

A window on the unique and fragile New Caledonian flora and habitats

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Abstract

On the occasion of the complete refurbishing of the National Natural History Museum (MNHN) facilities for the tropical plant collections, a New Caledonian glasshouse (Serre de Nouvelle-Calédonie) has been created. The implication of the past and current MNHN research teams in the study of the Flora of New Caledonia and the strong collaboration between the MNHN and New Caledonian Institutions have guided the choice of this new thematic. The new glasshouse is a showcase to present the unique and fragile New Caledonian flora and habitats through five distinctive ecosystems: the rainforest, the dry forest, the mine maquis, the savannah and the mangrove. It has become a public information platform on the conservation and research activities and programmes of the Museum and collaborating institutions, particularly the programme for the conservation of dry forests. An original scenography completes the plant and landscape presentations.

Keywords

Biodiversity, Conservation, Endemicity, Glasshouses, Handicapped public, New Caledonia, Renovation, Scenography.

Presenting the flora and habitats of New Caledonia

On the occasion of the complete refurbishing of the National Natural History Museum (MNHN) facilities for the tropical plant collections, a New Caledonian glasshouse (Serre de Nouvelle-Calédonie) has been created. The implication of the past and current MNHN research teams in the study of the Flora of New Caledonia and the strong collaboration between MNHN and New Caledonian Institutions and Conservation programmes (IRD, IAC, Maison de la Nouvelle-Calédonie and Programme de Conservation des Forêts Sèches de Nouvelle-Calédonie) have guided the choice of this new thematic.

A necessary renovation and opportunity for defining new targets

The New Caledonian collections are housed in one of the two superb metal and glass pavilions designed by Charles Rohault de Fleury, and built from 1834-1836. They are sited in the heart of the Jardin des Plantes in Paris.

The renovation project was not only the occasion to improve the security and the access of the Great Glasshouses of the Jardin des Plantes (Joly *et al.*, 2010) but it created the opportunity to redefine the conception and the thematics. Before the renovation, the New Caledonian glasshouse was the home of Mexican plants and xerophytes from arid land. In the contiguous glasshouse, a large art-deco building erected in 1936-1937, the presentation of various tropical plants has been enriched and is now dedicated to the vegetation of the Tropical Rainforest.

Furthermore, two other glasshouses have been opened to the public. In the second Rohault de Fleury's pavilion, the former collection of Australian, New Zealand and South

African plants has been replaced by plants from very ancient families and fossil casts of extinct groups and is now devoted to the history of plants. The long gallery which was used for multiplication, care and storage has become the glasshouse of desert and arid land plants.

New Caledonia, an archipelago with an exceptional endemism

Discovered by James Cook in 1774 and situated in Oceania, New Caledonia is composed of the islands of Grande Terre, Ouvéa, Lifou, Tiga and Maré, the Archipelago of Belep, Ile des Pins and a few remote islands. Attached to France in 1853 and part of the French overseas territories, the statute of New Caledonia was redefined in 1999 on the basis of the Noumea Agreement (1998) which increases its autonomy.

With exceptional endemic flora and fauna species and natural habitats (Violette, 2009; Joannot, 2008; Jaffré *et al.*, 2001; Jaffré & Veillon, 1994), it is the smallest of the hotspots of biodiversity in the world. The lagoons received a UNESCO recognition as an *exceptional heritage* on 7th July 2008 under the name “Lagoons of New Caledonia: reef diversity and associated Ecosystems” for their exceptional natural beauty and diversity of coral and fish species, a continuum of habitats from mangroves to sea grasses.

With an area of 18,575 km², New Caledonia (NC) is the home of 2,430 endemic species (76% of the flora), five endemic families: Amborellaceae, Oncothecaceae, Paracryphiaceae, Phelliniaceae, Strasburgeriaceae, and 108 endemic genera among which are *Arthroclianthus*, *Austrotaxus*, *Beauprea*, *Codia*, *Pancheria*, *Strasburgeria*, etc. It claims the world's only parasitic conifer (*Parasitaxus ustus*) and nearly two-thirds of the world's species of Araucaria trees, all of which are endemic.

The threats to this unique flora are numerous: fires, land development exploitation such as intensive nickel mining, forest destruction and the spread of invasive plant and animal species to count but a few.

Five contrasted ecosystems

The new glasshouse is a showcase to present the unique and fragile New Caledonian flora and habitats through five distinctive ecosystems: the rainforest, the dry forest, the mine maquis, the savannah and the mangrove. Characteristic species, mostly endemic, come from the MNHN plant collections, have been shipped by air from the archipelago, or have been provided by the Royal Botanic Gardens Edinburgh and Kew and the Paris Auteuil greenhouses. The plants have been installed in the five different habitats and are now growing well. In addition, this glasshouse has become a public information platform on the New Caledonian conservation and research activities and programmes of the Museum and collaborating institutions, particularly the “Programme de Conservation des Forêts Sèches” (PCFS). An original scenography completes the plant and landscape presentations.

1. The humid forest

The humid forest is a paradise for botanists, counting around 2,000 plant species, with 82% endemics. It covers an area of 4,000 km² (21% of the archipelago) and receives 1,500mm annual rainfall. Conifers, palms, tree ferns and orchids are characteristic elements of the flora, most of them endemics, along with many trees and shrubs, herbs, mosses, lichens, epiphytes and parasites. The humus and root system holds the soil

(acid, *ultramafic* or limy), an essential role against erosion.

Iconic species include the shrubby *Amborella trichopoda* (Amborellaceae), already present for 140 million years, and thought to be the most ancient flowering plant on the planet. The Kagu bird, the emblem of the country, whose song is a sort of high pitched bark, is a vulnerable species as it doesn't fly and it is the only surviving bird in its family.

Araucaria, Agathis and some other conifers and tree species come from the MNHN collections and from other botanic gardens. Most other species have been introduced from New Caledonian nurseries: palms (*Alloschmidia glabrata*, *Cyphophoenix elegans*, *Kentiopsis* spp...), tree ferns (*Cyathea intermedia*), trees and shrubs from several families: Araliaceae, Cunoniaceae, Hernandiaceae, Myrtaceae, Pittosporaceae, Rubiaceae...

2. The dry forest

The 'sclerophyllous' or dry forest receives less than 1,100mm annual rainfall and comprises more than 450 plant species, with no palms, no conifers, few orchids but a wealth of remarkable plants with rare, ornamental and medicinal species. 57% are New Caledonian endemics and 13% are dry forest endemics. A rich but understudied fauna with insects, birds, reptiles and gastropods (*bulimes*), with numerous endemic species also live in this unique formation.

The dry forest is one of the most threatened ecosystems on the planet (Gillespie & Jaffré, 2003), only remaining in a surface area of 50 km² (1% of its original size!). Today it is very much reduced and fragmented due to human activities (fires, firewood) and the establishment of introduced species (invasives).

An ambitious conservation Programme of Dry Forests (Programme de Conservation des Forêts Sèches de Nouvelle-Calédonie, PCFS; Gunther/IAC, 2004) was implemented in 2002 to inventory, preserve, restore, enhance and manage sustainably the remnants of dry forests now considered as ecological, patrimonial and economical treasures.

Some characteristic species are planted in the glasshouse, such as: *Pittosporum tianianum*, a very rare species that has been saved from extinction, and many other *Pittosporum* species (*P. brevispinum*, *P. cherrieri*, *P. coccineum*...), *Terminalia cherrieri*, one of the dry forest's tallest tree, *Turbina inopinata*, a vine with pink trumpet flowers, *Ixora (Captaincookia) margaretae*, a rare and small monocalcous and cauliflorous treelet with abundant pink flowers, and also other botanic treasures such as *Arthroclianthus* sp., *Oxera pulchella*, *Oxera sulfurea*, *Jasminum* spp. and the New Caledonian endemic rice, *Oryza neocaledonica*.

3. The mine maquis

It spreads over 4,500 km² (24% of the archipelago) and receives 800 to 4,000mm annual rainfall. The mine maquis hosts 1,200 plant species with an exceptional endemism rate of 90%!

It is made of slow growing, shrubby, and herbaceous species. This is a result of the repeated fires and the slow destruction of the humid forest. This vegetation grows on *ultramafic* soils, rich in nickel, chrome, iron, and cobalt forming a unique vegetation, essential against erosion.

The soil shows low levels of water, azote and phosphore and high concentrations of minerals toxic to plants. Remarkable adaptations and even nickel accumulation are observed in some maquis species like the beautiful tree *Geissois pruinosa* (Cunoniaceae). The rehabilitation of sites destroyed by mine exploitation uses such species, which also help to detoxify the soils.

The mine maquis is home of unique conifers like *Retrophyllum minor*, the 'bois bouchon' a species with a very light wood, *Neocallitropsis pancheri*, *Araucaria muelleri* and the very rare *Dacrydium guillauminii*. Some other very characteristic families are represented in the glasshouse including the Myrtaceae (*Xanthostemon laurinus*, *Sannantha leratii...*), the Proteaceae (*Stenocarpus milnei*, *Beauprea spathulaefolia...*) and the Cunoniaceae (*Geissois pruinosa*).

4. The savannah

The savannah spreads over an area of 6,000 km² on the North and West coast of Grande Terre (31% of the archipelago) and includes 130 plant species representing 6% of endemic species. It receives about 1,000mm annual rainfall. It is a secondary formation resulting from the degradation of the humid and dry forests, after fires. The 'niaoulis' *Melaleuca quinquenervia* (Myrtaceae) are emblematic trees of the savannah while invasive plants like *Lantana camara*, *Psidium guajava*, *Leucaena leucocephala* and the 'gaiac' *Acacia spirorbis* are locally well developed. Some orchids are found like *Spathoglottis vieillardii* (*S. plicata*).

The wild pigs, rats and goats are also threatening the equilibrium of the natural environments and local biodiversity, as well as the electric ant *Wasmannia auropunctata*. The deer *Cervus timorensis russa*, introduced in 1870 is a pest for forests and cultivated ground. It is now part of a monitoring programme.

5. The mangrove

The mangrove covers 200 km² (1% of the archipelago) and receives 1,000mm of rain per year. It is formed of very few (about 20) tree or treelet species which form large populations. This ecosystem constitutes a wealth of biodiversity where birds, fishes (260 species inventoried) and crustaceans abound. It is highly threatened by urbanization and mining pollution. Some species are used by the local populations, such as the bark of *Bruguiera*, rich in tannins, which is used to paint the hairs of the great bats used in the local ceremonies.

Sonneratia alba, *Bruguiera gymnorhiza*, *Avicennia marina*, *Rhizophora apiculata* and some other characteristic species are shown to the public, despite difficulties in maintaining the necessary environmental conditions for their cultivation.

A link with the MNHN studies and conservation projects

For more than 150 years the MNHN botanists have highly contributed to the knowledge of the New Caledonian flora and habitats, enriching at the same time the Paris Herbarium and publishing the 'Flore de la Nouvelle-Calédonie' and many other articles. MNHN is pursuing taxonomic studies on the archipelago's flora (e.g. in the Fabaceae genus *Arthroclianthus*) and on the biodiversity of fish and corals. The new glasshouse has created an opportunity for the MNHN researchers to participate in the pedagogical

project and present their research to the public.

It has also strengthened a collaboration with people engaged in conservation actions on the New Caledonian flora and endangered habitats like the 'International Conifer inventory and conservation programme , ICCP' initiated by the Royal Botanic Gardens Edinburgh, the 'Programme de Conservation des Forêts Sèches de Nouvelle-Calédonie' and other local initiatives such as mangrove preservation.

Scenography and educational targets

Presenting the New Caledonian Flora to the public on a small scale was a real challenge, the landscaping and the selection of species should provide a good evocation of the New Caledonian habitats. Additionally, the scenography highlights specific aspects of the local environment of each relevant habitat:

- the humid forest: with a focus on endemism,
- the dry forest: on plant richness and extreme threats
- the mine maquis: on exploitation (mines), soil degradation, endemism and exceptional plant adaptations
- the savannah: on biological invasions, transitions and degradation of habitats
- and the mangrove: on the importance of the fauna and environmental threats

A steel *vine*, integrated in the presentations, is the conducting thread that supports the information. It is completed by high definition large screens that display a selection of photos of New Caledonian plants. An innovative technology simulating plant growth on small screens applied to three New Caledonian plants has also been developed in collaboration with a French scientific team specialised in plant architecture.

The glasshouse scenography and plant presentation have also given us a unique opportunity to demonstrate the very strong links existing between the New Caledonian population (especially the Kanaks) and nature. Other aspects of their very rich culture are represented with totems, Kanak designs and architectural features. These presentations have been made possible through the expertise and financial support of the 'Maison de la Nouvelle-Calédonie' in Paris and the Political Authorities of New Caledonia.

Conclusion

2010, the International Year of Biodiversity, has been the perfect timing for reopening the glasshouses of the Jardin des Plantes of Paris and redefining the thematic. These significant developments better serve all our public including the handicapped, and embrace new ways of communication to emphasize the new commitments of the Institution towards the preservation of biodiversity. The New Caledonian glasshouse, in particular, is emblematic since it concentrates all these different aspects in one volume and attempts to sensitize the public to the exceptional biological richness and the crucial environmental problems affecting this unique territory. In this project, the research and conservation initiatives have not been forgotten.

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