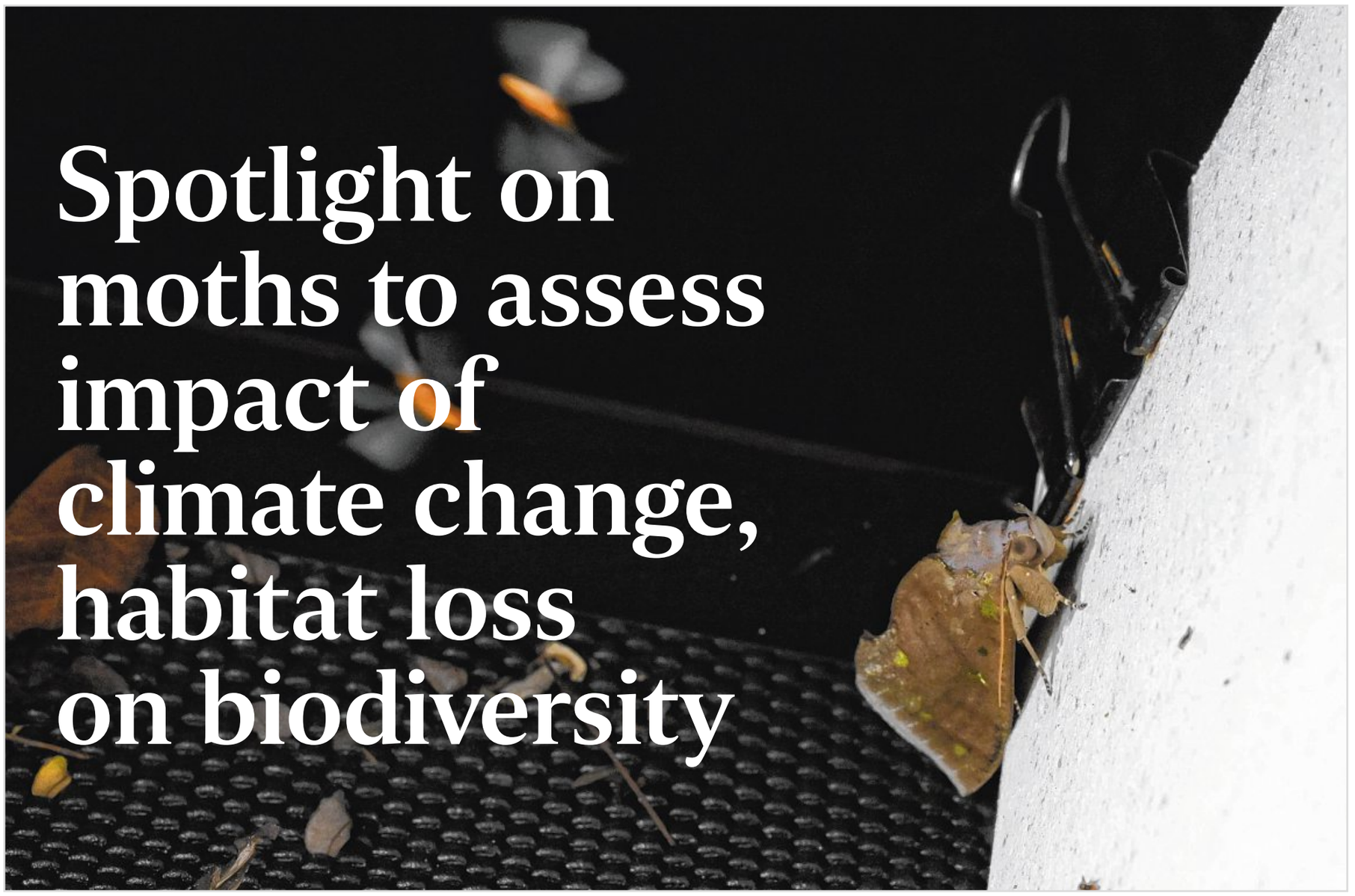
Spotlight on moths to assess impact of climate change, habitat loss on biodiversity



Above: Moth species and other insects found at various biodiversity monitoring systems across Singapore. PHOTO: NTU

Left: A moth seen on a remote biodiversity monitoring unit on the NTU campus. Moths are critical in helping to pollinate plants and flowers at night. ST PHOTOS: MARK CHEONG

The remote biodiversity monitoring unit on the NTU campus, one of 10 that have been placed around the island to help determine the moth species in Singapore. Each unit is fitted with an ultraviolet light source to attract the insects and a camera to automatically photograph them.

From left: NTU Asian School of the Environment project officer Ng Wan Lin, Associate Professor Eleanor Slade, PhD student Nicole Su-Yin Dorville and research fellow Sean Yap beside the biodiversity monitoring unit on the campus.

Monitoring stations set up islandwide to identify insect species key to ecosystem

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While one might think of them as the half-ignored siblings of butterflies, moths play a role in the Singapore ecosystem that has not been adequately understood.

Local researchers are now shining a spotlight on these flitting, mostly nocturnal, creatures.

Moths are critical in helping to pollinate plants and flowers at night, taking over the role played by butterflies and bees during the day, said Associate Professor Eleanor Slade of NTU's Asian School of the Environment (ASE).

They are also an important food source for bats and birds, and their presence is a good indicator of the health of an ecosystem, she added.

Reports have pointed to an insect Armageddon caused by pollution, climate change and habitat loss, which could have ramifications on food production for humans.

To help determine the moth species found in Singapore, 10 remote monitoring stations have been placed around the island, each fitted with an ultraviolet (UV) light source to attract the insects and a camera to automatically photograph them.

With the help of artificial intelligence, the moth species can then be identified in real time, said Prof Slade, who runs ASE's Tropical Ecology and Entomology Lab.

However, a local database of moth species has to be established first, and the researchers plan to use images from citizen science platform iNaturalist.

The iNaturalist app allows the public to photograph and record interesting plant and animal species that they encounter.

Moths can help scientists understand how biodiversity might be impacted by climate change and forest loss over the years. Coming to grips with how these species fare over time can also provide insights on their resilience, Prof Slade added.

There are between 400 and 1,000 moth species in Singapore, but since most of them are active at night, they are not very well studied, said Ms Nicole Su-Yin Dorville, who is doing her PhD in novel methods for monitoring the response of biodiversity to environmental change.

"Dragonfly or butterfly enthusiasts often take a passing interest in moths, but there has never been an in-depth study of the moth species in Singapore," she added.

While the researchers will not disclose the locations of the monitoring stations to the public, the sites chosen run the gamut from nature reserves to neighbourhood parks, said Prof Slade.

"These sites range across a gradient of vegetation from undisturbed forests to parks, which have more light pollution and human activity that can disturb the moths' natural behaviour," she added.

Moths are attracted to blue radiation and UV light, which the moon reflects.

However, light pollution could disorient the moths away from their food sources or refuge – moths congregating around street lamps are exposed to predators.

Sound recording systems are also placed close to the light traps in order to help identify potential bat species which feed on these moths, said Prof Slade.

Bats use echolocation to find food and navigate – they emit high-frequency sounds inaudible to the human ear and listen to the echoes as the sound waves bounce off different objects in the environment.

The data from the monitoring systems will feed into a larger study helmed by Britain's Centre for Ecology and Hydrology (CEH) and the Alan Turing Institute, which is looking to better establish moth populations in tropical regions where there are large numbers of understudied moth species.

As part of the Amber Project, as it is called, a network of 40 monitoring systems will be deployed in places that are biodiversity hot spots, including Singapore, Kenya, Costa Rica, Japan and Thailand, said Dr Jenna Lawson, an ecological network manager at the CEH.

For instance, Costa Rica has some 20,000 species of moths, but only 6,000 have been properly identified.

In contrast, most of Britain's 2,500 moth species have been relatively well studied.

Outside the Amber Project, the same biodiversity monitoring system has so far already been tested in Britain – where projects have focused mostly on measuring the impact of sustainable agriculture on biodiversity – by the CEH.

Farmers in Britain are encouraged to maintain hedgerows and plant a wide variety of flowers in a bid to help attract more biodiversity.

This comes as the country's biodiversity net gain rule states that wildlife habitats must be left in a measurably better state than they were before development.

Monitoring systems have shown that this has been helpful in attracting more night-time flying insects, such as moths, to local farmland, helping bat and bird species to thrive, said Dr Lawson.

Prof Slade hopes to use the monitoring systems in Singapore to also document other elusive insects, particularly nocturnal ones, which might otherwise be difficult to study.

They include dragonflies, beetles, cicadas and crickets, all of which have inadvertently landed on some of the monitoring stations islandwide, she noted.

With better data on the insect diversity in Singapore, and the roles these insects play in an ecosystem, more can be done to conserve them, said Prof Slade.

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