

MOOR HOUSE

21st ANNUAL REPORT, 1980.

THE NATURE CONSERVANCY COUNCIL

MOOR HOUSE

1980

21st ANNUAL PROGRESS REPORT

M. RAWES

Moor House Field Station,
Garrigill,
Alston,
Cumbria.
CA9 3HG.

Tel: Alston (049-83) 435.

1. 1950-1951

2. 1952-1953

3. 1954-1955

4. 1956-1957

5. 1958-1959

1950-1951	1952-1953	1954-1955
1956-1957	1958-1959	1960-1961
1962-1963	1964-1965	1966-1967
1968-1969	1970-1971	1972-1973

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I. GENERAL.

This report covers the year 1 October 1979 - 30 September 1980.

Despite the decrease in scientific work and the increasing depression as the future of Moor House continues to be debated, I thought a brief report would maintain the continuity given by previous Annual Reports over the past 21 years.

Following the Nature Conservancy Council's decision not to re-open the hostel this summer, and the continuing reduction in staff and facilities, it was inevitable that there would be a marked reduction in use. In the event the fall off was greater than expected, but there was an increase in interest by research workers from the Institute of Ecology and a number of projects started.

A major blow has been the disbandment of the Meteorological Office Climatological Station in May after which daily observations and recording could no longer be assured on a 7 day week basis. The refusal of the Met. Office in allowing even the most basic of instrumentation to remain was much regretted, but determined efforts have, and are being made to maintain records from a Station which has given useful data, if not complete before 1951, for nearly half a century. We have received assistance in partially re-building the Station: the Northumbrian Water Authority have loaned us a rain gauge, and Merlewood Research Station have provided a cup counter anemometer and weekly run thermograph. A screen houses thermometers which together with grass minimum and soil thermometers are read at 0900 h G.M.T. when a member of staff is available. These recordings are essential in providing a check to the Institute of Hydrology Automatic Weather Station which gives data of temperature, solar radiation, wind speed and direction, and precipitation. The relationship over the past few years between the A.W.S. records and the 0900 h G.M.T. readings of the Climatological Station will be studied.

I pay considerable importance to the value of the Moor House climatological data, to its continuation, and its availability to all. So efforts will be made to continue to service the Station throughout the winter when I and Judith Scott pay fortnightly visits.

The Warden, P. Burnham, left Moor House on 1 September 1980 and now for the first time no-one is resident. P. Burnham lives at Red Croft, Knock, Appleby, and by being there the west side of the Reserve will receive the wardening it has lacked in the past. Judith Scott, Phil Holms and myself will return to work daily at Moor House in April 1981. Those who wish to contact us during the winter can do so at Newlands, Ruckcroft, Arncliffe, Cumbria, CA4 9QR (telephone Croglin 264) or at Merlewood (Grange-over-Sands 2264). Whenever possible we shall meet the requests of research workers.

Although there have been few visitors to the Field Station during the reporting year and it was perhaps ironic that the last party to stay in the hostel were Russian scientists, there are signs of returning interest. The number of projects proposed, and being discussed, include several by the Institute of Terrestrial Ecology, whilst Drs. K. Taylor, R.S. Clymo and J. Grace have new students about to start.

II. SCIENTIFIC (Moor House Staff).

a) Climatology.

The report for this year is incomplete and in the future some information, such as number of days of snow, will be unavailable. However, a better coverage will be given when Automatic Weather Station print-outs for the whole year are available for publication.

Rainfall despite expectations proved to be only 100 mm more than average, but April and May were exceptionally dry months, recording 1/10 the average with April having the lowest (10 mm) monthly rainfall measured since records started in 1952. On the other hand the June rainfall, 220 mm, was the most recorded for that month. There were 65 days of snow lie (27 year average 70 days), and February was an exceptionally unseasonable month with less snow and higher temperatures than usual; the monthly mean temperature (1.6°C) was the third highest since records have been taken.

The summary table for 1979 is given in the Appendix.

b) Studies of vegetation and sheep (M. Rawes and Judith Scott). Effect of removing sheep grazing.

The programme of recording the botanical composition of different vegetation types has continued with the repeat point quadrat analyses of two high-level cotton grass (Eriophorum vaginatum) sites at Trout Beck Head and Silverband. These two sites were selected in 1966 as representative of a degraded vegetation that is common on either side of the summit ridge. More severe climate and heavier sheep grazing perpetuate this vegetation, which at lower altitudes is seen temporarily after heather burning. Protection from grazing could be expected in time to result in an ericaceous vegetation; Empetrum nigrum is common in the grazed situation, but Calluna vulgaris is not. Prior to statistical analysis of the data it would appear that both Empetrum and Calluna are slowly increasing their cover and that in Silverband enclosure Narthecium ossifragum and Carex nigra have increased considerably.

A paper on the effects of excluding sheep from the high-level grasslands of Moor House has been accepted for publication in the *Journal of Ecology*.

c) Natural grassland communities (M. Rawes and Judith Scott)

Plant introductions made in 1956 and 1957 to create, or recreate, floristically rich, or richer, vegetation in four enclosures have had a low success rate. The trials on Hard Hill and Little Dun Fell have failed but the range and number of species were not great. The small protected grassland of Knock Fell and the larger enclosure of Rough Tike with its gorge providing a variety of habitats from dry ledges to flushes have given some successes.

Success is measured by persistence, vegetation spread or flowering and seeding. The willows, Salix arbuscula, S. phylicifolia and S. reticulata, and Angelica sylvestris, Luzula sylvatica, Polygonum viviparum and Thalictrum alpinum have all spread. Potentilla crantzii

and Polystichum lonchitis are suitable species, and in all probability Saussurea alpina. The planting of Saussurea was on an unstable site and plants have been lost in rock falls. Alchemilla alpina has done well where the surrounding vegetation was short, but it has been unable to compete with dense and more aggressive species. It has been particularly successful on the limestone ledges of Knock Fell. Cerastium alpinum, Dryas octopetala, Silene acaulis, Sibbaldia procumbens, Saxifraga oppositifolia and Oxyria digyna were unsuccessful where planted.

Self introductions are not common but the presence of Centaurea nigra, rare and only on a few ledges on the west side of the Reserve, was noted this year in Rough Sike.

d) Red Grouse (P. Holms)

Work continued this year on the population study of the red grouse, Lagopus lagopus scoticus. Counts were carried out in the Spring of adult breeding birds, in Summer of nests and eggs, and in August of young birds. The eight study sites were used as in previous years.

There was an extremely low Spring population of only 0.23 birds/ha compared with 0.51 in 1979. The mean for the previous 10 years was 0.95 birds/ha.

Density per study site.

Site	Area (ha)	No. Adults	Birds/ha.
Bog End	10.2	4	0.39
Burnt Hill	20.3	6	0.30
The Drive	20.2	2	0.10
Hard Hill 11	14.0	1	0.07
Hard Hill A	21.2	4	0.19
Hard Hill B	24.5	4	0.16
Green Burn A	15.6	6	0.38
Green Burn B	14.7	4	0.27
Overall average			= 0.23

The earliest hatching date was 29 May, though most chicks hatched in the first week of June, rather earlier than last year.

Although the August counts were low, the broods when flushed were generally of a good size indicating a productive breeding season. The young to old ratio of 2.5:1 was excellent and compared well with the 1.46:1 recorded last year. The poor breeding year of 1979 gave rise to a low 1980 Spring population, but a good breeding season with fine weather conditions however, produced large numbers of young birds and a healthy Autumn population.

Replicated counts to estimate breeding success.

<u>Area</u>	<u>No. Young</u>	<u>No. adults</u>	<u>Ratio</u>	<u>Average/Area</u>
Bog End	3	6	2.0:1	3.0:1
	2	8	4.0:1	
Burnt Hill	2	3	1.5:1	1.8:1
	3	6	2.0:1	
The Drive	2	6	3.0:1	2.5:1
	2	4	2.0:1	
Hard Hill 11	2	4	2.0:1	2.0:1
	-	-	-	
Hard Hill A	4	7	1.75:1	1.4:1
	3	3	1.0:1	
Hard Hill B	2	6	3.0:1	3.0:1
	0	2	-	
Green Burn A	2	10	5.0:1	3.8:1
	4	6	2.5:1	
Green Burn B	4	7	1.75:1	2.4:1
	2	6	3.0:1	
			Overall average =	2.5:1

III. RESEARCH BY THE INSTITUTE OF TERRESTRIAL ECOLOGY.

- a) Competition between grass species.
(Helen E. Jones, Merlewood Research Station).

The project, to study the growth and interactions of Agrostis tenuis and Festuca ovina under various cutting regimes, is nearing conclusion. Results from the experiment, in which the two species were grown in a 1:1 mixture in pots in the glass house, and subjected to a range of clipping treatments, are being analysed. A preliminary report has been given in a Merlewood R. & D. paper (No. 80: Experimental observations on competition in grasses).

- b) Risk of frost damage at bud burst on Sitka spruce.
(M.G.R. Cannell, Bush Estate, Penicuik).

Moor House observations are being used to build a model to predict the date of Sitka spruce bud-burst and frost de-hardening, and the results will be published.

- c) Bog End Lodgepole Pine fertilizer trial.
(A.H.F. Brown, Merlewood Research Station).

Planting took place in May 1962 in order to test the efficacy of different fertilizers in establishing Pinus contorta on the exposed area of deep peat at this site. The initial response over the first five years (i.e. the establishment phase) has been summarised in Carlisle & Brown (1973). Briefly, a combined PK fertilizer was best, with N

additions giving either no additional benefit or even proving deleterious.

In 1980 it was decided to boost the growth of the trees, which by now had declined considerably, by further additions of fertilizer. The recommendation of the Forestry Commission's Research Branch was for a combined PK fertilizer, such as Fisons Double Season PK, to be applied at the rate of 575 kg/ha. In the event a slightly smaller dose of this fertilizer was applied on 30 April 1980, by giving about 152 gm per tree, scattered by hand over the space occupied by each tree.

In order to provide a comparison between trees so treated and those with only the original treatment, Block D (i.e. one quarter) was left unfertilized on this occasion. Similarly all the original control (i.e. unfertilized) plots were also left unfertilized.

- d) Studies of mycorrhiza in *Pinus contorta*.
(J. Dighton and Ashok Debba, Merlewood Research Station).

Work has started to assess the P-stress test using Lodgepole (*Pinus contorta*) from the Bog End tree plantation and investigate water logging on mycorrhizal survival.

- a) Annual growth of trees in relation to climate.
(A. Millar, Merlewood Research Station).

Measurements of annual ring width and height growth of conifers are being made and will be related to climatological data.

IV. RESEARCH BY FRESHWATER BIOLOGICAL ASSOCIATION.

- a) Fish populations.
(D.T. Crisp).

Routine sampling of trout in the River Tees and its tributaries has continued.

V. RESEARCH BY UNIVERSITIES.

- a) Studies on the Common Sandpiper (*Actitis hypoleucos*).
(Shirley Jones, Department of Zoology, Durham University).

Work at Moor House on the Common Sandpiper (*Actitis hypoleucos*) has continued as part of a study of habitat selection of breeding wading birds in Upper Teesdale.

Since 1977 the number of pairs of Common Sandpiper breeding on the eastern part of the Reserve has fluctuated between 22 and 30 pairs, 24 pairs holding breeding territories this year. From observations of colour ringed birds it appears that about 50% of the population returns to breed at Moor House each year. In spite of this population turnover and the slight fluctuations in the number of breeding pairs, the positions of the territories occupied from year to year are remarkably constant. In order to assess the factors influencing the distribution of sandpipers on the Reserve, various

habitat variables have been measured for computer analysis. It seems unlikely that vegetation is a major factor in the birds' habitat selection since they will nest in a wide range of vegetation types from open moorland to woodland. Therefore, habitat measurements have concentrated on variables within the stream. Preliminary analysis indicates that the birds generally avoid stretches of stream less than 2 m wide, while on streams of suitable width the major factor attracting birds to a particular area is the number of exposed shingle banks.

- b) An investigation of the different forms of the harvestman (*Mitopus morio*) (Fabr.) in northern England with reference to altitude.
(Amanda Jennings, Department of Zoology, Durham University).

Work on this project has continued from last field season. Pitfall trapping was repeated for the two forms, alpinus and cinerascens, at Bog End, together with hand collections.

Bog End is one major site in a series over a wide range of altitudes in north east England. It was the highest site in 1979. In conjunction with these other sites, it was found that:

1. There was a decrease in femur length with increasing altitude, both for adult cinerascens, and for instars 3 to 6.
2. Growth (and presumably hatching) occurs earlier at the lower sites, but the instar intervals are similar.
3. Moulting occurs at a smaller size at the high altitudes, resulting in a smaller adult size. Bog End specimens were smaller than all others.
4. Eggs dissected from mature adult cinerascens were not significantly different in diameter between sites.

Results for the 1980 field season are being analysed at present.

- c) Long term studies on upland Homoptera.

Sampling has continued.

- d) Post-fire succession in *Calluna*-dominated communities.
(R.J. Hobbs, Department of Botany, University of Aberdeen).

For the third successive season unfavourable weather prevented experimental burning. The one occasion on which burning was carried out at Moor House coincided with experimental burning in Aberdeenshire. Thus it was not possible to obtain temperature data for fires on blanket bog to compare with those from dry heaths.

Analysis of the permanent transects and quadrats set up in the Hard Hill experimental plots in 1978 was carried out in August. The results from these indicate that the trends found last year are continuing. *Eriophorum vaginatum* and *E. angustifolium* both increased in cover and frequency and in many places formed dense mats. *Calluna* also increased in frequency while most mosses and liverworts decreased. Some liverworts recorded in previous years have been completely eliminated. In general, *Calluna* and most liverworts, mosses and lichens were more frequent in the long rotation plots.

As in previous years, samples of Calluna were taken from each treatment in all four blocks of the Hard Hill experiment. From these terminal shoot lengths will be obtained.

It is intended to include the findings of these investigations in an overall analysis of vegetation development in heath communities after fire and to produce a model describing this development.

- e) The nitrogen economy of semi-natural upland soils.
(W. Howard, Department of Soil Science, Newcastle University).

Samples of peat from the Bog End tree plantation and A.J.P. Gore's blanket bog trials were taken to investigate and compare the organic matter, biomass and mineralisation relations of improved (N, P, Ca treatments) and untreated peat.

Reports awaited from the following Ph.D. projects:-

- f) Physiological studies of root growth in moorland species.
(Celia Jones, Department of Plant Sciences, University of Leeds).
- g) Seasonal dynamics of foliage in Eriophorum vaginatum.
(K. Robertson, Department of Plant Sciences, University of Leeds).
- h) Carbon balance of Sphagnum capillifolium (Ehrh.) Hedw.
(S. Daggitt, Department of Plant Sciences, University of Leeds).
- i) Adaptation to the upland environment in two closely related species.
(J.D. Graves, University College London).

Publication List.

- Crisp, D.T. & Robson, S. 1979. Some effects of discharge upon the transport of animals and peat in a North Pennine leadstream. *J. appl. Ecol.* 16, 721-36.
- Hobbs, R.J. & Gininghan, C.H. 1980. Some effects of fire and grazing on heath vegetation. *Proc. Colloque sur l'Ecologie des Landes*, Rennes, 1979. (in press).
- Horsfield, D. 1979. Notiophilus (Col., Carabidae) in Upper Teesdale. *Ent. Mon. Mag.* 114, 106.
- Rawes, M. & Hobbs, R. 1979. Management of semi-natural blanket bog in the Northern Pennines. *J. Ecol.* 67, 789-807.

Reports:

- Holms, P.J. 1979. Ecology and reproduction of the common frog, Rana temporaria temporaria (Linnaeus) in an upland and a lowland area in the northernmost counties of England. *Cert. in Field Biol., Special Study*.
- Jones, H.E. 1980. Experimental observations on competition in grasses. Merlewood Research and Development Paper, No. 79.
- Stewart, A.J.A. 1979. The environmental impact of moor gripping. Report to Chief Scientist Team, N.C.C.
- The following papers were noted as having data from Moor House.
- Burgess, I.C. and Wadge, A.J. 1974. The Geology of the Cross Fell area. H.M.S.O.
- Ferns, P.N. 1979. Growth, reproduction and residency in a declining population of Microtus agrestis. *J. Anim. Ecol.* 48, 739-58.
- Livett, E.A., Lee, J.A. & Tallis, J.H. 1979. Lead, Zn and Cu analyses of British blanket peats. *J. Ecol.* 67, 865-91.
- Manley, G. 1955-6. The climate at Malham Tarn. *An. Rpt. Council Promotion Field Studies*.
- Manley, G. 1979. Temperature records on Fountains Fell, with some Pennine comparisons. *Field Studies* 5, 85-92.

Meteorological Summary for Moor House 1979 (Met Office Station No 7188)
 c 558 m OD (Main Instrument Site) Lat 54° 41' N. Long 2° 23' W Nat Grid Ref NY/758328

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp °C	-0.9	-1.3	1.4	5.3	8.5	14.4	14.4	13.3	11.6	10.0	4.9	3.2	7.1
Mean min temp °C	-6.9	-5.1	-2.6	-0.4	1.5	6.0	7.8	7.1	5.3	4.9	-0.03	-0.9	1.4
½ (max + min) °C	-3.9	-3.2	-0.6	2.5	5.0	10.2	11.1	10.2	8.5	7.5	2.4	1.2	4.2
Highest max temp °C	4.6	1.9	6.3	12.4	15.8	22.4	19.6	19.3	17.3	16.9	10.9	8.7	22.4
Lowest min temp °C	-15.9	-11.5	-7.3	-8.9	-5.4	1.5	2.0	0.2	-2.9	-2.4	0.2	-7.9	-15.9
Lowest max temp °C	-5.1	-7.5	-3.8	0.5	1.2	8.7	10.2	10.2	6.7	5.2	-0.5	-2.6	-7.5
Highest min temp °C	1.5	0.4	3.6	4.8	7.4	11.2	12.6	12.5	12.3	10.5	7.0	5.6	12.6
Lowest grass min temp °C	-22.5	-16.6	-11.9	-12.4	-9.9	-1.9	-3.7	-4.6	-7.7	-6.5	-13.7	-12.6	-22.5
Earth temp 30 cm 0900 hr	1.2	0.7	0.8	2.6	5.5	9.9	11.0	11.2	10.0	8.4	4.5	3.7	5.8
Rainfall (mm)	379.4	465.7	508.7	168.7	172.2	78.9	102.2	174.6	159.5	155.8	241.3	358.8	2965.8
Rain days (0.2 mm)	22	18	28	24	23	14	21	23	21	24	27	25	270
Wet days (1.0 mm)	20	18	26	21	19	9	14	17	19	17	24	21	225
Days snow/sleet	10	15	16	14	5	0	0	0	1	0	10	10	81
Days snow lying	30	28	26	12	1	0	0	0	0	0	7	14	118
Days hail	0	1	4	1	2	0	0	0	1	1	0	1	11
Days snow/ice pellets	0	0	1	3	2	3	0	1	2	0	7	1	20
Thunder	0	0	0	0	2	3	0	1	0	0	1	0	7
Fog	8	12	7	3	3	1	3	1	3	8	5	7	61
Air frost	30	27	28	15	11	0	0	0	4	3	12	19	149
Ground frost	30	28	30	24	15	5	3	7	9	8	20	23	202
Av daily bright sun (hr)	1.42	1.49	1.69	3.18	4.55	6.30	4.20	3.74	3.94	2.55	1.41	0.78	2.94
Total bright sun (hr)	44.0	41.7	52.4	95.4	141.2	189.1	130.0	116.1	118.3	79.0	42.3	24.1	1073.6
Total snow (cm)	392	237	316	70	3	0	0	0	0	0	32	18	1068
Greatest depth snow (cm)	45	64	47	22	3	0	0	0	0	0	23	8	64
Days with gales	2	7	7	1	0	1	1	2	12	5	13	10	61
Solar radiation gm cal/cm ²	2002	3496	5861	7364	10785	*	*	*	*	*	*	*	*

* Data not yet received from Met. Office.

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