MOOR HOUSE
I.B.P.

MOOR HOUSE, WESTMORLAND

4th Annual Progress Report 1962/63

by M. Rawes and D. T. Crisp

GENERAL

The scientific staff in post on 30th September, 1962, remained unchanged. R. W. Martin (Estate Worker) retired, because of ill health, in December, 1962, and was replaced by D. Snowdon. A. Mason was appointed to the additional post of honorary Warden, assuming responsibility for the wardening of the west side of the Reserve.

A. SCIENTIFIC RESEARCH

I. Climatology (Mr. J. M. Nelson)

Routine observations at the Moor House Station continue. Measurements of air temperature are now being recorded by the Ministry of Aviation at its Great Dun Fell Radar Station (2,780 ft. O.D.) and have been included in the Meteorological Office's Monthly Weather Report.

II. Vegetation

The influence of management on the grasslands of Moor House
(Mr. M. Rawes and Mr. D. Welch)

(a) Measurement of changes in vegetation and soil following the removal of grazing

A paper entitled "First results of excluding sheep from high-level grasslands" has been prepared and presented for publication. This paper deals with botanical changes and production of herbage after seven and a half years enclosure.

(b) The establishment of natural grassland communities

Observations of plant introductions continue. In Rough Sike enclosure a small area, 3 m x 6 m, of limestone pavement in the process of colonisation, has been mapped in detail and records of species from point quadrat data, and details of soil depth, have been made.

(c) An experiment to raise the productivity of limestone grassland

Despite the late spring, grass yields have generally been high. Compound fertiliser - 10% N, 20% P and 20% K - was applied at the rate of 3 cwt/acre to the pasture enclosure and to the sampling area of the meadow. This increased the hay yield from 3420 lb. dry matter per acre to 4190 lb. in the meadow, whilst the pasture produced its largest crop to date, 4095 lb./acre.

(d) The productivity of grasslands in relation to sheep grazing

Measurements of grazing pressure (by direct observation and by recording dung deposition) and herbage intake continue. Three relatively productive Festuca/Agrostis grasslands of contrasting position, elevation and surrounding sheep density are being compared. One study area, Knock Fell (2 450 ft. O.D.) was investigated in the same way in 1962 and these results together with those from Little Dun Fell and Hard Hill have been prepared for publication. The other two sites are an alluvial grassland (the subject of productivity experiment, see "e" below) by the Tees at 1,700 ft. and a limestone grassland at 1 500 ft. on the western escarpment.

(e) The productivity of high-level Festuca/Agrostis alluvial grassland

A paper on this four year investigation has been submitted for publication. The effect on yield and chemical composition of different cutting regimes and a fertiliser application is described for enclosed and grazed grassland.

(f) Measurements of production in certain species of Sphagna (Dr. R. S Clymo (Westfield College, London))

Experiments were started in April, 1963, to measure production of eleven, and the break-down of three, different species of Sphagnum. The results will be compared with those obtained at a lowland site (Thursley Common, Surrey).

(g) The establishment of high-level woodland (Dr. A. Carlisle, Mr. A. H. F. Brown, Mr. E. J. White)

i. Species Trials

These plots survived the winter quite well. It is of interest to note that the Queen Charlotte Island Sitka Spruce were badly damaged by the cold winter, but that the Alaskan provenance of the same species was undamaged.

The Raasay provenance of Scots Pine in the pasture plot, which died during 1962, was replaced by Glentanar (Allachy) provenance.

ii. Tree Nutrition

The Lodgepole Pine Fertiliser Trial at Bog End had only 5% losses in spite of the severe winter. Failures were replaced in the spring. Many of last year's leaves were badly frosted and this caused a generally small height increment for 1963 but in spite of this there are already differences (particularly in leaf length), between the trees receiving different treatments. The plot was resampled in the autumn of 1963 and the data are being analysed. The recolonisation of the bare peat ridges is also being recorded, and it is quite clear that there are differences between plots. For example the bryophyte flora is coming in much more rapidly on plots receiving Ground Mineral Phosphate.

(h) Plant nutrition studies on peat (Mr. A. J. P. Gore)

Factors limiting plant growth on peat

1. Part III of the series "Factors Limiting Plant Growth on High-Level Blanket Peat" is now in press and is due to appear in the July volume of the Journal of Ecology.

2. A general summary of this work to date was given in a paper to the International Peat Congress Leningrad, 1963, entitled "Comparative ecological studies on peats at two different altitudes in Northern England".

3. Analysis of the second field experiment continues.

(i) Productivity of Blanket Peat Vegetation

The first cycle of observations has been completed with the 1963 harvest. It is now possible to give an estimate of the mean annual growth increment of the major higher plants of blanket bog at Moor House for a five year period. A measure of litter accumulation by Eriophorum vaginatum has also been obtained. Annual cropping of Eriophorum vaginatum for five consecutive years has produced no substantial fall in yield so far.

Improved methods of collecting rainwater for chemical analysis have been examined. These have involved a change of collecting site to a situation less likely to be influenced by domestic smoke. Phosphorus is difficult to determine accurately, partly because of its low concentration and partly because of the possibility of its removal from solution by bacterial action. The use of iodine impregnated polythene collecting bottles has virtually eliminated the second difficulty.

Before the new methods are placed on a routine footing further exploration of site variability will be undertaken.

(j) Reclamation of Eroded Peat Areas

A new experiment was set up in 1963, a short distance from the new road in Troutbeck, to test (a) the response of Deschampsia flexuosa to different forms of nitrogenous fertiliser and (b) the effect of surface disturbance (ploughing) of eroded peat on the growth of the same species.

The main object of this experiment was to find a way of getting the grass established sufficiently well in the first season to withstand the effects of frost-heaving in the first winter. Once the plants had survived one winter, past experience has suggested they were then able to become fully established, provided grazing was excluded.

The results so far indicate:

1. That formalized casein is a better source of nitrogen than either Nitro Chalk or Urea formaldehyde. This may prove important since a formalized casein is a so called "slow acting" nitrogenous fertiliser and if its effects are prolonged into later years it will clearly be advantageous as it is not proposed to make further applications of nutrients after the initial one.

2. Ploughing of the peat released available nitrogen in such a way as to produce a growth response equivalent to the formalized casein at the "high-level" treatment.

The effects of winter will be of interest in this experiment and it should be possible to report on these in the next progress report.

(k) The autecology of Juncus squarrosus (Professor D. H. Valentine)

Mr. Welch has continued his studies and is beginning to write them up in the form of a thesis in candidature for the degree of M.Sc. The work includes studies of seed production, germination and establishment, a phytosociological survey of the main Juncus communities and an investigation of the morphology of the plants and the tussocks which it forms. Some experiments at Durham on the effects of light on germination are being planned for the coming season.

(l) Laboratory scale burning experiments (Mr. S. E. Allen)

This work has now been virtually completed and is being prepared for publication.

III. Fauna

(a) Durham Colleges Zoology Department (Dr. J. C. Coulson and Dr. L. Davies)

Students from the Durham Colleges, under the supervision of Drs. Coulson and Davies have continued to make full use of the Reserve for ecological studies.

i. Studies on the Auchenorhynca (Hemiptera : Insecta) of Pennine Moorland with special reference to the Cercopidae (J. B. Whittaker)

A total of 32 species of Auchenorhynca have been collected on the Moor House Reserve.

The biology of two Cercopidae (Neophilaenus lineatus and N. exclamationis) has been studied with emphasis on the function of their spittle. Two species of Auchenorhynca which do not have protective spittle have been studied for comparison. The spittle is shown to be of some survival value at Moor House, but the advantages are not sufficient to give the Cercopidae a significantly higher survival rate than other Auchenorhynca.

The Auchenorhynca at Moor House are at the edge of their vertical range, and suffer local extinction.

The work is completed and written up in thesis form.

ii. Studies on the Acarina of Moorland Areas (W. G. Block 1960-62)

A total of 76 species of mites has been recorded from the Reserve, while several more will be added when certain species groups have been critically examined. All of these species have been previously recorded from Britain. The closest similarity exists between the Moor House fauna and the records from north Finland and Iceland.

Seasonal changes in the density of Acarina have been studied using a modified Macfadyen high gradient extractor. Spring and autumn peaks of density were recorded and were related to the breeding pattern of individual species. The Acarina are aggregated in the soils studied, and only Rhodacarus roseus has a vertical migration. The overwintering mortality in a three month period for the total mite fauna is estimated to be 20-23 per cent.

The species compositions of the upland peat and mineral soil types are similar, but quantitatively there are significant differences. The biomass of Acarina on these areas ranges from 0.89 to 1.85 grammes per square metre.

The study has now been completed and is written up in thesis form.

iii. Biological studies on Enchtraeidae (Annelida)
(Mrs. J A. Springett)

Work is being carried out on the Enchytraeidae of Moor House at five vegetation types:- Juncus squarrosus, Nardus stricta, Limestone grassland Mixed moor and Bare peat. Population densities, species composition, age structure, and the vertical distribution of the worms are being studied. The main progress during the year has been the development of a successful method of culturing the animals in the laboratory. Field observations can now be compared with the results of laboratory breeding experiments.

iv. Ecological Studies on Carcass Beetles (B. P. Springett)

Trapping with baited pit-falls has shown that only one species of the genus Necrophorus occurs at Moor House. This is Necrophorus investigator, Zett, which is active as an adult from the second week in July until mid-September.

Detailed observations on the biology of these beetles are being made elsewhere.

V. M. Hadley D. Gibbons and M. Edge have recently begun research at Moor House. The former is working on Tipulidae and the two latter on Diptera associated with sheep dung.

(b) The ecology of testate amoebae in Sphagnum (Dr. O. W. Heal)

The study of seasonal fluctuations in numbers of Testacea in Sphagnum has been completed and, along with other data, is being prepared for publication.

(c) The Ephemeroptera of the Moor House Nature Reserve (Dr. D. T. Crisp and Mr. J. M. Nelson)

Some additional sampling was carried out during 1963. The species of over 1,000 nymphs of the genus Baetis will be determined during the winter of 1963-64 and the work will then be written up for publication.

(d) Studies on Diptera (J. M. Nelson)

i. The Diptera of Rough Sike

During the 1963 season five rafts carrying sticky tops have been maintained in the lower reaches of Rough Sike to sample the Diptera on and near the stream surface. Five other sticky traps have been operated on the stream banks for comparison. It is hoped that this work will be written up during the winter of 1963-64.

ii. General collecting of Diptera

General collections of Diptera are being made. Particular attention is being paid to the Empidae of which about 35 species have been identified. Pairs of sticky traps have also been operated throughout the season in four habitats. The bulk of the catch on these traps was Anacrostichus verralli Callin., which did not appear to show any obvious habitat preference. Other Empids were only caught singly at irregular intervals on the traps.

IV. Hydrology

(a) Studies on selected catchments (Mr. A J. P. Gore)

This work is still in abeyance so far as studies on a catchment scale are concerned. However, research on the vegetational aspects of the problem is in progress and is described above (II j).

(b) The hydrology of upland areas (Mr. V K. Collinge)

Work has progressed on the dozen recording rain gauges and on improving their reliability. It is intended to extend the rain gauge network of Troutbeck in 1964. Work has also progressed on the development of methods of stream gauging using chemicals and it will now be possible to check the calibration of the weir on the Troutbeck.

(c) The effects of streams on the productivity of Moorland (Dr. D. T Crisp)

The modifications necessary for operating the apparatus in high floods were completed in late October 1962. A year of routine sampling is almost completed and it is expected that calibrations of the apparatus and several small additional observations will be completed by early 1964. The work will then be prepared for publication.

V. Soils

(a) Respiratory activity of moorland soils (Mr J. B. Cragg)

This work is continuing.

(b) Fungi and Bacteria associated with moorland sites (Miss P. M Latter)

In addition to the work described in the 1962 report, studies are in progress on the succession of fungi on decomposing Juncus leaves.

VI. The list of research projects in the Management Plan /E/M/59/51 (3) (j) p. 20-23/ should be amended as follows:-

(iv) Zoology

Completed	Studies on the Auchenorhynca (Hemiptera) of Pennine moorland with special reference to the Cercopidae (Mr J. B. Whittaker)
	Studies on the Acarina of moorland areas (Mr. W. C. Block)
	Ecology of testate amoebae in Sphagnum (Dr. O W. Heal)
In progress	Studies on Diptera (Mr. J. M. Nelson)

(v) Botany

Completed	The productivity of high-level Festuca/Agrostis alluvial grassland (Mr. M. Rawes)
In progress	Measurements of production in certain species of Sphagna (Dr R. S. Clymo - visitor)
	Reclamation of eroded peat areas (Mr. A J. P Gore)

(vii) Hydrology

In abeyance	Studies on selected catchments (Mr. A J. P. Gore)

VII. Publications

Banage, W. B. (1962) Some Nematodes from the Moor House National Nature Reserve, Westmorland, Nematologia 7, 32-36.

Banage W. B. (1963) The ecological importance of free-living soil nematodes with special reference to those of moorland soil. J. anim. Ecol. 32, 133-140.

Barling, D. M. (1962) Studies in the biology of Poa subcaerulea Sm. Watsonia. 5, 163-173.

Bradshaw, M. E. (1962) The distribution and status of species of Alchemilla vulgaris L. aggregate in upper Teesdale. J. Ecol. 50, 681-706.

Bradshaw, M. E. (1963) Studies on Alchemilla filicaulis Bus. sensu lato and A. minima Walters. Introduction and 1) morphological variation in A. filicaulis sensu lato Watsonia, 5, 304-320.

Crisp, D. T. (1963) A preliminary survey of brown trout (Salmo trutta L.) and bullheads (Cottus gobio L.) in high altitude becks. Salm. Trout Mag. 45-59.

Hale, W. G. (1963) The Collembola of eroding blanket bog. Soil Organisms, ed. J. Doeksen and J. van der Drift. 406-413.

Heal, O. W. (1963a) Morphological variation in certain Testacea (Protozoa : Rhizopoda). Arch. Protistenk. 106, 351-368.

Heal, O. W. (1963b) Cladocera (Crustacea) from Pennine moorland. Naturalist. Lond. No. 885, 47-49.

Lines, R. and Howell, R. S. (1963) The use of flags to estimate the relative exposure of trial plantations. Forestry Commission. Forest Records No. 51. 31p.

Springett, J. A. (1963) The distribution of three species of Enchytraeidae in different soils. Soil Organisms, ed. J. Doeksen and J. van der Drift, 414-417.

B. ESTATE WORK

(a) Roadworks

Six hundred and fifty yards of the access road, in two sections, has been re-surfaced. One section was from the top of the "Snead" north to the concrete bridge, and the other, from a point about 300 yards north of Lady Vein Gate towards "Mine Rails". Stone from Hard Chines Mine heaps was laid, rolled and bound with clay and limestone waste, and finally surfaced with fine gravel from Rotherhope Mine. The depth of new work varied between six and eighteen inches, though a sunken portion of twenty yards was built up 2-3 feet.

Maintenance of drains, culverts, retaining walls and the filling of pot holes has been continued and Trout Beck bridge has been extensively repaired. Joists are now supported at each abutment with 12" thick reinforced concrete slabs. New sleepers have been laid and the side rails replaced.

(b) Moor Burning

No heather was burnt this year.

(c) Hay Meadow

The crop was cut in July and August. Half a ton was purchased from the Warden for the horse.

(d) Enclosures

Repairs to the summit ridge grassland exclosures have been continued and the remainder of the original fencing wire and some posts on Little Dun Fell have been replaced. New wire has been put to sections of the pasture fence, whilst two new enclosures were erected in Troutbeck.

(e) Winter

Access by road to Moor House was blocked from 29th December to 19th March. Much of the final clearance was made by a hired bull-dozer. Half-tracks for the tractor were acquired in mid-January, but whilst they were of distinct value the depth of snow limited their usefulness. Horse and sledge proved the most satisfactory means of transporting provisions.

(f) Wardening

Pest control: five foxes were killed on the east side of the Reserve.

C. PUBLIC RELATIONS

Interest in the Field Station continued. The number of visitors, including research workers, increased over previous years. 165 people signed the visitors' book compared with 72 the previous year.

A new Youth Hostel Association hostel at Close Houses, Knock, was opened in April and good relations have been established with the Warden. More walkers have used the rights-of-way over the Reserve but there has been no call for complaint. Increased use by private cars of the Ministry of Aviation's road up to Great Dun Fell has been noted.

During National Nature Week the Field Station was open to the local public for the week-end 25th-26th May and invitations were sent to Eden Field Club.

Invitations were sent to representatives of over sixty organisations to attend a field demonstration on 29th May of the work in progress. Some thirty people attended.

Visitors to Moor House this year have included:-

Drs. D. Jenkins, A. Watson, G. R. Miller (Unit of Grouse and Moorland Ecology)
Mr. M. Mountford (London Headquarters)
Miss V. Collins (Freshwater Biological Association)
Mr. I. Thorsteinsson (University Research Institute, Reykjavik)
Dr. A Milne, Mr. R. Coggins (A.R.C., Unit of Insect Physiology)
Dr. Loughlin (University of Newcastle)
Mr. Dewing (Deputy C.A.O., Westmorland)
Mr. Thompson (D.A.O., Westmorland)
Mr. Godfrey (Manchester Water Board, Thirlmere)
Dr. W. A. Clark (Department of Botany, University of Newcastle)
Mr. C. Clay (Chief Engineer, Wear and Tees River Board)
Dr. and Mrs. Berthet (Louvain University, Belgium)
Dr. C. Kidson (Furzebrook)
Mr. D. B. Smith, Mr. T. V. Parsons, Mr. Wurzel (A.E.R.E., Harwell)
Mr. J. C Edwards (London Headquarters)
Mr. D. Parnwell (Treasury)
Mr. and Mrs. Paul Holmes, Miss D. Williams (Malham Tarn Field Centre)
Mr. O. Gilbert (Department of Botany, University of Newcastle)
Mr. G. Schlätzer (Desert Arboretum, Denmark)
Dr. R. Scott-Russell (A.R.C., Radiobiological Laboratory)
Dr. D. Anderson and party of students (Botany Department, University of Sheffield)
Dr. M. C. Pearson and Mr. B. H. Green (Botany Department, Nottingham University)
Dr. P. J. Newbould (Botany Department, University College London)

In September eight students of the University College London Diploma Course in Conservation spent a full week at the Field Station, under the instruction of Drs. F. B. O'Connor and K. Taylor.