

Botanic gardens and medicinal plants: Prioritising conservation action.

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Background

Plants have been used as medicine by man for many thousands of years. In the 1960s at a burial site at Shanidar Cave in Iraq a Neanderthal man was discovered. He'd been buried 60,000 years ago. Buried alongside him were 8 species of plants. Palynological analysis has since evaluated these plants and suggests that they possessed therapeutic effects and that their medicinal properties were the intentional reason for their selection by Middle Paleolithic Shanidar Neanderthals (Lietava, 1992). The very much alive systems of Traditional Chinese Medicine (TCM) and Indian Ayurvedic medicine have been well documented for several thousands of years and Hippocrates, the 'father of modern medicine' himself, studied and respected ancient Egyptian medical texts. So, we have a rich, continuing heritage of using plants for medicine.

In terms of species numbers it's estimated that up to 70,000 plant species have medicinal properties (Schippmann *et al.*, 2002). Putting it another way, up to 20% of the world's vascular flora is medicinal. This means that medicinal plants are one of the biggest, if not the biggest, spectrum of biodiversity used by people for a specific purpose (Hamilton, 2003).

Of these about 2,500 are fairly widespread in international trade, but double this, about 5000 species, are 'of commercial importance' within domestic markets (Iqbal, 1993). In China, although we hear more about tiger bone and rhino horn remedies, it's actually mainly plants (greater than 80%, about 5000 species) which are the basis of TCM. In India, medicines are based on around 7,000 plant species (PlantTalk).

As well as a high species number, there are also huge numbers of people reliant on medicinal plants. The World Health Organisation estimated that up to 80% of people in developing countries are dependent on plants for their primary healthcare (Farnsworth and Soejarto, 1991). They have little or no access to Western medicine. Medicinal plants are fundamental to their welfare. They are not a luxurious alternative remedy.

In short, the range of medicinal plant species used and their scope for healing is vast.

Supply and demand

Medicinal plants are clearly an important resource in terms of healthcare but they are also an important economic trade resource, and form an important industry. Many of the world's poorest people rely on the collecting and selling of medicinal plants for income generation (van Rijsoort, 2000, Hamilton and Hamilton, 2006, World Bank, 2004).

It's an industry worth billions of US dollars a year set to expand alongside population growth in the developing world and an increase in demand for alternative and herbal remedies in the West (World Health Organisation, 2004, Koul and Wahab, 2004).

However, very little of the raw material to supply this demand is from cultivated sources, in fact of the 2500 or so species known to be in international trade perhaps only a few hundred are in formal commercial cultivation (Schippmann *et al*, 2002). The bulk of raw material therefore comes from the wild. This level of trade and wild harvest is said to be currently unsustainable (Leaman, 2006). We know this because herb gatherers are having to go farther and farther a-field to harvest the plant they want; they're experiencing a drop in harvest levels. Some species just aren't there anymore.

It's very difficult to scientifically assess the status of medicinal plants in the wild and to quantify the threats they face because these are often multiple. For example land clearance for agriculture and urbanization as well as collection for trade. Quite often we don't have base-line data on wild populations of medicinal plants against which to measure current scenarios.

Further, it's hard to collect accurate trade data since most medicinal plant species are not traded under their scientific name. *Arnica montana* for example has at least 66 trade names (Lange and Schippmann, 1999). It's hard to produce a list of key threatened species because of this variety of names, of uses, of habitats, of regions, of threats and of conservation methods. The sheer numbers of species involved means that thousands of medicinal plants could be threatened. Large gaps in data and knowledge hamper efforts to protect this resource.

What is certain, according to the Millennium Ecosystem Assessment, 2005, is that; "Among the most commonly exploited species or groups of species are plants and animals harvested for the medicinal trade."

Need for Conservation

If we don't act to conserve medicinal plants;

- species will be lost to extinction, including possible future drugs yet to be discovered
- healthcare will be impoverished
- livelihoods will be threatened, with associated poverty
- ecosystems will be degraded.

As well as being useful to humans for healthcare and income generation these plants also occupy unique environmental niches and are integral parts of the systems that offer us other vital ecosystem services such as clean water, clean air and soil stability. The place and function of some of the medicinal species in the wider environment may not even be known or fully understood by us yet.

Medicinal plants are therefore wonderful examples of how the wellbeing of man and the wellbeing of wildlife and biodiversity are inseparable. Using the ecosystem approach to conservation humans are part of the ecosystem, and ultimately one is entirely dependent on the other.

Role of Botanic Gardens

Against this backdrop, botanic gardens are perfectly placed to respond to the very specific local needs of medicinal plants and the people who rely on them for health and livelihood in a particular region.

Some of the main areas in which botanic gardens are actively working with medicinal plants are:

Research

Obviously this is an enormous area of work, aspects include;

- screening plants for medicinal properties, looking at the potency of the active compounds in the plant, possibly done in conjunction with pharmaceutical companies
- researching the agronomy of plants and harvesting techniques
- looking at cultivation techniques and the domestication of medicinal plants including special soil conditions, germination requirements, growth rates etc
- studying the impacts of cultivation, looking at markets and commercial viability

Education

Again, this is normally one of the major remits of botanic gardens and includes;

- educating end consumers about the sources of their medicines and the value of medicinal plants
- educating farmers and herb gatherers about the value of sustainable harvest, working to incentivise people to protect the environment
- gathering information, looking at policy, making it relevant and achievable, publicising relevant material such as the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP).

Partner organisations

Gardens are often involved in implementing and supporting local projects in conjunction with partner organisations. For example, cultivation projects, where botanic gardens help prioritise species for cultivation and then advise on propagation techniques and provide ongoing support.

Seed banks

Many gardens maintain a seed bank, collecting germplasm and protecting genetic diversity. This is particularly important with threatened medicinal plants where protection in the wild may not be realistic in the short-term.

Expertise

Botanic gardens are often centres of expertise and can inform legislation, such as CITES.

Traditional knowledge

Botanic gardens document indigenous knowledge and promote appropriate traditional healthcare. It's important that this traditional knowledge is not lost, because it may become relevant within the area of intellectual property rights.

In short, botanic gardens work with medicinal plants in a variety of ways and all of these activities are valuable conservation tools, since there is no panacea solution to the over-exploitation of medicinal plants. Traditionally, botanic gardens have been primarily involved with ex situ work but are becoming more involved with in situ conservation work.

Case studies

A few case studies to illustrate practical medicinal plant conservation work underway by botanic gardens:

- In Uganda, the Poverty Alleviation and Healthcare Promotion through Conservation Project run by the Nature Palace Botanical Garden is engaging over 50 subsistence farmers in medicinal plant cultivation alongside food crops for extra income. The project has been very successful and is delivering real community benefits as well as protecting plants in the wild.
- Malabar Botanic Garden in India is training local farmers on the cultivation, and storage techniques of medicinal plants as well as providing market guidance. They have trained over 200 farmers in 2 years, who have gone on to form a farmers' society to share knowledge.
- The Ethnomedica project run by various gardens in the UK distributed survey cards to document the herbal remedies that people remembered, thus recording the knowledge of the people.
- Tasmania Herbarium in Australia was involved in a large-scale screening with a pharmaceutical company, looking for new drugs and researching the active compounds of local medicinal plant species.
- Wuhan Botanic Garden in China has researched new medicines and developed traditional remedies.
- Chicago Botanic Garden maintains a seed bank of local, rare medicinal plants and is researching their medicinal properties.
- And in Paraguay, in association with the Botanic Garden of Geneva in Switzerland, the Etnobotanica Paraguya project is researching the use of local plants and running targeted education campaigns and setting up community gardens and looking at the best application of the plants.

BGCI's role

There is clearly a lot of work underway around the world and BGCI wants to strengthen botanic gardens' capacity to work in these areas. To this end we have been collecting national lists of threatened medicinal plants and developing the PlantSearch database to contain information on threatened medicinal plants and where they're held in botanic garden collections. This means the database can be used as a planning tool to identify gaps in botanic garden collections.

A wider consultation exercise launched at Wuhan aims to assess priority species and appropriate conservation actions. Feedback received will feed into a report containing case studies and best practice to help match botanic garden capabilities with medicinal plant conservation.

To conclude

Medicinal plants are amazing!

Botanic gardens are uniquely well placed to help conserve medicinal plants in a variety of key ways. They understand local people and their needs, local habitats and plants. This inherent knowledge is crucially important for effective conservation.

References

- Farnsworth N. and Soejarto, D. (1991) *The Global Importance of Medicinal Plants*, in *The Conservation of Medicinal Plants* (eds. Akerele, O., Heywood, V. and Synge, H.) Cambridge University Press, Cambridge, UK
- Hamilton, A. (2003) Medicinal plants and conservation: issues and approaches. [Online] Available from <http://www.wwf.org.uk/filelibrary/pdf/medplantsandcons.pdf> [Accessed 5th April 2007].
- Hamilton, A. and Hamilton, P. (2006) *Plant Conservation: An ecosystem Approach*. Earthscan, London, UK.
- Iqbal, M. (1993) International trade in non-wood forest products: An overview. [Online] Available from <http://www.fao.org/docrep/x5326e/x5326e0e.htm> [Accessed 3rd May 2007].
- Koul, O. and Wahab, S. (2004) *Neem*. Kluwer Academic Publishers, Boston and London
- Lange, D. and Schippmann, U. (1999) *Checklist of medicinal and aromatic plants and their trade names covered by CITES and EU Regulation 2307/97*. (Version 3.0) Bundesamt für Naturschutz, Germany.
- Leaman, D. (2006) Sustainable Wild Collection of Medicinal and Aromatic Plants. [Online] Available from http://library.wur.nl/frontis/medicinal_aromatic_plants/07_leaman.pdf [Accessed 2nd April 2007].
- Lietava, J. (1992) Medicinal plants in a Middle Paleolithic grave Shanidar IV? [Online] Available from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed&cmd=Retrieve&dopt=AbstractPlus&list_uids=1548898&query_hl=1&itool=pubmed_MEDLINE [Accessed 3rd May 2007].
- PlantTalk (no date) Plants in traditional and herbal medicine. [Online] Available from <http://www.plant-talk.org/Pages/Pfacts10.html> [Accessed 3rd May 2007].
- Schippmann, U., Leaman, D. and Cunningham, A. (2002) *Impact of Cultivation and Gathering of Medicinal Plants on Biodiversity: Global Trends and Issues*. FAO, Rome, Italy.
- van Rijsoort, J. (2000) *Non-timber forest products (NTFP's): Their role in sustainable forest management in the tropics*. National Reference Centre for Nature Management, Wageningen, Netherlands.
- World Bank (2004) *Sustaining forests: a development perspective*. World Bank Publications, Washington, US.