

SKYRISE GREENERY SHOWCASE

3rd Edition

**Part 2:
Educational Institutions**



Foreword

Skyrise greenery refers to both rooftop and vertical greenery, strategically used and adapted by building owners, architects and contractors as a nature-based sustainable solution to enhance the built environment, reduce energy usage, attract biodiversity back into the city and extend greening efforts skywards. This multi-tiered greening strategy of facades, balconies, mid-level, and topmost roof spaces helps to optimise urban spaces for greenery and recreation, enhancing urban dwellers' quality of life through their work and living environment.

As Singapore transforms into a City in Nature where nature is further restored into the built environment with greenery, incorporating more rooftop greenery and vertical greenery into the built environment contributes towards:

- (i) **Climate resilience**, as skyrise greenery mitigates the urban heat island effect by cooling the immediate surrounding environment, improving rainwater retention, reducing stormwater runoff and improving air quality by airborne pollutants.
- (ii) **Ecological resilience**, as skyrise greenery promotes naturalistic and biodiversity-attracting planting in the built environment to complement urban ecology of the area.
- (iii) **Social resilience**, as the green spaces act as communal spaced for gathering to connect people to nature while improving their well-being.

This year's edition seeks to feature a range of interesting skyrise greenery projects across the island and on different building typologies. We hope they will provide some valuable project insights and technical considerations in designing, installing and managing skyrise greenery projects.

For more information on skyrise greenery initiatives, head on to www.nparks.gov.sg/skyrisegreenery.





Skyrise Projects 2022 (Educational Institution)

Note: Projects featured in this newsletter are contribution pieces by landscape designers and/or building owners. NParks does not endorse, recommend nor guarantee the quality of product or services offered.

Skyrise Greenery (Rooftop & Vertical)



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Rooftop Greenery



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Vertical Greenery



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INSEAD Asia Campus

1 Ayer Rajah Avenue, Singapore 138676

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Building owner: INSEAD

Landscape Implementer: BSG Landscape & Construction

INSEAD Asia Campus in Singapore features pervasive greenery with its verdant green walls and extensive landscaping within the campus. In 2021, INSEAD added another four green walls and two rooftop edible gardens using NParks' Skyrise Greenery Incentive Scheme to mitigate urban heat island effect, by lowering ambient and surface temperatures with greenery.

Its vertical greenery installations not only help to soften the building facade but more importantly, acts as an effective thermal, solar radiation barrier and lower energy consumption. Its lush and functional rooftop gardens help to bring building occupants and visitors closer to nature, creating a biophilic relaxing environment providing health and well-being benefits.

Because of its continual efforts to enhance climate resilience, cut carbon footprint, reduce air pollution, and create a green and naturalistic atmosphere, INSEAD have recently been conferred the Green Mark Platinum award.



1 Photo Source: INSEAD

2 Photo Source: NParks (Grace Koh)



TOP ROW: INSEAD 's newly installed rooftop gardens

MIDDLE ROW: INSEAD 's newly installed green walls



1. Can INSEAD share on how your skyrise greenery installations contribute to the campus' sustainability efforts?

Sustainability plays a huge part in INSEAD curriculum. It is the basis of all the decisions that we take on how we operate and manage our campus. We are striving towards 67% reduction in greenhouse gas emission by 2035 and net-zero emissions by 2050. We were motivated to install skyrise greenery on our buildings, due to the cooling effects that the installations will bring. Our green walls and rooftop gardens act as an effective thermal barrier between the indoor environment and the heat from the solar radiation outdoors. In addition, skyrise greenery helps to reduce noise and improve air quality in and around the building, providing a conducive academic study environment. They also increase the building's high aesthetic value as they soften the urbanised harsh surroundings and offer a tranquil environment.



2. Could INSEAD share how it maintains its vertical green wall?"

Our first green wall was installed in 2013. To ensure that the plants are easy to maintain, we curated the plant palette to include foliage plants suited for outdoor planting such as *Philodendron* spp., *Epipremnum* spp. and *Heptapleurum arboricola*. Maintenance for these plants is minimal, i.e., we apply fertilizers and pesticides and replace plants if needed.

We consciously try to be environmentally friendly. Our irrigation system is linked to weather sensors, which will stop the irrigation and conserve water on rainy days. We also installed rain chains to direct runoff water from the green wall irrigation trays to potted plants below.



TOP CLUSTER: Harvested vegetables and biodiversity found in the rooftop garden

BOTTOM CLUSTER: Staff harvesting, weeding and helping with plant replacement during INSEAD's Gardeners' Day Out.



3. Why decide on an edible garden for the rooftop?

As part of our efforts to create awareness on food resilience in Singapore, we installed edible gardens at our rooftop. What used to be an unusable space is now a vibrant green pocket for our faculty, staff, students and guests to gather, interact, and bond as they harvest and farm together.

The plants at our rooftop are made up of edible herbs and vegetables that will be harvested for use in our campus kitchen. We also selected plants that are biodiversity-attracting, with the intention to draw in pollinators such as bees and birds, in support of Singapore's 'City in Nature' vision.

4. Any long-term plans to sustain interest in maintenance of the garden?

We encourage our staff and students to use the gardens and enjoy the garden's produce. To sustain interest and increase visibility, we held monthly culinary workshops using freshly harvested plants from the rooftop gardens. This is in collaboration with our kitchen.

In April 2022, we organised our first INSEAD Gardeners' Day Out and we have plans to do more. With these programmes, we hope to sustain interest in our edible gardens, which will in turn help to retain our community of gardening volunteers.

1 Photo Source: INSEAD

2 Photo Source: NParks (Grace Koh)

UWCSEA – East Campus

1 Tampines Street 73, Singapore 528704

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Building owner: United World College of Southeast Asia East Campus

Landscape Implementer: Prince's Landscape

A member of the global UWC movement, UWCSEA has a passionate belief in the power of education to be a force for good in the world. Our mission is to use education to help all our students to realise their potential as agents of positive change and actively identify ways to contribute to a sustainable future for all.

Centered around this mission, our learning environments are thoughtfully and deliberately designed to provide age-appropriate opportunities for students to develop the skills, qualities, and competencies that we have identified as necessary for them throughout their lives.

The Infant Sky Garden, atop the roof of our Infant School block at UWCSEA East, is one of our thoughtful spaces specially created to help our youngest students engage with nature for learning and for play.



BOTTOM ROW: Class photo of children in heritage wear during annual UWC day celebrated globally on 21 September which coincides with UN International Day of Peace. UWC Day is a moment to celebrate the strength and diversity of the UWC movement and the school's mission for a more peaceful and sustainable future.



1. Your rooftop garden has a good variety of plants. What is your design inspiration?

Our Sky Garden was carefully designed for infants, with due considerations given to ensure that our young students have a safe but flexible space to learn, explore and play. We test bedded different concepts and observed responses before firming up on the installation of the permanent structures. For example, it was observed that the mud play area was more popular with the children and less well-received by staff or their parents. Through test-bedding, we can ensure that our play features are well-received by all stakeholders.



Continuing the themes of our classrooms and other learning spaces, we deliberately selected neutral colour palette and use of natural materials to create a more biophilic play environment. Through thoughtful design, our large open area is now transformed into a safe and welcoming space which encourages exploration and imaginative play.

Our living walls and raised movable sensory garden beds are planted with a wide range of plants curated to educate the students and provide sensory play opportunities using plants' varied textures and features. The garden beds and its surrounding play spaces such as the water play are often used by teachers and students to examine nature and test theories for concepts taught in classrooms.

Different zones in the space allows different activities to take place simultaneously, providing our students with options to physically explore and engage in active play, find moments to quietly observe nature, or connect and engage with each other in the background of a natural setting



TOP ROW: Children observing biodiversity at sky garden and interacting with the garden by play.

BOTTOM ROW: Children playing at the nature playground beside sky garden.



2. How does the newly installed skyrise greenery complement UWCSEA Tampines' corporate objective?

Our focus at UWCSEA Tampines is to create educational spaces and empower our students to act and contribute to a sustainable greener future. For example, our nature program enables students to learn about plants and the know-hows for plants to thrive. Our young students then regularly explore the gardens with their teachers as they observe and apply knowledge learned in the classroom to their real-life surroundings. By also involving students in the routine maintenance and plant replacements at the Sky Garden, we hope to give them opportunities to appreciate and learn how they can care for the natural world.



3. Alongside your rooftop garden, UWCSEA Tampines also implemented green walls under Skyrise Greenery Incentive Scheme. Could you share on how green walls help to value-add to your rooftop garden and overall campus greenery?

Green walls are a distinctive feature of our East Campus. The installation of green walls in key locations across the campus helps to reduce heat radiating from walls that receive full sun, provide sound dampening insulation in high footfall areas, protect building from weather elements and bring nature closer to people.

Given the several benefits of green walls, we made the deliberate design decision to add in green walls at our Infant Sky Garden. This aligns our project with BCA's Green Mark Platinum criteria, contributing to our campus' status as a super low energy building. The green walls at Sky Gardens are also erected for safety reasons, i.e., to keep our young students away from building edge while creating visual continuity with the rooftop greenery.

Stamford American International School

1 Woodleigh Lane, Singapore 357684



Building owner: Stamford American International School

Landscape Implementer: Greenology

Stamford American International School opened their rooftop edible garden in April 2021 with the objective to harvest crops and give back to the community. This is in alignment with the Singapore Green Plan and Singapore’s ‘30 by 30’ food resilience goals. The rooftop garden serves as an edible green sanctuary for students to plant seeds and grow tomatoes, eggplants, cucumbers, mint, fruit trees and more.

Staff educators proactively use this newly created rooftop garden to educate their students to promote biodiversity and ecological sustainability in the cityscape. It is also an opportunity for students to equip themselves with hands-on skills in growing and propagating edible plants as they take ownership of the rooftop garden.

1. What is the rationale behind the selection of Stamford American’s plant palette?

We installed cost-effective planters made of drainage cells to grow fruit trees that would thrive in our tropical climate, such as *Dimocarpus longan* (Longan), *Nephelium lappaceum* (Rambutan), *Mangifera indica* (Mango) and *Musa* spp. (Banana) trees. Our landscape designers also handpicked a variety of edible herbs and leafy greens to create an educational garden for students to learn to grow plants, understand plant harvesting cycles and deepen their knowledge on heritage foods on a whole new level.

Within the rooftop garden is a plant propagation area where educational workshops are held for students to learn about urban farming and plant growth. We also provided the school with indoor hydroponics kits with LED growth lights for students to compare growth cycles of the plants.

The rooftop garden ignites students’ interest in plants and offers an immersive educational experience.

2. We noticed that there are black nettings at top of your rooftop garden, and this is commonly seen at edible gardens. Could you explain the purpose of these nettings?

We highly recommend the use of these lightweight black nettings in gardens with heat-sensitive plants such as vegetables, orchids, and shade-loving plants. These nettings are effective in deterring pest attacks, providing shade and shielding the plants from Sun’s heat, ultraviolet radiation, and wind. Its semi-permeability also protects plants from heavy rainwater by controlling the speed of water passing through the netting and reducing the leaching of water onto the soil in planters.

1 Photo Source: Greenology

UWCSEA – Dover Campus

1207 Dover Road, Singapore 139654



Building owner: United World College of Southeast Asia – Dover GreenHeart

Landscape Implementer: BSG Landscape Construction

UWCSEA’s mission of creating a sustainable future lies at the heart of all decision making in our education and operations. Several years ago, when the campus was undergoing extensive refurbishment, we conceived the idea of a ‘Green Heart’ flowing through the centre of the campus. Meanwhile, we used the site as a holding area for our own tree nurseries and to house two research projects, (i) a field trial by NUS/Future Cities Laboratory to measure microclimate effects of native trees in an urban environment and (ii) research project with Yale-NUS’s Assistant Professor Dr. Michiel Van Breugel, a tropical forest ecologist, with help from his doctoral student Hao Ran Lai and Singapore Botanic Gardens’ Elango Velautham.

In line with UWCSEA’s own long-running Rainforest Restoration Project, Dr. Van Breugel designed an experiment to examine the responses of tree seedlings with various characteristics to different light levels to help guide species selection for reforestation programmes across the region. After a period of being home to other projects, we decided to actualize our idea of GreenHeart at the concrete space in year 2020 and transform UWCSEA’s student-led Rainforest Reforestation Project nursery into an actual living outdoor classroom for students across campus to continue their student-led educational journey.

BELOW PHOTOS: UWCSEA students getting involved with the maintenance of rooftop garden by weeding.



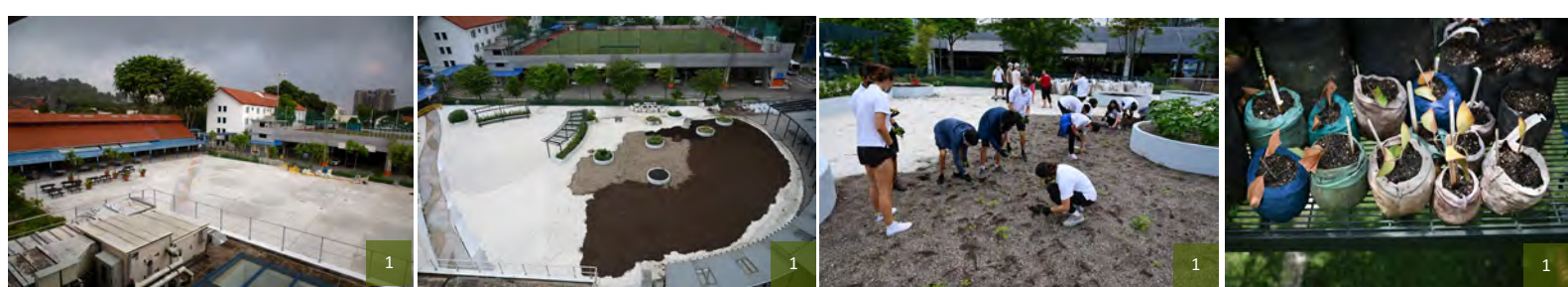
1. What is the design intent behind 'GreenHeart'?

The design intent is simple, i.e., to bring a more natural, organic feel to a manmade space. GreenHeart on Dover is first and foremost intended to be a natural free play area that supports our students' wellbeing. The space brings to our students an experiential learning experience as it can be used for multiple purposes to create a holistic learning programme for outdoor education, sports activities, personal well-being, social bonding, and development of gardening skills.

The design and execution of our rooftop garden was a challenge, as our garden sits above the music department and a fully operational drama theatre that can seat 300 people. We had to consider and overcome several factors such as loading capacity, irrigation, and drainage to ensure campus flood prevention measures were not compromised. We also had to factor in growing space for planters containing trees that will flourish and mature over time.

TOP ROW: Before photos of empty space as contractor fill up the space with soil and students help to grow and plant in seedlings.

BOTTOM CLUSTER: Staff and students participating in the installation of rooftop greenery, such as planting trees, pouring soil into the planters and watering.



2. We heard that your students are very excited with the rooftop garden and appreciate the new green installation. Could you share with us on the responses you received?

The rooftop garden helps to mitigate urban heat island effect, build climate resilience, strengthen ecological resilience, and educate students on biodiversity. We designed a green space that provides learners of all ages an opportunity to connect with nature. Our students now actively explore GreenHeart rooftop garden as part of their outdoor education programme to seek for evidence of the concepts taught in their classroom.

Our whole community has been eagerly waiting for the opening of the green space. Since 2020, we worked with groups of students, staff and parents to prepare the soil, lay the turf, carry large trees into the planters and plant the species into garden beds. They have also been helping with the ongoing maintenance of the rooftop garden. We are very appreciative of their help and glad that the rooftop garden brought a community together.



BELOW: Students working on their Rainforest Reforestation project as they transplant the plants cultivated with loving care from UWCSEA Dover's nursery to the forest.



Juno Pelczar, Grade 11 Rainforest Restoration Project Student Leader:

"Our current location over the past 16 years has served us well, but we are looking forward to moving into a more visible part of our school. We hope that the green space in conjunction with our nursery, which houses dozens of indigenous species, can truly be the beating heart of environmental stewardship on campus. The connections that people make with nature and each other are what really makes green spaces come alive. We hope that with the opening of the nursery at our new location, we can make the Green Heart such a space."

Damayanti Chakraborty, Grade 11 Rainforest Restoration Project Student Leader:

"Although the Climate Crisis often feels like too big of an issue to tackle alone, we hope that the new nursery will encourage more people to get involved and realise that together we can foster a community that is ready to take action. The move to the Green Heart is an opportunity for us to spread our message to the wider UWCSEA community as well as get more community members involved in environmental stewardship. With the new nursery being more easily accessible to the UWC community, we hope that members can create their own personal connection with nature and discover the importance of having green spaces close to us."

Pathlight School

5 Ang Mo Kio Avenue 10, Singapore 569739



Building owner: Pathlight School

Landscape Implementer: Prince's Landscape

Pathlight School is the first autism-focused school in Singapore that equips students with life readiness skills together with Singapore's national curriculum. With a green area of 89 sqm, the green walls stand out from its surroundings and are impressionable to passers-by. The use of different plant species helps to create texture and visual interest to the green wall while softening the overall look of the carpark. The green walls lower ambient temperature to create a cooling environment and create a calmer and more comfortable environment for students from Pathlight School who may be easily affected by noisy sounds in their surroundings. The school is pleased with the green wall installation as it has observed students stopping and appreciating the large green walls created for them.

1. What are your design objectives and considerations behind the vertical greenery installations at Pathlight School?

In the design and installation of vertical greenery, Prince's Landscape typically considers (i) how accessible the green walls are for installation and maintenance, (ii) how much sunlight is available as this will affect plant selection, (iii) whether water source or tap off point is available as this will affect our choice of irrigation system and (iv) type and strength of supporting wall which will affect the type of green wall system that can be installed.

For Pathlight, we used pot system and Elmich's VGP tray to erect green walls of 89 m² that weights around 62kg/m² including plants and wet soil weight. The green wall system is low maintenance and thus, also ensures that plant care will not be adversely affected by restricted access to the school. We chose plants that are easy to maintain, slow growing and budget friendly. As water point is readily available, we installed irrigation system to supply plants with required water and nutrients. For our irrigation, we installed online emitters to eliminate wasteful irrigation between plants and battery-operated controllers which eliminates the need for an electrical connection for auto-irrigation to work.



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Interview with Pathlight School

1. What are some of the feedback that you received from your staff and students?

Our curriculum adheres to Pathlight’s teaching philosophy of active, applied and authentic learning. We always try to get our students involved with hands-on practice that connected what they learnt in Science lessons to real-life applications. Adding onto our existing gardens, the vertical green walls helped to educate our students on important components necessary for plant growth, namely, soil, space, sunlight and water. Our students enjoyed the green installations in our campus – it allowed them to calm down while actively learning about useful science knowledge.



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2 Photo Source: Pathlight School

3 Photo Source: Prince’s Landscape