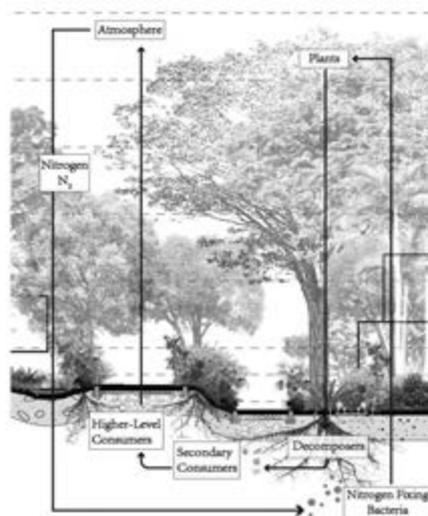
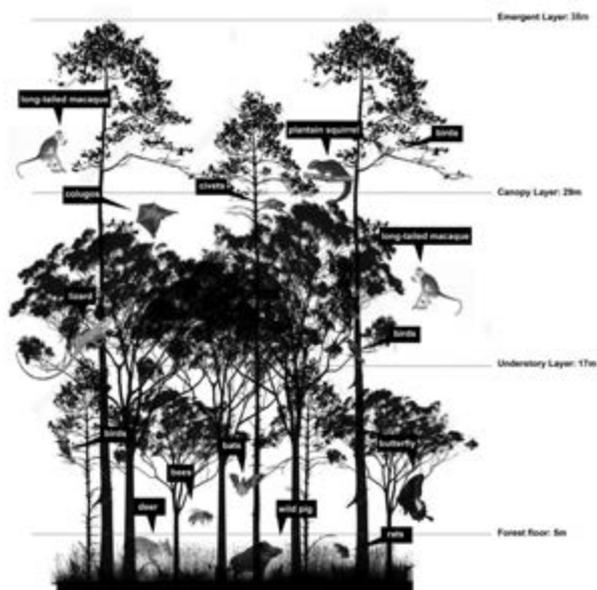
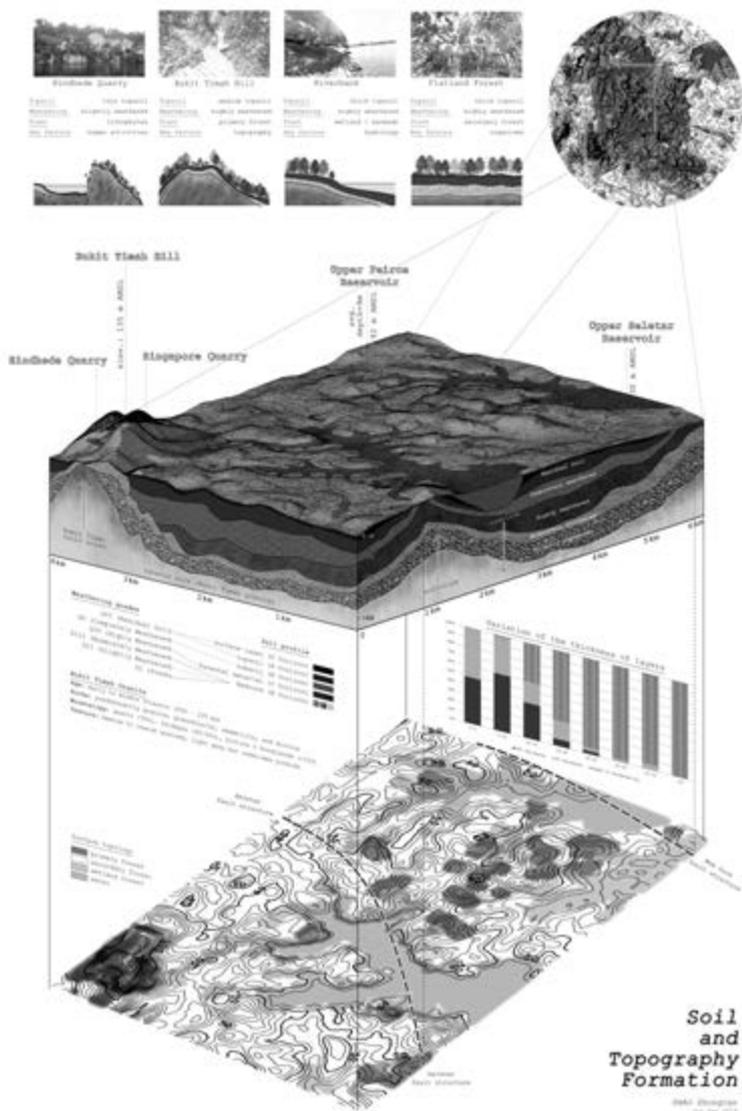
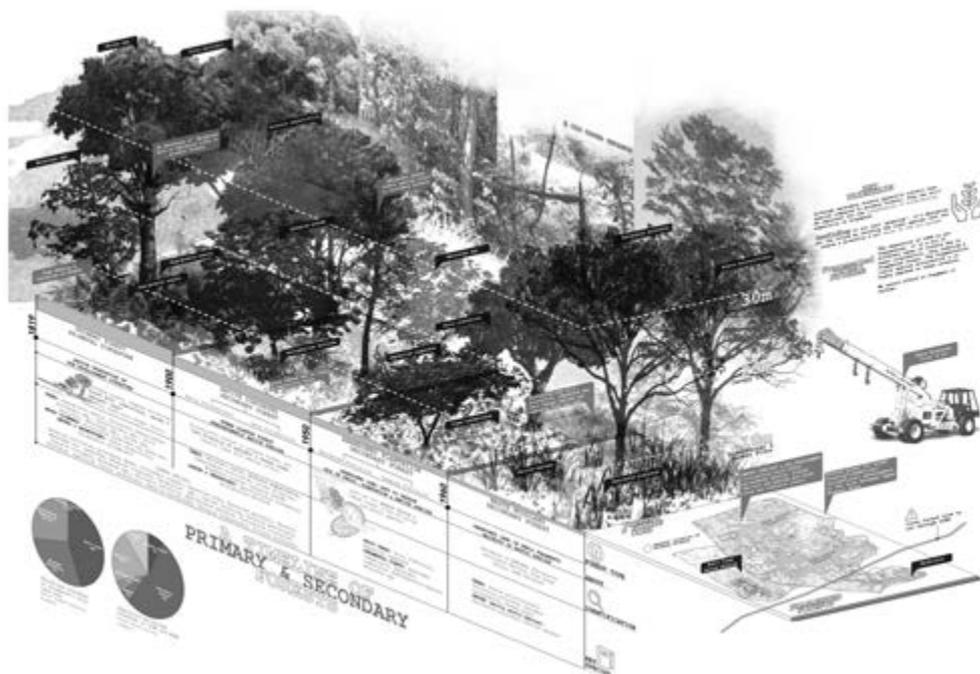


Rewilding Singapore: Exploring Landscape Design Strategies That Bring Forest Ecology Into The Urban Context

Text by Hwang Yun Hye, Kenya Endo and Shawn Lum
Images as credited

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...mimicking the tropical rainforest may be an ideal design approach to improve the ecosystem of managed urban green spaces.

Why Rewilding?

Situated upon the Equator, and bathed in the tepid water of the great tropical Oceans, this region enjoys a climate more uniformly hot and moist than almost any other part of the globe, and teems with natural productions which are elsewhere unknown. (Wallace, 1986)

This sentence briefly sums up the characteristics of Malay Archipelago—formerly one of the most complex and exuberant ecosystems in the world. However, with urbanization and as a result of contemporary landscape architectural practices, the extraordinary dynamics of tropical lowland evergreen forests have largely been forgotten. The primary rainforest made up 99% of Singapore just two centuries ago (Corlett, 1992), but along the way to green the city, co-existence with wild nature has somewhat been de-emphasized and underappreciated, as a tidy appearance and maintainability become key concerns.

More recently, Singapore is starting to transit to a new phase of its greening policy by focusing on enriching biodiversity and fostering a notion of the ecological age (Berry, 1988). Botanist Dr. Hugh Tan suggests (Tan et al., 2007) mimicking the tropical rainforest may be an ideal design approach to improve the ecosystem of managed urban green spaces. But exactly how should landscape architects interpret tropical forest ecology and apply it to existing urban green space? To what extent can proposed design prototypes infuse greater ecological

functions and diversity into the urban context? How can design bring city dwellers closer to nature in everyday landscapes?

Rewilding Design Studio

In response to these questions, the Department of Architecture at the National University of Singapore set up a series of ‘rewilding Singapore’ design studios¹ as part of its course module in 2019. The main tasks in the studio were, firstly, to understand how the ecosystems of forests function and, secondly, to translate this acquired knowledge into design projects. As part of the first task, students learned about the spatial and temporal characteristics of tropical forests, including geological and edaphic conditions, habitats, biological diversity, interaction among species, hydrological cycles, nutrients and energy flows, and human influence through literature reviews, including Forman’s ‘Urban Ecology’ (2014) and Ashton’s book on Asian tropical forests (2014). Local ecologists delivered a series of lectures on ‘Overviews of urban greenery and ecological networks in Singapore’, ‘Forest dynamics vs manicured landscapes’, ‘Human and wildlife interactions’, and ‘A forest walk in Central Catchment Nature Reserve (CCNR)’. Ultimately, students were asked to visualize their acquired knowledge of forest ecology in informative and artistic drawings (see Figure 1), identify Urban Green Spaces (UGS) close to CCNR, an ecologically critical area, and then carry out design strategies for those spaces. The following paragraphs discuss the design potential of eight of these spaces.

1. Examples of visualization of forest ecology as informative and artistic drawings. Soil and land formation of tropical forests (top left, by Shao Zhongran (MLA'21)), wild animals and forest strata (top right, by Zhou Zuyuan (MLA'21)), micro-organisms and bacterial community in a tropical forest's subsurface environment (middle right, by Wang Haobo (MLA'21)), structural characteristics of primary and secondary forest ecology in relation to Singapore's history (bottom, by Bargotra Poornima (MLA'21)).



Landscape Design Strategies For Rewilding UGS Typologies

Rewilding streetscapes Well-connected and evenly distributed streets could co-function as ecological networks of the city, biologically connecting protected nature areas (e.g. primary/mature secondary forests in CCNR) and man-made open spaces, like large patches of urban parks (e.g. Pang Sua pond). Design proposals for 'Rewilding streetscapes' included increasing the tree canopy connectivity and enhancing structural diversity, as well as introducing species of all strata, including forest trees, epiphytes, and shrubs, at ecologically critical points along streets. When applied to forest gateways and elevated walkways, this scheme would provide more room for avian and arboreal wildlife movement. Designs also noted the need to ensure room for forest seed dispersal and the full growth of vegetation, thus incorporating forest succession into the design process.

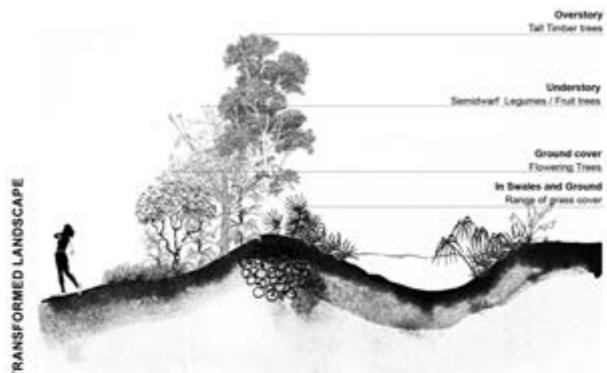
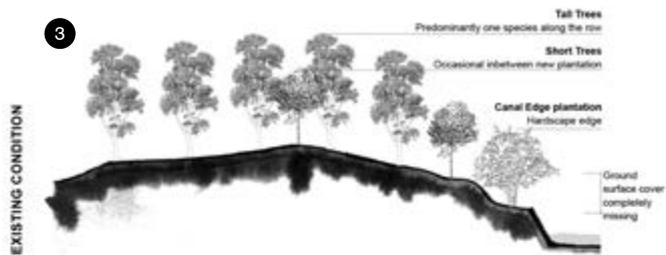
Rewilding vacant land A significant amount of temporarily unused open space is left as static green turf in Singapore. Many of these spaces are reserved for future development and, they lack a sense of place, even though they are within residential estates. Students were challenged to create scenarios for these vacant lands, nurturing

both immediate and long-term ecological values. Their proposals were represented in a series of phases. In Phase 1, the space could be developed as a biologically diverse mini-forest by improving soil nutrients (i.e. allowing organic matter to decompose and keeping a surface litter layer of dead leaves and twigs, fallen boughs and trunks), ensuring water resources, and introducing a key set of vegetation such as *Dipterocarpaceae*, *Moraceae*, *Myrtaceae* *Euphorbiaceae*, and *Rubiaceae*. In Phase 2, more mature plants would begin to mimic forest dynamics to attract urban adaptive habitats. Flexible landscape features, including pathways and seats, could be periodically introduced to boost users' appreciation of the evolving landscape. In Phase 3, the focus could be on the renewal of old housing estates. The densely grown green patches could be a key landscape feature and a stepping-stone to CCNR while allowing new development. The design projects included associated programmes that could be temporarily operated, such as a forest tree nursery, a bioretention pond, and a one-family-one-tree planting initiative.

Rewilding recreational spaces Urban recreational spaces, such as playgrounds and golf courses, are typically homogeneous, mono-functional, and decontextualized. Within the

2. Spatial and experiential design scenarios of a vacant lot in a public housing estate. Proposed by Bargotra Poornima (MLA'21).

3. Comparison of existing condition and ecologically sensitive golf course. Proposed by Rakholiya Ekta (MLA'21).

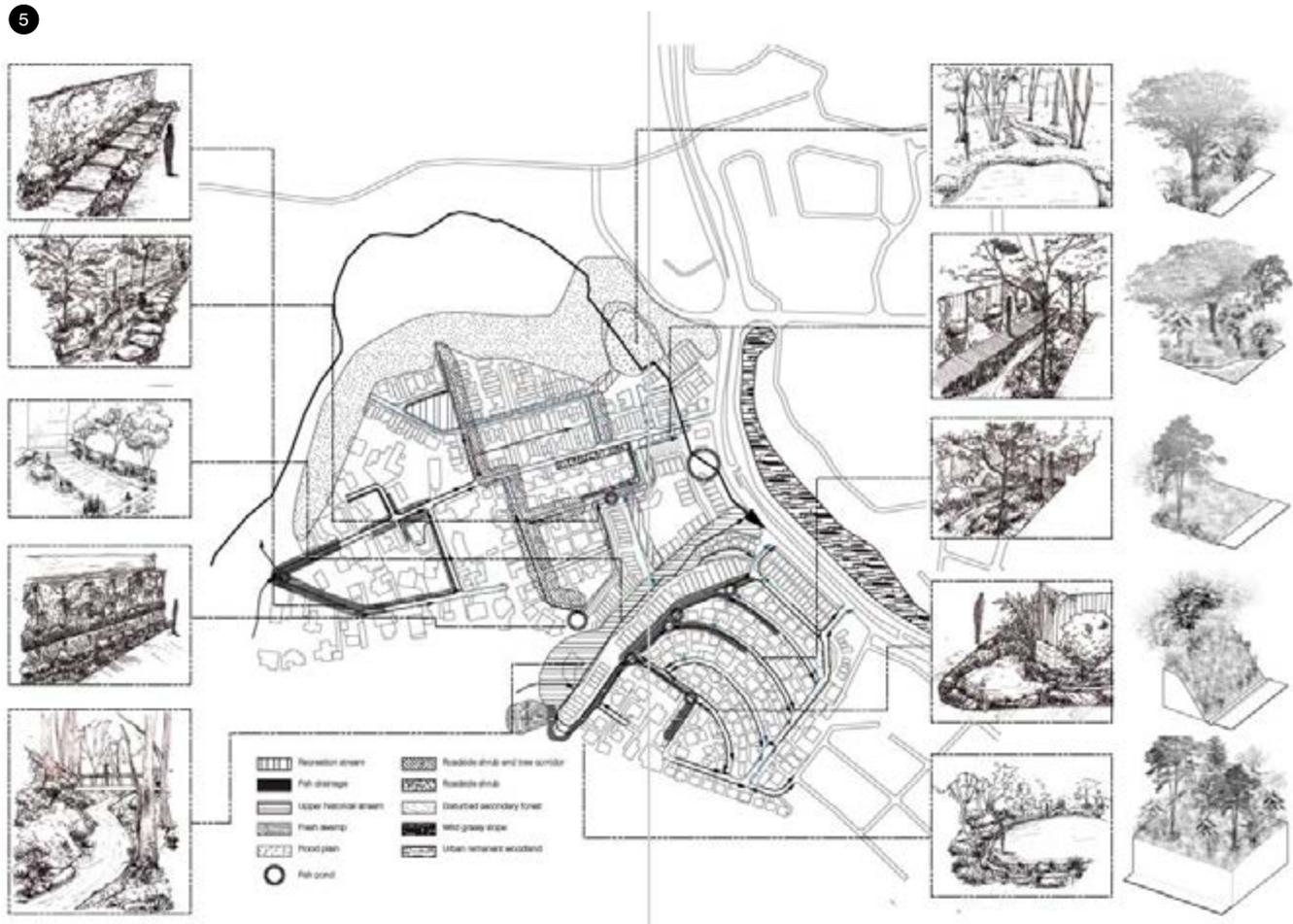


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studio framework, student designs focused on incorporating multi-functionality and leveraging geographical opportunities for these otherwise plain spaces. For instance, situated at the base of Upper Seletar Reservoir and beside a pristine fresh-water swamp forest, Mandai Executive Golf Course was re-envisioned as a conjunction of the game of golf and ecological habitat creation, with an emphasis on ecologically sustainable management practices. Inspired by the nutrient cycling system and species composition of tropical forests, design strategies included the use of rainwater to minimize irrigation and hardy plants to prevent the need for chemical fertilizer. Minimizing fragmentation was addressed by introducing forest patches on the golf course, with careful layering of native forest species clustered in the form of a continuous corridor, keeping the existing function as a recreational golf course but making it more scenic and challenging.

Rewilding commercial estates Shopping malls are typically hardscape-centric and developed with little consideration of thermal comfort and biodiversity. Especially for sites close to CCNR, climate-sensitive landscape strategies that minimize the urban heat island effect, facilitate wildlife movement, and simultaneously insert outdoor environmental programs would be beneficial for humans and nature alike. Students also addressed the question of how to incorporate greenery and an outdoor environment with commercial activities. They answered this by strategically classifying outdoor spaces into several zones; for instance, a habitat creation zone with plenty of food sources for wildlife and minimum programs for people. In another example, courtyard spaces could be associated with communal and educational activities, including outdoor classrooms for children, nature therapy, and community gardens. In this way, users and nearby residents could shop while being exposed to greenery and nature-based activities.

Rewilding urban waterways Located at the edge of CCNR where the freshwater swamp forest stream ends, the water infrastructure of the Windsor and Tagore estates has a backbone strong enough to revive the forest ecosystem. Students' design strategies for the waterways included restoring historical streams, diversifying water flows, and rearranging available spaces,

such as open canals, alleyways, private yards, swimming pools, and public spaces. Motivated by a freshwater swamp forest where the waterway historically existed before being urbanized, one project reshaped a concrete canal to support urban adaptive swamp habitats. The intent was to optimize the flow of water, flora and fauna movement, and water quality for aquatic habitats, while considering traffic flows, pedestrian movements, and recreational trails. In this way, the urban waterways could be transformed into dynamic ecosystems as part of nature.

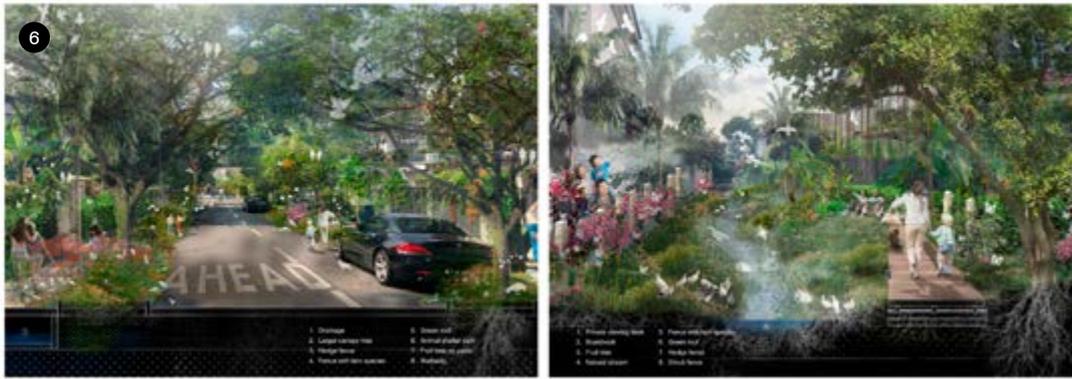
Rewilding degraded forests The CCNR forms the largest nature reserve in the centre of Singapore's mainland, but the forested areas along its periphery are fragmented, resulting in multiple disturbed habitats, the remnants of abandoned cultivation and intensive urbanization. The student design project aimed to retrofit these degraded forested areas into resilient and biodiverse hot-spots as a destination. The prime strategy was to mimic the intact life cycle of a primary forest (seed bank, germination of dipterocarps, establishment of seedlings, maturation or flowering of vegetation, reproduction, aging, death with gap formation, and decomposition) through strategic spatial and temporal planning. Proposed actions included using the remains of a cultivated fruit tree plantation area and injecting relevant plant communities to support habitats for microorganisms and targeted wildlife, such as banded leaf monkeys, hornbills, and sunda pangolins. The design interventions were bound together by grounded and arboreal connections for both wildlife and humans, by means of landform modification and planting, as well as constructed elements, such as forest trails and observation decks.

Rewilding neighbourhood landscapes

A dominant type of local housing estate was chosen for rewilding: private landed houses in Meng Suan, Windsor Park, and Tagore Estate. Since all neighbourhoods abut CCNR, the design vision was to soften the edges between residential areas and the forest. To this end, four strategies were proposed for private properties: reviewing barriers to enhance positive, urban-adaptable, and acceptable interactions between humans and animals; utilizing built structures, such as fences, roofs, and walls, as well as the unique topography of some old estates, to create local habitats;

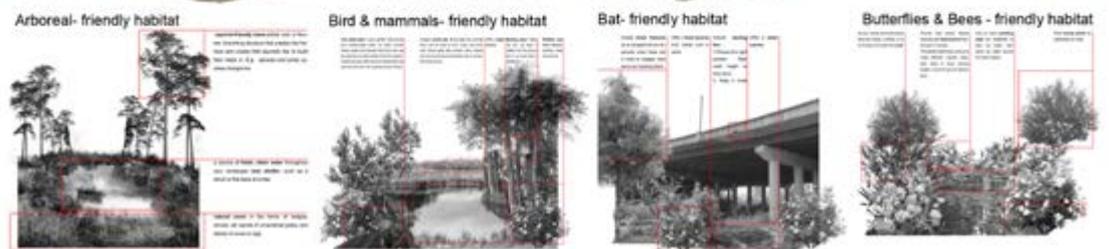
4. Selected nodes for deploying rehabilitation strategies. Gentle design elements for people's recreation purposes blend well with the context. Proposed by Chin Carissa and Dhuri Ruiee (MLA'21).

5. Water sensitive neighbourhood plan, where water flow becomes the catalyst for human and fauna flows. Proposed by Wang Haobo, Tanaka Mamiko, and Zhang Bingyi (MLA'21).



6. Concept of defencing a landed property site, for gradual and enhanced interaction between residents and wildlife. Proposed by Zhong Yixin (MLA'21).

7. Diversifying conditions beneath and around viaducts for enhanced movement of wildlife to and from CCNR. Proposed by Zhou Zuyuan (MLA'21).





An interdisciplinary approach has value - we learned from relevant theories in biology before site analysis. In particular, local ecologists provided practical advice on whether the proposed habitats could feasibly be implemented in an urban context.

establishing a new housing landscape typology for the spontaneous growth and maturation of landscapes; naturalizing front and back yards, street greenery, and drainage with multi-tiered native vegetation.

Rewilding spaces under viaducts Located in the southern part of the nature reserve, neglected space under viaducts could offer a safe haven for animals by fostering terrestrial habitats, as these areas are typically less disturbed by human presence. For example, the poor lighting conditions may become a positive opportunity to attract bat species. The design strategies for spaces under viaducts included the following: improving the soil for retention of fertility to grow microorganisms as food sources for small insects so that the space ultimately attracts diverse groups of animals; forming an outward cold airflow and then reconfiguring planting to assist seed dispersal, plant reproduction, and movement of pollination from CCNR; diversifying landscapes, including wetlands, grass lands, and dense canopy areas; building culverts, canopy bridges, and tunnels to help wildlife cross the road safely.

Key takeaways from rewilding projects

All proposals tried to reflect tropical forests as intact ecosystems able to support significant long-term sustainability and biodiversity and store bio-elements, with hardiness in the face of external disturbances. The proposed design strategies show how learning from the forests can be applied to UGSs to enhance the city's ecosystems, particularly in the areas of habitat creation, defragmentation and mitigating impacts of climate change, thus increasing connectivity and adding to the resilience of existing habitats and nature reserves.

The projects offer several key takeaways. Firstly, rewilding actions can be applied in a variety of urban landscape typologies. Secondly, each typology has unique opportunities and challenges in the degree of wildness that people and nature

accept. Thirdly, an interdisciplinary approach adds value; we learned from relevant theories in biology before site analysis. In particular, local ecologists provided practical advice on whether the proposed habitats could be feasibly implemented in an urban context, how they were likely to grow over time, and whether targeted fauna species would be attracted to and impacted by them.

For the successful implementation of a rewilding approach in the real world, however, urban planning policy and economic ramifications need to be considered, with long-term monitoring and value assessment from multiple angles. It is also necessary to deal with practical challenges, including having wildlife in home gardens or managing increased roadkill in rewilded streetscapes. The next rewilding studio will push beyond a rudimentary understanding of ecology and seek to build practicability by balancing the coexistence of humans and nature, while evoking the untapped/speculative opportunity to create design for a more ecologically rich and robust Singapore. 

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¹ Design Studio is a course module at the National University of Singapore; it serves as a platform for design instructors, students, practitioners, and other professionals to collaboratively investigate a common issue. Students from the landscape architecture programme took part in this 14-week module. The academic design studio facilitates the generation of systemic design strategies because of its emphasis on the comprehensive understanding of related theories in various fields, as well as its relative independence from commercial concerns.

