

Following the removal of sheep, deep ploughing of the site prior to planting, and subsequent tree growth, surveys made in 1972 and 1975 on a permanently-marked sampling grid with intersections at 100 m have detected vegetation changes. In the first three years after planting, the herbaceous and rushy vegetation of a poorly-drained pasture has become dominated by coarse grasses and colonizers of bare-ground such as willow herb (*Epilobium* spp. and *Chamaenerion angustifolium*), foxglove (*Digitalis purpurea*) and thistle (*Cirsium vulgare*) (Plate 11). Species of meadows (*Ranunculus acris*) and heaths and moors (bilberry) (*Vaccinium myrtillus*) and deer grass (*Trichophorum caespitosum*) have decreased.

The distribution of vertebrates to some extent reflects habitat changes—a study of these inter-relations being an integral part of the project. Of five species of wading birds which bred on the area in 1972, only one pair of curlews (*Numenius arquata*) remained in 1977. In contrast, passerines, such as the whinchat (*Saxicola rubetra*), have become more numerous, with a pair of breeding goldcrests (*Regulus regulus*) being recorded in 1977. The woodmouse (*Apodemus sylvaticus*) was recorded in 1972 and 1977, but not in the intervening years, whereas the common shrew (*Sorex araneus*), which was uncommon in 1972, had become the most abundant small mammal species by 1976. Numbers of field voles (*Microtus agrestis*) reached a peak in 1974–75 and then decreased, with those remaining in 1977 being widely distributed in small colonies.

J.M. Sykes and V.P.W. Lowe

Reference

Hill, M.O. and Evans, D.F. (1976). Effects of ageing plantations of Sitka spruce on the semi-natural vegetation of south-west Scotland. *Institute of Terrestrial Ecology. Annual Report 1975*, 54–57. HMSO.

SCOTTISH DECIDUOUS WOODLANDS

(This work was commissioned by the Nature Conservancy Council as part of its programme of research into nature conservation)

Before a resource can be rationally managed it is desirable to have a detailed understanding of its amount and distribution. Because observations suggested that the decreases, noted by Forestry Commission censuses made in 1947 and 1965, may be continuing, ITE was asked to make a total enumeration of Scottish deciduous woodlands (Plate 12). Accordingly a map search of Scotland was made using the 7th series Ordnance Survey maps. This identified 3500 woods marked with broadleaf symbols and individually larger than 5ha. All sites excepting the most remote have now been visited; in the instance, it was first necessary to establish the presence of woodland before making visual estimates of canopy composition including the abundance

of birch, oak, beech, sycamore, elm, ash and others. Woods with over 50% of non-native species were omitted but 'policy' woods were included. A data bank is now being established with details of canopy composition being allied to the name, location, grid reference, area and altitude of each wood. It will provide a framework for assessing the significance of individual sites and the need for more intensive sampling in the future. Additionally, by comparing with the FC survey done in 1965, it should be possible to assess if the loss of deciduous woodlands is continuing or has been arrested—there was a 21% loss between 1947 and 1965.

R.G.H. Bunce and R.C. Munro

LICHEN MONITORING OF AIRBORNE FLUORIDE POLLUTION

Lichens, not having roots, absorb nutrients directly from the air and from solutions bathing their thalli. Whereas those growing on the bark of trees (corticolous species) absorb substances from stemflow, which is often enriched with tree leachates, those growing on relatively dry rock surfaces (saxicolous lichens) are, to some extent, dependent upon minerals released from those rocks, the weathering process often being influenced by the lichens themselves. Many lichens, particularly epiphytes on hedgerow twigs, depend almost entirely for their nutrition on substances (ions) captured from aerosols and suspended rainwater droplets.

Because they continue to absorb ions even if non-essential or required only in very small quantities, it has been possible to use lichens when monitoring the occurrence and dispersion of airborne pollutants. In North Wales and elsewhere, corticolous lichens have been shown to accumulate airborne pollutant fluoride more efficiently than saxicolous species. On accumulating 50 to 80 $\mu\text{g F}^{-1}\text{g}^{-1}$ thallus dry weight, lichens begin to be adversely affected and death may ensue. In continued studies of a series of permanent quadrats, using assessments made on annual photographs, it has been found that the growth of saxicolous lichens was retarded, without obvious blemishes, by sub-lethal concentrations of fluoride, a relation extending the range of concentrations of fluoride that can be detected in the 'field'.

Not all lichen species are affected equally by pollutants, sensitivity appearing to be related to habitat and life-form. Observations for 6 years since the release of airborne fluoride indicate that corticolous species are affected before fruticose (erect) saxicolous species, e.g. *Ramalina* sp, which are good absorbers of airborne substances. The foliose (leaf-like) saxicolous forms, e.g. *Xanthoria parietina* and *Anaptychia fusca*, are usually less sensitive than the types already mentioned, but