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Butterflies benefit from roadside greenery



Plants, especially flowering ones, are often grown along roads to beautify cities. Now, a new Singapore study has found that such small artificial green spaces beside busy roads are also beneficial to butterflies, which are important pollinators in urban ecosystems. The research findings could aid urban planners in developing strategies to build more sustainable cities, where roadside greenery with flowers improves the aesthetics and biodiversity of highly urbanised environments. The study, led by Nanyang Technological University, Singapore (NTU Singapore), revealed that road verges in Singapore – strips of vegetation planted along roads – can improve butterfly numbers and their diversity. This positive effect is especially true for verges with various flowering plants that are cut less frequently or selectively pruned. The greenery surrounding the verges has a positive impact on butterflies, suggesting that road verges can act as corridors linking the insects to other green spaces. The researchers also discovered that busy roads negatively affect butterflies. However, the benefits of road verges could offset this effect if traffic speeds are moderate. These results, published in *Landscape and Urban Planning*, were derived from extensive field surveys of 101 road verges across Singapore, each at least 30 m long and located along major roads with speed limits of 50 km/h to 70 km/h. These verges are artificially constructed and mainly planted with shrubs that are not native to the country. The effects of road verges on butterflies have not been well studied in tropical countries like Singapore until now. Earlier studies mainly concentrated on road verges in temperate climates, focusing on naturally occurring plants in less urbanised areas such as the countryside. But, the latest research examines cultivated vegetation along major roads in a highly urbanised tropical city-state. The findings of how road verges can improve butterfly biodiversity

support Singapore's long-term urban greening efforts since the 1960s. These efforts have evolved from the "Garden City" vision to today's "City in Nature" approach. It includes plans to turn more roads into nature ways, where trees and shrubs are planted along roads to mimic the natural structure of forests and help wildlife move between green spaces.

Blossom boost

The researchers studied butterflies because they adapt to new habitats like road verges and are important pollinators in urban ecosystems. Butterflies' sensitivity to environmental changes makes them valuable indicators of the health of ecosystems, and the insects are useful for highlighting conservation and biodiversity issues since they are easily recognised by the public. The Singapore study established that road verges with a mix of different flowering plant species directly increase both the total number of butterflies and the number of butterfly species in the verges. Butterflies indirectly benefit from verges that are larger and have a variety of plants, too, including flowering and non-flowering ones. This is because these factors boost the verges' diversity of flowering plants, which could then provide a steady supply of nectar for butterflies throughout the year since different plants bloom at different times. "A greater diversity of flowering plants offers a variety of nectar sources for butterflies. This can attract more species of butterflies, especially those that prefer a broad range of nectar from different flowers," explained Associate Professor Eleanor Slade from NTU's Asian School of the Environment (ASE), the senior author of the study. She collaborated with Associate Professor Janice Lee, also from ASE, who is a co-author of the research. "While road verges provide nectar sources for butterflies, green spaces away from busy roads may offer better conditions for butterflies to lay their eggs and rest," said Dr Tharaka S. Priyadarshana, a Research Associate from ASE and the study's first author. He added that butterflies were rarely observed laying eggs or basking in verges.

Gentle grooming

Another key finding of the study was that butterfly numbers, and species diversity improve when plants in road verges grow to different heights, such as when they are allowed to grow naturally and unevenly with less frequent pruning. This might be because a mix of taller and shorter plants creates different micro-climatic conditions – such as variations in temperature, humidity and light intensity – within road verges that appeal to different butterflies, said Dr Priyadarshana. A greater variety of plant heights might also offer better protection for the insects. Taller plants could provide cover from predators like birds and act as wind barriers that shield butterflies from turbulence caused by passing vehicles. Such wind turbulence can disrupt butterflies' ability to forage for nectar within road verges, making it harder for them to reach flowers and fly across roads to find other nectar sources or resting spots. On the other hand, having more uniform plant heights, such as from frequently cutting verge plants, reduces

butterfly abundance and species richness. These results could arise from regular pruning that hinders the plants' ability to flower. Similar plant heights are likely less suitable for butterflies and offer less protection. For road traffic, the study found that road verges have fewer butterflies and butterfly species when traffic density is higher. Traffic density increases when road speed limits are higher, and vehicles can travel faster. Besides wind turbulence, fast-moving traffic increases the likelihood that butterflies collide with vehicles and die. Roads with dense traffic tend to have worse vehicle pollution as well, and this has been shown in previous studies to affect both plants and butterflies adversely. For example, exhaust fumes can change floral scents, which makes it harder for butterflies to find flowers.

Where nature meets the city

However, the researchers demonstrated that for roads with speed limits of up to 70 km/h, the adverse effects of traffic on butterflies could be partially reduced by small changes made to road verges. In cities with limited space, these adjustments could be made without widening the verges. The changes include increasing the variety of flowering plants in road verges and allowing verge vegetation to grow to varying heights, such as by cutting only selected plants and trimming them less frequently. Selective or less regular pruning could also lower maintenance costs for road verges. However, such adjustments need to be balanced with safety needs, as verges with tall plants could obstruct motorists' view. Even so, the researchers believe that for roads with higher speed limits, the adverse effect of dense traffic could be too strong for verges to compensate. The study's findings thus offer valuable insights for urban planners and policymakers to design cities that are practical and more conducive to nature. Paper titled "The direct and indirect effects of road verges and urban greening on butterflies in a tropical city-state", published in *Landscape and Urban Planning*, 28 February 2025. DOI: 10.1016/j.landurbplan.2025.105335

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