

Medicinal plant conservation and sustainable use: questions about an important global resource

Danna J. Leaman

Medicinal Plant Specialist Group, Species Survival Commission, World Conservation Union (IUCN), Ottawa, Canada

Abstract

China holds a place as one of the world's most important sources of knowledge of traditional medicine, and one of the world's most important sources of the plants that produce these medicines. Recent reassessments of the world's flora, threats to plant species and habitats, and the use, trade, and management of medicinal plants indicate that, worldwide, a much larger proportion of plant species is used in medicine than previously suggested, and that a substantial proportion of medicinal plant species may be threatened with extinction. However, current global and regional efforts to better understand and manage impacts of wild harvest can greatly advance the conservation and sustainable use of this important plant resource. Botanic gardens play an important role in these efforts by contributing expertise to conservation status assessment, monitoring, and protection *in situ*, by assisting the development of alternative sources *ex situ*, and through public education.

The wise teacher and the good student

There is a story about a wise teacher who devised a final test of a talented student. "Go out into the world," said the teacher, "and do not return until you have found a plant that is not used by anyone, anywhere, as medicine." The student journeyed into the world, visited many countries and many peoples, and after many, many years, returned in failure. "I have travelled everywhere, teacher" said the student sadly, "Nowhere have I found a single plant without healing properties." The teacher, of course, being very wise, had known all along that the student would never find such a plant.

Questions about "how many?"

As scientists, we tend not to put our faith in wise stories like this one, but prefer to ask a lot of questions that require counting. How many medicinal plants are used as medicines worldwide? How many medicinal plants are commercially important? What is their value? How many are cultivated, and how many are collected wild? How many are threatened, and how many are extinct? To answer these "how many" questions, we must use the numbers that exist for some countries to make educated guesses, or estimates, about the global situation.

How many plants are used as medicines worldwide?

In the late 1970s, the World Health Organization (WHO) produced a list of 21,000 species of plants used in traditional medicine (Penso, 1980). However, more recent accounts indicate that the number is much larger. In China alone, 4,941 of 32,200 indigenous plant species are used as drugs in Chinese traditional medicine (Groombridge & Jenkins, 1994), an astonishing 15.3 percent of the flora of China. If a similar calculation is carried out for other national floras for which the number of medicinal plants has been published, and then applied to the global total of 422 000 flowering plant species (Bramwell, 2002; Govaerts, 2001), it can be

estimated that the number of plant species used for medicinal purposes is more than 70,000 (Schippmann, Leaman & Cunningham, 2006).

How many medicinal plants are commercially important, and what is their value?

China is the world's leading exporter of medicinal and aromatic plant material. Information compiled from the UNCTAD COMTRADE database by Lange (2002) indicates that, between 1991 and 1998, China exported 139,750 tonnes of plant material, with a value of USD 298,650,000, in the commodity group "pharmaceutical plants". China's exports were nearly four times the volume, and more than five times the value in USD recorded for India, the second leading exporter, in the same years.

It is difficult to know precisely the global volume of medicinal plants in commercial trade, the value of the commercial trade, or how many species of plants are involved. However, Lange (2006) estimates that the global international export volume of medicinal plant material grew from 377,000 tonnes in 1991 to 585,000 tonnes in 2003, having an annual average export volume of 467,000 tonnes with an average annual value of USD 1.2 billion. Schippmann, Leaman, and Cunningham (2006:4) present a "qualified guess that the total number of MAP in international trade will be around 3,000 species world-wide".

How many medicinal plant species are cultivated?

In 1991, Xiao Pei-gen reported "about 100 species of medicinal plants are under cultivation" in China, "covering 460,000 hectares (Xiao, 1991: 308). Several additional wild-collected species "which are needed in vast quantities" were at that time being introduced into cultivation: *Glycyrrhiza uralensis*, *Rheum palmatum*, *Cistanche deserticola*, *Poria cocos*, and *Dioscorea nipponica*.

A more recent study conducted by TRAFFIC International reported that 228 species of medicinal plants are cultivated, or are beginning to be cultivated, in China (Mulliken & Inskipp, 2006). This study identified 900 species of medicinal plants worldwide (removing those used principally for culinary purposes) for which commercial cultivation is underway or being developed.

Cultivation has many production benefits, such as ease of quality control and standardization of sizes, age classes, and so forth. However, cultivation also has substantial costs, including agronomic research and crop development, as well as required investments in land and other agricultural inputs. It is unlikely that cultivation will be practical or even possible for many medicinal plant species.

How many medicinal plant species are wild-collected?

If our estimates of the number of species of plants used medicinally (70,000) and the number in cultivation (900) are approximately correct, we must conclude that approximately 69,000 species of medicinal plants are collected from the wild. If our estimate is approximately correct that 3,000 species of medicinal plants are important in commercial trade, and if we make a rather extreme assumption that all of the 900 species of medicinal plants in or near cultivation are among these species, we are still left with a rather impressive number of species – more than 2000 – that are collected from the wild in significant volumes for trade. It is clear that wild collection is, and will continue to be, an important system of production for the majority of species of medicinal plants.

How many medicinal plant species are threatened?

One of the goals of the IUCN Medicinal Plant Specialist Group is to identify the species that have become threatened by non-sustainable harvest and other factors, such as habitat degradation and loss, climate change, the

impacts of invasive species. The enormity of this task is illustrated by the following estimate: According to the 1997 IUCN Red List of Threatened Plants (Walter & Gillett, 1998), 34,000 species out of 49,000 species assessed were found to be globally threatened with extinction. A more recent assessment by Bramwell (2002) estimates that 21% of the world's flora is threatened. If the latter figure is applied to our earlier extrapolation that 72,000 plant species are used medicinally, it leads us to estimate that about 15,000 MAP species are threatened at least to some degree (Schippmann, Leaman & Cunningham, 2006).

How many medicinal plants are found in botanic gardens?

Take a walk through any botanic garden in the world, and you are very likely to encounter a section devoted to medicinal plants. Some of the oldest botanic gardens in the world began as teaching gardens for herbalists (Waylen, 2006). Some years ago, Botanic Garden Conservation International (BGCI) conducted a survey of 460 botanic gardens worldwide concerning their activities involving medicinal plants (Dennis & Wyse Jackson, 1998). Nearly every garden surveyed (455) maintained living collections of medicinal plants. Only 68 of these gardens, however, claimed to emphasize native species. To my knowledge, a thorough species inventory of medicinal plants in botanic gardens does not yet exist.

Cautionary tales: how many medicinal plants are known to be extinct?

I don't have an answer, even an approximation, for this question, but I will try to answer with another story or two.

Two and a half millennia ago, the roots of a plant known as *Silphion* produced perfume and spices; the juice treated gynaecological and many other ailments. *Silphion* was so important to the local economy of Cyrene, now Libya, that its image was minted on coins. Today, we no longer benefit from the use of this plant, nor do we know its Latin name (except that it was possibly a relative of the carrot, a member of the carrot family, Apiaceae), because it is extinct. Why was it lost? We can only speculate: its geographic distribution was limited; attempts to cultivate the plant failed; demand grew. Management of the harvest may have shifted from permanent local residents to short-term governors who were watching the bottom line, maximizing near-term profits. Collectors were poor and needed the trade. By the first centuries AD, *Silphion* was gone from markets, and all that remains is the image on a coin (Schippmann, 1995).

This is an old story, but there similar examples in our time. For example, in the Dominican Republic, which shares the Caribbean island of Hispaniola with the country of Haiti, the bark and leaves of a tree species known as Canelilla is used in an important local remedy. This species, *Eugenia yumana* Alain (Myrtaceae) is a rare, narrow endemic; only one small population of this tree exists on the southwest coast of the island. Little is known about its biology or its ability to regenerate. It is considered critically endangered according to the IUCN Red List categories and criteria (IUCN, 2001). Canelilla has resisted attempts at cultivation undertaken by the National Botanic Garden in Santo Domingo. There are plans to build a hotel and a golf course on the only site where this species is known to exist. The area is not protected. (See Lagos-Witte *et al.*, 2005.)

How can threats to medicinal plant survival be avoided, and extinction prevented?

Many organizations and individuals around the world are contributing to the conservation and sustainable use of medicinal plants. It would require a much longer paper than this one to describe them. I would like to mention a few of the activities in which the Medicinal Plant Specialist Group has been involved on behalf of the Species Survival Commission (SSC) of the World Conservation Union (IUCN).

1. Policies

Laws that will protect medicinal plants from extinction come from government policies that recognize the importance of medicinal plants to health and the economy, and support conservation and sustainable use of this resource. The MPSG is working with our partners – WHO, WWF, and TRAFFIC – to revise global *Guidelines on Medicinal Plant Conservation* (WHO, IUCN & WWF, 1993) first published more than one decade ago, updating them to include new understandings of how best to conserve wild populations through approaches that promote sustainable wild collection, applications of local knowledge and practices, and equal sharing of benefits.

2. Trade

We work with the TRAFFIC network, with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and with the IUCN Wildlife Trade Programme to identify species of medicinal plants with significant international trade, and to evaluate whether and how the countries that have signed this convention should monitor international trade.

3. Conservation status assessment

We support and facilitate assessment of the conservation status of medicinal plant species according to the IUCN Red List categories and criteria (IUCN, 2001), and help to train our members and partners to conduct these assessments and to train others in applying these methods. We recently supported a Red List workshop in the Dominican Republic, part of the Caribbean Island of Hispaniola, to train staff of the National Botanic Garden in Santo Domingo in the application of the IUCN Red List categories and criteria to priority species of medicinal plants (Lagos Witte *et al.*, 2005). These professionals are now training other professionals throughout the Caribbean in the application of these methods to plant conservation.

4. Sustainable use

We have just released, together with our partners – the German Federal Agency for Nature Conservation (BfN), WWF, and TRAFFIC – the first public version of an international standard for sustainable wild collection of medicinal and aromatic plants (ISSC-MAP) (MPSG 2007). We are working with collectors, herbal products companies, and industry associations around the world to apply this standard in certification schemes and other wild harvest scenarios.

References

- Bramwell, D. 2002. How many plants are there? *Plant Talk* **28**:32-34.
- Dennis, F. & Wyse Jackson, P.S., 1998. Directory of botanic gardens medicinal plant collections. 1st draft, February 1998. Botanic Gardens Conservation International (BGCI), Kew, UK.
- Govaerts, R., 2001. How many species of seed plants are there? *Taxon* **50**:1085-1090.
- Groombridge, B. & Jenkins, M., 1994. *Biodiversity data sourcebook*. WCMC Biodiversity Series 1. World Conservation Press, Cambridge, UK.
- IUCN, 2001. *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, UK.

- Lagos-Witte, S., García, R., Peguero, B., Castillo, D., Jiménez, F., & Leaman, D.J. (eds.), 2005. *Taller de capacitación Lista Roja de la UICN: aplicación de los criterios de la Lista Roja de la UICN al Plan de Asesoría y Manejo para la Conservación (CAMP) de plantas medicinales priorizadas en la República Dominicana*. Reporte Técnico, 03-05 Febrero 2004. Grupo Especialista en Plantas Medicinales (UICN) y Proyecto Mediano TRAMIL – UNEP / GEF / enda caribe. Jardín Botánico Nacional, Santo Domingo, República Dominicana.
- Lange, D., 2002. The role of east and southeast Europe in the medicinal and aromatic plants trade. *Medicinal Plant Conservation* **8**:14-18.
- Lange, D., 2006. Medicinal plants in the cosmetic, health care, and food sector: ecological, economic and social aspects. In: *Proceedings, Sustainable Wild Collection of Medicinal and Aromatic Plants: Workshop on Potential Implementation Strategies for the International Standard (ISSC-MAP)*, 5 May 2006, Banja Vrucica, Teslic, Bosnia and Herzegovina. WWF, Frankfurt, Germany.
- MPSG, 2007. *International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)*, Version 1.0. BfN-Skripten 195. BfN, MPSG/SSC/IUCN, WWF Germany, and TRAFFIC, Bonn, Gland, Frankfurt, and Cambridge.
- Mulliken, T. & Inskipp, C., 2006. Medicinal plant cultivation – scope, scale and diversity: results from an initial analysis. In: *Proceedings of the 1st IFOAM International Conference on Organic Wild Production*, Teslic, Bosnia and Herzegovina, May 2006. IFOAM, Bonn, Germany.
- Penso, G., 1980. *WHO inventory of medicinal plants used in different countries*. WHO, Geneva, Switzerland.
- Schippmann, U., 1995. The Silphion story. *Medicinal Plant Conservation* **1**:2-4.
- Schippmann, U., Leaman, D. & Cunningham, A.B., 2006. Cultivation and wild collection of medicinal and aromatic plants under sustainability aspects. In: *Medicinal and Aromatic Plants*. Bogers, R.J., Craker, L.E., and Lange, D. (eds.) Wageningen UR Frontis Series no. 17. Springer, Dordrecht, The Netherlands. Pp. 75-95.
- Walter, K.S. & Gillett, H.J., 1998. *1997 IUCN Red List of Threatened Plants*. IUCN, Gland, Switzerland.
- Waylen, K., 2006. Botanic gardens: using biodiversity to improve human well-being. *Medicinal Plant Conservation* **12**:4-8.
- WHO, IUCN and WWF., 1993. *Guidelines on the Conservation of Medicinal Plants*. IUCN: Gland, Switzerland, and Cambridge, UK.
- Xiao, P., 1991. The Chinese approach to medicinal plants – their utilization and conservation. In: *The Conservation of Medicinal Plants*. Proceedings of an International Consultation, (eds.) O. Akerele, V. Heywood, and H. Synge. Cambridge University Press, Cambridge, UK. Pp 305-313.