

Windsor Nature Park

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Windsor Nature Park is located on the eastern side of Singapore's Central Catchment Nature Reserve (CCNR). While it is currently predominantly a regenerating secondary forest, much of the land once served as a rubber plantation. Up until the 1950s, kampong villages and remnants of an aquatic plant farm existed on site. Visitors familiar with the area would take a natural trail leading to the TreeTop Walk, a key attraction in MacRitchie.

The planning of the nature park is based on three objectives put forth at its inception: (a) strengthening the integrity of the CCNR through preservation of a green buffer that protects the nature reserve core from surrounding urban impacts; (b) providing enhanced recreational possibilities in a natural environment; and (c) promoting appreciation of Singapore's natural and cultural heritage through education and community involvement.

Green Buffer

Nature reserves are protected areas of rich biodiversity that are representative sites of key indigenous ecosystems. As part of a holistic conservation approach, some nature parks have been established on the margins of the Nature Reserves to act as green buffers—an extension of the nature reserves. National Parks Board (NParks) enhances the habitats within these buffers so that they remain rustic and forested, and at the same time provide an alternative venue for the public to enjoy recreational activities. There are currently six nature parks in Singapore, covering more than 250 hectares. The 75 hectare Windsor Nature Park is Singapore's sixth nature park.

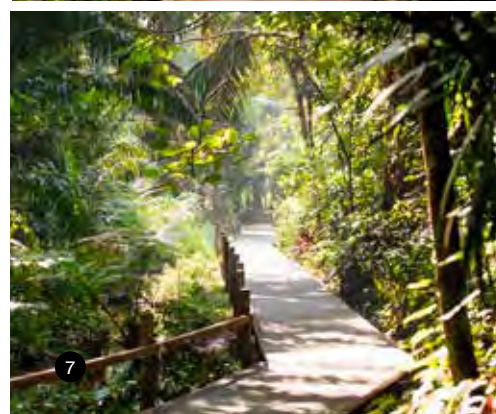
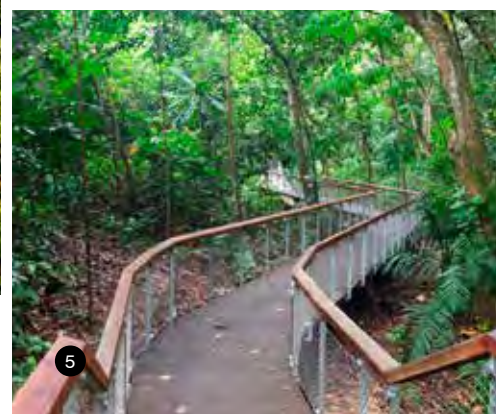
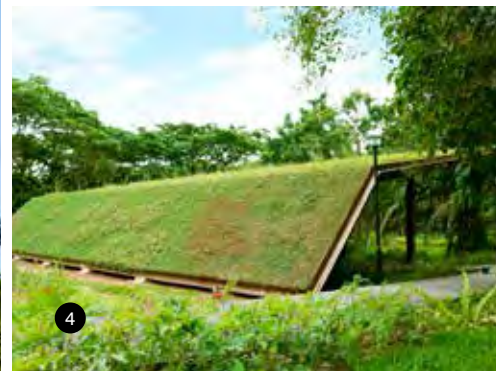


Conservation Begins at the Design Stage

Set amidst a backdrop of green oasis and a marsh habitat teeming with biodiversity, the amenities at Windsor Nature Park are thoughtfully integrated with the lush greenery.

At the entrance node, the back of the visitor pavilion was designed to face northeast with the intention to screen off the glaring heat of the morning sun. The green roof of the visitor pavilion planted with *Ischaemum muticum*, *Portulaca grandiflora*, *Arundina graminifolia* and *Axonopus compressus* var. dwarf not only maintains a cool temperature under the pavilion, but also provides visitors respite from the sun and rain. The roof of the public toilet is raised to utilise natural lighting and ventilation, minimising energy usage. Between the public toilet and the visitor pavilion, a vegetated swale meanders through the sloping terrain to divert storm water away from the entrance node.

1. Main entrance at Windsor Nature Park. Image by Zarch Collaboratives Pte Ltd
 2. Entrance to Venus Loop. Image by Zarch Collaboratives Pte Ltd



As part of the enhancements, existing trails were repaired. New trails and raised boardwalks were added to the trail network to minimise compaction on tree roots, and to enhance the experience of nature lovers by bringing them through a dynamic spatial journey. From the entrance node, a section of Venus Loop which runs along the newly created wetland leads to the Hanguana Trail, an educational trail planted with native plants, and upward into the swampy habitat of the Squirrel Trail. The trail then continues further to the elevated boardwalk (Drongo Trail).

A critical element in the implementation of the nature park was to construct the boardwalks, features, and facilities within the forest in a manner that would not harm the sensitive environment. To minimise the impact on the fragile streamside and forest ecosystem, much of the trail consists of boardwalk constructed of Fibre Reinforce Plastic (FRP) panels. These are lightweight anti-slip panels which could be transported to the worksite manually. Viewing decks located at key points allow visitors to observe the riparian forest close-up without trampling the forest floor vegetation. The Drongo Trail, which is an elevated boardwalk (of maximum height of 4m off the ground level), was built entirely without the need to bring in machineries. Existing trails were revamped with raised boardwalks, allowing lower impact access to the forest. Protective barriers were also erected around vulnerable areas of the forest.

3. Public toilet with raised roof for natural ventilation. Image by National Parks Board Singapore

4. Visitor Pavilion. Image by Zarch Collaboratives Pte Ltd

5. Drongo Trail. Image by Zarch Collaboratives Pte Ltd

6. Venus Loop before trail enhancement. Image by Zarch Collaboratives Pte Ltd

7. Venus Loop after trail enhancement. Image by Zarch Collaboratives Pte Ltd



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Since 2008, NParks and researchers have recorded 56 dragonfly species in Windsor Nature Park, which is nearly half of the 122 dragonfly species found in Singapore.



8. A wetland was created to form a marsh habitat. Image by Zarch Collaboratives Pte Ltd

9. Hanguana Trail. Image by National Parks Board Singapore

10. *Hanguana rubinea*. Image by Ang Wee Foong

11. Aerial view of habitat enhancement. Image by National Parks Board Singapore



Sensitive Enhancement and Ecological Linkage Wetland

Sensitive enhancement of the nature park began in early 2014. Within the entrance node a newly-created wetland, which includes an area broadened out to form a marsh habitat, is planted with native plant species such as the Spiny Lasia (*Lasia spinosa*) and the Aquatic Ginger (*Alpinia aquatica*). Due to the topography of the area and a high water table, much of the terrain at the entrance node was initially flooded during heavy rain. The wetland was created to divert away excess storm water runoff, to transform the area into an additional wetland habitat for the biodiversity associated with the existing stream network. The stream is a habitat for a number of rare species, so the protection of the banks and adjacent land was of outmost importance during the enhancement of the park. Water monitoring and biodiversity assessments were carried out during the planning and construction phases to ensure that the health of the stream systems were being maintained.

Trail network

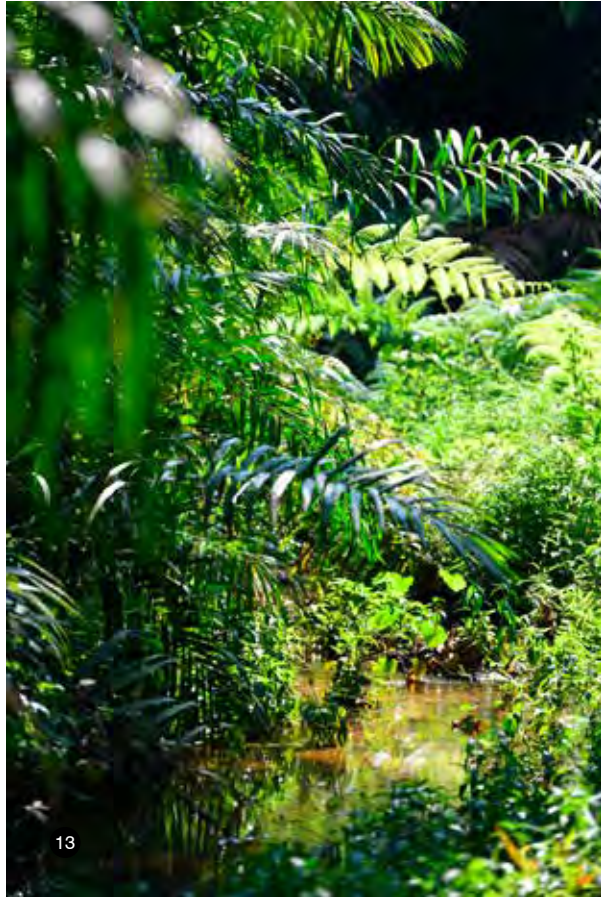
Off the main trail is the Hanguana Trail, an educational trail featuring rare native endangered *Hanguana neglecta* and endemic *Hanguana rubinea*. Plants named after Singapore such as *Zingiber singaporense* and *Durio singaporensis* are also highlighted here. More than one hundred trees comprising 10 native species, including the Kayu Gaharu (*Aquilaria malaccensis*) and Kayu Arang (*Cratoxylum cochinchinense*), are also planted at the Hanguana Trail.

The trail then splits into a fork continuing along the streamside Squirrel Trail where one can get up close to the freshwater swamp habitat. The end of the Squirrel Trail transverses into steps which climbs further up a steep forested slope. Here, a 150 m elevated boardwalk named the Drongo Trail provides visitors an opportunity to experience the forest at sub-canopy level while also preventing the impact of a surface trail along the slope.





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12. Students from Ngee Ann Polytechnic conducting ISM. Image by Chenny Li
 13. Natural stream. Image by National Parks Board Singapore
 14. Squirrel trail. Image by National Parks Board Singapore

The Drongo Trail loops back to the Venus Link, where remnants of the kampong house foundation and former aquatic farm can be seen along the streamside trail. Here, a rich biodiversity of dragonflies can be seen. Since 2008, NParks and researchers have recorded 56 dragonfly species in Windsor Nature Park, which is nearly half of the 122 dragonfly species found in Singapore. Three of these species – the Nighthawker (*Heliaeschna crassa*), the Lesser Nighthawker (*Heliaeschna uninervulata*), and the Spear-tailed Duskhawker (*Gynacantha dohrni*), are new records for Singapore. Other native freshwater fauna that visitors can look out for are the Masked Rough-sided Frog (*Pulchrana laterimaculata*), the Malayan Pygmy Halfbeak (*Dermogenys collettei*) fish, and the Malayan Freshwater Prawn (*Macrobrachium malayanum*).

Habitat Enhancement

In addition to improving the trail network, the forest habitat was sensitively enhanced and planted with more than 400 trees including native plants such as the *Cratoxylum maingayi*, the Penaharan Pianggu (*Horsfieldia irya*) and the Penarahan Gajah (*Horsfieldia sucosa*), as well as native plants salvaged from the Central Catchment Nature Reserve (CCNR) such as the Kembang Semangkuk Jantung (*Scaphium macropodum*). Planting these trees will help to attract more biodiversity, which in turn, will help to sustain a thriving ecosystem. This ecosystem supports a wide variety of native fauna including the Sunda Pangolin (*Manis javanica*) and the Mangrove Snake (*Boiga dendrophila*). The enhancement of the forest habitat also strengthens the ecological linkage between the northern and southern parts of the CCNR, facilitating the safe passage for fauna.



Windsor Nature Park offers opportunities for communities to be equipped with conservation knowledge through various outreach programmes.


Community Involvement

Outreach plays a crucial role in nature conservation. Windsor Nature Park offers opportunities for communities to be equipped with conservation knowledge through various outreach programmes such as guided walks, invasive species management and “Operation No Release”.

Nature appreciation walks allow visitors to discover the importance of Windsor Nature Park as a buffer to the CCNR. The walk is held monthly, interested participants can register for the walk at www.nparks.gov.sg.

Invasive species pose a threat to our native biodiversity. They compete for space, light, water and nutrients with other native species, causing the latter to die and prevent other native species from establishing. Invasive species management requires manual removal of these competitive invasive species, and is one of the management

strategies of controlling fast growing populations. It is labour-intensive and needs to be a sustained effort. Students from Ngee Ann Polytechnic have been working with NParks to create an environment conducive for our native biodiversity by removing invasive plant species.

“Operation No Release” is a campaign that aims to spread public awareness on the dangers related to the release of animals into parks, nature areas, reservoirs and waterways. Windsor Nature Park is one of the sites where NParks, schools such as Nanyang Junior College and volunteers share the impacts of animal release with the public through a simple survey. 

Acknowledgements

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