

Saving Our Planet's Flora, the Contribution of the French National Natural History Museum to the Implementation of the Global Strategy for Plant Conservation

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Abstract: The National Natural History Museum plays a key role in the implementation of the GSPC through its botanical gardens, the Conservatoire Botanique National du Bassin Parisien, the Herbarium, and also by providing expertise on all areas of the Strategy (botany, conservation, ethnobotany, article 8j, sustainable use), etc. For 2 of the goals of GSPC (conserving plant diversity, Understanding and Documenting Plant Diversity), the Muséum has developed activities all over the world, including compilation of various flora and description of new species, as well as establishment of plant conservation schemes and habitat protection policies. It also conserves endangered species in the botanical garden.

Key words: Global Strategy for Plant Conservation; Conservation; Botanical expertise

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1 Introduction

Created in 1626 as “The King's Garden for medicinal plants” and taking its current name in 1793, the National Natural History Museum (the *Muséum*) has, over 350 years of existence, developed many facilities in the fields of natural and human sciences. With 1800 staff members (including 500 researchers in a wide variety of disciplines) it is today a major research and education institution (400 MSc and PhD students), a centre of expertise, a renown public museum with its galleries, botanical and zoological gardens and the Museum of Mankind, receiving over 2 million paying visitors per year.

With its 70 millions specimens or artifacts including 800 000 type specimens, it is one of the world's major databank on the Earth's natural and cultural diversity, helping to build sustainable nature management policies as well as a museum aiming at mobilizing the citizens on environmental issues through its outreach programmes.

Today the institution is supported by the Ministry of Higher Education and Research, the Ministry of Ecology, Sustainable Development, Transport and Housing. Its mission is “to discover, understand, highlight and help preserve the Earth's natural and cultural diversity”.

Contributing to the global strategy for plant conservation

The Global Plant Conservation Strategy (GSPC) was adopted by the Conference of Parties to the Convention on Biological Diversity in April 2002 with an ultimate and long term objective to halt the current and continuing decline in plant diversity. It included outcome-oriented global targets for 2010 which provided a framework for the scientific institutions. At the *Muséum*, the Strategy is implemented through its botanical gardens, the Conservatoire Botanique National du Bassin Parisien, the Herbarium and the different Departments by providing expertise on all

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areas including botany, plant conservation, ethnobotany, Article 8j, and the sustainable use of biodiversity. This contribution is done in partnership with other scientific institutions, French authorities, conservation organizations and foreign local communities in diversity-rich countries.

Out of the ten Departments of the *Muséum*, five of them are directly contributing to the sixteen targets of the GSPC.

- The Department of Botanical and Zoological Gardens
- The Department of Systematics and Evolution
- The Department of Mankind, Nature, Societies
- The Natural Heritage Service
- The Department of Ecology and Biodiversity Management

The Department of Botanical and Zoological Gardens (DJBZ) manages, in its five botanical gardens and four zoological parks, all the living collections of the *Muséum*. These collections are used for dissemination of knowledge, the conservation of rare and endangered species and are used in research programs.

The maintenance and development of the plant collections are based on the global strategies for the curation of living species. Recent achievements and current projects demonstrate a commitment to plant conservation and education with the display of rare and endangered floras (opening of a New Caledonian glasshouse, development of the Malagasy collections, and of the flora of arid zones, c), the ecosystemic presentations (forests of the *Ile de France* region) and the global fauna/flora projects (planning of Madagascar and Guyana ecosystems at the Paris Zoological Park). All these projects involve the *Muséum* researchers and are connected to programs of dissemination of scientific knowledge and aim at raising awareness of the importance of conserve plant diversity. For this, the DJBZ uses all types of mediation, the richness and the diversity of its botanical collections and the knowledge of its staff. Through its rich diversity, it manages this imposing heritage in a spirit of sustainability.

The Department of Systematics and Evolution

is concerned with the flora of the planet in several respects.

(1) Firstly, its members are in charge of the curation of the National Herbarium. This Herbarium, one of the largest in the world with more than 10 million specimens, represents a true historical record of plant diversity on the surface of our planet. It includes historical herbaria, such as those of Lamarck or Jussieu, which were among the first of such importance. It also includes herbaria resulting from the great explorations of the world which started in the 18th century. The complete digitization of the National Herbarium is in process.

(2) Secondly, the Department of Systematics and Evolution, in relation with the Herbarium, the *Conservatoire Botanique du Bassin Parisien* and the Department of Botanical and Zoological Gardens, conducts active research on biodiversity, and the systematics and evolution of plants, algae and fungi. These studies include explorations of areas where a large part of the diversity remains undescribed (Madagascar, New Caledonia, South-East Asia, China, ...), participation in large expeditions (Santo/Vanuatu, Mozambique, ...), research in taxonomy and systematics, as well as an investigation of the evolutionary forces that have led to today's diversity, thus allowing an understanding of the present situation and the development of possible scenarios for the future.

The Department Mankind, Nature, Societies

includes researchers in the human sciences (social and cultural anthropology, ethnobiology, human geography, ethnomusicology...) and the life sciences (biological anthropology, population genetics, primate ethology...). Research projects concern modern man and his relationship with his environment, in all ecosystems-tropical as well as temperate - including those in France. Research involving plants follows two lines: the uses of wild or cultivated plants; and classification systems and knowledge about plants in different societies.

Among the Department's research programs, several deserve mention: non-timber forest products in French Guyana, palm trees in Amazonia, wild yams in Madagascar and West Africa, and therapeutic plants consumed by chimpanzees in Uganda, among others. Regarding cultivated plants, our approach associates inventories of local agro-diversity with its management, and raising awareness of local products through the use of labels (coffees in Ethiopia, roiboos in South Africa, fruit varieties in France...), in relation with the protection of ecosystems.

The Natural Heritage Service (*Service du Patrimoine Naturel*) is a national structure and is supported by the Ministry of Ecology, Sustainable Development, Transport and Housing. It coordinates, within the *Muséum* and for the French government, the scientific inventories of the natural heritage by providing taxonomic referentials, referentials on habitat types and methodologies for the study of biodiversity.

It co-operates with all types of partners, in both the academic and the associative sectors (scientists, naturalists, managers of natural habitats). Within the national *Système d'Information sur la Nature et les Paysages* (SINP, Information facility on nature and landscapes) initiated by the Ministry of Ecology, Sustainable Development, Transport and Housing, it is responsible for the scientific administration of the coordination. This information facility aims at providing the public with information on biodiversity which is scientifically validated using the best available criteria.

In addition, the Natural Heritage Service provides its expertise to the different ministries and assists them in the implementation of EU directives, in particular those relating to the Natura 2000 sites network and to the conservation status of species and habitats (Directive 92/43). It also provides the scientific coordination of the French conservation programme on ZNIEFF (*Zones naturelles d'intérêt écologique, faunistique et floristique* - Natural Areas

of Animal and Plant Ecological Interest). In collaboration with the French IUCN National Committee, the Natural Heritage Service is responsible for updating the Red Lists of threatened species. Finally, the Natural Heritage Service develops and manages the National Inventory of Natural Heritage which aims at establishing a synthetic source of information on the natural heritage in France: distribution of fauna, flora and habitats in metropolitan France and overseas (<http://inpn.mnhn.fr/>).

The Department of Ecology and Biodiversity Management combines both the study of nature and its management. It contributes to its inventory, analyses its history within different scales of space and time, it studies its determinism and the mechanisms behind its functioning and its role in ecosystems. It puts forward scenarios of its evolution and implements management protocols.

The Conservatoire Botanique National du Bassin parisien (CBNBP), created in 1994 within the *Muséum*, fulfills four missions with the Paris Basin as territorial responsibility (Bourgogne, Champagne-Ardenne, Centre, Ile-de-France regions and Sarthe Departments):

It performs scientific studies and monitor the native flora and natural habitats of the Paris Basin

(1) identifying endangered native species and natural habitats in this geographical area and ensuring their conservation

(2) providing expertise to the French government and local authorities

(3) raising public awareness of the importance of plant biodiversity and its protection

Data on plant distribution in the Paris Basin (approximately 4.5 million entries) are computerized in the FLORA[®] database and are linked to the Global Biodiversity Information Facility (GBIF). The CBNBP is currently the sixth largest provider of data to GBIF.

In the Paris Basin, the CBNBP evaluates the conservative status of all species, establishes regional Red Lists of threatened species, diffuses know-

ledge to the public, and serves as the scientific adviser of the French government and local authorities. The CBNBP also conducts specialised research projects on subjects such as urban biodiversity and the role of ecological corridors in maintaining plant diversity. Plant conservation activities involve both *in situ* actions (population reinforcement, reintroductions and transplantation) and *ex situ* activities in the laboratory (including a seed bank) as well as in cultivation. The CBNBP's activities have an international dimension through scientific partnerships developed with foreign institutions. www.mnhn.fr/cbnbp

2 Achieving the targets of the GSPC

2.1 Understanding and Documenting Plant Diversity

2.1.1 A widely accessible working list of known plant species, as a step towards a complete world flora

The National Herbarium, founded in the 18th century, houses more than 10 million specimens, including more than 400 000 type specimens. It participates in the compilation of various floras (New Caledonia, Madagascar, Gabon, Cambodia, Laos, etc.), including the description of new species. It participates in the African Plants Initiative and Latin American Plants Initiative Projects and in the Millennium Seed Bank, contributes to periodical publications on plant systematics (Adansonia) and to international databases of plant species: GBIF (more than four million data entries), BGCI, SONNERAT (<http://www.mnhn.fr/base/sonnerat.html>) and BRYOMYCO (more than 700 000 entries in these two databases).

The CBNBP carries out an inventory of the Paris Basin flora and monitoring of the list of protected plant species and sets up national methodologies for the inventories of French natural heritage. It cooperates with the *Société française d'Orchidophilie* for the publication of a national atlas of orchids and participates in the creation of a website to access national inventories.

The inventory and computerization of the collec-

tions of the Muséum (National herbarium, seed banks, carpological collections, reference seed collections, living plants from the botanical gardens) and of the six regional herbaria as well as the reference documentation and archives of the Muséum botanical gardens are in process.

Finally, the Muséum is the French coordinator for the European network of excellence EDIT (<http://www.e-taxonomy.eu/>)

2.1.2 A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels

The Museum carries out several plant inventories at the national and regional levels. It contributes to the establishment and facilitation of regional contact networks and of contracts with public and private institutions for the surveillance of plant populations, to the monitoring of common vascular plants on the French (metropolitan) territory through the Vigie-Flora program and to the national coordination and evaluation of the conservative status for plants species included in the appendices of the European directive 92/43. It participates in the national and regional red data books on plants and to the follow-up program on the distribution of habitats and to the identification of priorities for the protection of habitats.

At the regional level, the CBNBP has initiated a detailed analysis of endangered plant species and of the threats to their populations and habitats and developed reliable rarity indices for the Parisian Basin flora, carried out bibliographic analysis of plant distribution. Local and regional plant watchdog groups are also contributing to the plant inventories for the Paris Basin region.

2.1.3 Development of models with protocols for plant conservation and sustainable use, based on research and practical experience

Three programmes contribute to this objective:

(1) The determination of harvesting and conservation protocols for wild plants (*in situ* and *ex situ*) and a follow-up of the operations for improving the methods to conserve the Paris Basin wild flora.

(2) A research program on the causes of the disappearance of plant species (Allee effect, inbreeding depression, etc.) and the implementation of on-site experiments to test the theoretical approaches for the region.

(3) A programme on the *in vivo* and *in vitro* multiplication of the botanical Fuchsias reference collection which was launched by the DJBZ in 2006.

3 Conserving plant diversity

3.1 At least 10% of each of the world's ecological regions effectively conserved

The Paris Basin region possesses rare habitats of European interest and the CBNBP establishes plant conservation schemes such as the conservation scheme of *Luronium natans* a threatened species in Europe, listed in the European Directive on the conservation of natural habitats and of wild fauna and flora.

It participates in other national conservation schemes (*Liparis loeselii*, companion plants to crops ...), to public open-space habitat conservation programs in the *Ile de France* region, is being consulted on sensitive local natural areas and establishes site habitat protection policies.

3.2 Protection of 50% of the most important areas for plant diversity assured

The Muséum participates in the National Park of French Guyana pilot program committee and in scientific committees and boards of National Parks, in the study of natural reserve and other protected areas projects.

It develops tools to prioritize ecological zones of high interest and takes part in the advisory committees of protected areas in the Bourgogne, Centre, Ile-de-France, Champagne-Ardenne regions and in the Sarthe *Département*.

The DJBZ presents in the Ecological garden and in the New Caledonian glasshouse, the natural habitats diversity to the general public and a reconstitution of Malagasy habitats is planned for the renovation project of the Paris Zoo.

3.3 At least 30% of production lands managed consistent with the conservation of plant diversity

The companion plants to crops species are particularly threatened with extinction in the grain plains of the Paris Basin and harvest of seeds and cultivation programs are undertaken by the CBNBP along with the recognition and management programs for the heritage ecosystems in agricultural lands (Mouillères of Gâtinais).

3.4 60% of the world's threatened species conserved *in situ*

The Muséum contributes to *in situ* plant conservation initiatives in Africa and South America and regionally to the development of partnerships with relevant public authorities as well as with the public and private land owners to implement on-site conservation schemes for threatened species.

3.5 60% of threatened plant species in accessible *ex situ* collections, preferably in the country of origin, and 10% of them included in recovery and restoration programmes

Two Muséum Departments (DJBZ and CBNBP) maintain *ex situ* living plant collections in cultivation or in seed banks. The four botanical gardens of the DJBZ conserve and propagate rare and threatened plants in particular Cycadales, orchids, succulent plants including aloes, cacti, Euphorbiaceae

The Chèvreloup Arboretum maintains 2 654 tree and shrubs taxa including, for the conifers, 266 species, 507 cultivars and 33 hybrids and, for the broad-leaved trees, 1 065 species, 671 cultivars and 135 hybrids. Among those, 110 species are red-listed by the IUCN. The other botanical gardens of the Muséum have a collection of 17 520 taxa of plants, including 411 taxa which are red-listed by the IUCN (<http://www.iucnredlist.org/>)

With its seed bank collections, the DJBZ has been, from 2004–2009, the French partner of ENSCONET (European Native Seed Conservation Network) a European programme coordinating native seed plant conservation within Europe (<http://www.ensconet.eu/>). The seed bank of the CBNBP con-

serves 7 million seeds of more than 450 species of protected heritage plant species of the Paris Basin.

3.6 70% of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained

The Department of Mankind, Nature, Societies establishes conservation programs of Ethiopian garden biodiversity through raising awareness of local products cultivated in these gardens (coffee, spices, seasoning...), studies the biological and morphological diversity of manioc in Amazonia and the impact of slash and burn cultivation in southern French Guyana and carries out research on traditional varieties of cultivated plants and fruit trees in rural areas of France.

The DJBZ encourages the conservation and promotion of useful tropical plants in its glasshouses and uses thematic collections of food plants to raise awareness on the importance of conserving the genetic diversity of useful plants. It takes part in the creation of a centre for the conservation of the regional plant genetic resources at Savigny le Temple.

3.7 Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems

The *Muséum* contributes to the establishment of lists of invasive alien plant species in France for regional environmental management committees and the CBNBP collaborates in the programs to fight against invasive species of *Ludwigia* and to the surveillance, monitoring and survey of invasive plants in the Paris Basin.

4 Using plant diversity sustainably

4.1 No species of wild flora endangered by international trade

The *Muséum* is the French Scientific authority for the Convention on International Trade in Endangered Species of wild flora and fauna (CITES, also known as the Washington Convention) and participates actively in the Convention's plant Committee.

It assists French customs in plant identification and reception of confiscated plant specimens from customs authorities. During specific exhibitions, the visitors are informed on the risks resulting from illegal plant trade, in particular in cacti, orchids and cycas.

4.2 30% of plant-based products derived from sources that are sustainably managed

The Department of Mankind, Nature, Societies develops a database on useful plants, participates to forest certification procedures and organises conferences on the sustainable utilisation of forest products in French Guyana and in the evaluation of the social and environmental impacts of labelled and eco-certified products (organic agriculture, fair trade...) in six southern countries.

The CBNBP provide its expertise to companies on sustainable plant exploitation for the production of medications and cosmetics, for example the sustainable utilisation of *Arnica montana*.

4.3 The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted

The Department of Mankind, Nature, Societies has set up an information centre on horticultural know-how: The House of Local Products used in Ethiopia.

In French Guyana, it implements the results of a research programme on non-timber forest products and associated knowledge and has created an association to promote and develop the utilisation of plants traditionally used (GADEPAM) and a cooperative for trade in natural and traditional goods taking into account economic, cultural and environmental aspects to promote sustainable and fair development.

5 Promoting education and awareness about plant diversity

5.1 The importance of plant diversity and the need for its conservation incorporated into communication, educational and public awareness programmes

Post-graduate training on plants, their taxono-

my, ecology, conservation, management, and industrial, artisanal and traditional utilization is one of the Institution statutory missions performed within the *Muséum* (MSc and PhD programmes) and is also in some other French and foreign universities.

Pedagogical activities for pupils (each year the *Muséum* welcomes 350 000 pupils) and training for primary and secondary school teachers are on permanent offer for the general public. Professional training for civil servants (state and local) and for the private sector is done on a yearly basis.

Permanent and temporary exhibitions are organised for the general public and for specific audiences together with workshops and conferences, installation of “biodiversity paths”, guided tours of the botanical gardens and of the arboretum, publication of brochures, leaflets and books are some of the means used to present the local, regional, national and global biodiversity to the general public and for targeted audiences and raise awareness on the importance of its preservation.

6 Building capacity for the conservation of plant diversity

6.1 The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy

Training in botany, plant conservation and horticulture and continuing education of botanical garden staff and teachers (each year the *Muséum* trains around 3 000 teachers) is being organised.

Supported by the Ministry of Foreign affairs, the *Sud Expert Plantes* Program (in cooperation with three other French institutions) develops scientific expertise and training in plant biology in Western and Central Africa, Indian Ocean and South-East

Asian countries.

6.2 Networks for plant conservation activities established or strengthened at national, regional and international levels

The different Departments of the *Muséum* participate in national, European and global networks of botanical gardens, conservatories and herbaria:

Jardins botaniques de France et des pays francophones (<http://www.bgci.org/jbf-fr/>)

Fédération des Conservatoires botaniques nationaux (<http://www.conservatoiresbotaniquesnationaux.com/>)

European Botanic Gardens Consortium (<http://www.bgci.org/global/2245/>)

Botanic Gardens Conservation International (<http://www.bgci.org/>)

National Network of Arboreta

Network of biodiversity observatories in the *Ile-de-France* Region

The International Agenda plaque acknowledges the commitment of the *Muséum's* botanical gardens to plant conservation.

7 Conclusions

The *Muséum*, through its botanical gardens, CBNBP, the herbarium and other departments clearly plays a major role in the implementation of the GSPC. Its activities contribute to the achievement of all 16 targets and support plant conservation both in France and in a number of countries around the world. The GSPC has provided a useful framework to bring together activities carried out by a number of different Departments of the *Muséum* around a common theme—plant conservation.

For more information on the *Muséum* activities, visit our website: www.mnhn.fr