

Volume 4 • Number 1

roots

Botanic Gardens Conservation International Education Review

April 2007

Is it an apple? Is it a pear?
Who knows?!
Cultivating urban
ambassadors for nature
Systematic education and
interpretation
BGCI education – your views!

Linnaeus:
still relevant 300 years on?

20
YEARS
1987-2007



BGCI

BGCI education – **your views!**

BGCI education department decided last year that it was time we practiced what we preached and carried out some formative evaluation of our resources. With the 6th International Congress on Education in Botanic Gardens bringing hundreds of our colleagues from around the world together we couldn't think of a better time to get your opinions down on paper. A massive thank you to everyone who completed the forms at the congress and on the International Diploma on Education in Botanic Gardens (run at Kew in October and November 2006), and to those who returned one of the forms sent out with the last issue of *Roots*. We appreciate your input and can assure you that your responses, comments and ideas are feeding directly into our planning for the next couple of years.

What did we find out from you?

You read *Roots*

Happily, there is a high level of readership of *Roots* – with 87% of people either reading selected articles or reading *Roots* cover to cover. 96% of users usually read the editorial and everyone reads at least one article in *Roots*, with ¾ of users reading 3–7 articles on average per issue. The resources section is also popular with 82% of people always or sometimes reading it. Interestingly only ¼ of readers sometimes obtain hardcopies of the recommended resources, whereas ¾ of readers (always/sometimes) access the recommended websites. Due to this we will be increasing the number of online resources we include in the resource section; if you have any ideas, do get in touch.

Roots is useful

Roots readers find the articles the most useful (50%), followed by the whole of the journal (22%), then the resources section (17%), then the editorial (6%). This does indicate overwhelmingly that readers find *Roots* supports their work. Importantly, 84% of respondents said they found the different language sections useful – indicating that we should continue with our trilingual editorial, summaries and resources section.

You want to get involved!

Over half of the respondents offered to contribute an article. We have your details and will contact you in due course. One suggestion was that we should make forthcoming themes more widely known (e.g. through the website, or given more prominence in *Roots*) so that potential authors can offer to share their experiences on the subject. We will do this through the website, and remember if you have any news or ideas that could fit into *Roots* do let us know.

You want more practical ideas

On the whole, respondents think we have a good mix of content in *Roots* – they want to keep the amount of theory and research, external contributions and contributions from botanic garden colleagues the same. What you want is more practical ideas. As so many of you offered to provide articles for *Roots* we will follow this up and ask for your favourite practical activities.

Sustainability is the top issue

There were a huge number of responses to the question about what themes you want the next few issues of *Roots* to cover. The top five were: Education for

Sustainability; Marketing your education programmes; Interpretation; Working with school gardens; Volunteers. We will focus on these themes over the next few issues – keep an eye out for the ones you voted for. We will also provide material on the other themes you selected and include this on the website.

You enjoy surfing the web!

Your feedback on the website has been particularly useful, nearly ¾ of you have accessed it, which is very encouraging. Your ideas for improvements are excellent and we have been implementing some of them already. For example, we have just loaded over 300 case studies from back issues of *Roots* and congress proceedings onto the website. As requested by many of you, we are currently working on the resource section of the website and this should be ready soon.

Future developments

You gave us ideas about *Cuttings*, the BGCI newsletter, how many of you receive it and read it and what format you would like it in, which again will feed into BGCI's planning

You were also very supportive of the ideas we have about creating an international e-newsletter and an on-line distance learning programme for education in botanic gardens. Because of this we have submitted funding proposals and hope to be able to take these projects forward, we will keep you updated!

So thank you again, and if you have any other comments, queries or suggestions for us please do get in touch, education@bgci.org



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Cover Photo: Taxonomy in action, Timothy Walker, University of Oxford Botanic Garden, UK

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Forthcoming Issues

Volume 4 Number 2 – Education for Sustainability - focus on water. Last submission date July 20 2007

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BGCI would like to thank the co-editors for their work in the production of *Roots*:

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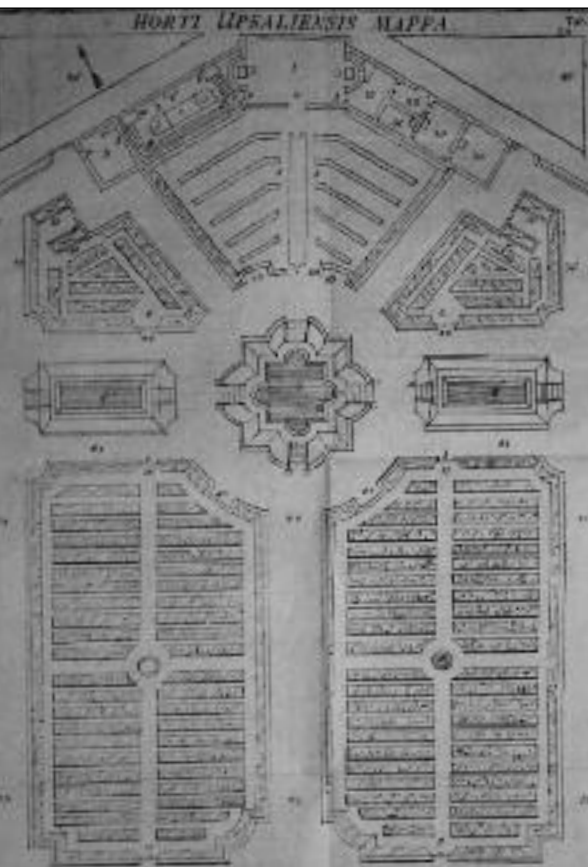
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Linnaeus

- still relevant 300 years on?

Editorial - English



Above: The original drawing for Linnaeus' Garden

A recurring concern of many of our botanic garden colleagues over the years has been the apparently inexorable decline in the popularity of taxonomy. With 2007 marking the tercentenary of Carl Linnaeus, the father of binomial nomenclature, we feel that the time is right for a reflection on Linnaeus' legacy and current relevance and have devoted our latest issue of *Roots* to explore this theme.

Editorial - Français

Le déclin vraisemblablement inexorable de l'intérêt porté à la taxonomie semble, au fil du temps, être devenu une inquiétude récurrente chez beaucoup de nos collègues des jardins botaniques. L'année 2007 marque le tricentenaire de la naissance de Carl Von Linné, le père de la nomenclature binomiale, et nous pensons donc que le moment est venu de réfléchir à l'héritage de Linné et à sa pertinence actuelle. C'est la raison pour laquelle nous consacrons notre nouveau numéro de *Roots* à l'analyse de cette thématique.

Nos recherches d'études de cas ont abouti à plusieurs exemples de jardins enseignant la taxonomie aux étudiants en horticulture ou en sciences biologiques, ou offrant des cours spécialisés pour adultes. Mais, des cas concrets de programmes sur taxonomie et classification destinés aux enfants et au grand public étaient bien plus difficiles à trouver. La question à nous poser, en tant qu'éducateurs, est la suivante : est-ce que cela est important ? Cela nous concerne-t-il ? Plus précisément, étant donné que la santé de notre planète dépend de la diversité, les jardins doivent-ils porter leurs efforts sur l'enseignement de la taxonomie ? Après tout, à moins que les jeunes commencent à reconnaître et comprendre l'importance de la diversité végétale, comment pourraient-ils faire le lien avec la notion plus générale de développement durable ?

Afin d'analyser ces problématiques, nous avons demandé à Gail Bromley, consultante internationale en éducation à la biodiversité et responsable du

Editorial - Español

La inexorable pérdida de popularidad de la taxonomía con el paso de los años ha sido una preocupación recurrente entre nuestros colegas de los jardines botánicos. El año 2007 marca el tricentenario del nacimiento de Carl Linnaeus, padre de la nomenclatura binomial, y creemos que es el momento justo para una reflexión acerca de su legado y relevancia actual, por lo que dedicamos este nº de *Roots* a ello.

Buscando a nuestro alrededor casos paradigmáticos, nos encontramos varios ejemplos de jardines que enseñan taxonomía a estudiantes de horticultura y biológicas, así como clases especializadas para adultos. Sin embargo no hay prueba de que se enseñe taxonomía y clasificación al público en general ni a menores. La pregunta es si a nosotros como educadores nos parece importante y si nos concierne. En concreto, dado que la salud del planeta depende de la biodiversidad, ¿tienen los jardines que dar el salto y dedicar esfuerzos a enseñar taxonomía? En definitiva, a menos que la juventud reconozca y comprenda la importancia de la biodiversidad vegetal ¿cómo pueden asimilar el escenario global de la sostenibilidad?

Hemos pedido el artículo principal a Gail Bromley, Consultora Internacional de Biodiversidad y Gerente en Educación del Royal Botanic Gardens de Kew, RU. Gail comenzó su carrera como taxónoma en el herbario de Kew antes de organizar su actual departamento de educación.

Looking around for case studies, we came across several examples of gardens teaching taxonomy to students of horticulture and biological sciences, as well as offering specialist classes for adults. But evidence of children and the general public being taught taxonomy and classification was much harder to find. The question we as educators need to address is does this matter? Should it concern us? More specifically, given that the health of our planet depends on diversity do gardens need to step up their efforts in teaching taxonomy? After all, unless young people begin to recognise and understand the importance of plant diversity how can they connect to the bigger picture of sustainability?

To examine these issues we asked Gail Bromley, International Consultant for Biodiversity Education and Education Development Manager, Royal Botanic Gardens, Kew, UK, to pen our lead article. Gail began her career as a taxonomist before moving out of the herbarium to set up Kew's education department. Her thoughtful article concludes that gardens do need to find new ways to engage young people in taxonomy.

300 years ago Linnaeus had little difficulty in engaging young people's interest in taxonomy. Students flocked from far and wide to study with him and contemporary accounts suggest that his natural history excursions were notorious events! In their tribute to the great man, Magnus Lidén, Curator, and Mariette Manktelow, Education Officer of Uppsala University Botanical Garden, Sweden, emphasise that Linnaeus was a teacher first and passionate about his subject. He believed that the best way to acquire knowledge was through a desire for learning. Two articles, from Timothy Walker, Director of Oxford Botanic Garden and Harcourt Arboretum and Gregory Kenicer, Head of Horticulture at the Royal Botanic Garden, Edinburgh, Scotland, outline the taxonomy programmes they run in their respective gardens. They share Linnaeus' belief that the best place to teach taxonomy is 'in the field', whether that be a botanic garden or arboretum. With hindsight, we can see that Linnaeus was in the vanguard for advocating hands-on education!

développement de l'éducation aux jardins botaniques royaux de Kew, au Royaume-Uni, d'écrire notre article central. Gail a commencé sa carrière en tant que taxonomiste avant de quitter l'herbier pour créer le département d'éducation à Kew. Son article, riche en réflexions, conclut que les jardins doivent en effet trouver de nouvelles méthodes pour inciter les jeunes à faire de la taxonomie.

Il y a 300 ans, Linné n'avait pas grande-peine à éveiller l'intérêt des jeunes pour la taxonomie. Les étudiants venaient en masse de tous côtés pour suivre ses cours et des récits de cette époque indiquent que ses sorties botaniques étaient devenues des événements de grande notoriété. Dans leur hommage au grand homme, Magnus Lidén, directeur, et Mariette Manktelow, responsable de l'éducation au jardin botanique de l'université d'Uppsala en Suède, insistent sur le fait que Linné était avant tout un enseignant et qu'il était passionné par son sujet. Il était persuadé que la meilleure méthode pour acquérir des connaissances passe par le désir d'apprendre. Deux articles, celui de Timothy Walker, directeur du jardin botanique d'Oxford et de l'arboretum d'Harcourt, et celui de Gregory Kenicer, responsable du service d'horticulture au jardin botanique royal d'Edinburgh en Écosse, brossent les grandes lignes des programmes de taxonomie qu'ils conduisent dans leurs jardins respectifs. Ils partagent les convictions de Linné sur le fait que le meilleur endroit pour enseigner la taxonomie, c'est « dans les champs », qu'il s'agisse d'un jardin botanique ou d'un arboretum. Avec du recul, nous pouvons constater que Linné était un pionnier en matière d'éducation par la pratique.

Un numéro de Roots sur la taxonomie serait incomplet sans jeter un regard aux parterres consacrés à la systématique. Ils sont les fondements de l'activité des jardins botaniques et, s'ils sont accompagnés d'une bonne interprétation, ils permettent aux visiteurs de remettre de l'ordre dans la confusion. Nick Meijdam, responsable du service éducatif au jardin botanique de l'université d'Utrecht, décrit les plans du plus grand jardin de systématique des Pays-Bas et les

Su profundo artículo concluye constatando la necesidad de encontrar nuevas formas o caminos para atraer a la juventud hacia la taxonomía.

Hace 300 años Linnaeus tuvo poca dificultad en conectar con el interés de la juventud por la taxonomía. Estudiantes de todas partes viajaban para estudiar con él y los relatos de la época cuentan que sus excursiones de historia natural eran muy famosas. En reconocimiento y tributo al gran hombre que fue, Magnus Lidén, Superintendente, y Mariette Manktelow, Educadora Jefe del Jardín Botánico de Uppsala, Suecia, subrayan que Linnaeus era profesor ante todo y un apasionado de su tema. Creía en el profundo deseo de conocer como la mejor forma de aprender. Dos artículos de Timothy Walker, Director del Jardín Botánico de Oxford y el Harcourt Arboretum y Gregory Kenicer, Jefe de Horticultura del Jardín Botánico de Edimburgo, Escocia, describen los programas de taxonomía que desarrollan en sus respectivos jardines. Comparten con Linnaeus la firme convicción de que donde mejor se aprende taxonomía es en el campo, ya sea un jardín botánico o un arboretum. Mirando atrás y con perspectiva podemos afirmar que ¡Linnaeus fue la vanguardia de la pedagogía activa!

No estaría completo este n° de Roots dedicado a la taxonomía sino hablamos del jardín sistemático. Es el eje de actividad del jardín y correctamente interpretado ayuda a los visitantes a poner orden donde había caos. Nick Meijdam, Educador Jefe del Jardín Botánico Universitario de Utrecht, describe la planificación del jardín sistemático más grande de Países Bajos y los métodos de interpretación empleados para comunicar el mensaje al público. Nick ofrece una fascinante historia de los jardines sistemáticos, en la que demuestra cómo han cambiado radicalmente con los avances de la tecnología y el conocimiento.

Volviendo nuestro interés hacia el público joven, destacamos dos programas de educación con mucho éxito. Merilyn Haigh, Coordinadora de los Servicios de Visitantes del Jardín Botánico de Gladstone Tondoon,

Right: The Baroque Garden at Uppsala Royal Palace became the new botanic garden in 1790. The Linnaeanum, in the background, will house exhibits and an information centre during the Linnaeus jubilee this year

No issue of *Roots* on taxonomy would be complete without looking at systematic beds. They are the bedrock of botanic garden activity and, if well interpreted, help visitors make order out of chaos. Nick Meijdam, Education Officer at the Utrecht University Botanic Garden, describes the layout of the largest systematic garden in The Netherlands and the methods of interpretation used to communicate their messages to the public. Nick also offers a fascinating short history on systematic gardens, demonstrating how radically they have changed over time with increased knowledge and technology.

Turning our attention to younger audiences, we showcase two very successful education programmes. Marilyn Haigh, Visitor Services Coordinator at Gladstone Tondoon Botanic Gardens, Australia, has found that hands-on-learning enables children to gain an understanding of the importance of taxonomy. Using data record sheets, children are encouraged to investigate various characteristics of plants. And from India, Suma Tagudar, Education Officer for the Foundation of the Revitalisation of Local Health Traditions, tells us of her work with urban children to develop their own taxonomic plant databases. Through this process, she argues, children become ambassadors for conservation.

Internationally there does appear to be consensus that taxonomy *per se* is important for the conservation and sustainable use of plant diversity. We know that botanic gardens play a significant role in training the next generation of taxonomists. The question is what role should they play in educating school children and the general public about taxonomy? If botanic gardens, custodians to an unrivalled diversity of plants, do not see a role for themselves in this process, then who will?

méthodes d'interprétation utilisées pour diffuser leurs messages au public. Nick présente également brièvement l'histoire fascinante des jardins de systématique, démontrant comment ils ont radicalement changé au cours du temps grâce à l'enrichissement des connaissances et des technologies.

Portant notre attention au jeune public, nous présentons deux programmes éducatifs qui rencontrent un grand succès. Marilyn Haigh, coordinatrice du service « visiteurs » aux jardins botaniques de Gladstone Tondoon, en Australie, s'est aperçue que l'apprentissage par la mise en situation permet aux enfants de comprendre l'importance de la taxonomie. Utilisant des fiches pour enregistrer leurs informations, les enfants sont encouragés à rechercher les différentes caractéristiques des plantes. Dans un autre exemple provenant d'Inde, Suma Tagudar, responsable éducatif de la Fondation pour la revitalisation locale de la santé traditionnelle, nous raconte son travail avec les enfants des zones urbaines pour développer leur propre base de données taxonomique de plantes. A travers ce procédé, soutient-elle, les enfants deviennent des ambassadeurs pour la conservation des plantes.

Sur le plan international, il apparaît que la taxonomie est importante, en soi, pour la conservation et l'utilisation durable de la diversité végétale. Nous savons que les jardins botaniques jouent un rôle déterminant dans la formation de la prochaine génération de taxonomistes. La question est donc : quel rôle doivent-ils jouer dans l'éducation des scolaires et du grand public, en matière de taxonomie ? Si les jardins botaniques, gardiens d'une diversité végétale inégalable, ne trouvent pas leur rôle dans ce processus, qui d'autre le fera ?



Australia, descubre cómo el aprendizaje activo capacita a la infancia en el reconocimiento de la importancia de la taxonomía. Usando hojas con estadillos, se anima a los infantes para que investiguen diferentes características de las plantas. Y desde India, Suma Tagudar, Educadora Jefe de la Fundación para la Revitalización de las Tradiciones Locales de Salud, cuenta su trabajo de cómo los niños urbanitas desarrollan sus propias bases de datos de plantas. Argumenta que la infancia se convierte en embajadora de la conservación a través de este proceso.

Internacionalmente existe un consenso de que la taxonomía *per se* es importante para la conservación y el uso sostenible de la biodiversidad vegetal. Sabemos que los jardines botánicos juegan un importante papel en la capacitación de la nueva generación de taxonomistas. La pregunta es ¿qué papel deben jugar en la educación de escolares y público en general en taxonomía? Si los jardines botánicos, custodios de una insuperable diversidad de plantas, no ven su función en este proceso ¿quién pues?

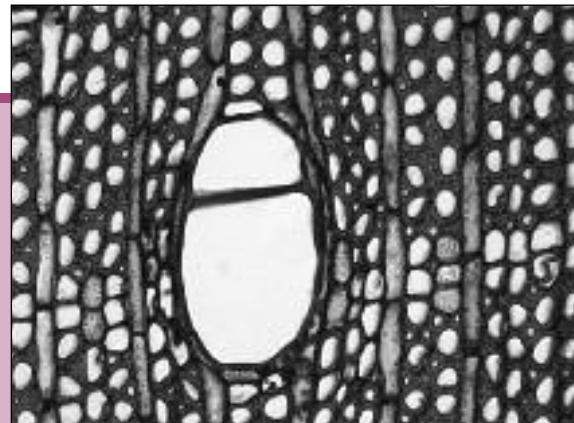
Is it an apple? Is it a pear? Who knows?!

Summary Since the demise of ‘whole organism’ biology in favour of biotechnology and molecular biology at universities and research institutes, taxonomy has become less available as a subject and is fast disappearing out of school curricula across the world. And yet taxonomy is as important today as ever, supporting forensic work, the search for new medicinal compounds, the fight to combat climate change and the development of many new everyday products.

As huge repositories of diverse species, botanic gardens offer the ideal site for the teaching of taxonomy to a number of audiences - inspiring a passion for plants, developing observation skills and ultimately building capacity for environmental action and conservation work globally. Many botanic garden education staff, in countries from Australia to the UK, have been developing and offering activities and programmes that encourage people to recognise, identify and understand plant relationships and are rolling out everything from games, role-play, talks, tours and fancy microscopes to hook and inspire their audiences. We need all gardens to take up the baton, explaining new and exciting stories about the role of taxonomy and encouraging the next generation of field botanists; without them, plant conservation will be even more of an uphill struggle.

The importance of teaching about classification and taxonomy is one of those issues that occasionally divides friends and colleagues in education circles. When I talk to some who work in formal science education, I find that many think that identifying and naming plants, or any other living creature for that matter, is neither particularly useful nor exciting. A sort of ‘so what’

mentality seems to pervade the system. And yet we know that the discipline itself is at the very heart of how we organize everything in our everyday lives, whether at work or play. It comes as second nature to sort out the world around us, to classify it, so that we can easily distinguish the nature, role and value of any item or process. As humans, we all have our ‘name’ tags



Left: Transverse section of Ramin (*Gonyostylus* sp) viewed under the microscope, reveals its unique structure (Photo: Dr Peter Gasson, RBG Kew)

and easily recognizable characteristics that can be used identify us. And so it is with the plant world. If we know what a plant looks like, where it comes from, what it is called and what it is related to – everyone else, from the gardener to the medical practitioner and from the florist to the forensic scientist is able to work with it.

Taxonomy has unfortunately become one of those disciplines that are unsung and un-championed in our world today. This was certainly not the case for the two centuries following the initial publication (1753) of the classification system as developed by Carl Linnaeus; in fact taxonomy was taught well and enjoyed up until the 1970s. Throughout that period, children and older students regularly enjoyed nature studies, ecology and fieldwork, and the discipline of biological sciences focused on the study of ‘whole organisms’, recognizing the importance of their overall morphology and their relationships to other living specimens.

Right: Series of posters produced for the 'taxonomy' festival days held at the University of Oxford Botanic Garden, UK (Photo: University of Oxford Botanic Garden, UK)



In today's formal education system in the US, the UK and across much of Europe, you can just about get by without knowing the name, scientific or common, of any plant. Children are occasionally able to recognise more commercially available species such as daffodils, roses or tulips – but usually only because they have been with their parents when the flowers were bought at a supermarket or, in the case of a few keen families, because their parents have got them to help out in the garden or on allotments. This general lack of knowledge was highlighted recently in a recent survey completed by Dr. Anne Bebbington. She found that in a sample size of over 800 A level biology students, almost half (41%) could name only one wild flower from a selection of 10; trainee teachers were only marginally better with 36% able to name only one wild flower and 64% able to name more than one. Little wonder then that our local, regional and national biodiversity goes unloved and undervalued! And the trend continues in universities, where taxonomy has largely been abandoned in favour of newer and rapidly growing disciplines such as molecular biology, genetics and biochemistry.

But does it really matter? Do we really need to know how to tell the difference between a dandelion and a daisy? Arguably yes, if we want to support conservation and encourage more people into the field of plant science. Edward Wilson (2004) wrote '*Among its cascade of derivative functions, taxonomy... provides the requisite database for ecology and conservation science, and, not least, it makes accessible the vast and still largely unused benefits offered by biodiversity to humanity!*' And it is becoming ever more evident that the lack of these basic skills hamper our every day lives.

For example, nowadays construction work across the developed world usually requires an environmental impact assessment, but there is often no-one with the skills to identify the biodiversity present on potential development sites. Many botanic gardens across Europe are regularly receiving requests to run short courses to help staff in local councils and survey companies identify flora and fauna. Similarly, poison cases still occur, fairly often in the case of pets and livestock, but nearly all of these need to be referred to botanic gardens for help in identifying potential poisonous plants and fungi, as neither farming nor veterinary workers have had training in the basic identification skills that could help them identify potential hazards. Officers bravely trying to control illegal trade in natural products and living specimens the world over, need specialist training to enable them to identify suspicious cargoes of plants and animals. And the current 'big issue', tracking the effects of climate change, also relies heavily on the ability of data recorders to identify and track targeted species. Recently scientists demonstrated, using the results of a monitoring study of 1700 plant and animal species, that there had been a range shift of 6.1 km per decade of these species towards the poles.

It is estimated that there are currently about 6000 taxonomists working worldwide on all organisms combined, and yet there is an enormous task

facing them. In the 250 years post Linnaeus, we have documented only about 10 % of the world's biodiversity, so there is still a great deal of work to be done, even in the area of higher plant groups, where roughly 2000 species are described and published each year. Worse still, taxonomists globally are not evenly distributed. Over 80% of the world's population live in less developed countries, alongside probably 80% of the world's biodiversity, but where only about 15% of the wealth exists and where good quality training and resources to deliver plant taxonomy is often sadly lacking.

Even in the UK, of the 25,780 students who took a topic in biological sciences as a first degree, only 60 studied botany and for the 4,340 taking straightforward biology, there was very little emphasis on whole organism biology. Where it does exist in courses, it is mostly skewed towards zoology. This huge problem has at least now been recognised by signatories to the CBD and Global Strategy for Plant Conservation, who have set up a programme called the 'Global Taxonomy Initiative' (GTI) to actively promote and develop taxonomic skills and hopefully implement them so that we can at last do more to document global biodiversity.

So what can we, as botanic garden educators, do to help this key initiative? How can we inspire and support the next generation to take up the baton,

Right: In 2001, the torso of a boy was found in the River Thames in London. When Dr Hazel Wilkinson, a scientist at Kew, examined samples from the boy's gut, she found fragments of the poisonous calabar bean which is indigenous to Western Africa and commonly associated with voodoo practices. (Photo : Dr Peter Gasson, RBG Kew.)



select plant science as a chosen field and, in particular, take up coursework in higher and further education that will facilitate future taxonomic work? How can we build public interest and sympathy for taxonomy and its relevance, so that people everywhere can support the work of taxonomists and lobby government to ensure resources are available for future training and research work? We are nearly all based in botanic gardens, where an amazing wealth of taxonomic skill and knowledge exists. We could be helping to translate and transform this for our audiences - and we should be doing more!

Once audiences are captured, they seem to revel in their newly found skills. Kew and several other gardens teach 'Basic Botany', focusing on the skills needed to identify and recognize the plant world around us, and I have to say that the adults who participate in the classes love it. There are shrieks of excitement at exploring the various elements of flowers under the microscope and breathless wonder at the amazing diversity. Students have huge deliberations over whether the character in view under their hand-lens is what they think it is and huge pride in being able to articulate what they can recognize about a plant. And they find it enormously encouraging that even good taxonomists have problems sometime! Students go away happy that they know what to look out for, confident to try out a key and positive about exploring the world about them. They are inspired!

Several education programmes around the world have already stepped up to the mark, although when researching for this article, I found far less than I had hoped for. One common offering is through professional or further education courses, mostly in the larger institutes across the northern hemisphere and Australia. New York Botanical Gardens, for instance, offers a huge range of adult education courses. This year's course programme has, as usual, taxonomy as a pivotal element, even when geared towards the amateur taking such courses as 'Herbal identification and cultural importance' and 'Plant structures for naturalists'. A few are designed for



Left: Close-up view of a wooden blind containing illegally imported Ramin wood (*Gonystylus* sp), which is listed in CITES appendix 2 (Photo: Dr Peter Gasson, RBG Kew)

those seeking further education qualifications, as in New York's accredited courses on 'Field botany' or 'Plant systematics'.

But how about something for the family (no pun intended!)? The University of Oxford Botanic Garden held a wonderfully inspiring series of 'taxonomic' festival days in 2006. They chose to celebrate five plant families (rose, buttercup, mint, daisy and potato) and held a number of activities that included tours of the plant family specimens in the garden, storytelling sessions, performance art and 'drop-in' botanical illustration sessions to help understand the plant family characteristics. Over 1,000 people per day enjoyed that taste of taxonomy!

A new EU project will shortly provide a resource to use with younger children. Botanic gardens in Italy, Austria, Bulgaria and the UK will be offered downloadable free resources for primary schoolchildren aged 8-11. One activity gets the children to record, using hand held electronic data collectors, the similarities and differences across a range of key plant families for vegetables (cabbage, potato, carrot, mint, pumpkins and

gourds) and then to decide which of a range of fresh vegetables they've been given fits where! In a pilot, the children found the exploration fun- and were heard to make such comments as 'No silly, it can't fit in the potato group can it - the flowers are different!', and 'Gosh, these two smell exactly the same, Miss!' (celeriac and celery).

So who says it can't be fascinating and fun? Let's take on the challenge: after all, we are the best placed people to do it. Botanic garden educators are renowned for tackling the invisibility of plant science - coming up with interesting activities and positive outcomes. And this is one field where there is no shortage of new things to discover.

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Right: Customs Officer, Guy Clarke, examining the wooden blind suspected to contain Ramin wood (*Gonystylus* sp) (Photo: Dr Peter Gasson, RBG Kew)

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Résumé

Depuis la fin de la biologie des « organismes entiers » dans les universités et les instituts de recherche au profit de la biotechnologie et de la biologie moléculaire, la taxonomie a peu à peu été délaissée et a rapidement disparu des programmes scolaires à travers le monde. Pourtant, de nos jours, la taxonomie est plus importante que jamais pour soutenir les sciences légales, la recherche de nouveaux composés en médecine, la lutte contre le changement climatique et le développement de nouveaux produits du quotidien.

Comparables à d'immenses entrepôts de la diversité des espèces, les jardins botaniques sont des lieux parfaits pour enseigner la taxonomie à un large public, inspirer la passion des plantes,



développer l'art de l'observation et enfin renforcer les capacités pour la conduite d'actions environnementales et des travaux de conservation au niveau mondial. De nombreux services éducatifs de jardins botaniques de divers pays, depuis l'Australie jusqu'au Royaume-Uni, proposent des activités et des programmes qui encouragent les gens à reconnaître, à identifier et à comprendre les relations entre les plantes par le biais d'animations, des jeux de rôle, des discussions, des visites et des microscopes originaux pour accrocher et inspirer leur auditoire.

Nous avons besoin du relais de tous les jardins pour expliquer les nouveaux enjeux prometteurs de la taxonomie et encourager les prochaines générations de botanistes de terrain. Sans eux, la conservation des plantes risque davantage d'être une lutte vaine.

Resumen

Desde el ocaso del concepto del "organismo como un todo" en la biología a favor de la biotecnología y biología molecular en las universidades e institutos de Investigación, la taxonomía ha empezado a hacerse menos disponible como un tema y esta desapareciendo de los programas de todas las escuelas alrededor del mundo. Sin embargo, la taxonomía es tan importante hoy como nunca, apoyando el trabajo forense, la búsqueda de nuevos compuestos

medicinales, la lucha para combatir el cambio climático y el desarrollo de muchos productos nuevos cada día.

Como depósitos inmensos de diversas especies, los jardines botánicos ofrecen el sitio ideal para la enseñanza de la taxonomía a un número de audiencias – inspirando una pasión por las plantas, desarrollando habilidades de observación y construyendo capacidades para la acción ambiental y trabajo de conservación a nivel global.

Mucho personal de educación en Jardines Botánicos, en países desde Australia al Reino Unido, ha estado desarrollando y ofreciendo actividades y programas que animan a la gente a reconocer, identificar y entender relaciones de plantas y están produciendo todo desde juegos, obras para actuar, viajes y sofisticados microscopios para atraer e inspirar sus audiencias. Nosotros necesitamos que todos los jardines tomen la batuta, explicando nuevas y excitantes historias acerca del papel que la taxonomía y animen la siguiente generación de botánicos de campo, sin ellos, la conservación de plantas serán aun mas difíciles cuesta arriba.

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Linnaeus as a teacher

Summary It is 300 years since the birth of Carl Linnaeus ‘when the cuckoo was announcing the imminence of summer’. His tercentenary has created quite a stir in Sweden, not only in Uppsala, but also among the learned societies of England and America. But why? This man, who created a now obsolete plant classification system, who believed that swallows hibernate deep in the bottom of ponds and that species were created once and for all in the Beginning of Time, who was a racist and a biopirate, had a big nose and wore a wig, is he really someone to celebrate? It is true that our Swedish national hero has not met uniform acclaim. But while there may be a grain of truth in some of the statements above, this article will testify that they completely miss his more important achievements and fail to consider that his ideas developed through time.

Linnaeus the scientist

‘There has not been a greater botanist or zoologist’

(Linné, Vita III, autobiographical manuscript)

It is indisputable that Linnaeus was of immense importance for systematic biology, and we can only list his more significant contributions here. He completely reformed botanical terminology into a clear and economic language that we still use today. His *Systema sexualis*, although artificial and not a theoretical improvement on pre-existing systems, was much easier to use and resulted in botany reaching an all time high in terms of popularity. As a scientific tool this system was replaced by attempts at natural



classifications. His binomial system for naming species is ingenious and will probably survive as long as taxonomy. His encyclopaedic project *Species Plantarum* is a fantastic achievement.

This two-volume work is the primary starting point of plant nomenclature as it exists today. In the spirit of the enlightenment he stressed *observation* as the primary source of knowledge, and contributed to innumerable studies on phenology, ethnobotany, ecology, insect biology, distribution, etc. His *ordines naturales* for the Plant Kingdom, where he suggested that all plant diversity evolved from 58 original creations, is also worth noting, although he completely mistook the mechanisms of change.

The socially adept

Besides a remarkably structured mind, his charm and charisma were of critical importance in earning him benefactors from the early years, from Stobaeus in Lund, Celsius and Rudbeck in Uppsala to Gronovius, Boerhaave, Burman and Clifford in Holland. The rapid spread of his ideas is of course primarily explained by their clarity and utility, but without well timed promotion, money and authority provided by senior scientists, the success of these ideas would have been less certain. Linnaeus paid his debt, with high interest, in his generosity towards his own students.

The poet

‘Now the earth began to thrive and smile, now Flora comes and sleeps with Phoebus’

So starts his Lapland diary. It shows a side of Linnaeus that is very important for his status as a national figurehead. His personal and poetic prose was full of love and amazement yet economic

Left: What better crown for Linnaeus than his own *Fumaria nobilis* L. (now *Corydalis nonioides*) (Photo: Uppsala University Botanical Garden)

Right: In 1758 Linnaeus bought the manor estate of Hammarby, outside Uppsala, where he built a small museum for his extensive personal collections (Photo: Uppsala University Botanical Garden)

in style. His travelogues and other works in Swedish are reprinted in new editions and read by new generations. Linnaeus detested needlessly embroidered language, and claimed that clear and straightforward writing was more entertaining to read: a recommendation that still holds.

The teacher

Now you perhaps begin to understand why Linnaeus became a legend during his own lifetime and why 74 foreign students came to Uppsala and Hammarby to seek enlightenment. The same traits that enabled his scientific success made him a star on the teaching stage. Together with his co- professor Rosén he was responsible for education in the Faculty of Medicine at Uppsala University.



made the audience burst out laughing. In contrast to other professors at the academy, he always spoke without a manuscript. Instead he held a narrow strip of paper, with selected key-words, between his thumb and index finger. Eventually, his rhetorics became a standard academic example of excellence.

Next he took his students to the *Hortus Academicus* (botanic garden), which was laid out as a living textbook of his *Systema sexualis*. "In the garden" he remarked "there are more plants than you could possibly see if you wandered through all Europe looking for plants". And he added "in the field you will see the species in their habitats". He saw field studies as a natural and necessary follow-up of the demonstrations in the garden.

The field botanist

His annual field excursions '*Herbationes Upsalienses*' (eight in all) were extremely popular and organised in an almost military fashion. The students were instructed to wear loose-fitting, robust and comfortable clothes. He selected an able student as responsible for shooting birds, another to keep the protocol, and one with the authority to discipline those that dropped behind or otherwise misbehaved. All finds were duly recorded. This may have appeared to be a strict regime, but the field excursions attracted up to 200 students. This was a significant number considering that the total number of students at the academy was less than 600.

After the students searched an area, Linnaeus assembled them at certain stations along the path to discuss and teach about their various finds. The student who contributed the rarest plant or bird was particularly credited. The returns to Uppsala in the evening after a full day's fieldwork involved veritable triumphant processions with singing, trumpets, and merriments. Some of his colleagues of course highly disapproved of Linnaeus' shameless encouragement of such improper behaviour!

Linnaeus' students were very keen about natural history. He always tried to answer every question from every student, and – while happily repeating the message time and again for those who did not get it the first time – kept a special regard for those with particular talent. These students were selected for more personal supervision, and eventually took part in or led explorations to other Swedish provinces. A treasured few of the students, his *apostles*, were deemed so bright and independent that they were encouraged to take part in explorations to other parts of the world. Linné (as he was known after being granted nobility in 1761) was there, as mentor and supervisor, all the way from the professor's chair to the port in Göteborg.

The team leader

In the creative atmosphere that developed between Linnaeus and his senior students, new scientific ideas were born and tested. A case in point is binary nomenclature, which started to



Above: The Uppsala University Botanical Garden is a tremendous resource for students to learn about the identification of plants (Photo: Uppsala University Botanical Garden)

They had divided the subject between them, such that Rosén lectured in pathology and physiology, Linnaeus in diet, diagnosis, and natural history. Linnaeus's lectures were widely renowned. They attracted students from other faculties than his own to such an extent that he became the victim of his colleague's jealousy. He hypnotized his audience. Listeners described how they would hang on his words while he led them from stories about the greatness of Creation to down-to-earth particularities, from broad generalisations to detailed and vivid accounts of a plant or animal, often interspersed with jokes that

develop during excursions, and was used in some dissertations before being finally launched in an international arena with *Species Plantarum* 1753. Linnaeus encouraged in his students a desire to learn, love and discover, and this helped many of them carve out great careers. Of course he benefited himself from their activities. He expected his apostles to send back to their master plants and animals from 'unexplored' parts of the world and was annoyed by Solander who kept his collections for himself. Solander, whom he had pictured as his son-in-law and his successor to the botanical chair, remained in London following his expedition on the *Endeavour* with Captain Cook to the Pacific.

Linnaeus' summer school

Linnaeus received several students for private lessons, and not only Swedes. Of a documented 74 foreign students, the majority came from neighbouring countries. After returning home, several of them became professors, from which position they further extended their teachers' fame. His supervision of his favourite foreign students continued throughout the summer months at Hammarby, his retreat in the countryside 15 km SE of Uppsala. Linné's tuition fees were not fixed: poor students went for free or were even provided for, whereas the two Demidoffs, Russian noblemen, paid 3 500 dalers.

What can we learn from Linnaeus?

Linnaeus passion for teaching seems to emanate from his very early years. Encouraged by a loving father, he learned every species of plants in the Stenbrohult countryside. At the age of eight, he taught his play-mates. When he later had a [private] teacher, he suffered a different regime: if he did not know his homework, he received a spanking. Unlike many others with that experience, he drew the conclusion that the best way to acquire knowledge is through a desire for learning, and that it is the duty of every teacher to inspire that love. He would rather spend his time botanising in the forest than wasting it on boring lessons with sadistic teachers. Consequently he was deemed unfit for an intellectual career (priesthood, that is). Eventually, however, his talents for natural history

were appreciated, and his high school teacher Rothmann helped him to obtain a university education in natural history and medicine. The rest is history.

250 years have passed since Linnaeus lectured, and yet his pedagogical ideas, unlike his theories on hybridisation, seem completely modern. It is our conviction that we could all learn from his example, not only his general attitude, but his actual teaching practice.

Résumé

Cela fait 300 ans que Charles Linné est né, « lorsque le coucou annonçait l'imminence de l'été ». Son tricentenaire a créé de véritables remous en Suède, notamment à Uppsala, mais aussi parmi les sociétés savantes d'Angleterre et d'Amérique. Mais pourquoi ?

Cet homme, qui a créé un système de classification des plantes à présent obsolète, qui croyait que les hirondelles hibernaient sous l'eau au fond des marais et que les espèces avaient été créées une fois pour toutes au début des temps, qui était un biopirate et un raciste, avait un gros nez et portait une perruque, est-il réellement digne d'une commémoration ?

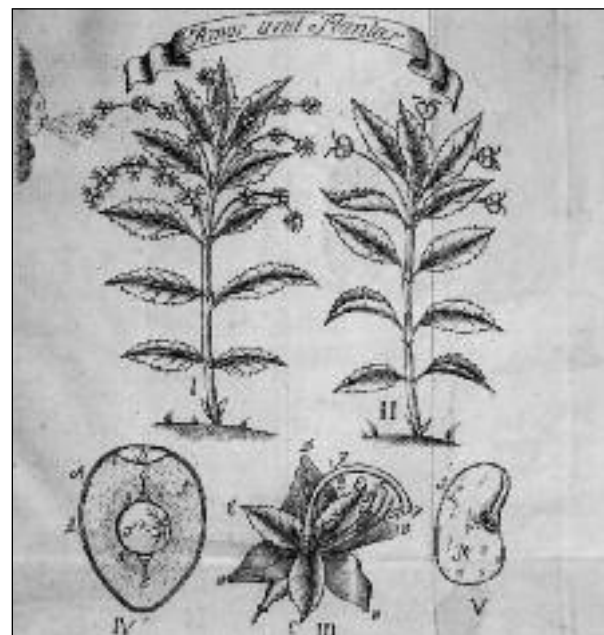
Il est vrai que notre héros national Suédois n'a pas été acclamé de façon uniforme. Mais, bien qu'il y ait un soupçon de vérité parmi les allégations susdites, cet article témoignera qu'elles passent complètement à côté de ses exploits les plus conséquents et négligent le fait que ses idées se soient développées au fil du temps.



Resumen

Ya son 300 años desde que Carl Linnaeus nació 'cuando el cucú estuvo anunciando la inminencia del verano'. Su tricentenario ha creado una agitación en Suecia, notablemente en Uppsala, pero también entre las sociedades cultas en Inglaterra y América. Pero porque? Este hombre, quien creo lo que ahora es un sistema obsoleto de clasificación de plantas, quien creyó que las golondrinas hibernan en la profundidad de los estanques y que las especies fueron creadas en el Principio del Tiempo, quien fué un racista y un biopirata, tenía una gran nariz y usaba una peluca, es realmente alguien para celebrar? Es verdad que nuestra heroe nacional Sueco no tiene una aclamación uniforme. Pero mientras hay gran parte de verdad en algunas de las afirmaciones hechas anteriormente, este artículo testificara que ellos no mencionan el logro más importante alcanzado y fallan en considerar que sus ideas se desarrollaron a través del tiempo.

Bottom middle: Flowering plants are sorted into classes according to the number and organization of the stamens. This *Canna indica* has only a single stamen and belongs in the class Monandria (one man)
Below: In Linnaeus' very first scientific paper, '*Praeludia Sponsaliorum Planetarum*', he discusses the sexuality of plants (Photos: Uppsala University Botanical Garden)



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We shall always need **taxonomists**

Summary 2007 is the 300th anniversary of the birth of one of the greatest biologists of all time: Carl Linnaeus (1707-1778). When he was just 20, Linnaeus recognised that the naming of plants had never been treated seriously by botanists. It is impossible now to imagine how biology could function without the universally accepted system of binomial nomenclature which he developed. Taxonomy lies at the core of biological science and for that reason is still taught in many universities all over the UK. In fact the best place to teach taxonomy is not in a classroom but “in the field”; be it a field, a botanic garden or an arboretum.

It is a valuable lesson (for all of us) to read the observations made by Theophrastus over 2,300 years ago. The groups of plants that he describes are clearly identifiable today. Despite the fact that cataloguing the world’s plants has been ongoing for more than 80 generations it is still not complete and it does not seem to be getting closer to completion since the number of new species (a group of plants that share a unique set of characteristics that can be replicated into the next generation) described each year

Right: Biology undergraduates at Cape St. Vincent learning how to use a botanical key (Photo: Timothy Walker)

All the great botanists have been exceptional field biologists. From Theophrastus to Mark Chase via John Ray, Carl Linnaeus and Charles Darwin, we have only been able to make sense of the fascinating matrix that is biology by observing organisms in their habitats and comparing each one with its neighbour. The exact science and subtle art of comparative biology has enabled us to create catalogues of names of groups of organisms that are distinct from one another. We can thus monitor the rise and fall in abundance of any one group and act to support those that are declining. We are now able to identify those areas that are particularly rich in numbers of different groups. We can identify regions that have exceptionally high numbers of unique groups found nowhere else. This enables us to set conservation priorities.

The process of describing individuals, defining groups and placing the groups into a hierarchy began many years ago.





remains constant at over 2,000. It is therefore clear that we must still train new taxonomists to work in the field.

At the University of Oxford we teach a three year Biological Sciences degree that replaced and combined the separate degrees in Zoology and Botany. When this change occurred in 1991 many saw it as the final death knell for botany and plant taxonomy in particular. The reverse has happened. In their final year 25 of the 100 students opt to become plant scientists. So it is in the final year that they are exposed to field botany and plant systematics in fine detail for the first time. This is a significant change from the situation 30 years ago when this was taught at school in the UK. The fact that very few students applied to read botany could signify that they were not ready for field botany and systematics. It could also be because they did not have sufficient exposure to field work during their school days. However, by the time they reach their third year, our undergraduates are certainly ready to see how taxonomy and systematics lie at the core of all biology.

For our 21st century botanists the field trip occurs in the second half of March in the form of a two week field trip to the Algarve. Southern Portugal is an especially magical place in the spring and it is the perfect place to introduce our fledgling botanists to field biology. Within a 250 km² area there are representatives of over 50 botanical families many of which flower in March. Student feedback shows that this is a

very successful piece of teaching as well as being very enjoyable. One student reported that he had “never learned so much, so quickly and so pleasurably since meeting his first serious girlfriend”. When the students return to Oxford there are further lectures and tutorials in the botanic garden looking at the world flora and how we now classify it using phylogenetic approaches.

Of course, field trips and lectures are nothing new as a teaching strategy but they have become more subdued. In the summers of the 1740s Linnaeus led twice-weekly 12 hour natural history excursions that started from the University of Uppsala. These field trips were very colourful affairs with the students carrying banners and with Linnaeus marching at the front accompanied by a band. Sadly, in 1748 the Rector of Uppsala ordered a halt to the field work following complaints from local residents who objected to being woken at seven o'clock in the morning. The Rector's bizarre reason was that Swedes could not “unite the pleasurable and fun with the serious and useful” (Koerner, L. 1999). All of us involved in environmental education, in its broadest sense, know this to be nonsense. Linnaeus later claimed that the Rector's actions nearly killed him and that he didn't sleep for two months.

Despite the pomp and ceremony these were serious scientific events and were planned like military expeditions with each of the 300 participants being given a specific task. Among these

were the Annotators. Their work was difficult because not only were there no universally accepted system for naming plants but also each of the species would have a name as long as a sentence (a polynomial). This hampered the process of recording the data in the field. Linnaeus realised that a simple, accessible language was required for naming species if he was to practice science. Furthermore, he believed (correctly) that without permanent names there could be no permanence of knowledge. From the practical needs of field biologists came Linnaeus's main contribution to science – binomial nomenclature. The genus was retained in the name (using the genera listed in Tournefort's 1694 *Éléments de Botanique*) but all the rest of the polynomial was reduced to a trivial, but often descriptive, specific epithet. It is clear that it was only towards the end of his career that Linnaeus realised that his legacy to science would be binomial nomenclature.

Linnaeus really wanted to be taken seriously as a taxonomist rather than *just* a nomenclaturist. He wanted to create an artificial system designed specifically for ease of use in the field. He used a hierarchy from classes, through orders, genera and species, to varieties (interestingly omitting the concept of ‘family’ proposed by Ray). This was welcomed by many for its workaday usefulness and because it was understandable by novices as well as experienced botanists. When Linnaeus visited the University of Oxford Botanic Garden in 1736 he received a cool welcome from J.J. Dillenius (Professor of Botany). This is not surprising since here was a 29 year old botanist proposing a radical, new way to classify the world's plants that would require a re-labelling and reorganising of the plant collection. By the end of the tour of the botanic garden Dillenius was so impressed by Linnaeus that he offered Linnaeus half of his professorial stipend to remain in Oxford.

Linnaeus's system was totally artificial and made no attempt to reveal evolutionary relationships, not least because evolution had not been proposed. However, we now think we know differently. Since Darwin's

Left: Biology undergraduates identifying euphorbias during their annual field trip to Portugal (Photo: Timothy Walker)

Great botanists and their legacy

Theophrastus (371-286 BC) was a pupil of Aristotle and spent the decisive years of his life in Athens, where he was in charge of the first existing botanical garden. He is author of two remaining works *Enquiry into Plants*, and *On the Causes of Plants*, which constitute the most important contribution to botanical science during antiquity and the middle ages.

John Ray (1627-1705) laid the foundations of botany and zoology in Britain. The botanical terms 'petal' and 'pollen' were first used by Ray, and he was the first botanist to distinguish between monocotyledons and dicotyledons. Ray's *Historia Plantarum* was the first textbook of modern botany.

Carl Linnaeus (1707-1778), was a Swedish botanist, physician and zoologist who laid the foundations for the modern scheme of nomenclature. He is known as the "father of modern taxonomy."

Charles Darwin (1809 –1882) was an eminent English naturalist who achieved lasting fame by convincing the scientific community that species develop over time from a common origin. His theories, explaining this phenomenon through natural and sexual selection, are central to the modern understanding of evolution.

Mark W. Chase (1951–present day) is Keeper of the Jodrell Laboratory, Kew, UK, and a Fellow of the Royal Society. He has pioneered the use of DNA to unravel the relationships of flowering plant families and this has caused a major shift in the field of botany and taxonomy. Chase is a member of the Angiosperm Phylogeny Group who have published a number of papers on the subject. Their first paper in 1998, known as APG1, resulted in the systematic reclassification of angiosperms (flowering plants) on the basis of their molecular characteristics.

proposal "that from so simple a beginning endless forms ... have been, and are being, evolved" we have the opportunity to classify plants into phylogenies in line with the great unifying force of biology i.e. evolution. Of course, this meant that we had to reorganise the botanical family beds again but that is the nature of science. It is inconceivable that we should attempt to teach our undergraduates about the classification proposed by the Angiosperm Phylogeny Group (APG) if the botanic garden's collection was not arranged according to the APG orders and families. The new classification, based on an amalgamation of both the morphological and molecular data, has breathed new life into taxonomy and systematics and thus into the teaching of the same.

We do not see the decline in interest in taxonomy. These claims are based on the decline of botany degree courses. However, taxonomy and systematics are alive and well in biology, conservation and environmental science courses to name but a few. Taxonomy is at the core of all of these subjects and if it is taught as a practical

tool then the students instantly grasp the value of their studies. However, unlike most tools, the study of taxonomy is "most beautiful and most wonderful" (Darwin 1859).

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Résumé

2007 est le 300ème anniversaire de la naissance de l'un des plus grands biologistes de tous les temps : Carl Linné (1707-1778). Lorsqu'il avait tout juste 20 ans, Linné s'est rendu compte que la dénomination des plantes n'avait jamais sérieusement été traitée par les botanistes. Il est maintenant impossible

d'imaginer comment la biologie pourrait fonctionner sans le système universellement accepté de la nomenclature binomiale. La taxonomie se trouve au cœur de la biologie et, pour cette raison, est toujours enseignée dans la plupart des universités du Royaume-Uni. Et le meilleur endroit pour enseigner la taxonomie ? Pas dans une classe, mais sur le terrain ! Qu'il s'agisse d'un champ, d'un jardin botanique ou d'un arboretum.

Resumen

2007 es el año del tricentenario del nacimiento de uno de los mas grandes biólogos de todos los tiempos: Carl Linnaeus (1707-1778). Cuando solo tenía 20 años, Linneo reconoció que el nombre de las plantas nunca había sido tratado seriamente por los botánicos. Es imposible ahora imaginar como la biología podría funcionar sin el universalmente aceptado sistema de nomenclatura binomial. La taxonomía radica en el corazón de la ciencia de la biología y por esa razón todavía se enseña en muchas universidades en el reino Unido. Y el mejor lugar para enseñar taxonomía? no lo es el salón de clases, sino en "la naturaleza"; estar en el campo, el jardín botánico o el arboretum.

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Right:
J.J. Dillenius
(Professor of
Botany) when
Linnaeus visited
Oxford (Photo:
Timothy Walker)

Taxonomy

for horticulture students

Summary At the Royal Botanic Garden Edinburgh, Scotland, horticulture students learn taxonomy from the plants themselves. We encourage students to be constantly aware of how plants are related to each other. By training the students' eyes to look for common characteristics in flowers, patterns of veins in the leaves or any one of the thousands of other different characters in the plants, they gain a new appreciation of the sheer diversity that is linked together by so many common threads. This article describes the various methods we use to teach plant taxonomy, including:

- Short garden tours and discussion sessions that allow the students to see the plants in a living horticultural situation
- Close observation and dissection of flowers and other important structures in the laboratory, encouraging students to develop their drawing skills.
- Lectures on the theory of taxonomy and classification by enthusiastic experts.

It used to be difficult for many horticultural students in further education to understand the importance of plant taxonomy and systematics. Although they became familiar with cultivating and identifying a huge range of plants during their studies at college, they seldom had the chance to relate all these plants together in the grand scheme of the Plant Kingdom.

This has all changed since the concept of 'biodiversity' entered the mainstream discourse. Plant biodiversity gives tutors and lecturers an accessible, easily understood framework within which to base lessons. Students can relate to the idea that taxonomy is a

great tool for understanding biodiversity. Because horticulture students use garden plants every day, it makes sense to introduce them to taxonomy through these familiar plants. At The Royal Botanic Garden Edinburgh (RBGE), we do this throughout our four year BSc course in 'Horticulture with Plantsmanship'. Plantsmanship is a subject that emphasises the diversity and flexibility of plants in horticulture, and draws in key elements of plant conservation and ecology. Students are taught plants in a taxonomic context throughout the whole course, and there are some modules that focus purely on taxonomy and systematics.



Left: Student learning how to work a dissecting microscope which is bringing the intricacies of ferns to life (Photo: RBG Edinburgh)

Plant Classification and Systematics, a module in the second year of the course, lasts for 35 half-day sessions and gives the class a broad but fairly complete overview of the Plant Kingdom. Last year we started following the most modern APG II (Angiosperm Phylogeny Group) classification. The phylogenetic trees that are available on the APG website (see references) are a great resource – an excellent way for students at this level to visualise the relationships among the plants. We begin the classes with a look at mosses and liverworts, then ferns and gymnosperms. This is then followed by a grand tour through the most important horticultural flowering plant families. Throughout the course we discuss the theory as well as the practical applications of taxonomy and encourage students to use and build botanical keys.

The usual format for a teaching session begins with a short lecture on a plant family or other taxonomic group, picking out the key characters and the ecological similarities that tie the members of the family together. We then turn to the main teaching tools -



Above:
Lecturer and
conservationist
Phil Lusby
shows students
the distinctive
flora of Atlantic
clifftop habitats
during a study
tour in Cornwall
(Photo: RBG
Edinburgh)

the plants themselves. RBGE has a world class living collection, which allows us to study live plants as they grow. This offers us an opportunity to discuss the plants before we return to the teaching lab and dissect them. As the students dissect flowers we get them to make close observations – a $\times 10$ magnifier or dissecting microscope is extremely useful here. They make careful drawings and over the course of a year, build up a portfolio of botanical drawings, which we use to assess their work. The groups of students also research the diversity in a flowering plant family and present their findings to their fellow students.

The greatest challenge in teaching this course is availability of plants at the right time through the year. This is a particular problem as climate change appears to be playing havoc with flowering times of interesting species in the garden such as *Corylus avellana* (hazel). However, the local florist is always a useful backup and as I write this, I am already planning a trip there to buy some showy flowering monocots for this week's class!

The third year *Plant Geography* module builds on the knowledge gained in *Plant Classification and Systematics*, putting plant relationships in an evolutionary context and looking at the evidence for plant evolution through paleobotany and the modern distribution of plant diversity 'hotspots'. *Horticultural Taxonomy* (also a third-year course) focuses purely on the science of taxonomy. By the time students take this course, they are armed with a good working knowledge of plant diversity and relationships so they can begin to get to grips with the 'how' of classification.

As well as these core courses, students apply their taxonomic training during regular plant identification sessions as well as on the annual study tour. The study tour takes the students to important historical gardens, nurseries and also to sensitive wild habitats, where they can make use of their identification skills in the field.

Although the very best learning resources are, of course, the plants, we have found that Michael Simpson's *Plant Systematics* is a very useful core text for students at this level, although it is only available in English.

There has always been a trend in garden design and horticulture in the UK to use plants from farther afield. In recent years, plants from New Zealand, South Africa and Chile have become particularly popular. As such, we feel it is extremely important that our horticulture students have the chance to truly understand the diversity of plants and gain a real appreciation of how good stewardship of plant biodiversity is the key to a sustainable horticulture industry.

References

- ➔ Angiosperm Phylogeny Group
Website: <http://www.mobot.org/MOBOT/research/APweb/>
- ➔ Simpson M., 2005, *Plant Systematics* Elsevier, Amsterdam.

Résumé

Au Jardin Botanique Royal d'Edinburgh, les étudiants en horticulture apprennent la taxonomie à partir des plantes elles-mêmes. Nous encourageons les étudiants à avoir constamment connaissance des relations qui existent entre les plantes. Nous formons leurs yeux à relever les caractéristiques communes des fleurs, des motifs des nervures des feuilles ou les mille et unes autres particularités des plantes ; ainsi les étudiants acquièrent une nouvelle perception de la véritable diversité, reliée par tant de fils communs. Cet article décrit les diverses méthodes que nous utilisons pour enseigner la taxonomie végétale, telles que :

- Balades – de courtes sorties dans le jardin avec des sessions de discussion qui permettent aux étudiants de voir les plantes en situation de culture.
- Observations précises et dissections en laboratoire de fleurs et d'autres parties clés, afin d'encourager les étudiants à développer leurs compétences en dessin.
- Conférences théoriques par des experts passionnés sur la taxonomie et la classification.

Resumen

En el Jardín Botánico de Edinburgo, los estudiantes de horticultura aprenden taxonomía de las plantas mismas. Nosotros animamos a que los estudiantes estén constantemente alertas de cómo las plantas están relacionadas una con otra. Por entrenamiento de los ojos de los estudiantes para buscar características comunes en flores, patrones de venación en las hojas o en cualquiera de las miles de caracteres en las plantas, ellos adquieren una nueva apreciación de la cantidad de diversidad que esta relacionada por muchas ligas comunes. Este artículo describe los varios métodos que nosotros usamos para enseñar la taxonomía de plantas, incluyendo:

- Caminatas – paseos cortos por el jardín y sesiones de discusión que permita a los estudiantes ver las plantas en una situación hortícola viviente.
- Observación cercana y disección de flores y otras estructuras importantes en el laboratorio, animando a los estudiantes a desarrollar sus habilidades en el dibujo.
- Lecturas sobre la teoría de la taxonomía y clasificación por expertos entusiastas.

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Systematic education and interpretation

Summary The Systematic Garden at Utrecht University Botanic Garden is the largest and arguably the most attractive systematic garden in the Netherlands. Laid out in 1988, it follows the ideas of the American botanist Arthur Cronquist (1919-1992). Its central point is the 'Magnolia square' (*Magnoliidae*), from which springs four evolutionary paths. The systematic garden was primarily developed to guide university students in biology in identifying plants in the field and to give them an overall idea of the relationships between the different families as well as the evolutionary development in the flowering plants. However, over the last few decades, the focus of biology and botany has shifted more to a molecular perspective. As a result the Systematic Garden has also changed and today interpretation has become particularly important, with signs and guided tours being the main methods used to interpret the garden.

History

The Systematic Garden of the Utrecht University Botanic Garden is the largest and arguably the most attractive garden in the Netherlands. Its history dates back to 1639 when the first Utrecht University Garden was created on an old bastion in the fortified area of the city. In 1724, due to lack of space, the Systematic Garden was moved to another place within the city. Then in the 20th century the garden was finally located in the university centre situated just outside Utrecht. Nowadays the Systematic Garden consists of three distinct and spatially separate areas: 1) the so called 'paleocorner' with Gymnosperms, 2) the Monocotyledons and 3) the Dicotyledons, which take up

the main part of the garden. In this article, the term Systematic Garden refers only to the Dicotyledons.

Five evolutionary paths

The Systematic Garden was laid out in 1988 following the ideas of the American botanist Cronquist (1919-1992). Its central point is the 'Magnolia square' (*Magnoliidae*), a cluster of Magnolia trees, from which spring four evolutionary paths. These paths represent the *Dilleniidae*, *Caryophyllidae*, *Rosidae* and *Hamamelidae*. At some point the *Rosidae*-path forks into an *Asteridae*-branch (the fifth evolutionary path) and a *Rosidae* branch. The distance from the central Magnolia square equals the

progression of evolution with respect to flowering plants. So it is possible for visitors to travel through time in just a few steps! In the Magnolia square, visitors will find a stone table which displays the layout of the Systematic Garden.

Evolution at a dead end

As mentioned before, the main part of the Systematic Garden consists of Dicotyledons only (or *Magnoliopsida* in terms of Cronquist). The Monocotyledons (Cronquist: *Liliopsida*) are set apart from the Dicotyledons for evolutionary reasons in this particular taxonomic system.

In our Systematic Garden the five paths represent subclasses of the plant kingdom. Every path has several hexagonal beds representing orders in which plants are placed. The hexagonal shape has no special meaning, except an aesthetic one. Plants on a path that grow near each other are more closely related than plants further away. All paths are dead ends and at the ends visitors find the most advanced plant families, according to Cronquist.



Above:
Using familiar
flowering plants
makes the study
of plant
evolution more
enjoyable
(Photo: Utrecht
University
Botanic Garden)

Education and interpretation

The Systematic Garden was primarily developed to guide university students in biology in identifying plants in the field and give them an overall idea of the relationships between the different families as well as the evolutionary development in the flowering plants. Over the past few decades, however, the focus of biology and botany has moved more towards a molecular perspective. As a result, the focus of the Systematic Garden and the Botanic Garden, as a whole, has changed. There is less focus on teaching Biology students and more emphasis on interpreting the garden for the general public.

To make the Systematic Garden more accessible to the general public, we have made some minor adaptations. First of all, the plants used to illustrate the evolutionary paths are flowering plants that most people are familiar with. We choose colourful plants so that the garden looks beautiful and not like a 'boring and dull study garden'. Visitors are attracted to the vibrant colours and varying shapes - information is an additional benefit! Easily accessible sign boards are used to convey information and in the Systematic garden many plant families have their own sign board.

We find the best way to inform visitors is through guided tours. These guided tours can be 'garden wide' or with a strong focus on, for instance, the Systematic garden. Our guides are well trained to interpret the ideas behind the Systematic garden and the general evolutionary trends in (flowering) plants. Every year we organise a special theme (such as 'Darwin's

Dating Service' in 2004, about pollination), during which children and adults can follow specially laid out trails. The trails are designed for the public to cross the Systematic garden and become familiar with its structure and lay out. Nevertheless, despite the signage and tours, the Systematic garden can sometimes be hard to appreciate by visitors who know little about botany – particularly teenagers whose minds are often on other things and lack the concentration or motivation to listen and read.

A short history of systematic gardens

Order beds have been a part of botanic gardens almost since their establishment in the 1540s at Pisa (1544), Padua (1542), Bologna (1547) and Florence (1540s). Other historical gardens include Leipzig and Leiden (1578), Montpellier (1593), Oxford (1621), Utrecht (1639) and Edinburgh (1670).

These early botanic gardens were used to familiarise university students with medicinal and other useful plants. They were not open to the general public. Hence, the collection was displayed in a methodical, scientific manner. Typically the plants were planted in formal geometrical beds arranged by properties and gross morphological features. The earliest layout of the Utrecht Botanic Garden is often referred to as a 'hondenkerkhof', which means dog cemetery: rectangular beds in rows resembling a graveyard. However, as increasing numbers of plants were discovered and described (especially when new territories were discovered), the work of botanic gardens extended to include displays of how plants might be related to one another. Throughout history plants have been ordered according to various systems. The following is a brief overview of the major systems used:

- **'Heterodox' systematics** (16th and 17th centuries), e.g. alphabetizers, chronologists (based on a floral calendar or clock), topographers (with a geographical arrangement), rhizotomi (by the form of the roots) and physiognomi (by general habit). The latter is the basis of most folk classifications. A famous heterodox systematist is Dalechamp.
- **'Orthodox' or 'universal' systematics** (16th, 17th and 18th centuries) This kind of classification is based on reproductive features, such as characters of the fruit (fructists), the corolla (corollists), the calyx (calycists) and the stamens and pistils (sexualists). Well known botanists in this category are Andrea Caesalpino, Pierre Magnol and Tournefort.
- **'Natural systematics'** (18th, 19th and 20th centuries) This classification system is based on overall similarity and difference. The relative weight given to particular features varies. Bernard de Jussieu, Linnaeus and Bentham & Hooker are exponents of this group.
- **'Phylogenetic' systematics** (20th and 21st centuries) This is a fairly recent development, explicitly taking into account evolution and relationships between plants. The relationships established by phylogenetic systematics often describe a species' evolutionary history and, hence, its phylogeny, the historical relationships among lineages or organisms or their parts, such as their genes. The work of the Angiosperm Phylogeny Group (APG) is the latest development in this field. Mark Chase, Royal Botanic Gardens, Kew, is a pioneer of this system.

This text is largely taken from the presentation 'Order beds in a botanical garden' by Dr. D.G. Frodin, June 2003

Having said that, we still think our Systematic Garden is presented in such a way that the concept is easy to grasp.

Changes due to APG

Nowadays the Cronquist-system has become obsolete due to the insights of the Angiosperm Phylogeny Group (APG). Lots of presumed relationships between plants were found to be incorrect. We are therefore adapting the Systematic Garden to this new situation. However, due to lack of money and the value of the Cronquist-garden in its own right, we have decided for now not to reconstruct the garden altogether. For the time being we are planning to place 10 APG-sign boards to explain the changes in some plant families and orders. An example of such an alteration is the shift of the Monocotyledons from outside the Dicotyledons in the Cronquist-system to a more central place, comfortably embedded in between the Dicotyledons, in the APG-system. The signage is designed for the general public. For visitors who want to know more about APG, we have an elaborate brochure in our shop.

There are inconveniences associated with the partial transition of the Systematic Garden to the APG-system, however they can also be seen as opportunities. Every time a change takes place in the Systematic Garden, we make sure it's marked in an eye-catching way so that people know about it. Changes in scientific beliefs and knowledge are an inherent component of science. We might not know where Systematics will take us in the future, but we do know that our garden will be user-friendly and up-to-date!

Résumé

Le jardin de systématique du jardin botanique de l'Université d'Utrecht est le plus grand et probablement le plus attractif des Pays-Bas. Tracé en 1988, il suit les idées du botaniste américain Cronquist (1919-1992). Son point central est le « square des Magnolias » (*Magnoliidae*) d'où surgissent quatre chemins de l'évolution. A l'origine, le jardin de systématique a été créé pour



aider les étudiants en biologie à identifier les plantes sur le terrain et leur donner une idée globale des relations entre les différentes familles ainsi que des évolutions dans le développement des plantes à fleurs. Cependant, au cours des dernières décennies, l'intérêt porté à la biologie et la botanique a changé au profit d'une approche plus moléculaire. Par conséquent, ce jardin de systématique a lui aussi changé et aujourd'hui l'interprétation, notamment à l'aide de panneaux et de visites guidées, est devenue particulièrement importante dans la compréhension de ce jardin.

Resumen

El Jardín Sistemático en el Jardín Botánico de la Universidad de Utrecht es el más grande y probablemente el jardín sistemático más atractivo en Holanda. Iniciado en 1988, continúa las ideas del botánico Cronquist (1919-1992). Su punto central es la "Cuadra de las Magnolias" (*Magnoliidae*), de las cuales surgen cuatro vías evolutivas. El jardín sistemático estuvo principalmente desarrollado para guiar a los estudiantes de la Universidad en Biología en la identificación de plantas en el campo, darles una idea total de las relaciones entre las diferentes familias así también como del

desarrollo evolutivo de las plantas con flores. Sin embargo, en las últimas décadas, el principal objetivo de la biología y botánica se ha movido a una perspectiva molecular. Como resultado, el jardín sistemático también ha cambiado y su interpretación ha empezado a ser particularmente importante, siendo la señalización y tours guiados, los principales métodos usados para interpretar el jardín.

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Above: An aerial photograph illustrating the layout of the Systematic Garden (Photo: Utrecht University Botanic Garden)

Teaching children using the essence of nature

Below:
Hands-on-
learning can
inspire children
about the
wonders of
taxonomy
(Photo: Bill
Watson,
Brisbane,
Australia)

Summary Gladstone Tondoon Botanic Gardens is a regional garden maintaining a scientific collection of plants from two main areas, the Port Curtis Region and Far North Queensland. Through a range of botanical and environmental experiences, we aim to increase students' awareness of their natural environment. We find hands-on teaching is the best way to deliver interpretation and the importance of taxonomy to school children. We encourage children to investigate characteristics such as: leaf features, bark, petals, tubular flowers, stamens, fruit and seeds. We also look at plant structures, classification and reproduction and explain the role of the herbarium in identifying plants. Around 5,000 students per year enjoy environmental education experiences in Gladstone Tondoon Botanic Gardens.

Botanical and environmental experiences have been developed to increase awareness of our natural environment and stimulate students' awareness in line with Queensland's, Australia Syllabus Learning Outcomes.

Through our team of dedicated staff, the Gladstone community has embraced environmental education at the garden extremely well and interest is growing in the programmes we offer. We have found that a hands-on-learning approach is the best way to deliver interpretation and the importance of taxonomy to school children. This approach also helps students to become more aware of the botanic garden and encourages them to gain an appreciation of plant conservation and taxonomy from an early age.

Students often work in small groups to experience hands-on activities. One such activity involves them using data record sheets to discover different plants and investigate what special characteristics are visible, for example:

- Leaf features
- Bark
- Visible petals
- Tubular flowers
- Numerous stamens
- Woody fruit - eg if seeds are papery
- Woody fruit - eg fine seed
- Fluffy seed

A popular activity is the collection of many different shaped coloured, textured leaves, seed pods, and grasses. Students enjoy collecting them and then discovering the uniqueness of each plant and their special associated characteristics.

Students from Year Level 4-7 study different structures of plants and their classification and how plants reproduce. To identify and classify plant structures, the students examine:

- Different types of leaves
- Different types of flowers
- Different types of seeds (fruits)
- Different types of bark

The students also visit the Norm Gibson Herbarium which contains only plants from the local area. We show students what a plant looks like pressed and explain how, once pressed, it can be kept like this for



The physical qualities of the 104 hectare site were the major determinants influencing the planning concept for the Tondoon Botanical Gardens, which provides for an arboretum and forest reserve as an adjunct to the botanic gardens. These elements are integrated with a lake and water system to enhance the site.

years allowing us plenty of time to identify it. We also explain that unidentified specimens are sent to Queensland Herbarium for other botanists to identify.

The Herbarium has a collection of 3,000 pressed plant specimens which are used for research and as reference material to verify plant identifications. It is a major resource for scientific research by visitors, the community and future generations. Our volunteers and staff dedicate many hours to ensuring plant species are collected from the surrounding region and providing specimens to the Queensland Herbarium, Brisbane. When teaching children, staff place a great deal of significance on the importance of plant classification and why and how plants are classified. The significance of plant biodiversity is also emphasized using the Port Curtis area (prime display) in the garden, which contains only local species. Around 5,000 students per year currently enjoy environmental education experiences in the Gladstone Tondoon Botanic Gardens. Future planning for plant classification and identification experiences will include interpretative and interactive displays so we can further educate children and the public about the importance of plant classification in our local area.



Left: Marilyn Haigh delivering education to some of the 5,000 students that visit Gladstone Tondoon Botanic Gardens each year (Photo: Bill Watson, Brisbane, Australia)

Résumé

Les jardins botaniques de Gladstone Tondoon sont des jardins régionaux qui maintiennent une collection scientifique de plantes provenant de deux zones principales : la région de Port Curtis et le Grand Nord du Queensland. À travers un éventail d'expériences botaniques et environnementales, nous avons pour objectif de sensibiliser les étudiants à leur environnement naturel. Nous avons constaté que l'enseignement pratique est la meilleure façon de transmettre une interprétation ainsi qu'une compréhension de l'importance de la taxonomie auprès des scolaires. Nous encourageons les enfants à rechercher des caractéristiques telles que : les particularités des feuilles, du tronc, des pétales, des fleurs tubulaires, des étamines, des fruits et des graines. Nous nous intéressons aussi à la structure des plantes, la classification et la reproduction des végétaux et expliquons le rôle de l'herbier dans l'identification des plantes. Environ 5 000 étudiants par an profitent de ces expériences d'éducation à l'environnement aux jardins botaniques de Gladstone Tondoon.

Resumen

El Jardín Botánico de Gladstone Tondoon es un jardín regional que mantiene una colección de plantas en dos áreas principales, La región de Port Curtis y la región Far North Queensland. A través de un rango de Jardines Botánicos y experiencias medioambientales, nosotros pretendemos incrementar la preocupación de estudiantes por su medio ambiente natural. Nosotros



encontramos que la enseñanza práctica es la mejor forma para llevar interpretación y la importancia de la taxonomía a los niños de las escuelas. Nosotros promovemos que los niños investiguen características de las hojas como, corteza, pétalos, flores tubulares, estambres, frutos y semillas. Nosotros miramos en las estructuras de las plantas, clasificación y reproducción, explicando el papel del herbario en identificar plantas. Alrededor de 5,000 estudiantes por año disfrutaron las experiencias de la educación ambiental en el Jardín Botánico de Gladstone Tondoon.

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Above: Encouraging students to get their hands dirty increases their awareness of the natural environment (Photo: Bill Watson, Brisbane, Australia)

Left: Close observation reveals the special characteristics of the plant (Photo: Bill Watson, Brisbane, Australia)

Cultivating urban ambassadors for nature

Genesis of an idea

One evening during November 2005, over a cup of coffee, some of us at FRLHT, came up with an idea, 'Why not develop a nature education programme for busy city kids to learn about their neighbourhood plants through a combination of nature walks, talks and e-learning, using an interactive CD-ROM?'. Driving us was our view that children increasingly lead busy life styles and spend more time on indoor activities. Their lack of time to appreciate nature has resulted in a drift away from nature to monotony. There is also sparse coverage of local flora and fauna in the school curriculum, inadequate availability of educational material on local biodiversity and a lack of awareness about medicinal plants and traditional knowledge.

Right:
Students
making careful
observations
and drawings of
plants (Photo:
Suma Tagadur)



Summary This article describes FRLHT's new experience related to encouraging young minds to appreciate and explore their neighbourhood plants. Students learn that many plants have medicinal value and are related to their lives. We strongly believe children are ambassadors who will carry forward our conservation messages to their families and friends in a constructive way, provided their interest is nurtured.

We began the project by attempting to understand urban students' interest towards nature, their natural skills, their understanding about nature, their traditions, their hobbies and kinds of outdoor activities they prefer. This exploratory study showed that students lack exposure and awareness towards nature. Foreseeing the cascading implications, we have initiated a participatory approach, where teachers and children are involved in an interactive, educative and enjoyable manner to learn about the plants in their vicinity. Our aim is to ignite young minds to think and act locally, to conserve medicinal plants and traditional knowledge.

Convinced that our idea was a good one, we scrutinised book stalls to find out what the availability was of publications dealing with local flora, especially on medicinal plants for school students. Next, we consulted textbooks from state and central education departments. All these efforts confirmed our views, enabling us to feel confident about designing an educational programme and resources.

Our objectives

The main objectives for the programme were:

- To inspire young minds to appreciate the plants in their neighbourhood

- To know that many of the plants have medicinal value and are associated within traditional knowledge
- To encourage students to think globally and act locally
- To generate pro-environmental behaviour and attitudes
- To design the supplementary resources in the form of an interactive CD-ROM entitled 'Neighbourhood Medicinal Plants of Bangalore City'
- To demonstrate the use of a CD-ROM prototype with the outdoor-based activities such as nature walks, observation studies, project work etc.
- To undertake participatory field testing of the CD-ROM prototype with the school students (high school) and teachers.

At FRLHT, we identified two main steps in testing the educational programme:

1. Designing a CD-ROM prototype entitled 'Neighborhood Medicinal Plants for School Children of Bangalore City'
2. Field-testing and dissemination of prototype CD-ROM through the nature education programme.

Step one - Designing the CD-ROM

A comprehensive checklist of common plants was prepared by experienced field botanists through field surveys across Bangalore city. Field data was overlaid with information in the Encyclopaedia on Indian Medicinal Plants database (www.medicinalplants.in). A list of 269 plants emerged as common medicinal plants in Bangalore city. To this list, additional information on medical systems, medicinal uses and associated information was included gradually. This list was then incorporated into the prototype CD-ROM.

Step two - Field-testing and dissemination

Once the first prototype CD-ROM was designed, we organised a teachers' workshop to get feedback on the nature education programme and CD-ROM. The biology teachers and education experts who took part said



Left: Students using their detective skills to identify plants from a range of materials (Photo: Suma Tagadur)

this programme was interesting and provided 'life long learning' experiences for students. They said it would provide students with the correct information and would allow them space to link the learning to their lifestyles in an enjoyable fashion. Their first impression about the CD-ROM was that "it could become a supplementary learning aid for students and teachers to know about the commonly found medicinal plants of Bangalore city, learn the plant names, use it as authentic reference material for building science projects, and enthuse students to identify plants, thus building interest and skills."

With this initial feedback, we moved forward to test the education approach and the CD-ROM among five schools in Bangalore city. The teachers were also willing to participate in the trialling of the nature education programme.

With the teachers as the backbone to the programme and the driving force behind its implementation, we designed the approach. This was based on the teachers' views about the



Below: Demonstrating the CD-ROM prototype 'Neighborhood Medicinal Plants for School Children of Bangalore City' (Photo: Suma Tagadur)

students' level of knowledge about their neighbourhood plants, whether they could identify them and whether they knew their medicinal values and the traditional practices associated with them. The teachers also suggested that the ideal target audience was students of 7th to 9th standard. These students are free from competitive examinations and so have ample time to explore and learn about plants. They are also receptive and

Right: Students planting a school herb garden with the support of their teachers (Photo: Suma Tagadur)

inquisitive at this age. Looking at all the practical possibilities, we collectively developed learning objectives for the nature walks and trails and project works. These objectives focused on developing observational, data organisation, data collection and analysis skills as well as improving communication skills and developing empathy and a positive behaviour and attitude towards the environment.

Learning through experience

We began our nature education programme with schools, through the establishment of nature clubs. In each club there are 20 to 30 students as members by choice. Before taking the students on nature walks, we assessed their level of understanding about local plants through games and themed discussions. During the nature walks, learning objectives developed by teachers were delivered. The initial walks focussed on looking at plants, learning their various parts and how these are arranged and observing their interactions with other plants and animals.

We found that motivated students took the initiative to come up with nature books, record their observations, and share information with their friends. They learnt to identify plants in a simple way and also learn the local names and botanical names with the help of a botanist and the CD-ROM.

To date, 130 students representing 6th to 9th standard (11 to 14 years old) have taken part in the nature education programme and are involved in various activities including:

- Active participation in nature walks to deepen their understanding of local plants.
- Exposure to well referenced education material such as the prototype CD-ROM based on the Encyclopaedic series
- Obtaining feedback from students and teachers for improving the educational material
- Undertaking self-defined research projects related to local plants
- Sharing of learning experiences with participating schools
- Gradually setting up school herbal gardens with students and teacher participation.

Audience based evaluation

The nature education programme and CD-ROM have undergone front end and formative evaluation. During the testing stage, we have received feedback from students on the usefulness and user- friendliness of the prototype. So far nearly 220 students across Bangalore city have fed back their comments - from urban and semi-urban students who visit the FRLHT campus and are part of the nature education initiatives. This feedback was



obtained through focused group discussions, personal interactions, frequent peer reviews and questionnaires. Based on the suggestions, we have included a module in the programme called 'Green Pad', to help users create their own personal digital database on field notes. Thus the educational material is evolving and has graduated to include two interactive prototypes.

What next?

We are looking forward to finalising the nature education programme. In the future we are keen to develop similar approaches and CD-ROMs for various other cities across India and to share our experiences with like-minded organisations. Currently we are experimenting with school children on tree identification in a similar way. The feedback suggests that another e-tool would be useful in helping children identify trees of Bangalore city.

Conclusion

The prime focus of this interactive approach is to nurture love towards plants and build scientific skills in students. Through this approach we aim to build skills, provide authentic information and create learning environment to think, act and share experience with others. Our goal is to create many ambassadors who can propagate the conservation message.

Additional inputs: K. Ravikumar, V.P. Mangala, B. Lavanya and B.S. Somashekhar from FRLHT, Bangalore

Acknowledgements

The authors wish to thank all the teachers for extending their time and

Right: Motivated students from Ramagondana hali School share their learning experiences (Photo: Suma Tagadur)



support. In particular Dr. Meenakshi Barve, Retired Reader, SNDT College of Education, Pune, Mrs. Shobha Bhat, Principal, biology teachers and students of Nagajuna Vidyaniketan School, Yelahanka Bangalore; Mrs. Anu Thomas, Principal, biology teachers Mrs. Sandya, Mr. Eshwarappa and Mr. Ananda Kasturi, and students of GC-KVCRPF, Yelahanka, Bangalore; Mrs. Hemalatha, Principal and Mrs. Anuradha, biology Teacher and students of Seshadripuram Primary School, Yelahanka, Bangalore and Mrs. Shyamala, Principal, biology teachers Mrs. Manjula and Mrs. Shashikala, and students of Seshadripuram High School, Yelahanka for their input, zest and enthusiasm to actively engage in this approach. Our heartfelt thanks are also due to all the students, educationalists and FRLHT staff members for their kind co-operation and constant support and encouragement.

Résumé

Cet article décrit les nouvelles expériences menées par le FRLHT, qui cherche à encourager les jeunes esprits à apprécier et à explorer leur environnement végétal. Les étudiants apprennent que beaucoup de plantes ont une valeur médicinale et sont liées à leur vie. Nous pensons fermement que les enfants sont des ambassadeurs qui diffuseront notre message sur la conservation d'une façon constructive auprès de leur famille et de leurs amis, pour autant que leur intérêt soit sustenté.

Nous avons commencé le projet en essayant de comprendre l'intérêt des étudiants des zones urbaines envers la nature, leurs compétences naturelles, leur compréhension de la nature, leurs traditions, leurs passe-temps et quels types d'activités de plein air ils préfèrent. Cette étude exploratoire a démontré le manque d'exposition et de sensibilisation à la nature dont souffrent les étudiants. Au vu de l'enchaînement des implications, nous avons initié une approche participative où les enseignants et les enfants sont engagés dans un apprentissage interactif, éducatif et agréable concernant les plantes de leur voisinage. Notre but est d'enflammer



Left: Close observational drawing is a good way to learn the different parts of a plant (Photo: Suma Tagadur)

les jeunes esprits pour les inciter à penser et à agir localement afin de conserver les plantes médicinales et les savoirs traditionnels.

Resumen

Este artículo describe la nueva experiencia FRLHT destinada a motivar jóvenes mentes a apreciar y explorar sus plantas vecinas. Los estudiantes aprenden que muchas plantas tienen un valor medicinal y están relacionadas a sus vidas. Nosotros creemos fuertemente que los niños son embajadores quienes llevarán nuestros mensajes de conservación a las familias y amigos en una forma constructiva, probando que su interés queda consolidado.

Nosotros comenzamos el proyecto intentando entender los intereses de los estudiantes urbanos hacia la naturaleza, sus habilidades naturales, su entendimiento acerca de la naturaleza, sus tradiciones, sus pasatiempos y tipos de actividades extramuros que ellos prefieren.

Sus estudios exploratorios mostraron que los estudiantes carecen de exposición y preocupación hacia la naturaleza. Previniendo las implicaciones derivadas de esto, nosotros hemos iniciado iniciativa participativa, donde los maestros y niños están involucrados en una manera interactiva, educativa y amena para aprender acerca de las plantas en sus alrededores. Nuestro objetivo



Left: Interactive sign board, encouraging students to identify as many plants as possible (Photo: Suma Tagadur)

es animar a estas mentes jóvenes a pensar y actuar localmente, para conservar las plantas medicinales y conocimiento tradicional.

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Website: www.frlht.org

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Website: www.nagarjunaeducation.com

Reporting on BGCI's education congress

Right: Congress delegates on the day trip to the Royal Botanic Gardens, Kew



Far right: Thanks to the generosity of businesses, botanic gardens and individuals, the congress was able to offer 32 scholarships to educators around the globe

BGCI's 6th International Congress on Education in Botanic Gardens, held from 10-14 September 2006 and hosted by the University of Oxford Botanic Garden, UK, was a resounding success. 340 delegates attended from 45 countries and 32 delegates from 18 countries received a scholarship to attend the congress. Endorsed by the UK Ministry of the Environment and Professor Wangari Maathai, Nobel

Peace Laureate, this was the largest botanic garden education congress to date, demonstrating the growing importance of education in the work of botanic gardens around the world. The congress showcased the contribution of botanic gardens to the UN Decade on Education for Sustainable Development, with papers and workshops highlighting the innovative and inspirational ways in





Oxford was a superb location for the congress and the University of Oxford Botanic Garden was a fantastic host. Delegates all remarked on the excellent organisation carried out by the staff of BGCI and OBG. The day visit to the Royal Botanic Gardens, Kew and the pre- and post-congress tours were also very successful. The feedback, both solicited and un-solicited, from delegates on all aspects of the congress was extremely positive.

which gardens can encourage visitors to live more sustainably. The importance of integrating evaluation into practice was also emphasised, with a larger than usual number of academics attending the congress to share their research. Findings were presented during the congress from six national meetings convened in 2006 by BGCI to examine the status of plant based education in their respective countries. The aim of the meetings was to take forward the implementation of Target 14 of the Global Strategy for Plant Conservation. The meetings revealed the need for governments to provide increased support for training, resources and information exchange. This call was subsequently presented to an Expert Group meeting in Dublin who met to review the implementation of the GSPC.

Achieving the international biodiversity conservation strategies cannot happen without education. This congress proved unquestionably that botanic gardens have the tools and the vision to encourage their audiences to secure plant diversity for the well being of people and the planet.



Far left top: Enjoying the outdoor theatre. Left to right Khaled Sawalha, Palestine, Alla Andreeva, Russia and Malta Qwathekana, South Africa

Left: Jacob Bobart, first curator of Oxford Botanic Garden, returns to discover how the garden has changed since 1642

Far left: The party is in full swing on the last night of the congress.

Left: Delegates listen to the key note speech by Christian Samper, Director of the Smithsonian National Museum of Natural History, USA

Left: Emma Williams, Education Officer, shows congress delegates round the glasshouse at the University of Oxford Botanic Garden

Far Left: During the visit to the University of Oxford Botanic Garden, delegates were encouraged to experience nature through drawing

Resources

Resources

Proceedings of the 6th International Congress on Education in Botanic Gardens

BGCI's 6th International Congress on Education in Botanic Gardens, 'The Nature of Success: Success for Nature', was held in September 2006 at University of Oxford Botanic Garden. The congress proceedings are available at <http://www.bgci.org/educationcongress/>

The report, evaluation, congress photo and delegate list are all available on the BGCI education website at <http://www.bgci.org/education/1588/>

Learning science outside the classroom

Informal non-classroom based contexts make an important contribution to learning for pupils in many subjects, including science. This book demonstrates how a wide range of contexts for learning science can be used with pupils, including learning at botanic gardens, museums, science centres and zoos. Using case studies and with contributions from practitioners in all fields of science education, this book offers guidance for teachers enabling them to widen the scientific understanding and experience of pupils.

*Martin Braund and Michael Reiss (eds.), 2004
RoutledgeFalmer, London, 238pp
ISBN 0-415-32117-4*

Disponible

Comptes-rendus du 6ème Congrès International sur l'Éducation dans les Jardins Botaniques

Le 6ème Congrès International sur l'Éducation dans les Jardins Botaniques du BGCI, 'The Nature of Success: Success for Nature' ('La nature du succès: le succès pour la nature'), s'est déroulé en Septembre 2006 au jardin botanique de l'université d'Oxford. Les Comptes-rendus du congrès sont disponibles à l'adresse <http://www.bgci.org/educationcongress/> Le rapport, l'évaluation, la photo du congrès et la liste des délégués sont disponibles sur le site éducation du BGCI à l'adresse <http://www.bgci.org/education/1588/>

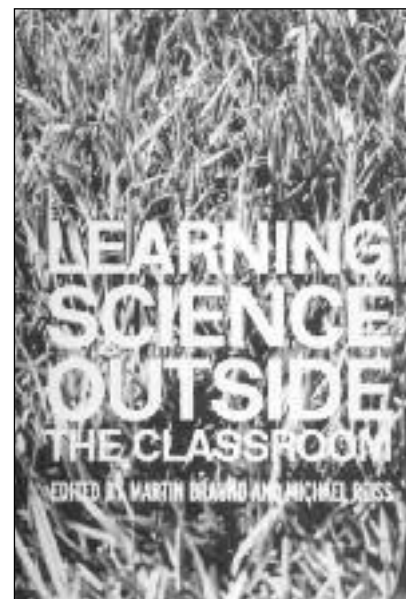
Apprendre les sciences en dehors des salles de classe (en anglais)

Des contextes informels, en dehors des salles de classe, apportent une contribution importante à l'apprentissage des élèves dans de nombreuses matières, y compris la science. Ce livre démontre comment un large éventail de contextes, y compris l'apprentissage dans les jardins botaniques, les musées, les centres de science et les zoos, peut être utilisé avec les élèves pour l'apprentissage des sciences. En donnant des exemples pratiques et par des contributions de praticiens de tous les bords de l'éducation aux sciences, ce livre offre son assistance aux enseignants et leur permet d'élargir la compréhension et l'expérience scientifique des élèves.

Recursos

Memorias del 6o Congreso Internacional de Educación en Jardines Botánicos.

El 6o Congreso Internacional de Educación en Jardines Botánicos de la BGCI tuvo el tema 'El éxito de la naturaleza: éxito para la naturaleza'; éste se llevó a cabo en septiembre del 2006 en el jardín Botánico de la Universidad de Oxford. Las memorias del congreso se encuentran disponibles en la liga <http://www.bgci.org/educationcongress/> Reporte, evaluación y fotografía de los delegados del congreso se pueden consultar en la página de la BGCI <http://www.bgci.org/education/1588/>



Education for conservation (Spanish)

Education for Conservation brings together the perspectives of 37 researchers and practitioners from different national and international organisations. Aimed at professionals and students working in the field of educational research, in particular environmental education, this work brings together aspects of history, the theory of knowledge, of communication and environmental education with experiences and concrete actions for biodiversity conservation. Section one defines and discusses concepts such as biodiversity, conservation, restoration and social participation, while section two and three focus on formal and informal case studies with initiatives orientated towards the development of flexible and participative methodologies in education. The end result being people directly involved in environmental education activities.

Ana Barahona and Lucia Almeida-Lenero (eds.), 2006
Faculty of Science, Nacional University of Mexico, Mexico City
ISBN: 970 32 2868



Learning for sustainable living in Kenya

This very attractive resource book, produced as a collaboration between Nature Kenya and Birdlife International, is targeted at ages 8 – 11 and aims to explore some issues of sustainable development. Importantly it is

Martin Braund and Michael Reiss (eds.), 2004
RoutledgeFalmer, London, 238pp
ISBN 0-415-32117-4

Éducation à la conservation (en espagnol)

Éducation à la conservation rassemble les opinions de 37 chercheurs et praticiens de différentes organisations nationales et internationales. Destiné aux professionnels et étudiants dans le domaine de la recherche sur l'éducation, en particulier l'éducation environnementale, ce livre assemble des aspects de l'histoire, de la théorie du savoir, de la communication et de l'éducation environnementale à des expériences et des actions concrètes pour la conservation de la biodiversité. La première section définit et discute les concepts, comme la biodiversité, la conservation, la restauration et la participation sociale, alors que les sections deux et trois se concentrent sur des études de cas formelles et informelles sur des initiatives orientées vers le développement de méthodologies flexibles et participatives dans l'éducation. Le but final étant que les gens soient directement impliqués dans les activités d'éducation environnementales.

Ana Barahona and Lucia Almeida-Lenero (eds.), 2006
Faculty of Science, Nacional University of Mexico, Mexico City
ISBN: 970 32 2868

Apprendre pour une vie durable au Kenya (en anglais)

Ce livre de ressources très attractif, produit en collaboration par Nature Kenya et Birdlife International, est destiné aux 8 à 11 ans et vise à explorer quelques sujets du développement durable. Il est conçu non seulement pour augmenter la conscience environnementale, mais aussi pour développer les connaissances pratiques et encourager les lecteurs à s'engager activement dans des mesures de conservation. Les chapitres traitent de sujets comme l'homme et l'environnement, l'eau, l'énergie, la santé et l'agriculture. Le livre est rempli de descriptions écrites, d'activités pratiques et d'expériences,

Aprendiendo ciencia fuera del salón de clases

Actividades fuera del salón de clase contribuyen al aprendizaje de los alumnos en diferentes temas, incluyendo ciencia. Este libro muestra a los alumnos en un contexto amplio como pueden aprender ciencia usando los jardines botánicos, museos, centros científicos y zoológicos. Por medio de casos de estudio y contribuciones de algunos de los practicantes de varios campos en la educación científica, el libro orienta a los profesores, habilitándolos a ampliar el conocimiento y entendimiento científico y experiencias con los alumnos.

Martin Braund and Michael Reiss (eds.), 2004
RoutledgeFalmer, London, 238pp
ISBN 0-415-32117-4

Educación para la conservación (Español)

El libro reúne las perspectivas de 37 investigadores y profesionales a diferente nivel nacional e internacional. Es dirigido a estudiantes y especialistas que trabajan en el campo educativo, particularmente en educación ambiental. Este trabajo conjunta aspectos históricos, teoría del conocimiento, comunicación y educación ambiental con experiencias prácticas y acciones concretas para la conservación de la biodiversidad. En la primera sección se define y discuten los conceptos como son biodiversidad, conservación, restauración y participación social; segunda y tercera secciones se enfocan a caso estudios, formales e informales. En ambos, con iniciativas orientadas para el desarrollo de metodologías educativas flexibles y participativas. El libro concluye con gente directamente involucrada en las mismas actividades.

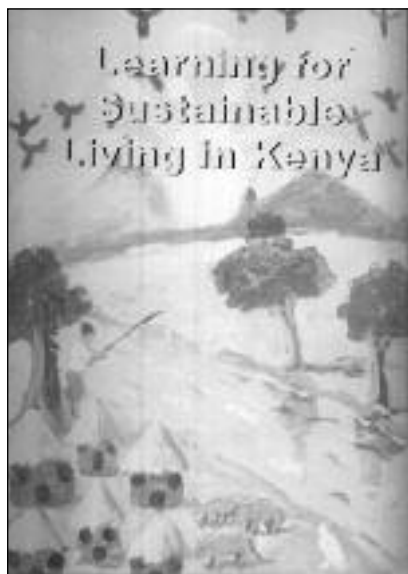
Ana Barahona and Lucia Almeida-Lenero (eds.), 2006
Faculty of Sciences, Nacional University of Mexico, Mexico City
ISBN: 970 32 2868

Aprendiendo sostenibilidad viviendo en Kenya

Es un libro muy atractivo, producido en colaboración entre Nature Kenya y Birdlife International, es orientado a

designed not only to raise environmental awareness but also to develop practical skills and encourage learners to become actively involved with conservation measures. The chapters cover themes such as people and the environment, water, energy, health and agriculture. It is filled with written descriptions, practical activities and experiments, colourful illustrations and highlighted text boxes with local case studies to make the subject relevant to the reader. The sections are also colour coded to allow ease of navigation. This resource book is a very nice example of a children's resource on the environment with a practical and positive focus.

Fleur Ng'weno, Eric Deche and Paul Matiku
Nature Kenya, The East Africa Natural History Society, 2006
 ISBN 9966-761-01-2
 Website: www.naturekenya.org
 Contact: office@naturekenya.org



Websites

Setting up and running a school garden: A manual for teachers, parents and communities

Schools in the West are currently under pressure to ensure they provide children with healthy food; this manual aims to address the issue on a global scale. Produced by the Food and Agricultural Organisation (FAO), the authors argue that education about nutrition must begin at an early age,

d'illustrations multicolores et d'encarts accentués, qui présentent des études de cas locaux afin de rendre le sujet attrayant au lecteur. Les différentes sections sont codées en couleur pour faciliter la recherche. Ce livre de ressources est un très bel exemple d'un support sur l'environnement destiné aux enfants, avec une note pratique et positive.

Fleur Ng'weno, Eric Deche and Paul Matiku
Nature Kenya, The East Africa Natural History Society, 2006
 ISBN 9966-761-01-2
 Site Internet: www.naturekenya.org
 Contact: office@naturekenya.org

Sites Internet

Mettre en place et entretenir un jardin d'école: Un manuel pour enseignants, parents et communautés (en anglais ou espagnol)

Les écoles de l'occident se trouvent en ce moment sous pression pour assurer une alimentation saine de leurs enfants; ce manuel vise à adresser ce problème à une échelle globale. Les auteurs du livre, produit par l'organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), argumentent que l'éducation sur l'alimentation doit commencer en bas âge au moyen de l'apprentissage « en faisant » - cultivant et mangeant leurs propres aliments sains dans un jardin d'école. Destiné aux enseignants travaillant avec des jeunes de 9-14 ans, le développement d'un jardin d'école est supposé améliorer le bien-être social et physique de la communauté écolière et donner aux élèves une meilleure compréhension du monde naturel. Le manuel doit assister les enseignants, les parents et les communautés, en se rapportant à des expériences faites dans les salles de classe à travers le monde. Parmi les astuces données: de quoi a-t-on besoin? quelle taille aura le jardin? combien de temps cela prendra-t-il? et comment s'occuper de plantes malades? aussi bien que des sujets plus complexes comme la gestion intégrée des parasites. Tout ce dont vous pourriez avoir besoin pour mettre en place un jardin d'école.

chicos de 8 – 11 años de edad; como meta, explora algunos aspectos de desarrollo sustentable. Está diseñado no solo para profundizar la conciencia con medio ambiente sino también para desarrollar aptitudes y motivar a los chicos a involucrarse activamente en estrategias o medidas para la conservación. Los diferentes capítulos cubren temas como son: la gente y el medio ambiente, agua, energía, salud y agricultura. El libro contiene descripciones, actividades prácticas y experimentos, ilustraciones a color; tablas y cuadros resaltados donde se exponen casos de estudio para hacer el tema más relevante hacia el lector. Las diferentes secciones tienen códigos a color y facilitan la localización de temas. Este libro es un ejemplo muy bonito, para los chicos, de recursos del medio ambiente con un enfoque positivo y práctico.

Fleur Ng'weno, Eric Deche and Paul Matiku
Nature Kenya, The East Africa Natural History Society, 2006
 ISBN 9966-761-01-2
 Website: www.naturekenya.org
 Contact: office@naturekenya.org

Páginas Web

Crear y manejar un huerto escolar

Escuelas en el Oeste se encuentran estos días bajo la presión de asegurar que los alumnos tengan comida sana; este manual trata y orienta este tema de manera global. Fue elaborado por la Organización de Alimentos y Agricultura (FAO); los autores fundamentan que la buena nutrición debe comenzar a edad temprana, aprendiendo como y llevándolo a la práctica – creciendo y alimentándose sanamente con un huerto escolar. El manual está dirigido a profesores que trabajan con alumnos de 9 – 14 años de edad. Llevando a cabo actividades en un huerto escolar, se estima que el bienestar social y físico de la comunidad mejora y asimismo dará a los estudiantes un mejor entendimiento y comprensión del mundo de la naturaleza. Este manual orienta a profesores y padres y comunidades, fue diseñado en salones escolares de varias partes del mundo. Las pautas para hacer un huerto escolar incluyen aspectos como: qué tan grande debe

with learning by doing - growing and eating their own healthy food within a school garden. Aimed at teachers working with 9 – 14 year olds, development of a school garden is thought to improve the social and physical wellbeing of the school community, and give students a better understanding of the natural world. The manual is to assist teachers, parents and communities, drawing on classroom experiences from across the world. Tips include deciding what will be needed, how big the garden will be, how much time it will take, and how to look after 'sick' plants, as well as more complex topics such as integrated pest management. All you could need for setting up your own school garden!

Available electronically in English at www.fao.org/docrep/009/a0218e/a0218e00.htm, or in Spanish (**Crear y manejar un huerto escolar**) at www.fao.org/docrep/009/a0218s/a0218s00.htm

Ellen Muehlhoff (ed), 2005
Published by the Food and Agricultural Organisation, Rome
Spiralbound, 208pp, price \$30.00 plus shipping
ISBN 92 5 105408 8
Order hardcopy through
www.fao.org/catalog/inter-e.htm

The National Linnaeus Secretariat

www.linnaeus2007.se

The National Linnaeus Secretariat at the Swedish Royal Academy of Sciences is coordinating the celebrations, events, information and marketing for the tercentenary. Their website includes a timeline of events in Linnaeus' life, a biography of his journeys and discoveries and details of *Project Linnaeus*, which is hoping to publish all known letters written by or sent to Carl Linnaeus. There is useful information about exhibitions on Linnaeus, celebrations being held this year of his work, an expedition and film being produced and a schools programme. A free e-newsletter is available to keep up-to-date with the latest activities and projects to celebrate his work, which could be helpful when setting up or running themed events.

Disponible en anglais sous forme électronique à l'adresse www.fao.org/docrep/009/a0218e/a0218e00.htm, ou en espagnol (**Crear y manejar un huerto escolar**) à l'adresse www.fao.org/docrep/009/a0218s/a0218s00.htm

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Le Secrétariat Linné National (en anglais)

www.linnaeus2007.se

Le Secrétariat National Linné (National Linnaeus Secretariat) à l'Académie Royale des Sciences de Suède coordonne les célébrations, événements, informations et les commercialisations pour le tricentenaire. Leur site Internet comporte une chronologie des événements dans la vie de Linné, une biographie de ses voyages et découvertes et des détails sur le *Project Linnaeus*, qui espère publier toutes les lettres connues écrites par ou envoyées à Carl Linné. On y trouve des informations au sujet des expositions sur Linné, sur les célébrations de son oeuvre qui auront lieu cette année, sur une expédition et un film en train d'être réalisés et un programme d'écoles. Une lettre d'information électronique gratuite est disponible, qui permet de rester à jour avec les activités et les projets de célébration les plus récents, ce qui peut être utile pour mettre en place ou organiser des manifestations thématiques.



ser el huerto, cuánto tiempo llevara esta meta y como cuidar las plantas (incluyendo a las no estén sanas); también abarca temas mas complejos como son un control y manejo de plagas. ¡Tiene todo lo que usted necesita para crear su huerto escolar!

Versión electrónica disponible en inglés www.fao.org/docrep/009/a0218e/a0218e00.htm, o en Español www.fao.org/docrep/009/a0218s/a0218s00.htm

Ellen Muehlhoff (ed), 2005
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www.fao.org/catalog/inter-e.htm

Secretaria nacional de Linnaeus (en inglés)

www.linnaeus2007.se

El Secretaria nacional de Linnaeus de la Academia Real de Ciencias Sueca está coordinando la celebración, eventos, información y publicidad de los festejos del tricentenario de Linnaeus. El sitio web incluye eventos oportunos de la vida de Linnaeus, biografía, viajes, descubrimientos y detalles del *Proyecto Linnaeus*, eventualmente se publicara toda la correspondencia escrita o enviada a Carl Linnaeus. Al momento hay información acerca de las exposiciones acerca de él, celebraciones acerca de su trabajo, una excursión, también se esta haciendo una película y un programa para escuelas. Existe un boletín gratuito para estar al día con las actividades y proyectos que se están celebrando de su trabajo, este puede ser muy útil si usted esta llevando actividades relacionados al tema.

Sociedad Linnaeana, UK

www.linnean.org

La Sociedad Linneana de Londres es la sociedad biológica mas antigua en el mundo, fundada en 1788; es también la cede de las colecciones botánicas, zoológicas y biblioteca de Linnaeus. Esta sociedad publica revistas periódicas científicas (en la actualidad impresas y en forma electrónica), asimismo guías de campo y un boletín trimestral '*The Linnean*'. Los resúmenes de la revista y boletín de

Linnaean Society, UK
www.linnean.org

The Linnean Society of London is the world's oldest biological society, founded in 1788 and is home to Linnaeus' botanical and zoological collections and library. It publishes scientific journals (in print and online) as well as field guides and a quarterly newsletter 'The Linnean'. The abstracts of back issues of their journals and the newsletter can be searched on-line for free. It is a useful source of news about the latest in biological findings, and this year has a lot of information about Linnaeus himself and news on the celebrations.

Order from Chaos: Linnaeus Disposes

<http://huntbot.andrew.cmu.edu/HIBD/Exhibitions/OrderFromChaos/pages/Disclaimer.shtml>

Developed by the Hunt Institute for Botanical Documentation, this on-line exhibition includes details of the science of taxonomy, its history, the role of Linnaeus and the legacy of Linnaeus' work. It includes a lot of good background and source material for anyone wanting to develop education programmes based on this theme, as well as useful links and a bibliography.



Société Linnéenne, Royaume Uni (en anglais)
www.linnean.org

Fondée en 1788, la Société Linnéenne (Linnean Society) de Londres est la plus ancienne société biologique du monde et abrite les collections botaniques et zoologiques de Linné, ainsi que sa bibliothèque. Elle publie des journaux scientifiques (imprimés et en-ligne) ainsi que des guides pratiques et une lettre d'informations trimestrielle 'The Linnean'. Une recherche en-ligne gratuite dans les résumés des éditions antérieures de leurs journaux et de la lettre d'information est offerte. C'est une source utile pour des nouvelles sur les dernières trouvailles en biologie qui contient cette année beaucoup d'informations sur Linné lui-même et des nouvelles sur les célébrations.

De l'Ordre en partant du Chaos: Linné dispose (en anglais)

<http://huntbot.andrew.cmu.edu/HIBD/Exhibitions/OrderFromChaos/pages/Disclaimer.shtml>

Développée par le Hunt Institute for Botanical Documentation, cette exposition en-ligne présente des détails sur la science de la taxonomie, son histoire, le rôle de Linné et le legs de son travail. Elle contient beaucoup de matériel de fond pour quiconque voulant développer des programmes éducatifs sur ce thème, avec des liens utiles et une bibliographie.

números ya publicados se pueden consultar electrónicamente y son gratis. Este es un recurso muy útil para estar al día con las últimas noticias y descubrimientos biológicos; en este año, en particular, hay numerosa información acerca del mismo Linnaeus y las celebraciones conmemorativas que se están llevando efectuando.

Orden desde el caos: Linnaeus decide

<http://huntbot.andrew.cmu.edu/HIBD/Exhibitions/OrderFromChaos/pages/Disclaimer.shtml>



Esta es una exposición en línea [electrónica] desarrollada por el Instituto Hunt para la documentación Botánica: incluye detalles de cómo se desarrollo la taxonomia, su historia, el papel que tuvo Linnaeus, su trabajo y su legado. La exposición contiene bastantes y muy buenos fundamentos para cualquier persona que desea elaborar programas educativos en este tema, asimismo numerosas ligas electrónicas y bibliografía.

How to join Botanic Gardens Conservation International

The mission of BGCI is to mobilise botanic gardens and engage partners in securing plant diversity for the well-being of people and the planet. It was founded in 1987 and now includes over 525 member institutions in 115 countries.

Institutions can join BGCI for the following benefits:

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- Botanic Garden Management Resource Pack (upon joining)*
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 - the regular newsletter, *Cuttings*
 - *BGjournal* – an international journal for botanic gardens (2 per year)
 - *Roots* - environmental education review (2 per year)
 - A wide range of new publications
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 - *BGjournal* - an international journal for botanic gardens (2 per year)
 - *Roots* - Environmental Education Review (2 per year)
- Invitations to BGCI congress and discounts on registration fees

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M	Friend (<i>Cuttings</i>) available through online subscription only (www.bgci.org)	10	15	15

*Contents of the Botanic Garden Management Resource Pack: *The Darwin Technical Manual for Botanic Gardens*, *A Handbook for Botanic Gardens on the Reintroduction of Plants to the Wild*, *BGjournal* - an international journal for botanic gardens (2 past issues), *Roots* - environmental education review (2 past issues), *The International Agenda for Botanic Gardens in Conservation*, *Global Strategy for Plant Conservation*, *Environmental Education in Botanic Gardens*, *BG-Recorder* (a computer software package for plant records).

Payment may be made by cheque payable to Botanic Gardens Conservation International, or online at www.bgci.org or by VISA/Mastercard sent to BGCI, Descanso House, 199 Kew Road, Richmond, Surrey, TW9 3BW, U.K or Fax: +44 (0) 20 8332 5956.

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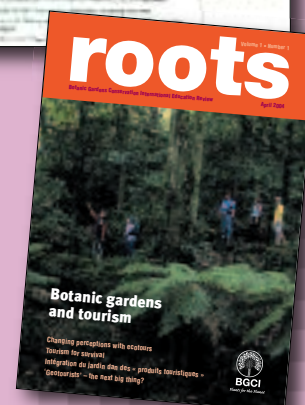
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BGCI's latest education congress 'The Nature of Success: Success for Nature' was held in September 2006 at University of Oxford Botanic Garden. The congress proceedings are available at www.bgci.org/educationcongress

For more information including the congress report and evaluation, congress photo and delegate list, visit www.bgci.org/education/1588

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