

Sweating for a cooler Singapore

July 11 2018, by Samuel Schlaefli



A good place for research and sport: many Singaporeans already use the Rail Corridor as a recreational area. Credit: Lina Meisen

Students from the Institute of Landscape Architecture are planning some natural ways to cool the heat-afflicted metropolis of Singapore. Their testing ground is a disused railway line reclaimed by nature and converted into a tropical recreation area.

The midday heat in Singapore is merciless. The sun over this tropical metropolis doesn't shine, it burns. That's why the city has air-conditioned underpasses that connect metro stations to shopping centres and office buildings, creating kilometres of interconnected tunnels that give its 5.6 million inhabitants at least some temporary respite from the adverse climate. This Wednesday lunchtime, ETH Professor of Landscape Architecture Christophe Girot, 4 teaching assistants and 14 students have sought shelter beneath the broad tin roof of the Maxwell Food Centre in Chinatown. One of Singapore's countless down-to-earth food markets, it serves a wealth of delicious meals that combine the influences of Chinese, Malaysian and Indian cuisine – the dominant cultures of the former British Crown colony.

Tucking into a spicy noodle soup and Chinese dumplings, Girot explains why he brought his students to Singapore: "Most of them have never been to Asia, so it's hard for them to understand what life in a tropical metropolis is like – it's something physical you have to experience in the flesh." He hopes this experience will help his students gain a better understanding of the growing problem of urban heat islands (UHIs). Heat is increasingly posing health and energy challenges in big cities throughout the tropical belt, from Jakarta and Manila to Bangkok and Singapore. In Singapore, temperatures in central, heavily built-up areas such as Orchard Road sometimes exceed those in surrounding rural areas by up to 7 °C.

The city is heated not just by its tropical climate, but also by the continuous injection of anthropogenic heat from car exhausts, industry and fossil fuel power stations, as well as waste heat from hundreds of thousands of air conditioning units. Other UHI drivers include densely packed building complexes that are not optimised for wind, as well as dark surfaces such as tarmac roads and building facades that store heat instead of reflecting the sun's rays.

Green spaces to cool the city

Giroto's colleagues at the Future Cities Laboratory – an urban research group at the Singapore-ETH Centre – are hoping to break the vicious cycle of self-heating cities. As part of the large-scale project Cooling Singapore (see box), they are working together with partner universities to develop a roadmap by the middle of this year that will offer measures designed to cool the city down.

The Bachelor's and Master's students who Giroto has brought to Singapore as part of his three-month seminar Singapore hot, Singapore cool are here to help with that project. The testing ground is a 24-kilometre-long green space known as the Rail Corridor, a disused railway line that stretches from Malaysia in the far north of the island down to the port in the south. It was built at the turn of the century under British colonial rule. In 1918, the British handed over ownership to Malaysia, which ceased operating the line in 2011. Everything that was easy enough to remove was taken back to Malaysia, including the rails, signals and signs. What remained was a largely undeveloped green space, a corridor that nature has gradually reclaimed. Today, one million people live within a one-kilometre radius of the Rail Corridor – a space that offers tremendous potential for the city-state.

"The value of urban green spaces has been rising for years," says Giroto. "Not just for decorative purposes like before, but because they are increasingly taking on key functions." Researchers have shown that green areas contribute to a more comfortable climate in urban environments. What's more, targeted [landscape architecture](#) interventions can unlock further potential benefits such as using wind and water to cool the environment. "Urban planning in the 21st century is increasingly about landscape planning," insists Giroto, an award-winning landscape architect. "It will play a key role in giving cities a more liveable climate in the future."

In the urban jungle

After lunch, the group splits up. I take an Uber to the central section of the Rail Corridor together with a teaching assistant and two students. At the edge of a busy road, we scramble up a slope to a rusty iron bridge. The temperature has now hit 32 °C with a humidity of over 80 percent, causing us to sweat profusely with every step we take. We walk along the green corridor past the crumbling Bukit Timah station and slowly make our way into the tangled undergrowth. We see giant ferns, tall shrubs festooned with tiny green bananas, and rubber trees overgrown with vines that occasionally attract bright yellow butterflies. Cicadas chirrup in the bushes around us.

Jonas Haldemann and Manuel Viecelli are familiar with the area from plans they studied in Zurich at the start of the seminar. Shortly after arriving in Singapore on Sunday, the students carried out an initial reconnaissance of the Rail Corridor.

Today they are back with a 3-D laser scanner. Jonas and Manuel place the blue box on its tripod and start taking measurements.

The scanner begins to rotate slowly around its own axis, while a round mirror in the open, central part of the device spins around vertically at tremendous speed. The scanner is sweeping the area with a barrage of invisible laser beams, which are reflected by any objects within a distance of 300 metres, including leaves, wooden posts, puddles and mounds of earth. The scanner converts each reflected pulse into a data point in a three-dimensional model. It captures up to 500,000 points a second, and the intensity of the reflected beams provide information on the properties of the surface they bounce off. The scanner also shoots 80 images of its surroundings, so that they can be assembled into a 360° panorama, to later on render the point clouds in their original colours. Girot's group has spent years using these kinds of three-dimensional

point cloud models to map large-scale urban topographies and their characteristics. As part of this seminar, the students will create their own point clouds of the Rail Corridor and then flesh them out with interventions to combat Singapore's [urban heat island](#) effect.

Just before sunset, as the first mosquitoes start to bite, the two students successfully complete the last of their six laser scans. We bid farewell to the wild stretch of urban rainforest and, just 15 minutes later, find ourselves back in the heart of the noisy, bustling metropolis. A heavily air-conditioned metro train, which runs every five minutes, whisks us back to Little India where the students are staying the night – back to the ever-chaotic part of Singapore, where the humid air smells of masala, carnations and perspiration.

Transcontinental cooperation

Christophe Girot has spent many years establishing a broad network of contacts across Japan and Singapore, including Professor Erwin Viray at Singapore University of Technology and Design (SUTD). Girot managed to persuade Viray to hold the seminar in tandem at SUTD, and on Sunday evening the students from Zurich and Singapore met for the first time. Two days later, they were already in mixed teams working on designs for the Rail Corridor. Another joint workshop is scheduled for Thursday morning, this time at SUTD, which is near the airport on the eastern part of Singapore island. Palm trees tower over the courtyard of the modern, organically-shaped building, and the bougainvillea has transformed the balconies into a riot of violet. The university's motto – For a better world through design – is displayed on the white facade of the reception building.



Nicolas Wüthrich (at the front) and Julian Fischbacher set up the laser scanner at a crossroads immediately adjacent to the Rail Corridor. They will subsequently insert their designs for the corridor in the point cloud images created by the scanner. Credit: Lina Meisen

In a heavily air-conditioned seminar room, the six project groups have pushed together tables and set up their plans and laptops. They are now using a cocktail of different software to process the data they captured the day before to create three-dimensional point clouds. They will then integrate these in lower resolution but more comprehensive spatial data sets based on data collected by aircraft using lidar. Each team must submit multiple views of their planned interventions in different scales by 10 p.m. – but nobody intends to stay that late, not when the evening beckons as the perfect time to explore Singapore! From the stylish waterfront promenade at Marina Bay to the delicious food of the hawker centres and the rooftop bars with their magnificent views, there is no shortage of things to do.

Expert audience in the Value Lab

Friday morning arrives, and it's clear that the students are a little bit nervous. We're heading to the west coast for their final presentations, specifically to the sweeping campus of the National University of Singapore (NUS), the city's oldest and largest university. We can see the CREATE Tower from far off. Adorned with greenery and topped with photovoltaic solar panels, this glass tower lies at the heart of the eight-year academic collaboration between Singapore and Zurich. The Singapore-ETH Centre (SEC) stretches over two floors of the tower. Some 200 employees from all over the world work for ETH here,

surrounded by colleagues from MIT, the Technical University of Munich (TUM) and Cambridge University.

SEC's Future Cities Laboratory (FCL), which specialises in urban research, helped organise Girot's seminar. The students gather at the centre of the lab on the sixth floor in an area known as the Value Lab, a loft-style, multi-functional presentation room bathed in light and featuring a three-by-six metre LED wall. For the final presentation, Girot has invited two FCL researchers and Abby Ng, who works for NParks, Singapore's park authority. Each group of students has ten minutes to present their intervention for one of the three sections of the Rail Corridor. They have to win over their audience with four to ten slides containing sketches, axonometric projections, point clouds and reference images.

The six teams have come to similar conclusions. Their designs propose channelling the wind to cool the city, regrouping buildings and trees to allow the wind to blow unimpeded, and creating pleasant spaces to spend time in the Rail Corridor by increasing the amount of greenery. All the groups emphasise the need to create new links between neighbourhoods to replace ones that were eliminated by roadbuilding.

The Pont des Arbres project has pushed this idea the furthest, with the team creating a spacious new park for the Rail Corridor by re-routing four lanes of the main road through tunnels. This would transform a noisy, unattractive and segregated space into a green and predominantly shady oasis of tranquillity for neighbourly encounters.

The audience expresses enthusiasm for the three-dimensional point cloud model of this visionary project. Depicted as nothing but points, the urban topology takes on a mystical, almost ephemeral air, yet the depiction is precise and easy to relate to. Girot smiles; he has advocated this technology for over 20 years, but now it is cheap and user-friendly

enough to form part of the toolkit of a new generation of landscape architects. FCL Programme Director Stephen Cairns encourages the [students](#) to continue developing their proposals during the remainder of the seminar, both in Zurich and in Singapore. "In my experience, Singapore's city planners take persuasive ideas very seriously, no matter where they come from," he says.

Provided by ETH Zurich

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