

A pre-adaptive approach for tropical forest restoration during climate change using naturally occurring genetic variation in response to water limitation

ABSTRACT

Effective reforestation of degraded tropical forests depends on selecting planting material suited to the stressful environments typical at restoration sites that can be exacerbated by increased duration and intensity of dry spells expected with climate change. While reforestation efforts in nontropical systems are incorporating drought-adapted genotypes into restoration programs to cope with drier conditions, such approaches have not been tested or implemented in tropical forests. As the first effort to examine genetic variation in plant response to drought in a tropical wet forest, we established a watering experiment using five replicated maternal lines (i.e. seedlings from different maternal trees) of five dipterocarp species native to Borneo. Apart from the expected species level variation in growth and herbivory (3-fold variation in both cases), we also found intraspecific variation so that growth in some cases varied 2-fold, and herbivory 3-fold, among genetically different maternal lines. In two species we found that among-maternal line variation in growth rate was negatively correlated with tolerance to water limitation, that is, the maternal lines that performed the best in the high-water treatment lost proportionally more of their growth during water limitation. We argue that selection for tolerance to future drier conditions is not only likely to impact population genetics of entire forests, but likely extends from forest trees to the communities of canopy arthropods associated with these trees. In tropical reforestation efforts where increased drought is predicted from climate change, including plant material resilient to drier conditions may improve restoration effectiveness.