Forests reserved for rubber?

Among the world's tropical regions, Southeast Asia has the highest relative deforestation rate and, for many faunal and floral groups, very high proportions of endemic and threatened species (Sodhi *et al.* 2010). Malaysia – which lies within this region – should therefore be lauded for retaining nearly 60% of its land area under forest cover, to help sustain its rich biodiversity. However, tropical rainforests there and elsewhere still face manifold threats. Recently, Mann (2009) highlighted how rubber plantations are already gnawing away at natural forests across much of Southeast Asia. Now, it appears that because of a policy loophole, even Malaysia's forest reserves will not be spared.

Much of the remaining forests in Peninsular Malaysia are retained within Permanent Reserved Forests (PRFs). These fall into 11 different classifications, according to Peninsular Malaysia's National Forestry Act of 1984, and most are designated for "timber production under sustained yield". A key problem, however, is that the Forestry Act does not stipulate the need for PRFs to consist entirely of natural forest, an ambiguity worsened by an overly broad definition of "forest" adopted by the UN Food and Agriculture Organization (FAO; www.fao.org/docrep/008/a0400e/a0400e00.htm). This loophole is allowing large expanses of natural forest on the Peninsula (including those that are already being selectively logged) to be legally replaced by monocultures, such as latex-timber clones, commonly referred to as "rubberwood" (Adnan 2009; Tan 2009).

As its name implies, rubberwood provides not only rubber latex per se, but also timber. Fast-growing, genetically modified variants of rubberwood, developed by the Malaysian Rubber Research Institute, yield substantial latex by their 5th year and can be harvested for timber at 15 years (Tan 2009). Around 80% of the wood supplied to the local furniture industry in Peninsular Malaysia now comprises rubberwood, and investor interest in these clones is expected to rise in response to government tax incentives (Adnan 2009).

Rubberwood plantations are now expanding dramatically. From 2006 to 2007, the total area of Malaysian PRFs gazetted for rubberwood leapt from 1626 to 17 443 ha – a nearly 11-fold increase (FDPM 2007). A further 11 497 ha of plantations were approved for 2008, and 16 207 ha more for 2009. Indeed, the Malaysian government has established a target of 375 000 ha of timber plantations for the year 2020 (Tan 2009).

Although rubberwood plantations are suitable for establishment on degraded lands, their widespread expansion into "native" (ie intact and largely undisturbed) forests is of great concern. Areas currently slated for conversion in Peninsular Malaysia include those identified as important habitats and key ecological corridors for species such as the Malayan tiger (*Panthera tigris jacksoni*). Apart from diminishing forest biodiversity, the expansion of plantation monocultures may lead to losses of important ecosystem services and increased human–wildlife conflict.

A large proportion of Malaysia's remaining native forest cover could be transformed into rubberwood if present trends continue unabated. It is encouraging that the forestry sector in Malaysia and environmental NGOs are finally discussing strategies to address this issue after it was highlighted in the media (Tan 2009). We recommend that national data on tropical forest cover in Asia be carefully scrutinized to distinguish between native forests (including selectively logged forests) and those converted into plantations. We also urge the FAO to revise its current definition of "forest" to exclude plantations of rubber and other monocultures. Otherwise, large reserves of native forest could be replaced by greatly simplified monocultures like rubberwood.

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doi:10.1890/10.WB.014

Pesticides and tropical biodiversity

The UN declared 2010 as the "International Year of Biodiversity" to raise awareness of both the value of biodiversity for improved human well-being, and human impacts on the world's ecosystems (www.cbd.int/2010/welcome/). Besides informing readers about threats to biodiversity such as climate change and habitat loss, the website provides recommendations on how various stakeholders and interested parties can help protect biodiversity. Wise consumption choices – using products obtained through sustainable production – is listed as a top priority.

Actions such as the International Year of Biodiversity and articles about the tropical biodiversity crisis (eg Bradshaw *et al.* 2009) are invaluable for communicating related threats and addressing potential mitigation. However, the debate has so far largely neglected one issue that is gaining greater importance in tropi-

cal ecosystems – namely, increased pesticide application. Pesticide expenses in tropical countries with the highest deforestation rates increased from US$2 million in 1980 to US$73.1 million in 2006 (FAO 2009). Small-scale farmers in the tropics may be more likely to use pesticides excessively if, for instance, pesticide prices remain stable or decrease in parallel because producers often sell pesticides with expired patents at low cost. In Sulawesi (Indonesia) between 2000 and 2006, pesticide prices remained stable (US$3.30 L^{-1}; Balai Penelitian Teknologi Pertanian Palu, pers comm) but pesticide use increased (US$7.20 to US$9.00 ha^{-1}; n = 279 households; unpublished data). As a result, pesticides may be applied as often as once every 2 weeks, while application is recommended by the manufacturer once every 4 months (Figure 1). Such intensified pesticide use has substantial negative impacts on the early reproductive stages of non-target organisms (eg Relyea 2005), and may also counteract the beneficial effects of tree-shaded crop production that can be of high conservation value for maintaining biodiversity.

In expanding tropical agricultural lands, such as those devoted to cacao, oil palm, or soy, pesticides are likely to play a key role for "biodiversity friendly" production. In the tropical biodiversity debate, pesticide effects are, however, critically under-represented. To our knowledge, through an ISI Web of Science search (http://thomsonreuters.com/products_services/science/science_products/a-z/web_of_science, performed on 31 March 2010), 36 published studies have investigated pesticide effects on – mostly invertebrate – tropical biodiversity, and only two such studies have been conducted in Southeast Asia. The benefits to biodiversity from tree-shaded cacao production are well known. However, future management recommendations should include results from experimental studies evaluating the dosage or application threshold of pesticides in tropical agricultural landscapes, for a more realistic assessment of the biodiversity–pesticide relationship. Ultimately, farmers should pursue organic crop production to preserve some of the remaining biodiversity and related ecosystem services. Nevertheless, these efforts must yield higher prices for products than those obtained through non-organic means and succumb to stringent control of producers so that further cropland expansion is less likely.

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Figure 1. *Pesticide applications in cacao plantations in Sulawesi, Indonesia.*

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