

CHAPTER 27

Future Directions of Habitat Restoration and Enhancement in Singapore

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The Story So Far

This Handbook on Habitat Restoration showcases only 24 diverse habitat restoration initiatives, spread across the whole of Singapore (Fig. 1 & 2), out of the many other past and ongoing habitat restoration and enhancement work that the National Parks Board (NParks) has had implemented. From an ecological perspective, the ecosystems that are restored or enhanced cover a broad spectrum that are found in Singapore, including forests, freshwater swamps, rivers, wetlands, freshwater marshes, grasslands, coastal forests, beach vegetation, urban ecosystems and coral reefs. As a result, these habitat restoration and enhancement efforts contribute significantly to the conservation of Singapore's native biodiversity.



Fig. 1. The above map shows the locations of the habitat restoration initiatives carried out across Singapore. (Image modified from OneMap)

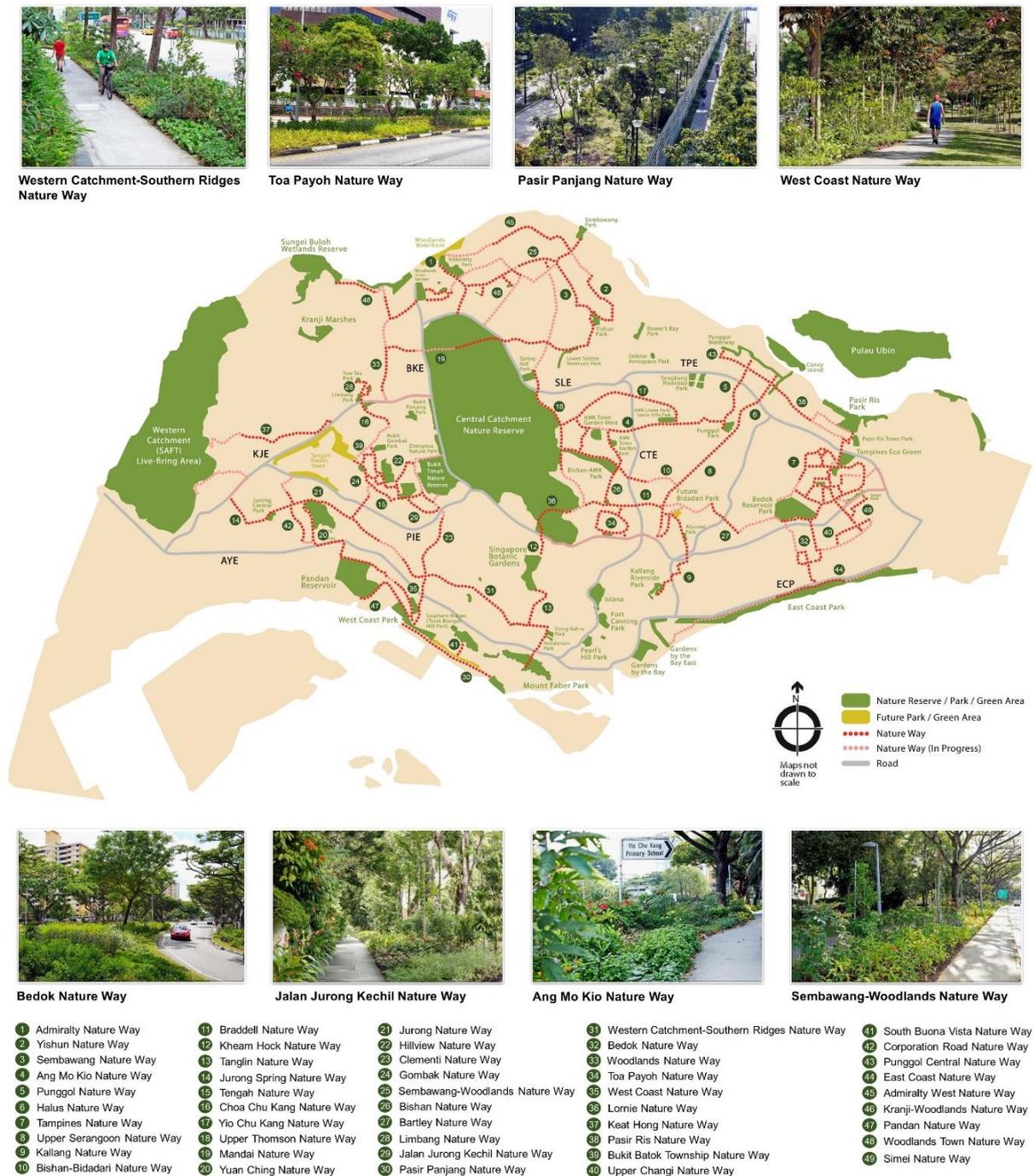


Fig. 2. The current extent of the nature ways is presented in the above map.

Central to making Singapore a City in Nature a reality is the conservation and restoration of ecosystems. This linkage is discussed in Chapter 1. Playing our part as a global citizen in biodiversity conservation, the publication of this handbook is NParks' contribution to help build capacity in making the UN Decade on Ecosystem Restoration 2021–2030 a success.

The handbook has a chapter on general principles and approaches that are frequently used and well-tested locally and globally (Chapter 2) for easy access by practitioners of habitat restoration and enhancement.

To ensure credibility and consistency in the habitat restoration initiatives, the scientific approach of systematically identifying targets, setting goals and objectives, selecting appropriate methodologies and monitoring indicators was adhered to as closely as practical. The methods used for habitat restoration were diverse, including natural or assisted natural regeneration, framework species, and maximum diversity method, and a combination of methods. Emphasis was placed on engaging the community and enhancing park-users' experience as it was recognized that social resilience was key to long-term sustainability of these efforts.

Additionally, it is crucial that the health status of the ecosystems be monitored regularly, and expeditious adaptive management measures be applied to retain the integrity of the whole system.

There are far more NParks' officers, partners and collaborators who contributed to making the habitat restoration and enhancement projects featured in this handbook a successful reality than the 55 listed authors. From a strategic perspective, the involvement of officers from at least fifteen NParks' divisions and external agencies attests to the inter-disciplinary and cross-sectoral nature of the projects.

NParks' officers have a wealth of knowledge and experience in botany, horticulture, zoology, planning, and biophilic design. From a technical perspective, the officers applied their skills and knowledge in the implementation of the restoration projects innovatively. Most of the case-studies contained lists of plants that were used for restoration and enhancement for different habitat types and for varied purposes as in the Learning Forest (Chapter 3), Rifle Range Nature Park (Chapter 5), Coney Island Park (Chapter 11), Kent Ridge Park (Chapter 15), and the HortPark Bee Trail (Chapter 17). Checklists of bird, dragonflies and damselflies, butterflies and moths, and bees and wasps that were recorded a few years after the completion of the Bishan-Ang Mo Kio Park (Chapter 9) were shared. For keen ornithologists, Kranji Marshes (Chapter 10) and Hampstead Wetlands Park (Chapter 19) had good reference lists of birds found in these two habitat restoration sites.

Restoration efforts commenced in some areas like the Learning Forest (Chapter 3), Eco-Link@BKE (Chapter 8), river restoration at Bishan-Ang Mo Kio Park (Chapter 9), mangrove restoration at Pasir Ris Park (Chapter 21), etc., more than 10 years ago. These sites continue to thrive and render multiple free ecosystem services like cooling the ambient temperatures, reducing flooding, retaining moisture during drought conditions, providing habitats for wildlife, serving recreational and educational opportunities, and many more. That people and biodiversity are still benefiting is an indication of the value of restoration and rehabilitation.

Positive outcomes of more recent projects like an increase in the quality and quantity of biodiversity recorded, are already evident in Kranji Marshes (Chapter 10), Kent Ridge slope stabilisation site (Chapter 15), parks in one-north (Chapter 16), Hampstead Wetlands Park (Chapter 19), etc. It could be inferred that results from restoration could be achieved rapidly.

Way Forward and Future Directions

It is crucial for cities in particular, that we should invest in more habitat restoration so that ecological resilience and resilience against the consequences of climate change could be addressed together more effectively and synergistically. It has been shown that the benefits of restoring a diversity of ecosystems in urban areas are ecologically and socially desirable as well as economically advantageous (Elmqvist *et al.*, 2015). As environmental changes accelerate (Prober *et al.*, 2019), and become more complex and unpredictable, it is imperative that there be a paradigm shift in our approaches to habitat restoration. It is no longer sufficient to restore or rehabilitate to the former ecological state, but the following will also have to be taken into consideration:

- 1) There is a diversity of reasons for habitat restoration, some of them might be conflicting and hence, practitioners have to set and balance priorities. For example, not all climate change solutions are good for biodiversity, but most biodiversity conservation actions usually contribute positively to mitigate negative climate change effects.
- 2) A broad range of ecosystems must be restored, i.e., quality not merely quantity. Hence, it is important to draw a plan to coordinate a range of habitat restoration projects that would be diverse in nature. This would increase ecological resilience, agility and flexibility in the event of scenarios of extreme conditions and unpredictability.

- 3) It is essential to include a complete representation of all the successional stages rather than concentrate on the climax stages. This strategy also helps to increase ecological resilience, agility and flexibility as well as long-term self-sustenance.
- 4) Long-term monitoring and adaptive management must be mandatory.
- 5) The involvement of all sectors of the community is pivotal to the success of the initiatives. Since it is difficult to predict the future, it is, hence, crucial to plan for known unknowns or unknown unknowns.

Final words

The Handbook on Habitat Restoration is a work that distils the best of NParks' passion, technical expertise, and dedication to collaboration with numerous partners. It is a celebration of the past habitation projects that we had carried out; the ones which are still being implemented at present; and many more that we will be embarking on in the future. We have learnt much during this journey and will continue to innovate, improve, improvise, adapt, change, and renovate for biodiversity conservation and resilience to climate change.

References

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- Prober SM, Doerr VAJ, Broadhurst LM, Williams KJ & Dickson F (2019) Shifting the conservation paradigm: a synthesis of options for renovating nature under climate change. *Ecological Monographs*, 89(1): e01333. DOI:10.1002/ecm.1333