Global Flora

Net-zero greenhouse for Wellesley College, Boston, USA

Main authors

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Project data

Project group:	Architecture, building and civil engineering
Client:	Wellesley College
Project background:	Private commission
Planned start:	March 2018

Image 1: Global Flora: interdisciplinary botany center.

Summary and appraisal of the project by the jury

This project is an expansion of the botanical collection at Wellesley College. It is conceived as an educational link between the institution and the community. This project reimagines the greenhouse – typically an energy- and water-intensive program – as a net zero energy building. Particular care is taken to source all materials for the projects locally and with low resource intensity both for construction and operations. The lightweight pillow cladding weighs just three percent of what the same area would out of typical insulated glass. The three biomes – dry, temperate, and humid – help support each other through passive air and heat exchange.

From Joseph Paxton onward, the greenhouse has been a compelling architectural type for everything from plants to exhibitions to radical housing. Greenhouses stand for challenges posed to the profession of architecture to reduce the means needed for enclosure. The jury greatly valued this project for addressing this history with a reduction not just in material for enclosure; but also in the resources needed for ongoing use. Sustainability is at the very core of the design in structure, form, and system. The project meets sustainability metrics as a matter of course and then goes much further to achieve a virtuosity of integration.

Statements on the sustainability of the project by the authors

Global Flora's sustainable design strategies strengthen the collective public realm
The sustainable use of living soils connects Global Flora plant specimens to local topography and ecosystems, enhancing Campus use as a public resource. An innovative Interactive Platform provides real time air, water, soil and energy status, expanding public access for on-site and online users. Instead of being bounded by a lot line, Global Flora creates a precinct of shared clean energy and water exchanges that remediate the natural landscape and improve land use, value and the sustainability of renovated and new Science buildings. Repurposed masonry, stone and wood from Campus and region-sourced ETFE cladding minimize embodied and operational energy. Global Flora meets living building net zero challenges with intelligent, passive design and humid air transfer between biomes.

Global Flora reinvents the "stand alone" conservatory typology with net zero performance
Global Flora achieves net zero and expands public programs with a new integration of site, buildings, biomes and sustainable passive systems. 1-hectare precinct site is net zero water, managing rainfall in cisterns and filtering waste water from the Science Center roof. With a 10K kwh solar grid, harvested water is reused for plants, toilets and maintenance, minimizing high energy municipal water treatments. Passive design, site orientation and material choices minimize energy use. Global Flora is heated by on-site geothermal wells, and 100 % passively cooled through natural ventilation, fans and water design. Each biome helps to support another's needs through passive air & energy transfer: the design demonstrates ecological synergy and supports comparative study of adaptive plant biology.

Interdisciplinary innovations advance design, natural sustainability and public education
Global Flora advances practice with interdisciplinary collaboration and innovative integration of affordable, passive ecological principles and architectural design. Use of thermal mass with ETFE minimizes structure, enables air/heat exchanges and direct visual comparison of plant biomes. Public knowledge on sustainable natural specimens is disseminated globally with an open source interactive research and bio-feedback sensor platform. This monitors and enables on-site and online access of matter flows in Global Flora, and the display of ongoing research and data that reveal plant processes and growth over time. Linking immersive, physical experience of nature with digital technology, Global Flora's design redefines public access to nature and transfers knowledge of its systems.

Image 2: Responsive building envelope: material efficiency, embodied and operational.

Further authors

John Swift, structural engineer, Buro Happold, Boston; **Pratik Raval,** engineer, Transsolar; **Suzan Tillotson,** designer, Tillotson Design; **Kevin Callery,** consultant, Jensen Hughes; **David Conway,** engineer, Nitsch Engineering; **James Vermuelens,** cost estimator, Vermeulens; all from New York; **Thomas Amoroso,** landscape architect, Andropogon, Philadelphia; **David Small,** designer, Small Design Group, Cambridge; **Scott Kelly,** architect, ReVision, Philadelphia; all USA

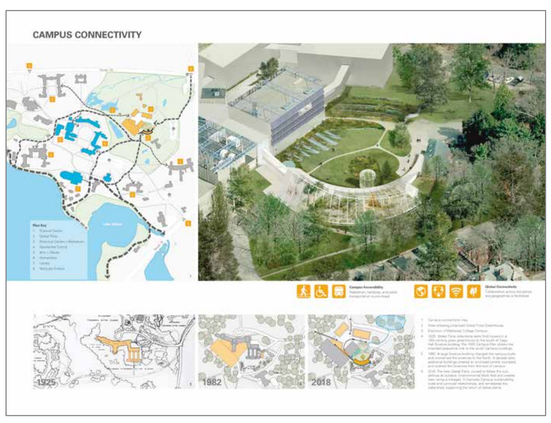

Image 3: Campus connectivity.

Image 4: Public presence on campus.

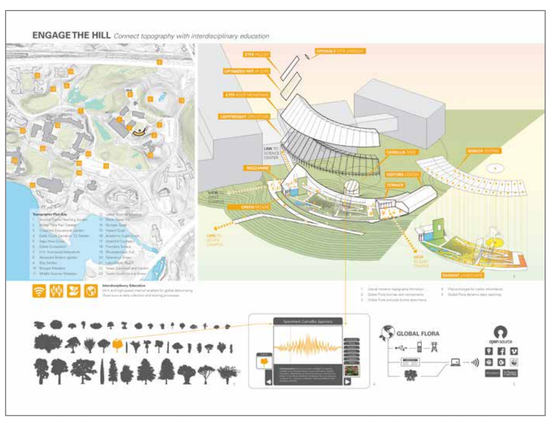

Image 5: Engage the hill: connect topography with interdisciplinary education.

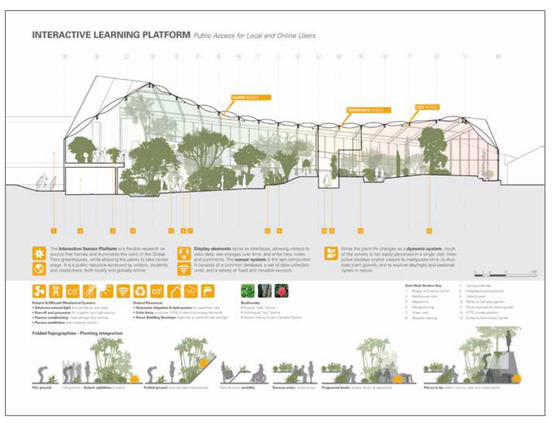

Image 6: Interactive learning platform: public access for local and online users.

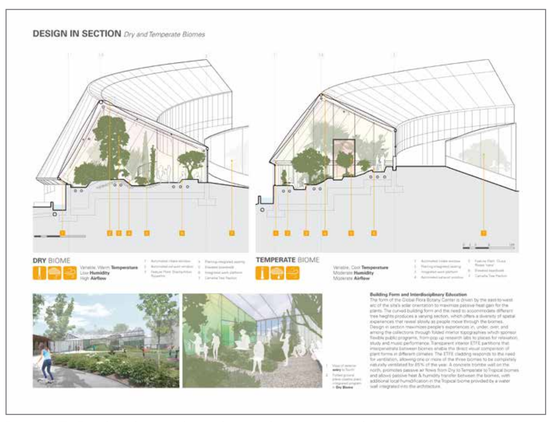

Image 7: Design in section: dry and temperate biomes.

Image 8: Design in section: humid biomes.

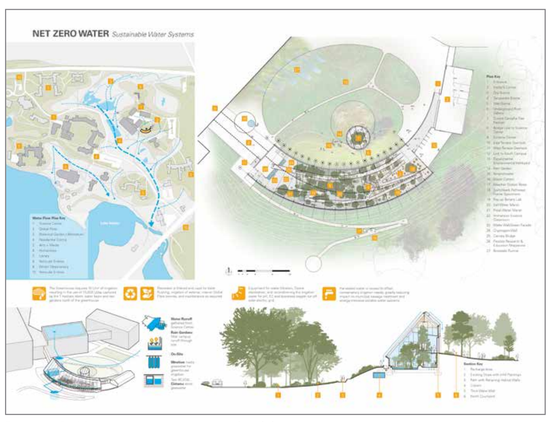

Image 9: Net zero water: sustainable water systems.

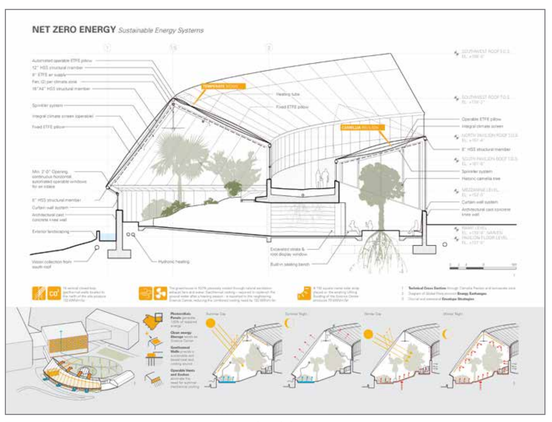

Image 10: Net zero energy: sustainable energy systems.