

Gauging benefits of natural ecosystems in fighting floods

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How much can a forest do in mitigating floods in Singapore and what are the economic and human costs of cutting the forest down?

These may seem hard to quantify, but researchers from Nanyang Technological University's (NTU) Earth Observatory of Singapore (EOS) have developed a framework to evaluate the impact of nature-based solutions, such as forests, in reducing flood risk.

Using modelling, they are able to quantify the benefits of natural ecosystems in fighting floods as well as losses when these natural resources are destroyed.

The framework also produces metrics that can allow policymakers to compare the effectiveness of nature-based solutions with other flood mitigation measures such as flood walls and levees, in terms of economic and human costs.

The study, which was published in the journal paper *OneEarth* on Sept 17, comes as Singapore is looking to employ a range of nature-

based solutions, such as mangroves, to tackle climate change.

Assistant Professor David Lallemand, of NTU's Asian School of the Environment, and a principal investigator at EOS, said: "While we have known of the benefits of natural ecosystems in reducing flooding for a long time, one of the main obstacles to the widespread use of such solutions has been the difficulty to quantify this natural protection.

"Our study demonstrates that the benefits of the natural ecosystem can be calculated with the same amount of rigour, and using the same metrics, as engineered infrastructure. These tools can be used by engineers and water resources managers in Singapore as part of their arsenal to increase the local flood resilience."

Using modelling, the study zoomed in on the possible scenario of continued deforestation at the Myanmar Chindwin River basin, and showed that protecting these forests could reduce the economic and human costs of floods by 14 per cent.

Protecting these forests from deforestation prevents around



US\$1 million (S\$1.35 million) in flood losses annually and protects some 30,000 people in the next decade, said Prof Lallemand, who co-led the study.

This is especially important as deforestation is known to be rife in South-east Asian countries.

The modelling can also be applied to other nature-based solutions, such as river restoration, where floodplains are used to expand the size of the river.

"Natural ecosystems such as forests can absorb a lot of rainwa-

ter and slow down the travelling of water to low-lying lands and rivers. So rather than a rapid and intense surge of water which can cause flash floods, these forests can reduce the total amount of water channelled to rivers and drainage systems and spread it over time, which manages the extreme rainfall," Prof Lallemand added.

In Singapore, urban trees can only do so much in flood proofing, given the high intensity of storms here and the high level of urbanisa-

tion, said Assistant Professor Perrine Hamel of the Environment and an EOS principal investigator who co-led the study.

"However, cutting down forests such as the Clementi and Dover forests will have an impact on increasing run-off, though the flood mitigation benefits that these forests provide can be replaced with built infrastructure," she added.

For example, this could include PUB's Active, Beautiful, Clean

Assistant Professor Perrine Hamel, an Earth Observatory of Singapore principal investigator who co-led the study, says cutting down forests such as the Clementi and Dover (left) forests will have an impact on increasing run-off, though their flood mitigation benefits can be replaced with built infrastructure. ST PHOTO: ONG WEE JIN

(ABC) Waters features, which are hybrid solutions combining engineered systems and nature-based solutions that can go a very long way to reduce flooding.

The framework therefore can also be used to compare and evaluate these ABC Waters features, measuring the benefits they provide in reducing the economic and human costs of flooding, taking into account a range of flooding events from small frequent ones to rare extreme events, said Prof Lallemand.

In Singapore, such costs could arise from the disruption and delays in traffic, or damage to homes and infrastructure due to flooding.

And with more erratic weather patterns and flash floods occurring because of climate change, Singaporeans would have to plan and adjust their activities according to the weather forecast, Minister for Sustainability and the Environment Grace Fu said recently.

To that, Prof Lallemand said it is important to begin discussions on risk levels that people will find acceptable, with flash floods becoming a mainstay in our daily lives.

"No city can be completely flood-proof. Are Singaporeans okay with having difficulty going to work, maybe two to three days a year because of a disruption in the transportation network due to flooding? Perhaps they are, perhaps not. And so we need to design our flood resilience strategies according to our acceptable risk level," he added.

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