



Response

Silvicultural intensification for tropical forest conservation: a response to Sist and Brown

FRANCIS E. PUTZ^{1,*} and TODD S. FREDERICKSEN²

¹*Department of Botany, P.O. Box 18526, University of Florida, Gainesville, FL 32611, USA;* ²*Life Sciences Division, P.O. Box 1000, Ferrum College, Ferrum, VA 24088, USA; *Author for correspondence (e-mail: fep@botany.ulf.edu; fax: +1-352-392-3993)*

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Introduction

We welcome the comments by Sist and Brown (henceforth S & B) about our suggestion that in some tropical forests, silvicultural interventions need to be intensified to promote regeneration of some commercially valuable species and to otherwise sustain timber yields. Although there is nothing particularly new about this suggestion, it is often lost in campaigns to minimize the deleterious environmental impacts of logging. We also applaud S & B's efforts to promote reduced-impact logging (RIL) and agree that for forests well stocked with advanced regeneration of commercial species, maintaining pre-intervention forest structure by using RIL techniques represents a major step towards the goal of sustainable forest management. Given how difficult it is to improve logging practices (e.g., Putz et al. 2000; Blate et al. 2001), even when application of RIL techniques would be to the loggers' short-term financial advantage (e.g., Holmes et al. 2002), S & B's emphasis on logging to the exclusion of other silvicultural interventions seems justified. Also, if we had actually made a blanket endorsement of the creation of extremely large felling gaps, which was apparently S & B's interpretation, we would share their concern about proliferation of vines and other weeds. Instead, we argued that there are conditions under which any of a number of silvicultural treatments, such as gap enlargement, vine cutting, liberation of future crop trees, and soil scarification, can be justified if they promote the regeneration and growth of commercial species. Ultimately, maintaining the value of forests for timber production may be the best incentive for keeping forests from being converted to other land uses.

Forests differ and so should silvicultural prescriptions

Due to differences in biogeography, soil, climate, and history, tropical forests differ from one another in structure, composition, and dynamics. Forest

managers also differ in their technical capabilities, access to capital, tenure security, and financial expectations. To this diverse mixture of factors should be added the range of stakeholder concerns about biodiversity, ecosystem services, and other forest values, only some of which are reflected in the multitude of policies governing forest management. Given this wide range of forest conditions and contexts, it is not at all surprising that the appropriate approaches to forest management also vary widely.

As S & B remind us, disturbances in tropical forests vary in intensity and occur over a wide a range of spatial and temporal scales. Where the disturbance regime that shaped a forest is dominated by the formation of small canopy gaps, advanced regeneration of canopy trees is often abundant in the forest understory. Under these conditions, we agree that it is of the utmost importance to promote the survival and growth of this advanced regeneration by creating only small openings in the canopy through directional felling, pre-felling vine cutting (where needed), planning skid trails, or using aerial extraction techniques (e.g., skyline yarding). In contrast, where advanced regeneration of commercial species is scarce because the seedlings are light-demanding or only establish on exposed mineral soil, retention of pre-intervention canopy cover is equivalent to mining the forest for timber. Contrary to S & B's repeated assumption that silvicultural intensification would only favor a limited number of shade-intolerant timber species, in many cases, such as Bolivia, nearly all the major timber species are long-lived pioneers, which are experiencing regeneration failures due to a lack of silvicultural interventions (Mostacedo and Frederickson 1999). RIL techniques are designed to ensure that soil erosion is minimized, the understory remains humid and thus less fire prone, and plants and animals that require shaded conditions are favored, but do little to secure future timber yields, at least of some of the species being harvested. Where sustaining timber yields is not a major concern, such as where a rich international conservation group is willing to buy the logged-over land (Bowles et al. 1998), high-grading timber using RIL techniques may be a reasonable goal.

We worry that for many environmentalists, especially the growing number who are not involved in forest management, the best management is the least management. Many fear forest domestication and undue attention to timber production at the expense of other forest goods and ecological services. To some extent, these fears rest uneasily on the assumption that the forests being logged or managed were virgin, pristine, or otherwise unsullied by previous human intervention. While we do not doubt the existence of truly virgin tropical forests, archaeologists and ecologists are increasingly realizing that many forests were substantially influenced by humans in the past. Researchers in South America, for example, suggest that 10–20% of the forests in the Amazon Basin developed after abandonment of agriculture on the black anthrosols ('terra preta do Indio') created by Amerindian farmers centuries ago (Heckenberger et al. 2003; Glaser and Woods 2004). Exactly how these nutrient-rich soils were made is still being debated, but it is clear that their

genesis required intensive ecosystem manipulations and was carried out over extensive areas. Elsewhere in the tropics, it seems futile to try to separate the history of agriculture and human-ignited fires from the combined effects of hurricanes and wildfires. The question we face as environmentally concerned forest managers is: if severe silvicultural manipulations are required to regenerate some of the commercially important timber species, then are such interventions warranted?

Given the scarcity of managed forests in the world, our suggestion that management should be intensified where forest conditions warrant is unlikely to be followed, at least by industrial forest managers working under the constraints of insecure tenure and high financial discount rates (Pearce et al. 2002). But what about the estimated 25% of the tropical forests of the world in the control of rural communities (White and Martin 2002) with economic utility functions very different from those of commercial concessionaires (Putz 2000; Henrich et al. 2001)? Might it be more attractive to them to manage forests intensively, perhaps by mimicking some of the forest-farming practices of their ancestors who created the forests that we appreciate today?

Conclusions

We hope that other readers do not confuse our suggestion that management intensification is warranted in some forests with a blanket advocacy of increased logging intensity in all forests. Our point was, and remains, that given the diversity of tropical forests, no single approach to forest management can be expected to be effective everywhere. While some silvicultural conventions apply universally, such as protecting streams and areas of especial biodiversity value, others should be allowed to vary with forest conditions and management objectives. Given the rapid accumulation of ecological and silvicultural knowledge about tropical forests, it is time to start tailoring silvicultural prescriptions to fit the forests being managed. In many forests, merely reducing overall logging impacts, as suggested by S & B, is not enough to ensure sustainability. Environmentalists, conservationists, and foresters should all be concerned with maintaining the regeneration and growth of species following logging and encourage application of the silvicultural treatments that best promote sustainable forestry.

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