

## **Peatland conservation - the Cinderella Syndrome**

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Individually, the Sphagnum bog moss is a small and delicate plant; collectively it can control watersheds or even dominate whole landscapes. It can also destroy organisations. A widely-held belief continues to circulate that the passing of Britain's official nature conservation body into history on 2 April 1991 can be attributed to the political controversy provoked by this genus. As Malcolm Newson observes elsewhere in this volume, conservation ultimately comes down to politics, and peatland conservation has experienced politics in no small measure during the last decade.

No-one outside the Cabinet of the UK government really knows what stimulated the highly controversial decision to split the Nature Conservancy Council (NCC) into country agencies, but it is widely reported that the political embarrassment of issues such as Duich Moss, Islay, and the Flow Country, Caithness and Sutherland, were the final straws. In the case of Duich Moss, intervention by the European Commission eventually forced the UK government to reverse its original decision to permit commercial peat extraction on this internationally important peatland site. In both cases, however, the scientific evidence indicated the need for difficult political decisions to be made between conflicting land-uses.

In advising on these cases the NCC was simply fulfilling a statutory obligation to inform the government of the scientific significance of the cases. For the Flow Country, for example, the scientific evidence accumulated by NCC pointed strongly to the international significance of the area, and also to the profound impacts resulting from the expansion of afforestation into the Flow Country heartlands.

NCC's evidence was undoubtedly unpalatable and politically uncomfortable, but one might reasonably ask what NCC, as statutory messenger, could be expected to do; should the bearer of difficult tidings re-write the message to bring only good news? The lesson from history is that rational judgements are only possible when the entire story is presented accurately. This, NCC took considerable pains to do.

In the case of the Flow Country, discussed later in this paper, it is generally believed that the government ultimately took a swipe at both protagonists. The Chancellor first closed the tax loop-hole which was encouraging widespread land-use change to forestry in the north of Scotland. Then, following pressure from an incensed forestry lobby, the Secretary of State for the Environment is then thought to have turned his attention to the NCC, whose own Chairman described the resulting proposals as "dismemberment". The voluntary conservation movement expressed its united disapproval of the whole plan to dismantle the NCC into separate country agencies.

One of the major claims used during this debate to justify the break up of the NCC was that its activities and statements were "shot through with opinions and value judgements". But is this a valid criticism? Can conservation science be completely objective in the academic sense?

### **Science and conservation - mutually exclusive, or one and the same?**

Science is driven largely by curiosity, an urge to discover how the world around us works, but in its purest form, science has no value judgements. Complete environmental catastrophe gives rise to many research opportunities, but deliberately stimulating catastrophe in order to study it is an approach normally only open to small-scale, enclosed experimental environments.

In contrast, conservation differs profoundly from this set of circumstances in two important ways. Firstly, conservation science always deals with systems which cannot be separated from all the influences of the

wider environment. It is forced always to deal with completely open systems. Secondly, and perhaps most relevantly to the charges laid at the NCC's door, conservation is actually founded upon a set of value judgements. These judgements assume that certain things are more desirable than others. "Desirability" is, however, an entirely subjective factor. It is thus unreasonable to demand that conservation should adopt an entirely objective approach because "objective conservation" is a nonsense, an oxymoron. UK conservation legislation is founded upon judgements derived from scientific observation, but ultimately some individual or group of individuals must still make a value judgement, based on the data presented, as to what is a "desirable" threshold for initiating a particular conservation action.

The formal definition of such subjective value judgements gives rise to its own problems because they can be based on such a wide range of perceptions. For example the pure scientist might consider that loss of Sphagnum would deprive mankind of some potential understanding of plant physiology whereas the applied scientist may argue that loss of Sphagnum will cause erosion and lead to serious effects on water quality. Some may argue that society needs to assess all the medicinal properties of Sphagnum. The simple moral argument states that we do not have the right to decide what species will or will not be passed on to succeeding generations. Others may argue simply for its irreplaceable beauty.

Conservation is such a broad church that each of these arguments is valid. Conservation is a concept which reflects the ideas of society and encompasses social, moral and even emotional issues. Fundamentally, conservation is what society wants it to be.

Conservation science is also a profoundly practical discipline, interacting directly with events in the real world and subject to all the pressures and problems of society. Conservation is to ecological science what engineering is to physics. Both lie at the applied end of the scientific spectrum, where practical ventures are founded on a bedrock of theoretical science, but in engineering most things are measurable, and everything is generally predictable, to the extent that projects generally mirror the controlled laboratory conditions of the physicist.

Of course even in physics the theoretical bedrock is not always as sound and complete as was imagined. Sometimes important gaps in our knowledge are not recognised until events in the real world confound accepted wisdom. The spectacular collapse of a cooling tower at Ferrybridge Power Station in high winds in 1965 was broadcast on the national evening TV news, with dramatic pictures of the huge tower wobbling like a badly made pot on a potter's wheel. This is one example of many where natural forces suddenly add some hitherto unsuspected complexity to an otherwise apparently well-defined engineering project.

Although this is increasingly the exception rather than the rule in physics and engineering, the reverse is true for ecology and conservation science. Ecology is in many ways closer to meteorology than it is to physics. In meteorology most things are by definition not predictable, at least not in the long-term; connections can extend to the entire global weather pattern, and science is only just beginning to make some order out of the apparent chaos. The pure scientist is simply an observer, measuring whatever happens. Yet ecology and conservation are concerned with completely open systems and, because Nature is so complex, almost by definition it is therefore impossible for the ecologist to determine everything about an ecosystem. So little is known about most ecosystems, let alone their interactions with other ecosystems, that in terms of most conservation actions both ecologist and conservationist are forced to grope ahead together in the dark.

The dearth of hard scientific information on which to make conservation decisions exists largely because ecological science is one of the newest of the science disciplines. This means that the relationship between science and conservation is often not as helpful as it might be. Indeed ecology is such a new science that although the word "ecology" was coined by Ernst Haeckel in 1869, university courses have only been turning out graduates formally trained in the subject since the late 1960s. Only in the most unusual circumstances are ecologists therefore able to make confident predictions about the full response of any ecosystem to events. Attention is more usually focussed on only one or two aspects. Even then the

prediction, like a long-range weather map, is likely to spiral progressively away from the real sequence of events with time.

The pure scientist may honestly state that all aspects of a particular ecosystem or individual site have been quantified as far as possible; everything that can be measured has been measured. But how often does this mean that a prediction can then be made about, say, the environmental impact of a proposed dam, with the same confidence that the engineer feels about the construction methods necessary to build that dam?

The pure scientist may argue that predictions and actions should only be based on available data, and that the available data point to a particular sequence of events. This may be so, but in ecological systems these are never the complete data. Natural systems are increasingly being recognised as subject to the laws of non-linear dynamics (better known as Chaos Theory), and the common theme throughout such systems is that a tiny difference in initial conditions can give rise to dramatic differences over time.

Those responsible for giving conservation science advice must therefore routinely include in their deliberations and advice three additional factors which are not generally of concern to the engineer. Firstly, although judgements must be based on the best available science, it is equally important to identify those aspects for which the data or predictive models used are likely weakest or even absent. Secondly, it is necessary to consider the implications of these information gaps, and to combine these with the available predictions to anticipate the potential extent to which the long-term sequence of events may spiral away from those predicted. Thirdly, and following from this, the "precautionary principle" must be applied to any advice given because most conservation casework involves proposals from which recovery is likely to be impossible if the models used prove to be inaccurate and the suggested protective techniques fail. The precautionary principle involves making some assessment of the likely worst-case scenario, and incorporating this into the offered advice.

Unfortunately, in the face of short-term commercial and political pressures, a statement that "no impact can be detected" is positive, clear and accurate and will tend to be favoured by, for example, a politician faced with a difficult choice. However, a technical inability to measure change in a natural ecosystem often says more about the limitations of the techniques used than it does about the stability or otherwise of the ecosystem. Equally, the precautionary principle of potential long-term change can seem too nebulous a concept when difficult decisions must be made in the here and now.

It is therefore only natural that all protagonists except the conservation scientist feel more comfortable with the reductionist approach of the pure scientist. This approach states that only certain things can be demonstrated or predicted about the response of the ecosystem to the proposal on the basis of current scientific knowledge and method. This proven response should be taken as the only effect of the proposal until proven otherwise. The conservation scientist, on the other hand, observes that complete measurement of natural ecosystems is impossible, and thus an apparently trivial gap in the information-set may lead the system response to spiral increasingly from the reductionist model in time, with little prospect of reversing this spiral.

The conservation scientist must look beyond the provable and anticipate the probable, not just in scientific terms but also in terms of what society may require in the years to come because usually, when dealing with changes to natural ecosystems, such changes are irreversible. Benefits to the environment or to society, which are not yet provable but which are strongly indicated by current knowledge, may be irretrievably lost unless such factors are explicitly highlighted by the advice given.

### **Conservation is more than science**

Effective conservation is therefore more than pure, objective science. It is based on a set of judgements, some of which are scientific and objective, others are scientifically based but require an intuitive leap into the unknown, while others still are a reflect of society. The accusation of subjectivity is therefore correct

and NCC stands guilty as charged, but only because existing nature conservation legislation requires it to be so. By their very nature, conservation criteria are "shot through with opinions and value judgements" because this is how the legislation has been framed by parliament.

But if conservation really is what society wants it to be, significant progress in conservation is only possible when it has the support and the understanding of the general public. This is one crucial area where, I believe, both peatland scientists and conservationists have so far failed. Even the number of peatland textbooks for scientists is limited. Popular books for public consumption are even rarer. In the public's mind, peatlands are still seen as - to quote Brian Wheeler - "squalid and inhospitable" places. They are of no consequence, and only of value if put to good productive use; rather like Cinderella.

### **A peatland fairy story**

Cinderella (or Tuchkatriinu, as she's known in Estonia) was a young girl who was seen by her family as no more than a servant, or slave, of interest only when there was work to be done, and to be used and abused without a second thought. Most people didn't even know the family had a third daughter, because she was kept hidden away in the kitchen. When the family went to the social event of the year, the Prince's Ball, she was left behind to work in the kitchen.

The parallels with society's view of peatlands are quite striking; a glance at Pilgrim's Progress, The Hound of the Baskervilles, or Lorna Doone, will quickly give a clear idea of the part given to peatlands in English literature. The very language - "bogged down", "stuck in the mire" - re-inforces the link between peatlands and the dismal side of life and the urge to put such places to the back of our minds, use them, abuse them, avoid them, destroy them.

However, peatland scientists and conservationists have the privilege of knowing that the world's peatlands are some of the most fascinating and spectacular landscapes of the natural world. Increasingly, nations with significant peat resources are recognising the need to draw up rational land-use strategies for these areas because, almost despite peatland ecologists, public awareness and interest is growing.

### **Peatland Conservation Strategies**

Nothing is quite so valuable as those things which we have lost. A series of inventories of peatland systems in countries around the world, many originally designed to do no more than identify the range and variation of the resource, have also unexpectedly begun sounding alarm bells for the habitat. These inventories have therefore inevitably given a picture not just of the extent and range of peatland types, but also of the threats affecting peatland systems. Larsen (1982), for example, opens his account of bogs in the northern United States with the statement "In this book I have attempted to capture the essence of a distinctive native plant community in what may be the last fleeting moments before final extinction...This, then, is intended to be a record of the last of the bogs."

Almost all countries with significant peatland habitat are engaged in national peatland inventories which are in various stages of completion. Finland, for example, has already completed its national inventory (Ruuhijärvi 1982), whereas the South African government has only recently begun an inventory of the country's peatlands (Smuts pers. comm.). Norway, Sweden, Austria, New Zealand, Canada, the USA, and the USSR represent just some of the countries actively engaged in peatland resource survey (Moen 1985, Göransson 1983, Steiner 1984, Wells and Zoltai 1985, Thompson 1980).

The Republic of Ireland has already completed a broad-brush survey of peat resources, though this was on behalf of Bord na Mona, the Irish Peat Development Board (Hammond 1979). This study illustrates very clearly the way in which resource inventories can also be used to highlight the extent of habitat loss. Hammond's (1979) map distinguishes "man-modified" peat from "natural" peat, and even a cursory glance reveals that the vast majority of midland raised mires are classed as "man-modified". Ryan and Cross (1984), in carrying out a more recent review of the situation in the republic were dismayed to find that the

concept of an "extinction date" for Ireland's midland raised mires is not a theoretical idea, but a rapidly-approaching reality. In his paper below, John Cross describes the current position.

Grünig et al. (1986) have completed a similar survey for Swiss mires, and their studies have revealed that, from an original mire resource of some 10,000 hectares, only 1,400 hectares still retain some form of mire vegetation. However, of these 1,400 hectares, only 33% of this area can be classed as primary, undisturbed mire; the remainder consists of "secondary mire" types which are regenerating after gross disturbance.

In Britain, early estimates of the peat resource were provided by Robertson and Jowsey (1968), then Taylor (1977), both of whom gave estimates for exploitable resources. More recently, the Department of Energy has commissioned the Macaulay Institute to review current exploitable resources based largely on the work of the Soil Survey for Scotland and Soil Survey of England and Wales 1:250,000 scale soil maps. Measures of peat quality (for exploitation) are also to be provided for major deposits.

Until now, there has been no comparable review of Britain's peat resource from a nature conservation perspective. The most commonly quoted figures for peat are the 1,300,000 hectares estimated by Robertson and Jowsey (1968), yet these represent only the exploitable reserves based on a depth of some 50cm minimum. It is clear that if nature conservation is to regard peat as an organic soil of only 30cm minimum depth, as proposed by Clymo (1983), the total extent of resource under scrutiny is almost certainly very much greater than that provided by Robertson and Jowsey (1968).

In order to provide a more up to date estimate of the total peat resource for Britain, the Nature Conservancy Council (NCC) has embarked on an exercise which combines actual field survey with collation of existing published data concerning the extent and quality of the habitat. The project is called the National Peatland Resource Inventory (NPRI) and consists of two separate elements; the Peatland Survey, and the Peatland Database. The data are being integrated on NCC's Geographic Information System (GIS) to provide both a graphic and non-graphic synthesis of this information. The NPRI has established close working links with the DoEn Survey carried out by the Macaulay Institute.

"Peat", as mapped on the Drift editions of the British Geological Survey 1" maps is used as the primary source of information about peat boundaries for the NPRI, and these boundaries then form target areas for field survey. Survey methods differ somewhat between blanket mire and raised mire because the latter give simple discrete units which are unmistakable. In such areas, the range of broad land-uses found within the peat (as mapped by BGS) are recorded, thus giving an indication of remaining peatland habitat, as well as the extent of habitat loss to other land-uses. Within the surviving peatland habitat, the range of vegetation and microtopography types are recorded, as is an estimate of conservation quality for the different parts.

Peatland units are much more difficult to define in blanket mire areas. Under such conditions, the peat boundaries provided by the BGS maps can only be taken as a somewhat generalised indication of the extent of peat. Furthermore, the sheer extent of the habitat makes it difficult to map every part of the resource for its vegetation and land-use characteristics. Consequently, blanket mire areas are being mapped using a combination of the BGS peat boundaries, LANDSAT TM imagery, aerial photography and field survey.

Meanwhile, the NCC has already carried out a selective review of peatland losses in Britain, based upon known concentrations of lowland raised mires and data available from the 1st edition Ordnance Survey maps, dating back to 1840. This study, which examined mires below 100m O.D. in the Forth Valley, around the Solway, in South Cumbria, and Lancashire, found that changes between 1840 and 1978 were dramatic.

Throughout the four study areas, the total extent of loss was found to be some 87%, only 13% still possessing an original mire surface. However, many of these surviving surfaces were found to be very dry and badly burnt, and many were only tiny fragments with little hydrological integrity remaining. Overall, the total extent of mire which was still laying down peat was found to be less than 600ha from an original total of some 14,000 hectares. This represents only 4% of the resource existing in the middle of the last

century. Such a scale of loss suggests that Ireland might not be the only country faced with imminent extinction dates for its natural raised bog systems.

### **Conservation Strategies**

Of course conservation is not simply concerned with the protection of large quantities of peat, otherwise protection of 10,000,000 hectares of Soviet taiga or Canadian muskeg might be considered sufficient for all conservation purposes. The principles of nature conservation require that adequate examples of the range of variation should be protected in order to ensure that the maximum amount of 'information' is maintained for scientific study, or ecosystem stability, or maintenance of the gene pool, or any of the other principles on which conservation is based. By providing the data and framework within which the range of ecological variation can be described, peatland ecology lays an important part in the conservation process.

It should also be noted, however, that geographical spread can also play an important part in the conservation process irrespective of ecological variability, because local interest in an area may raise its conservation value far beyond its value as judged only by its position in the range of ecological variation. Again, protection of 10,000,000 hectares of Canadian muskeg, no matter how variable, is unlikely to satisfy the conservation values of someone living in the midst of Minnesota's remaining wetland fragments.

Nonetheless, the first comprehensive review of European peatlands, carried out by Roger Goodwillie for the Council of Europe (Goodwillie 1980), has proved to be of great value in putting particular mire types into context, no matter how crude this original map is now considered to be. It highlights quite clearly the way that Fennoscandia, for example, have a European responsibility to protect as wide a variety and large an extent of aapa mires as possible, because between them Sweden and Finland represent the major 'resource bank' of this type for Europe. Similarly, blanket mire is evidently a responsibility for those northern countries having a seaboard on the Atlantic, particularly Britain and Ireland.

In fact, the recent history of blanket mire conservation in Britain illustrates very well the importance of establishing the range of ecological variation for particular types on an international and even global scale. With almost 825,000 hectares of blanket mire, and 10.4% of its land surface dominated by this type, blanket mire is an extremely common type of mire in Scotland, and its conservation status in public and even scientific perception has tended to reflect this - i.e. so common that little active conservation is required; enough will always survive whatever happens. This view has changed quite significantly during the 1980s.

In 1980 the UK government introduced a Forestry Grant Scheme in an attempt to encourage large-scale investment in forestry. This resulted in a dramatic expansion in the general size of afforestation proposals compared to those typical under the old Woodland Grant Scheme which it replaced. Furthermore, land purchase and fencing costs were not subsidised under the new Scheme. This had the effect of moving afforestation proposals out onto large expanses of cheap and easily-fenced land - notably the flat or gently-sloping expanses of blanket bog in Scotland. Within three or four years, almost 60,000 hectares of the most important of Britain's blanket bog areas, the Flow Country of Caithness and Sutherland, had been transformed into a corduroy landscape of ploughing furrows or formed part of a future planting programme.

During the early phase of this massive expansion, the two volumes of Gore (1983) *Ecosystems of the World*, Volumes 4a and 4b, describing the mire systems of the world, were published. The second volume was of particular interest in that it provided regional accounts of mires throughout the world. What volume 4b revealed was that blanket mire is in fact an extremely localised mire type, restricted almost entirely to oceanic extremes, and probably more extensively developed in Britain and Ireland than in any other place in the world. Furthermore, NCC's Peatland Survey Programme was also engaged in detailed survey of Caithness and Sutherland, the results of which revealed that the Flow Country was the most important and most extensive example of blanket mire in Britain and Ireland. This, coupled with more extensive inquiries about the world distribution of blanket mire, led to the realisation that probably the most important single expanse of blanket mire in the world was being destroyed at a rate previously regarded as impossible. The

position was confirmed by the International Mire Conservation Group (IMCG) during their 2nd Field Symposium which looked at, amongst other places, the Flow Country. The IMCG Resolution, published at the end of the Symposium, declared all of Britain and Ireland's blanket bogs to be of the greatest international importance, and the Flow Country to be unique (International Mire Conservation Group 1986).

With such international support for the conservation arguments, but powerful economic interests pressing for large-scale planting, the whole issue clearly represented a major clash of conflicting government policies, with one of the most significant remnants of Britain's near-natural areas caught in the cross-fire. Indeed the Chairman of NCC described the issue as being the most important nature conservation issue since the Second World War.

With the publication of NCC's scientific statements about the importance of the Flow Country for international nature conservation (Stroud et al. 1987, Lindsay et al. 1988), coupled with widespread publicity in the media and general outcry from a wide range of countryside interests, the UK government firstly changed the tax incentives driving much of this afforestation, and subsequently agreed to protect half of what remained.

This victory, though only partial, represented a major watershed in UK nature conservation because the scale of nature conservation designation in Caithness and Sutherland means that nature conservation will eventually become the primary land-use throughout two entire Districts of Scotland. Nature conservation and regional land-use planning are becoming inextricably linked. Indeed the IUCN has called for the area to be proposed by the UK government for World Heritage Site designation. Nevertheless, despite this progress, losses to forestry will continue in the area because the government wishes to see a further 40,000 hectares planted in the area to "maintain a viable forest industry".

The case of the Flow Country, however, highlights the kind of political and value-judgement problems which arise from attempts to draw up regional peatland conservation strategies. It also highlights the problems of scale, whereby any national strategy must be capable of coping with issues at the landscape level while still being effective at the scale of small lowland sites which may be only a hectare or two in extent.

A number of countries are already well-advanced with such strategic and policy considerations. Perhaps because it has the highest proportion of peat-covered land surface in the world, Finland leads the way with an established National Peatland Conservation Policy now being implemented (Ruuhijärvi 1982). Canada's Peatland Conservation Policy is currently in the drafting stage, whilst a number of other countries such as Sweden, Norway, the Soviet Union and Switzerland are currently moving from resource survey exercises to the policy formulation stage. In contrast, Austria has a detailed catalogue of its mire systems (Steiner 1984) but there is little enthusiasm within the Austrian government for developing this into either a policy document or a conservation programme. Britain, along with Thailand, New Zealand, Northern Ireland, the Republic of Ireland, South Africa, and much of the Soviet Union, is still engaged in the task of gathering basic resource data.

Where official conservation efforts are limited either by funding or policy, it falls to the voluntary organisations to press for peatland conservation programmes and policies. In the Republic of Ireland the main pressure for peatland conservation comes from the voluntary organisations, particularly the Irish Peatland Conservation Council (IPCC), aided, ironically enough, by support and funding from conservation bodies in the Netherlands (Irish Peatland Conservation Council 1989). The Dutch argue that it is better to help protect virgin mires in Ireland than to pour money into mire re-creation programmes in the Netherlands, thereby providing an object lesson for all countries currently adopting the philosophy that in widespread exploitation of their mires is possible on the assumption that mire restoration is the long-term solution. Joosten's warning in this volume about the price of such thinking is a sobering tale.

In Switzerland the voluntary sector has been engaged in a programme of resource inventory and public education (Grünig et al. 1986, Schweizerischer Bund für Naturschutz 1983). A proposal to destroy a small mire in order to construct a military installation was successfully steered to a full national referendum about

the issue. Much to everyone's surprise the mire conservation lobby won by a handsome majority, and peatland conservation is now very firmly on the Swiss political agenda.

Such success illustrates just how vital it is to bring peatlands out from the environmental shadows and ensure that everyone is aware of their value and importance. In Ireland the IPCC has organised a peatland poster competition through the nation's schools, does a brisk trade in "Save the Bogs" sweatshirts, and has been involved in the publication of several items designed to raise general awareness of Ireland's peatlands.

In Britain the conservation movement is only just now beginning to focus its attention on the peatland habitat. A major campaign for 1990 involves the Royal Society for Nature Conservation, Friends of the Earth, Royal Society for the Protection of Birds, British Association of Nature Conservationists, WWF and Plantlife. The main purpose of the campaign is to promote the use of alternatives to peat as a horticultural medium and to emphasise the environmental damage caused by the present peat-based industries. Clearly one objective of the campaign is to raise the current level of awareness about peatlands with the general public.

Another target for this campaign has arisen recently with the UK government's conversion to green issues. The possibility that items for sale could be given a "green label", or that environmentally damaging products might have an "environmental surcharge", raises the possibility of both promoting the idea of peatland conservation and directly influencing the general public's buying habits in relation to peat-based products.

While such proposals have already caused outcries from the peat industry (e.g. Steven 1989), in fact the campaign will be seeking a long-term sustainable future for the industry as a compost production industry rather than one based on peat extraction, although attitudes to peat as a 'garden' medium are firmly entrenched, and not just in Britain. Who doesn't have a bag of peat in their garden shed?

Even environmentally aware sections of the media often still have a blind spot where peatlands are concerned. Consider the two BBC TV series "Life on Earth" and "The Living Planet", the latter series in particular claiming to look at most of the major environments to be found on the planet today. Considering that peatlands cover a remarkably high proportion of the temperate zone, is it not remarkable that from a total broadcast time of several hours, peatlands (as peatlands, rather than an adjunct to tundra or boreal forest) featured for some 1 minute 20 seconds beneath the end credits of a single episode?

A follow-up series called "The Living Isles", again by the BBC, looked in more detail at Britain's natural landscapes, but little had changed for peatlands. Although on an international scale blanket mires represent Britain's most important natural asset, peatlands appeared in the series as a mere extension of the heathland environment.

This is not just a British problem, however. Two superb books (Knystautas 1987, Fitzharris and Livingston 1988), one about the wildlife of the Soviet Union, the other about the environment of Canada, have many beautiful photographs and much well-informed text. Both divide their subject into biotic zones, but one looks in vain for a chapter about peatlands, although these two countries between them contain almost 90% of the total world peatland resource.

Cinderella is clearly still very much in the kitchen; somehow we have to get her out of there. Yes, peatlands can be a nightmare when the air is warm and still; eyes, nose and mouth quickly clog with a mass of flying, biting insect hordes. And yes, to the un-initiated the first walk out onto a wet, quaking bog surface can be fairly frightening; after all, they are walking on something with less solids in it than milk.

But if we are to free Cinderella from the kitchen people must be encouraged to go beyond these experiences. They need to be shown how to appreciate the very special beauty of our peatland landscapes, and see the valuable part these play in the overall functioning of our environment. One of the most dramatic examples of the special place peatlands have in our culture was the discovery a few years ago of Lindow Man, in a bog in Cheshire. The interest shown in 'Pete Marsh', as he was popularly known at the



time, now lying in his final resting place in the British Museum where he is one of the most popular exhibits, shows that there is a valuable place for archaeology in helping with the process of teaching the public about the value of peatland sites.

But it is to the ecologist that the greatest burden falls in this respect. It is not enough to study the habitat simply as an intellectual exercise in the hope that the published results will eventually encourage someone else, probably another peatland ecologist, to investigate the questions further. In the scientific archive are astonishing aerial photographs of string bogs, beautiful close-ups of sundews, photomicrographs of delicate moss structures, all associated with an encyclopaedia of fact and figures at least as intriguing and exciting as their better-known equivalents for woodlands or grasslands.

The ecologist should also be a conservationist because ultimately scientists are recipients of public funds and therefore have a duty to the public and to society. The ecologist should learn to share his or her enthusiasm for the habitat with others, and, bearing in mind the spectacular features which are so typical of many mire systems around the world, this should not be difficult.

Such an evangelical approach is important because, unlike many other habitats, few people other than peatland ecologists actually visit such areas in the knowledge that they are peatlands. The only way that peatlands can be brought to a wider audience is if we, who earn our living studying the habitat, are prepared to share our knowledge with society at large, perhaps by writing popular articles, giving public talks, interviews with the media and, most important of all, provide active support for the conservation of such areas, especially those threatened by development.

### **Does conservation need science?**

Earlier in this paper it was suggested that confusion often exists between the definition of what is science and what is conservation. The idea that conservation was more than just science may have left the impression that the pure scientist has only a minor function within the conservation movement. Nothing could be further from the truth. Only after science has teased apart the way in which a particular strand of the ecosystem works is it subsequently possible to identify the correct objectives in the wider sphere of conservation action.

For example, what if the proposal to take the wonder of the peatland environment to a wider audience succeeds? 156 billion people queuing up to look at peatland sites. Already in the Peak District the problems of visitor pressure have been studied and solutions proposed, to the extent that parts of the Pennine Way now resemble sections of motorway, with bridges, geotextiles and even metalled surfaces. However, these solutions themselves could eventually prove to be worse than the original problems unless research continues into the most benign means of enabling the many thousands of feet which tramp this popular long-distance footpath without damaging the fabric of the peatland ecosystem itself.

Many of the most basic aspects of the peatland ecosystem have yet to be understood at a functional level. Grazing, at various intensities, represents an almost universal process within peatland system dynamics but, as Chapman and Rose (1986) and the paper by Smith and Charman in this volume indicate, studies which provide a clear picture of the way in which grazing can influence peatland vegetation dynamics are far from providing the clear unequivocal answers so eagerly sought by politicians anxious to apply or remove grant-aid.

Peatland erosion is another little-studied phenomenon, though widespread on blanket mires. Opinions continue to differ about whether erosion is a natural process or not. Until this fundamental question has been resolved by the scientist it is impossible for the conservationist to decide the status of heavily eroded areas. If it should prove that erosion is a natural part of the peatland cycle, many areas currently dismissed as "degraded" will need to be re-evaluated. If not, the current land-uses will need to be re-assessed. Should upland grazing be implicated by further research, the political implications are likely to be profound as many rural communities rely on existing grazing subsidies.

Some impacts are obvious, others are not. In the Flow Country and other blanket mire areas, despite protestations that the pool complexes themselves are not ploughed, areas left unploughed appear to undergo significant change in the long-term (Chapman and Rose 1986), possibly because peripheral drainage has reduced the water content of the peat significantly, or perhaps through changes in the regime of grazing and burning. The hydrological models produced by Dundee University, discussed by Ingram in this volume, have been invaluable in evaluating such problems, but so much more is needed. For example, it seems almost ludicrous that physicists can measure temperatures within the gas jets of stars many light years from Earth, yet no-one has yet constructed a field instrument for measuring the lateral flow of water through peat.

### **Peatland conservation and the future**

For the future? In the world of conservation science I believe we shall see the steady emergence of non-linear dynamics, "Chaos Theory", increasingly used as a means of understanding and predicting many aspects of the peatland ecosystem, in particular within the field of hydrology. Fractal geometry is already used by geologists to model the diffusion of oil through semi-porous geological deposits; to what extent can this be applied to the behaviour of water flow through the peat? Can erosion patterns be modelled using such geometry?

In other topics, several papers in this volume clearly point to the new directions and ideas, many of which are clearly directly related to pressing conservation problems. This is encouraging, but, in Britain, is also a source of concern. If peatland research is wholly funded by conservation organisations and thus restricted to solving immediate problems, "blue-skies research" becomes a victim of the market economy. With the obvious links between blue skies, global warming, peatlands and the carbon cycle, it would be good to see government funding for a much wider research-base into the peatland ecosystem than is possible through the supply and demand processes which are inevitably associated with conservation funding.

Even so, without an active programme of taking the peatland environment to a wider audience, the future is bleak. The Netherlands and The Fens show us what the future holds unless we all involve ourselves with the active promotion of peatland conservation. Unless they become conservationists, peatland ecologists may soon have little left to study.

### **The fairy tale ending**

However, I believe that there is no need to finish on such a gloomy note. What of our fairy story? Of course Cinderella was rescued by her fairy godmother who, with the help of a few mice and a pumpkin, ensured that Cinderella did go to the ball. There, the Prince fell in love with her; they married, and everyone lived happily ever after.

Could the story of peatland conservation also have such an ending? I suppose that depends on whether you believe in fairy stories or not. If we are all prepared to give back something to the habitat which has provided us with our livelihoods, if we are all prepared to become, perhaps, peatland fairy godmothers, Cinderella might yet escape the cultural obscurity of the kitchen. It is not impossible: "Where there is great love, there will also be great miracles".

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