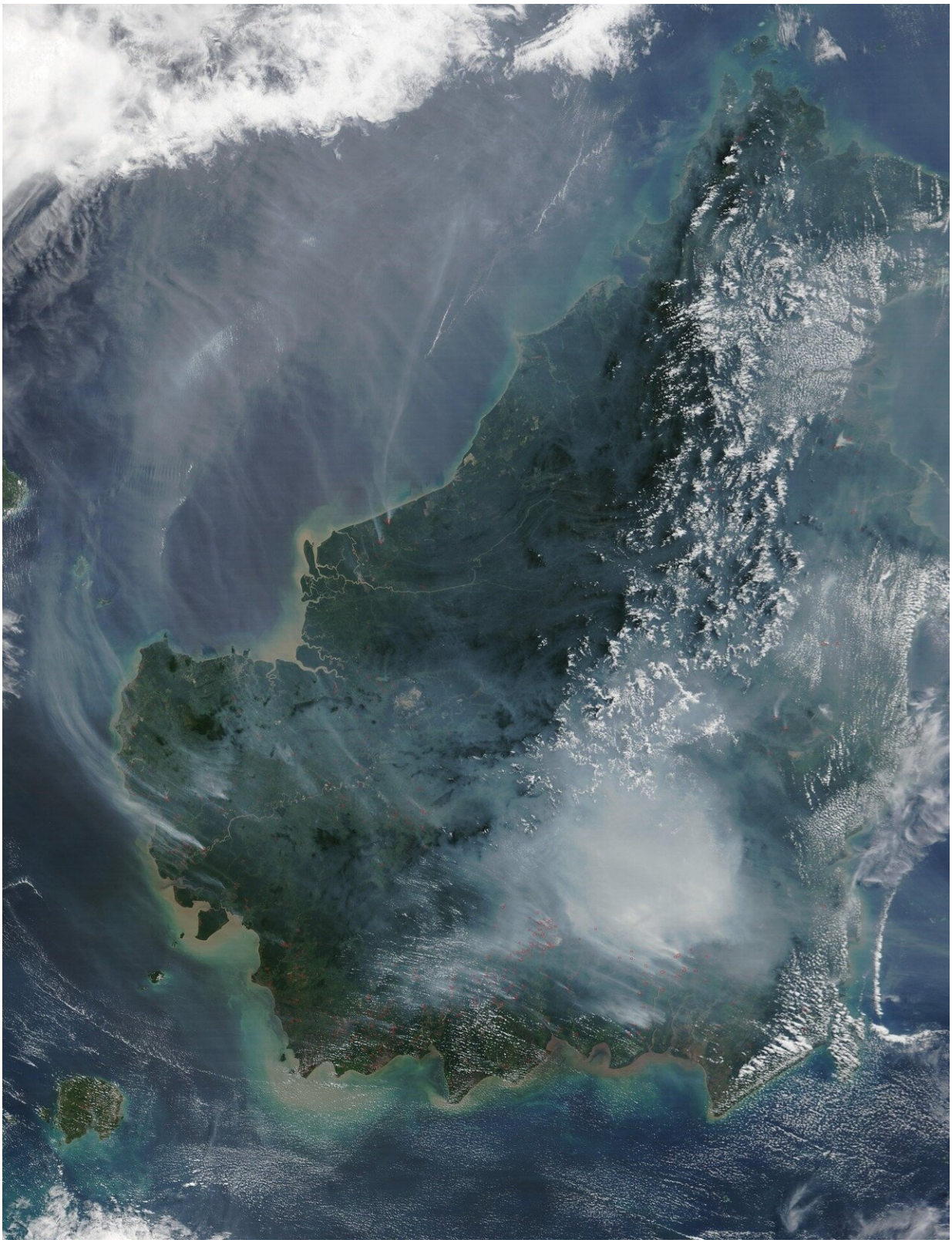
Study shows replanting logged forests with diverse mixtures of seedlings accelerates restoration

September 15 2023



Credit: Pixabay/CC0 Public Domain

Satellite observations of one of the world's biggest ecological experiments on the island of Borneo have revealed that replanting logged forests with diverse mixtures of seedlings can significantly accelerate their recovery.

The study "Positive effects of tree diversity on tropical forest restoration in a field-scale experiment" is published in *Science Advances*.

The experiment was set up by the University of Oxford's Professor Andy Hector and colleagues over 20 years ago as part of the SE Asia Rainforest Research Partnership (SEARRP). This assessed the recovery of 125 different plots in an area of logged tropical forest that were sown with different combinations of tree species.

The results revealed that plots replanted with a mixture of 16 native tree species showed faster recovery of canopy area and total tree biomass, compared to plots replanted with four or just one species. However, even plots that had been replanted with one tree species were recovering more quickly than those left to restore naturally.

Lead Scientist of the study, Professor Andy Hector (Department of Biology, University of Oxford) said, "Our new study demonstrates that replanting logged tropical forests with diverse mixtures of native tree species achieves multiple wins, accelerating the restoration of tree cover, biodiversity, and important ecosystem services such as carbon sequestration."

Greater diversity gives greater resilience

According to the researchers, a likely reason behind the result is that different tree species occupy different positions, or '"niches," within an

ecosystem. This includes both the physical and environmental conditions that the species is adapted to, and how it interacts with other organisms.

As a result, diverse mixtures complement each other to increase overall functioning and stability of the ecosystem. For instance, some tropical tree species are more tolerant of drought because they produce a greater amount of protective chemicals, giving the forest resilience to periodic times of low rainfall.

Professor Hector added, "Having diversity in a tropical forest can be likened to an insurance effect, similar to having a financial strategy of diverse investment portfolios."

In turn, a diverse mix of trees can support a much wider range of animal life. For instance, hornbills specifically require large mature trees with holes where the females can nest.

One of the world's biggest ecological experiments

Tropical forests cover just 6% of the planet's land surface but are home to around 80% of the world's documented species (WWF), and act as major carbon sinks. However, these critical habitats are disappearing at an alarming rate, chiefly due to logging for timber and conversion to palm oil plantations.

Between 2004 and 2017, 43 million hectares of tropical forest were lost—an area roughly the size of Morocco (WWF).

Restoring logged tropical forests is a crucial component of efforts to tackle both the nature and climate crises. Up to now, however, it has been unclear whether this is best achieved through allowing forests to restore themselves naturally (using dormant seeds in the soil) or through active replanting.

To investigate this, the researchers collaborated with local partners to set up the Sabah Biodiversity Experiment on 500 hectares of logged forest in the Malaysian state of Sabah on the island of Borneo. This was divided into 125 experimental plots that were either left to recover naturally or planted with mixtures of either one, four, or 16 tree species that are frequently targeted for logging.

The 16 species included several endangered species and the worlds' tallest species of tropical tree (Shorea faguetiana) which can reach over 100 m in height. The first trees were planted in 2002, with nearly 100,000 planted in total over the following years.

The recovery of the plots was assessed by applying statistical models to aerial images captured by satellites. Within a few years, it became apparent that those with one species did worse than those planted with a mixture of four species, and those enriched with 16 species did best of all.

Lead author Ryan Veryard (who analyzed the data as part of his Ph.D. at the University of Oxford), said, "Importantly, our results show that logged forest can recover so long as it is not converted to agricultural uses like oil palm plantation. They also emphasize the need to conserve biodiversity within undisturbed forests, so that we can restore it in areas that have already been logged."

The Sabah Biodiversity Experiment team are now starting a new three-year project to take a census of all the surviving trees in the experiment. This will be combined with a wider range of remote sensing methods (including lidar sensors carried by a helicopter and smaller sensors carried by drones) to give a more comprehensive analysis of forest health.

More information: Ryan Veryard et al, Positive effects of tree

diversity on tropical forest restoration in a field-scale experiment, *Science Advances* (2023). DOI: 10.1126/sciadv.adf0938. www.science.org/doi/10.1126/sciadv.adf0938