Axiophytes in the Meres & Mosses

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The idea of axiophytes is not a new one: conservation organisations have been drawing up lists of important species for decades. Even before that, ecologists such as Prof. Ronald Good of the University of Hull used indicator species to describe vegetation. Phytosociology itself, which was introduced to Britain by Arthur Tansley early in the 20th century, is entirely predicated on the ecological preferences of plants.

There are several things, however, which are a bit new and interesting about the concept of axiophytes. Instead of trying to identify *habitats* by the use of indicators (which, when you think about it, is a bit of a circular argument) we are trying to identify something else entirely: conservation *quality*. An axiophyte is a 'worthy plant' – the sort of species we want more of. Imagine this was a way to study literature: first, one must learn to recognise the various styles of writing - prose and poetry and so forth; then one learns to distinguish *good* prose, *good* poetry, etc. It is a much more subtle concept, and infinitely harder to define empirically.

Secondly, we now have access to vastly better information than ever before, and have a better chance of getting the lists right. In the past many people have had a go at drawing up indicator species lists for various habitats. They tended to do the woodlands and species-rich grasslands near to their home, and then they would run out of steam (and knowledge). In the last few years, BSBI County Recorders have been drawing up lists of all axiophytes for all conservation habitats. These are very different in Scotland and England, and just as different between, say, Cardiganshire and Shropshire, even though these counties are not very far apart.

Thirdly, with computers we now have the ability to manipulate and analyse lists that would have been impossible in even the recent past. In the Botanical Society files there is a hand-made table of axiophytes of the meres that Charles Sinker drew up in the 1970s. It must have been quite arduous to construct. By the 1980s it was possible to analyse the vegetation data for the Flora by computer; but now we can extract lists of hundreds of axiophytes in thousands of grid squares in a matter of seconds and analyse them in a whole host of ways. This is what we are exploring in the current analysis.

The purpose of this report was to explore the use of axiophytes as a mechanism to provide information that will help to focus conservation effort and resources within the Meres & Mosses Natural Area. The questions to be addressed were:-

- To what extent does axiophyte data complement and quantify the existing conservation framework?
- Does the data present new insights into conservation objectives?
- Can the axiophyte data be used to quantify changes in site quality?
- What are the limitations and weaknesses of the axiophyte approach?
- How can the axiophyte system be developed and used in future?

With help from John Hawksford and Graeme Kay, the County Recorders for Staffordshire & Cheshire, we drew up a list of 109 species that we considered to be characteristic of the wetlands of the Meres & Mosses and which were of sufficiently restricted distribution to be useful in the analysis, following the guidelines given by the BSBI. For these species we extracted 17,747 records from the databases of the three county recorders. All the records were at tetrad scale or better, so it was possible to analyse the data at the tetrad (2km) scale.

Q1: Do axiophytes identify the sites of conservation importance?

The answer to this was, undoubtedly, yes. We assumed that the existing SSSI framework must be about right, because it is based on decades of experience of many skilled naturalists. If the axiophyte analysis came up with a totally different list of important sites, then something very strange would be going on. As it turns out, the top ten tetrads for axiophytes all contain SSSIs (whereas only 1 in 5 tetrads at random would do so).

Q2: do axiophytes present new insights?

Among the top 20 sites identified by the axiophyte data were just two that are not SSSI: The Mere at Ellesmere and The Yesters, a peatland not far from Ellesmere. Both of these sites are, in fact, descheduled SSSIs, but the axiophyte data shows that they haven't lost all their ecological importance.

Sites do change, sometimes for the worse, but some sites have been known to recover again. Rare plants can sometimes survive in restricted areas and then return to their former habitat if it becomes suitable again. One outcome from this analysis could be a decision to review the former SSSIs and see whether they might not warrant re-designation. With more money available for conservation these days, it is possible that some of the damage done to these sites could be reversed.

Another analysis we conducted was to compare the SSSI network with the rest of the countryside. We found that all but five of the axiophyte species occur outside SSSIs. The exceptions are: *Calamagrostis stricta*, *Carex limosa*, *Carex viridula* ssp. *viridula*, *Nuphar pumila* and *Utricularia minor*. This means that the SSSIs are vital for conserving rarities, but that non-designated sites, collectively, are equally important for conserving the other characteristic features of the Meres & Mosses.

Q3: Can axiophytes quantify changes?

One of the most difficult challenges in nature conservation is to find empirical measures of change. All sorts of complex procedures have been proposed, but none of them has been widely adopted because they are too difficult to use. The idea behind axiophytes is that the analysis is as simple as counting species – the only tricky part, of course, is identifying the plants in the first place.

We counted the number of axiophyte species in each tetrad in each decade, and found that the biggest and most recent change has been experienced in SJ43B, which is the tetrad containing White Mere and Blake Mere. These two meres, therefore, are the ones that are currently declining in quality faster than any other. It would make sense to examine why these changes are taking place and take steps to avoid further deterioration. It is even possible, using the axiophyte lists, to say precisely which species have been lost and to identify which ones should return if suitable action is taken. For instance, Shoreweed, *Littorella uniflora*, has been lost from White Mere (last seen in 1979), but there is every chance that it could return if the shoreline was less wooded.

Q4: What are the limitations of axiophytes?

The most obvious limitation of the current analysis is that it depends entirely on species-richness, which favours the calcareous water bodies over the more acid mires and peaty woodlands. There are two ways this could be overcome: to analyse the different habitats separately, to find the best bogs, best meres, etc.; alternatively, we could incorporate another taxonomic group such as *Sphagnum* into the axiophyte lists to even the balance somewhat. As *Sphagna* are habitat-forming mosses, they are clearly just as important as vascular plants, and it makes sense to include them. The main difficulty, of course, is that this would make the quality of the field surveys necessary for the axiophyte approach even more demanding than before.

Q5: How can we best develop the axiophyte approach?

It is becoming increasingly clear that axiophytes represent the first direct measure of conservation quality that could be practically applied. In the past various proxies have been used, such as the presence of rare species or bird populations, which have provided a practical way to find out about the underlying habitat quality. But it has been found that these proxies can be directly influenced without benefiting the environment – for example, by feeding birds so their populations increase. This does no good to anything other than the birds themselves, so it does not work as a measure of the broader nature conservation objectives.

Nature conservation is very much about managing habitat, and the axiophytes themselves are what make up the habitat. By counting axiophytes we are directly measuring the quality of the habitat, and by-and-large all other environmental benefits will flow from that. It is very hard to encourage an axiophyte to grow where the conditions are unsuitable, and a whole suite of axiophytes pretty much guarantees that success has been achieved.

The key requirement for the future of this approach to nature conservation is competent and active field survey. We need surveyors with the necessary skills to regularly survey the entire countryside, so that the information exists for this sort of analysis. That means that training to a high standard must be provided; that organisations such as the Botanical Society have to thrive to coordinate the survey work; and that expert backup in the form of herbarium collections, taxonomic expertise and so forth has to be available. If we can do all these things, the potential benefits in targeting conservation resources and monitoring the outcomes far outweigh the cost of collecting the data.

Using axiophytes to target areas for action

The coincidence map below shows the hotspots for wetland axiophytes in the region. Larger dots show the higher species densities. There are clearly many places throughout the region that contain axiophytes, but the map confims that, based on current knowledge, the SSSIs are by far the most important features.