

Conserving wild plants for livelihoods

botanic gardens working
with local communities



BGCI

Plants for the Planet

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Introduction

The need to value and conserve biodiversity has received increasing attention as a global political issue in recent years. Despite a lack of basic information on many components of biodiversity and their interactions, it is apparent and generally understood that ecosystems and species are under increasing threat worldwide. Documentation of threatened plant species remains inadequate and needs to be scaled up globally, but nevertheless it is estimated that one third of all plant species are currently threatened with extinction. The impact of climate change is expected to place increasing pressure on plants that are naturally rare, restricted to especially vulnerable ecosystem types, or those that are declining rapidly through over-exploitation or habitat loss. The potential loss of plant species on a global scale threatens ecosystem stability, reduces the potential to mitigate or adapt to the impact of climate change and directly affects the provision of resources for human livelihoods around the world.

While the main drivers of loss of biodiversity relate to factors of global scale – conversion and loss of habitat, commercial logging and climate change – the world’s poorest people are generally the most acutely dependent on the maintenance of biodiversity for their well-being and livelihoods. Over 80 per cent of the rural poor depend directly on biodiversity, particularly wild plant species, for their primary healthcare but also for a variety of other needs including food, fuel and non-timber products for market. The use of wild plants for food is commonplace, supplementing the staple crops grown in developing countries. So loss of biodiversity threatens the supply of medicinal plant products and compromises food security. Reconciling the needs of biodiversity conservation at a time of rapid global change with the need to address poverty alleviation is the goal of current conservation and development policies. It is by no means easy to achieve.

Socio-economically valuable plant species, which are not crops include important forage, agroforestry and forestry species, as well as important ornamentals, medicinal plants and crop wild relatives. Such plant genetic resources, and the associated indigenous knowledge, are among the most important, and often the only, assets available in many poor, rural communities and their significance increases as other resources dwindle or disappear. (CBD Secretariat)

This paper discusses challenges faced in community-based conservation of wild plants which are used for local rural livelihoods and looks at how botanic gardens might provide effective solutions that help to address both socioeconomic needs and conservation ends. It considers pilot projects and consultations with a range of individuals and organizations in Madagascar and Uganda carried out by BGCI and partners, with support from SwedBio through the *Wild Plants for Food*



Photo: Missouri Botanical Garden

and Medicine project. This project was designed to support IUCN Red Listing for plants, selection of Important Plant Areas (IPAs) and community approaches to plant conservation in the two countries. The paper also draws on experiences from elsewhere in the world, either directly related to BGCI projects, or based on a review of literature and discussions with botanic gardens and partner organizations. Botanic gardens already act as vitally important resource centres for the conservation of plant diversity. We hope this discussion paper will encourage a wider debate on how botanic gardens can scale up efforts and effective initiatives that contribute to the direct conservation of plants of critical importance for local people. We also hope to stimulate discussion on how BGCI can best support such efforts and how BGCI can continue to develop its own programme on plants for rural livelihoods.





Information first



Photo: John Manning

Information on the conservation status of wild plants is an important component in conservation planning. Initial attempts to document the scale of threats to plant diversity worldwide began in the 1970s. Information collection and analysis proceeded with the development of IUCN Red Listing, resulting ultimately in the 1997 IUCN Red List for Plants (Walter and Gillett, 1998).

The initial progress in Red Listing slowed for a period during the 1980s, when it was decided to place more emphasis on documenting areas of particular value for plant conservation globally. It was considered more realistic to develop conservation solutions for priority plant areas rather than priority species. The Centres of Plant Diversity project undertaken by WWF and IUCN, with support from the UK Overseas Development Administration and the European Commission, aimed to identify which areas around the world, if conserved, would safeguard the greatest number of plant species, to document the scientific and economic benefits of conserving these areas and to provide a strategy for their conservation.

More recently the site-based approach to documentation for plant conservation has been developed at a finer scale with the development of the Important Plant Areas approach, based to a large extent on the Important Bird Area model developed by BirdLife International (Oldfield, 1998). A unified approach to IPA selection has been developed which takes into account three criteria:

- i) The site holds significant populations of species of global or regional concern.
- ii) The site has exceptionally rich flora in a regional context in relation to its biogeographic zone.

Box 1: Involving local communities in conservation assessment and livelihood initiatives

Custodians of Rare and Endangered Wildflowers (CREW) is a programme based at Kirstenbosch Botanic Gardens in Cape Town that involves local volunteers from a range of socioeconomic backgrounds in the monitoring and conservation of South Africa's threatened plants. All volunteers are given the opportunity to attend courses and workshops in plant identification and conservation. The programme links volunteers with their local conservation agencies and particularly with local land stewardship initiatives to ensure the conservation of key sites for threatened plant species.

CREW volunteers have been involved in vegetation surveys to re-find species listed on the IUCN Red List as being either Critically Endangered or Possibly Extinct. Data are collected for the Threatened Species Programme by CREW, allowing the volunteers to actively participate in both national and international policy development including the National Biodiversity Strategy and Action Plan (NBSAP), CITES, national committees of the IUCN and the GSPC.

CREW also runs the annual Plant Monitoring Day. This involves CREW groups running educational trips for schoolchildren to local nature reserves. Successful project work is also nearing completion in the community of Mamre (Western Cape, near Atlantis). The key aim was to involve local communities in monitoring and conserving threatened plants as well as exploring the possibility of developing livelihood opportunities in the community. One of the principal ways to achieve this was by developing tourism opportunities linked to the annual Mamre Wildflower Show.

Source: www.sanbi.org



iii The site is an outstanding example of a habitat type of global or regional importance.

A site is considered to qualify as an IPA if it fulfils one or more of these criteria.

IUCN Red Listing for plants is currently progressing slowly on a global scale. As noted by Vie (Vie *et al.*, 2009), since 2000 the number of plant assessments on the Red List has increased very slowly compared to other taxonomic groups. Currently 8,457 plant species are listed as globally threatened. Estimates suggest that 15,000 medicinal plants alone may be threatened with extinction (IUCN/SSC MPSPG, 2007) and many other species of value for rural livelihoods are known to be under pressure in the wild. The slow pace of global Red Listing means that the visibility of plants in biodiversity analyses, priority-setting and financial resource allocation is limited, despite the fundamental value of plants to all life on earth.

In the same way as information on plant species under threat in the wild remains incomplete globally, identification of important areas for plant conservation is equally inadequate in many parts of the world. The revised *Global Strategy for Plant Conservation* (GSPC) agreed by the CBD in 2010 retains targets for documenting and understanding plant diversity as a basis for undertaking conservation action. Specific targets were agreed both for assessing the conservation status of plants (Target 2) and the identification of IPAs (Target 5). The 16 targets of the GSPC, designed to achieve the overall goal of halting the current and continuing loss of plant diversity, are available at www.bgci.org.

In order to help address the lack of information on threatened plant species, in 2006 BGCI worked with IUCN on a Global Environment Facility (GEF) Project Development Fund (PDF) B project that looked at implementation of GSPC targets in five countries – one of the very few examples of international funding being made specifically available for GSPC support. The project looked at current knowledge and institutional capacity, with regard to the assessment of plant species and important plant areas for conservation and development of community-based conservation solutions. As a further development from this work, SwedBio supported the one-year project, *Wild Plants for Food and Medicine* to improve information and practical plant conservation in Uganda and Madagascar.

Overall the GSPC has been relatively successful in pushing forward the plant conservation agenda, but major problems in implementation remain (Secretariat of the Convention on Biological Diversity, 2009). One underlying problem is the continuing disconnect between the science-based approach to plant conservation and conservation on the ground. Writing about plant conservation in the Caribbean, Maunder and colleagues (2008) point out that effective conservation solutions must increasingly include strong elements of social science, resource economics, and commercial practice; an ‘academic’ awareness of the need for plant conservation alone will not necessarily change practices: ‘Here, the botanical community needs to improve its ability to more effectively communicate

the value of plants and the need for their conservation to the world beyond the herbarium. There is an enormous gap between “academic” research and its application to the practical management of threatened habitats and species by community groups, protected areas and motivated volunteers.’ The gap is arguably equally large between the conservation/development rhetoric and finding practical solutions to secure plants of livelihood value at local level.

Finding a way to bridge the gap between academic research and practical community-based conservation requires new mechanisms for sharing data, prioritizing conservation needs and learning from successful outcomes. Consideration needs to be given to strengthening plant conservation bodies and networks to deliver results.

Box 2: Community contributions to Red Listing in Malaysia

Red Listing of threatened plants can benefit greatly from community involvement, especially in those parts of the world where botanical survey is inadequate or out-of-date. Experts in local communities are often well aware of the local conservation status of many species, while field research with communities selected according to a well designed sampling strategy can result in a good understanding of the conservation status of species over a wider area. An example of such a survey is Projek Etnobotani Kinabalu (PEK), a community-based ethnobotanical inventory (1992–98) carried out by Sabah Parks, Universiti Kebangsaan Malaysia and the People and Plants Initiative (Martin *et al.*, 2002; Hamilton and Hamilton 2006). Mount Kinabalu (4,094 m) in Sabah (Malaysia) has one of the richest floras in the world, its fame attracting more than 200 visiting botanists since 1851 to collect mountain plants for herbaria.

The ethnobotanical inventory involved plant collectors from 9 Dusun communities distributed in a ring around the mountain, so that altogether their collections constitute a good sample of plants from the area. The effectiveness of involving knowledgeable local people can be gauged from the results. Over the 6-year period of PEK, the local collectors managed to increase the number of monocotyledons known from the mountain (excluding orchids, which PEK collectors were instructed not to collect) by 7 families, 28 genera and 99 species, corresponding to increases of 26, 21 and 28 per cent respectively.

In addition to greatly expanding knowledge of the flora, PEK has much enriched information on the local names, uses and distribution of plants, and on local systems of plant classification. The data now available from PEK, for example, provide a much clearer picture of palm distribution and conservation status on Mt Kinabalu.

Source: Dr Alan Hamilton





Biodiversity and livelihood



Wild plants are of immense value to rural communities in the provision of ecosystem services, for direct consumption or for income generation through trade. Timber is by far the most valuable plant product extracted from the wild for international markets, but is generally managed on an industrial scale with few benefits for local communities. Other plants, categorized as non-timber forest products (NTFPs), that are of major significance in international trade include medicinal plants, essential oils, gums, resins, rattans, bamboos, edible nuts, oils, fibres and ornamentals. An estimated 50,000 plant species are used medicinally around the world, some 3,000 of which are in international trade (Schippmann *et al.*, 2002; 2006). Trade in wild NTFPs generally involves millions of people in harvesting, processing and commerce – many in remote areas, distant from other forms of employment, and frequently women. Some products provide regular annual income, others are fall-back options when other sources of income fail.

As biodiversity diminishes so do essential livelihood resources. Threats to the diversity of wild plants of value to rural communities include the general processes of habitat destruction and modification and direct over-exploitation.

As recognized by Roe (2008), the role and value of biodiversity, or wild natural resources, in supporting the livelihoods of poor people has been widely debated for over 25 years. Within the last few years three key concerns have come to dominate the conservation–poverty debate. These are:

- i) the activities and accountability of big international conservation NGOs, and their impacts on local communities;
- ii) the increasingly protectionist focus of biodiversity conservation policy, particularly in relation to protected areas and associated impacts on local people; and
- iii) the lack of attention to biodiversity conservation on the development agenda.

Addressing these concerns involves closer engagement of different sectors, whether it be international NGOs with local communities or conservationists with development experts.

In reality, seeking biodiversity conservation solutions that also address the livelihood needs of local people remains very challenging. As BirdLife (undated) points out: ‘No blueprint





Photo: Sary Chelek

exists for biodiversity-livelihood links. Whilst organizations can support local development and sustainable resource management through provision of technical expertise, access to networks and information relevant to a rapidly changing world, there is no substitute for local people's knowledge and action in designing and carrying out measures that address their needs.'

The needs of local people may not always correspond with the biodiversity conservation priorities established by those who have no direct relationship to the species and habitats that are targeted. Global concerns tend to focus on preventing loss of endemic or globally rare species or important habitats, as represented for example by the IUCN Red List or IPAs. Local people may not be aware that plants growing in their vicinity are different from those growing further away and that because of the overall rarity of the species people in other parts of the world find them of interest. But even if they are aware, faced with the reality of rural poverty such considerations are likely to be viewed by locals as at best irrelevant and, where conservation measures are imposed, as violating rights of benefit and access. When local and conservation interests do coincide it is likely to be because of the direct decline of a resource species – used for example for food or medicine.

The main trend in global conservation solutions that address the livelihood needs of local people and protect biodiversity has been in the promotion of alternatives to ecologically damaging landuse activities. Examples include ecotourism

schemes, and sustainable harvesting or production of local wild species for local consumption or trade. Hutton and Leader-Williams (2003) argue, 'Because the use of wild living resources remains an essential livelihood strategy for many, use that is biologically sustainable with the potential to provide incentives for conservation, seems a clear goal for which to strive.' The production and trade in NTFPs has been widely promoted as a means of achieving both ecosystem and species conservation as well as improving livelihoods. According to Belcher and Schreckenberg (2007), intervening in NTFP commercialization requires a long-term and multidisciplinary approach that ranges from providing support to both the technical and social aspects of natural resource management, to understanding how markets function from local to international level.

Yet it is interesting to note that so, too, has there been a tendency within the globalized conservation community to overlook the sustainable practices of local resource-dependent people whose traditions have, as in the case of much of the world's remaining forests, served to protect vast biodiverse areas. It follows that it may be important to identify such practices, since they will provide opportunities of analysing how the objectives of global conservation coincide with local priorities. These cases may present a challenge to the western trained scientist, since it requires some intellectual humility to validate local systems of knowledge and practice (Pritchard, in litt. 2010).



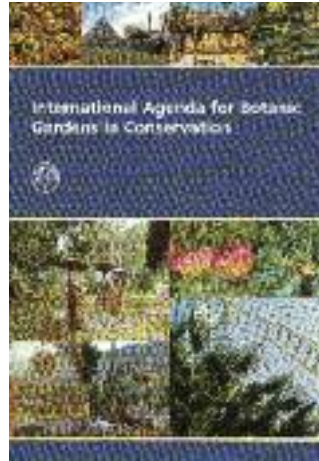


Changing role of botanic gardens

Botanic gardens are multi-functional, with a variety of different roles. Since the 1970s the conservation role has become increasingly important and prominent. Initially focusing on plant exploration and documentation, *ex situ* conservation, display and education, botanic gardens have become more involved in formulation of conservation policy and engagement with local communities. The first global strategy for this role, The Botanic Gardens Conservation Strategy, was published in 1989. Post the Rio Earth Summit in 1992, the international policy framework for biodiversity conservation changed markedly and in response to this, the *International Agenda for Botanic Gardens in Conservation* was published in 2000 (Wyse Jackson and Sutherland, 2000). This provides a global framework for the development of botanic garden policies and programmes towards the effective implementation of international treaties and national laws, policies and strategies relevant to biodiversity conservation. The *International Agenda* was one of the key source documents used in the development of the GSPC.

With regard to sustainable development, the *International Agenda* calls on botanic gardens to take the following actions to raise public awareness and empower communities:

- i) Take an active role in extension services and outreach programmes in local communities in such areas as poverty alleviation, healthcare, horticultural training and development and other fields that will generate better living standards and sustainability of lifestyle.
- ii) Use visitor, interpretative and educational services within the botanic garden to promote corporate citizenship and the sustainable use of natural resources, to raise awareness of consumer lifestyles, and show the link between environmental protection and healthy economics enabling sustainability in development and individual livelihoods.
- iii) Work with communities to develop craft industries that are not detrimental to biodiversity and the environment, but which support conservation and sustainable development in priority regions.
- iv) Develop partnership projects that facilitate the appropriate sharing of plant knowledge with local communities.



Botanic gardens are thus increasingly connecting with community-based conservation programmes.

The capacity of the gardens to deliver local conservation and livelihood benefits varies enormously depending on their location, mandate and financial situation. The botanic gardens of South Africa, forming part of SANBI, are fully integrated in national biodiversity conservation action, with community engagement in plant conservation assessment (see Box 1) and a wide range of livelihood activities. Other botanic gardens in Africa, India, elsewhere in Asia and in Latin America manage a range of community-based conservation projects with livelihood benefits (Waylen, 2006).

In Europe and the US, a number of major botanic gardens are increasingly working through partnerships to support conservation and livelihood initiatives in a range of biodiversity-rich countries. The work of Royal Botanic Gardens, Kew (RBGK) and Missouri Botanical Garden (MBG) in supporting plant conservation in Madagascar for example, is described below. The work of the Hortus Botanicus, Leiden, together with the Netherlands Centre of Biodiversity (NCB) Naturalis, on biodiversity and livelihood initiatives, began with J. van Valkenburg's study on the potential for development of NTFPs in East Kalimantan, Indonesia, undertaken from 1991 to 1995. Recently the Garden has been involved in a collaborative study of the uses and conservation of plant species in Ben En National Park, Vietnam (Kessler, in litt. 2010).





Botanic gardens and the use of wild plant resources in Uganda

As already mentioned BGCI has recently worked with botanic gardens in Uganda on sustainable livelihood issues. Uganda is essentially a rural subsistence economy, 80 per cent of Ugandans being subsistence farmers growing a mix of crops, including bananas as the staple. At the same time there is still a huge reliance on wild plants from the remnant natural vegetation. The demand for fuelwood is enormous and is partly supplied from plantations, but also from natural forests and woodlands. Charcoal is sold along the country's main roads and the demand for building poles is also substantial. Plants such as raffia (*Raphia farinifera*) and bamboo (*Arundinaria alpina*) are collected to make baskets and mats – some of the main handicrafts in Uganda. Wild plants are also harvested on a grand scale for traditional medicines, which provide the only form of healthcare for the majority of people. Some information on the conservation status of Uganda's useful plants has been compiled and preliminary priorities for the conservation of declining medicinal plants have been determined at a national level.

Uganda has four botanic gardens recorded in the BGCI GardenSearch database. Two of them have a particularly strong connection with the rural livelihoods of local communities.

Tooro Botanical Garden, in the town of Fort Portal, was established in 2001 on a site formerly managed as the Njara Forest Reserve by the Ugandan National Forest Authority. In 2004 the Garden was officially registered as an NGO. Its location is in the foothills of the Rwenzori Mountains and Rwenzori Region is one of the most species diverse areas of Uganda – a Global Biodiversity Hotspot. For example, the nearby Kibale Forest National Park contains approximately 350 tree species in an area of only 766 km². Within the park there is a diversity of vegetation types, including evergreen rainforest and savanna. Many plants growing in these habitats are valued and wild-collected by local people for food and medicinal use. Herbal medicine is commonly used throughout the region because western medicine is perceived as too



expensive and is often not readily available. At present, no accurate figures exist for herbal medicine use or the volumes that are traded within and across country borders. There is known to be increasing informal trade in wild medicinal plants to neighbouring countries, including the Democratic Republic of Congo, Sudan and Tanzania, which has led to growing demand and indiscriminate harvesting of desirable species, threatening some plants with extinction.

Tooro Botanical Garden is committed to demonstrating ways of conserving biodiversity and at the same time improving the supply of important plants – and thus income for local needs. This means encouraging cultivation of valued species to decrease the pressure generated by wild collection. The medicinal plants particularly valued by local people have been identified and documented through community meetings. Now the Garden is working with around 70 local women on a voluntary basis to grow local herbs and spices and has produced a book to show how these can be used medicinally to improve family health. A model farm has been developed at Tooro showing how medicinal plants grown for family use can be planted between cash crops. Every two months traditional healers come together at the Garden to discuss specific health topics.





People living around the Nature Palace Botanical Garden have formed the Tweekembe Herbal Medicine Promoters Association and are involved in processing the medicinal products they harvest from their gardens. They have opened a small distribution centre where they sell herbal products mainly to local people. The *Wild Plants for Food and Medicine* project supported both scientific verification of the medicinal plants grown by the Garden and the Garden's propagation facilities.

Box 3: Sharing resources for effective conservation in Uganda

A stakeholder workshop was held on 11–12 February 2009 at Makerere University Faculty of Forestry and Nature Conservation as part of the *Wild Plants for Food and Medicine* Project. Facilitated by BGCI, the workshop brought together eight organizations involved in plant conservation in Uganda. It was agreed at the workshop that working within an innovative system integrating the efforts of all stakeholders is the best approach to successfully achieve plant conservation goals. A steering committee was formed and charged with spearheading the implementation of two priority activities:

- To establish linkages, eliminate duplication of efforts and enable strategic planning for conservation approaches in Uganda.
- To develop a national strategic plan and a white paper to be used for resource mobilization and guide the conservation of medicinal and other plant resources.

It was recognized that stakeholders in plant conservation include: local communities, NGOs, government policy makers, Extension workers, credit facilities, research teams, seed dealers, private sector and conservation practitioners. Key stakeholders in the 'conservation practitioners' category include:

1. Makerere University Herbarium and Botanic Garden
2. Makerere University Faculty of Forestry
3. Tooro Botanic Garden
4. Entebbe Botanic Garden
5. Nature Palace Botanic Garden
6. Natural Chemotherapeutic Research Laboratory
7. Nature Uganda
8. INIBAP

A report of the conservation activities, strengths and weaknesses of these organizations was subsequently produced as a basis for developing a new national conservation partnership.

The Garden has also begun drying and packaging medicinal herbs for sale. So far these include non-native species such as wormwood (*Artemisia annua*), a plant with great promise in the battle against malaria, *Justicia adathoda*, used to treat measles, flu and respiratory problems and *Centella asiatica* – a memory booster. These species have been chosen primarily because income from their sale helps to pay the running costs of the Garden and provides employment for people in the Fort Portal area. The Garden also cultivates medicinal plants of local wild origin, some of which are under threat such as *Prunus africana* and *Warburgia ugandensis*. Ultimately, production of these species may provide both an income and a conservation solution by reducing pressures on the wild. The *Wild Plants for Food and Medicine* project helped to document the local usage of medicinal plants and to improve facilities within the Garden to process medicinal plants for income generation.

The second garden is the Nature Palace Botanical Garden located in the Wakiso District, relatively close to the capital city of Kampala, also being developed on a former forest reserve. It is mainly surrounded by farmland but there are some good remnant patches of forest in the vicinity. In 2005, Nature Palace Foundation started implementing a poverty alleviation and health care promotion project. This aims to strengthen community collaboration through cultivating medicinal plants for income and health promotion within home gardens. The Garden consulted local people to find out which medicinal plants were becoming scarce. A nursery was established so that these plants could be grown and seedlings distributed for the villagers to cultivate in their own plots. Nature Palace's community medicinal garden serves as a conservation store for declining species and a local centre for horticultural training. Over 50 species are now grown in the home gardens – wild or naturalized plants that were previously harvested from the remnant natural forests and farmlands.





Botanic gardens and wild plant resources in Madagascar



BGCI has also recently worked with the botanic garden community on pilot plant livelihood projects in IPAs of Madagascar. This island is internationally renowned for its rich diversity of plant species, 80 per cent of which are endemic. Commercially valuable wild species include hardwood timbers such as rosewoods *Dalbergia* spp. and ebonies *Diospyros* spp. that have recently been ruthlessly and illegally logged for export; ornamentals, resins and fibres from *Raphia* palms. For local livelihoods, firewood, medicinal and edible plants are also of considerable value. Recent research by the Madagascar Plant Specialist Group, as part of the *Wild Plants for Food and Medicine* project, has produced a consolidated checklist of over 2,000 species of medicinal and nutritional plants. Of these, 1,880 are of medicinal and 237 of nutritional value. Currently, the primary producers of natural products in Madagascar gain meagre benefits from their work because they supply raw products and are at the tail end of the value chain. Therefore, there is considerable potential for increasing their income while reducing quantities exploited, by enabling access to lucrative markets. Over time, though highly challenging, the development of sustainably produced rosewood and ebony timber would be a desirable goal.

In the shorter term sustainable production of NTFPs may be more feasible – for example, the aromatic and medicinal plants discussed by Juliard and others (2006). An immediate priority is to support sustainable utilization of wild plants for direct use by local people.

Madagascar urgently needs effective protocols enabling the sustainable exploitation of natural resources by the local community, for the benefit of that community. Current applications of this management approach are failing and, if allowed to continue without improvement, will lead to species extinction. However, if Madagascar rejects community-based exploitation of natural resources, then rural Malagasy will be disenfranchised from their natural heritage and their poverty will worsen.

As identified by the overview of wild medicinal and nutritional plants, most species on the consolidated checklist have medicinal virtues while species with potential as significant sources of food are few. It is noteworthy that the stakeholders of the pilot projects in Madagascar have emphasized the role of wild nutritional plants in improving the livelihoods of local



Box 4: BGCI Ibity pilot project

The project site of Ibity in the heart of Madagascar is characterized by 'inselberg' ecosystems on quartzite stone at 2,050 meters above sea level, rich in dry, sclerophyllous forests, rock vegetation and shrubby grasslands. Gullies and ravines serve as refugia for rare plant species requiring higher water provision. According to MBG, the estimated plant endemism in this area of Madagascar is more than 90 per cent, including species from families that are endemic to the country (Asteropeiaceae, Sarcolaenaceae). Besides a number of important wild medicinal and nutritional plants, the area also has various species of ornamental importance, including succulent species of *Pachypodium*, *Aloe* and *Kalanchoe*.

A keystone species of the sclerophyllous forests is one of the Euphorbiaceae, *Uapaca bojeri* (Tapia), a plant that provides habitat for the native caterpillar *Brocera madagascariensis*, used in the local production of silk, a product of prospective socioeconomic significance. The decline of these Tapia woodlands leads to dwindling populations of the silkworm. Tapia fruit is collected by local people during the dry season as an additional source of food – which seems to further pressurize the species. General threats to biodiversity include 'tavy' slash and burn

agriculture, charcoal production, livestock grazing, overexploitation of medicinal and ornamental species, invasive species (e.g. *Buddleia* spp.) and mining for cement production. Although Ibity has been proposed for inclusion in Madagascar's protected areas system and has been given temporary official protection status, encroachment on its biodiversity continues.

The *Wild Plants for Food and Medicine* pilot project in Ibity aimed at the development of a number of recovery programmes for threatened species. Activities were led by the local farmers' association TAMIFA, that includes 96 members of the district of Ibity, with the support of the local branch of MBG. As in the case of the pilot project at Antrema, horticultural capacity building (collection of plant material, propagation and cultivation techniques, in particular of ornamental succulent species) has been extended to members of TAMIFA. This training has been organized in collaboration with experts from the small botanic garden, Arboretum d'Antsokay in Tulear, which holds the most significant dryland flora ex situ conservation collection in Madagascar. A number of the flagship species are now being propagated in nurseries on site; while trials for raising the Tapia plant and the native silkworm are ongoing as part of exploring novel income-generation schemes.

communities, be it in directly addressing immediate food demands or for use in novel income generation schemes. This reflects the serious health situation of rural communities in Madagascar whose poverty, far from being mitigated by development aid, is believed to be on a steep rise. As highlighted by Bioversity International, 'simple intensification of production will not be enough, especially in Africa. Agricultural biodiversity has a significant and under-appreciated role to play in delivering more resilient harvests, adaptability to climate change, better nutrition and health, environmental protection and economic development' (Bioversity International, 2009). Promoting native wild plants with nutritional virtues through managed wild-collection or through systematic cultivation could constitute a valuable and potentially cost-effective source of supplementary food, at least locally.

Madagascar has three botanic gardens, as listed in BGCI's GardenSearch Database, that are involved in plant conservation – however, the influence of overseas botanic gardens remains much more significant. Missouri Botanical Garden (MBG), based in St Louis, USA, has become a major coordinator for plant conservation activities in Madagascar. MBG now has two permanent offices and over 60 members of staff based in the country. Over the past 30 years, their Madagascar Program has focused on taxonomic research, botanical exploration, and in-country capacity building, with special emphasis on training. More recently the emphasis has shifted to conservation. At a series of strategic planning



sessions held in 2002, MBG identified four key types of action to improve the conservation status of the Malagasy flora:

- i) analysis of botanical information to assist in conservation planning and decision-making;
- ii) improved advocacy for the conservation of Malagasy plants;
- iii) species-focused conservation of plants on the very brink of extinction; and
- iv) community-based conservation of priority areas for plant conservation.



Box 5: BGCI Antrema pilot project

The project site in the far northwest of Madagascar is known for its particularly diverse forest, grassland and coastal ecosystems and wealth of endemic species. It is recognized as an IPA. The lemur species, *Propithecus verreauxi*, is regarded by locals as their direct ancestor and is of huge cultural importance. By promoting lemurs as a primary conservation target, recovery programmes for threatened mangrove ecosystems could be initiated. The pilot project for *Wild Plants for Food and Medicine* aimed to test a number of conservation activities, including population reinforcement for some of the heavily exploited wild nutritional plants such as yams, the cultivation of introduced crops to help alleviate demand for greater provision of food resources, and steps to aid the recovery of mangrove ecosystems. Five local village associations, including one women's organization, were engaged in the pilot activities coordinated by IDENTITERRE, a local NGO that has been active in the project region for many years. The pilot project also has the blessing of the local prince, who ultimately guarantees cohesion and coordination within the local community. During the project period, training in nursery management, propagation and cultivation techniques has been provided for representatives of the five participating organizations.

RBGK also has an active conservation programme in Madagascar that includes plant conservation assessment, and is increasingly working with local partners on community-based conservation solutions (See Box 6). In just one example, Kew has worked with local partners over the last ten years researching the taxonomy of Madagascan yams. There are more than 40 native species of yams in Madagascar, 80 per cent of which are edible. They represent an important food in rural areas during periods of famine.

Since the 2002 workshop, MBG has analysed botanical information to identify 78 priority areas for plant conservation (PAPCs); estimated the risk of extinction of 2,850 Malagasy plant species; lobbied successfully to integrate PAPCs into the nation's plans for an expanded protected area network; provided a safety net for 30 critically endangered plant species by ex situ conservation measures; and established community-based conservation projects at 11 PAPCs.

These sites for community-based conservation are distributed throughout the country in a diversity of vegetation types: dry forest and thicket (at Anadabolava and Oranjia); littoral forests (at Agnalazaha and Pointe à Larrée); low-elevation humid forest (at Analavelona, Ambalabe, Analalava, Makirovana, and Vohipaho); sclerophyllous woodland and shrubland (at Ibity); and mid-elevation humid forest (at Ankafobe). At each site,

Box 6: Conservation and sustainable use of yams in the Fandriana–Vondrozo Forest Corridor

RBGK is working on a project to improve management of humid forest in Madagascar, encourage sustainable use of local yam species and to improve food supplies for local communities. The project is located in the Fandriana–Vondrozo Forest Corridor, an area important for conservation because it encompasses two different ecological zones and allows gene flow between Andringitra and Ranomafana National Parks. The corridor is jointly managed as a new protected area and is important for local people from Tanala and Betsileo ethnic groups.

The project launch involved full consultation and permission from the local authorities and villagers concerned. Three focus groups and 700 household studies were conducted over three months to find out about use of yams. The local communities involved received training in collection of herbarium yam specimens (both cultivated and wild) and cultivation of yams. Eighteen participant communities were initially selected for the study and collection of yams, with four of the most motivated communities chosen for follow-up activities. Demonstration plots were created in each of the four villages and seed distributed for yam production.

Lessons learnt: In future projects the number of initial target villages selected would be reduced. Yam cultivation in the four selected villages was mainly successful. The communities involved were highly motivated to learn the necessary horticultural skills. There was sometimes poor organization and lack of strong collaboration between community members which led to delays in planting and death of seedlings. Additionally there were problems with pests and diseases. In terms of survey work on wild species, more detailed training for community members on species recognition and collection needs to be provided. In general, collection and storage of data proved to be straightforward. Newly developed software was easy to use for data entry.

Source: case study presented at the *Wild Plants for Food and Medicine* project workshop

a local Community Champion has been appointed to pursue conservation by working closely with local stakeholders to reduce poverty, improve human well-being, and promote the sustainable management of natural resources.





The work of BGCI



As mentioned above, BGCI has promoted the importance of working with local communities in plant conservation through the International Agenda. More recently the BGCI Five Year Plan 2007–12 states that BGCI will:

Enhance the conservation and sustainable use of threatened medicinal and nutritional plants to address human well-being and livelihood issues as a contribution towards Targets 3 and 13 of the GSPC.

In working towards this objective, BGCI produced a review of work undertaken by botanic gardens in relation to biodiversity and human well-being (Waylen, 2006) and a report *Plants for life: medicinal plant conservation and botanic gardens* (Hawkins, 2008) which sets out priority actions for medicinal plant conservation.

BGCI has worked with botanic gardens in a range of countries to support community-based plant conservation, with projects generally developed on an ad hoc basis in response to requests from botanic gardens or other conservation partners. We intend to continue developing work in this area, enhancing the role of botanic gardens in supporting community-based conservation initiatives. In general, the infrastructure for plant conservation support is not as well established as, for example, the network for bird conservation, and work is needed at different levels in different countries to fill the gaps in information, institutional capacity or appropriate partnerships. Botanic gardens, with appropriate support, are often well-placed to act as local

resource centres for community-based plant conservation. Engagement with new partners will however most likely be needed to fully utilize and enhance the strengths of botanic gardens in many instances.

A major challenge in working to achieve conservation outcomes while improving livelihoods of rural communities lies in addressing the overarching socioeconomic and political frameworks beyond the local level – at the regional and national scales that ultimately influence the environment and the human population. Evidently, small-scale projects such as those undertaken in the *Wild Plants for Food and Medicine* project could not practically address the ‘external’ context during the short implementation period and this is a major problem with project interventions for many conservation organizations. Attempts to develop novel income-generation schemes may help conservation through sustainable use to become self-financing, thus are particularly attractive in theory. Such approaches provide both a challenge and a major opportunity for BGCI to assist its botanic gardens constituency in exploring new partnerships with institutions that can help devise alternative, economic incentive schemes tapping into the botanical, horticultural and ethnobotanical knowledge of botanic gardens.

At the same time, while financial gain from conservation is certainly attractive to people in countries such as Madagascar and Uganda, the opportunities offered for conservation by other types of incentives should not be overlooked. Other conservation benefits can be directly to health, through having assured supplies of medicinal plants available, and to



Box 7: BGCI working with local communities in SE Asia

In Cambodia, where no botanic garden currently exists, BGCI is working with the Department of Nature Conservation and Protection on the sustainable management of natural resources in O Toch village, in Bokor National Park. This village has been badly affected by the construction of a dam, with the loss of the natural stands of bamboo, rattan (used in basket making) and *Aquilaria* (agar wood) which had previously supported local livelihoods. Working with the local community, success has been achieved in establishing a Community Protected Area (CPA) and developing nurseries for bamboo, rattan, *Aquilaria* and other native timber species. Replanting in the CPA is ongoing for these species and harvesting levels are controlled by the community. In addition to bamboo and rattan collection, other NTFPs are gathered for extra income, such as wild fruits and vegetables, resin and medicinal plants. Community members reported that Bokor National Park holds at least 27 species of medicinal plants that are regularly gathered for the treatment of disease in O Toch Village.

In Vietnam and Indonesia, BGCI has also been working on the conservation of medicinal plants (*Cibotium barometz*, *Stephania dielsiana* and *Ardisia gigantifolia*), making use of the botanical skills of staff at local botanic gardens. In this



instance the focus has been on establishing propagation facilities in home gardens and working with traditional herbalists. The aim has been to produce seedlings which are used to reinforce wild populations and for growing plants for home use.



Photo: Fiona Secrett

cultural identity. Many communities worldwide have traditionally conserved certain features of their natural worlds for religious or cultural reasons. An advantage of promoting conservation based on fundamental features of cultures is that the benefits of associated beliefs and practices are likely to be relatively resilient with the passage of years, in contrast with the ups and downs of economies and markets (known to be fickle for medicinal plants) and the changeability of many governments' environmental policies.

As a global network of institutions dedicated to plant conservation, BGCI works through its botanic garden members and in-country partners. The small secretariat can help identify priority projects, access funding for local projects and 'broker' partnerships between different institutions. Building local capacity of botanic gardens in countries such as Madagascar and Uganda is of fundamental importance. At the same time strengthening the core staff of BGCI as well as its international partnerships will prove essential if the organization is to take on a greater role in practical project development and delivery.





Developing methodologies

Methodologies for community-based plant conservation with a focus on wild harvesting are described by Cunningham (2001) and more generally by Hamilton and Hamilton (2006). Usually such methodologies will be site-specific and vary according to local conditions.

Outside nature reserves under effective, strict protection (a very rare commodity), the pursuit of *in situ* conservation is a complex task. An evidence-based approach may prove useful for improving practices. The 'black box' approach to scientific progress draws together recommendations from systematic reviews of the evidence relating to the success or failure of different approaches and methodologies. These recommendations are then used to form hypotheses for further advance.

This type of approach has been applied to community-based conservation of medicinal plants in a recent programme by Plantlife International involving 14 projects in 8 countries (including 3 projects in Uganda) (Hamilton, 2008). Ten were 'action-research' projects supporting communities in developing conservation, the other four being designed to share experiences on best practice. As a result of the analysis, recommendations have been drawn up for action by three groups of players identified as critical – community groups, project teams and policy makers. Medicinal plants were selected for the programme because they are more likely to motivate community conservation, engaging people's interests in their own health, income and cultural identity. Three elements are considered necessary for success in promoting community-based conservation of medicinal plants:

- i) Establishment of a thriving community group that is inclusive and recognizes local priorities and best practice.
- ii) Establishment of a supportive project team including representatives from the local communities and a cross-disciplinary advisory group.
- iii) Provision of the right enabling environment with support for national centres of excellence, and district centres to serve community needs relating to medicinal plants, such as provision of information and plant resources.

Following discussions of the *Wild Plants for Food and Medicine* project, elements of model projects for community-based plant conservation in Madagascar are identified by G. Schatz (pers. comm., 2009) as follows:

- develop community organizations that have a sense of ownership of exploited species and the power to control access to the species;

- assess and monitor the exploited species – by training a monitoring officer within each community organization and working with him/her to estimate the abundance of exploited species (using replicated plots or transects) and their population structure, and by tracking exploitation with log books – to provide the information necessary to determine appropriate sustainable levels of use that are responsive to actual populations;
- integrate incentives (for example, assistance to transform products, reduce wastage, and access new, lucrative markets) and penalties for misuse of resources;
- include measures (for example, village nurseries that propagate the exploited species and plant the seedlings back in the wild) to reinforce the populations of species reduced by over-exploitation where populations are unlikely to recover naturally;
- provide long-term external assistance to the community organizations, including facilitating good management practices, identifying and satisfying training needs, acting as a respected advocate for the organization with government partners, and advising the organization when faced with new challenges and opportunities.

These elements are now being incorporated into project activities undertaken by MBG and provide guiding principles for broader application by BGCI.





Developing conservation infrastructure

It is generally accepted that communities need a degree of support if they are to take on the burden of conservation as well as sustaining their rural livelihoods in increasingly difficult conditions. At a global level the partnership between IUCN and BGCI developed through the GEF project, and taken forward through *Wild Plants for Food and Medicine* could provide a practical impetus for promoting community-based conservation. BGCI and IUCN are currently collaborating in Red Listing for plants and in the promotion of the GSPC.

BGCI as a global network, with a small central secretariat and working closely with national botanic garden networks, has the potential to work from the global to community level in a much more strategic way if adequately resourced. The BirdLife International model – where BirdLife is acting as a Red List partner, working with its global secretariat, national partners and IBA Site Support Groups (BirdLife, 2006) – provides an interesting parallel. In the short term further developing methodologies and activities in Madagascar, East Africa and SE Asia remain important priorities for BGCI. Strategic partnerships with botanic gardens involved in conservation in these areas offers great scope in this regard.

The approach taken in the pilot projects in Madagascar and Uganda has been to use scientific data to inform the setting

of national plant conservation priorities, to use international standards and methodologies, and to use local knowledge and expertise in project implementation for key species. Facilitation of new partnerships by BGCI has contributed to the success of pilot projects and, at least in Uganda, has developed a framework for scaling up interventions for the conservation of plants linked to livelihoods (see Box 3).

In future, BGCI may explore ways of Red Listing and identification of IPAs involving communities in trial locations, recognizing that there are two advantages to community involvement. First, assessments of the local conservation status of species and threats to them can be much more accurate, as shown by the Kinabalu example (Box 2). Second, involving communities in assessing the status of local species and habitats has the advantage of developing a collaborative platform on which action can be undertaken to improve that status. This contrasts with the normal processes of Red Listing and IPA identification undertaken by scientists alone. Despite the apparent advantage of wider geographical perspectives, a major downside to the traditional scientific approach is that any resulting recommendations for conservation come to the communities from ‘completely outside’. Thus, the communities are unlikely to take action unless inducements are offered on a continuing basis.

Box 8: The Agnalazaha and Blessing Basket Projects

The Agnalazaha Forest is located 50 km south of Farafangana on the east coast of Madagascar. It is a rare fragment of coastal forest with numerous endemic plant taxa. It is also home to critically endangered lemur species (*Eulemur albocollaris*). The forest provides many important natural resources for local populations, including wood, medicines, firewood and craft materials. Threats to the Agnalazaha Forest include slash and burn agriculture, wildfires, cutting wood for fences and other selective exploitations (particularly during periods of famine).

Conservation of the threatened forest ecosystem through the Agnalazaha Project undertaken by MBG with the Mahabo Mananivo community is now being combined with work to assist in the alleviation of poverty in local communities. Community engagement has been achieved by combining awareness raising and education about ecosystem importance with craft product design and improved cooperative marketing.

The Blessing Basket Project is working with MBG to reduce poverty through the sale of baskets at a price five times greater than their normal value. A local cooperative of over

160 weavers has been created since 2007, facilitated by staff at MBG, based both on site and in Antananarivo. The reeds used come from the plant *Lepironia articulata* (Cyperaceae), a common species in marshes along the Madagascar coastline. Reeds of the best quality are rare locally, owing to over-harvesting and wildfires. Work is underway to encourage sustainable harvesting of reeds and new planting of mahampy (*Juncus*) reed.

Orders of baskets from the US so far have resulted in a total profit for the weavers involved of US \$18,000 or 34,200,000 Ariary, which is equivalent to 10 per cent of the normal annual revenue of the community. Members of the cooperative have been given advice on making effective use of the money and a donation of \$3,500 has also been made for improvement of health services.

It is recognized that the impact of social change brought about by the increase in community wealth needs to be carefully monitored. The success of this project was dependent on outside help, which allowed the local cooperative to develop and market their products by opening up communication with international clients.

Source: Case study presented at the Wild Plants for Food and Medicine project workshop





Conclusions



While international trade patterns and other key drivers that fuel demand for natural biological resources remains unabated, discourse and action to address the biodiversity–poverty nexus continue to be at the heart of the agenda for contemporary conservation organizations. This presents a major challenge for institutions traditionally committed to conserving threatened species and ‘pristine’ habitats, but who are now also aiming to achieve improved livelihoods for local communities. BGCI has promoted ‘sustainable development’ since its establishment and has increasingly taken steps to demonstrate approaches at a practical level. At the same time BGCI recognizes the huge potential botanic gardens have to offer, working individually or collectively, particularly given their advantage of being within range countries with vulnerable and declining species.

Choosing medicinal and nutritional plants as target species to achieve biodiversity conservation outcomes at large appears to be a promising approach – engaging local communities in the management of their natural resources, while addressing the socioeconomic, health and dietary aspects and potential of these species. Botanic gardens are well placed to tackle research questions relating to NTFPs, such as such as what factors control their distribution, establishment and reproduction, what physiological and morphological aspects control their utility and potency and how such factors influence sustainability of harvesting (Lascurain *et al.*, 2008). Also, botanic gardens have a well-established track record in propagation and cultivation methods that can be called upon to grow such species on a larger scale for local consumption,

thereby reducing collection pressure in protected areas. Major challenges remain however, in meeting project expectations. Long-term commitment is desirable for gardens to provide training and other forms of support to local communities. At a practical level, climate variability, extreme weather events, soil suitability, extent of propagation material, and genetic diversity, are all factors which can affect the success of cultivation programmes.

The development of marketing strategies for the generation of alternative income and other incentive schemes offers great potential, but the challenges of this approach should not be underestimated. Again, expectations need to be managed with a realistic assessment of requirements for marketing and potential for sales. The creation of alternative income schemes may also require consideration of the possible consequences of sudden or unprecedented revenue generation and its distribution among the community, as shown by the innovative project ‘Blessing Baskets’ (see Box 8). Such initiatives in partnering with relevant organizations, the private sector and so on, that can bring about the development of new conservation and development models, will at the same time help botanic gardens to be seen as major stakeholders in addressing the biodiversity–poverty agenda.

BGCI’s pilot on-the-ground conservation projects therefore support the gathering of conservation information that integrates assessments of species, of the ecosystems in which they occur (e.g. through the IPA approach) and conservation and development priorities identified locally by representatives of rural communities.





The next steps



Photo: Kamla Kulshreshtha

BGCI's recent projects in Uganda and Madagascar have highlighted a range of factors necessary for successful conservation and livelihood interventions. They have demonstrated the enormous unfulfilled potential to support local communities in their efforts to conserve plant diversity and improve their supply of food, medicinal plants and products to provide a source of income. BGCI is considering how to scale up its activities to further develop the plants for rural livelihoods programme, drawing on the skills and resources of botanic gardens worldwide. In doing so we will consider:

- the need to find new ways of connecting academic research (meaning Red Listing and IPA identification) to community-based conservation
- the need to find ways of linking community interests to better *in situ* management of resources and to involve communities in developing measures of success
- the recommendations in the *International Agenda* for botanic gardens to take an active role in extension services
- the desirability of promoting an evidence-based approach to *in situ* plant conservation
- the desirability of further developing the 'conservation infrastructure' in Uganda
- the usefulness of 'medicinal plants' as a focus for *in situ* conservation promotion involving botanical gardens

In the short term we will take the following steps:

- i) BGCI will establish a web-based forum for discussion on biodiversity and livelihoods with the botanic garden community.
- ii) BGCI, as Secretariat for the IUCN/SSC Global Tree Specialist Group, will work with the IUCN/SSC Medicinal Plant Specialist Group and IUCN/SSC Crop Wild Relative Specialist Group to undertake threat assessments and plan conservation action for priority socioeconomically important wild plants. BGCI will specifically use this information to support livelihood interventions working with local botanic gardens.
- iii) BGCI will continue to work with botanic gardens to maintain/improve their expertise and knowledge of species, ecosystems and horticultural practices; documenting and capitalizing on indigenous knowledge and integrating it with external 'scientists' knowledge of climate and other global change impacts on ecosystem services.
- iv) BGCI will seek funding to continue supporting plant conservation and sustainable livelihoods in East Africa, Madagascar and SE Asia, building on the successes of the pilot projects in these regions and will endeavour to broaden its programme to include similar projects in the Americas.
- v) BGCI will support the development of income generating and livelihood improving schemes, either directly through work with the target species or indirectly, by supporting conservation activities that do not have the prospect of immediate returns – this will require working with botanic gardens as well as with other sectors, both private and public, that can help devise such initiatives.
- vi) BGCI will explore the potential for marketing plant-based products that support rural livelihoods: with over 200 million visitors a year, botanic gardens worldwide attract a target audience for plants and plant-based products, yet, in most cases, stock sold in their shops does relatively little to address ethical trade and the sustainable use of plant biodiversity. BGCI will identify best practice by conducting a survey of botanic gardens, assessing shop stock and policies and identifying ways to link suppliers in rural communities with the shops.
- vii) BGCI will continue to work with governments, influencing and assisting policy development on key aspects arising from the work with rural communities, such as complying with access and benefit-sharing requirements.





References

- Belcher, B. & Schreckenber, Kathrin, 2007. Commercialisation of Non-Timber Forest Products: A reality check. *Development Policy Review* **25**(3).
- Biodiversity International; press release, 8 July 2009; http://www.biodiversityinternational.org/news_and_events/ (accessed 9 November 2009).
- BirdLife International. Undated. Conserving biodiversity, improving livelihoods. Birdlife International, Cambridge, UK. http://www.birdlife.org/news/news/2007/06/people_and_biodiversity.pdf (accessed 13/09/2010).
- BirdLife International, 2006. *Livelihoods and the environment at Important Plant Areas: Listening to local voices*. Birdlife International, Cambridge, UK.
- Botanic Gardens Conservation International, 2007. *Conserving wild plant resources for rural livelihoods in Cambodia*. Unpublished project summary report.
- Cunningham, A. B., 2001. *Applied ethnobotany. People, wild plant use and conservation*. Earthscan Publications Ltd, London.
- Hamilton, A. and Hamilton, P., 2006. *Plant conservation. An ecosystem approach*. Earthscan Publications Ltd, London.
- Hamilton, A.C. (editor) 2008. *Medicinal plants in conservation and development: case studies and lessons learnt*. Plantlife International, Salisbury, UK.
- Hawkins, B., 2008. *Plants for life: medicinal plant conservation and botanic gardens*. Botanic Gardens Conservation International, Richmond, UK.
- Hutton, J. & Leader-Williams, N., 2003. Sustainable use and incentive-driven conservation: realigning human and conservation interests. *Oryx* **37**(2): 215–26.
- IUCN/SSC MPSG, 2007. International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP). Bundesamt für Naturchutz (BfN), Bonn, Germany.
- Juliard, C., Benjamin, C., Sassanpour, M., Ratovonmenjanahy, A. and Ravohitrarivo, P., 2006. *Madagascar aromatic and medicinal plant value chain analysis*. microREPORT 70. USAID, Washington DC.
- Lascurain, M., Lopez, C. and Sharrock, S., 2008. The role of botanic gardens in supporting the conservation and sustainable use of non-timber forest products. *BGJournal* **5**(1): 16–19.
- Martin, G., Lee Agama, A., Beaman, J.H. and Nais, J., 2002. *Projek Etnobotani Kinabalu: the making of a Dusun ethnoflora*. (Sabah, Malaysia).
- Maunder, M. *et al.*, 2008. Plant conservation in the Caribbean Island Biodiversity Hotspot. *Bot. Rev.* **74**: 197–207.
- Oldfield, S. 1998. Important plant areas: the concept and the criteria for selection. In: Syngé, H. and Ackeroyd, J. (eds.) *Planta Europa. Proceeding of the Second European Conference on the Conservation of Wild Plants, Uppsala, Sweden*. Swedish Threatened Plants Unit and Plantlife.
- Roe, D., 2008. The origins and evolution of the conservation-poverty debate: a review of key literature, events and policy processes. *Oryx* **42**(4): 491–503.
- 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.
- Schippmann, U., Leaman, D. and Cunningham, A., 2006. Cultivation and wild collection of medicinal and aromatic plants under sustainability aspects. In: Bogers, R., Craker, L., and Lange, D. (eds.) *Medicinal and aromatic plants*. Springer, Dordrecht, the Netherlands.
- Secretariat of the Convention on Biological Diversity (2009) *The Convention on Biological Diversity Plant Conservation Report : A Review of Progress in Implementing the Global Strategy of Plant Conservation* (GSPC), 48 pp.
- Vie, J-C, Hilton-Taylor, C. and Stuart, S.N., (eds.) 2009. *Wildlife in a changing world. An analysis of the 2008 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland.
- Walpole, M. and Wilder, L. 2008. Disentangling the links between conservation and poverty reduction in practice. *Oryx* **42**(4): 539–547.
- Walter, K.S. and Gillett, H., (eds.) 1998. *The 1997 IUCN Red List of Threatened Plants. Compiled by the World Conservation Monitoring Centre*. IUCN, Gland, Switzerland and Cambridge, UK.
- Waylen, K., 2006. *Botanic gardens: using biodiversity to improve human well-being*. Botanic Gardens Conservation International, Richmond, UK.
- Wyse Jackson, P.S. and Sutherland, L.A., 2000. *International Agenda for Botanic Gardens in Conservation*. Botanic Gardens Conservation International, Richmond, UK.





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