

Chapter (non-refereed)

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The speculative step in the calculation concerns the relationship between tractive stress and sand transport rate in a zone where both are changing spatially. Uniform flow relationships cannot be relied on in such a zone, since one implication of Bagnold's two-stage model is a dislocated grain transport response to a change of wind condition. An attempt is being made to establish this relationship with sufficient accuracy to make predictions of dune growth reliable.

Were the attempt to be successful, there would be several useful consequences in terms of machair. Most obviously, the predictive capacity developed would help in deployment

of fences used to control sand drifting. Perhaps this would be less useful, however, than the consequent ability to predict sand behaviour in areas where tractive stress varies for unintentional reasons in no way connected with fences. Such circumstances occur, for instance, on any topographical feature, wherever patches of bare sand occur in a generally vegetated area, or where there are dry areas in a generally wet sand surface.

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Extensive Survey of Dune Vegetation in Scotland

D. S. Ranwell

Over the past ten years, regular visits have been made to Scotland to improve botanical knowledge of coastal sites in anticipation of inevitable changes. These reconnaissance visits provided lists of vascular plant species, information on the range of habitat and vegetation types, and on human impacts on the environment, for the Nature Conservancy.

Within the past five years, with more assistance available, a more quantitative approach was developed to sample the range of habitats in representative examples of our bigger dune systems such as St. Ouens Bay, Jersey, Channel Islands (Ranwell 1975, 1976), Strathbeg, Aberdeenshire and Dunnet Links, Caithness. Data have been subjected to reciprocal averaging analysis (Hill, 1973) and indicator species analysis (Hill, Bunce & Shaw, 1975), but results of these exploratory analyses have not been published.

Recently, these studies have been transformed by the needs of the Nature Conservancy Council for objective information on a large scale urgently in relation to oil and other developments on the Scottish coast. The Institute of Terrestrial Ecology has been asked to take responsibility for biological survey of 94 sites (mainly sand dune) all round the coast of Scotland, covering a total area of some 32,500 ha. The study was started in April 1975 and is expected to run for 3 years.

The objectives are to determine the nature and extent of habitats and composition of vegetation so that objective comparisons can be made between sites. Also the survey aims to record the vascular plants, terrestrial bryophytes and lichens on each site, and to estimate so far as possible, population sizes and distributions of rare species. Estimates of the effects of human activities on the site are also to be given.

The method for objective botanical and habitat survey has been adapted from Bunce and Shaw (1973). Sampling points were pre-located objectively on 6 inch to the mile maps and located in the field by direction and distance from fixed features on the map. Each sampling point was the centre of a uniformly orientated nest of six quadrats increasing in size from 1m² to 200m². The nest of quadrats gives information on habitat variability around the sampling point. Vascular plants are recorded in an additive way so that only new species are recorded in quadrats successively larger than the 25m² quadrat. Cover and height measurements of the vegetation are made for the 25m² quadrat, and a collection of bryophytes and lichens from this size also made. Environmental data and a sketch map are recorded on the 200m² quadrat. Soil and water table data are collected from a small pit and augur borings to 2m at the sampling point, the centre of the nest of quadrats.

In 1975, 1,117 sampling points were recorded at 28 sites by 4 teams of two people working from May to September. Data are coded, punched onto tape and stored in a computer. Analyses will provide objective site to site comparisons and explore correlations between a wide range of environmental factors and vegetation.

Further information on the progress of the survey is given in Institute of Terrestrial Ecology: Annual Reports for 1975 and 1976.

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Birds and Machair

I. R. Hepburn

INTRODUCTION

Sand dunes and machair systems have attracted a large number of workers from a variety of disciplines within the general field of 'environmental sciences'. These include plant and animal ecologists, geomorphologists and palaeo-ecologists. It appears, however, that little attention has been paid to the bird-life of these systems. A search of the more recent ornithological literature uncovered only one paper on the "bird populations of a Welsh sand dune system", and nothing at all relating to machair birds.

This dearth of information is particularly apparent when considering breeding birds. Many sand dune systems (such as Blakeney Point, Norfolk and Minsmere, Suffolk) are very well known to ornithologists for their regular attraction of passerine migrants. Such birds are normally not associated with the dune systems, but with the scrub or tree cover which is invading the dunes either through natural succession or with aid from man. Less is known (or at least little is published) about the breeding birds of these same systems.

This paper, while not pretending to rectify the present situation, may be regarded as an initial statement summarizing the ornithological status and significance of one particular sand dune and machair area in the Outer Hebrides — the Monach Isles.

The work reported here was carried out during the summer of 1973, and concentrates on the distribution of breeding bird populations within different habitats.

HABITATS

The plant communities of the Monach Isles (Photos 4 and 5) were described by Dr. Randall during the first meeting of the Machair Working Group. As a brief summary, the 5 islands situated 10 km south-west of North-Uist are comprised of 8 basic vegetation habitats:

1. Unstable dunes, dominated by *Ammophila arenaria*
2. Flat dunes, dominated by *Ammophila* and *Bellis perennis*
3. Stable dunes, dominated by *Ammophila* and *Carex arenaria*
4. Machair pasture, dominated by *Bellis perennis*
5. *Carex arenaria* pasture
6. Maritime cliffs and coastlands, dominated by *Armeria maritima*
7. Peatlands, dominated by *Carex nigra*
8. A 'residue' of strandline and cobble-beach habitats

The habitats relevant to the following discussion are firstly, stable dunes (which includes flat dunes), and secondly, machair pasture. These two habitats cover about 75% of Ceann Ear, the island on which most of the bird distribution survey work was carried out.

BREEDING BIRDS

Nine species were recorded as breeding in either or both of the stable sand dune and machair habitats. This record accounted for 25% of the total number of species found breeding on the Monachs. Two species were found nesting on stable sand dunes but not machair: eiders, which require the extra cover provided by marram compared with the shorter, grazed machair turf, and starlings which used deserted rabbit burrows in the dunes. Three species nested in both machair and stable dunes: fulmars, skylarks and meadow pipits. The last two are commonly associated with dune and grazed pasture habitats, but the fulmar's use of sand dune and machair habitats is of particular interest. The nest site distribution of this species was the subject of a detailed investigation, and it was found that 57% of the total fulmar population of 176 nests on four islands was using sand dune/machair nest sites. Most of these nests were located in stable sand dune areas adjacent to the sea. Others were inland on the machair, often where rabbit