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The Difficult View

PALM-HOUSE Prototypes for the Orto Botanico

The Botanic Gardens of Padua, Italy (Orto Botanico di Padova) were founded by the University of Padua in 1545 for medicinal plant research. Located along the city's Santa Chiara canal south of the Basilica of Sant'Antonio, the herbarium takes the form of a circle divided into four quadrants each containing a carefully curated arrangement of specimens (Fig. 1). The herbs and plants in the garden, imported from all over the world, were used to train medical students to identify specific species for medical and therapeutic remedies—a difficult practice in which mistakes could lead to incorrect dosages or ingredients. Also critical, the specimens in the garden served as the herbarium's plant stock for the Venetian Republic's emerging pharmaceutical trade.[1] Because of the rarity of the specimens housed inside, the Orto Botanico was fortified against theft with a circular stone wall, demonstrating how valuable both the botanical specimens and associated medical knowledge was at the time.

Such ideal Renaissance botanical gardens performed two functions: rationalizing the natural world into an organized and carefully sorted collection and producing an exclusive space of biomedical knowledge production (Fig. 2). The organization of the plant species within the

1. Vittorio Dal Piaz and Maurizio Rippa Bonati, "The Design and Form of the Padua *Horto Medicinale*," *The Botanical Garden of Padua 1545-1995* (Venice: Marsilio Editori, 1995), 44.

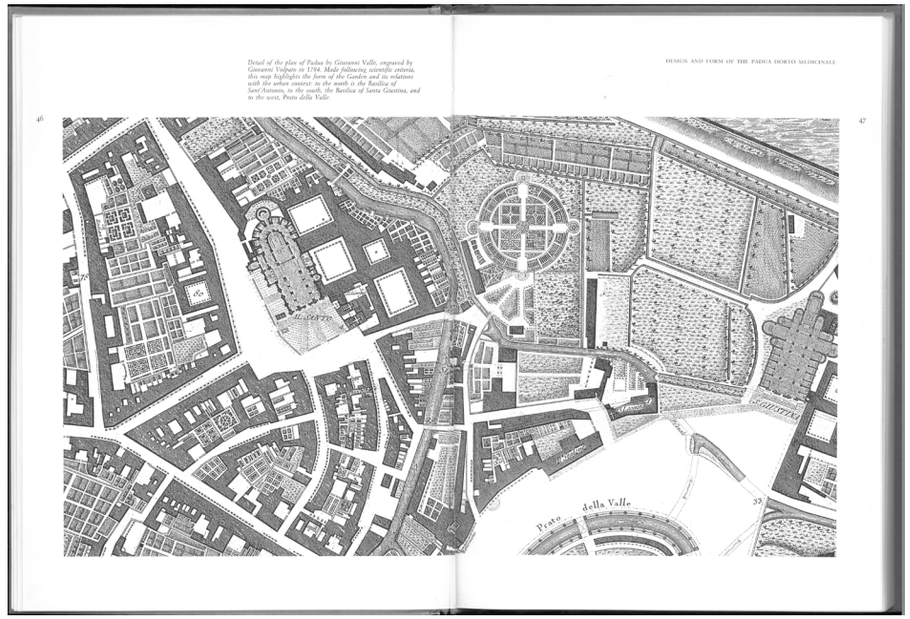

Figure 1. Plan of Padua by Giovanni Valle, engraved by Giovanni Volpato, 1784.

2. Ibid., 54.

3. Andrea Ubrizsy Savoia, "The Botanical Garden of Padua in Guilandino's Day," *The Botanical Garden of Padua 1545-1995* (Venice: Marsilio Editori, 1995), 173.

walled space reflects the development of pharmaceutical technology in the 16th century. The geometrical layout of the plant specimens in the herbarium represented the classification systems and taxonomic structures of botanical medicine.[2] Historians argue that the four quadrants of this ideal Renaissance garden reflected either "the four Aristoleian elements (earth, fire, water and air)" or else "the four curative properties Galen [the Ancient Greek physician] identified in plants (dry, humid, hot and cold), but it may also have been motivated by distinct climatic situations."[3] However, the geometry and organization of this *Hortus sphaericus* were not only tied to the pedagogical and functional apparatuses of medical training. The classification of the species was also a direct representation of the power of scientific knowledge: knowledge that was protected, coveted, and proprietary.

In the northeast quadrant of the Orto Botanico, along the garden wall, survives the oldest of the garden's specimens: a 450 year old Mediterranean Palm, or *Chamaerops humilis*, a species indigenous to southern Europe (Fig. 3). This palm was included in the garden's collection owing

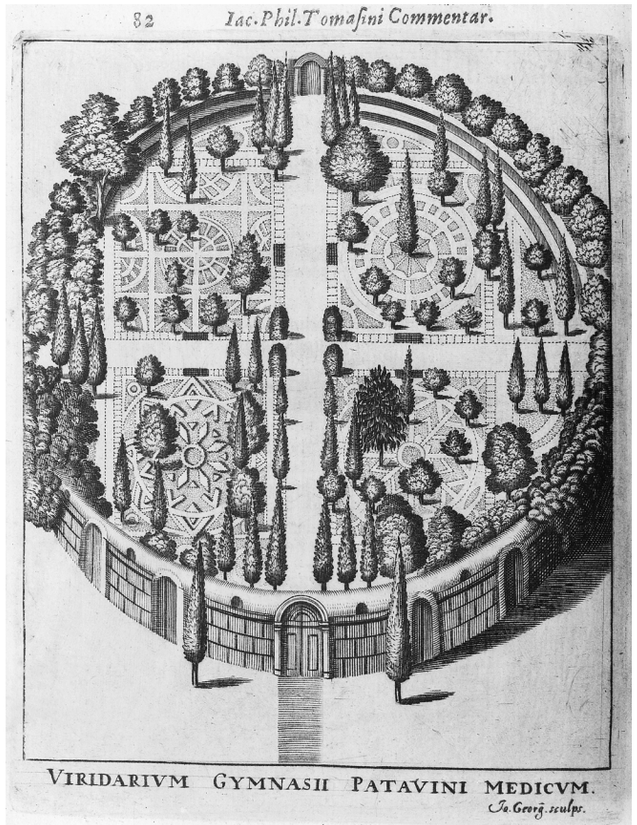

Figure 2. Drawing of Orto Botanico, in *Gymnasium patavinum* by Jacopo Filippo Tomasini, 1654.

to a variety of traditional medicinal uses. However, this particular specimen became known more famously as *Goethe's Palm*, serving as a primary inspiration and subject for Johann Wolfgang von Goethe's theory on botanical morphology enumerated in his essay *The Metamorphosis of Plants* from 1790. In this text, Goethe outlines a theory describing the relationship between a plant's environmental conditions and its patterns of growth and development. The theory argues that within each plant, there exists an *urform*, or original archetypal model, that drives the plant's structure and form. According to Goethe, this internal morphological impulse is in constant tension with the environmental conditions of the plant itself. As Gordon L. Miller argues, "Goethe's emphasis on the

Figure 3. La Palma di Goethe, Orto Botanico di Padova, 1928.

interdependence of organism and environment, as well as organism and organism... presents a view that can surely be described as ecological, seventy-five years before German biologist Ernst Haeckel coined the term."[4] Beyond the strictly formal mechanics of Linnaean classification, Goethe expanded theories of plant morphology to include a plant's climatic conditions from the atmospheric compositions to soil nutrients and availability of water.

To protect this scientifically and culturally valuable specimen over the centuries, university gardeners constructed a series of temporary and permanent palm houses to both shelter and display the palm. Early etchings reveal elaborate structures that were built around the palm each winter and then removed in late spring. The earliest

4. Gordon L. Miller, introduction to *The Metamorphosis of Plants* (Cambridge: MIT Press, 2009), xxi-xxii.

photographic evidence of a palm house structure is an ornate wood and glass shelter designed and built in the 1870s, which was later replaced by an operable concrete, steel, and glass greenhouse in the 1930s after a cold wave of 1929 almost killed the palm. The current structure was a renovation in the early 2000s that transformed the palm house into an operable enclosure featuring radiant heating as well as large panes of plate glass that open and close depending on temperature. This evolution from a mostly open-air structure to an environmentally contingent enclosure can serve as an architectural index of the emerging technics of environmental control and display. If architecture is a frame for beholding, each stage of the palm house reveals the changing relationship between a living ecosystem and the technical-environmental contexts required for both its care and viewing.

While early greenhouses were often temporary structures built to protect non-native species vulnerable to extremes in temperature and weather, industrial forms of horticultural production radically transformed greenhouse architecture and its technologies. The transformation of these seasonal shelters into large-scale infrastructures emerged from the reciprocal development of building technologies such as iron and glass, mobilized by an emerging network of colonial extraction and emerging markets, most notably the Palm House at the Royal Botanic Gardens at Kew. These greenhouse innovations produced new architectural types and systems that subjected imported plant specimens to a colonial gaze. In gardens such as Kew, beholding the specimens housed in these vitrines became a way to recognize the reach and power of colonial networks of extraction.

From empire to industrial-scale cultivation, current generations of greenhouse landscapes have taken the form of immense distribution centers for living material. In horticultural areas such as the Westland region in the Netherlands, the hectares of artificially illuminated fields are eerie ecosystems, continuously monitored and remotely measured by automated drones and biometric sensors. The incorporation of data and surveillance technologies provide these logistical enclaves with full

biological, climatic, and digital control, analyzing growth patterns and precisely calibrating lighting, temperature, and humidity. The scale of these spaces reflects how our habits of consumption have profoundly redirected the planetary flows of resources and capital that they rely on.

These case studies prompt us to ask: how can architecture complicate the traditional role of nature as an object of consumption and contemplation? Horticultural architecture instead could be reframed through an aesthetic that relates its technical systems to its environmental conditions, transforming the distanced condition of consumption into a renewed and immersive awareness of ecological cohabitation. Paying attention to the material histories of these greenhouse enclosures, the following project remobilizes the constructed environment of the palm house to challenge the way we consume and mediate nature.

PALM-HOUSE is a project that examines the relationship between a plant, the people who care for it, and the architecture that houses it (Fig. 4). From extraction to cultivation to protection, this project examines architecture's often fraught relationship with the landscapes it organizes and mediates. Continuing the four centuries of cultivation that began in 1585 with the planting of Goethe's Palm, PALM-HOUSE proposes three possible prototypes to house this specimen, expanding the political postures and creaturely alliances of the caretaker, viewer, and palm. While greenhouse architectures (such as the Palm House at Kew or the Westland Greenhouses in the Netherlands) often represent a problematic conflation of colonial extraction and ecological optimization, can an alternative deployment of the tectonic and climatic systems used for horticultural care instead be used to promote a renewed awareness of planetary ecology? Operating as a proxy for new modes of mediation between architecture and its environments, these three palm houses propose a new ecosystem of care and curation, implicating the viewer, the specimen, and the maintenance worker in the daily life of the palm. Rather than seeking to optimize the growth of the palm, these prototypes make visible the

Figure 4. Forest view of PALM-HOUSE by HOME-OFFICE, 2020.

fragility of indigenous ecologies, producing an architecture of maintenance, conservation, and support.

Palm House #01 is a circular structure that suspends a series of fabric air ducts around the palm, surrounding it completely (Fig. 5). Each duct is connected by hose to an air and vapor compressor that is controlled by an air schedule. By adjusting this air schedule, botanical technicians are able to create new atmospheric compositions, expelling clouds of gas and vapor to envelop the palm when external conditions are far from ideal. Calibrating the palm's immediate atmosphere to counter dangerous particulate clouds, molecular swarms, and synthetic ozones, care workers can curate a more chemically-compatible environment for the palm. The architecture also allows the palm to retreat from the touristic gaze, visible only when the ducts are deflated and the atmosphere is safe. The structure breathes—inhaling, inflating, exhaling, and sighing—becoming an extension of the plant's living and sensing ecology.

Palm House #02 similarly responds to the increasing concentration of environmental pollutants that threaten

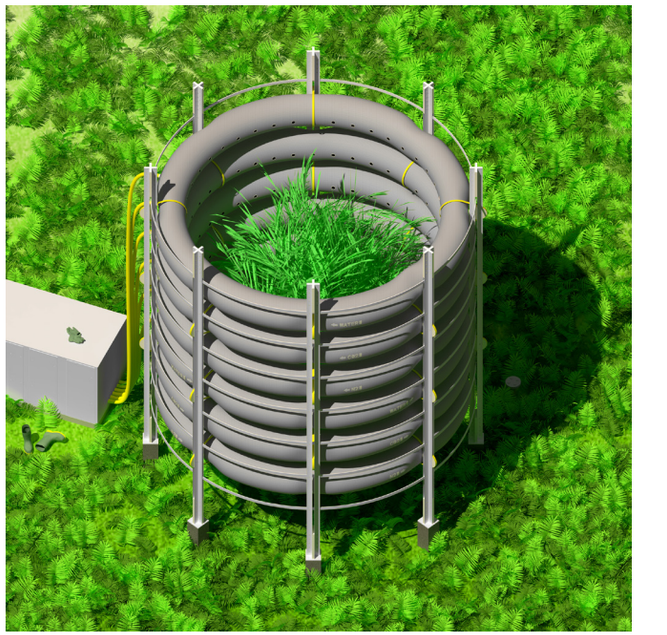

Figure 5. Render of PALM-HOUSE 01 Prototype by HOME-OFFICE, 2020.

to overwhelm the palm's osmotic defense systems (Fig. 6). Composed of an infrastructure of filtration panels, the wall assemblies can open and close with a motorized gear system, limiting the infiltration or increasing the ventilation of airborne particulates. The shingled and breathable envelope is maintained by workers who carefully monitor current atmospheric systems, replacing spent filter units in the structure or operating the facade to open and close in order to influence pollination protocols and particulate counts. When fully open, the palm is clearly visible, and when closed it is abstracted through the mesh filters, once again deferring the possibility of unmediated contemplation during moments of ecological precarity.

Palm House #03 allows botanical technicians to calibrate the palm's balance of heat and light, protecting it from extreme temperatures and lighting conditions as the climate radically shifts (Fig. 7). The structure is designed as an open armature that uses solar greenhouse curtains to regulate the palm's exposure to light while also providing a thermal barrier. A secondary structure of moveable

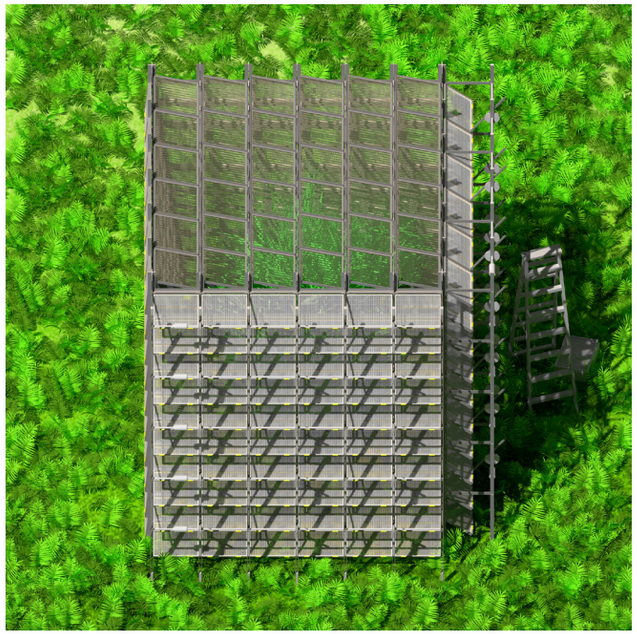

Figure 6. Render of PALM-HOUSE 02 Prototype by HOME-OFFICE, 2020.

wall modules installed with panels of grow lights and heat lamps can be repositioned to provide the palm with extra heat and light as needed. By calibrating heat gain and solar exposure as the climate radically shifts, care workers can adjust and design the spectral output for the palm, protecting the plant from extreme temperature fluctuations while also preventing the harmful absorption of excess solar radiation. In the eerie glow of the lights, the shimmering veil of the solar blanket, and the caution stickers lining the public ladder, an aesthetic of ecological crisis creates a new lens through which to behold the palm, foregrounding the specimen's increasing need for mediation and protection.

By adjusting these assemblages to curate atmospheric compositions, filter dangerous pollutants, and shield the palm from extreme temperature fluctuations, botanical technicians can continuously calibrate the enclosures to mitigate deteriorating environmental conditions. Performing as socio-ecological and socio-technical objects, the three palm houses seek to recenter the palm in an

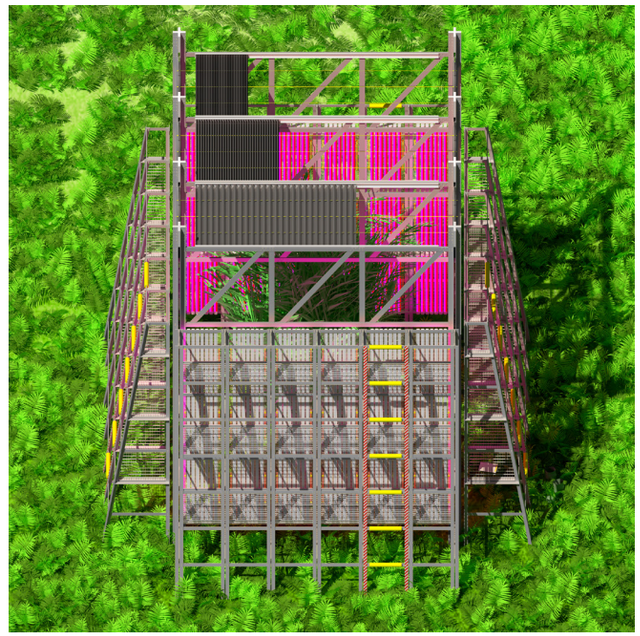

Figure 7. Render of PALM-HOUSE 03 Prototype by HOME-OFFICE, 2020.

infrastructure of care, reimagining the architectures of climatic control in order to produce new ecological alliances.[5] While the elaborate assemblies of these new palm houses reveal the degree to which we have profoundly altered planetary ecology, they also express the reciprocal labor, maintenance, and care work required for a species' survival.

Exhibited in the Citygroup Gallery in New York City from November 2020 to March 2021, the installation sought to further entangle the material politics of the greenhouse with a new material ethics in architectural production (Fig. 8). The representation of the maintenance and care required of both the palm and the architecture was critical to this research agenda. Images, texts, and drawings displayed in the exhibition documented the role of the palm's caretakers, including how often workers clean and prune the leaves, their watering schedules, and when to add nutrients and chemicals to the soil.[6] Email dialogues discussing the histories of the palm houses and the maintenance protocols of the palms with the head

5. For more information on the theorization of the *socio-technical* and *socio-ecological*, see Damian F. White, Alan P. Rudy, and Brian J. Gareau. *Environments, Natures, and Social Theory* (New York: Palgrave Macmillan, 2016), 2.

6. Information gathered in email conversations with Dr. Roberto Tachetto, Curator of the Botanic Gardens, Rossella Marcucci, Curator of the Botanical Museum, and Paola Mario at the Library of the Botanic Gardens.

librarians, curators, and gardeners of the Orto Botanico were represented among the drawings on the wall of the gallery.

The exhibition also included research on the origins of the materials used in the exhibition. Documents examined the supply chains of materials typically used in greenhouses, like glass or acrylic panels and aluminum extrusions, following their trail from extraction to production to distribution. For instance, a key source of the aluminum used in the gallery is bauxite, which we traced to an alumina refinery in the Brazilian Amazon owned by Norwegian company Norsk Hydro. The tailings dams that sequester the waste from this process frequently breach their banks and empty toxic heavy metals including lead, chromium, and nickel into adjacent rivers and lands. Norsk Hydro is currently undergoing litigation for environmental damages, and by using this material in the exhibition, the project is implicated in these landscapes of extraction.[7]

In addition to the drawings and text that describe these material histories, the project deploys a tectonic system that visualizes a supply chain, showing the complex entanglement of resources, labor, and capital involved in its realization. The exhibition included a material acknowledgement which described the origins, mining and refining locations, trade legislation, and the regional environmental impact of the materials used to construct the project. Replicating the material inventory of each prototype, the lightboxes were composed of approximately 100 pounds of 1.5" extruded aluminum angles, 3 fluorescent utility lights, 336 hex head screws and nuts, 3 yellow extension cords, 6 zip ties, 84 aluminum spacers, and 6 flat-bed printed acrylic sheets. By duplicating the details of the palm houses into the aluminum frames, the lightboxes function as a series of hyperreal artifacts that mirror the material assemblies and tectonic details of the palm houses within the space of the gallery. The images suspended in the acrylic sheets mediate their environmental backdrop, creating a superimposition that alters the reading of the image depending on its context. Positioned in the gallery, the images are juxtaposed against

7. Jondison Rodrigues and Marcel Hazeu, "Brazil: Hydro Alunorte's Alumina Tailings Dam. A Disaster Foreshadowed," *World Rainforest Movement*, November 25, 2019, http://wrm.org.uy/articles-from-the-wrm-bulletin/section1/brazil-hydro-alunortes-alumina-tailings-dam-a-disaster-foreshadowed.

Figure 8. Exhibition view of PALM-HOUSE by HOME-OFFICE, 2020.

a background of technical drawings and documents, staging the architectural object alongside the bureaucratic processes of architectural production, sourcing, and specifying.

Calling attention to its own technical, environmental, and notational systems, architecture can produce a difficult view: a view obscured by the material, environmental, and political conditions of both the beholder and the object of their gaze. Jane Hutton writes in her book *Reciprocal Landscapes*: "The textures, smells, structures of particular materials give people tactile and intimate contact with fragments of distant landscapes and their myriad social and ecological relationships."[8] Hutton moves beyond the implications of this haptic and sensorial encounter, situating materials within the messy depths of their socio-political contexts. Such a strategy calls for a renewed awareness of both the environmental and technical lineages of architecture. Positioned at the hinge point between this awareness and agency, these palm house prototypes seek to entangle the beholder into a more textured relationship between architectural systems and the ecologies that they mediate.

8. Jane Hutton. *Reciprocal Landscapes: Stories of Material Movements* (New York: Routledge, 2020), 221.