. Most of this compartment is undisturbed raised bog with deep heather, except for the tracks which are grassy and the disturbed ground where the pipeline was laid.

9 Horsetail Swamp

The extreme west end of the Reserve where peat digging has exposed the underlying clays. It is mainly a low lying area of marshy ground dominated by horsetails but including extensive areas of rush and sedge swamp.

The Central Ponds (Figure 2) lie within a depression in the peat bog thought to be the result of subsidence from the collapse of underground shale mine workings. It is in this area that the present study is focussed.

METHODS

Faunal collections were made from ponds A, B, D, E, F, H and I. Due to time limitations not every pond in the Central Ponds area could be studied.

Samples were taken using a Freshwater Biological Association type dip-net with which a standard number of sweeps were made in each pond. Organisms were extracted manually in the laboratory from shallow trays, identified to the lowest possible taxonomic level and individuals in each taxonomic group were counted.

Measurement of acidity/alkalinity (pH) of the surface waters of the above ponds and additionally of the South Pond were made.

Variation of pH with depth was investigated in two known alkaline ponds (A and B) and one acid pond (F). Acidity/alkalinity measurements were made in the field using a portable pH meter and probe.

All field work was carried out in July 1983.

RESULTS and DISCUSSION

Acidity/alkalinity determinations are presented in Table 1 together with a guide to the relationship between pH values and acidity/alkalinity. Values recorded in the present study were in the range pH 3·6 – 7·8 (i.e. more acidic than lemon juice to slightly alkaline). Peat bog pools typically may be expected to have low pH acidic waters because of the nature of the sphagnum moss making up the peat and the waterlogged anaerobic conditions (Darlington 1978). Only two of the ponds in the Central Ponds area however are of this type (pond F, pH 4·0 and pond H, pH 3·6). The other ponds investigated have higher pH (neutral to alkaline surface waters) which are uncharacteristic of the peat bog habitat.

Table 1 pH values of water samples taken from Central Ponds. Values in brackets are results from previous studies.

Pond	pH
A	7.2
B	7.2
C	(7.3)
D	7.6
E	7.3
F	4.0
G	4.1
H	3.6
I	(6.9)
South Pond	7.8

	pH	
	12	– ammonia
Alkali	11	
	10	
	9	
	8	
pH	7	– distilled water
	6	– clean rain water
	5	– orange juice
Acid	4	– lemon juice

Similar pH values for the surface waters of the Central Ponds have been reported in previous studies (McPheely 1982, Richardson 1982). Prior to the commencement of the present study, speculation as to the cause of the atypically high pH values was, (a) the presence of alkali bearing material in the sediments either from natural limestone deposits or from calcareous pharmaceutical wastes, (b) agricultural run-off. It proved impossible to obtain samples of bottom sediments during the present study and therefore the presence of calcareous material could not be tested-for directly. However, the results of the study of variation of pH with depth in the water column (Figure 3) are inconsistent with the presence of a source of alkali material in the bottom sediments, there being a slight decrease in pH with depth in the two alkali ponds studied (ponds A and B).

The slight fall in pH with depth is not unusual and may be explained by the presence of phytoplankton in the surface waters (Mills 1972). These microscopic plants carry out photosynthesis and the oxygen released causes slightly more alkaline conditions. Little photosynthesis can be carried out at greater depths because of reduction in light penetration.

In Figure 4 direction of surface water flow across the Central Ponds area is illustrated along with the position of the raised part of the bog relative to the ponds (as observed in summer 1983). The pH of the respective ponds is also shown. There is a clear pattern of decrease in pH across the lower depressed area in the same direction as the water flow, i.e. from South Pond to ponds A and B. Ponds located in the raised part of the bog are acidic, presumably because water reaching them from the main flow has to percolate through acidifying layers of peat. Pond I is only slightly acidic which perhaps is a reflection of its proximity to the edge of the raised area. Pond F, which lies within the depression

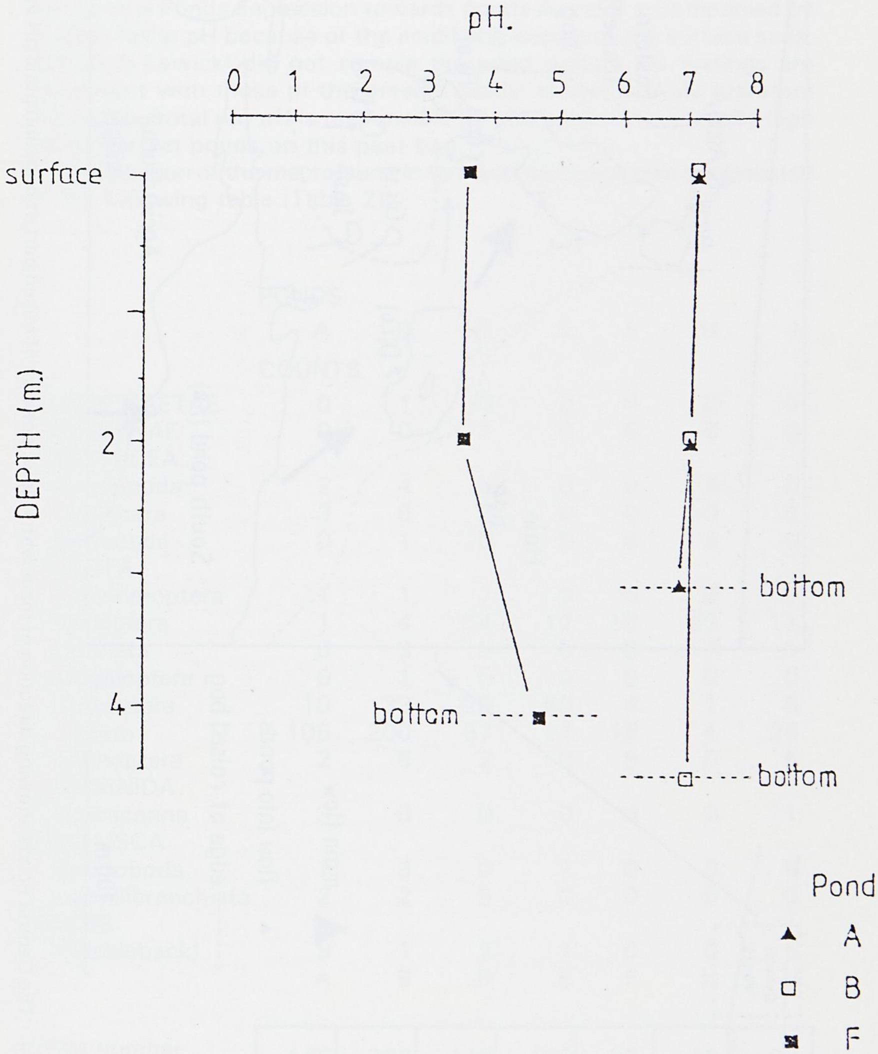

Figure 3 Variation in pH with depth in two alkali (A, B) and one acid (F) ponds (July 1983).

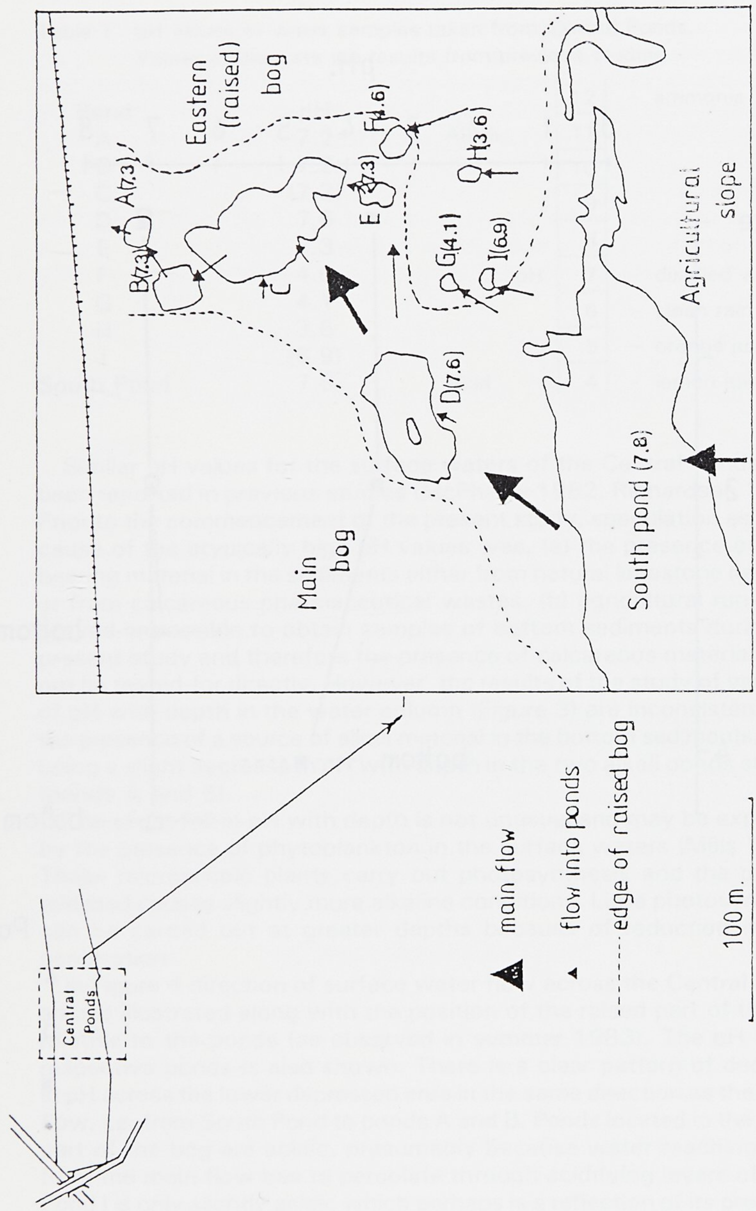

Figure 4 The Central Ponds showing direction of main water flow, position of raised part of bog, and pond pH values.

but is acidic, is an exception to the general trend, however it most probably receives acid water draining from the surrounding raised bog.

Lewicki (1983) working on surface soil water, observed that alkaline water rich in nutrients entered the Central Ponds area from the agricultural slope to the south of the reserve, and this then flowed across the Central Ponds depression towards ponds A and B accompanied by a slight fall in pH because of the acidifying nature of the surface soils. Although Lewicki did not sample the pond waters his findings are consistent with those of the present study. It seems likely therefore that agricultural run-off is responsible for the uncharacteristically high pH of certain ponds on this peat bog.

Composition of the macrofauna in terms of the major taxa is presented in the following table (Table 2).

COUNTS	PONDS A	B	D	E	F	H	I
OLIGOCHAETAE	0	1	0	0	0	0	0
HIRUNDINAE	0	0	1	0	0	0	0
CRUSTACEA							
Amphipoda	2	4	5	0	0	0	0
Cladocera	3	6	2	0	0	0	0
Ostracoda	0	1	0	0	0	0	0
INSECTA							
Ephemeroptera	1	1	7	0	0	0	0
Hemiptera	1	4	54	12	10	23	12
Odonata	0	3	5	5	0	7	1
Megaloptera	0	1	0	0	0	0	0
Coleoptera	10	33	26	83	4	1	8
Diptera	105	200	37	17	18	4	26
Trichoptera	2	5	2	0	5	0	5
ARACHNIDA							
Hydracarina	3	0	0	0	0	0	1
MOLLUSCA							
Gastropoda	7	3	0	1	0	0	6
Lamellibranchiata	2	2	5	0	0	0	0
PISCES							
(Stickleback)	9	1	2	1	0	0	5
	A	B	D	E	F	H	I
Total number of individuals	145	265	146	125	37	35	93

Table 2 Macrofauna components (major taxa) of Central Ponds (July 1983)

Taking the ponds as a whole, aquatic insects and larvae were by far the most abundant and widespread of the major taxa with Diptera (mainly midge larvae), Coleoptera (water beetles) and Hemiptera (water bugs), particularly well represented. Some insect groups, the Trichoptera (caddis) and Ephemeroptera (May-flies) were surprisingly few. This is probably a reflection of the time of year sampling took place, with most of their larvae and nymphs having matured earlier and emerged as adults. The same may well be true for the Odonata (dragonflies); although these large insects were not very abundant in samples, numerous adults were seen during fieldwork. Oligochaetae (worms) and Hirundinae (leeches) were very poorly represented. Crustaceans and molluscs were reasonably common, but only in certain ponds. Sticklebacks were encountered in most, but not all ponds.

Substantial differences in macrofauna composition are apparent between acidic and alkaline ponds. The acid ponds F and H were considerably impoverished in terms of overall abundance and in the numbers of major taxa present. Most notably crustaceans, molluscs and fish were entirely absent from samples. A much richer fauna was found in the alkaline ponds, with overall abundance greater than in the acidic ponds and with most major groups including crustaceans, molluscs and fish at least moderately well represented. Pond E (pH 7·3) was an exception to this pattern, with abundance and taxonomic richness intermediate between the acidic and other alkaline ponds. Pond E is alternatively known as the Iron Pool, because of the iron oxide red colour of the water. Dissolved and particulate iron is known to cause both disturbance and stress in freshwater animal communities which may explain the results found here. On looking more closely at the faunal composition of ponds A, B and D, some differences are apparent. Dipteran larvae (midges) were numerically dominant in ponds A and B, while in pond D Hemiptera and Coleoptera were more numerous. Ponds A and B were mostly of open-water. Pond D, however, had considerable floating and emergent vegetation disturbing the surface of the water, which perhaps provides a more suitable environment for good swimmers, scramblers or surface skaters (e.g. water-beetles, water bugs).

A full list of species identified in the present study is given in the following systematic list. Water-bug nymphs (Hemiptera) are difficult to identify to species, as are early dragonfly larvae, therefore positive identification in some cases was impossible. Identification of water-beetles to species is a specialist task, which was carried out by Dr G. N. Foster of The Balfour-Browne Club, to whom grateful thanks are expressed.

The species list must be considered as incomplete, not least because of the time of year sampling took place, but also because it represents the status quo of one instant in time. However it is hoped it will provide a useful baseline for future studies. All species identified so far are common widespread British fauna.

SYSTEMATIC LIST

Macrofauna of Central Ponds (July 1983) with numbers of individuals by species.

POND A

CRUSTACEA		
Amphipoda (shrimps)	*Gammarus pulex.*	2
Cladocera (water fleas)	*Simocephalus exspinosus*	3
INSECTA		
Ephemeroptera (May-flies)	*Caenis horaria*	1
Coleoptera (water beetles)	*Hydrobius fuscipes*	1
"	*Ilybius fuliginosus*	1
"	*Hygrotus inaequalis*	1
"	*Helophorus aequalis*	2
"	*Helophorus brevipalpis*	2
"	*Hydroporus palustris*	1
(weevils)	Chrysomelidae larva	1
Hemiptera (lesser water-boatmen)	*Glaenocorisa propinqua* (late nymph)	1
Diptera (midges)	(Tendipedidae)	105
Trichoptera (caddis)	*Phryganea* sp.	2
ARACHNIDA		
Hydracarina (water mites)	*Hygrobates longipalpis* (?)	1
"	*Piona rotundoides* (?)	1
"	unidentified sp.	1
MOLLUSCA		
Gastropoda (freshwater snails)	*Valvata macrostoma*	1
"	*Hydrobia jenkinsi*	4
"	*Lymnaea pereger*	2
Lamellibranchiata (pea mussels)	*Pisidium* sp.	2
PISCES (sticklebacks)	*Gasterosteus aculeatus*	9

POND B

OLIGOCHAETA Lumbriculidae	unidentified sp.	1
CRUSTACEA		
Amphipoda (shrimps)	*Gammarus pulex*	4
Cladocera (water fleas)	*Simocephalus exspinosus*	6
Ostracoda	unidentified sp.	1
INSECTA		
Ephemeroptera (May-flies)	*Cloeon dipterum*	1
Hemiptera (pond-skaters)	*Gerris* sp. (nymph)	1
(water-crickets)	*Microvelia pygmaea* (nymphs)	2
Odonata (dragon-flies)	*Lestes sponsa*	1
"	*Coenagrion puella*	2
Megaloptera (alder-flies)	*Sialis lutaria*	1
Coleoptera (water-beetles)	*Potamonectes assimilis*	3
"	*Hygrotus inaequalis*	1
"	*Helophorus brevipalpis*	28

Coleoptera (water-beetles)	*Helophorus minutus*	1
Trichoptera (caddis)	*Phryganea* sp.	5
Diptera (midges)	(Tendipedidae)	200
MOLLUSCA		
Gastropoda (water snails)	*Lymnaea pereger*	3
Lamelibranchiata (pea-mussels)	*Pisidium* sp.	2
PISCES (sticklebacks)	*Gasterosteus aculeatus*	9

POND D

HIRUDINEA (leeches)	*Helobdella stagnalis*	1
CRUSTACEA		
Amphipoda (shrimps)	*Gammarus lacustris*	5
Cladocera (water-fleas)	*Simocephalus exspinosus*	2
INSECTA		
Ephemeroptera (May-flies)	*Cloeon dipterum*	3
"	*Caenis horaria*	4
Hemiptera (water-boatmen)	*Notonecta viridis* (?) (nymphs)	2
(lesser water-boatmen)	*Callicorixa praeusta*	1
"	*Sigara dorsalis*	1
"	Corixidae (nymphs)	43
(water-crickets)	Gerridae (nymphs)	7
Coleoptera (water beetles)	*Rhantus exsoletus*	1
"	*R. exsoletus* (larvae)	4
"	*Helophorus aequalis*	2
"	*Helophorus flavipes*	2
"	*Helophorus brevipalpis*	4
"	*Hygrotus inaequalis*	2
"	*Hygrotus* sp. (larvae)	2
"	*Hydroporus erythrocephalus*	1
"	*Hydroporus* sp. (larvae)	1
"	*Agabus* sp. (larvae)	3
"	Hydrophilidae (larvae)	3
(weevil)	*Rhinoncus pericarpius* (?)	1
Odonata (dragon-flies)	*Lestes sponsa*	2
(Coenagriidae)	early nymph, unidentified sp.	1
(Aeshnidae)	early nymph (?) *A. juncea*	1
Diptera (midges)	(Tendipedidae)	34
(Dixidae)	*Dixella attica*	2
Trichoptera (caddis)	*Phryganea* sp.	2
MOLLUSCA		
Lamellibranchiata (water-snails)	*Pisidium* sp.	5
PISCES (sticklebacks)	*Gasterosteus aculeatus*	2

POND E

INSECTA		
Hemiptera (pond skaters)	*Gerris* sp. (nymphs)	9

Hemiptera (lesser water-boatmen)	*Sigara dorsalis*	
	(adults)	1
	(nymphs)	2
Diptera (midges)	(Tendipedidae)	15
(Dixidae)	*Dixella amphibia*	1
"	*Dixella aestivalis*	1
Coleoptera (water beetles)	*Helophorus brevipalpis*	71
"	*Helophorus flavipes*	4
"	*Helophorus aequalis*	3
"	*Haliplus obliquus*	2
"	*Haliplus wehnckei*	2
"	Colymbetinae (larva)	1
Odonata (dragon-flies)	*Coenagrion puella* (?)	1
"	*Aeshna juncea*	4
MOLLUSCA		
Gastropoda (water-snails)	*Lymnaea pereger*	1

POND F

INSECTA		
Hemiptera (lesser water-boatmen)	*Hesperocorixa moesta* (?)	
	(adults)	1
	(nymphs)	8
(pond skaters)	*Gerris* sp. (nymphs)	1
Coleoptera (water-beetles)	*Helophorus brevipalpis*	1
"	*Ilybius aenescens*	2
"	*Ilybius fuliginosus*	1
Trichoptera (caddis)	Limnophilidae (larvae)	5
Diptera (gnats)	*Chaoborus* sp.	12
(midges)	(Tendipedidae)	6

POND H

INSECTA		
Hemiptera (pond-skaters)	*Gerris lacustris*	2
"	*Gerris* sp. (larvae)	9
Odonata (dragon-flies)	*Aeshna juncea*	3
"	*Sympetrum scoticum*	4
Coleoptera (water beetles)	*Agabus bipustulatus*	1
Diptera (Ceratopogonidae)	*Atrichopogon* sp.	1
(midges)	Tendipedidae)	3

POND I

INSECTA		
Hemiptera (water-boatmen)	*Notonecta* sp. (nymphs)	3
(lesser-water-boatmen)	*Sigara dorsalis*	2
"	*Hesperocorixa moesta*	3
"	Corixid nymphs	3
(pond skaters)	*Gerris* sp. (nymphs)	1

Odonata (dragon-flies)	*Coenagrion* sp. (early nymph)	1
Coleoptera (water-beetles)	*Hygrotus inaequalis*	7
"	*Helophorus brevipalpis*	1
Diptera (midges)	(Tendipedidae)	26
Trichoptera (caddis)	Limnophilidae (larvae)	4
ARACHNIDA		
Hydracarina (Hydrachnella) (water-mites)	*Libertia* sp.	1
MOLLUSCA		
Gasgtopoda (water-snails)	*Lymnaea pereger*	6
PISCES (stickle-backs)	*Gaterosteus aculeatus*	5

There appears to be a clear relationship between taxonomic diversity, in terms of both major taxa composition (Table 2) and species composition (Systematic List) and the pH of pond water. Low pH acid ponds were taxonomically poor (and with low abundance), while alkali/neutral ponds were much richer in species and numbers of individuals. A number of features combine to make the typical peat-bog pool an inhospitable habitat. In shallow pools temperature fluctuations can be great, partly because of heat absorbing dark coloured water, but also because the surrounding peat may become hot on sunny days and transmit heat into the pools. Correspondingly, oxygen levels may frequently be very low below the surface. Dissolved nutrient concentrations tend to be very low, with layers of peat on the pond bottom preventing access to mineral salts in the underlying bedrock. Probably the most important restricting feture is the great acidity. Few animal, plant (except *Sphagnum*) or microbial species are able to cope with high acidity. Some sensitive species such as Mayfly, freshwater shrimps and snails are intolerant of pH below 6 (Mills 1972). With fish it is not just the acidity of the water that is the problem but as pH falls toxic aluminium salts are formed which are lethal to most species. Certainly Mayfly, snails, shrimps and fish were absent from the low pH acid pools of the Central Ponds and it seems likely that acidity was responsible.

Other environmental factors, such as pond surface area, the quantity and type of floating/emergent vegetation, and the presence of dissolved/particulate metal ions, almost certainly contributed to differences in macrofauna community structure between ponds. Clearly this study represents only a beginning in an attempt to understand the ecology of Tailend Moss ponds and of the reserve as a whole. Little is known at present of seasonal and long-term variability of the biotic and abiotic components of the environment.

As a nature reserve, Tailend Moss would appear to be something of a paradox. Nature reserves are commonly held to be natural unspoiled areas, or at least areas not markedly affected by the influence of man's activities. There is clear evidence, however, that the richness and diversity of habitats in the Central Ponds and in the Moss as a whole, is influenced strongly by outside agencies, past (mining) and present (agricultural run-off). This would seem, therefore, to detract from the value of Tailend Moss as a nature reserve. However it is this richness and habitat diversity which enhances the attractiveness of the Moss to the many wildfowl and wildlife residents and visitors. The main value of Tailend Moss as a nature reserve is probably that it provides a valuable wild-life refuge and a reservoir of species in a region where such habitats are scarce because of drainage and industrialisation. In addition, the reserve may be of particular scientific interest since it is most unusual to have bodies of water in close proximity of such widely differing pH. The Moss may therefore provide a suitable site for acid-rain modelling studies, particularly as geographical variables (altitude, substrate, weather conditions, etc.) are minimised.

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Key to Figure 5 Selection of pond organisms – copied from *Pond Life*, Burke, 1964, with the kind approval of the author, Professor W. Engelhardt of Munich.

A	Cased caddis larva	*Phryganea* sp.
B	Pea shell cockle	*Pisidium* sp.
C	Damsel fly nymph	*Coenagrion* sp.
D	Water beetle	*Hydrobius fuscipes*
E	Water shrimp	*Gammarus pulex*
F	May fly nymph	*Caënis* sp.

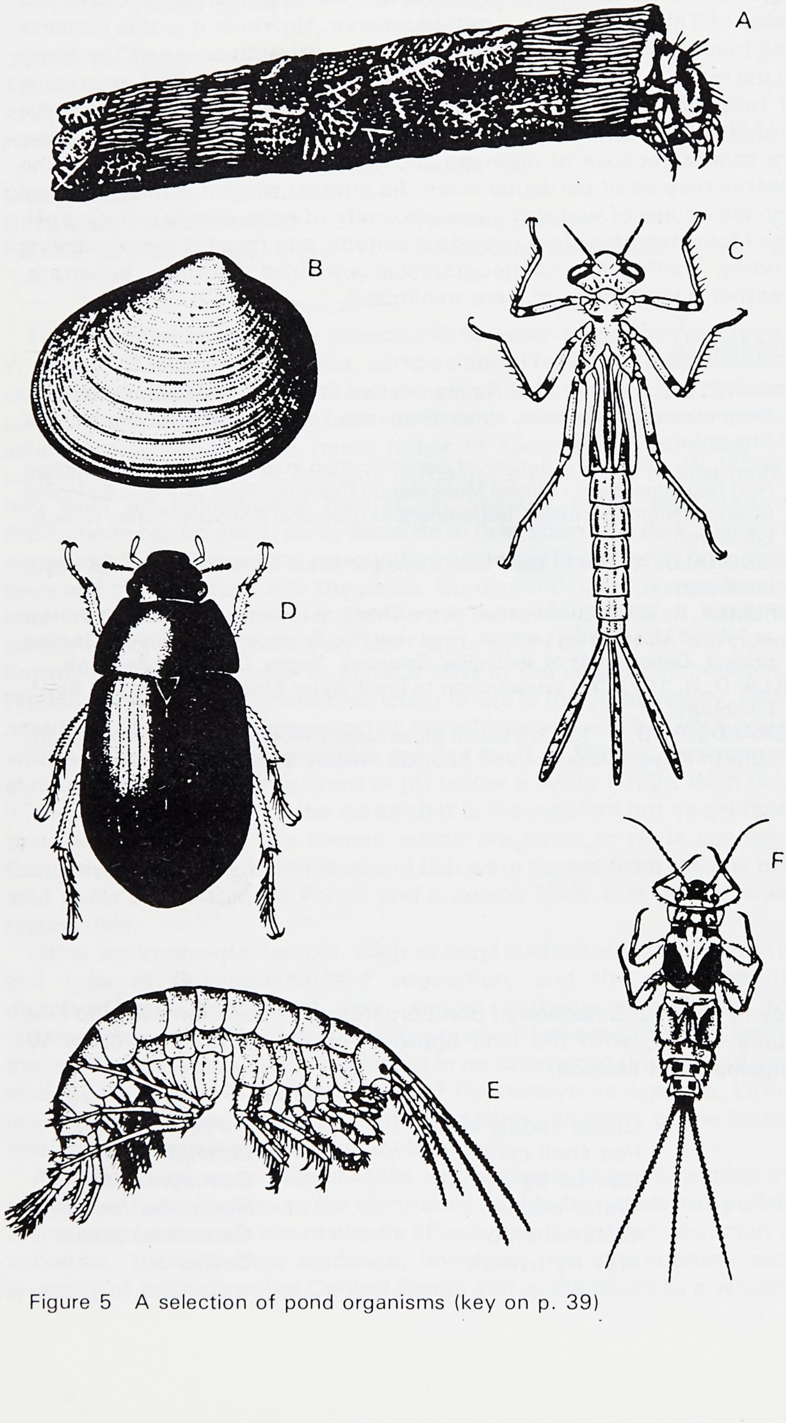

Figure 5 A selection of pond organisms (key on p. 39)

IT'S YOUR REGION 'NATURALLY'

M. McGinnes

An Exhibition on the Natural History of the Central Region, at The Smith Art Gallery and Museum, Stirling, 1st June to 1st September, 1985.

'Extremely interesting', 'fabulous', 'superb', 'out of this world'; just some of the comments registered in our visitors book about the natural history exhibition. A fitting way, I think for the Smith to return to its historical connections with natural history.

The Natural Sciences have always been a major part of the activities of the Museum especially in its early days as the Smith Institute when Curators such as Croall and Sword were actively involved in research and collection. Equally important were the contacts and co-operation that existed between the museum and the Stirling Natural History and Archaeological Society. The collections that resulted from this co-operation have always played an important part in the life of the Smith, and the old natural history room with its stuffed birds, crocodiles and other exotica is still mentioned by some visitors. However time has led to many changes, the old displays have gone and the building is in the middle of a full restoration programme. As a result we run a programme of short-term exhibitions, some, like this one, are based on our own collections.

The differences between the traditional style of natural history exhibition found in many museums and the exhibition we planned is indicative of a change in attitude towards natural history today. Simply displaying mounted specimens no longer serves a purpose as the public are now aware, through television and other media, of the complexities of nature and the relationships between human beings and the wildlife that surrounds us. It is, therefore, necessary to show those relationships and also the variation that occurs in the 'natural' habitats of the region. This would obviously involve discussion of the problems associated with modern land use, such as farming and road building, where some of our common wildlife have been severely reduced in numbers, or even eliminated; but equally it was vital that the exhibition did not seek to find a scapegoat for these problems. There are many positive aspects of human influence which we wished to stress. Perhaps the most vital part of the exhibition developed out of these ideas. Rather than making the exhibition an end in itself, our aim was to let it be an introduction to the real world outside and to stimulate the visitors to go out and view that world with a new understanding. If even a few visitors became appreciative of the countryside around us, or even better joined an active local or national organisation, then the exhibition could be judged a success.

In a practical sense the preparation of the exhibition caused many problems. The Museum's original collections of mounted specimens had been largely lost due to natural decay or at the very least were not of good enough quality for display. Fortunately we have started to replace these losses but the cost is high and we did not have sufficient for our needs. The remainder we borrowed from Glasgow Art Gallery and Museum and Perth Museum and Art Gallery. The script was prepared in collaboration with Stirling District and Clackmannan District Ranger Services who provided the experience, local knowledge, and accuracy we required to produce a well balanced and interesting result. Even the technical language, often associated with natural history subjects, was a problem as it would have restricted the audience likely to appreciate the exhibition. The script was, therefore, kept short and relatively simple; plants were described by common name rather than latin name and complex lists of species and localities were avoided. The exhibition was, therefore, intended to be of use – to children and adults alike.

The final design and content of the exhibition reflected all the above considerations and problems as well as the usual limitations of finance and time. The whole display was constructed of cardboard with wood framing and all painted to match the habitat represented; the woodlands had individual trees and shrubs and the farmland was bright yellow, representing corn, with green hedgerows. Seven habitats were illustrated; upland, mixed woodland, coniferous woodland, wetlands, the Forth estuary, farmland and urban. Colour photographs, used throughout the exhibition, and the mounted specimens provided the visual attraction necessary to encourage the visitor to read the information panels. It was also possible to get very close to the specimens, allowing the visitor, especially the children, to view animals and birds which they would never get close to in the wild. It is surprising how many people were unaware of the *size* of some of our common wildlife. The mounted specimens, in particular, introduced a 'realness' to the whole experience but it was also clearly stressed that mounted specimens are now obtained as a result of accidents or natural deaths and not deliberately killed. In order to further enhance the effect of the exhibtion the wetlands section was constructed as a waterfall and river extending into the estuary. Although this caused some technical problems in maintenance, it was well worth the effect it achieved and I am unaware of any other natural history exhibition using such as open water area.

As mentioned previously, the purpose of the exhibition was to encourage every member of the public to go out and do something positive in natural history. The final section of the display was therefore vital as it consisted of a 'What's On' section with a weekly noticeboard of events, associated leaflets, membership forms etc., from local and national organisations. It was here that the link existed between the museum room and the real world outside. Several hundred leaflets were taken by visitors so we can assume that there was a great interest, but it could be several years before there is any feedback.

What conclusions can be drawn from the exhibition? Firstly there are no 'natural' areas in Central Region; human influence permeates every area, although some areas are more natural than others. However, there are many positive features which can be built upon. Even urban areas and farmland are vital wildlife zones and something as simple as a bird table or nest box can make all the difference to our wildlife. It is as important today to stress the positive role that every member of the public can play as it is to protect those vital few remaining natural wildlife sites.

The exhibition was, from the Museum's viewpoint, a great success and its short-term on view something of a disappointment to visitors and staff alike. It attracted the attention of a national radio programme for which I was interviewed, and there were enthusiastic audiences – although they could have been larger – at the Saturday morning lectures which ran for six weeks during the exhibition. These were –

'Urban Opportunities for Wildlife' – Margaret Page
'Don't Waste our Wetlands' – Bill Brackenridge
'Mountains and Moorlands' – Ian Findlay
'Wildlife of Loch Lomondside' – Steve Nunn
'Woodland Wildlife in Central Scotland' – Douglas Napier and Andrew Graham
'Countryside – What Kind of Heritage' – Keith Graham

The information and experience gained will be used again, hopefully in a more lasting way, once the renovations to the Museum are more complete. Hopefully too we might have the same effect on a future audience as we seemed to have on one visitor from London – 'Totally mind blowing' was the comment he left us with; so we will have high standards to live up to on the next occasion.

ACKNOWLEDGEMENTS

We are grateful to the following for their help in the preparation of this exhibition.

Information, script preparation and photographs – Margaret Page and Bill Brackenridge, Stirling District Ranger Service; Ian Findlay, Clackmannan District Ranger Service.

Photographs – Nature Conservancy Council and Stirling Conservation Volunteers.

Saturday Lectures – Margaret Page, Bill Brackenridge, Ian Findlay, Andrew Graham, Douglas Napier, Steve Nunn, Keith Graham.

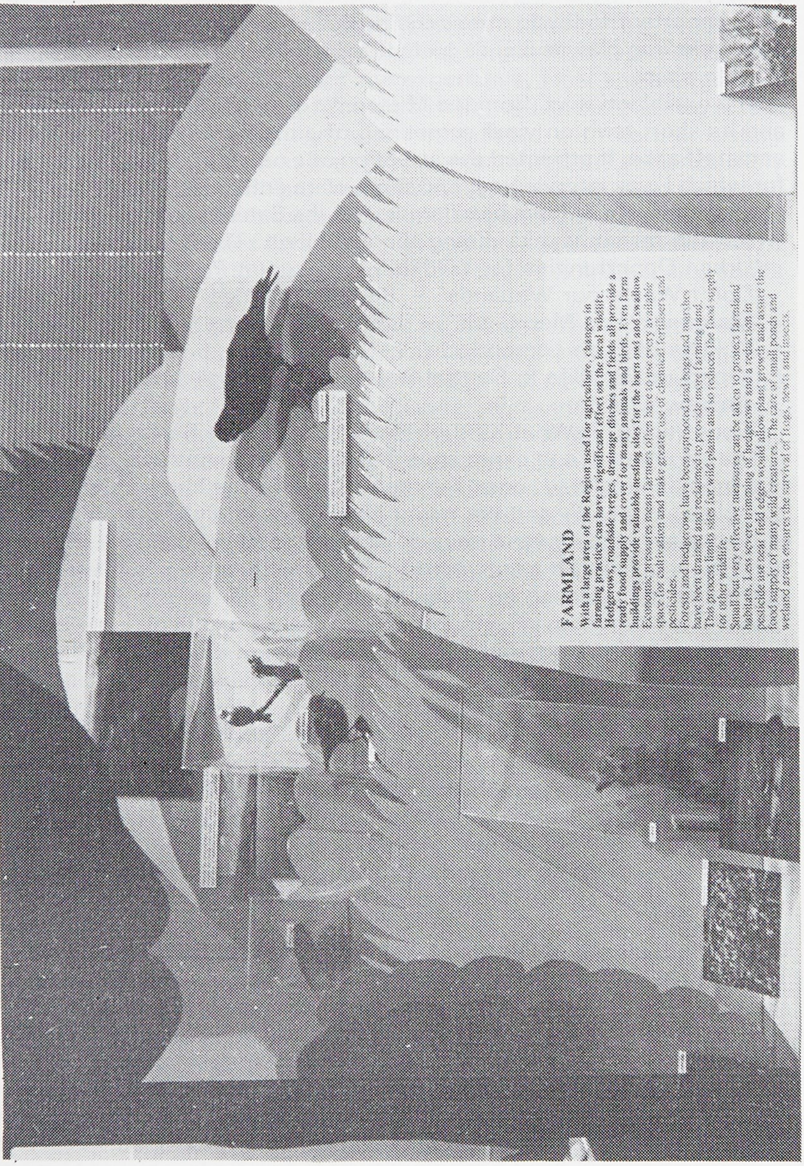

Figure 1 The farmland habitat

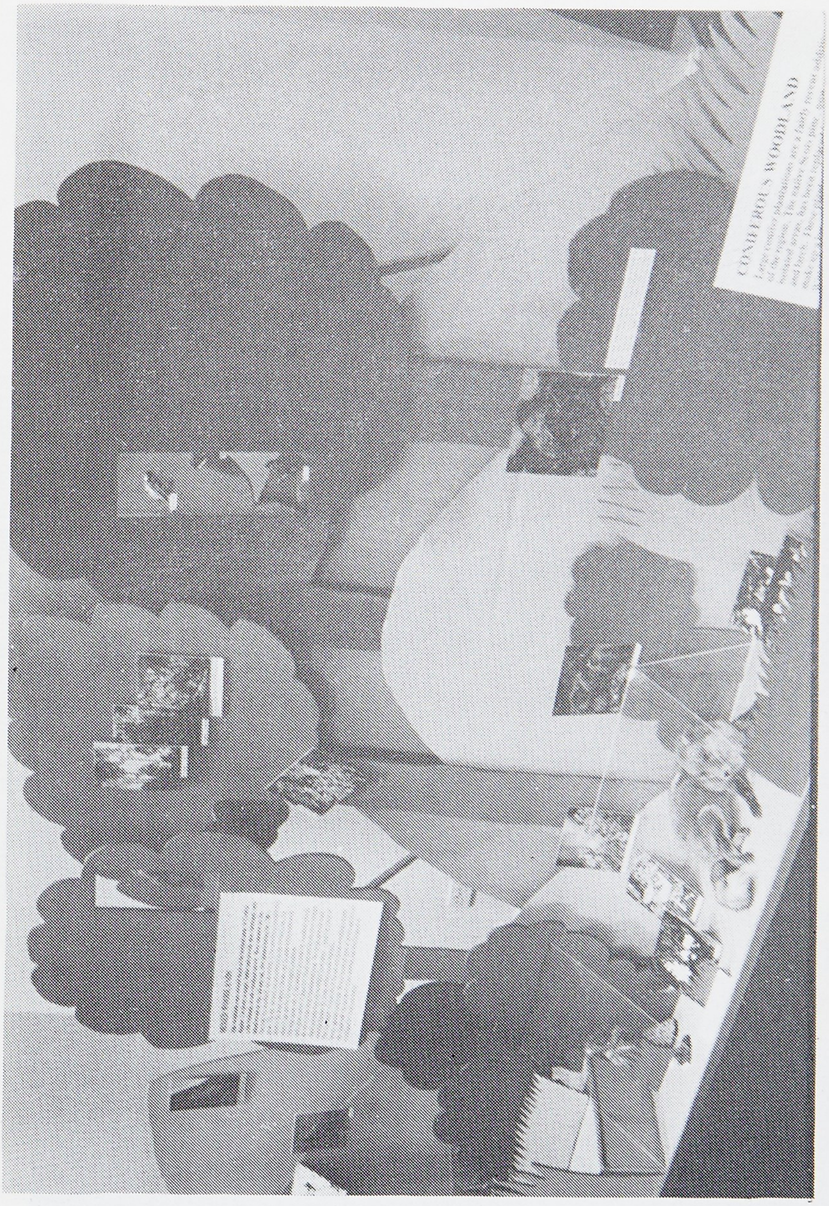

Figure 2 The upland and mixed woodland habitat

Figure 3 The estuary, farmland and urban habitats

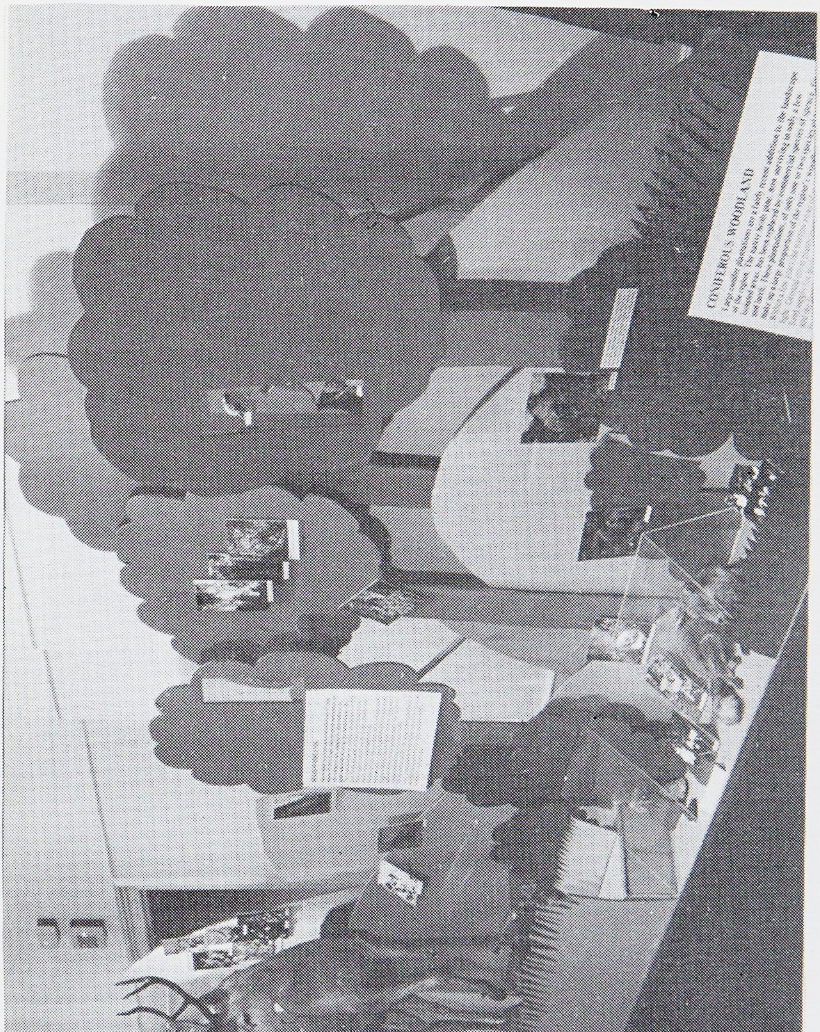

Figure 4 Mixed woodland habitat

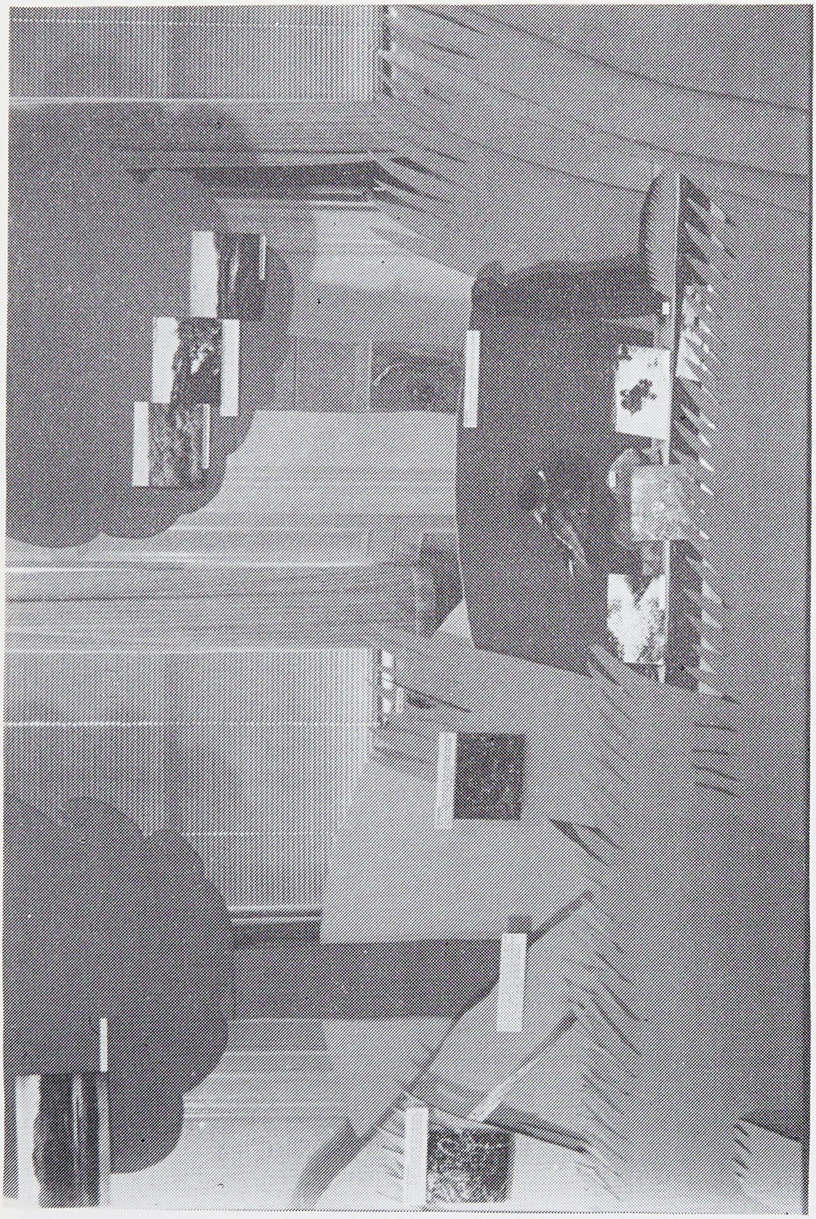

Figure 5 The wetlands section with the waterfall on the left. The whole system held approximately 150 gallons of water with the pump circulating the water through the waterfall at 15 gallons per minute.

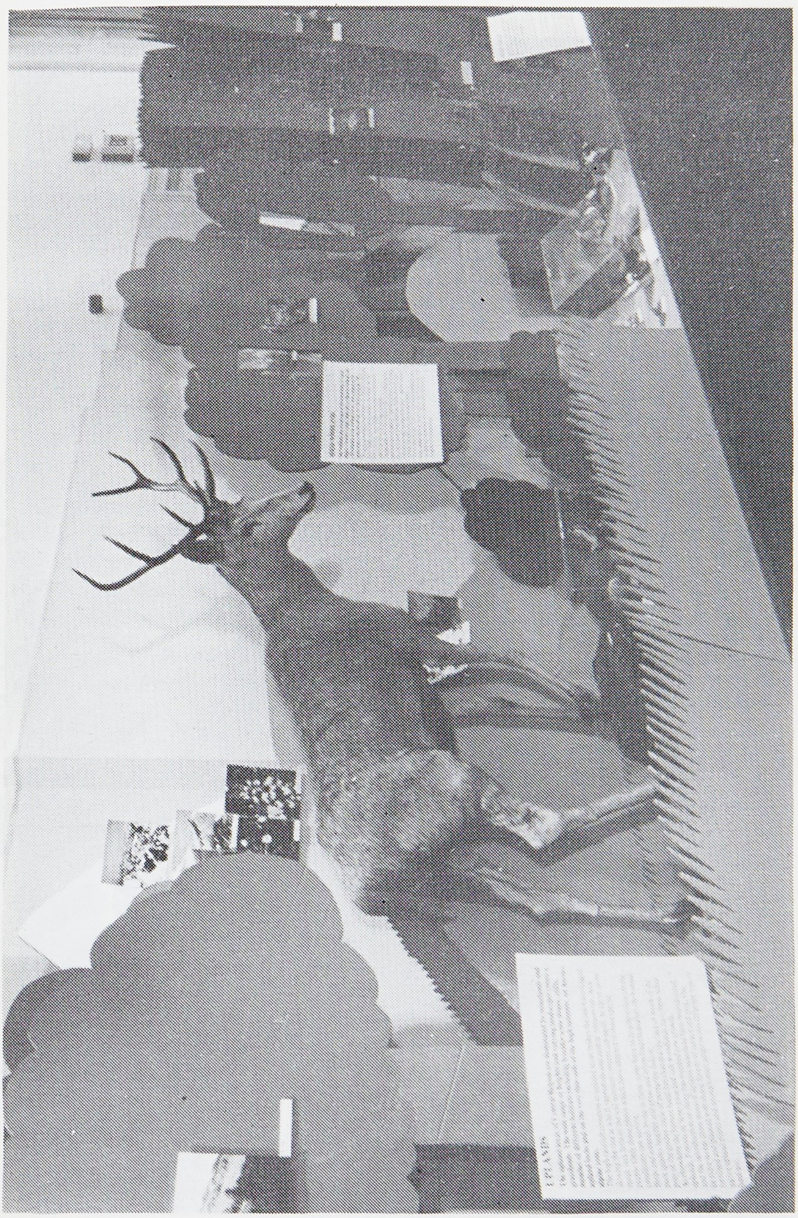

Figure 6 The upland habitat with the children's favourite animal.

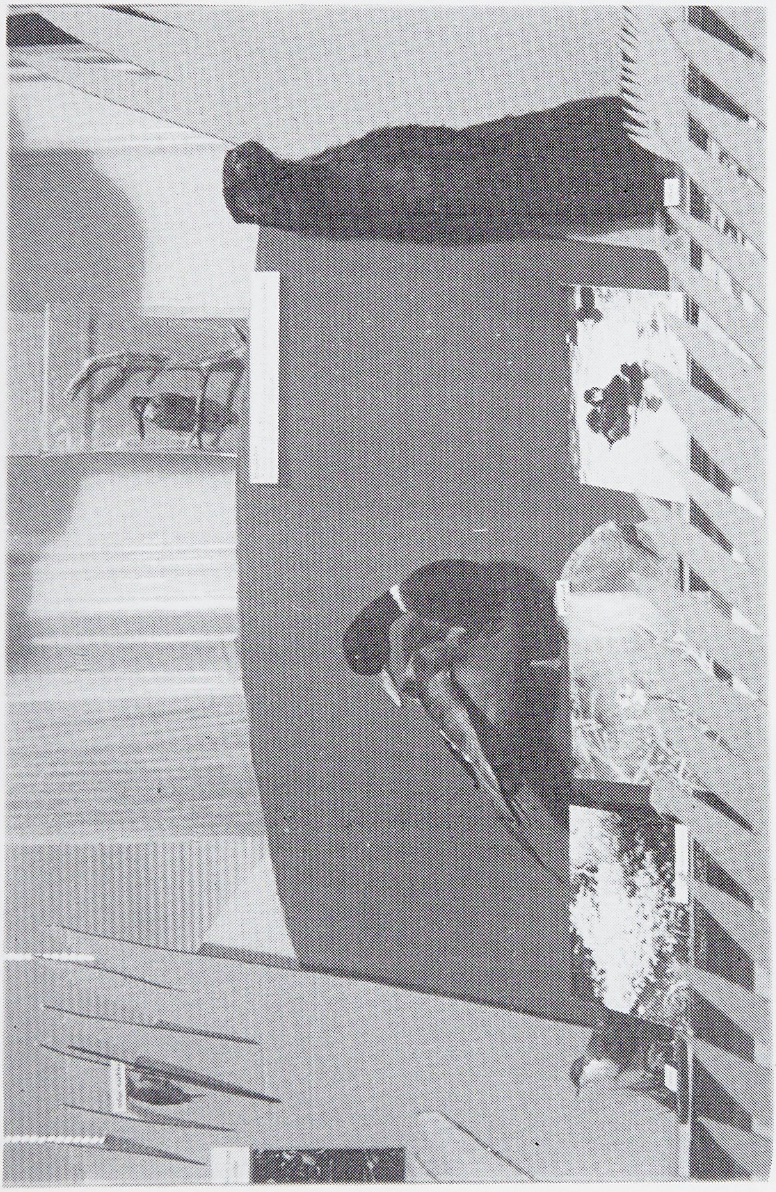

Figure 7 Detail of the wetland habitat.

FORTH AREA BIRD REPORT 1983

C. J. Henty
University of Stirling

Due to the absence of the report editor abroad it has not been possible to compile a full account of the birds of the Forth area for 1983. As an interim measure we are publishing the skeleton version sent to the Scottish Ornithologists' Club for the national report. This is limited to Stirling and Clackmannan counties (except for one southwest Perth on Sand Martins), and includes only those notes thought to be useful in the national context. It is hoped to produce a full set of reports covering 1984 and 1985 in the next volume and this would also include locally interesting notes for 1983.

SYSTEMATIC LIST

Compiled from notes submitted by
K. Barr, R. Bernard, W. R. Brackenridge, J. G. Conner, G. M. Cresswell, P. Heath, C. J. Henty, G. Jones, D. H. McEwen, J. Potter, P. W. Sandeman, J. Simpson, J. Speakman, D. Thorogood, A. Whitelaw, A. D. Wood, T. J. Youd, A. Young

C, S and SWP refer to notes for Clackmannanshire, Stirlingshire and southwest Perthshire respectively.

BLACK-THROATED DIVER
S at L. Arklet, 2 pairs on 9th May, 1 on 11th; unsuccessful

GREAT CRESTED GREBE
S 2 pairs at Carron Valley Reservoir

GANNET
S 3 immatures W over Stirling on 16th October

WHOOPER SWAN
S 1st, 5 at Kippen on 17th October, 28 at North Third Reservoir on 13th November

BEAN GOOSE
S 46 at Carron Valley Reservoir on 22nd October

BARNACLE GOOSE
S 5 at Carron Valley Reservoir on 2nd October, 2 on 12th November

BRENT GOOSE
S Light breasted, 1 at Gargunnock on 17th March and 1 at Arnprior on 1st April

SHELDUCK
S 1525 at Grangemouth on 16th January

TEAL
S 1404 at at Carron Valley Reservoir on 2nd October and 1421 on the 22nd; 1250 at Grangemouth on 31st December

MALLARD
S 800 at Grangemouth on 13th February
C 1140 at Gartmorn Dam on 12th December

PINTAIL
S 40 at Skinflats on 18th December

POCHARD
S 444 at Carron Valley Reservoir on 13th February

TUFTED DUCK
S 350 at Carron Valley Reservoir on 20th August

SCAUP
S 2f at Carron Valley Reservoir on 2nd October, 1 on 22nd

LONG-TAILED DUCK
S f at Carron Valley Reservoir 22nd October to 12th November

VELVET SCOTER
S 2 (m & f) at Carron Valley Reservoir on 22nd October

GOLDENEYE
C At Cambus, 2 on 12th June and 3 on 27th August

LITTLE RINGED PLOVER
C 1 at Cambus on 17th April

LITTLE STINT
S At Skinflats, 1 on 24th September, 2 on 2nd and 8 on 9th October

CURLEW SANDPIPER
S At Skinflats, 2 on 24th September, 1 on 9th and 30th October

RUFF
C 8 at Alloa on 27th August

JACK SNIPE
S 4 at Carron Valley Reservoir on 12th November

BLACK-TAILED GODWIT
S At Grangemouth, 3 on 15th January, 1 on 19th March, 7 on 24th September

SPOTTED REDSHANK
S 1 at Skinflats on 22nd August

GREENSHANK
S 11 at Skinflats on 15th August

WOOD SANDPIPER
C 1 at Cambus on 24th May

HERRING GULL
S 8500 at Skinflats on 23rd January

ICELAND GULL
S 1 at Kinneil on 3rd April

GLAUCOUS GULL
S 1 (2nd winter) at Gargunnock on 27th February

GREAT BLACK-BACKED GULL
S 115 at Skinflats on 23rd January

COMMON TERN
S 2 pairs at Carron Valley Reservoir

BLACK TERN
S 1 at Skinflats on 24th September, 4 at Carron Valley Reservoir on 2nd October

RAZORBILL
S Juv at Airthrey Loch on 27th February

LITTLE AUK
S 1 freshly dead at Skinflats on 13th February

SWIFT
S 1st at Bridge of Allan on 6th May

SAND MARTIN
SWP 500 pairs at Barbush (900 in 1982), poor breeding due to cold, wet spring

YELLOW WAGTAIL
S 3 at Kinneil in June, 2 at Skinflats on 2nd August

BLACK REDSTART
S f/imm at Kinneil on 23rd January

CHIFF CHAFF
S 1st at Airthrey on 5th April

PIED FLYCATCHER
S m singing at Bridge of Allan in May

GREAT GREY SHRIKE
S 1 at Carron Valley Forest on 13th February

TWITE
S 40 at Kinneil on 13th February

CROSSBILL
S 60 in Carron Valley Forest on 22nd October and 58 on 12th November

SNOW BUNTING
C 100 on Ben Cleuch on 15th December

NOTES ON BIRD REPORTS

Previous reports for central Scotland or Forth Area were published in this journal, from 1974 to 1979 as *Stirling and Clackmannan Bird Report,* and from 1980 as *Forth Area Bird Report (Clacks, Stirling, Southwest Perth).*

Reports covering the whole of Scotland are published in *Scottish Bird Report,* available from the Scottish Ornithologists' Club, Bird Bookshop, 21 Regent Terrace, Edinburgh.

Scottish areas local annual reports by recorders are published as follows, all available from the Bird Bookshop:

Angus Wildlife Review
Argyll Bird Report
Ayrshire Bird Report
Borders Bird Report
Caithness Bird Report
Clyde Area Bird Report
Fair Isle Bird Report
Fife and Kinross Bird Report
Forth Area Bird Report in *The Forth Naturalist and Historian*
Hebridean Naturalist
Lothian Bird Report
North-East Scotland Bird Report
North Sea Bird Club's *Annual Report*
Orkney Bird Report
Perthshire Bird Report
Shetland Bird Report

For other counties and regions, apply to their recorders. All recorders, together with much more information on bird watching, recording, organisations, ringing, book reviews and feature articles, are given in *The Birdwatchers' Yearbook and Diary* edited by John E. Pemberton, Buckingham Press (1985 edition £6.95).

SOME INSECTS FROM A PORTION OF EAST FLANDERS MOSS, CENTRAL REGION

J. M. Nelson
Nature Conservancy Council, Edinburgh

INTRODUCTION

East Flanders Moss is an area of peat bog over 5 km square situated to the north of the River Forth approximately 18 km west of Stirling. It is the remains of a larger moss the edges of which have been reclaimed for agriculture. Its biological importance, mainly botanical and ornithological, has been recognised by its inclusion in the Nature Conservation Review, Ratcliffe (1977) and in 1982 part of the moss was declared a National Nature Reserve. The butterflies and moths were described by MacLaurin (1974) who also gave a general description of the area.

THE STUDY

The aim was to identify the more abundant insects present together with their times of appearance by sampling regularly for a year (1981). This gives an introduction to the insects of a habitat about which there is little published information relating to Scotland.

THE STUDY AREA

Much of the moss is covered by active birch and pine regeneration which appears to increase the insect diversity. For this reason an open area with few trees was selected as its fauna was expected to resemble more closely that of the primordial bog surface. Such conditions were found at around map reference NS 623976 at an altitude of about 20m where the vegetation cover consisted of a limited number of species. Heather, cross-leaved heath and cottongrass were codominants with *Sphagnum* moss, deer grass, purple moor grass, cranberry and bog rosemary occurring in lesser quantities. The peat has an average depth of 4·3m and retains its surface moisture as the underlying carse clay impedes drainage. It is therefore too wet to be grazed by domestic animals and perhaps because of this has been subject to infrequent but extensive fires.

METHODS

Once a month, except for February, November and December, 10 pitfall traps 6·5 cm diameter and 3 orange washing-up bowls 31 cm diameter all containing water with a few drops of detergent were exposed on the bog surface. The former caught species moving on the bog surface while the basins actively attracted some flying insects and caught others accidentally. In addition, when the traps were being visited and the vegetation was dry enough and wind conditions would allow, a sweep net was used to collect insects from the study area. This consisted of a line 100m long with pitfall traps sunk into the bog surface at 10m intervals. The catch was sieved off after a week, preserved in industrial spirit and where possible identified. Some small fragile insects such as chironomid flies were too badly damaged by this treatment to allow identification. Other species e.g. some spring-tails were so small that they passed through the sieve.

RESULTS

From the catch 148 species were identified in addition to about 40 species of spider not included in this analysis. The breakdown of the catch given below shows that flies were the main component in terms of species.

Order	Number of identified species
Collembola (Spring-tails)	1
Orthoptera (Grasshoppers)	1
Hemiptera (Bugs)	12
Coleoptera (Beetles)	25
Hymenoptera (Bees, ants, etc.)	11
Diptera (Flies)	98

Other groups were not identified for a variety of reasons. Thus Lepidoptera were excluded in view of MacLaurin's account. Many more species would be added if the bulk of the Hymenoptera could be readily identified. The list of species identified includes the numbers taken and the months in which their adults were captured.

Most species caught were common and widespread in a variety of damp terrestrial habitats. Others are well known as inhabitants of heaths and raised bogs and show considerable variation in life history and ecological requirements. In the following account only the more obvious species are mentioned with particular reference to those considered to be associated with the moss habitat.

On account of their abundance Collembola (spring-tails) are clearly important as food for larger invertebrates. One extremely abundant species *Isotomurus palustris* was taken in the basins and traps mainly in the first half of the year and is well known for frequenting water-edge habitats. It would appear to be predated upon by some spiders and ground beetles whose periods of activity are synchronized with the explosion in numbers of spring-tails which occurs in the early months of the year.

The catch of Hemiptera (bugs) included a high proportion of peatland species which being sap feeders are relatively sedentary and consequently were caught in small numbers. Few species of beetles were caught but they included the attractive metallic ground beetle *Agonum ericeti* restricted to peat bogs, and the abundant heather beetle *Lochmaea suturalis* which is so troublesome on grouse moors at lower altitudes. One of the latter's parasites, the fly *Medina collaris* was also abundant.

Few species of Hymenoptera were identified. These included two ants *Myrmica ruginodis* and *Formica lemani* which are not confined to peatlands but were active almost throughout the year and are clearly important predators on other small animals. The capture of two spider-hunting wasps *Arachnospila spissus* and *Anoplius nigerrimus* was rather unexpected. Both as adults capture wolf spiders *(Lycosidae)* which are abundant on the moss and with which they provide underground cells for their larvae. These wasps frequent a range of habitats though *A. spissus* is usually associated with woodland. The solitary bee *Colletes succincta* is a heathland species feeding almost exclusively at heather flowers but as it requires mineral soil in which to dig its nest burrow is unlikely to be resident on the moss.

Among all the flies identified only four can be considered to be exclusively peatland species. The crane-fly *Tipula subnodicornis* was surprisingly scarce but the empid *Empis borealis* a distinctive species with dark brown wings was frequent, performing its mating dance around small birch trees. Its predatory larvae feed on minute enchytraeid worms which are also abundant in peat. Of the numerous species of dolichopodids, which are small usually metallic green flies found in damp habitats, only one *Dolichopus vitripennis* favours peat habitats. *Hydrophorus albiceps* is an interesting northern species which in the adult stage spends most of its time on water surfaces. Flies of the genus *Linnaemya* parasitic on various lepidopterous hosts were very noticeable around heather but though most abundant on heaths do occur elsewhere.

DISCUSSION

Flanders Moss because of its large extent and relative lack of disturbance is an important locality for insects. Only a small proportion of the species present on the Moss are believed to have been found in this study. When compared with Blawhorn Moss (Nelson 1983) Flanders Moss is characterised by the presence of a distinct lowland element typified by the grasshopper, the heath bug and spider-hunting wasps. Its fauna is richer in species than that of Blawhorn which is probably impoverished by frequent burning and consequent loss of tree cover. When compared with the list of species characteristic of heaths in southern England compiled by Richards (1964) the Flanders fauna appears very restricted, this being particularly obvious in the sun-loving aculeate Hymenoptera. The northern upland element though represented at Flanders by species such as *Hydrophorus albiceps* is not an obvious feature of the fauna.

The majority of insects identified appear to be widely distributed in Britain though many are restricted to damp habitats. There is a considerable similarity with insects found on blanket bog at Moor House around 550m in the northern Pennines (Nelson 1971). Of the species found at Flanders 45% also occurred at Moor House where the lowland element in the fauna was impoverished.

Comparison may also be made with the extensive work of Krogerus (1960) on the insects of Scandinavian peatlands. Thus 44% of the species found at Flanders also occurred in the coniferous zone in Scandinavia in which birch is a pioneer species, the true birch zone being found at higher altitudes. Only 11% of the Flanders species were found by Krogerus in the true upland birch zone in Scandinavia. Many of the insects of this zone are not found in Britain.

The catch included a number of species scarce in Britain such as the dolichopodids *Hydrophorus albiceps* and *Campsicnemus pusillus* and the small heleomyzid *Eccoptomera longiseta* apparently associated with the burrows of small rodents and thus perhaps easily overlooked.

An interesting observation was the apparent scarcity of the cranefly *Tipula subnodicornis* which has been shown by Coulson (1962) to be very abundant on upland moorland in the Pennines where it forms a large part of the diet of adult and nestling meadow pipits. He found the population of this cranefly to be greatly reduced when the rainfall was low. It is not possible to tell if this caused the low numbers of *T. subnodicornis* on the Moss in 1981. It seems likely, however, from the catch in the bowls that there would be a plentiful supply of alternative food for meadow pipits provided they were capable of utilising it. Their scarcity on the Moss is thus probably due to other causes while the small numbers of tipulids appears to be a feature of moss sites at low altitudes.

Much remains to be found out about the species of insects present on the Moss and especially their life histories and inter-relationships. With such a complex subject this will be a slow process. If the entomological interest of the Moss is to be retained, however, it is important that management should aim to maintain conditions as they are at present. Alterations to the water table from drainage or reclamation appear to be the greatest risks to the survival of biological interest in this reserve.

ACKNOWLEDGEMENTS

In attempting a study of this kind one is very dependent on others for help with identifications and I am most grateful to the following specialists

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APPENDIX

This lists insect taxa found at Flanders Moss. Figures in brackets indicate the number of specimens taken followed by figures indicating the month(s) of capture. Nomenclature follows Kloet and Hincks (1964-78).

The specimens are deposited with the Nature Conservancy Council, 12 Hope Terrace, Edinburgh.

Order COLLEMBOLA (Spring-tails)
Isotomurus palustris (Very many) 1 3 4 5 6 8 10

Order ORTHOPTERA (Grasshoppers)
Chorthippus parallelus (2) 8 (Meadow grasshopper)

Order HEMIPTERA (Bugs)
Nabis ericetorum (2) 5 (Heath damsel bug)
Anthocoris nemorum (1) 5
Neophilaenus lineatus (6) 9 10
Ulopa reticulata (1) 4
Aphrodes bifasciatus (4) 7 8
Stroggylocephalus livens (4) 4
Sorhoanus xanthoneurus (5) 7 8 9
Scleroracus plutonius (20) 8 9
Macustus grisescens (1) 5
Macrosteles viridigriseus (1) 9
Cixius nervosa (1) 7
Psylla subferrugineus (1) 3

Order COLEOPTERA (Beetles)
CARABIDAE (Ground Beetles)
Notiophilus palustris (1) 5
Loricera pilicornis (1) 5

Bembidion guttula (1) 4
Pterostichus diligens (5) 4 5 6 7
P nigrita (33) 3 4 5 6 7 9
Agonum ericeti (10) 3 4 5 8
Bradycellus ruficollis (1) 3
DYTISCIDAE (Water Beetles)
Hydroporus pubescens (6) 4 9
Agabus bipustulatus (9) 3 7 9
HYDROPHILIDAE
Helophorus aquaticus (15) 4 7 9
H brevipalpis (3) 4 7 10
H flavipes (47) 4 5 6 7 9
H grandis (27) 4 5 9
LEIODIDAE
Agathidium atrum (1) 9
SILPHIDAE
Nicrophorus vespilloides (2) 6 (Burying beetle)
STAPHYLINIDAE (Rove Beetles)
Olophrum piceum (2) 1 3
Philonthus cognatus (1) 4
Platydracus stercorarius (17) 7 8 9 10
Drusilla canaliculata (3) 4 7
SCIRTIDAE
Cyphon ochraceus (1) 5
ELATERIDAE (Click Beetles)
Ctenicera cuprea (Many) 6
Sericus brunneus (2) 5 6
NITIDULIDAE
Meligethes aeneus (3) 5 9
COCCINELLIDAE (Ladybirds)
Scymnus nigrinus (1) 4
CHRYSOMELIDAE (Leaf Beetles)
Lochmaea suturalis (Many) 4 5 6 7 8 9 (Heather beetle)

Order HYMENOPTERA (Bees, ants, wasps, etc.)
ICHNEUMONIDAE
Sussaba cognata (1) 5
S dorsalis (1) 5
S erigator (5) 7
Diphyus palliatorius (6) 7
FORMICIDAE (Ants)
Myrmica ruginodis (94) 1 3 4 5 6 7 8 9 10
Formica lemani (54) 4 5 6 7 8 9 10
POMPILIDAE (Spider hunting wasps)
Arachnospila spissa (5) 7
Anoplius nigerrimus (16) 7 8
COLLETIDAE (Solitary bees)
Colletes succinctus (2) 8 9
APIDAE (Bumble bees)

Bombus lucorum (13) 9 10
B pascuorum (2) 8 9

Order DIPTERA (Flies)
TRICHOCERIDAE (Winter gnats)
Trichocera regelationis (10) 1 3 4 10
TIPULIDAE (Crane flies)
Tipula subnodicornis (4) 5
Pedicia rivosa (3) 7
CERATOPOGONIDAE (Biting midges)
Culicoides (Many) 5 7 8
CHIRONOMIDAE (Non-biting midges) (Many) 1 3 4 5 7 8 10
SIMULIIDAE (Black-flies)
Simulium (Many) 5
MYCETOPHILIDAE (Fungus gnats) (Many) 1 3 5 8 10
STRATIOMYIDAE (Soldier flies)
Microchrysa cyaneiventris (1) 8
EMPIDIDAE
Platypalpus (1) 8
Hybos femoratus (Many) 7 8
Trichina clavipes (1) 9
Rhamphomyia curvula (Many) 5
R obscura (5) 6
R sulcata (Many) 5
Empis livida (1) 6
E borealis (Many) 4
E verralli (Many) 5
E chioptera (4) 5
Hilara chorica (1) 7
H interstincta (1) 5
H manicata (2) 8
Phyllodromia melanocephala (6) 7 8
Chelifera precatoria (3) 9
Clinocera fontinalis (1) 10
DOLICHOPODIDAE
Dolichopus atratus (30) 6 7 8
D discifer (3) 6
D festivus (1) 7
D griseipennis (1) 8
D lepidus (2) 7 8
D simplex (7) 8 9
D trivialis (1) 7
D vitripennis (3) 8
Hercostomus aerosus (9) 7 8
H cupreus (1) 6
H germanus (1) 8
Hydrophorus albiceps (2) 9
Syntormon pallipes (1) 6
Chrysotus kowarzi (2) 7

Campsicnemus curvipes (6) 7
C loripes (7) 1 3 5 9
C pusillus (1) 10
C scambus (14) 4 7
C alpinus (Many) 8 9 10
LONCHOPTERIDAE
Lonchoptera lutea (17) 1 3 4
PHORIDAE (Scuttle flies)
Megaselia brevicostalis 4 7 9 10
M errata 4
M giraudii 4 5
M longicostalis 6
M lutea 6 7 8
M meconicera 4 6
M parva 4
M pulicaria 4 5 6 8 9
M pumila 6
M vernalis 4 5
M zonata 4
Phora stictica 8
SYRPHIDAE (Hover-flies)
Syrphus ribesii (2) 9 10
Dasysyrphus tricinctus (1) 8
D venustus (7) 5 6
Melanostoma mellinum (18) 5
Platycheirus albimanus (1) 5
Sericomyia silentis (4) 8 9
Helophilus pendulus (8) 5 6 7 9
Eristalis pertinax (1) 8
HELEOMYZIDAE
Eccoptomera longiseta (1) 10
SEPSIDAE
Sepsis flavimana (1) 5
S flugens (3) 5
S orthocnemis (1) 4
SCIOMYZIDAE (Snail killing flies)
Hydromya dorsalis (1) 7
SPHAEROCERIDAE
Copromyza atra (1) 10
C equina (1) 1
Leptocera fenestralis (3) 3
L humida (21) 3 4 7 8 10
EPHYDRIDAE
Hydrellia modesta (Very many) 5 6 7 8 9
Scatella stagnalis (2) 3
DROSOPHILIDAE (Fruit flies)
Scaptomyza pallida (11) 1 3
TACHINIDAE (Parasitic flies)
Elpe inepta (1) 6

Linnaemya rossica (Many) 8
L vulpina (Many) 8
Ernestia vagans (1) 5
Actia pilipennis (1) 5
Siphona geniculata (3) 5
Medina collaris (Many) 6
Exorista larvarum (1) 8
SARCOPHAGIDAE (Flesh flies)
Sarcophaga subvicina (1) 8
CALLIPHORIDAE (Blue bottles)
Pollenia rudis (2) 9 10
SCATHOPHAGIDAE (Dung flies)
Scathophaga furcata (4) 1 10
S stercoraria (36) 3 4 6 7 8 10
S suilla (5) 5 7 9
S taeniopa (1) 5
ANTHOMYIIDAE
Nupedia aestiva (3) 3 10
MUSCIDAE (House flies and their allies)
Polietes lardaria (6) 6 9 10
Dasyphora cyanella (1) 10
Morellia simplex (1) 5
Hydrotaea irritans (Many) 7
Phaonia errans (2) 8 9
P incana (2) 6
P serva (1) 5
Mydaea detrita (2) 9
M electa (1) 8
M scutellaris (1) 10
M urbana (1) 10
Pseudocoenosia abnormis (1) 6

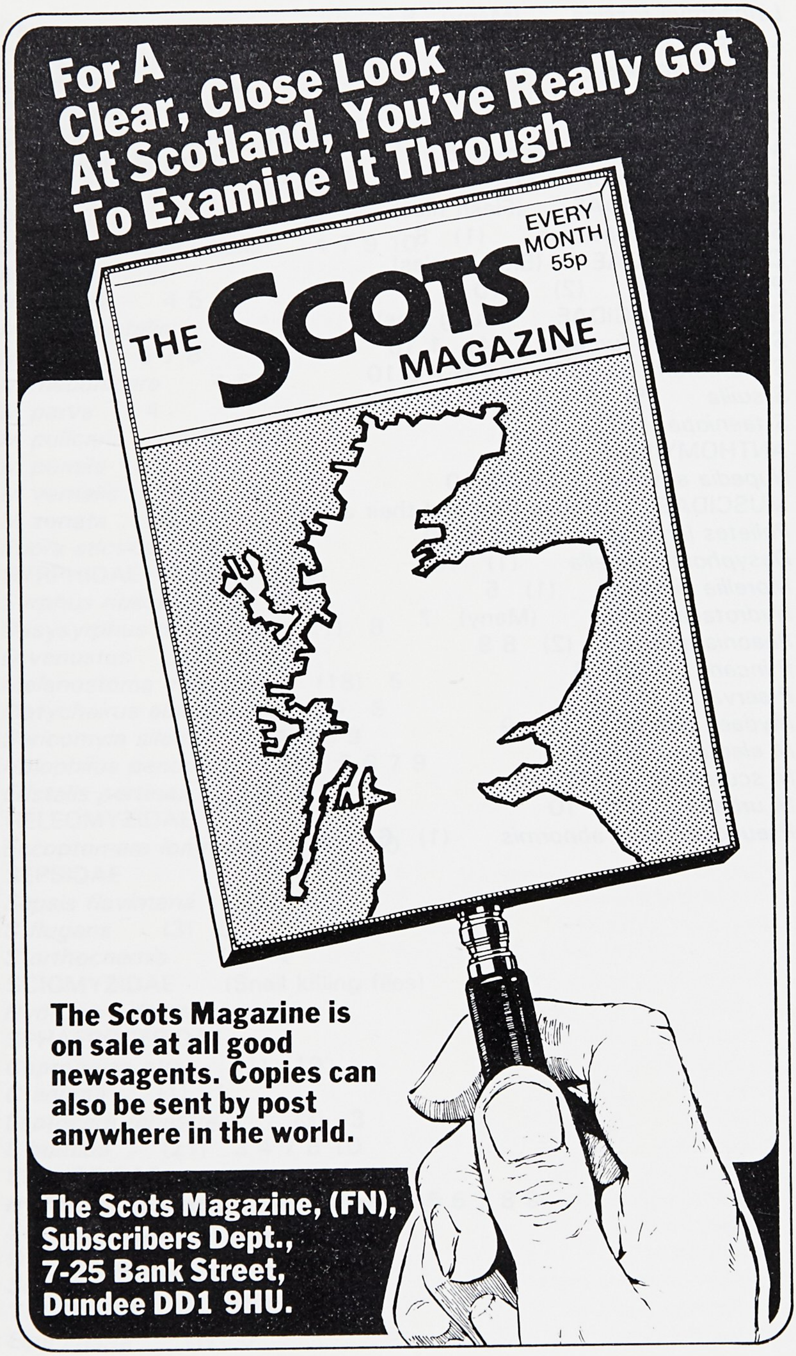
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Figure 1 Robert Kidston at 12 Clarendon Place

ROBERT KIDSTON
THE MOST PROFESSIONAL PALAEOBOTANIST

A tribute on the 60th anniversary of his death

Dianne Edwards
University College, Cardiff

It was with much trepidation that I arrived in Stirling at the joint invitation of the University's Forth Naturalist and Historian Editorial Board and its Airthrey Gardens Group. My brief was to talk about Robert Kidston LLD DSc FRS FSE FRPSE FGS; born in Renfrewshire in 1852 but a resident of Stirling for almost all his life. He died on a visit to Wales in 1924. As a Devonian palaeobotanist I was already very well acquainted with the seminal work of Dr Kidston and Professor W. H. Lang on the early land plants of the Rhynie Chert, Aberdeenshire, but was less familiar with the former's monumental contribution to our knowledge of Carboniferous vegetation. The lecture thus presented me with an opportunity to discover more of the life and work of one of Stirling's most celebrated citizens and someone I have long admired. Researching his work was relatively easy: almost 200 papers testify to the quality of his science while the respect and appreciation of his peers are recorded in numerous obituaries.

Kidston, the man, was far more elusive. At the time of preparing and delivering the lecture I knew of no living descendants and had found only one person who had met him, she being just a small girl at the time. I was therefore forced to rely on anecdotes in the obituaries, particularly that by Professor W. H. Lang (1925), and some reminiscences of Dr Albert Long of Berwickshire, a student of Lang's at Manchester University. More recently resulting from contacts made at the lecture I had the pleasure of meeting and corresponding with Kidston's daughter, Mrs Marjorie Wilkinson (Figure 2), now living in Helensburgh, who has very kindly provided me with the more personal information incorporated into this account.

I suspect that Kidston himself would not have completely approved either of the timing of this lecture on a Sunday, or the person giving it. As a staunch Presbyterian he never worked on the Sabbath. Mornings and evenings he attended church, making on foot the steep climb between his home in Clarendon Place and the Holy Rude Church near the castle. About two years before his death, he was persuaded, at least for evening services, to worship at another church on the flat. Sunday afternoons he took long walks either alone or with friends and family, but occasionally, out of courtesy, he allowed visiting palaeobotanists to examine his extensive collection of fossils. As to a female lecturer, Albert Long tells me that although the friendliest of men, Kidston had two *bêtes noires* – a Mary and a Marie. There was Mary, Queen of Scots, the dislike easily explained by his religious denomination and then, far more intriguing, Marie Stopes. Her early career was as a successful Carboniferous palaeobotanist, probably the first woman to make any

Figure 2 Kidston's daughter, Mrs Wilkinson at Stirling with her husband and Dr Mackay looking at the Minute Book of the Stirling Field Club

Figure 3 12 Clarendon Place, Stirling – Kidston's home, gardens, laboratory, study . . . . from 1898 significant contribution to the discipline. Kidston was certainly no misogynist: throughout his life he was surrounded by women. On the death of his mother he continued to live with his three elder sisters who took a keen interest in his work. At the age of 46, he married Miss Agnes Oliphant, not without some initial misgivings from his sisters who considered her rather flighty, and in 1898 moved a stone's throw away to 12 Clarendon Place (Figure 3). By 1907 even this substantial house needed a conservatory and other extensions to accommodate both his collections and the family of two daughters. Perhaps he disapproved of professional women, or more likely he was disconcerted by Stopes' unusual manner and, later on, by her much publicized activities in family planning.

The 19th century was a time of revolution in the natural sciences. The repercussions of Darwinian evolutionary theory on both science and society have overshadowed the radical changes in the status of geology and more particularly of biology in Universities. By the end of the century zoology and botany had emerged as subjects in their own right, no longer appendages of medicine although the initial degrees of many University teachers, e.g. Williamson and Lang, were medical. There were also the dedicated amateurs; and Scotland had excelled in these particularly in geology. Hugh Miller, stonemason . . . . and eventually newspaper editor, wrote geological best sellers. More weighty were Lyell and Murchison who like Kidston were men of private means. Unlike him they eventually became part of the scientific establishment, Murchison becoming Director of the Geological Survey, while Lyell was, albeit briefly (1831-3), Professor of Geology at King's College, London. Kidston's approach was very much that of the professional scientist: Mrs Wilkinson recalls that his day began with a brief visit to his three unmarried sisters who lived closeby in Victoria Place, followed by a half hour tour in the garden where he inspected, often in the company of his equally enthusiastic gardener, his collections of saxifrages and alpines. He then retired upstairs to his study which W. H. Lang described as museum, library, study and laboratory rolled into one. It also served as a darkroom, as Kidston was an outstanding photographer responsible for all his illustrations. The large number and high quality of his publications could only have been the product of a methodical and hardworking man. Walton, the last palaeobotanist to hold the Chair of Botany in Glasgow had heard that he had a special desk built so that he could work in his bath! He certainly worked into the night. Yet Mrs Wilkinson records that he encouraged his daughters and their friends to visit his study, was interested in their activities and proffered advice and help on a wide range of topics ranging from photography to suitable food for caterpillars. His own hobbies included fishing, curling and philately. While Mrs Wilkinson remembers his intense interest in natural history, she is unable to account for his major preoccupation with palaeobotany.

Little is known about his early life: according to W. H. Lang his childhood ambition was to be a sailor but on leaving Stirling Grammar School he joined the City of Glasgow Bank, where he was employed until 1878. His departure from the banking world and a job which he strongly disliked was presumably precipitated by the failure of that bank, considered by many to be one of the greatest disasters in Scottish Banking. In the following two summers he undertook his only formal training in botany when under the tuition of Sir Hutton Balfour in Edinburgh he obtained a first class certificate and a medal in practical botany. As Balfour (1872) had published one of the earliest palaeobotanical text-books to be written in English and had dabbled in a few investigations in fossil plants he may well have lectured to Kidston on the subject. It seems probable that the latter would also have heard lectures by the more active and acclaimed palaeobotanist, Professor W. C. Williamson of Manchester University, when the British Association met in Stirling in 1876 and Williamson led an excursion to Arran to collect the famous Carboniferous tree lycopods (clubmosses). Mrs Wilkinson recalls that during and shortly after periods of study her father spent a considerable time in Helensburgh with his brother Adrian and members of the well-known West of Scotland family the Laws: indeed the politician Bonar Law remained a close friend until his death.

During this time and throughout his banking career he must have accumulated quite a collection of fossil plants, because by 1880 and aged 28 his reputation as an authority on Carboniferous plants was so well established that on the retirement of Sir J. D. Hooker he was invited to become the honorary Palaeozoic plant consultant to the Geological Survey of Great Britain. It is suggested in his obituary in the *Stirling Observer* that it was this invitation that prompted him to become a full-time palaeobotanist. He was also very actively involved in studying local natural history and together with a small group of friends including Colonel J. S. Stirling was responsible for the founding of the Stirling Field Club in 1878 (renamed the Stirling Natural History and Archaeological Society in 1882), becoming its Joint Secretary. His meticulous minutes make interesting reading. He remained a very useful member of the Society until his death, producing with Colonel Stirling a *Flora of Stirlingshire* published in 10 parts. The early published reports of the Club provide a vivid account of the activities of its members. They were treated to talks on all sorts of topics ranging from diatoms to fossil plants. Kidston's account of an excursion to Schiehallion with a Mr Gentleman is typical, and a delight to read –

> 'We arrived at Pitlochry Station about half-past ten, and at once went to find the driver of the post gig to Tummel Bridge, to ascertain if he had kept two seats for us. We had previously written to him, but at that season of the year possession is often nine-tenths of the law.'

He then described the journey, the scenery, the vegetation and the collection of desmids and diatoms from bog pools. Later in the evening these were examined under a microscope.

> 'A microscope is a useful addition to the botanical excursion, and an essential, if the lower forms of vegetable life are to receive a due share of attention. It also makes you very independent of a wet day. The next day was very wet, so we mounted permanent

STIRLING FIELD CLUB.

PRELIMINARY MEETING.

[Circular calling Preliminary Meeting.]

Smith Institute,
Stirling, 11th November, 1878.

Sir,

A Private Meeting of a few gentlemen interested in the Natural History and Archæology of the district was held in the Smith Institute, Stirling, with the view of establishing a Naturalists' Field Club for Stirling and neighbourhood. The objects aimed at by the promoters are field excursions for the collection of specimens of natural history; visits to interesting localities; meetings for the reading of papers and discussions thereon, and for the exhibition of specimens; the formation of collections of specimens and a reference library; and generally any means likely to promote the interests of the Field Club.

It was resolved to call a Preliminary Meeting of gentlemen interested in these subjects, to be held in the Smith Institute, on the evening of Tuesday, the 19th curt., at eight o'clock, when it is hoped it will be convenient for you to attend. Should you be unable to attend the meeting, but be inclined to support the movement, an intimation to that effect will greatly oblige,

Sir,
Your obedient Servant,

ALEX. CROALL,
Interim President.

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Figure 4 The Stirling Field Club, inaugural meeting 1878, and its first officers, including Kidston

preparations of the desmids got on the previous evening.'
Members of the society would undoubtedly have had the opportunity to examine these preparations at a later date!

On that excursion Kidston recorded finding some clubmosses, *Lycopodium clavatum, Huperzia (Lycopodium) selago* (Figure 16), and our only native *Selaginella, S. selaginoides.* These comprise very insignificant components of our vegetation today, yet back in his study Kidston must have been pondering over a time about 300 million years earlier when relatives of these plants were trees some 30m high, with trunks almost a metre in diameter. They grew in dense forests on the low lying coastal swamps of Carboniferous times, their decomposing remains producing peat which on compaction eventually formed coal. Indeed Kidston gave a talk to the Field Club (1881) on the commonest arborescent lycopod *Lepidodendron,* and it was a description of the structure/anatomy of a species of *Lepidodendron* (Figures 5 and 6) that formed the basis of Kidston's first publication in a recognised scientific journal – the *Journal of the Royal Physical Society of Edinburgh* (1881).

In these times of easy access to scientific literature, of reviews and text-books that marshall the enormous data base and neatly summarize theories, and of international and local conferences that facilitate debate, it is difficult for us to appreciate the enormity of the tasks confronting 19th century palaeobotanists working on small fragments – difficulties both in reconstructing plants and in elucidating their relationships. Walton (1959) describes palaeobotany in Britain at the end of the last century as 'awakening from a long sleep.' Although by this time most workers had accepted that evolution had occurred, the mechanism or processes involved remained highly controversial. Kidston's teacher Hutton Balfour sums up one point of view in his 1872 textbook –

> 'We have thus seen that the vegetation of the globe is represented by numerous distinct floras connected with the different periods of its history, and that the further back we go, the more are the plants different from those of the present day. There can be no doubt that there have been successive deposits of stratified rocks and successive creations of living beings . . . . but one thing is certain; that both Revelation and Geology testify with one voice to the work of a Divine Creator'.

Here was no supporter of Darwinian evolution! Unfortunately we have no direct record on Kidston's views. There is no evidence that he took part in the evolutionary debate, but his later writings mention ancestors and one group deriving from another.

His major preoccupation was with the identification and description of plants of the late Palaeozoic, the age of pteridophytes. But while the fossils showed sufficient morphological characters, both vegetative and reproductive, to be identified broadly as ferns (Figure 13), horsetails (Figure 9), or clubmosses (Figure 16), in many cases their enormous dimensions compared with modern forms posed questions as to how they grew. Were they, for instance, timber trees comparable to modern conifers and hardwoods producing large amounts of extra (secondary) wood? Most of Kidston's fossils were coalified compressions, known to him as encrustations. These were sheets of coaly material produced by the complete flattening of fragments of the original plant and provide sufficient morphological features for identification but little anatomical information. The latter is best obtained from petrifactions, the most useful in the Carboniferous being calcium carbonate concretions called coal-balls found at certain horizons in coal seams. As they represent regions of uncompressed peat, they provide not only an excellent record of the overlying vegetation that contributed to the peat but also anatomical information on the plants themselves. The pioneer in the study of coal-balls in Britain was Williamson, holder of the Chair of Natural Philosophy in Manchester. This involved teaching zoology, geology, botany, anatomy and physiology, and presumably left little time for his medical practice on the outskirts of the city! His childhood hobby as lapidarist led him to slice and grind down pieces of coal-ball (Figure 7) so that it was eventually possible to see individual cells under a microscope, the resulting sections being similar to those produced on a microtome. From such preparations Williamson had shown that *Lepidodendron* stems produced secondary wood in much the same way, although in lesser amounts, as modern gymnosperms or flowering plants. He therefore concluded that the growth processes were similar. (This immediately led certain French workers to transfer them to the gymnosperms, an assignment clearly at odds with their reproductive characteristics).

In Kidston's first paper (1881) he demonstrated a layer ('meristem or formative zone' – *f* in Figures 5 and 6) producing extra tissues to the outside of the stem just below the diamond shaped, expanded leaf bases or cushions. He therefore suggested that this was the major support tissue of the trees. Dickson, the Professor of Botany in Glasgow University confirmed Kidston's anatomical observations but Kidston wrote –

> 'as to the relation between the increase of the bark from the meristem and the acquisition of arborescent dimensions by a lepidodendroid stem, Professor Dickson reserves his opinion.'

Both Williamson and Kidston were correct, Kidston perhaps more so. The lepidodendroids do produce small amounts of secondary wood, but the marginal meristem produces most of the support tissue. This was not to be the last difference of opinion between Kidston and Williamson. The latter became very much aware of the Scotsman's careful and conscientious research, and of his well founded criticisms of other workers including Williamson himself. Sir Albert Seward (Cambridge University) in conversation with the latter referred to one such criticism to which Williamson responded 'Confound Mr Kidston and his impressions.'

Returning to the forests of the Carboniferous, one of the best indications we have of the density of the trees comes from stumps preserved in Victoria Park, Glasgow (Figure 8). It must have given Kidston great pleasure to have been involved in their excavation in 1887-8.

It would be impossible to describe in detail the whole range of his

Vol. VI. *Royal Physical Society, Edinburgh*

Explanation of Plates.

(*The same letter indicates the same part in the various figures.*)

a. Central vascular bundle. *a'.* Small scalariform vessels of foliar system; *a''.* Large scalariform vessels of vascular bundle. *a'''.* Parenchymatous axis of reticulated and non-reticulated (?) cells.

b. Foliar vascular bundles, embedded in traces of the bundle sheath.

c. Space originally occupied by the bundle sheath.

d. Inner portion of bark.

e. Channel through which foliar vascular bundle passed to leaf.

f. Meristem or formative zone.

g. Outer portion of bark.

h. Leaf base.

i. Foliar vascular bundles.

Plate II.

Lepidodendron selaginoides.

Fig. 1. Longitudinal section of portion of stem—$\frac{4}{1}$.

Fig. 2. Transverse section of portion of stem—$\frac{12}{1}$.

Fig. 3. Transverse section of portion of inner and outer parts of bark, showing meristem layer situated between them—$\frac{50}{1}$.

Fig. 4. Longitudinal section of portion of central vascular bundle, showing foliar vessels, large scalariform tubes, and reticulated and non-reticulated parenchyma of axis—$\frac{125}{1}$.

Lepidodendron Harcourtii.

Fig. 5. Transverse section, showing junction of inner portion of bark and bundle sheath—$\frac{50}{1}$.

Plate II.*a.*

Lepidodendron selaginoides.

Fig. 1. Central vascular bundle—$\frac{25}{1}$.

Fig. 2. Transverse section of stem—$\frac{4}{1}$.

Plate II*a*

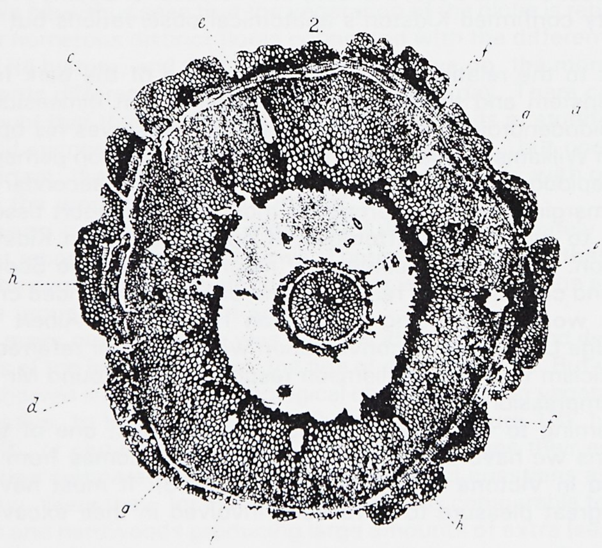

Figure 5 Transverse section of stem of *Lepidodendron selaginoides* – Plate IIa, and explanation of this and other sections in Plate II

Figure 6 .... from Kidston (1881)

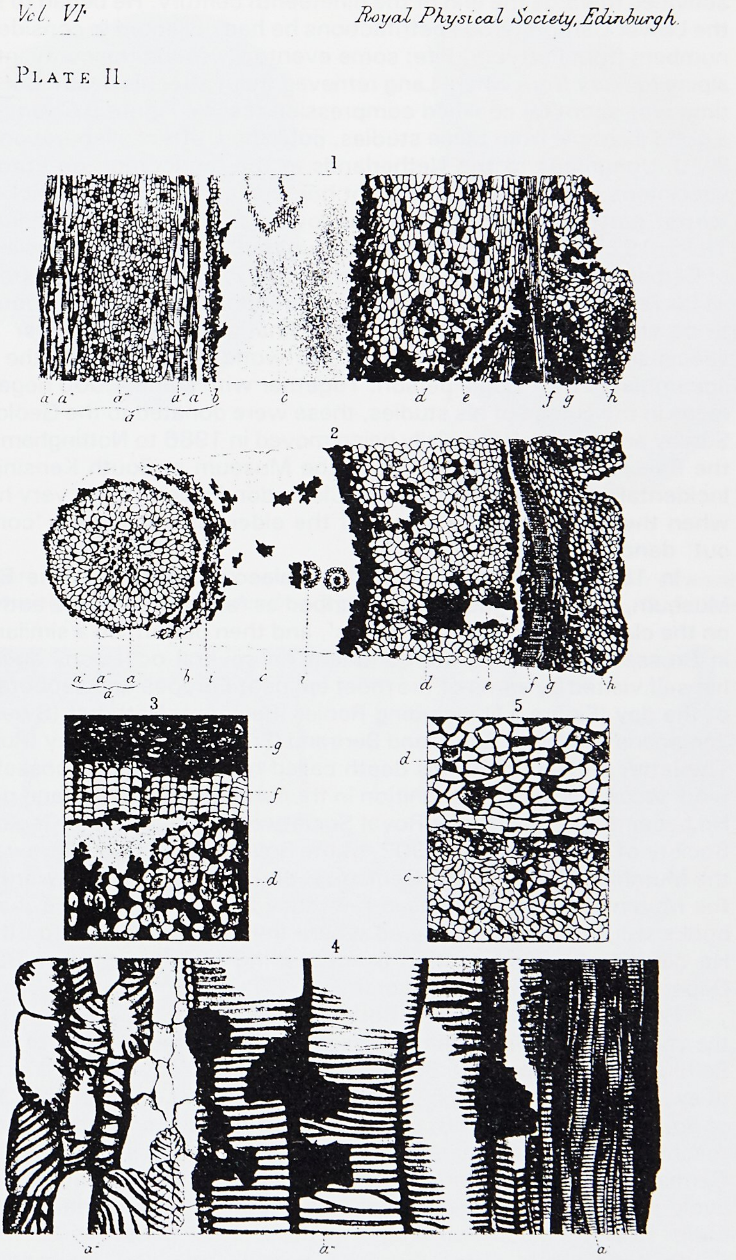

Figure 6 Sections of *Lepidodendron selaginoides,* plate II of Kidston (1881) – explanation/key is given in Figure 5.

activities towards the end of the nineteenth century. He began to study the Lower Carboniferous petrifactions he had collected in considerable numbers from Pettycur, Fife: some eventually found their way into his alpine rockery from where Lang retrieved them after his death! But most time was spent on coalified compression fossils. Figure 9 *Calamites* is a good example from these studies, published, after collaboration with W. J. Jongmans of the Netherlands in the monograph on European specimens of *Calamites,* the giant horsetail which grew in thickets in wetter parts of the Carboniferous lowlands (Kidston and Jongmans 1915, 1917). Figure 10 illustrates a kindred living plant. His collection of Carboniferous compressions from all over Britain became as extensive as his reputation. Initially housed in Clarendon Place, where floors had to be strengthened to support it, the final collection is of over 7000 specimens, one of the finest in the world and probably the best accumulated by a single person. Together with some 4,000 negatives made in the course of his studies, these were donated to the Geological Survey and are controversially being moved in 1986 to Nottingham from the Reserve and Study Gallery of the Museum in South Kensington. Incidentally the reinforced floor at Clarendon Place came in very handy when the study was the venue of the elder Miss Kidston's 'coming-out' dance.

In 1886, he catalogued all the Palaeozoic fossils in the British Museum, the catalogue since described as 'an indispensable authority on the classification of these fossils', and then performed a similar task in Brussels. He visited the continent on several occasions and was himself visited by some of the most eminent European palaeobotanists of the day (Figure 11) including Renier (Belgium), Nathorst (Sweden), Jongmans (Holland), Zeiller and Bertrand (France) and Zalessky (Russia). The latter on learning of his death called him 'ce soleil d'Ecosse!' His work received official recognition in the form of fellowships and prizes. He became a Fellow of the Royal Society of Edinburgh, the Geological Society of London and, in 1902, of the Royal Society. He was awarded the Murchison Medal of the Geological Society and from an award from the Murchison fund purchased reference books 'in the hope that the books will eventually be placed where they will be of help to others.' He carried out this intention by depositing his library in the Botany Department in Glasgow University.

His connection with the Botany Department had developed over the years. Dickson had been succeeded by Bayley Balfour (son of Hutton Balfour) and then by F. O. Bower. As a result Glasgow became a centre of excellence for studies on ferns. Bower's reminiscences in *Sixty Years of Botany in Britain* (1938) capture the excitement of practical botany teaching in Universities at that time. Much of this stemmed from Germany: Hoffmeister had demonstrated the universal nature of the life-cycle in green plants and botanists flocked to the continent to learn more. Bower himself had taught at the Normal School of Science in South Kensington where the 'new botany' involving integration of lectures and practicals had been introduced to Britain. Bower also wrote about Kidston's weekly visits to the Department of Glasgow. He

Figure 7 A Coal Ball – a small intact one, and an etched section of another showing twigs of *Lepidodendron* again .... D. Edwards

Figure 8 The Fossil Grove, Victoria Park, Glasgow – spectacular tree stumps in a Carboniferous forest.

described him as

> 'a very particular *persona grata.* He came to study the structure of modern plants, but actually brought in exchange a wealth of his own knowledge of fossils'.

Popular with all staff members, he was much in demand as a lunchtime guest. It was at this time that David Gwynne-Vaughan of St Margaret's College and W. H. Lang came to know him well. Lang in his Royal Society obituary (1925) wrote that for them both

> 'the most important and valued influence of our mature scientific lives was the privilege of working with Kidston.'

The whole Kidston family attended the frequent staff-student gatherings held at Lang's house: supper was provided on one plate to be eaten with one piece of cutlery: Mrs Wilkinson found a spoon to be the most versatile. The visits were reciprocated. Gwynne-Vaughan and Lang often visited Stirling to work on Kidston's fossils. They were met at the station by Kidston, usually smoking his white pipe, taken home for tea with the family and then retired to the study. Mrs Wilkinson particularly remembers these visits: Professor Lang was the children's favourite being always 'so cheery and full of life'. He had to be: one of their most popular pastimes was tray-racing down two flights of stairs. Lang joined in but Kidston using a stopwatch was official time-keeper. Lang (b. 1874) had entered Glasgow University at the age of 15 first studying science and then medicine. He graduated in 1895 and although a registered doctor, never practised except for one occasion when he prescribed medication for the elder Miss Kidston's chilblains, a product of boarding school in Edinburgh! Much influenced by Bower, he remained in the Botany Department until 1909 when he became Professor of Cryptogamic Botany in Manchester.

It seems that Gwynne-Vaughan and Kidston got on particularly well. The former was a skilled anatomist who provided expertise on living plants and encouraged Kidston to publish more on the structure of his fossils. He was 25 years younger than Kidston and a member of an old Welsh family whose ancestors had fought at Agincourt. He was married in 1911 to the mycologist Helen Fraser, a formidable woman (Izzard 1969). In 1921 in his old college (Birkbeck) she was elected Professor of Botany. Very active in war-work, in 1918 she was Commandant WRAF, created DBE in 1919, then GBE in 1929. Still active in the Second World War, Dame Helen was Director of the ATS. The most important outcome of Kidston's and Gwynne-Vaughan's collaboration was a classical study on the petrified stems of members of the *Osmundaceae* (Figure 12 – a kindred living plant is the Royal Fern *Osmunda* Figure 13). In a series of papers (1907-1914) they reported on fossils from all over the world and on the basis of the very distinctive stem anatomy were able to trace the family back into the Permian and to suggest its origin in the Carboniferous. Their planned research on plants from the Lower Carboniferous of Berwickshire and the Devonian of Aberdeenshire was cut short by Gwynne-Vaughan's sudden death in 1915. So began his association with Lang and the publication of a series of papers on the Rhynie Chert which more than any others

Figure 9 Fossil giant horsetail – *Calamites* – a Kidston negative.

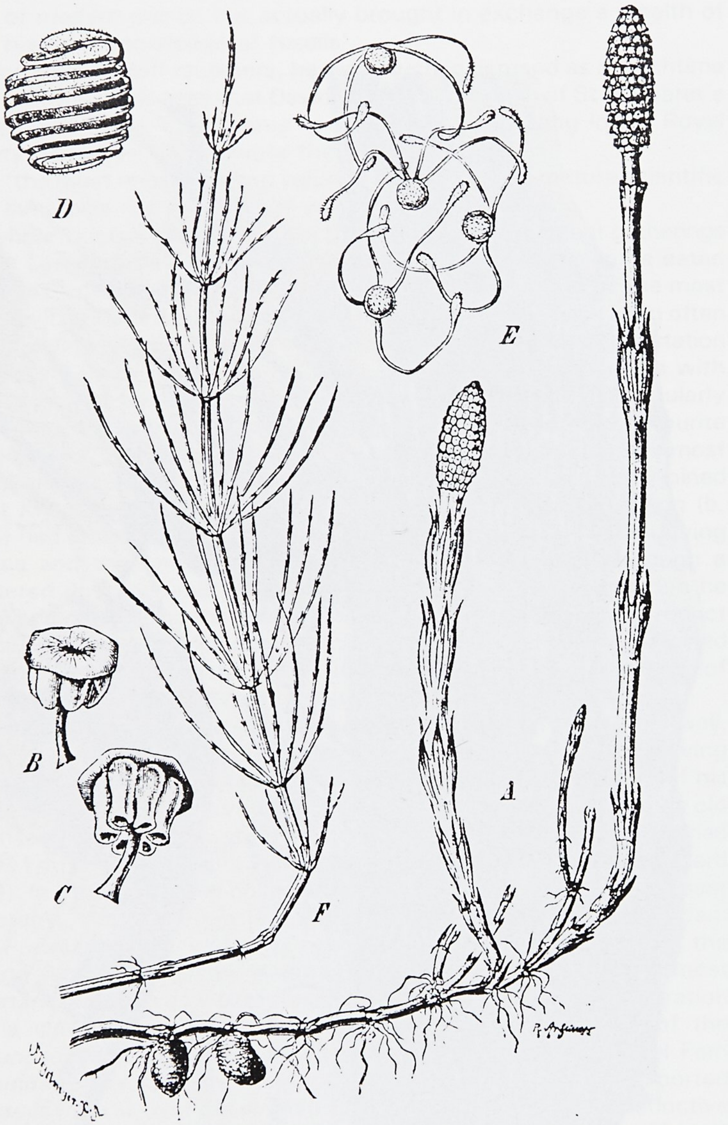

FIG. 420.—*Equisetum arvense*. *A*, Fertile shoot, springing from the rhizome, which also bears tubers; the vegetative shoots have not yet unfolded. *F*, Sterile vegetative shoot. *B*, *C*, Sporophylls bearing sporangia, which in *C* have opened. *D*, Spore showing the two spiral bands of the perinium. *E*, Dry spores showing the expanded spiral bands. (*A*, *F*, ½ nat. size. *B*, *C*, *D*, *E*, enlarged.)

Figure 10 A common living horsetail, *Equisetum* – from Strasburger (1908).

Figure 11 Eminent palaeobotanists – 'Boys and girl of the Coal Ball Brigade' (Long) – a rare photo of a group on a palaeophytological study excursion at mine owner Sutcliffe's house, 1909 .... A. G. Lyon

were to bring Kidston's name to the attention of all botanists, both past and present.

The discovery of new plants and the subsequent naming of new taxa are almost mundane activities of a palaeobotanist, but the realisation that some plants present such novel combinations of characters that they necessitate the erection of a new major group (higher taxon) must surely be one of the most satisfying, joyful and definitely the rarest of experiences. At the beginning of the century Kidston had been associated with the description of the pteridosperms, a new group of gymnosperms. It had long been suspected that such a group comprising plants with fern-like (Figure 13) foliage and gymnospermous anatomy had existed in Carboniferous times. Kidston along with other palaeobotanists must have been puzzled by the fact that although the most abundant and beautiful compression fossils of the Coal Measures looked like fern fronds, very few were fertile. In addition many petrified stems possessed organisation more similar to that in palmlike cycads than in ferns. Although the German, Potonié, was the first to actually name the group, he called it the Cycadofilices, it was the London based F. W. Oliver and D. H. Scott working on petrified fossils who showed that ovules, petioles and stems not found in organic connection shared certain anatomical idiosyncracies (small epidermal glands), and hence probably belonged to the same plant – 'a probability so strong as to be practically a demonstration'. In the interval between their initial note in 1903 and their extended publication (1904) in which they proposed the name Pteridospermae for the new group, Kidston illustrated a compression fossil of the fern-like foliage *Neuropteris loshii* (Figure 14) with attached ovules. Seward wrote –

> 'Like the earlier writers who described fossils as *lusus naturae* fashioned by devilish agency to deceive too credulous man, the discovery of seed-bearing plants with the foliage of ferns threatened to disturb the mental balance of palaeobotanists' (Seward 1910 p 282).

In later years Kidston speculated on the ancestry of the new group –

> 'When the Pteridosperms first assumed a definite point in botanical science, I believe it was generally accepted that they derived from Ferns. More recent investigations have removed any ground for holding this view. They may have sprung from a common ancestor in remote ages but even this is a mere speculative assumption' (Kidston 1923 p 21).

We now know that Kidston had actually worked on a member of the probable ancestral group when he investigated the Upper Devonian *Archaeopteris.* As the name suggests, this appears to be a fern frond, but is now interpreted as a leafy branch. *Archaeopteris* belongs to the Progymnospermae established about twenty years ago to accommodate plants with pteridophyte reproduction and gymnosperm stem anatomy.

But the most famous new higher taxon associated with Kidston is the Psilophytales, based on petrified plants from the Lower Devonian Rhynie Chert. This was discovered by a Dr Mackie of Elgin, who, it is reported, when mapping dykes in Aberdeenshire, rested on a stone

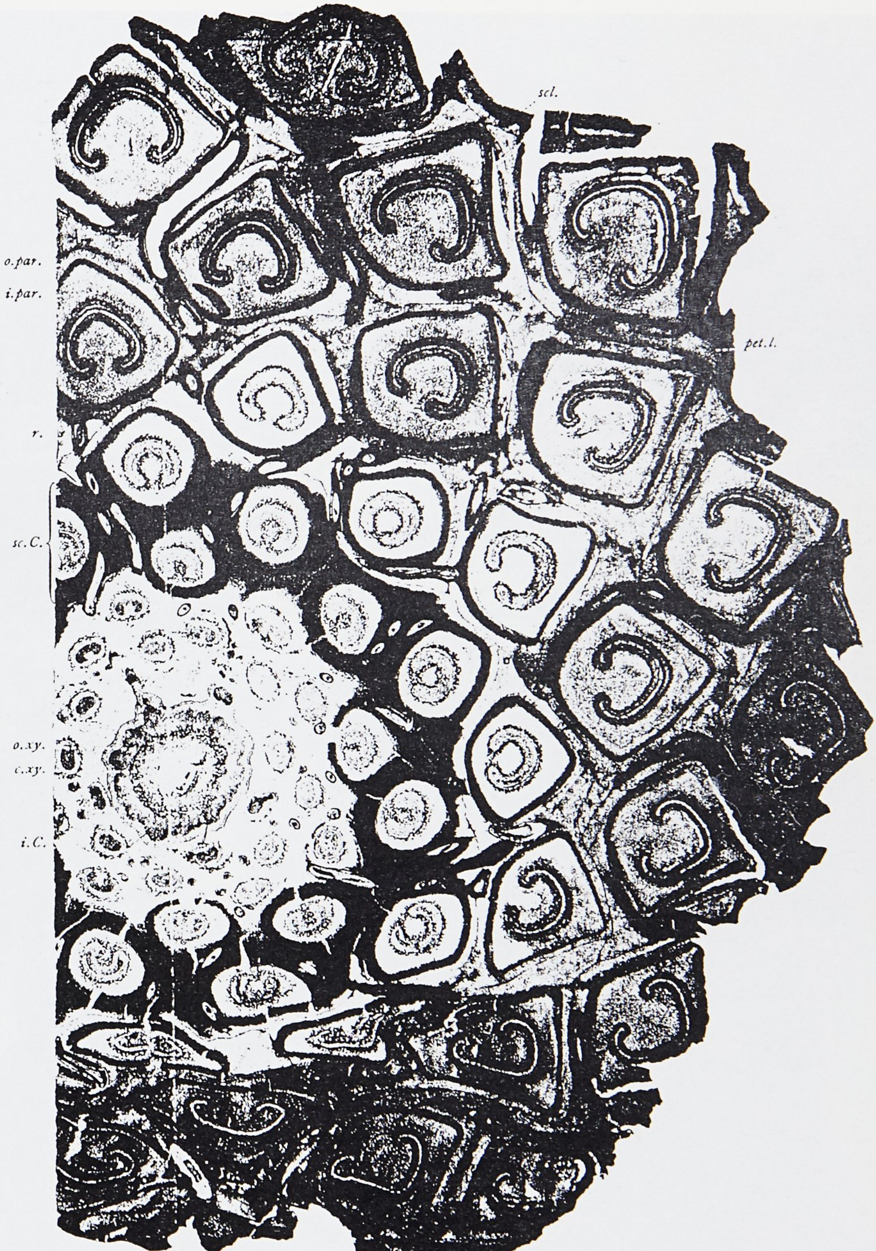

Figure 12 The Fossil *Osmundaceae. Thamnopteris* . . . Kidston and Gwynne-Vaughan (1909) - A transverse section of a 33cm specimen provided by Zalessky, showing stem iC, 50mm diamter, and encircling sheath of leafbases with horse shoe shaped leaf traces.

Figure 13 Living *Osmunda* – a Royal Fern *Osmunda regalis* . R. Phillips (1950)

Figure 14 Compression fossil of fern-like foliage *Neuropteris loshii.* NMW.

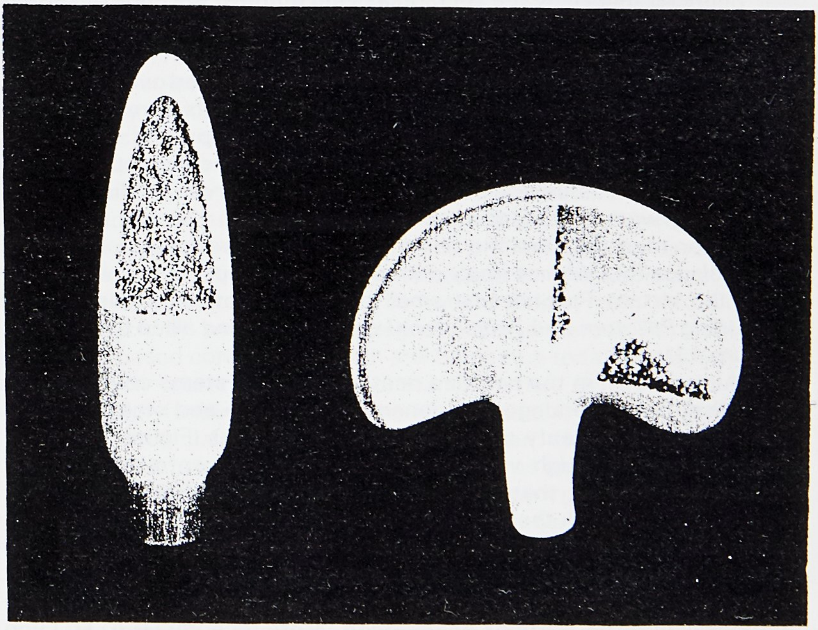

Figure 15 Cut away models of sporangia x 5;
left – *Rhynia,* right – *Asteroxylon* . . . . RSM

wall to eat his lunch and discovered he was sitting on siliceous blocks riddled with the stems of petrified plants. 'This most wonderful deposit', as it was described by Kidston in correspondence, provides an amazing insight into an ecosystem, including both plants and animals, that existed some 400 million years ago and was preserved *in situ* when periodically flooded and then petrified by siliceous waters from nearby springs. In this Lower Devonian wetland, plants of startling simplicity grew on accumulations of peat in which the beginnings of decomposition are recorded by an abundance of fungi. Algae lived in freshwater pools or as mats on damp surfaces. Although Kidston and Lang included both algae and fungi in their studies, their detailed anatomical descriptions and reconstructions of vascular plants present provoked most interest. The simplest, called *Rhynia* (Figure 18), was merely a collection of forking stems, devoid of leaves and also roots; the lower parts of the plant bearing hairs (rhizoids) for water absorption. Some of the erect stems ended in cigar-shaped sporangia (Figure 15) containing spores in clusters of four.

At the cellular level, the Rhynie Chert plants have much in common with living vascular plants – Kidston and Lang illustrated parenchyma with intercellular air spaces, xylem with tracheids, epidermis with stomata and cuticle or with rhizoids – yet in their gross morphology they have no modern counterparts. Kidston and Lang thus decided to erect a new group of pteridophytes, the Psilophytales

> 'characterised by the sporangia being borne at the ends of certain branches of the stems without any relation to leaves or leaflike organs.'

The name was based on the genus *Psilophyton,* proposed over fifty years earlier by Sir James Dawson for Lower Devonian fossils from the Gaspé, Canada. His descriptions of apparently very scrappy and somewhat featureless plants had been greeted with some incredulity, but now the discoveries of Kidston and Lang brought well deserved publicity to his pioneering work, and respectability to his plants. Kidston and Lang further pointed out that the name Psilophytales reflected superficial resemblance (but with no implications of relationships) of the new group with the extant Psilotales, a small group of rootless pteridophytes (including *Psilotum* and *Tmesipteris*) now considered allied to the ferns (Figure 11).

Also present in the petrified peat were sterile stems covered with small leaf-like appendages. In general appearance and stem anatomy they resemble the leafy stems of a small club moss (Figure 16). They differ in that although vascular traces leave the central conducting tissues of the stem these terminate abruptly at the bases of leaves, which therefore lack the single mid-vein characteristic of the leaves of lycopods. The plant was called *Asteroxylon mackiei* (Figures 17 and 19). Associated with the leafy remains, Kidston and Lang found smooth branching stems with terminal sporangia which they speculated were the possible fertile parts of *Asteroxylon.* More recently Dr A. G. Lyon has shown that these comprise yet another new plant called *Nothia* and that the sporangia of *Asteroxylon* were attached to the stems by short stalks (as illustrated in Figure 17). This again contrasts with the condition found in lycopods where a single sporangium is associated with a leaf. Thus *Asteroxylon* possesses a level of organisation intermediate between that seen in lycopods and psilophytes.

Lang once confided to Walton 'that the Rhynie Chert would lead to much trouble'. If by trouble he meant 'concentrations and contortions of the mind' then he was correct. The Rhynie Chert plants have formed the basis of innumerable theses on the early evolution of land plants and their relationships, and even today new research produces more data, more models and more controversy. Walton suffered trouble of a more domestic nature when the Rhynie Chert slides and almost 3,000 more of Kidston's preparations (Calder 1933-5 and 1959) were presented to the Glasgow Botany Department with the proviso that they should be housed in the safe in the Regius Professor's room. Walton instructed that the safe be left unlocked because a thief would surely cause more damage if he blew it open. The security problem has now been resolved by the designation of a small area of the Hunterian Museum, Glasgow University as part of the Professor of Botany's room!

Although Kidston and Lang continued to collaborate on Scottish Devonian plants, in the last years of his life Kidston returned to his first love – the Carboniferous compressions. The Geological Survey had acquired funds to publish a definitive illustrated catalogue of Carboniferous plants and commissioned Kidston to undertake the momentous task. Before his death in 1924 he had published four volumes on fern-like fronds including both ferns and pteridosperms. The illustrations are master-pieces: Carboniferous fossils, particularly where the shale entombing the compressions is a dark grey colour, are notoriously difficult to photograph. Most of the specimens figured came from Kidston's own collection. These Survey publications (Kidston 1923-25) remain important reference works even today. Kidston was also concerned with the usefulness of the plants in correlating sediments and hence coal seams in different coal fields. He showed that it is possible to subdivide the Carboniferous of Britain on the basis of plant assemblages and in this final *magnum opus* for the Geological Survey wrote 'it is no longer necessary to defend the employment of fossil plants as a means of zoning or dividing the Carboniferous Formation.' A securely based conclusion which still holds true today and which is the envy of all present day palaeobotanists who, in formulating their requests for funding from the research councils, seek to justify their projects with claims of industrial application. In Kidston's time the applied aspects of his research were equally as important; this was the end of the industrial revolution with its attendant great demand for coal and there was thus considerable exploration. Outside Britain, Kidston had been employed by the Belgian government to advise on coal resources in that country and he had also given advice to the United States' government on the development of their coalfields.

Dr Chris Cleal (Nature Conservancy Council), the only person in Britain still concentrating on the use of Carboniferous plant megafossils in Coal Measure stratigraphy writes

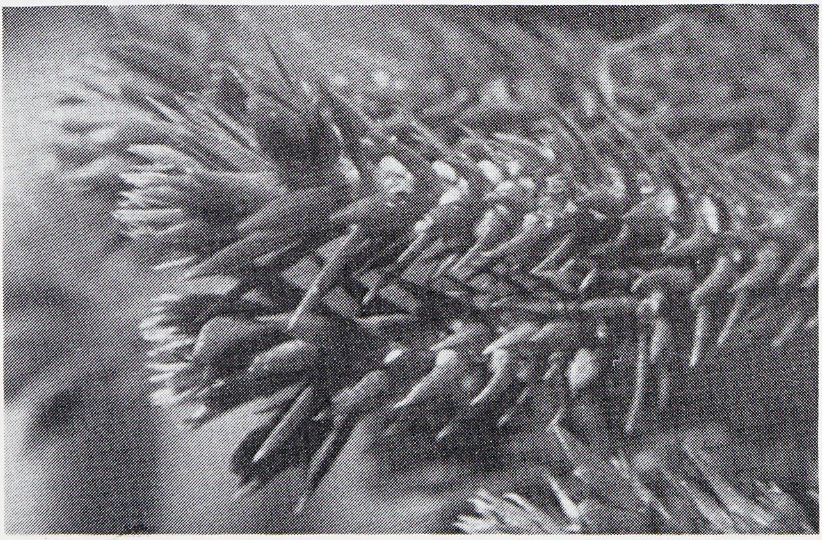

Figure 16 Living clubmoss *Huperzia* (*Lycopodium*) *selago* with sporangia .... RSM

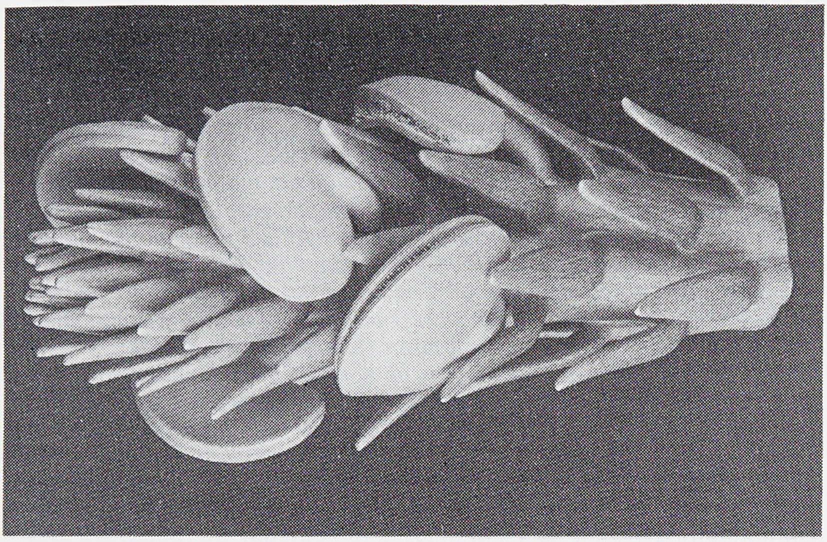

Figure 17 RSM model (based on Kidston and Lang) of clubmoss like fossil *Asteroxylon mackiei* showing lateral sporangia

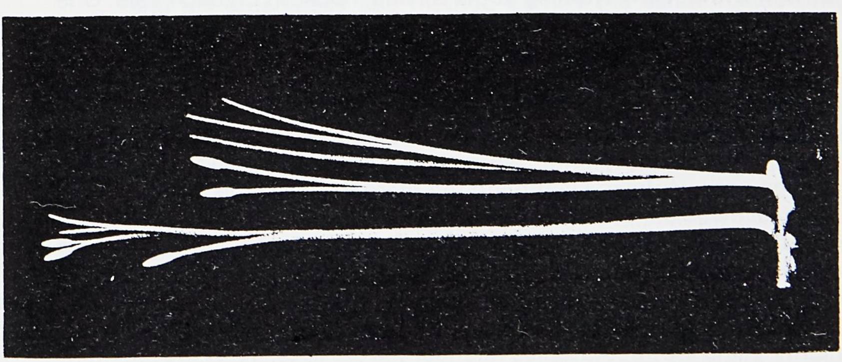

Figure 18 RSM reconstruction (model) of *Rhynia major* – actual size 45 cm.

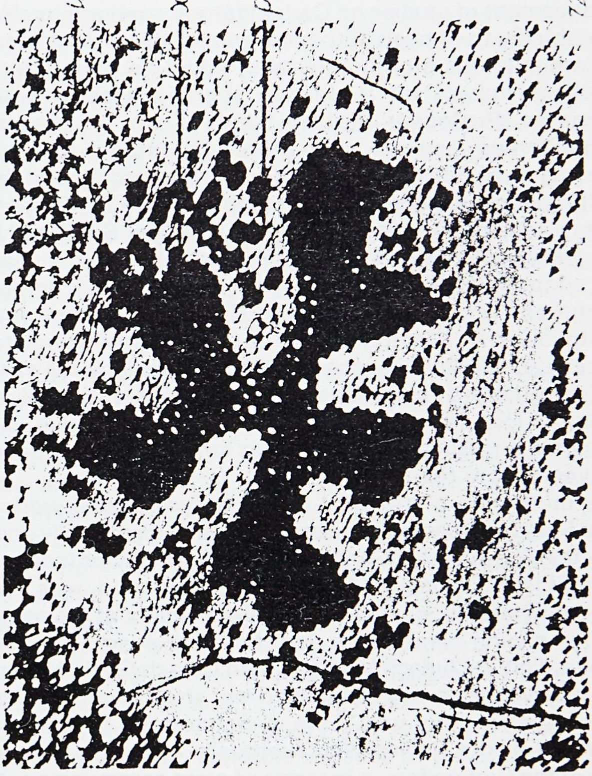

Figure 19 Transverse section of conducting tissue *Asteroxylon mackiei* . . . Kidston and Lang (1917-21)

> 'It was unfortunate that Kidston died only three years before the first Heerlen Carboniferous conference to promote the advancement of studies on Carboniferous stratigraphy. He would undoubtedly have been at the forefront of this internationalization of Carboniferous stratigraphy and would no doubt have had a beneficial impact on it. In the opening session welcoming delegates Professor Rutten said 'There is however in Carboniferous geology one branch of study for shich the prominency of British students is acknowledged around the world . . . It is almost unnecessary to add that I mean the Carboniferous botany, the work of masters such as Kidston, Scott and Seward being classical.' If Kidston had still been alive, we may have seen the adoption of Lanarkian, Yorkian, etc., as internationally recognised chronostratigraphical units, rather than the Westphalian A. Westphalian B, etc. whose nomenclature has caused such difficulties recently. Without the impetus of Kidston, the importance of plant biostratigraphy took a nose-dive in this country. The 'spectre' of the non-marine bivalve suddenly appeared, and British Carboniferous stratigraphy has never quite recovered from the shock!'

It was during the preparation of his encyclopaedic work for the Survey that Kidston became acquainted with an exceptionally acquisitive amateur in the South Wales Coalfield, one David Davies locally known as Dafydd Ffossil (Thomas 1986). His background was markedly different from Kidston's. He had no formal education: at the age of eight he began his mining career as a door boy and eventually became a colliery agent, first in Clydach Vale and then Gilfach Goch. He employed his men to retrieve the usually abandoned roof shales with their abundant compression fossils. This was done systematically so that from the associations of plants Davies was eventually able to reconstruct the vegetation of the Carboniferous in terms of plant communities. As soon as Kidston read Davies' first publication he set off for South Wales arriving without any warning at the Davies' house in Clydach Vale. One of David Davies' ten children (Figure 20), Mrs Eluned Jones, survives: she recalls how her mother recounted Kidston's first visit – that a strange man had arrived at their front door and asked to wait until her husband returned from work. He was ushered into the front room and ate 'cawl' – a Welsh equivalent of Cock-a-leekie – with the rest of the family at mid day. The two men became great friends – Kidston proving very useful in identifying the more troublesome fossils – and there followed annual visits to Gilfach Goch. Mrs Jones recalls that she equated Kidston with Father Christmas, he being the bearer of both gifts and a white beard. She and the three children remaining at home also formed some rather strange impressions of the habits of the Scots based on the Kidstons; for example, that all Scotsmen took cold baths every morning and that Scots ladies habitually wore hats, even to breakfast. I have to add that Mrs Wilkinson denies ever having worn one!

Towards the end of his life Kidston began to collaborate with Crookall at Bristol who was eventually to complete the Survey project.

The last photograph of Kidston (Figure 22) shows him lighting the familiar white pipe in Crookall's laboratory a few weeks before his death in July 1924. Shortly afterwards and in good spirits he set off for Wales to visit Davies, but soon became ill. Mrs Kidston was sent for and with her daughter Marjorie (Mrs Wilkinson) took the overnight train south. Although they reached Cardiff station at 11.00 am, the taxi driver had some difficulty in finding Gilfach Goch and the journey of 17 miles took over three and a half hours. They reached the house (Figure 21) on the outskirts of the village just half an hour after Kidston had died. They returned to Stirling the following day where they were met by Kidston's second daughter and equally distressed family servants. Kidston had been liked by all. Later Mrs Kidston gave David Davies her husband's dress watch with chain: it was inscribed 'Robert Kidston LLD FRS FRSE FGS from his beloved wife Agnes M. C. Kidston to David Davies MSc FGS July 29th 1924.'

Many of the eminent palaeobotanists of the day contributed to the obituaries. They all lauded his achievements as is usually expected on such occasions but they also recorded the admiration and affection which Kidston had inspired. The most sympathetic was Lang's for the Royal Society and I end as did Crookall (1933) in the official obituary for the Survey with Lang's last paragraphs –

> 'Kidston was one of the great amateurs of science, working for the pure love of discovery. Perhaps it was because of this that he spared himself so little and accomplished so much that is of permanent value. Endowed with the combination of qualities required for the best work in this chosen subject, industry, accuracy and critical caution, his insight and imagination were always under the strict control of well-tested observations. While this explains the high quality and reliability of all his work, its quantity was only possible because of the sound organisation of his time and energies. It is striking how at every critical point in his life he saw 'toward solid good what leads the nearest way,' and his orderliness and method carried the same instinct into details.
>
> In his work, and indeed in many other respects, Kidston remained young. He approached every question with real and vivid interest, held closely to the facts and drew his inspiration direct from them, distrusting merely speculative theories. His keenness in the discovery of something new, and in the piecing together of facts thus brought out, was a perpetual stimulus to all who came in contact with him at work. While he did not lightly change opinions he had formed, and required proof from the specimens for this, he was always ready to look for the evidence against his own views. He liked the most direct discussion in eliciting the truth of a matter, and he had a very keen sense of humour to which he gave full play in this work. This came out strongly in joint investigations, and the uncompromising arguments that took place in the study at Stirling and the healthy atmosphere of banter on the work that reigned there, were not only enjoyable but to the

Figure 20 The Davies family . . . . NMW

Figure 21 The Davies house, Gilfach Goch . . . . NMW

Figure 22 Robert Kidston in Crookall's laboratory, British University – taken shortly before his final visit to Gilfach Goch.

good of the final result. Kidston was the most modest of men, always ready to learn and especially encouraging to beginners at his subject. Indeed he responded to sincerity in every form, for he was himself absolutely genuine and big enough to be quite simple. And his keenness, sagacity and kindly humour were not for his work only, but for the whole of life. He was a wise counsellor and a delightful companion and inspired liking and love in all who knew him. For behind and above all was the charm of a personality which was even greater than his knowledge and insight'.

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Dr Page, Royal Botanic Garden, Edinburgh; Dr B. A. Thomas and the National Museum of Wales for information and illustrations on David Davies and for Figure 14; George Dixon of Central Region Archive; Dr Rolfe and Dr Dickson of Glasgow University's Hunterian Museum and Botany Department; the Smith Art Gallery and Museum, Stirling; R. Phillips and Pan Books for the Royal Fern illustration; and A. Craig, Stirling University, for assistance with illustrations.

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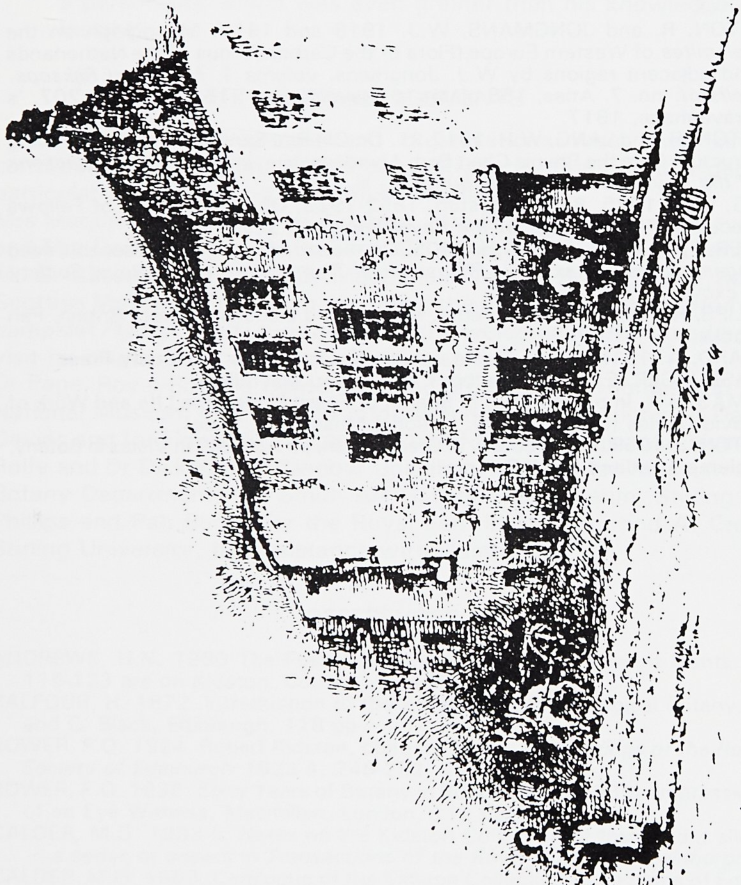

Old Gib's Inn, St Mary Wynd. This was Stirling's principal hotel before the Golden Lion was built in 1780.

THE ATTITUDES OF THE STIRLINGSHIRE CLERGY TO POVERTY, PAUPERISM AND POOR RELIEF REFORM 1790-1845

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In an earlier paper published in this journal (Gladstone 1980) I described the practice of poor relief in the parishes of Stirlingshire between 1790 and 1845. In spite of the population increase, agricultural improvement, industrial development and the growth of Dissent of that period, I showed the continuing importance of the Established Church in its operation. Ministers and their Kirk Sessions continued to act as the main agents for the distribution of poor relief and, though there was a move in some parishes towards legal and voluntary assessments, church collections together with other ecclesiastical dues remained an important source of the funds which they had available for this purpose.

The practical involvement of the Scottish clergy in the administering of help and relief has been used by Rosalind Mitchison (1962 p128) to suggest that the Scottish minister was kept 'more aware of social problems than his English counterpart, who might also dispense poor relief, but who stood nearer to the gentry in sympathy and outlook'. It would be unwise to push this distinction too far. Though they were involved in the practical operation of the system of poor relief, the Scottish clergy equally occupied a privileged position in every parish. Writing of the Scottish clergy in the eighteenth century Anand Chitnis (1976 p45) has described them as 'an educated elite'. The ministry of the Church of Scotland at that time provided one of the few career opportunities for those who were 'humble but talented' while, after training in Arts and Divinity, 'their education made them at least the equal of any man in their parish'. Their educational position was compounded by their income in which, especially in the first part of the nineteenth century, they were only superseded by the laird and the wealthy merchant.

The economic hardship experienced by some of the clergy from the mid eighteenth century was reversed after 1810 when, mainly at the instigation of Dundas, the government established a minimum stipend of £150pa plus manse and glebe. Though there was considerable disparity in stipends between parishes the rising price of grain up to the end of the 1830s meant that most stipends rose considerably above the minimum and represented by that date an average of ten times the labourers' wage and five times that of the parochial schoolmaster, their nearest educated rival. 'It was therefore, from a vantage ground of considerable security and elevation' (Smith 1953 pp195-6) that the ministers of the Church of Scotland engaged in the practical operation of poor relief. Together with the fact that, in the majority of parishes, ministers owed their charge to the exercise of patronage by the local heritor or landowner, the position of privilege created by education and income must be borne in mind when considering the attitudes of the Scottish clergy to poverty, pauperism and poor relief.

SOURCES

A unique record exists of the attitudes of the Scottish clergy in the returns which they made to the (Old) *Statistical Account of Scotland* (1790-97) and the *New Statistical Account* (1845). It is these sources which will form the basis for the subsequent discussion in this paper.

The Statistical Account of Scotland was instigated by Sir John Sinclair – the agricultural 'improving' landowner of Caithness and Member of Parliament – when he was a lay member of the General Assembly in 1790. Using a Questionnaire containing 166 items to request information on topics ranging from the natural environment to social conditions, Sinclair elicited – eventually – a reply from almost every parish minister except in the 12 cases where his own staff had to provide the information. A full account of the methods which he used is provided in volume XX of the *Old Statistical Account* (OSA) and a more general description is to be found in chapter 10 of Mrs Mitchison's biography of Sir John Sinclair (Mitchison 1962). Unique at the time when it was compiled the OSA represented 'the first detailed picture of a nation, parish by parish' (ibid p20), 'the most picturesque and widely descriptive social information of any in Europe' (C. F. Smith 1953 p35). That such an exercise was repeated again in 1840 constitutes a double bonus: for there is thus available a contemporary record of the changes in Scottish society over a formative period of her recent history. The picture of Scotland on the eve or in the early stages of industrialisation and agricultural change that is presented in the OSA has its counterpart fifty years later in the description of a more mature developed economy.

The uses to which the present day historian can put the parish returns, however, is somewhat limited. In seeking to explain the fact that 'no use has been made of the Account in economic studies commensurate with its possibilities'; Leeming (1963 p34) draws attention to 'the unevenness of its coverage'. Such disparity in the detail of the returns makes comparison between parishes difficult and with it the identification of historical generalisation. Campbell (1965 p327) points out that the parish accounts 'vary enormously in their value according to the personal knowledge a minister had of his parish and the strength of his prejudices.' Chitnis (1976 pp15-16) elaborates these criticisms.

> 'In general each parish account, for example, will depend for its accuracy and thoroughness on the care and attention devoted to its compilation by the minister concerned; the account will also depend, in terms of what is inserted and what is omitted, on the personality, predilections, prejudices and intersts of the minister himself.'

While there seems general agreement that the *Accounts* presented factual information (e.g. about population size) accurately, the parish returns are of far more interest to the present day writer as a source of material about the attitudes of the clerical correspondents. Writing of the OSA Smout (1969 p238) has observed

> 'One has only to turn the pages of that remarkable compilation to see them (the clergy) come to life, not as pastors, but as intelligent

> gentlemen sowing clover, speculating on ornithology, applauding a new linen work or a new road, agitated over the expense of poor relief, nervous of the effect of rising wages on rural virtue and watchful for any signs of idleness among the labouring classes.'

It is in this way that the clerical returns will be used in this paper: to provide an insight into the attitudes and views of the clergy of the time about what they considered to be important issues in the changing Scotland in which they lived. Among these a concern with poverty and the operation of the system of poor relief – especially as the NSA was compiled in the period immediately preceding the reform of 1845 – occupies a position of considerable importance.

All the returns to the OSA for the parishes of Stirlingshire were compiled by ministers. In the NSA there are only two accounts which were not written by the parish ministers themselves. In Alva, though the report was submitted by the minister, it was drawn up by a surgeon; in Baldernock it was drawn up by the parochial schoolmaster but he was himself ordained. As no minister occupied his charge at the time of the compilation of both the Accounts there are thus available 47 separate ministerial accounts relating to the 1790s and 1840s. What do they tell us of the clergy's attitudes towards poverty, pauperism and poor relief reform? Before reviewing the evidence to answer that question it is necessary to indicate something of the context against which the ministers of Stirlingshire formed their attitudes and wrote their reports.

CONTEXT

In the period between the two *Accounts* Scottish society in general underwent a significant social change. In this process the factors of population growth and migration, industrial development and agricultural change were all intertwined, each of them exercising an effect on the parish economy and the nature of parish life.

The population of the Stirlingshire parishes increased by just over 60 per cent from 50,825 in 1801 (the year in which the first national census was conducted) to 82,057 in 1841. The census returns of 1801, 1811 and 1821 showed a consistent growth in population of between 7,200 and 7,350 per decade. Between 1831 and 1841 the intercensal increase was much greater at 9,436 (Kyd 1952 p82).

The distribution of the population increase however, was far from even. In fact two parishes – Buchanan and Airth – recorded a decrease between 1801 and 1831. In the former this was attributed to 'the enlargement of farms and to the introduction of sheep husbandry' (NSA VIII p95). The enclosure movement also featured in the minister of Airth's reasons though he saw the explanation of decline 'chiefly from the Dunmore colliery having been given up' (ibid p283). In all the remaining Stirlingshire parishes however, the population increased: in some mainly agricultural parishes – such as Drymen and Gargunnock – the increase was only small; in others associated with new industries and the search for raw materials – such as Alva and Campsie – the population more than doubled in thirty years. Stirling itself grew as a commercial and service centre, increasing its population by some eighty per cent in the first thirty years of the nineteenth century (McKichan 1978 p69).

It was against a background of significant social and economic change in which 'hamlets became towns and towns became cities' that the ministers of Stirlingshire parishes – in common with their counterparts in many other parts of Scotland – wrote their contributions, especially for the NSA. In doing so, as C. F. Smith has pointed out, their attitude was one of ambiguity. On the one hand they welcomed the Industrial Revolution and gave their blessing to the men of enterprise who were providing employment and with it material prosperity, better housing and an improved diet for the Scottish worker (as in Larbert and Falkirk). On the other hand many of the Scottish clergy were not insensitive to the evils of the industrial system in child labour and conditions of work and to the strain on the system of poor relief created by the movement of population to the new industrial centres and the uncertainties of industrial employment. Withal there was a nostalgia for the Scotland that was passing.

> 'To have a population rapidly increasing in numbers and material wealth was a development that they undoubtedly approved; to have an increased poor roll, a declining standard of health and a lowered morale amongst the people was sometimes so manifest as to be disconcerting' (C. F. Smith 1953 p79).

The ambivalence in clerical attitudes which Smith detected in his national study is also apparent in the returns of the Stirlingshire parishes. One representative example is in the return for Balfron where, after a lengthy recital of the transport and commercial improvements that had taken place since the publication of the previous account, the minister concluded – 'The population has increased since 1792 but not so far, we fear, in comfort nor in happiness in an equal ratio' (NSA VIII p302).

If the changes associated with industrialisation were one factor that fashioned clerical attitudes to the social problems of their times, another factor was the national debate about the system of poor relief that gathered momentum in the late 1830s and early 1840s just as they were preparing their returns to the NSA. Nationally this debate centred particularly around the divergent views of the Rev Dr Thomas Chalmers and Professor W. P. Alison.

For Alison, Professor of the Institutes of Medicine at the University of Edinburgh between 1820 and 1856, an effective system of poor relief was 'the necessary basis of defence against the slum fevers' (Coats 1973 p8). From his work at the New Town Dispensary in Edinburgh came his conviction that 'destitution was a major factor in predisposition to disease'. After reviewing the proportion of the population in the Scottish cities dying from fever in the late 1830s, and contrasting it with the English experience, he concluded (Alison 1841 pv) that 'the most influential of all causes is Poverty and Destitution'.

> 'It is among those of the poor who suffer the greatest privations

> – whose employment is precarious, often suspended or little profitable, and among disabled men, 'lone' women, widows and orphans and especially among the poor Irish that fever most frequently appears and always spreads itself most rapidly and exhaustively' (Alison 1840 p 15).

It is not surprising that Alison's proposals for reform gave a high priority to a 'more liberal and better managed provision against the destitution of the unemployed or partially or wholly disabled poor' (British Parliamentary Papers 1842 XXVIII p25).

> 'I wish to see the funds augmented (he wrote) and the minds of those who are to distribute them disabused of the theoretical notion which I maintain to be contradicted by all experience that the more you give to the poor the more you contribute to their increase. I wish to see them furnished with the means and bound by the obligation to give such relief to destitution as shall preserve our poor from the misery and degradation and mendicity which are now so prevalent' (Scottish Record Office CH 1/2/184 pp50-51).

There can be little doubt that Alison's writings and research and the popular dissemination they received constituted 'a grave indictment of the Scottish system for the care of the poor' (Mechie 1960 p72), nor that his proposals for more adequate relief struck hard at the roots of the voluntary nature of the Scottish system.

In contrast to Alison, Chalmers was opposed to any guarantee of more adequate relief and to the extension of statutory means to fund it: though as Brown's (1983 pp367-9) recent study has shown Chalmers' social views underwent a significant change during the final months of his life in 1847. 'Pastor and preacher, theologian, economist and philanthropist, professor and ecclesiastical statesman' (Saunders 1950 pp208-9), Thomas Chalmers came to exercise a significant influence on Scottish affairs as the Evangelical Party of the Church of Scotland (of which he was the leader) gained supremacy in the General Assembly during the 1830s. Yet perhaps the central clue to understanding Chalmers 'was the ideal to which he dedicated both the oratory and the organisation. Essentially national and conservative it was to preserve the pattern of the old Scotland in a new age' (Wright 1960 p134).

Nowhere was this ideal more evident than in his attitude to poor relief reform. Any form of assistance to the poor which was public, legal, centralised and capable of infinite augmentation he considered wasteful, ineffective and totally lacking in remedial value. Such a guaranteed provision could only have a demoralising effect on its recipients, for such was the nature of man he believed

> 'that given the sight of a bottomless pocket in the public funds he would lose all incentive to strive for himself and his family and would be encouraged to lie back and wait for public charity to support him' (Young and Ashton 1956 p73).

But public charity did not only demoralise its recipients. It also broke down the natural systems of social support – the care of the local population, the concern of relatives, the sympathy of the rich for the less fortunate, and the help of the poor for each other.

These were the principles which Chalmers sought to re-establish as the basis of his social experiment in St. John's parish, Glasgow between 1819 and 1823. St John's was withdrawn from the city's poor relief system based on assessment and became 'a social laboratory' in which to test the efficacy of the traditional, voluntary method of poor relief which, by this time, was almost exclusively limited to parishes outside the urban centres (Owen 1964 p226). Associated with the changes in the operation of poor relief was an emphasis on Christian education and parochial visitation by elders and deacons in the districts into which the parish was subdivided.

> 'Though good work was certainly done, especially in schooling', (a recent assessment has concluded that) the St. John's experiment fell far short of demonstrating the practicability of the formula of denying aid to the able-bodied, urging the poor to save themselves by self discipline and mutual aid and using well intentioned middle class men to organise and exhort' (Cage and Checkland 1976 p52).

The same assessment has also pointed out how the poor relief arrangement 'was not financially viable within its own structure' (ibid p53). The detail, in this instance, is of secondary concern. What is more important, as McCaffrey (1981 p52) has recently pointed out, is that

> 'for the not-so-committed early Victorians, Chalmers' popularised views simply provided a rationale with which to bolster their prejudices against the pretensions of the poor; it gave them a theory which justified their conviction that the misfortunes of the poor were due to some inherent individual moral weakness in the poor themselves.'

EVIDENCE

Like the overwhelming majority of their clerical contemporaries, the ministers of Stirlingshire perceived the cause of poverty to lie in individual failing rather than as the consequences of the socio-economic changes of industrialisation or the unequal distribution of wealth and property in society.

Traditional Calvinist determinism tended to support the existing ordering of society: some had been born to riches, others to poverty. In the context of its belief in pre-destination it emphasized the importance of personal piety, industriousness and the conscientious fulfilment of the duties of one's social position. In the conditions of early industrialism, according to Smith, a variant of this principle developed which sought to incorporate the newly emerging middle class theologically, just as they had been incorporated politically by the 1832 Reform Act. Success, wealth and prosperity became an indication both of the divine favour and of the diligence, thrift and industry of the individual. Thus 'the self made man could think of himself – and be thought of by others – as the righteous man' (D. C. Smith 1964 p137).

Calvinist beliefs, whether in their traditional or modified form, had an obvious implication for the clerical view of poverty and the poor.

By this reasoning the poor (especially the able-bodied whose right to public support had long been denied in pre-industrial Scotland) had only themselves to blame for their situation. The minister of Killearn was expressing a widely held view when he identified poverty as 'commonly proceeding for the most part either from indolence or mismanagement' (OSA XVI p121). It was 'the idle and improvident habits of many of the lower classes' (NSA VIII p36), according to the minister of Falkirk, that explained by the time of the NSA a growing tendency to rely on public assistance in the form of poor relief. In Strathblane too, it was 'the dissipated and improvident who have no reluctance to ask parochial relief' (NSA VIII p88). Dissipation and improvidence were inextricably linked in the clerical mind with intemperance which was portrayed as a major cause both of poverty and pauperism.

In the OSA the minister of Balfron referred to 'a great many low public houses which deal only in whisky and are productive of the worst effects both to the health and morals of the people' (OSA XVII p536). In Stirling, with its 'report of rich funds' and the use of the Castle as a military hospital, the effect of a large number of ale houses and spirit shops was vividly described by the minister

> 'The fathers soon die worn out with intemperance. They leave their families beggared, unprincipled, debauched. These families are the nurseries of beggars. Nearly one half of the paupers in Stirling itself spring from these nurseries' (OSA VIII p291).

But it was in the NSA that the clergy's attitudes were expressed more overtly. This reflected both the reduction in the price of spirits introduced in 1822, alterations to the licensing system to retail whisky only in 1794, and the introduction in 1825 of a £2.2s. general licence for houses under £10 in rent.

> 'Those whose business it is to grant licences (the minister of Campsie wrote) and who should be guardians of the public morals would do well to remember that the multitude of taverns while it indicates a great demand for spirituous liquors also increases the demand: for every public house is a new centre of dissipation bringing the family itself and all its immediate connections into closer contact with their most dangerous and deadly enemy' (NSA VIII p258).

Attributing to intemperance 'a large portion of the crime, poverty, ignorance and misery of the working classes' (NSA VIII p339), the ministers of the Stirlingshire parishes were in no doubt about the deleterious effect on the health and morals of their people of the increase in the opportunities for obtaining spirits (e.g. NSA VIII pp115, 167, 271, 287, 377).

> 'The effect produced by the great number of low tippling houses (the minister of Stirling affirmed) and the facility with which almost the smallest pittance in the hand of a poor person can be exchanged for ardent spirits at a grocer's shop in increasing the number of the destitute and sinking them to deeper wretchedness has been for a long period forcing itself upon the notice of every real friend to the moral welfare of the poor' (NSA VIII pp447-8).

If intemperance was seen as one factor predisposing the lower orders to poverty and pauperism, another was the inadequacy of pastoral superintendence and the failure of church accommodation to keep pace with the growth and concentration of the population.

> 'If church accommodation remains stationary (the minister of Polmont pointed out) while the population is augmented and if the means are not afforded for their attendance on public worship for their being trained up in moral and religious habits it is more than probable that among the baneful effects thereby occasioned will be an increase of pauperism so great as to render necessary a compulsory mode of relief' (NSA VIII p200).

'To churchmen the fact that the poverty stricken masses were not in the churches, implied that true Christians seldom, if ever, found themselves destitute and in need of public assistance' (D. C. Smith 1964 p139). The practical solution to the problem of pauperism, and perhaps even to that of poverty, therefore, was quite clear. It lay in moral counteractives: a programme of Church Extension based upon Chalmers' Principle of Locality, a return in the industrial centres to the religious institutions and social relationships of traditional agrarian Scotland. Even before the major Church Extension programme on which the General Assembly embarked in 1834 under Chalmers' dynamic leadership, the minister of Stirling declared

> 'Let churches be built or decent places provided for the accommodation of the poor and their manners would soon be corrected at much less expense and much more effectually than by thousands expended on the building of bridewells and correction houses. Charity employed in preventing vice is charity indeed' (OSA VIII p292-3)

Forty years later in the NSA the minister of Falkirk, Stirlingshire's main industrial centre, expounded Chalmers' social ideal – the sub-division of the parish into separate districts each with its church and school – as the means by which 'the moral improvement may keep some equality with merely outward advantages . . . and the progress of crime and pauperism be most effectively checked' (NSA VIII p37).

That the clergy of Stirlingshire were at one with their colleagues in other parts of Scotland in pointing to intemperance and the moral remedies for pauperism is shown by the *Report on the Proposed Inquiry into the State of the Poor in Scotland* which was presented to the General Assembly in 1841. Intemperance, it considered

> 'the most immediate cause of the destitution now in action . . . how can it for a moment be doubted that besides throwing away on drink what would otherwise be employed in providing sustenance, clothing and education it incapacitates from labour and undermines habits of industry' (SRO CH1/2/184 pp8-9).

But the main significance of this report, published the year after Alison's pamphlet had opened the movement to reform the Scottish poor law, was its ardent advocacy of moral remedies to prevent the development of a reliance on public charity.

> 'The only effectual means for permanently improving the physical

> condition of the working classes, of materially diminishing the amount of pauperism or even checking its growth, consists in religious, moral and intellectual cultivation. It is in this way alone that a people can be secured against the vices which inevitably lead to poverty, that they can be trained to steady habits of industry, that they can acquire the prudence, forethought and self command necessary to their making provision for an evil day, the spirit of righteous independence which would make them shrink from maintaining themselves out of the substance of others' (ibid p10).

In other words, as a recent study has concluded (Cheyne 1983 p114), 'early Victorian Christians had fallen into the habit of reducing exceedingly complex political, social and economic problems to a simple matter of personal religion and personal morality'. The individualist dimension of the ascendant nineteenth century Evangelicalism – moral improvement and spiritual regeneration – thus preserved inviolate the social and political status quo and created within the Established Church the condition of 'social conformity and prophetic silence' (D. C. Smith 1964 p54).

The Stirlingshire ministers not only held attitudes about poverty and pauperism that were common to the overwhelming majority of the clergy of the Church of Scotland, they also concurred with them in support of the traditional parochially administered and voluntarily financed system of poor relief. Comments such as that of the minister of Kippen who spoke of the administration of poor relief as 'accompanied with considerable trouble' (OSA XVIII p341), were a minority. More representative of clerical opinion was the view that the Kirk Session was the most efficient and economical agency, 'the cheapest, best managed public fund in Great Britain', as the Rev James Lapslie of Campsie described it (OSA XVIII p363). Forty years later the minister of Balfron recorded his opinion

> 'Of all the public funds of Europe none is managed with so little expense to the fund itself, none so frugally, none so impartially and none is laid out more to the purpose for which they were raised than the poor's fund under the care of the Kirk Sessions of Scotland' (NSA VIII p301).

The number of Stirlingshire parishes in which an assessment was in operation to finance the system of poor relief had increased from 5 to 12 between the dates of the *Old* and *New Statistical Accounts.* But there is no doubt of the clergy's dislike of a regular rating nor of their preference for the practice of voluntary contributions. In Alva, where the traditional practices prevailed, the minister reported that 'examples are not uncommon of individuals refusing to accept charity from the parish and with that patience and honest pride, peculiarly Scottish, undergoing privations untold rather than take or ask relief' (NSA VIII p190). By contrast where an assessment was in operation the clergy suggested that those receiving relief showed less reticence in doing so and developed a tendency to regard relief as a right. 'Assessments', the minister of New or East Kilpatrick considered, 'are attended with more trouble and are consequently more expensive for many claim to be admitted on the poor's roll when the poor are supported in this way who, in the same circumstances would make greater exertions to support themselves' (OSA VIII p106). 'Increase the means of dependence' commented the minister of Stirling' and the effect is unavoidably increased' (OSA VIII p289).

Their support for the voluntary funding of the traditional system was well summarised by Sir John Sinclair (1831 volume ii p161) on the basis of returns to the OSA.

> 'When assessments are imposed less attention is paid to investigate the Character of the Objects or to distinguish those whose poverty has resulted from circumstances over which they have no control from those whose indigence has been the effect of their own idleness and profligacy . . . . where relief is compulsory . . . . the virtuous and the vicious share alike in the degrading pittance.'

The 1839 *Report of the General Assembly On the Management of the Poor* (BPP 1839 XX p17) expressed its support for the principles of the traditional system in similar terms. By it

> 'The poor are led to be industrious and provident; their relatives and neighbours are encouraged to assist them, a spirit of independence is cherished, an unwillingness arises to come on the parish for the pittance which it yields, the burden to the industrious part of the community is lessened, a compulsory assessment is avoided and the Church collections prove in general sufficient to provide the necessary funds.'

It was this final assertion that was to be most severely contested by Alison and the representatives of the medical profession (including those in Stirlingshire) during the debate about poor relief reform in the 1840s. On the basis of his analysis of the changes in Scottish society and his comparison of the amounts paid in poor relief in England, Alison was led to advocate a more generous level of assistance. Both his analysis and prescription thus represented a fundamental challenge to the prevailing attitudes of the Scottish clergy. While for Alison (1840 pvii) 'the evils are Poverty, Destitution and Mendicity . . . the legal provision the remedy', for the overwhelming majority of the ministers of the Church of Scotland it was the legal provision that was the evil in terms of its effect upon the moral values of the lower orders. For them as Thomas Chalmers expressed it, 'moral counteractives' were

> 'the alone excellent way because it provides for the two elements at once of the people's comfort and the people's character and through the medium of their own reformed habits raises them to a state of sufficiency and independence which all the supplies of a legal and artificial pauperism can never secure for them' (SRO CH1/2/184 p20).

CONCLUSION

What I have shown in this paper is the considerable uanimity and persistence of the views about poverty, pauperism and the reform of the Scottish system of poor relief expressed by the ministers of Stirlingshire in their returns to the *Old* and *New Statistical Accounts.* I have also pointed out the extent to which their views can be held to be representative of the thinking of the Church of Scotland on these issues.

The evidence which I have presented gives rise to several questions which lie beyond the scope of this present paper. How far were the social attitudes of the Scottish clergy the result of their privileged position and thus held in common with other professional men of the time? How far were they conditioned – for example in thinking about the able-bodied poor – by the value system of rural pre-industrial Scotland or – in their more general attitudes – by the individualist features of the system of education in Arts and Divinity in which they had been trained? In their advocacy of the traditional system of Scottish poor relief how far were they haunted by the Malthusian spectre of over-population and influenced by the extensive writings – both practical and theoretical – of Thomas Chalmers? To what extent was their reactionary position an attempt to maintain a distinctively national institution and a role for the Church in social welfare or a response to the English experience of a rising poor rate? To what degree in their thinking on these matters were the clergy of the Church of Scotland 'dazzled by the economists' (R. H. Campbell 1961 p147) and how far in that process did they move from the strong social commitment of the Reformed Church?

These are large questions and clearly more work needs to be done to locate the development and role of clerical attitudes in the broader context of Scottish intellectual history. But it is not without significance that though the Church lost its role in the practical operation of poor relief after the Scottish Poor Law Amendment Act of 1845, the denial of a legal right to relief to the able-bodied persisted. That in itself attests the pervasive influence of individualist ideas about poverty, of which the clergy had been important exponents, in the principles of the new system of poor relief in Scotland.

Editorial note: The three illustrations of Stirling taverns of this period are from *Old Ludgings of Stirling* by J. S. Fleming and E. Mackay 1897.

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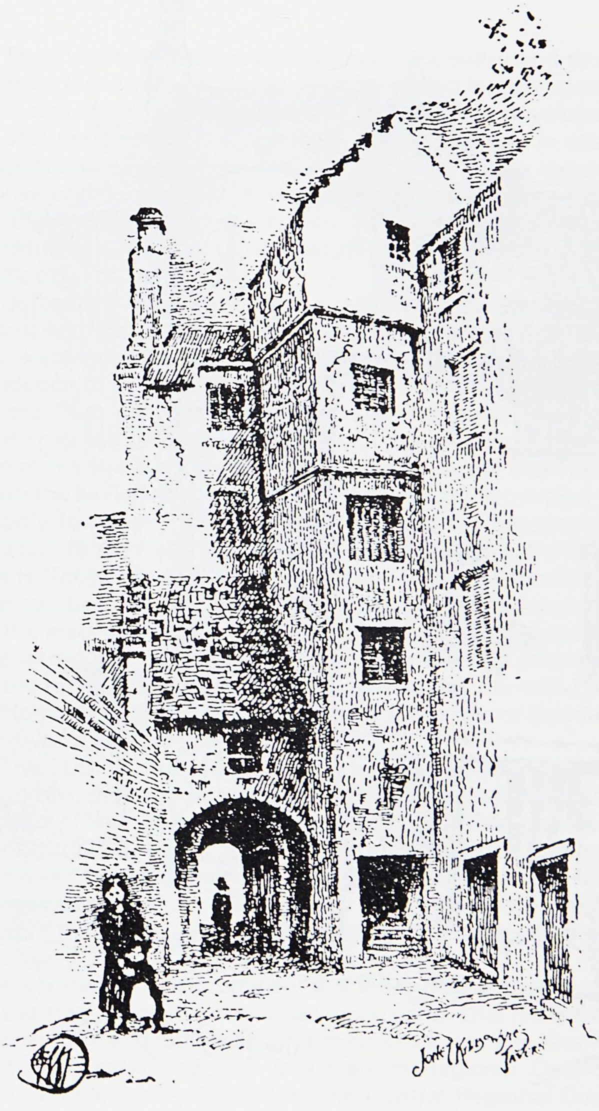

Janet Kilbowie's Tavern – a thriving tavern from the mid 1600's – was rear of Darnley's House at Broad Street.

Old Fleshers' Tavern – St. John Street – a fortress-like building once a rather famous tavern.

AN ORAL HISTORY OF THE HILLFOOTS TEXTILE INDUSTRY

Garry Scobie

The industrial outlook of Alva and Tillicoultry and to a lesser extent that of Menstrie and Dollar, has depended largely upon the changing fortunes of the textile industry. Despite much re-development, its impact is still apparent in the number of mill buildings in the area, though regretfully those which are still involved in the industry have been considerably reduced. However, if the conditions which existed prior to the factory based system are taken into consideration, it is hardly surprising that its influence has remained central to the history of the Hillfoots.

Before industrialisation the availability of water from the Ochil hills along with the practice of sheep farming, combined to provide the basis for weaving coarse woollen garments in the home. Although there is evidence to suggest that woollen manufacture on this scale dates back to the 16th century, it was not until the introduction of new carding and spinning machines in the late 18th and early 19th centuries that the move from a cottage-based industry to the mills became a reality. With the skills and experience of the workforce coupled with the water supply to power the new machinery and the geographical location in relation to the trade centres of Glasgow, Stirling, Perth and Edinburgh, the Hillfoots provided an ideal setting for the mill-based process. Initially the number of handloom weavers working from home did increase due to the level of output from the carding and spinning machines, but after the introduction of the powerloom the industry became firmly rooted in the mill system of production. Indeed, by the mid 19th century the Hillfoots Mills accounted for almost a quarter of Scotland's mills and for over a third of its labour force.

The 20th century has seen the industry suffer badly at the hands of economic depression and the changing nature of markets at home and abroad. There has been the occasional 'boom' period, most notably during the war years, and a more recent switch to the production of knitwear has resulted in some success for those firms involved. However, the industry is no longer the force it once was and the overall picture this century has been one of mill closures and gradual economic decline.

Awareness of the prominent role this industry has played in the history of the area prompted a decision to set up an Oral History Project dealing specifically with the mills and their workers. The Oral History of the Hillfoots Textile Industry is a Central Regional Council Community Programme, jointly funded by the Central Regional Council Industrial Development Committee and the Manpower Services Commmission.

Over the next year, a project team consisting of one supervisor, a clerical assistant and three interviewers, will be recording a series of interviews based on a questionnaire dealing with different aspects of mill life and on specific events such as the war years, the introduction of new techniques and the evenutal closures themselves. These interviews will be transferred to computer discs for editing and cross reference purposes with the final product being a comprehensive view of the industry as told by the people who earned their living from it. Copies of the recorded interviews should be a valuable information resource, and will be made available to libraries, schools and interested parties in the region, and it is hoped they will be of considerable interest to the community as a whole.

Although the project is still in its infancy, over one hundred ex-mill workers have been contacted and have given their consent to be interviewed in the near future. Their numbers include a wide variety of occupations spread throughout the mills in the Hillfoots, with much of their collective experience dating back to the First World War. However, the project will include workers who are still involved in textiles, though the emphasis has initially been on those who have since retired from the industry.

Any information regarding the industry or any inquiries regarding the project itself would be greatly appreciated. Please contact Special Programmes, 9 Coalgate, Alloa or telephone 218045.

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EDITORIAL NOTE – aims and forthcoming papers

The aims of the *Forth Naturalist and Historian* are to promote and increase knowledge of this central area of Scotland. We hope that by providing a vehicle for publication we might stimulate existing workers to present their findings, and encourage others in local studies. We also promote an annual meeting with similar aims; Saturday 16th November 1985 was the eleventh of these *Man and the Landscape* symposia, its theme Conservation.

The Editorial Board was set up after the British Association meeting at Stirling University in 1974 to provide this continuing focus following the summary survey *The Stirling Region* produced for that occasion, and to seek to revive the type of local studies of the pre-war era of the *Transactions of the Stirling Field and Archaeological Society,* when men of considerable scientific standing such as Harvie-Brown and Kidston, and others worthy though less famous, published papers of their researches and observations. For some time there had been no such suitable local journal to encourage publication particularly by the enthusiastic amateur naturalist or historian. The interest of the University and Central Regional Council is, though low key, encouraging, and the Editorial Board would be pleased to extend such assistance as it might raise to school teachers, local study groups, and others who might appreciate some consultation or sharing in their investigations.

Some forthcoming and expected papers –

Climatological reports – annually
Bird reports – annually
Flight and some Stirling connections
Airthrey roads
The Clan Gregor
Airthrey and Bridge of Allan – a guided walk; a revision and expansion of a 1975 pamphlet for Open University Summer Schools at Stirling
Gartmorn lades
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Alloa in days of prosperity
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