PEAT-CUTTING AND THE INVERTEBRATE FAUNA OF LOWLAND PEATLAND: THORNE AND HATFIELD MOORS IN A NATIONAL CONTEXT

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Lowland fen peatlands are among the richest habitats in Britain for their invertebrate faunas. Lowland acid peatlands, the raised mires such as those of the Humberhead Levels, West Wales and the Solway, naturally support less species-rich communities of invertebrates than do their fenland counterparts, but those species that do occur there tend to be specialists with exacting life history requirements, vulnerable to changes in their habitat. The diversity of fauna of these acid peatlands is agumented by species inhabiting the natural interface between lowland mire and surrounding vegetation, often fen, poor fen, reedswamp or carr, as well as the true inhabitants of these other types of habitat. The current total number of species of insect recorded from Thorne Moors in the Humberhead Levels is in excess of 2,500 (Skidmore, Limbert & Eversham, 1985) and this total is being added to annually. Hatfield Moors has been far less intensively studied, but still has a diverse recorded fauna, with a high proportion of rare and scarce species.

The lowland mire habitat has become so rare in Britain as a result of human activities, in particular agricultural reclamation, drainage and peat-cutting, that many of the associated species have declined to the extent that they warranted recognition either in the Insect Red Data Book (Shirt, 1987) or in the NCG's reviews of scarcer species (Ball, 1986). A number of very rare species of invertebrate are restricted to these habitats. The ground beetle, *Bembidion humerale,* and the pill beetle, *Curimopsis nigrita,* have been found on the two largest peatlands of the Humberhead Levels, Thorne Moors and Hatfield Moors, and nowhere else in Britain. Both are categorised as endangered in the Insect Red Data Book.

The lowland peatlands of central Britain are also of biogeographical interest in that boreal, moorland or montane peatland species, for example the shorebug, *Teloleuca pellucens,* co-exist with species more typical of southern peatlands such as the New Forest bogs or the wetter parts of the southern lowland heathlands, for example the shorebug, *Hicracanthia marginalis.* The only site in Britain where these two species with contrasting distributions have been found together is on Thorne Moors. The limits of many species' ranges lie on or close to the Humber-Mersey line, so the geographic position of Thorne and Hatfield Moors plays an important part in their faunal diversity. A separate subspecies of at least one northern species, ssp *davus* of *Coenonympha tullia,* the Large Heath butterfly, is recognised only from the lowland peatlands of central Britain and has declined considerably with the destruction of its former sites. A more detailed analysis of the biogeographical importance of Thorne Moors is given by Skidmore. *et al* (1985), but a few simple statistics illustrate the value of the two Moors.

If points are allocated to each recorded species, according to its national and regional status, an 'Invertebrate Index' can be calculated. Using this measure, Thorne Moors proves to be the richest locality in Northern England for invertebrates, and Hatfield Moors is the 10th richest. Compared with other lowland peatland sites, Thorne ranks fourth in Great Britain, and is narrowly beaten only by four *fenland* sites in East Anglia. In other words, Thorne is the richest acid peatland site in the country. On the strength of its recorded fauna, Hatfield is the fourth richest lowland raised mire in

Britain. (NB: the Invertebrate Index is heavily influenced by recording activity, so an under-worked site such as Hatfield will score disproportionately low. Thorne has been quite intensively studied, but so have many of the other 'top sites' such as Woodwalton Fen, Wicken, or the Somerset Levels.)

A high proportion of the remaining examples of lowland raised mire habitat have been recognised by the NCC's Invertebrate Site Register as supporting significant assemblages of rare invertebrates, such that they warrant recognition as Sites of Special Scientific Interest purely on their invertebrate fauna (eg. Key, 1986).

Of prime importance to the invertebrates of these peatlands is the hydrology of their environment. Almost all species restricted to peatland are obligate hygrophiles at some stage in their life history, many being aquatic or inhabiting wet moss or accumulations of wet plant litter. These species are very vulnerable even to short periods with unsuitable hydrological conditions such as might be caused by drainage of adjoining peatland prior to peat-winning. Less fastidious species do also inhabit these peatlands, but these tend to be more widespread species, responding more to other aspects of their environment such as vegetation structure than to the hydrology, and these tend also to occur in other habitats such as heathland or even arable land.

Microhabitats of particular importance to invertebrates in these peatlands include:

Sphagnum moss communities Specialist species inhabit *Sphagnum* with different water content and hummock structure. Predatory ground beetles (eg Agonum *ericeti)* and wolf spiders (eg *Pirata piscatorius)* range over the surface of the moss, while other species live within the moss hummock itself (eg the larva of the cranefly *Phalacrocera replicata)* or in the water in which the moss is growing (eg beetles of genus *Cyphon).*

Ericaceous wet heath Peatland specialists tend to be those species inhabiting the accumulation of damp litter beneath the heather. The endangered pill beetle *Curimopsis nigrita* lives at the interface between litter and wet peat where there is heather.

Bog dominated by sedge or cotton grass A small number of phytophagous species feed on the foliage of plants such as cottongrass - for example the Large Heath butterfly. Rather more species are associated with the litter accumulating beneath the plants or are dependent on the tussock structure afforded by the plants, which provides either cover and retreats, such as for the lygaeid bug *Lamproplax picea* or various beetles of the families Carabidae and Staphylinidae, or sites for web-spinning spiders such as the orb web spider *Neoscona* adianta.

Peat pools A rich assemblage of water beetles, dragonflies, water bugs and flies with aquatic larvae inhabit Sphagnum-dominated pools or ones with peaty water. While few of these are restricted entirely to lowland raised mires, a proportion are predominantly northern in distribution and therefore of biogeographic interest when occurring in peat bogs in the central parts of Britain. Traditional peat-cutting techniques have frequently favoured this fauna in leaving a varied topography with numerous hollows cutting into the water table.

Bare, wet peat (particularly in association with peat pools or old peatcuttings). Naturally occurring bare peat is probably one of the rarest microhabitats within a

natural raised mire ecosystem, but it is one which is richly exploited by specialist invertebrates, in particular by visually hunting diurnal predators which need open space in which to hunt. The endangered ground beetle, *Bembidion humerale*, is typical of the narrow band of wet peat at the margin of certain types of pool, particularly where there is a thin covering felt of algae. A number of peatland Diptera also exploit this habitat, their larvae developing in the semi-liquid peat and the adults often running rapidly over the peat surface, for example flies of the family Ephydridae. The presence of overhanging vegetation, in the form of heather or cottongrass tussocks, may be critical for species inhabiting this microhabitat, providing cover and retreats for the insects. Certain types of peat-cutting increase this type of habitat considerably when compared with the uncut peatland. The margins of some drainage ditches may provide a similar habitat, and the hollows left by traditional peat-cutting techniques, if sufficiently wet, may become colonised by this fauna.

Associated habitats. Lowland raised mires are frequently surrounded by and grade into other natural vegetation types, most frequently poor fen, fen, reedswamp and carr woodland, less frequently coastal habitats such as saltmarsh and sand-dune. the saline-influenced marginal vegetation at Thorne Moors is of particular significance for its invertebrates, supporting a range of species otherwise known principally from coastal habitats. A crucial factor in the survival of the full range of peatland microhabitats, and the wide variety of associated habitats, is the Thorne and Hatfield Moors. The larger a site, the better is the chance that it will contain all the important features on which rare and specialised invertebrates depend. Thorne and Hatfield Moors are the two largest lowland raised mires in Britain, which helps to explain their exceptional richness for invertebrates.

CUT-OVER PEAT

Traditional methods of peat extraction, hand-cutting or the turf-block/ peat-baulk system, generally do not appear to have seriously endangered the continued survival of the peatland invertebrates, at least not where natural mire community regeneration has continued apace with the peatcutting activities. Indeed, the populations of some species may initially benefit from the increased mosaic of habitat diversity, wet hollows with bare peat margins and increased tussockiness that frequently result from these methods of peat extraction. Regeneration of a small amount of birch and sallow may also benefit certain heathland/peatland phytophagous species but quite frequently lead to problems of succession to woodland, leading to loss of peatland habitat.

In contrast, milled or sausage-extracted peatland tends to be very inimicable to typical peatland species, notably because of the drainage of the habitat that precedes the cutting, leading to a very dry surface, coupled with the complete loss of vegetation which provides food and cover. A very small number of dry, open-ground species do utilise the aftermath of these cutting methods, but these are ubiquitous species, typical of disturbed or arable ground, or the less fastidious elements of the heathland fauna that may have been present on the site. Species typical of the bare peat in the uncut or traditionally cut-over peatland do not exploit milled-over peatlands as they are too dry and lack surrounding cover. Vegetation regeneration on such surfaces is most frequently dominated by dense bracken and/or birch scrub, neither habitat being suitable for mire-associated invertebrates.

RESTORATION OF PEATLAND

Entomologists have perhaps more cause to be sceptical concerning proposals to restore peatlands to their original mire conditions after peat-winning operations than have other conservation workers. While it may eventually be possible, by the judicious introduction of component plant species, to re-create an actively growing peat surface, with the same appearance and botanical composition as a natural system, this method is not an option for communities of invertebrates. It would be logistically impossible to attempt re-introduction of the thousands of species involved, particularly as the ecology of most species of invertebrates, even in some of the most well-recorded groups, is so poorly understood that the methodology for such a re-introduction programme could not be worked out.

The fauna re-establishing itself on a regenerated mire would therefore, of necessity, have to result from natural re-colonisation. The success or otherwise of this would be dependent on the presence of a refugium where the species are able to exist while the cutting operations are continuing, ie. an area of high-quality, undisturbed peatland. This refugium would have to be very close to the re-generating area, as many species of invertebrate, including peatland species, are flightless and slow or 'reluctant' to colonise or re-colonise new territory, particularly if the new habitat is separated from the refugium by non-suitable habitat. It would, in fact, need to be directly adjacent to the cut-over area and would therefore be likely to be vulnerable to the influence of drainage operations etc. carried out there.

The extremely specialised nature of most invertebrate species also necessitates that the refugium would need to be very diverse, in order to cater for the diversity of niche requirements of the various invertebrates, and very large, to circumvent the likelihood of chance extinctions likely on small sites. The habitat quality on the refugium would also need to be maintained to the highest level for the invertebrates which, with largely annual life cycles, need ideal conditions continually if they are to survive. Its fauna would therefore be vulnerable to even a short period of unfavourable conditions such as drought or fire, which could cause large numbers of extinctions.

Finally, in the event of some attempt having been made to re-establish some of the fauna, there is no way in which the success of the operation could realistically be judged. At Thorne Moors, for example, invertebrate recording has been going on for over a century, and yet the rate at which additional species are being discovered there shows no sign of abating. These new species are not ones colonising the site anew, but rather are species previously overlooked, perhaps occurring at extremely low densities or only revealed by novel invertebrate recording techniques. It is, therefore, impossible to establish a comprehensive baseline inventory of species at any particular site before peat-cutting operations begin, and this would apply equally to attempts to monitor the re-establishment of the fauna. At best, a small number of easily recorded 'target' species might be chosen as representatives to monitor. Almost inevitably the successful re-colonation of a small number of conspicuous species would be interpreted as success for the re-establishment technique and used as a precedent argument for the continued exploitation of pristine sites or ones that have only been cut over by traditional means.

In conclusion, the lowland peatlands of Britain are of national importance for the conservation of this country's invertebrate fauna, being of zoogeographical importance as well as supporting large numbers of rare, and in some cases, very rare

species. This fauna has been considerably reduced by the loss of habitat resulting from a number of human activities, including peat-cutting. There is considerable doubt that any kind of peatland re-generation programme could accomnodate more than a proportion of the invertebrate assemblage associated with this and associated habitats. The remaining intact, or only lightly damaged, examples of this habitat must not, therefore, be in effect 'traded off' against the dangers and uncertainties concomitant with attempts at re-establishment of the habitat on cut-over sites.

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