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Older forests here have been losing larger trees over past three decades

NParks boosts efforts to protect mature trees; DNA of roughly 100,000 insect species found

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Battered by storms, Singapore's older forests have been losing their larger trees over the past three decades, a national research programme has revealed.

Under the tropical forest ecology research programme, a first-of-its-kind survey of flying insects in forests here has also uncovered DNA belonging to roughly more than 100,000 species, of which about 10 per cent are known to science.

These findings were released on June 6 to kick off the Festival of Biodiversity 2026. The annual celebration of Singapore's natural heritage is held by the National Parks Board (NParks) and the Biodiversity Roundtable, a network of more than 20 non-governmental organisations.

The net loss of large trees in Singapore's green core, the Central Catchment Nature Reserve, has prompted NParks to accelerate efforts to protect its mature "mother trees".

According to the study, which tracked the trees in the reserve between 1992 and 2022, the number of trees measuring 30cm or larger in diameter in older forests dropped from 121 per hectare to 87.

The NParks researchers attributed this decline mainly to damage from storms, which can fell trees.

"Mother trees" are mature trees that play a key role in the ecosystem, producing the majority of the fruits and seeds that feed local wildlife and propagate the next generation of forests, said NParks' deputy director for forest ecology Chong Kwek Yan, who led the research project.

With adverse weather conditions expected to intensify owing to climate change, the loss of these trees is likely to become a challenge, he added, citing projections by Singapore's third National Climate Change Study.

The study predicts that wind speed could increase by up to 20 per cent by the end of the century, increasing the risk of trees toppling over.

Chong said the agency will thus step up surveys to locate these "mother trees" and prioritise them for seed collection and propagation to increase the supply of their saplings for forest restoration.

"NParks' researchers will also work closely with operational teams to translate the findings from studies into on-the-ground practices – for instance, by identifying which species and planting strategies can best support forest resilience against storm disturbance over the long term," he added.

On a positive note, the same research found that the reserve's younger forests have been maturing healthily.

Beneath the canopy, Singapore's largest survey of flying insects in its forests has set the benchmark for monitoring the health of Singapore's insect population.

The study was a collaboration between the National University of Singapore's (NUS) Plant Ecology, Evolution and Biogeography Lab, the Lee Kong Chian Natural History Museum and NParks.

The survey recovered an estimated 100,000 species from 24 plots across the Central Catchment Nature Reserve, Clementi Forest, Dover Forest and several nature parks between 2024 and 2025.

By comparison, Germany recorded about 35,500 insect species, based on past research. Temperate forests are typically less diverse than tropical forests.

Ecologist Lim Jun Ying, who coled the survey, said Singapore serves as a microcosm for tackling South-east Asia's broader conservation challenges, given that nearly all of its original forests have been cleared.

"A lot of conservation biologists and ecologists look to Singapore to see if we can recover our forests and biodiversity, which can yield insights that are transferred to other parts of the region," the NUS assistant professor said.

While physically small, flies, wasps and other flying insects form the foundation of healthy forest ecosystems by acting as a food source and by helping to decompose organic matter and support plant reproduction.

The diversity found by the study – a doctoral research project by Angelica See under the Plant Ecology, Evolution and Biogeography Lab – paints a picture of how many insect species Singapore's tropical forest is capable of supporting.

"It is possible that all these species are performing ecological roles in slightly different ways," said the Lee Kong Chian Natural History Museum's senior curator of insects Hwang Wei Song, who coled the study. "If so, that is a lot of ecological roles that they are doing."

Minister of State for National Development Alvin Tan, who opened the Festival of Biodiversity 2026, said the insect study's findings are a hopeful reminder of the richness of Singapore's tropical forests at a time when the animals' populations are declining globally.

He lauded another NUS and NParks study under the programme, which was the first to map the relationships between forest trees and the animals that feed on their fruits.

Tan, who is also Minister of State for Trade and Industry, said the Government will continue to invest in forest ecology research and welcomed researchers and corporate sponsors to join the tropical forest ecology research programme.

He also launched the updated Nature Conservation Masterplan to protect biodiversity in the city.

The refreshed strategy takes into account escalating challenges from climate change and urbanisation.

One new focus area is in strengthening ecological connectivity.

Although more than 90 per cent of Singapore's original primary rainforests, mangroves and freshwater swamps have been lost to development over the past two centuries, important pockets of biodiversity remain, according to NParks.

Tan said that beyond conserving key habitats, the plan will place greater emphasis on enhancing connectivity between these spaces, enabling species movement and ensuring their long-term persistence.

The masterplan also incorporates the new National Institute for Marine and Ocean Sciences, announced during the 2026 Budget debate.

The $60 million research centre reflects a growing emphasis on coordinating Singapore's marine science capabilities.

NParks says the institute aims to develop science-based adaptive management strategies to support both marine conservation and the sustainable management of shared sea spaces.

Tan paid tribute to the late NParks director for biodiversity information and outreach Cheryl Chia, who played a pivotal role in growing the Festival of Biodiversity and spent three decades working for the agency.

The 15th edition of the Festival of Biodiversity runs until June 7 at the National Library Building.

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Tropical insect census

Amid a global decline in insect populations, Singapore's largest survey of flying insects in local forests was carried out to capture the nation's biodiversity. Here are the highlights.

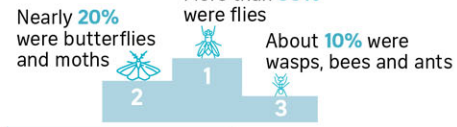
By the numbers

More than **100,000*** species of mostly flying insects from about **140,000** unique insect DNA sequences.

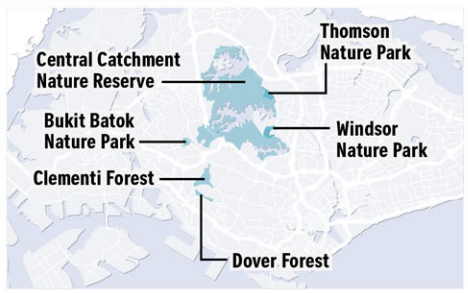
Only an estimated **10%** (or about 10,000) of Singapore's insect species are known to science. In comparison, Germany has about **35,500** insect species.

NOTE: *An estimate from preliminary analysis

Most common flying insects found*



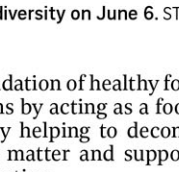
Location of survey



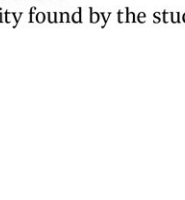
Method

1. Trapping
- Malaise traps were set up from early 2024 to early 2025.
- The insects flew into the traps' screens and moved upwards, where they were collected in containers.

2. Sorting
A piece of equipment called a fractionator sorted and separated insects by size.



3. Insects sorted
The specimens were sorted by size classes and counted.



4. Metabarcoding
- The DNA was indexed, sequenced and analysed using a speedy process called metabarcoding.
- Unlike DNA barcoding, metabarcoding allows for the simultaneous DNA sequencing of many insect species all at once within the same sample.

How flying insects keep forests healthy

- They are food for other animals
- They break down organic matter, releasing nutrients into the ground
- They help plants reproduce by spreading their pollen
- They keep pest species under control

Sources: LIM JUN YING, HWANG WEI SONG, ANGELICA SEE Photos: LIM LE XUAN, HWANG WEI SONG, LIM JUN YING, ANGELICA SEE
SUNDAY TIMES GRAPHICS

Minister of State for National Development Alvin Tan (in black) and National Parks Board chief executive Tan Puay Yok (left) checking out a booth by Commonwealth Secondary School students and senior biology teacher Jacob Tan at the two-day Festival of Biodiversity on June 6. ST PHOTO: GIN TAY