Trade, Traffic and Management of Botanical Resources in Horticulture

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Abstract

The maintenance of biological diversity is of importance for various reasons (genetic resources, ecosystem resilience, source of income, cultural heritage). The international trade in plants from wild source may have negative consequences for biodiversity (habitat alteration, introduction of invasive alien species, demise of wild populations). National and international legislation, among which the Convention on Biological Diversity and the Convention on International Trade in Endangered Species of wild fauna and flora are of worldwide validity, was developed to protect wild species and their environment and to regulate access and trade. A number of cases show that it must be possible to use botanical resources in horticultural trade in a sustainable way.

INTRODUCTION

Trade in horticultural products is an economic activity of great importance. In recent years the annual global market for ornamental horticultural products (cut flowers, bulbs, pot plants, foliage and bedding plants) probably approached the amount of 20 billion US dollars (wholesale value) (ten Kate and Laird, 1999); the trade in vegetables comprised a multiple of that figure.

According to the definitions used in the Convention on International Trade in Endangered Species of wild fauna and flora (CITES) the vast majority of the plant trade deals with artificially propagated plants: "plants grown from seeds, cuttings, divisions, callus tissues or other plant tissues, spores or other propagules under controlled conditions, i.e., in a non-natural environment (e.g., fields, greenhouses; RJB) that is intensively manipulated by human intervention for the purpose of producing selected species or hybrids. General characteristics of controlled conditions may include but are not limited to tillage, fertilization, weed control, irrigation, or nursery operations such as potting, bedding, or protection from weather. The cultivated parental stock must be established in accordance with the provisions of CITES and relevant laws and in a manner not detrimental to the survival of the species in the wild, and managed in such a way that long-term maintenance of this cultivated stock is guaranteed". Trade in artificially propagated plants does not fall within the scope of this paper.

The international trade in wild (i.e., not artificially propagated) plants (mainly ornamental, medicinal and aromatic plants and trees and parts or derivatives thereof) has for many years been a matter of concern to all those who are conscious of the possible negative consequences for nature conservation. In addition to habitat alteration, the introduction of non-native plants to sensitive ecosystems, and other environmental changes which make it impossible for a plant to complete its life cycle, intensive commercial collection of wild plants may be contributing to the demise of wild plant populations (Robbins, 1999). Hennipman (2000) states that we are facing an increasingly rapid, ongoing, worldwide destruction and degradation of natural ecosystems; details are given in several recent global surveys (e.g., UNEP, 1999 and WRI, 2000). According to Koopowitz (1984) the annual loss of plant species is estimated to be about 400 species, in particular in the tropical rainforests; this figure, however, is not based on actual, recorded

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extinctions, but results from extrapolation based on species - area relationships, combined with estimated rates of loss of habitat or 'area' (see discussion in May et al., 1995). Until recently the IUCN had listed 12 % of the world's plant species known to science as threatened with extinction (Cox, 2000), but the latest data indicate a much lower figure (ca 2.5 %), largely because new criteria have been introduced for assessing the degree of threat (IUCN, 2000). The FAO estimates that over time 10,000 plant species were used for human food and agriculture; today only 120 cultivated species provide 90% of human food supplied by plants, and more than 90% of the biodiversity in these food crops that existed at the beginning of the 20th century has been lost (Reuters, 2001), mainly through the replacement of traditional landraces by modern cultivars.

Vogtmann (2000) argues that it is equally important to conserve the genetic diversity of both cultivated varieties and wild species, as the genetic continuum existing between them is a basis for the sustained availability of a diversity of species and varieties. The genetic properties make distinct species of direct value in both human consumption and production. In addition, however, species have indirect value through the ecological functions they perform: the importance of biodiversity also lies in its role in preserving ecosystem resilience (Perrings et al., 1995). As plants are the basis of all food cycles and ecosystems, the removal of a plant species from the wild to fulfil the short-term need, and sometimes greed, of man can pose a serious threat to the survival of those ecosystems (Groves et al., 1993). The same may apply to the introduction of a new species into an otherwise stable ecosystem: one of the major threats to native biological diversity is acknowledged to be biological invasions caused by alien invasive species (SSC Invasive Species Specialist Group, 2000). In this review I will explore the possibilities for the sustainable use of wild botanical resources in horticultural trade.

COMMERCIAL EXPLOITATION OF WILD PLANTS

The commercial exploitation of wild plants involves and affects many actors, such as governments, private companies, researchers and local communities. Private companies play a dominant role in the trade in wild plants, in some cases through intermediaries such as botanical gardens and other established institutions. Although local agriculturists are sometimes seen as beneficiaries of illegal harvesting, causing destruction of habitats (Moyle, 1998), local and indigenous communities are often involved in biodiversity management, conservation and trade, as they have long been stewards and managers of the natural resources (ten Kate and Laird, 1999); this has been recognized through the International Undertaking on Plant Genetic Resources (farmer's rights principle, endorsed by the United Nations Food and Agriculture Organization) (Ruiz et al., 2000; Menini, 2000). Villagers may depend on the trade in wild species for an important, though not always reliable, part of their income. For those communities conserving biological diversity is a matter of direct, vital importance in itself, or, as Stone et al. (1997) put it: conserving biodiversity is a lifeline for future generations. Apart from this utilitarian point of view, normative ethical and aesthetic considerations oblige us to protect nature and its diversity as part of our civilisation and cultural heritage (Bogers, 1993).

According to a Panel of Eminent Experts of the FAO (2001) short-term and long-term benefits may be compatible if both receive adequate recognition in the management of the resource. It can be very tempting, though, to start collecting, trading and even smuggling wild plants. The value of wild animals and plants traded illegally is among the highest for any smuggled commodity (after drugs). The continuous and rising demand for specialties and novelties has in some cases been the cause of a tremendous rise in prices paid for (parts or derivatives of) rare wild plants and animals. This can easily lead to overcollecting, with populations and even species becoming threatened as a result. Barrett (1995) explains that the private and social costs of biodiversity depletion differ, and that it is the distribution of social costs that determines how effectively the problem may be addressed. If the main implications of biodiversity depletion lie in the loss of genetic information associated with the depletion of species or populations, then the main social

cost is global. If, however, the main implications lie in the loss of ecosystem resilience, then the main social costs will be ecosystem-specific and, thus, local, which makes the problem much easier to address.

Assessing the scope and scale of the (legal) international trade in wild plants is extremely difficult, as the sheer size of the trade in artificially propagated plants can mask the relatively limited trade in wild plants. CITES, though, has provided a reasonably good picture of the international trade in orchids, cacti, *Cyclamen* spp., some insectivorous plants and other groups of plants (Jenkins and Oldfield, 1992; Oldfield, 1993). Also, the trade in medicinal plants has received much attention (Lange, 1998). As a result, supermarkets and business chains are increasingly showing concern about environmental issues (Stone et al., 1997). It is their experience, as is confirmed by M. Moore (quoted by Nordström and Vaughan, 1999), that trade and environment need not be contradictory, but can indeed be complementary. Banning trade can even pose a serious threat to conservation if it reduces the incentive to conserve species (Coone, 2000). Sustainable exploitation of actual or potential natural resources is helpful to conserve the plants and their genes we need now and which our children will need for their survival (Hennipman, 2000). If land-owners can receive long-lasting economic benefits from wild plants, they will be the more inclined to support the species by maintaining healthy intact habitats, which would otherwise be vulnerable to destruction. Moreover, a good environmental profile is often more of an asset for a firm than a liability in the international marketplace, notwithstanding somewhat higher production cost. Environmental leaders are not less profitable. An increasing number of consumers are willing to pay a premium for "green labels" (Nordström and Vaughan, 1999).

LEGISLATION

The size and scope of the trade in wild plants and the growing concern for their conservation and sustainable use in recent decades have led to a whole range of national and international legislation. At the basis of many laws is the so-called Precautionary Principle: one should refrain from acting when there is a reasonable suspicion that one's action might cause an unwanted risk to sustainability (Nedergaard, 1998).

On the national level countries should adopt policies for education, public awareness and training with regard to the importance of biological diversity and the need to conserve it in a sustainable manner (Prescott et al., 2000). At the same time co-ordination of conservation measures on a supranational-regional and global level is becoming more important as threats to biodiversity do not respect national borders (McGough, 1997). In this respect the following international laws and conventions must be mentioned:

- The **Convention on Biological Diversity** (CBD), which was agreed upon at the United Nations Conference on Environment and Development in Rio de Janeiro, 1992. Its objectives are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources". In its preamble the CBD stresses the importance of maintaining viable populations in their natural surroundings. The CBD emphasizes national sovereignty over plant genetic resources (Ruiz et al., 2000), but obliges governments to take a number of measures in order to fulfil its objectives, including monitoring and identification of biodiversity, environmental impact assessments and national strategies to conserve and use the components of biological diversity sustainably (ten Kate and Laird, 1999). A decision of the CBD Conference of the Parties implies that each government should nominate a single focal point to inform people how to get access legally.

Genetic resources (defined in the CBD as biological materials of actual or potential value, containing functional units of heredity) provide the basis for the improvement of crops, for at least a quarter of new pharmaceuticals, for traditional

medicines for 75 % of the world's population and, increasingly, for biotechnology products that treat waste and support clean industrial development (ten Kate and Laird, 1999). Access to genetic resources is vital for food security, health and sustainable development. Genetic resources are conserved, exchanged and used by a variety of domestic and foreign actors, whose activities are meant to promote a healthy development of economically important sectors, but may not cause irreparable damage to the environment. Private-sector involvement ranges from the family selling garden produce and the individual entrepreneur to the multinational company (ten Kate and Wells, 2001). All of these are entitled to a fair share of the benefits resulting from the use of the genetic resources. A shared vision on access and benefit-sharing (ABS) should therefore be at the basis of any national ABS strategy and legislation. The study by ten Kate and Wells (2001) gives detailed information as to how governments may prepare such a strategy and how they may form ABS partnerships. A group of botanical gardens have now agreed to endorse a number of principles on access to genetic resources and benefit-sharing, including the obligation to obtain prior informed consent (PIC) from stakeholders before acquiring any genetic resource from in situ conditions (K. ten Kate, pers. commun.; cf. www.kew.org.uk/ conservation/principles). A problem may be that it is not always clear whose PIC is needed. Moreover, botanical gardens are not the main providers of breeding material to horticulture.

- The **Convention on International Trade in Endangered Species** of wild fauna and flora (CITES), which was signed in Washington, DC, 1973. Its aim is to prevent international trade from threatening the survival of wild fauna and flora by: monitoring and stopping commercial international trade in endangered species; maintaining those species under international commercial exploitation in an ecological balance; and assisting countries towards a sustainable use of species through international trade. Thus, CITES seeks to accommodate between commercial interests and global concern for conservation. Both are not merely compatible, but coincide around a concept of sustainable utilization (Bowman, 1998). At present more than 160 countries are parties to the Convention, which covers more than 30,000 plant and animal species, only about one eighth of which are animals (Dimitrov et al., 2001). The Convention is implemented through national legislation and through regulations of the European Union (McGough, 1997). The national legislation which all parties are required to have, must: designate at least one Management Authority (a government department having responsibility for issuing permits) and one Scientific Authority (giving the required advice and having the right, under certain conditions, to veto exports); prohibit trade in specimens in violation of the Convention; and penalize such trade and/or allow for confiscation of specimens illegally traded or possessed. At the 10th Conference of the Parties it was agreed that the conclusion of a comprehensive agreement on co-operation between CITES and the CBD should be pursued, and that the co-operation and information exchange between CITES and the General Agreement on Tariffs and Trade (GATT) should be enhanced (Hepworth, 1998).

In practice, CITES parties regulate wildlife trade through controls and regulations on species listed in three Appendices, which form the core of CITES regulations. These Appendices contain the names of plant and animal species that are subject to trade restrictions.

Appendix I includes more than 300 plant species threatened with extinction which are or may be affected by trade. International trade in wild plants, parts or derivatives of these species is usually forbidden; it may only be authorized in exceptional circumstances, e.g., if the export / import is for non-commercial purposes. Subject to licensing, international trade in artificially propagated specimens of Appendix I species is allowed. For export of Appendix I species the Management Authority of the exporting country will request from the applicant (exporter): an import permit from the country of destination; evidence of the legal origin of the specimen (or, in the case of re-export, evidence that the specimen was originally imported in accordance with the Convention); and a description of the procedure to be used for the transport of any live specimen. For

import of Appendix I species the Management Authority of the importing country will request from the importer: a detailed description of the purpose of the import, proving that the import will not have a negative effect on the survival of the species and that the specimens will not be used for primarily commercial purposes; a description of the installations where any live specimen will be housed; and the name, address and country of the exporter. Examples of Appendix I plant species are many *Cactaceae*, *Orchidaceae*, *Euphorbia* spp., *Aloe* spp., and *Sarracenia* spp.

Appendix II includes ca 25,000 plant species which, although not necessarily now threatened with extinction, may become so unless trade in wild specimens of these species is strictly regulated. Subject to licensing, international trade in both wild and artificially propagated specimens of Appendix II species is allowed. For export of Appendix II species the Management Authority of the exporting country will request from the applicant (exporter): evidence that the specimen was legally acquired (i.e., in accordance with the national wildlife protection laws); and a description of the conditions of transport of live specimens. For import of Appendix II species a valid export permit or re-export certificate must be presented; in case of a re-export certificate the country of origin and the number and date of issuance of the original, valid export permit must be given. Appendix II includes many *Cactaceae* and *Orchidaceae*, *Galanthus*, and *Cyclamen*.

Appendix III (at present containing less than ten plant species) acts as a support mechanism for states that want other countries to monitor international trade in species other than those listed in Appendices I and II. For export of Appendix III species from a country that has included the species in Appendix III the Management Authority of that country will request from the applicant (exporter): evidence that the specimen was legally acquired; and evidence that live specimens will be prepared and shipped with minimal risk to their survival. For import of Appendix III species a valid (re-)export document or certificate of origin must be presented; in case of a re-export document the number of the valid permit of the country of origin must be given.

Seedlings or tissue cultures in sterile containers, and some "supermarket plants" (e.g., some cacti and euphorbias and the pot plant, *Cyclamen persicum*), which are exclusively traded as artificially propagated plants, are not subject to the provisions of the Convention.

- The 1997 **European Union Council Regulation**, containing provisions concerning the possession of and trade in wild plants and animals. In addition to the Annexes A, B and C, which are almost identical to the CITES Annexes I, II and III, this Regulation contains an Annex D, which includes "species not listed in Annexes A to C which are imported into the Community in such numbers to warrant monitoring". Moreover, the EU Council Regulation is stricter than CITES in that it allows the import of species into the EU only where the "introduction into the Community would not have harmful effects on the conservation status of the species or on the extent of the territory occupied by the relevant population of the species, taking into account the current or anticipated level of trade". This means that the EU can ban the import of a plant even if it is listed on CITES Appendix II and accompanied by a valid export document, if this import is considered harmful to the conservation status of the plant. For a more detailed treatment of this subject see McGough (1997).

CASE STUDIES

The following cases will give an impression of some problems and possibilities regarding the trade and management of botanical resources in horticulture.

Invasive Alien Species

The natural barriers that have for thousands and even millions of years provided the isolation that caused the evolution of unique species and habitats have rapidly become ineffective. The movement of people and goods has been the direct cause of the, often inadvertent, spread of a host of organisms, including plants. In some cases also the

deliberate introduction of plants through national and international trade has caused problems. Alien species have invaded and affected native biota in virtually every type of ecosystem on earth. The biggest threat posed by introduced species is the disruption of ecosystems, often by invasive species that replace the native species, but also by species that change the ecosystem without smothering the native plants, for instance, by nitrogen fixation (Simberloff, 2000).

The scope and cost of biological alien invasives is global and enormous, in both economic and ecological terms. In the United States non-indigenous species do more than 130 billion dollars a year in damage to agriculture, forests, rangelands, and fisheries (Schmitz and Simberloff, 2001). This figure does not include the ecological impacts caused by invasive species, which are considerable.

Article 8(h) of the Convention on Biological Diversity (CBD) states that "Each contracting party shall, as far as possible and appropriate: prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". In the words of the IUCN Guidelines this also poses a serious obligation on international trade "to ensure that intentional introductions … are properly evaluated in advance, with full regard to potential impacts on biodiversity" (SSC Invasive Species Specialist Group, 2000). The 6th meeting of the CBD's Subsidiary Body on Scientific, Technical and Technological Advice has given ample attention to the problem of invasive species, emphasizing the need for risk assessments preceding the introduction, eradication or control of alien species and discussing various options for developing international instruments to handle the problem (SBSTTA, 2000).

A famous, or rather infamous, example of a noxious invasive plant is the purple loose-strife, *Lythrum salicaria*, which was introduced from Europe into North America almost 200 years ago, and has since taken over millions of hectares of wetlands. Wetlands once inhabited by a rich diversity of native plants are now overrun by dense stands of purple loose-strife that can grow to thousands of hectares in size, eliminating open-water habitat. The loss of native species and habitat is a significant threat to wildlife, including several rare amphibians and butterflies, that depends on wetlands for food and shelter (Stein and Flack, 1996). Therefore, the state of Indiana has completely banned purple loose-strife and related species of *Lythrum* for sale in Indiana (Waltz and Jansen, 1996). The same is true for other states, like Missouri. As many people like the bright blooms of this plant and, not knowing it is an invasive alien, would not hesitate to grow it in their gardens, others have started to promote the use of alternatives (cf., e.g., www.valleycafe.com), thus offering new opportunities for plant growers and traders. Public-awareness campaigns can greatly enhance public understanding of the impacts of alien species (SBSTTA, 2000) and, thus, the success of alternative options.

Medicinal and Aromatic Plants

Plants provide us with around a quarter of our medicines (Bird, 1991). In some parts of the world, in particular those with high biodiversity, the vast majority of (traditional) medicines is coming directly from botanical sources (ten Kate and Laird, 1999). In 1998 the retail value of botanical medicines in the USA approached 4 billion dollars (Brevoort, 1998). In her report on medicinal and aromatic plants in Europe Lange (1998) gives a detailed overview of the European trade in these plants. She found that in this part of the world at least 2000 medicinal and aromatic plant taxa are used on a commercial basis, of which 1200 - 1300 species are native to Europe; 900 of these are still wild-collected. Although 'only' 47 of these species appear in CITES Appendix II, about 150 species are endangered in at least one country; the overall annual volume of wild-collected medicinal plant material in Europe is estimated to be at least 20,000 - 30,000 tonnes (in dried form) (D. Lange, pers. commun.). Collectors are mainly rural people for whom collecting plants provides a supplementary income. In general the plant material is purchased from collectors and growers and sold to a limited number of wholesalers through several middlemen. Historically and globally, access and benefit-sharing have not received much attention (ten Kate and Laird, 1999); in some cases trade

is illegal.

Cultivation of medicinal and aromatic plants in Europe covers an estimated area of about 70,000 ha; in all about 135 species are being cultivated, such as lavender (*Lavandula*), opium poppy (*Papaver somniferum*), caraway (*Carum carvi*) and fennel (*Foeniculum vulgare*). As Lange (1998) points out, though, for the majority of taxa in trade cultivation is not profitable. Plants may be difficult to cultivate, and, in general, prices for wild-collected material are much lower than they can be for material of cultivated origin.

Threats facing medicinal and aromatic plant species (overcollecting and habitat destruction) are similar across the world. Their collection and trade are largely unmonitored and public awareness is slight. Lange (1997) estimates that the total international trade (cross-border, worldwide) is around 500,000 tonnes annually, with a value of ca 1.3 billion US dollars. The example of American ginseng shows that CITES Appendix II listing of a species can offer an effective mechanism for monitoring international trade without banning it (Mills et al., 1999). The 'protection through utilization' project of *Arnica* in the French Vosges, including measures to improve the growing conditions for natural populations, clearly shows that it is sometimes better to exploit those populations in a responsible way than to ban all collecting activities (Lange, to be published).

Wild Bulbs in Turkey

In a study about the collection and export of Turkish geophytes Ekim et al. (1984) had indicated that the populations of snowdrops (*Galanthus* spp.) in the Mediterranean region of Turkey were becoming threatened by overexploitation. In 1989 the World Conservation Monitoring Centre published an extensive survey of the international trade in bulbs, including those from Turkey (Oldfield, 1989). By that time the collection of wild bulbs in Turkey had raised the concern of a number of conservation groups in Europe and the USA (Read, 1989; Campbell, 1989). Although wild bulbs constituted less than 0.5 % of the Dutch bulb exports (in the 1988-1989 export season The Netherlands exported ca 10 billion bulbs, of which less than 50 million were of wild, mainly Turkish origin) the publications on this issue alarmed the Dutch bulb traders who were the main buyers and re-exporters of those Turkish bulbs. They invited scientists and representatives of international nature conservation organizations to discuss the problem. As a result an agreement was signed that all packaged bulbs sold in and exported from The Netherlands would have to be labelled as either "Bulbs grown from cultivated stock" or "Bulbs from wild source" (Bogers and van Leeuwen, 1992). This labelling agreement was made a legal obligation for all Dutch bulb exporters, giving customers all over the world the opportunity to make an informed choice. Publications like the one by Marshall (1993) may contribute to making the right choice.

In 1989 the Association of Turkish Flowerbulb Growers and Exporters was established. Some of its goals were to control the collection of wild bulbs and to encourage artificial propagation. At the same time the Turkish government introduced stricter rules as to the number of bulbs that could be collected and exported. Co-operation between the Association, the Turkish government, the Dutch traders, Dutch and Turkish scientists and Turkish and international nature conservation organizations led to the establishment of the Indigenous Plant Propagation Project, which started in 1992 and is co-sponsored by Fauna and Flora International (UK), the Turkish Society for the Conservation of Nature (DHKD) and some charities. The main aims of the project are: to reduce collection of bulbs from the wild; to secure long-term income for all rural people involved in bulb-collecting; to supply the exporters with high-quality, competitively priced bulbs from cultivated stock; and to raise public awareness of plant conservation issues. A pilot site comprising about 250 growers from three villages in the Taurus mountains has shown that for some species it must be possible to introduce artificial bulb propagation as a serious alternative source of income for rural communities (Atay, 2001).

European fact-finding missions have inspected the bulb regions in Turkey in 1992

and 1999 and found that, as artificial propagation has not always been successful, in some cases the sustainable exploitation under the present quota system appears to be better for nature conservation than merely artificial propagation (McGough et al., 1992; Schürmann and McGough, 2001). Here, too, the wild populations are probably monitored and protected better than they would have been if collecting had been banned completely.

The Wollemi Pine

A recent, unique case I want to mention briefly is the Wollemi pine (*Wollemia nobilis*). This 30-metre tall tree, originating in the Cretaceous period about 100 million years ago and belonging to the *Araucariaceae*, was detected in 1994 by David Noble in the Wollemi National Park in New South Wales, Australia. By carefully keeping people away from its habitat and at the same time investigating the possibilities of growing the tree commercially it is now expected that in 2005 about 150,000 plants will be for sale on the market, and that from 2007 on 2 million trees will be produced each year without any damage being done to the wild population and its habitat (Woodford, 2000). The Royal Botanic Gardens Sydney play a major role in Wollemi pine research. Thus, the Wollemi pine story would be a success both for trade and for nature conservation.

CONCLUSIONS

In 1987 the World Commission for Environment and Development (the Brundtland Commission) wrote that sustainable development is designed to meet (present) needs "without compromising the ability of future generations to meet their own needs". Meadows et al. (1992), combining utilitarian and normative moral considerations, argued that the sustainable level of use of renewable resources must not exceed the natural speed of regeneration. Both statements, which in fact form the rationale for the development and implementation of the CBD, can be applied to the trade and management of botanical resources in horticulture. Fortunately, in recent years there has been an increased awareness among the public that some current practices with respect to the utilization of natural resources are detrimental to nature (Netherlands Scientific Council for Government Policy, 1995). Also the horticultural trade is, in my opinion, increasingly aware of the need to use our natural resources in a sustainable way. Therefore, although it will always be difficult, if not impossible, to prevent certain people from acting irresponsibly when large sums of money can be earned, it is with some optimism that, with regard to horticulture, I look at the possibilities to effectuate measures, including the ones advised by Oldfield (1999) and ten Kate and Laird (1999), to secure the conservation of biological diversity and the sustainable use of its components in trade:

- increasing awareness of the threatened species and what must be done to save them
- research into the causes of decline
- protection through national legislation
- in situ protection within designated conservation areas
- ex situ conservation in botanical gardens, arboreta and seed banks
- management of populations outside formal protected areas, for example on farms and in natural production areas (e.g., forests)
- ecological restoration measures including control of invasive species
- strict (inter)national controls on products in trade
- initiatives for sustainable use
- regulated access and benefit-sharing, preferably by long-term partnerships involving a range of stakeholders
- technology transfer by commercial research collaboration
- measures to support artificial propagation
- involvement and commitment of local and indigenous communities.

I am inclined to believe that, if these measures are taken, sustainable utilization of wild botanical resources for horticulture is very well possible.

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