### Ecological Education Grants

The Ecological Education Grants (EEG) were launched last year and are proving successful with schools, especially in the categories of School Grounds Development and Field Equipment.

Professional development grants also continue to be well represented through our partnerships with the Field Studies Council and Science Learning Centres. Currently the majority of applications are from primary schools and we are now looking at ways to increase the applications from other sectors.

We remain keen that as many people as possible get to know about these grants so please help us to spread the word and let your colleagues know. Flyers about the grants are available from the London offices and updated criteria are on line.

### Innovation and research

**Description:** This grant helps teachers to develop creative approaches in teaching ecology.

### School grounds developments

**Description:** School grounds provide an opportunity for students to observe living animals and plants in their natural habitat. This grant supports initiatives which enhance school grounds for the teaching of ecology.

**Suitable for:** All levels

### Primary school field work or nature visit

**Description:** Funding is available for teachers to arrange for their class to participate in a field trip.

**Suitable for:** Primary

### Field equipment

**Description:** This grant supports the purchase of ecological fieldwork equipment.

**Suitable for:** All levels

### Teacher attendance at BES meetings

**Description:** Anyone involved in ecology education that cannot access funding from employers may apply for financial support.

**Suitable:** Schools and schools providers

### Higher education (HE) taster events

**Description:** Funding is available to support schools in attending events at HE institutions which promote ecology.

**Suitable:** Secondary and tertiary

### Professional development

**Description:** The BES sponsors a range of courses by contributing directly to tuition fees or by paying for supply cover.

**Suitable for:** All

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### Outreach Education in the North West

There are many barriers preventing teachers taking their students out into the school field let alone to the local park.

Well, now the BES and FSC have formed a partnership that hopes to address some of these barriers and make it easier for teachers to get out into their own fields at least.

Post SATS year nine students and their teachers are being offered a two day course in their school ground ecology. The project will be piloted in the North West region and is likely to have a focus on Manchester schools in particular.

Karen Devine of the BES and Annie Duckworth of the FSC will be working with teachers for one day and demonstrating lessons with year nine students on a second. They will be identifying outdoor education opportunities, producing the resources aimed at each school grounds and hopefully giving teachers the confidence to continue with a programme of outdoor activities through their schemes of work.

The next edition of TEN will feature the work they have been doing this year.

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About the Teaching Ecology Newsletter (TEN)
The original purpose of TEN was to help ecologists teaching around the country to keep in touch with each other and with what the society was doing in education, and to provide a forum for debate. These remain its functions and we welcome the contributions of any TEN reader, whether they take the form of a very short note, a letter, a book review or a longer article.

Submitting a Contribution
We will accept material in any form but a text file attached to an email is preferable. Illustrations, pictures or clip art are also welcome. Please make sure there are no copyright problems with anything you submit for inclusion in TEN. Any secondary source material should be properly acknowledged and the author’s permission obtained if necessary. The editor reserves the right to make modifications to material submitted in the interests of overall consistency, although we would normally get back to you in the case of major changes.

About the BES
The British Ecological Society is the oldest ecological society in the world and Sir Arthur Tansley was its first president. The BES has a worldwide membership of over 4000 ecologists, produces four internationally respected scientific journals and organizes meetings and symposia at both national and international levels.

The Education, Training and Careers Committee (ETCC) is a formal committee of the British Ecological Society, which administers an educational budget, has a growing number of educational initiatives, and advises the council on matters of educational policy.

You don’t have to be a member of the BES to receive TEN, but we hope you might want to join and play a full part in the Society once you start to get involved.
Thank you Debbie, welcome Karen.

When Debbie Smith left BES to take up a senior position back in school ETCC gave her a tankard as a memento of her time with us which described her as a ‘hard act to follow’ – for indeed she was. The appointment of an Education Officer in 2003 was an important landmark in Education within BES. Hitherto much depended on voluntary activity. ETCC has long been the source of innovative ideas but it was frustrating how long it took to put them into practice. Thanks to the commitment and creativity of ETCC members, however, a ‘joined-up’ education policy was gathering momentum. The arrival of Debbie meant that finally the growth of BES educational policy could go exponential and all sorts of things moved forward in several directions at once. Debbie saw being EO not so much as being an expert talking to people but as being a teacher amongst teachers whom she viewed as her professional colleagues. Throughout her time at BES she continued to spend 4 hours per week in the classroom and quickly became the face of ecological education. She did a lot of developmental work on the education pages of the BES website and not only made them more teacher-friendly with a lot more to offer but opened them up to students too. She also took TEGnews, which had already evolved a long way from the 2 sides of A4 I produced back in 1988 or 1989, changed it to TEN and gave it a fresh new look. The newsletter became a place to find exciting teaching ideas and ecological games, many of which she had designed herself. In the two years she spent with us she made a big difference and we were sorry to see her go.

Debbie may well be a hard act to follow but Karen Devine, our new EO, is clearly the woman for the job.

She too is a woman on a mission who was clearly at home in her new job as soon as she arrived at ASE and began setting up the stand. Karen comes from being a Head of Biology from a large rural comprehensive school in Yorkshire and looks likely, like Debbie, to remain a teacher at heart. She already has a good grasp of where Debbie left off, apparently limitless energy and plenty of good ideas which I will leave to her to tell TEN readers about herself. You can see her in action by looking at ‘on the stand’ (page 6).

The next five years.

The six months while we were between EOs provided a useful opportunity for ETCC to take stock. We reviewed the recent impressive progress we had made and then we looked to the future. BES has never had such an ambitious and joined-up Education policy before.

Ecological Education Grants (EEGs)

These were launched in 2005. For many years there was poor take up of Education Innovation and Research grants (although the few applications we had were often excellent). There are now a number of categories of EEG making up a ‘teachers toolkit, representing a substantial £22200 per year investment by BES in education. The toolkit still includes Innovation and Research grants but also covers training and professional development, equipment and school grounds development. Each application must make clear how the money will be spent to teach ecology from KS1 to KS5, with precise costing and a clear rationale of how the proposal will fit into the school curriculum, particularly in science. It is already apparent that we need to make the criteria clearer and more helpful. It’s also clear that whilst there is plenty of useful material out there on educational use of school grounds a lot needs doing on planning school grounds specifically for ecology and other types of outdoor science. This is one of Karen’s priorities at present and we are developing material for the BES website to help applicants soon.

Undergraduate Education
This is also part of ETCC’s remit. Expedition Grants used to encourage groups of students to go boldly on adventurous ecological expeditions overseas. They mainly benefited undergraduates and post graduates although schools did apply. We decided to abolish them partly because other organisations were doing this better and on a much bigger scale but also because we had targeted two specific areas that needed attention to nurture the ecologists of tomorrow. Undergraduate Ecological Project Support (UEPS) grants support a project where a student has ownership of his or her own project carried out in vacation under the supervision of a research ecologist. In these days of student loans these grants include a modest stipend. Field Ecology Grants (FEGs) will support expeditions/projects where students collect ecological data within the context of an interesting piece of research. The awarding of the grant will depend on the quality of the field experience and training opportunities the students will experience.

Other things we offer undergraduate education include the web-based Ecological Project Compendium (in the education pages of the BES website). Students are also eligible to apply for specialist course grants to improve their species ID skills.

Towards a national outreach network

Another priority is the building up a national outreach network to promote the teaching of ecology and related forms of Outdoor Science involving BES members, particularly in universities, but also by working in collaboration with other organisations. Karen is currently working on a pilot joint BES/FSC project in North West from which we expect a number of things to develop and which we look forward to hearing more about in future editions of TEN.

Outdoor Science

We have also have been working with FSC in promoting Outdoor Science. This arose out of a joint BES/FSC seminar held at Malham Tarn Field Centre in 2002 at which we examined the threats facing Biology fieldwork. We have subsequently realised that the best way to defend Biology field work is to recognise that, in fact, it offers a model of good science teaching. Chemistry and Physics also have their roots in observations of the environment – of the real world. The take-up for science A levels, Chemistry and Physics more than Biology, is falling and this suggests that many young people are not getting the message that science is exciting. We explored the idea that all forms of science come alive in the outdoors in a series of workshops at ASE

Independently of the work with FSC I became involved in another project also concerned with Fieldwork in Chemistry and Physics as well as Biology. On the BES stand at Reading we were able to launch the ‘Fieldwork Knowledge Library’ http://www.fieldworklib.org/ on the BES website. Whether it will ever become the ‘FKL’ remains to be seen but it seeks to be a kind of Hitch-hikers Guide to fieldwork – everything you might conceivably want to know about fieldwork! And it doesn’t just mean biology either. It has sections for Earth Science, Chemistry and Physics too. This was originally developed for School Science Learning Centres, directed by Michael Reiss, managed and edited by myself and funded by DfES. Its maintenance and continued development is now funded by the BES as a joint BES/London Institute of Education project. It is now overseen by an editorial board consisting of Michael Reiss, myself, Karen (now editor) and Disi Lian (a web-designer based at the London Institute of Education).

Deciding what should be included under biology at KS1 to KS5 was not too difficult (except deciding where to stop). There is already plenty of good material on the web about Earth Science fieldwork and Cally Oldershaw was able to produce a very useful section devoted to this. But whatever constitutes Chemistry or Physics ‘Fieldwork’ at KS2? I found this an interesting question because it involves asking ‘what makes people excited about chemistry and physics’ and ‘how does one introduce this excitement to young children?’. It is widely recognised that the outdoors has a lot to offer Chemistry and Physics but rela-
tively few people are actually working in that area. One person who is doing so is Peter Borrows and he contributed to FKL’s outdoor Chemistry at KS3 and KS4. As an interdisciplinary science ecology has a lot to offer when it comes to creating truly balanced science in the outdoors.

Karen has been looking at the education pages of the BES website with a view to expanding them. She is also looking at ways of developing FKL – recent developments at GCSE means it that an update of KS4 is already needed. At present the two sites are joined by hypertext links but it is intended to develop them in tandem and bring them progressively closer together in future. Another exciting web development is the growing series of virtual field courses developed by ETCC member Gary Skinner. This is currently on the BES site and will soon be also present on the FKL site too.

Bringing education back to the BES Annual meeting

What used to be called ‘the Winter Meeting’ is ‘the Annual Meeting’ and takes place in September. We used to have an education session made up mainly of offered papers and an evening discussion. All we need to get it going again is for people interested in ecological education to submit papers as good as they used to until only 2 or 3 years ago and, of course, bring their friends. The education session used to be good, well attended and well worth being part of. The next Annual Meeting will be in Oxford and this year we shall be giving education a particularly high profile. In addition to the re-launched education session there will be an exciting international thematic symposium entitled ‘Research and research priorities in ecological education and our guests will include Carol Brewer (USA, Vice-president of the Ecological Society of America (ESA) and chair of education), Mike Mappin (Canada), Bruce Grant (USA), Mark Langan (UK), Marcus Hannamm (Germany), Cheung Yung (Taiwan), Michael Reiss (UK) and Steve Tilling (UK) and Ros Roberts (UK). The object of the symposium is to bring together leading people in ecology education from different parts of the world to present their work and to explore the nature of ecological teaching and how we pass it on to the next generation. Some speakers work with undergraduates and others in schools. It is hoped that this symposium will be something special and that the outcome will be much more than the sum of the parts. If you would like to attend, perhaps offer a paper for the education session and take part in what promises to be an interesting evening discussion, keep an eye on the BES website or contact me (david@hamar.fsnet.co.uk). If you are a school teacher unable to get funding from your employer we might be able to help (contact Karen or myself).

Come and join the party if you can!
Ten years ago it came as shock that children could be so unfamiliar with the natural environment and that fact alone probably accounts for my decision to change my post graduate plans and find a PGCE course in Bath. I chose Bath because their PGCE course dealt specifically with environmental science and I knew Ecological/environmental education was where I wanted to work.

It took me another 7 and a bit years to get here. Along the way I’ve worked in inner city schools, an international school and a rural school. I am saddened by the increasing lack of opportunities that are available for young people to see the world outside their classroom, the increasing trend for field trips to be reserved for safe destinations, the lack of funding and time for schools to take students out into the environment and the resulting loss of enthusiasm in teachers and students for ecology.

It is true that there is a fashion for subject matter and higher education studies. Back when I made my choices, Ecology and Environment were near to the top of the most popular list. Nowadays, the fashion seems to be Forensic Science or Physiotherapy.

My role is to work with the ETCC in managing and developing the Teaching Ecology toolkit, ensuring that teachers have access to the resources they need to get their children out of the classroom. The next stage is the formation of a network of ecologists and teachers with an interest in sharing skills. Any willing volunteers are more than welcome to get in touch!

I have a personal vision of my role and of BES education as the innovators and advocates of inspiring ecological education.
When you are new to a post as diverse as education officer, you hear a lot of information in the first few days (or a couple of quick meetings before your first day) and you start working out which topics of conversation seem to be cropping up on a regular basis. I had heard lots of information about the Teaching Ecology Toolkit and the Ecological Education Grants, the website and a lot of talk about the ASE conference which I was to attend on my first day of work.

I wanted to write a brief paragraph about the ASE and success of the BES at the conference so I got to thinking, Did we have any? How do I know? And then Dominic Burton handed me the Grants applications. Problem solved.

Thursday Morning and we had arrived to set up the stand. The FSC had kindly brought most of the resources we needed and the rest came out of David Slingsby’s cellar, by way of my car boot. I was warned by experienced stand holders (not BES volunteers I hasten to add) that 80% of everything I had would be going home with me and I stood looking at all the boxes and had a sudden panic that there was no way I could get them all back into my car in three days time.

I have the feeling the ASE was a remarkably different event this year, everything I was told to expect was n’t quite true. It was a bustling event with a broad range of education providers all discussing the latest developments in science education. And there, close to the top of the list was outdoor science

A lot of teachers and student teachers came by the stand, I didn’t spend much time standing around waiting for someone to talk to, in fact it was hard to get away and have a look at what everyone else was up to. Let’s not forget the dozens of people with BES links or organisations working in similar areas who came by to introduce themselves and their work. As a way to meet BES partners present and future it couldn’t have been easier or a more friendly introduction to my new role.

The most common discussion I had at the ASE conference was with teachers and students who had little knowledge of Ecology and wanted some advice and support, or teachers who wanted to teach ecology outdoors but didn’t really have the resources available to them. We gave out a good number of flyers about the EEG’s.

Over 60% of the grants applications received for the current round arrived in January after the ASE conference. The majority of them for School grounds development. In fact we are dealing with £36,000 worth. That’s a success despite the problems it raises.

Sadly the quality of a number of the applications is poor and in some cases worrying with regard to introduction of unsuitable species, but there are also some truly interesting and well thought out applications. Those are the ones you’ll be hearing more about.

Ultimately the applications have shown us that there really is a need to develop ecological education in schools and more importantly that there is an army of teachers who want to improve the outdoor ecological education provision in their schools. They highlight a basic lack of knowledge for some teachers about the meaning of ecology and what exactly an environmental/ ecological/ wildlife area is.

There are likely to be some disappointed schools, some we can help without giving grants and others have taught us valuable lessons about the pre-conceptions of teachers with regard to ecological education. We can start to think about how we can help teachers directly, we will be developing a section on the website about how to create an ecological area, we now know we need to list the plants that could and more importantly shouldn’t be planted. There are some schools we will be contacting directly to discuss the innovation and the general application we can see in their proposals.

Finally many thanks to David Slingsby, Gary Skinner and Sue Haworth for their help manning the stands.
Introduction

The activities outlined here were planned as part of a day entirely devoted to studying Science. Withington Girls’ School is an independent school in Manchester, with 650 girls between the ages of 7 and 18. During 2004 - 5, the school embarked on an extensive rebuilding programme and, in celebration and to incorporate the formal opening ceremony, Friday September 9th 2005 was declared ‘Science Day’. The Senior School was involved in lectures, debates and visits, and the Junior School programme was designed to focus on practical activities in the school grounds.

Until July 2005, the playing fields were principally regarded as a sporting facility. However in early July, some Year 7 girls expressed an interest in creating a wildlife area in a rather secluded and untended section of the grounds. This was carried out as part of a whole school Citizenship Day, and they planted many perennials to encourage insect visitors as well as laying a splendid bark pathway.

It seemed an ideal opportunity to use this area for some fieldwork studies, and this article outlines some simple investigations that could be carried out in primary schools with adjacent grounds.

We outline four activities.

These activities were designed to occupy a morning session.

There are two activities for each of Years 3 and 4 and two for Years 5 and 6, with increasing complexity according to the mathematical and measurement skills of the pupils. The Year 3 girls had only been in our School for two days and so they really were thrown in at the deep end.

It was intended that each class should be split into two, so that each half of the class would carry out only one of the two activities designed for that year.

About 20 minutes was allocated at the start of the day to explain the procedures involved and the use of any novel equipment. The activity itself was designed to last for about 40 minutes.

For each activity, there was the opportunity for the results to be represented appropriately.

Some time was allowed for a plenary session when conclusions could be discussed.

Years 3 and 4
Activity 1 – Tree Survey

There are approximately 50 mature trees around the perimeter of the school field, varying in height from 6 m - to 20 m. On the day prior to ‘Science Day’, RO chocked a number on the trunks of about twenty trees, choosing ones without a lot of undergrowth because, in the risk assessment, it was noted that there could be objects hidden in long grass.

Aim  For children to be able to recognise a number of trees, use identification books and keys and devise a simple classification for leaves and bark.

Equipment needed
Clipboard (per pupil or pair of pupils);
Identification material - books, keys, etc..

Method
Each pair of girls had a stapled set of sheets:
The top one outlined that they were to go around the edge of the field where they would find numbered trees. For each tree, they had to do a simple bark rubbing and draw a leaf in the correct places on their table. They were allowed to bring a leaf back to stick onto the table if one was obtainable without damaging the tree.

This top sheet also included a table in which they could summarise their findings when back in the classroom, and suggested they draw a large bar chart to show their findings.

Tree Study

<table>
<thead>
<tr>
<th>Tree Number</th>
<th>Bark Rubbing</th>
<th>Leaf or Leaf Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Tree</th>
<th>Tally marks</th>
<th>Total number of trees of this type.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

On the last page each pair had some drawings of tree leaves to help with identification when back in the classroom.

Comment
We found 10 species in all, and noticed that they did occur in groups.

Activity 2 – Temperature Changes along a line transect

The school grounds are enclosed by a brick wall, approximately 2 metres high. We thought it would be interesting to record any temperature changes along a 10 metre line at right angles to the wall, and then link our findings to corresponding changes in vegetation.

Aim  To teach pupils about scientific enquiry (Sc1), including making a prediction to test, selection of suitable apparatus, what data to collect and recording and illustrating their findings.

Equipment needed
Measuring tapes;
Thermometers (or data loggers);
Identification material - books, keys, etc..

Method
An instruction sheet was given out that outlined the method. The girls were told to stretch out their tape from the wall keeping it as straight as possible. They had to take the air temperature by the wall, and then at 1 metre intervals along the length of the tape. They had to take 11 readings and then move the tape to another position, about 5 m away. Eleven readings were again taken for this new position of the tape. It was suggested they try
to complete results for 5 positions of the tape.
A table was provided for them to complete.

<table>
<thead>
<tr>
<th>Position</th>
<th>Temperature at One Metre Intervals from the wall (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

A series of questions was provided that encouraged the girls to look for links between the changes in temperature recorded, and the types of plants they found growing.

Comments
In true fieldwork fashion, we found no difference in temperature as we moved out from the wall! Instead of this dampening our spirits, the lack of variation initiated lots of really valuable discussion. It also proved a useful taster session on sampling techniques. With a little prompting, we talked about:

Whether we were justified in concluding that this lack of variation always occurred, and hence -

The need to take as large a sample as possible, including other sites.

Whether we need to sample on different days when weather conditions may vary.

Factors that might cause the difference in distribution of plant species, other than temperature variations, and how this would affect our sampling techniques. The girls thought, for example, that the direction the wall faced might be important.

Whether we could link the distance from the wall to the height of the most commonly occurring plant species, in this case a grass species would be the most appropriate.

The inevitable link to their knowledge of 'The Secret Garden'.

Years 5 and 6
Activity I - Invertebrate sampling
This was carried out in the newly created wildlife area.

Aim To use a sampling method to obtain careful and considered measurements and to identify species using keys.

Equipment needed
Umbrellas;
Metre rules;
Plastic trays;
Specimen jars (perhaps those including a magnification device);
Magnifying lenses;
Invertebrate keys or identification guides;
Something to transfer organisms from one place to another e.g. blunt forceps, artist’s brushes and plastic spoons.

Method
The girls were provided with an instruction sheet that outlined their method. They were told to hold their umbrella under a suitable branch. Another member of the group was to tap the branch sharply with the metre rule in such a way that any organisms falling would be caught in the upturned umbrella. The contents of the umbrella should be transferred to the plastic tray for identification. The plastic pots could be used if any specimen required containment or more detailed examination.

A table was included on this sheet so that they could tally and total their findings.

<table>
<thead>
<tr>
<th>Name of invertebrate</th>
<th>Number of organisms</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A branching key to identify the most commonly found invertebrates was stapled to their instruction sheet.

This time, there was a much more open ended instruction as to how the results would best be represented, and the girls were told to select an appropriate method.

Space was provided for them to write their own analysis of their results and for an evaluation of the exercise in terms of how it could be improved.

Comments
Year 5 had studied minibeasts in their previous habitat studies but we don’t think they had really appreciated that the school field was a habitat. This was a really useful exercise on many counts, but the most valuable aspects were:
The value of planting species, such as buddleia, that encourage invertebrates and other wildlife, especially in towns where so many natural habitats have been destroyed.

Using branching keys and other identification aids. This encouraged thorough observation skills.

Critical analysis of experimental methods and suggestions for improvement.

Activity 2 - Successful growth

In the wildlife garden area there was a section of unmown grass which was dominated by tall herbs (including Rosebay Willow Herb) and grasses (including Cocksfoot). This activity would use one of these plants to offer the opportunity to look at differences or variation in the growth of individuals within a species.

Aim To consider variation in one growth parameter (maximum height in cm) within a species of grass. The species selected was Cocksfoot (*Dactylis glomerata*), a common grass of waste ground, roadside edges and sports fields. It is also easily identifiable.

Equipment needed

- Metre rules;
- Identification guide;
- Marker pens;
- Scissors.

Method

1. After looking at the identification guide in class and a couple of specimens taken from the field, the pupils, working in pairs, went into the wildlife area to select stems of the grass to measure.

2. Each group was asked to select three stems to measure, the stems being selected without conscious bias. They selected one stem fairly close to the edge of the wildlife area, one in the central area and then one more or less close to the edge on the opposite side to where they began.

3. The pupils measured the height from the base of the grass stem using their metre rule. They placed a mark on the stem at 1 m if it was more than a metre tall and then measured the additional height.

4. After recording each height they cut the stem with their scissors and returned with the three stems to the classroom.

5. Each group then selected their tallest stem and placed it on a ‘grass graph’ to show the variation in height of Cocksfoot stems.

Comments

The activity showed the variation in height of individual grass stems and this was clearly evident on the ‘grass graph’. It was suggested that it would be a good idea to find the average (mean) for each group and then the average (mean) for all the stems.

The exercise clearly demonstrated the need to have samples of a good size in order to get a reliable representation of any biological parameter.

Follow-up questions produced suggestions as to what might determine the height of any plant, which reinforced their previous knowledge about the factors that influence the growth and nutrition of green plants.

References

- [www.naturedetectives.org.uk](http://www.naturedetectives.org.uk) (useful leaf pictures for identification)
- *Nature Detectives* (Environmental Science for Primary Children), De Boo, M. Association for Science Education, St Albans.

Authors

Rowena Owen is a teacher in the Biology Department at Withington Girls’ School, Manchester and Dr Michael Dockery is the ASAB (Association for the Study of Animal Behaviour) Education Officer and based at Manchester Metropolitan University. Rowena Owen supplied the photograph.
Now, where did we lose Kingdom Fungi ...?

The one place it’s difficult to find fungi is in the National Curriculum (NC). Although we’re surrounded by, and dependent on, fungi every hour of every day of our lives, the Qualifications and Curriculum Authority (QCA) doesn’t seem to know they exist. The word ‘fungus’ does not appear in the 87-page NC Programme of Study for Science, which is the statutory instrument that defines the curriculum for Key Stages 1-4 (ages 5 to 16)(1999), and the same applies to the revised 2006 curriculum. But it’s not just the case that the NC ignores fungi; rather they seem to be actively excluded right across the age range.

The ignorance starts at Key Stage 1, which instructs that “…Pupils should be taught…to relate life processes to animals and plants found in the local environment.” Continues to KS2: “Pupils should be taught…to make links between life processes in familiar animals and plants and the environments in which they are found.” At KS3, teachers are instructed, under ‘Cells and cell functions’ to teach “…that animal and plant cells can form tissues, and tissues can form organs… and … the functions of chloroplasts and cell walls in plant cells and the functions of the cell membrane, cytoplasm and nucleus in both plant and animal…” And so it goes on into KS4 and towards GCSE; the National Curriculum instructs that in Double Science (GCSE examinations taken by over one million pupils in 2004), “… Pupils should be taught: (a) about similarities and differences in structure between plant and animal cells; … [and] … (e) to relate ways in which animals and plants function as organisms to cell structure and activity.”

The closest we get to fungi is in instructions that pupils should be taught “that micro-organisms …are often too small to be seen, and that they may be beneficial [for example, in the breakdown of waste, in making bread] or harmful [for example, in causing disease, in causing food to go mouldy].” (KS2 ‘Micro-organisms’). In later years we find, at best, the same old stories about yeast fermentations (bread and alcohol) and the discovery of penicillin. Admittedly, these are important aspects of fungal biotechnology, but penicillin was discovered in 1928 and industrialised in the mid-1940s. How many other aspects of the Science curriculum are so firmly embedded in what must be seen as ‘the distant past’ by the pupils?

The fact that fungi are not plants, not animals, and not bacteria, is not even mentioned in current GCSE specifications. Instead, the National Curriculum persists with comparisons between animals with plants, and by so doing fails to show the pupils that fungi have their own unique cell biology, their own unique developmental biology, their own unique life style, and a crucial place in every ecosystem and in every food web on this planet.

Despite the NC, though, with a little bit of thought, fungi can be used for teaching many areas of the current curriculum specifications and in cross-curricular activities. Fungi are not just mushrooms, yeast and moulds. Fungi digest the grass eaten by cows (and all other herbivores) and by so doing indirectly provide the milk for our breakfast and the steak for dinner.

Fungi make plant roots work (more than 95% of all terrestrial plants depend on mycorrhizal fungi) and, even leaving aside the effect of this (and the lichen symbiosis) on the evolution of terrestrial flora, by so doing mycorrhizal fungi help today to provide the corn for our cornflakes, as well as every other crop plant, and even oxygen for our daily breath.

The fungal life style is to secrete enzymes into the environment to digest nutrients externally; and we harness this feature in our biotechnology to produce enzymes to start our cheese-making, clarify fruit juices, and even distress denim for ‘stone washed’ jeans, as well as, conversely, providing conditioners to repair day-to-day damage to our fabrics in the weekly wash.

Fungi also produce a range of compounds to compete with other organisms in their ecosystem; when we harness these for our own purposes we create products like cyclosporin, which prevents organ rejection by suppressing the immune response in transplant patients, the statins, which keep so many people alive these days by controlling cholesterol levels, and even today’s most
widely used agricultural fungicides, the strobilurins.

The British Mycological Society has recently published a range of teaching resources, including:

an integrated set of class sheets, quizzes and question sheets dealing with cells and cell biology, which ensure proper representation of both yeast and filamentous fungi.

a series of five ready-made KS4 lessons comprising an introductory Welcome to the World of Fungi, Reproduction and Conservation, Favourite or Nastiest Fungus, Fungi and Industry and Fungi and Disease. All of these lesson packages include class sheets for pupil and teacher, the latter including references to supplementary materials carefully chosen from articles previously published in British Mycological Society publications.

an integrated series of class sheets that describe 15 different ‘What’s your favourite fungus?’ stories from which the pupils extract important points, a pack of playing cards that mirror the class sheets and can be used to play a variety of games (and all the time the players are holding cards that each carry a different ‘fungal fact’), and a ‘name-game’ starter exercise.

These materials have all been classroom tested with groups of pupils ranging from year 8 through to year 11 and were all well received by the pupils and successfully increased their knowledge base. These resources, and the experience we have had with them, show that pupil understanding and pupil awareness of fungi can be improved with as little as one to five hours of ‘fungus-oriented’ lessons.

The resources are highly adaptable, allowing the teacher to include parts of them in other lessons. They can be mixed in a variety of ways and also work well as resources for plenary events or when used for the ‘theoretical’ background for a workshop featuring some practical activity (school foray, food science investigation, industrial visit, etc.).

The Key Stage 4 resources have been printed as a package that is available for distribution (free) from David Moore (address below), and all work-sheets and classroom materials (ranging in suitability from primary to post-16) can be downloaded (free) from the British Mycological Society website at

http://www.fungi4schools.org/.

David Moore, Stephanie Roberts, Charlotte Quinn, Ruth Townley & Kelly Fryer, Faculty of Life Sciences, 1.800 Stopford Building, The University of Manchester, Manchester M13 9PT.

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**Useful Web Addresses**

http://fungi.fvlmedia.dk/  This is one for the teachers and all those Interactive Whiteboard/PowerPoint presentations. This site can give you any image you might ever need of fungi. Photographs are arranged by scientific names and images are good quality even if you do need to have at least some basic knowledge of common names.

http://www.myfg.org.uk/fungus.htm.  The Mid Yorkshire Fungus Group has an interactive and fun site with games and quizzes. You can get in a little cross curricular benefit with the fungi in literature page, use the body parts section to help your students identify fungal structures and test yourself on basic fungi facts. The site is easy to use and navigate. There is enough on the site to keep most students entertained for a good half hour.

http://www.doctorfungus.org/  This site will allow your students to read up on all the possible fungi diseases they may have. It’s site aimed primarily at older students although some aspects are generally useful.
Starters and Plenaries:
The Fungi Name Game

Instructions
The object of this activity is to pick the true names from the fake fungal names. Students are encouraged to shout out names to find the real names, which form a path of touching squares from the top of the grid to the bottom.

<table>
<thead>
<tr>
<th>COFFEE HUMP</th>
<th>EAR PICK FUNGUS</th>
<th>DINGY TWIGLET</th>
<th>BUBBLE PUFF</th>
<th>HAIRY STINKWEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASP CRABTREE</td>
<td>TURTLE TRUFFLE</td>
<td>PLUMS AND CUSTARD</td>
<td>SQUARE PORE</td>
<td>WAXY SHEEP</td>
</tr>
<tr>
<td>DEADLY SPIDER</td>
<td>SILKY PIGGYBACK</td>
<td>TURKEY TAIL</td>
<td>WITCHES’ BUTTER</td>
<td>SMOOTH TALON</td>
</tr>
<tr>
<td>DOUBLE JEWEL</td>
<td>LEMON DISCO</td>
<td>FLUTTER DEVIL</td>
<td>SLIMY DONKEY</td>
<td>BOOTY MOULD</td>
</tr>
<tr>
<td>MOTTLED FAIRY</td>
<td>FROSTY FUNNEL</td>
<td>LAWYER’S WIG</td>
<td>DRUMSTICK TRUFFLE CLUB</td>
<td>BLUELEG BROWNIE</td>
</tr>
<tr>
<td>PEACOCK OYSTER</td>
<td>CHALK AND CHEESE</td>
<td>RABBITS TAIL</td>
<td>MOUSEPEE PINKGILL</td>
<td>CHERRY BONNET</td>
</tr>
</tbody>
</table>

This activity is provided courtesy of Stephanie Roberts, David Moore and the British Mycological Society. A full lesson plan and worksheets are available through the website www.fungi4schools.org.

Answers: available from www.fungi4schools.org
On ecological thinking.

It was my privilege to attend the 2005 joint meeting of ESA (Ecological Society of America) and INTECOL (International Ecological Congress). I spent most of my time with the ESA education people, most of whom I had already met the last time I went to ESA (in Snowbird Utah in 2000). What struck me was how far our American cousins had moved in five years. Back in 2000 there was a very seminal symposium put together by Alan Berkovitz called ‘Ecological thinking’. It had some excellent speakers who discussed various issues about teaching ecology. At the time although it was very stimulating it seemed to me abstract and philosophical and far removed from the reality of school and undergraduate students. During my second visit to ESA last summer in Montreal, I was aware that Alan’s symposium had, in fact, been the start of a process which, five years later, was developing strongly.

It did two important things:

- Established education as something important to the whole of ESA and to ecologists in general. It was where education in ESA finally came of age.
- Laid foundations for a ‘blue-sky’ approach to ecology education – why we wanted to teach people about ecology, how to introduce people to ecological thinking and what we should be teaching.

Clearly, by 2005, education had become much more prominent in the ESA Annual Meeting programme since 2000 and this was very much to the credit of a group of creative and dedicated ESA members.

The ESA/INTECOL programme

The five day conference had much more going on than in a normal ESA Annual meeting because it was combined with the INTECOL meeting. INTECOL usually takes place every 4 years hosted by a different national society each time. In 2005 it was hosted by ESA. In 1994 it was hosted by BES in Manchester. In 1998 it was in Florence hosted by the Italian Ecological Society but the Education Symposium was organised by BES (and convened by myself).

The Montreal meeting was a very intensive one. On the Tuesday I started at 8am, went to a lunch time session, an afternoon session, an education mixer (6.30pm) followed by another session until 10.30pm. Only then was there time to find a restaurant. The combined ESA/INTECOL Educational programme consisted of the following:

A website for biology teachers:
Teaching and Learning ecology in schoolyards.

Pathways to scientific teaching: design, implement and analyse:

Helping ecology faculty do research on their teaching with TIEE: 4 hour workshop lead by Charlene D’Avanzo, Bruce Grant and Jason Taylor (EO). TIEE is a web-based source of teaching material (for undergraduates) roughly equivalent to our Ecological Practical Compendium.

Contributed Oral Paper Session:
Ecological Education I:

Contributed Oral Paper Session:
Ecological Education II:

Diversifying Ecology:

Education group evening mixer

Evening meeting for High School teachers

I was very impressed by what had been achieved by the ESA Education Group in 5 years and it brought it home to me that although we in BES are making exponential progress in many ways (and there are plenty of things we are doing which ESA are not) we are not making effective use of our own Annual Meeting to flag up the importance of education to our fellow ecologists. Several ESA Education people are keen to come to the BES Annual meeting in Oxford next September to meet people who share their interests from the UK, other parts of Europe in an international thematic symposium. Merely to put this mix of people in a room and let them talk is potentially useful but the formal programme is looking interesting. We would like to make a special feature of education in Oxford. See ‘Bringing Education back’ page 4

Towards Oxford 2006

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Ecology Hits the Headlines

New Scientist 3 December: A possible consequence of Global Warming, the ocean currents that provide our balmy climate are slowing, studies of ocean circulation in the North Atlantic found a 30% reduction in the warm currents carrying water north from the Gulf Stream.

Nature, Vol 439, Issue 7079, 23 February 2006: John Whitfield reports in How green was my subsidy? That while Europe is funding schemes encouraging less intensive farming and so increasing biodiversity, landscape preservation, water and soil quality, threats are on the horizon. The latest EU budget could see funding fall by a fifth compared with 2006. In the absence of pre-set targets, measuring the schemes success is difficult and at a meeting convened by David Kleijn, half the schemes currently in place have no effect on biodiversity.

The Guardian, 29 March: With CO$_2$ emissions now on the rise, Margaret Beckett, the environment secretary, confirmed that measures to reduce emissions are now projected to cut UK CO$_2$ pollution by 15-18% below 1990 levels. Previous pledges stood at 20%.

The Scotsman, 31 March: Scotland followed this news by launching an ambitious strategy to become the greenest nation in the UK by cutting emissions through new and current initiatives.

Biozone Books

The Biozone Student Resource Manual is outstanding value for money, particularly at the special student discount rate. Students really need their own copies because the idea is that they write in them. As well as one book for AS and another for A2 ideally students need their own copies of the AS and A2 model answer books.

Biozone books are an amazing example of versatility. A single volume explicitly addresses the OCR, AQA, WJEC and Edexcel (including SNAB) specifications and also is intended to support Northern Ireland A level and Scottish Higher Biology. The items appropriate for a particular specification are clearly identified. Biozone can take any of the A level specifications it covers and turns it into student-led course. The books are updated each year. Biozone may well be a New Zealand organisation but when it produces material for the UK it is perfectly tailored for the UK system.
To refer to Biozone as ‘work books’ would be misleading because they are infinitely more sophisticated than the type of ‘fill in the blanks’ thing intended to help GCSE students revise. Biozone pages devoted to a particular topic start off as good quality stimulus material and the questions which follow are searching and clearly designed to encourage the application of knowledge. A Biozone activity, once the students have attempted it, creates a useful focus for class discussion.

When looking through the ecology section of Biozone it is important to appreciate that the choice of topics is dictated by the QCA Common Core and by what other people chose to put in there examination specifications. If the titles are a bit predictable – well it’s a reflection of the exam specifications. Biozone works within such constraints and works wonders by providing stimulus material to get the little grey cells working.

Ecosystems are illustrated by two interesting examples, Tropical Rainforest and a Kettle Hole Lake. Firstly of the ecological niche progressing from examples providing revision of GCSE to some very thought-provoking stimulus material featuring penguins, moles and snow buntings, followed by a section on cycles which draws together the different types of nutrition and gets beyond a sterile series of diagrams by inviting the student to apply ideas. The section concludes with a useful treatment of food chains, food webs and energy flow. The AS manual also has some interesting generic material on scientific process including hypothesis, graphs, data handling and statistics.

The Biozone A2 student resource and activity manual reflects the difficult ecological concepts currently featuring in many A2 specifications. Many of these topics are dealt with poorly in current text books at this level but in Biozone they are made accessible by the use of skilfully worded explanations and interesting examples. There is a good introduction to ecosystem stability and species diversity. There is an excellent and quite substantial section exploring many aspects of populations. Rarely does one ever see such topics as factors affecting population growth, survivorship curves, population age structure and r and k selection dealt with so lucidly at this level. Similarly one rarely sees predator-prey strategies, inter and intraspecific competition and the relationship between competition and niche size so well presented for A level. These are topics which many teachers find difficult to deal with. Biozone achieves a rare combination of accessibility and depth, well-explained theory, well-chosen examples and thought provoking activities. The ecosystem section concludes with useful activities about human impact on ecosystems and concise yet masterful treatment of succession and zonation.

There is also a very pleasing section on practical ecology including quadrats, transects, capture-recapture and statistics which looks very much designed to be used in the field. The latter covers the use of the t test, chi squared test and Analysis of Variance and features the use of spreadsheets as well as showing how to use pen and paper to carry out calculations.

Sections on population genetics and evolution and on biodiversity and classification complete a very useful resource for teaching ecology at A level which supports a variety of teaching styles. The Biozone approach succeeds, once again, in making topics like natural selection, gene pools, Hardy-Weinberg, founder effect, population bottlenecks, genetic drift, allopatric and sympatric speciation and evolutionary arguments from species distribution look almost easy. The ‘Analysis of a Squirrel Gene Pool’, based on a project carried out by college students in Illinois, sparkles with originality, providing both good stimulus material and an excellent teaching exercise. The activity on industrial melanism in moths is, on the other hand, a little disappointing. The traditional story is well presented but it plays safe and does not explore some of the challenges that have been levelled against Kettlewell’s work nor does it consider non-industrial selective advantages of melanism.

NEWBYTE CD-ROMS

The CD-ROMs which have been developed by Newbyte software www.newbyte.com/biology complement Biozone titles and demonstrate the same creativity shown by the rest of the package. They make difficult ideas easy – and even fun. Like Biozone, they are not intended as ‘frills’ – expensive luxuries to show the Ofsted inspector that you do use IT (sometimes). Newbyte CDs fit naturally beside the components of the biozone package which make the student resource and activity manual come alive – and have a ‘just what we need’ feel about them. They are certainly intended to be used as a part of the teaching programme.

Ecological titles available from Curriculum Online www.curriculumonline.gov.uk include:

**Foodwebs in Australian woodlands** £119 with full site license + VAT

**Foodwebs: ponds (UK and Australian versions)** £199 with full site license + VAT

**Natural Selection – peppered moths** £65 with full site license + VAT

**Natural Selection – frogs** £65 with full site license + VAT

**Natural Selection – beetles** £65 with full site license + VAT

All three natural selection programmes £160 with full site li-
cense + VAT

**Rock platform ecology** £99 with full site license + VAT

**Biozone Presentation Media**

This is presentation teaching material for particular topics available as Power Point, Keynote, QuickTime or Adobe Acrobat. Of particular use in ecology teaching are ‘Ecology' and ‘Genetics and Evolution' formats. Each one is relatively expensive (£159.95 ex VAT) but good quality and in colour, based on graphic material from pages of the student resource and activity manuals. This is, it has to be recognised, no ordinary Power Point presentation. The slides are clearly based on the student resource and activity manual but in many cases they explore the topics much further. There are many extra examples, beautifully illustrated with colour photographs. Extensive extra material illustrated by copious examples comparatively explores both the ecology of commercial fisheries and the changes in biodiversity in Britain, New Zealand and Australia. The Power Point treatment of statistics and fieldwork techniques will be found to be particularly useful.

There has been a certain amount of criticism recently about ‘off the peg’ PowerPoint presentations (see for example Kinchin 2006). Do they encourage a ‘linear approach to teaching’? Is the availability of such resources not anathema to the philosophy of Biozone which is, in many ways, such an antidote for spoon-feeding? Kinchin’s objection to the way PowerPoint is often used is that it fails to encourage the making of links, to looking at ideas from different perspectives and the building up of big concepts from many small ones. Kinchin considers that ‘Tension between linear and radial/integrated knowledge structures might be the catalyst to initiate a teacher student dialogue inviting student access to the academic discourse’. Biozone Presentation Media, very much the master of its genre, certainly could be used to achieve just this.

**Teacher Resource CD-ROM**

As the name implies, this is strictly for teaching and the very reasonable price (£59) assumes, with a few clearly defined exceptions, that material is not printed out for use by students nor transferred to intranets systems for general use. Each teacher using Biozone would need a new copy of the disc each year. It is a very powerful resource and well worth the money. It includes the following:

- Links to other useful websites
- Guide to text books, journals and periodicals
- AS and A2 student resource and activity manuals for current year
- Excel spread sheets for teaching statistics with worked examples
- Extra specification-specific worksheets for A2 (AQA A, AQA B, CCEAS, CIE, Edexcel, Scottish Highers, OCR, SNAB, WJEC.
- Worked examples for current year
- Extra activities on Applications of hormones, Muscles and performance, Point mutation problems, Review of gene technology and Stem cell research.
- Sample presentations
- Glossary worksheets

**Conclusion**

As part of a cocktail of learning styles and in facilitating a healthy interaction between teacher and student, the Biozone package has much to offer. It is a rich seam of creative ideas – and new ideas keep emerging thick and fast. It is making a contribution to good practice in teaching biology to students preparing for Higher Education in several parts of the World (UK, North America, Australia, New Zealand, Singapore and Malaysia) yet it is certainly not ‘one size fits all’. The UK versions are based on a thorough knowledge of examination specifications and have plenty of British examples. The inclusion of Australian and New Zealand examples is strength, adding a stimulating cosmopolitan flavour to a subject which knows no frontiers. It is always available in a local form which is perfectly adapted to local niches - and always kept up-to-date.

And it is both flexible and pragmatic enough to fit in with the limitations of real schools and colleges, real examination specifications, real teachers and real students.

**David Slingsby**

School Grounds Development

When the School Council at Ysgol Thomas Stephens requested a bird watching club, it was just the inspiration we needed to look at the way we were using our environment area. Our school is an English medium primary school of 22 pupils in Pontneddfechan in Powys, and environment education has been high on the agenda for several years, ever since a local farmer donated 0.8 hectares of land as a school nature area. However, although the site was integrated into many areas of the curriculum, including Science, English, Art and Design and Technology, we felt we had lost impetus in our work and that the site was being under-utilised owing to the small number of pupils. When we heard of the Welsh Assembly Community Focused School Grant, we came up with an idea to develop the environment area so that it can be used by the wider community, including other schools.

To be truthful, we did not really expect to be successful in our application, especially as most other schools seemed to be applying to set up community computer facilities. However, in January 2006 we were delighted to learn that we had been awarded £15,000 for our project, but a little unnerved to be given only weeks to finalise expenditure. Thankfully, there are a lot of environmental enthusiasts in our area, and with help from the British Ecological Society, the Forestry Commission, Brecknock Wildlife Trust and Brecon Beacons National Park we were able to develop our initial ideas into concrete plans. We found that the WAG grant was not actually enough to cover everything we needed – for instance, the existing boardwalk must be re-graded to facilitate disabled access – so we have had to undertake additional fundraising.

We hope to welcome visiting groups who will use the site for environmental education, and to run training courses and environmental activities. Thanks to support from the British Ecological Society, we are able to buy a range of field guides and software to enhance the hands-on activities. The site consists of a stream-fed pond, mixed deciduous woodland and wet meadowland, so it offers a variety of habitats for the children to investigate. The meadowland is rich in flower species, including orchids and the Devil’s Bit Scabious. This latter flower is the food plant for the caterpillar of the threatened Marsh Fritillary butterfly, which has a significant stronghold a few miles away in Ystradgynlais, so we try to manage the site to protect the plant, in the hope that this beautiful insect will find its way to us.

The children have been involved in all stages of the planning. They have really enjoyed meeting the people who have visited the school to advise us on the project. Working with all these enthusiasts is proving to be an inspiring experience for staff and pupils, and it is an exciting time to be at Ysgol Thomas Stephens!

By Mrs Janet Mulready of Ysgol Thomas Stephens

Careers

Ecology features in many careers to greater and lesser extents. In this section we hope to demonstrate a range of career paths and the contributions they make to Ecology

Elizabeth Hardcastle is the Living Churchyards Officer with the Yorkshire Wildlife Trust

Elizabeth joined the Yorkshire Wildlife Trust (YWT) in 1991 to do the administrative work rather than to work specifically as an ecologist.

Having obtained a Certificate in Education she now works with project volunteers to enable those managing churchyards and burial grounds to learn about their importance to our native wildlife. Elizabeth writes the living churchyards newsletter.

The Yorkshire Wildlife Trust has put together an information pack about the diversity of species likely to be found in our church yards. Elizabeth and trust volunteers visit interested sites to discuss possibilities for wildlife and draw up a list of species seen or heard during their visit. Species lists, annotated maps and management suggestions are then sent to the parish following analysis. The parish itself is then responsible for management and implementation.

For further details Elizabeth can be contacted at Yorkshire Wildlife Trust, 1 St George’s Place, York, YO24 1GN

www.yorkshire-wildlife-trust.org.uk
Frog picture