FRAGMENTATION, RESTORATION AND CLIMATE CHANGE: SEEING GREEN IN A SEA OF REDD

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Tropical deforestation and fragmentation continues to be the major driver of biodiversity loss and a major contributor to climate change. Increasing numbers of forest-dependent rural poor rely on degraded forest for their livelihoods. The lowland forests of Southeast Asia are unique in that they are dominated by a single family of tree species, the Dipterocarpaceae. These forests are economically and ecologically vital to the region, providing valuable timber resources, are habitat rich in biodiversity and among the most important terrestrial carbon sinks in the world. Surprisingly, relatively little is known about the implications of forest fragmentation for the reproductive ecology of these foundation tree species.

First, I provide a brief review of our current understanding of how forest fragmentation influences the reproductive ecology and population genetics of dipterocarps. Using examples from our work in Borneo, the Seychelles and India, I argue that variation among species in their vulnerability to fragmentation is likely to impact not only community dynamics and forest tree species assembly, but also the patterns of genetic biodiversity in tree populations. Experimental work in Borneo examines how variation in flower size, pollinator body size and pollen dispersal vary across dipterocarp species, coupled with limited seed dispersal, this suggests some dipterocarps may be especially vulnerable to habitat fragmentation. In highly fragmented landscapes species of dipterocarp may become genetically isolated due to a limited capacity to disperse pollen among fragments. In addition, most dipterocarps are unlikely to be able to disperse seed to new sites amenable to colonization in a fragmented landscape. Work using genotyped dipterocarp seedlings in a nursery experiment provides evidence of a heterozygosity fitness correlation in the early stages of seedling establishment. In contrast, an endemic dipterocarp species in the Seychelles appears to be relatively insensitive to an extreme genetic bottleneck. The rapid rate of land use change across Southeast Asia and increasing forest fragmentation necessitates that we integrate our scientific understanding of the reproductive

ecology of these trees into future land use and forest management policies. This will impact on levels of biodiversity, ecosystem function and critical ecosystem services such as carbon storage.

Second, I present the results of a comprehensive review conducted to evaluate masting phenology, seed storage and seed dispersal distances across important tropical timber tree families. This information is synthesized to identify the implications of these seed-related traits for ecological restoration of tropical forests and its integration into REDD+ with a focus on Southeast Asian forest. Reversing the current trend towards highly fragmented forest landscapes will require conservation and restoration of Southeast Asia forests. I propose a framework upon which forest restoration could be established to conserve forest biodiversity, help mitigate climate change and support rural livelihoods.

Finally, I will summarize the gaps in our knowledge of how current and future land use change is likely to influence the resilience of lowland forest in Southeast Asia and suggest new research that will be essential to scientifically informed sustainable forest policy.