

Teaching and Research: How University Botanic Gardens address Conservation

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The modern concept of the botanic garden emerged from the Universities of Renaissance Italy about 450 years ago. Botanic gardens have since then diversified away from these academic roots in such different directions that it is no longer a simple matter to give a generic definition of this concept. As with the mechanisms of organic evolution, the world's botanic gardens have changed over time due to chance events and random changes on the one hand (like neutral evolution) or driven by strong needs and financial or political pressures (evolution under selection) on the other. They have even recruited from other types of structure, such as the gardens and collections of wealthy individuals, in a process similar to introgression.

The demands placed on University botanic gardens shift and veer as biological, and primarily botanical, thinking has developed. They have often been subject to shifts in educational orientation and their existence challenged by financial stringency. However, in most countries of Europe and North America the thread of University Botanic Gardens has been a continuous one from these ancient roots to modern times. In developing countries too, linkage of Botanic Gardens to academic institutions has been a frequent occurrence. Sadly, in Britain particularly, a decline over the last 50 years in University teaching of botany has put severe financial pressure on their botanic gardens forcing some into an amenity status or causing others to close. Currently only nine remain amongst more than 100 Universities in Britain.

What then distinguishes University botanic gardens from others? The distinction resides in the commitment of Universities to advanced learning through teaching and research. The mission statements of University botanic gardens generally lack a specific focus on economic, medicinal or indeed environmental concerns but concentrate on teaching and learning.

The University gardens then have reacted to new academic areas of concern and have responded, consciously or unconsciously, to these areas. Thus we can often see in the structure and plantings of older European gardens the 18th and 19th concerns with the diversity of plants and the accumulation of new and novel species feeding intellectual curiosity about the world. As emphasis shifted from species-centred study into the 20th century, one can see the gradual development of habitat-based understanding derived from ecology affecting plantings. At the same time, the botanical academic tradition tended to fragment, with experimental science largely turning its back on botanic gardens. However, the influence of one experimental discipline, the science of genetics, is often implicit in University botanic garden plantings. For example, most gardens will attempt to illustrate the evolution of crop plants, a research area combining agriculture with traditional and molecular genetics.

The University botanic gardens then are heirs to a long intellectual tradition. How can they address our pressing need for conservation, an essentially applied discipline, while maintaining their primary roles in teaching and research? Clearly, University botanic gardens will hold collections illustrating the diversity of green plants. However, these collections will often differ from those of national botanic gardens, originating as they have from their own idiosyncratic roots and with unique intellectual drivers. They are likely to reflect studies carried out in the institution. Thus a walk around the University Botanic Garden here in Cambridge will quickly reveal distortions to the overall pattern of diversity – concentrations of species of *Geranium*, *Fritillaria*, *Bergenia*, *Ribes* and so on - resulting from Ph.D. studies and academic curiosity over the years.

Few collections in University gardens, then, directly target conservation concerns. There may, however, be some which provide insights into serious issues of conservation science, and which can give a firm foundation to practical conservation. I will illustrate this by reference to the species *Juniperus communis* in

Britain and Ireland. Over 50 years ago, systematic collections of this woody coniferous species were made from across the whole country by taking cuttings from shrubs in nature. As a result our extensive collection is an actual representation of genetic diversity in this highly variable species. During the last 50 years there has been a dramatic crash in numbers of populations across Britain and population sizes have plummeted to as low as 1-5 individuals.

By assessing morphology, *Juniperus* can be divided into 'highland' and 'lowland' forms. It is the lowland forms which have suffered most, perhaps through pollution adding to pressures of climate change. Conservation measures would point to transfer between different lowland populations by seed or cuttings coupled with habitat management. Genetic studies, however, have revealed a strikingly different situation. The 'highland' and 'lowland' forms have no genetic identities; instead there are distinct groups of genotypes which cut across this divide, and reflect not habitat but post glacial origins and the invasion of Britain. An academic study, therefore, has revealed ancient patterns which would have been destroyed by conventional conservation considerations.

Despite this, University botanic gardens cannot normally put conservation itself at the top of their agendas. There may, as we have seen, be unexpected but significant outcomes to academic study, but the nature of research leading to academic achievement generally puts a straight jacket on highly applied conservation; the award of Ph.D degrees generally requires intellectual debate not species restoration.

University gardens, however, must view their role as the dissemination of information, as enablers in the process of learning within the community. And the 'community' is not simply that of the University but should be the whole of society. Local people should be encouraged to turn to their University botanic garden for education in the broadest sense, for the provision of authoritative information, as well as for enjoyment. Collections can be tailored to teach the lessons of conservation through their displays. Recently, we have restored a superb range of 75 year old teak glasshouses to near-pristine condition. The restoration itself has given us opportunities to put over messages concerning sustainability and forest management, as well as the use of timber in 'green' architecture. Within the glasshouses we are concentrating on displays with strong conservation messages, concentrating on unique floras of the world and threatened floral kingdoms. Thus the large Temperate House compares and contrasts the Gondwanaland floras of the Cape floral kingdom and western Australia. The smaller houses of the range will focus on island floras, destroyed like that of Saint Helena or threatened like the Galapagos Islands.

The beauty of plants captures the emotional aesthetic senses of visitors, whilst allowing strong, and overt, messages about diversity, conservation and sustainability to be delivered effectively. University gardens must combine these two elements in their public presentations: aesthetics alone is not sufficient for their mission.

Universities with botanic gardens usually offer a wide range of academic disciplines to students, and so are supported by a highly skilled and diverse professional force of teachers and researchers. University gardens can position themselves to take advantage of this intellectual milieu and become centres for a broad spectrum of conservation concerns. At one level, the botanic gardens can be information foci for local individuals or organisations who have practical conservation aspirations. In Cambridge, for example, the local Wildlife Trust was formed within the Botanic Garden. Botanic gardens can also be viewed as a source of authoritative information by local, regional or national governments, with the intellectual independence of Universities key to this. But gardens can also draw to themselves other bodies such as conservation NGOs and provide them with a venue and home for exchange of views in a neutral but sympathetic setting. Here in Cambridge an informal linkage of individuals from within the University with their colleagues in locally-based NGOs has grown into the Cambridge Conservation Forum, a body which now has the power to lobby on conservation issues at local, national and international levels. This loose but focussed group started in the University Botanic Garden and holds all its meetings within the Garden.

The term 'conservation' covers an enormous spectrum of activities and encompasses a great range of disciplines – conservation has to be both multidisciplinary and often interdisciplinary to be effective.

Within Universities, these distinct academic strands coexist - from biological sciences through engineering to social science – all of which may impinge on conservation problems.

University gardens can use their particular strengths to gather together these strands into groupings which can address issues of national and international significance. They can be the catalysts in developing thinking about wide conservation issues in novel contexts and from distinctive perspectives. But the growth must come always from teaching and research.