The long history of the glasshouses in the Hortus botanicus Leiden

The first unheated glasshouse was probably constructed around 1800, because an increasing number of plants from far-off lands were arriving in Leiden which could not cope with our climate. The bird's eye view map drawn by Cruquius (1719) shows small 'glasshouses' next to the wall; the first of these was heated with bark and peat. Several smaller glasshouses were constructed in the gardens from 1777 onwards; the most striking of these was the cast-iron Victoria Glasshouse, dating from 1870. Until 1930 these glasshouses were all heated with coal fires: the Hortus botanicus employed firemen who kept the fires burning, day and night. The important collections at this time were tropical orchids and ferns, for which special glasshouses were built. There were also glasshouses specifically for palms, cacti and bromelias.

Construction of the current glasshouse complex, with its different glasshouses and climate zones, has been started in 1937, under the guidance of the prefect Baas Becking and the curator Veendorp. These glasshouses were heated by coal fires. There were a fire place and a coal bunker underneath the glasshouses; coal was delivered by boat via the Witte Singel canal. During the Second World War all the tropical plants were put together in one glasshouse, which continued to be heated; this shows just how highly the tropical plants were valued.

In 1965 coal fires were replaced by oil-powered heating. A large oil tank was dug into the ground near the Ginkgo tree. Up to 200,000 litres of oil was used during cold winters. The last large-scale renovation of the glasshouses took place in 1983; the roofs of the glasshouses were replaced by double layers of plastic, the oil-fired heating was replaced by gas, and all pipes and ducts were moved above the ground. Unfortunately there was no budget available for double-glazing at that time.

Renovation of the current glasshouse complex began in April 2012.

Renovation 2012-2013

The property management department of Leiden University instructed the architectural firm Architektenburo Veldman / Rietbroek / Smit to carry out an investigation into the architectural history of the complex; the aim was to gain insight into the characteristics and historical sections of the complex. The glasshouses are listed buildings ('gemeentelijk monument' GM 1235).

Historical value
The investigation showed that the central glasshouse complex dating from 1938, in particular the Victoria Glasshouse (including the façade, structure, and elements of the interior such as the tiled floor and slate staircases) have great historical value. The façade and structure of the other glasshouses are also noted as having 'positive historical value'. The process of renovation revealed the different historical layers and many fine details have been brought to light once more.

Glass panes
The width of the panes of glass in the façade and the roof has been made as uniform as possible, which gives a more pleasing and more regular appearance; the glasshouse is now more of an entity and looks more like the original building.

Preservation of original details
The concrete floor has been removed, revealing the original red tiles. The brick walls have also been removed, to show the glazed tiles and the original door and window frames in all their glory.

Draft-excluding porch
The exit from glasshouses 1 and 2 have been provided with a draft-excluding porch, as in the past.

Frame of the Victoria Glasshouse
The Victoria Glasshouse is regarded as the heart of the complex. This glasshouse has a tent roof, with a

smaller raised tent roof in the centre; the height at the ridge is 14 metres (45 feet). The appearance of the Victoria Glasshouse is determined to a great extent by the façade and the roof. The metal structure of the glasshouses, including the Victoria Glasshouse, was completely dismantled, removed, and spray-cleaned, as were the domes of the Leiden Observatory. The metal was then zinc-coated and finished off with double-component varnish.

Exit from the Victoria Glasshouse
One of the later additions to the complex was the orchid glasshouse next to the Victoria Glasshouse, which meant that the original exit from the Victoria Glasshouse had completely vanished from sight. As a result of a few small adjustments it is now possible to see how the original exit used to look.

Glasshouses raised in height
Glasshouses 1 and 2, through which the visitor first walks, have been raised to the same height, which gives the plant collection more space. A canopy walk has been constructed from which the visitor can look down on the tropical forest from above. A 4.5 metre (14 foot) wide classroom balcony has been created, which will serve as a starting point for groups of children, students and adults to take guided tours of the tropical glasshouses.

New elements

Visitors will notice the most changes in the non-historical glasshouses 1, 2 and 3 (the 'Hoge Kas' or 'Tall Glasshouse'). They have been combined and raised in height, and a classroom balcony has been created. Another new element is the canopy walk, from which visitors can admire the tropical forest from above.

The freestanding aquaria that used to stand in the glasshouse have now been embedded in the rear wall of the Tall Glasshouse ('Hoge Kas').

More energy efficient

The plant collection in the tropical glasshouses of the Hortus botanicus Leiden flourishes at high temperatures: 23 degrees centigrade (74 F) during the day and 18 degrees centigrade (65 F) at night is the most suitable temperature for most of them. During the renovation we have looked for sustainable solutions whenever possible. It impossible to operate at a completely CO2-neutral level in historical structures such as these glasshouses, but the CO2 footprint can be greatly reduced by applying some innovative measures, which will pay for themselves within a few years.

The following solutions have been applied:
- high efficiency insulation glass that allows less heat to escape
- energy screens on the inside of the windows to keep the heat in
- a computer-regulated system to open and close the windows; this used to be done by hand
- high frequency lighting: this type of lighting gives more light and uses less electricity
- extra insulation
- a small-scale energy power plant
- plates under the workbenches that store warmth during the day and radiate it back at night
- the radiators have been replaced and improved
- water from the surrounding canals is used for plant irrigation

The public can now look into the engine room and visitors are able to read information on the notice board telling them about the Hortus' energy-conscious approach.

Tropical plant collection – international scientific collections

Since the foundation of the Hortus continuous research has been carried out into various plant groups. The most important research collections are orchids, cycads, ferns, Hoya, Dischidia and pitcher plants (Nepenthes). More than 6,000 orchids are cultivated and cared for in our tropical glasshouses. Central to the collection are the East Asian orchids, which are collected by our own scientists in the high- and lowlands of New Guinea, amongst other places. These East Asian orchids form the heart of our orchid collection, with more than 3,000 individual plants; the collection is the only one of its type in the whole world. A large-scale molecular research is currently being conducted into the relationships (the family tree) within this family.

Tropical orchids from South-East Asia form a core collection in the Hortus botanicus Leiden, thanks partly to the contributions of staff from the Naturalis Biodiversity Center to the 'Flora Malesiana' project, in which the flora of the Malesian region are being described scientifically.
We also spotlight our collection of Cycas palms. This is a 'primitive' plant group, which grows slowly; the survival of many of the species is seriously threatened. Some of the large examples sheltered here are probably more than 300 years old, and are among the oldest living pot-plants in the world. We are trying to learn more about the relationships between the different species in this group by using molecular investigation methods. This research is being conducted in cooperation with the New York Botanical Garden (USA) and the Nong
Nooch Tropical Botanical Garden (Pattaya, Thailand).

Threatened species
Few people are aware of the huge danger posed to many plant species at the current time. When you say 'threatened species' most people think of animals, such as the giant panda, the tiger and the rhinoceros. Our botanical garden has succeeded in cultivating many threatened species and displaying these to the public. In contrast to the animals in the zoo, the public can get up close to these threatened plant species and even touch them: a very special experience for many people.

Tropical plant collection – Crowd pullers

Victoria amazonica
The famous Victoria amazonica is king of the water lilies. The flower opens at dusk. This plant has been seen in flower in the Hortus botanicus Leiden at regular intervals since 1872; the first flower attracted 30,000 visitors. We have been cultivating this species in our own glasshouse since 1938. Visitors have always been fascinated by this giant water lily. On special evenings young parents queue up to have their babies photographed lying on the giant leaf.

Amorphophallus
The Amorphophallus gigas, a huge Arum Lily from Indonesia, was introduced to the Hortus in 1863. Since 1956 the Hortus has regularly succeeded in bringing theAmorphophallus titanum, a closely related and equally impressive endemic threatened species from Sumatra, into flower and fruit, so that the seeds can be distributed to other botanical gardens.

Nepenthes
We also cultivate the carnivorous genus Nepenthes; almost all of the species come from Borneo. The Ark of Life Nepenthes project has been in our collection since 2010; within this project we care for and propagate four species that are under serious threat of extinction, with the aim of building up a supply of plants to extend and supplement the natural population. We are cooperating closely with the Carnivorous Plant Society and the Ark of Life Foundation on this project.