POLICY PERSPECTIVE

High Conservation Value or high confusion value? Sustainable agriculture and biodiversity conservation in the tropics

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Abstract

Green labeling of products that have been produced sustainably is an emerging tool of the environmental movement. A prominent example is the Forest Stewardship Council, which certifies timber that is harvested to manage and maintain forests defined as having High Conservation Value (HCV). The criteria for HCV are now being applied to four rapidly expanding crops in the tropics: oil palm, soy, sugarcane, and cacao. However, these criteria do not provide adequate protection for biodiversity when applied to agriculture. The only criterion that provides blanket protection to forests is one that protects large expanses of habitat (≥20,000–500,000 ha, depending on the country). Absent of other HCVs, the collective clearing of forest patches below these thresholds could result in extensive deforestation that would be sanctioned with a green label. Yet such forest patches retain much biodiversity and provide connectivity within the agricultural matrix. An examination of forest fragments in biodiverse countries across the tropics shows that future agricultural demand can be met by clearing only forest patches below a 1,000 ha threshold. We recommend the development of a new HCV criterion that recognizes the conservation value of habitat patches within the agricultural matrix and that protects patches above 1,000 ha.

Consumer preference for products certified as sustainable has become a powerful tool of the environmental movement. Even when governments are unwilling to strengthen environmental laws, consumer choice can be used to shift the behavior of corporations (both producers and purchasers) toward more environmentally benign practices (e.g., Greenpeace campaigns targeted at Unilever, Nestlé, and Sinar Mas; Greenpeace 2007, 2010, 2011). One of the best-known examples of this approach is the Forest Stewardship Council's (FSC) timber certification system that emphasizes the management and maintenance of so-called High Conservation Value (HCV) forests within timber concessions (FSC 2011b). HCV forests provide important ecosystem services, are of social importance (e.g., sacred forests), or have exceptional value for biodiversity. The FSC also requires the maintenance of basic ecological functioning elsewhere within certified logged forests. FSC timber certification in the context of logging (but not necessarily in the context of paper-pulp plantations; Edwards & Laurance in review) is likely to deliver biodiversity benefits by protecting rare species and ecosystems, by conserving large pristine forests, and by reducing the overall impact of logging.

On the coattails of the FSC principles for selective logging, the HCV concept is now being invoked as a criterion for "sustainable" production of some of the fastest expanding plantation agricultural crops in the tropics. The Round-table for Sustainable Palm Oil (RSPO), Round-table on Responsible Soy (RTRS), Better Sugar Cane Initiative (BSI), and Round-table for a Sustainable Cacao Economy (RSCE) are all using the HCV concept as the basis for ensuring that important tropical forests and their attendant biodiversity are not destroyed in the production of palm oil, soy, sugar cane, and cacao, respectively.

At first flush this seems like a positive step for biodiversity conservation, because global production of these four plantation crops has grown by 26% (cacao) to 56% (oil palm) from 1999 to 2008, equating to a total crop expansion of 36.5 Mha (Figure S1; FAOStat 2010). In addition, 28–74% of this growth has occurred in the world's megadiverse countries (Figure S2; Mittermeier *et al*. 1997), places of exceptional importance to biodiversity. However, we believe that the HCV concept does not protect biodiversity sufficiently when applied to green-labeled agriculture resulting in the potential for a dramatic loss of biodiversity within the agricultural matrix.

The key reason is that the economic activities in question—timber extraction versus agriculture conversion—have very different impacts on biodiversity. A selectively logged forest, even a heavily logged forest, can retain much of its biodiversity (Berry *et al.* 2010; Edwards *et al.* 2011) and, if left alone, is likely to become increasingly suitable for biodiversity as the forest regenerates. By contrast, conversion of a tropical forest to oil palm, soy, cacao, or sugar cane results in a dramatic loss of forest specialist species (Fearnside 2001; Petit & Petit 2003; Steffan-Dewenter *et al.* 2007; Fitzherbert *et al.* 2008; Edwards *et al.* 2010). Furthermore, there is no potential for restoration of biodiversity until the land has been abandoned and the long process of secondary forest regeneration begins (Barlow *et al.* 2007; Chazdon 2008), assuming that the abandoned land does not enter into a state of arrested succession and persist as low-biodiversity Imperata grasslands (Garrity *et al.* 1997; Styger *et al*. 2007; Veldman & Putz 2011). Application of the current HCV criteria to agriculture could therefore result in the perverse certification of agricultural plantations as being "sustainable" despite a dramatic, long-term loss of biodiversity. Below, we detail how this could happen. (Note that we do not address in detail issues related to the implementation and management of certification schemes within particular countries, an issue that some observers have identified as a major problem; e.g., Colchester *et al*. 2009; Laurance *et al.* 2010).

HCV criteria and application to agriculture

From a biodiversity conservation perspective, a forest is classified as HCV if it fulfills any of three conditions (Jennings *et al.* 2003). Our summary of these three HCVs is based upon the "global" HCV toolkit, from which national toolkits are developed:

(1) HCV1: Globally, regionally, or nationally significant concentrations of biodiversity values. In practice, HCV1 is designated when the forest: (i) has current legal protection; (ii) houses threatened or endangered species (one or more extremely rare species—e.g., IUCN critically endangered, CITES I, or those of exceptional international concern—or an outstanding concentration of simply rare species—e.g., IUCN vulnerable and endangered species); (iii) has outstanding concentrations of endemic species; or (iv) harbors critical temporal concentrations of species (e.g., migration stopovers).

(2) HCV2: Globally, regionally, or nationally significant, large, landscape-level forests. The guidelines encompass forest and other natural habitats (e.g., grasslands), and require that most species be found at naturally occurring densities.

(3) HCV3: Forest areas that are in or contain rare, threatened, or endangered ecosystems.

There are also three HCVs that deal with the retention of critical environmental services (HCV4) and locations of critical social importance (HCV5 and HCV6). For full definitions of HCVs 4–6, see Text S1.

Unfortunately, in many tropical regions, forests that fail to meet HCV1 or HCV3 can nonetheless harbor a tremendous amount of biodiversity. For example, very few vertebrate species within the Amazon, the Congo, and the lowlands of New Guinea are listed by the IUCN as being threatened with extinction (Hoffmann *et al.* 2010), and of those few species that are listed, most have tiny geographical distributions, are found at extremely low densities due to hunting (e.g., Poulsen *et al.* 2009), or are too rare or elusive to locate in the short time-frame of HCV assessments. The absence of a critically endangered species or an outstanding concentration of vulnerable and endangered species means that large swathes of forest in these regions are not necessarily protected under HCV, despite these regions being some of the most biodiverse locations on Earth (Lamoreux *et al*. 2006). The HCV1 and HCV3 criteria are much more effective at protecting forests when they are within an ecosystem that has already undergone dramatic changes and thus harbors many imperiled species, as is the case in Sundaland or the Atlantic Forest, Brazil (Hoffmann *et al.* 2010).

Another major concern about the application of HCV1 and HCV3 is the ambiguity of the language used. For instance, the criteria state that "outstanding concentrations" of specific animal groups should justify designation as HCV and that any identified HCV must be "maintained or enhanced" (Jennings *et al*. 2003). However, the quoted terms are open to interpretation by the assessors, potentially leading to differences of opinion with dangerous consequences for biodiversity. At the extremes, some NGOs argue that an HCV designation means that land cannot be converted, whereas other assessors believe it requires the protection of only small patches of habitat with the HCV, just enough to sustain viable populations of the imperiled species (although what is a viable population is also for debate).

The HCV2 criterion determines whether a large expanse of "habitat" should be protected from agricultural conversion or not; as such, it could in theory ride to the rescue of places like the Amazon and the Congo. However, to qualify for protection under HCV2, areas first must meet a minimum threshold size that is determined at the national level by multistakeholder groups consisting of environmental NGOs, academics, government officials, and industry representatives. Areas below this threshold are open to clearance if they do not quality for protection under other HCV criteria. The stakeholder groups, in turn, have set thresholds in the tens of thousands to hundreds of thousands of hectares: 20,000 ha in Indonesia, 100,000 ha in Ecuador and Bolivia; and 500,000 ha in Papua New Guinea (HCV resource network 2011). In other instances, no threshold was set at all because forests were deemed too fragmented to qualify for HCV2 (e.g., Ghana and Gabon; HCV Resource Network 2011).

Thus, in the case of Nigeria, which is one of the largest producers of oil palm and cacao, applying a 20,000 ha threshold for HCV2 (the lowest set in any tropical country thus far) and discounting all protected areas and all forests that border protected areas, would leave more than 3.9 million ha of forest on the table for potential conversion to agriculture (Figure 1A; full details of datasets and analysis are in Text S2). Fragments are clearly biased toward the smallest size class of <100 ha, but there are also numerous larger fragments between 1,000 and 20,000 ha in size (Figure 1B), and these would (in all likelihood) not be protected under HCV2. Moreover, despite the highly biodiverse nature of Nigeria's forests, there are few species that would qualify under HCV1. Only 26 vertebrate species in these lowland forests are listed by the IUCN as being globally imperiled and just two are critically endangered: *Gorilla gorilla* and *Procolobus preussi* (IUCN 2011). As unfathomable as it seems, without clear management criteria, an agricultural producer conceivably could clear tens of thousands of hectares of Nigerian forest for palm oil or cacao (absent of other HCV criteria) and still receive certification of the resulting crop.

All forest patches harbor some biological value, but how much depends on many factors including patch area, patch shape, surrounding vegetation type, and distance to similar habitat. Particularly important is patch area, with forest blocks over ≈10,000 ha having communities largely similar to those found in contiguous forest and with patches over 1,000 ha retaining most species found in contiguous forest (Beier *et al.* 2002; Harcourt & Doherty 2005; Benedick *et al.* 2006; Lees & Peres 2006; Michalski & Peres 2007; Struebig *et al.* 2008). As patch size declines further, so does biological value, such that the smallest patches (those below 100 ha in size) have highly degraded communities, which start to resemble those found in the surrounding agricultural plantation, and have few viable populations of forest-dependent species (Beier *et al.* 2002; Harcourt & Doherty 2005; Benedick *et al.* 2006; Lees & Peres 2006; Michalski & Peres 2007; Struebig *et al.* 2008; Edwards *et al.* 2010). Forest patches of all sizes, but particularly larger ones, also represent important stepping-stones for biodiversity, assisting dispersal across the agricultural landscape, reducing genetic isolation, and helping to maintain populations (Lees & Peres 2009; Gillies & St Clair 2010; Yabe *et al.* 2010). Patches also harbor populations of species that can recolonize regenerating forest should agriculture be abandoned in the future (e.g., Barlow *et al.* 2007; Laurance *et al.* 2011). Combined, it is clear that there are compelling reasons for retaining larger forest patches within the agricultural matrix.

A key question, therefore, is what fragment threshold would be needed to meet anticipated demand for the crops in question? Our analysis suggests that small threshold limits (i.e., allowing only small fragments to be converted to cropland) could be adopted and still meet the anticipated growth in demand for certified "sustainable" crops over the next 10 years, assuming a rate of growth equal to the past decade's (see Text S2). For the nations of Brazil, Indonesia, Malaysia, and Nigeria—which combined are responsible for 23–83% of the predicted increase in production of each of these four crops over the next 10 years—total demand could be met if conversion were restricted to forest fragments no larger than 100 (Nigeria) to 700 (Malaysia) hectares (Figure 2). If the threshold were 1,000 ha, these countries could produce between 111% and 248% of the total estimated demand of these crops for 2020 (Table S1).

This cursory assessment ignores economic considerations such as transaction and transportation costs, and losses of economies to scale; however, decentralized agriculture is not uncommon for oil palm or cacao production (Koh & Ghazoul 2010a; Clough *et al.* 2011). Nor can we be certain that all of the fragments we include in our analysis would be available to agriculture—some might be on land too steep to convert whereas others will inevitably be protected by other HCVs. These could combine to increase the required threshold.

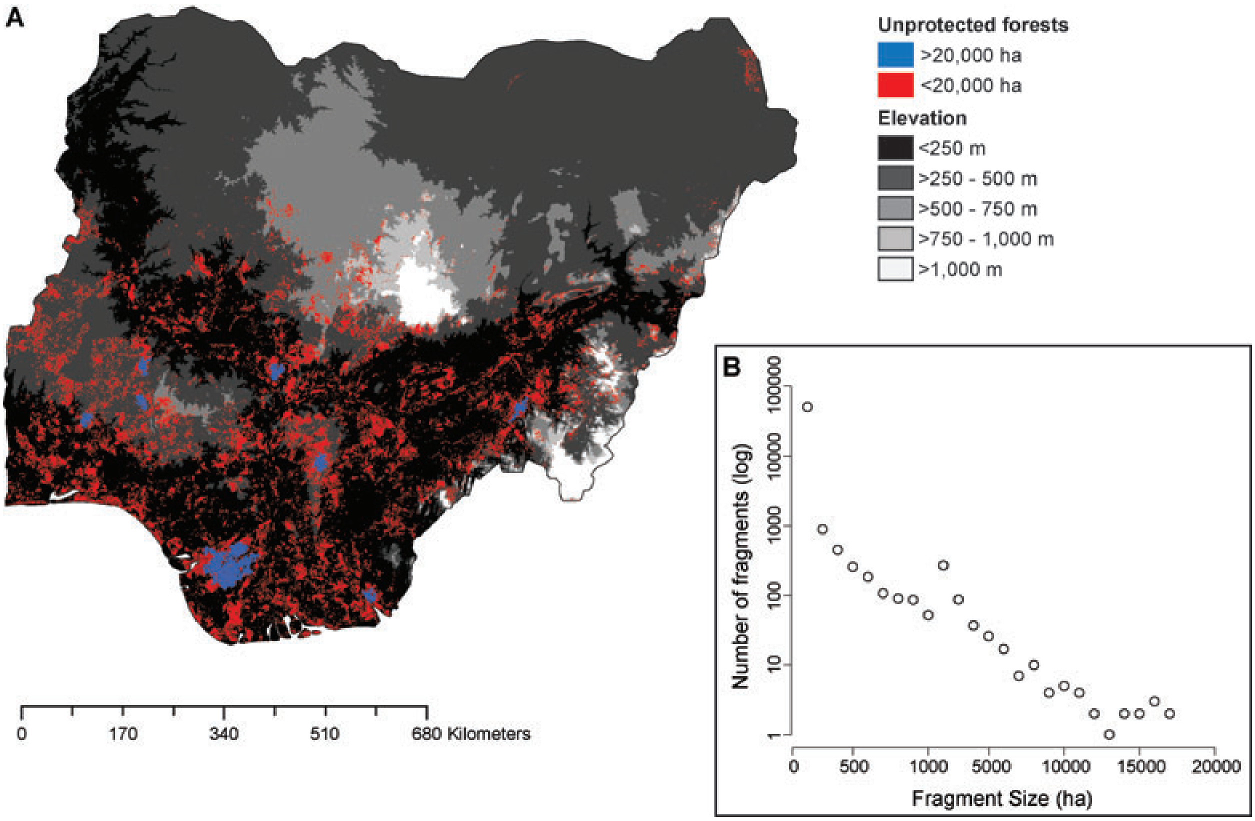

Figure 1 Unprotected patches of forest below 1,000 m a.s.l. that do not border protected areas in Nigeria. (A) Map of forests patches that are above (in blue) and below (in red) a 20,000 ha threshold for HCV2. Inset: (B) The size distribution of unprotected forest patches below 20,000 ha. *Note:* the *x*-axis is nonlinear, being scaled to represent 100-ha increments to 1,000 ha, and 1,000-ha increments thereafter to 20,000 ha.

At the same time, however, there are factors that would reduce the threshold further. First, we excluded peat-swamp forests from our analysis, because these protect vital carbon stores, but fragments of shallow peatlands are still liable to conversion (Text S1). Second, we excluded forest fragments below 25 ha, some of which would likely be suitable for conversion (Text S1) and which, by virtue of their small size, are less likely to be critically important for biodiversity. Third, in some locations there is ample scope for producing crops on nonforested lands, such as Imperata grasslands and inactive or abandoned farmlands (e.g., Indonesia; Koh & Ghazoul 2010b), or by converting other cash-crop plantations that are no longer very profitable (but see Lapola *et al.* 2010). In the short-term, some of these lands might not have license areas available, but as the global carbon market increases under REDD+, so will the clarification of land-planning laws to focus development on nonforested lands (e.g., the Partnership between Indonesia and Norway; Edwards *et al.* in press), while certified companies can apply political pressure to be allowed to use nonforested lands, just as other plantation companies have previously applied pressure to obtain permission to clear forests (e.g., EIA 2008). Finally, and most important, we calculated that *all* of the future demand for these four crops could be met on small fragments when, in fact, the demand for certified, ″sustainable″ products is certain to be a fraction of the total demand, as has been the case with certified timber (currently about 5% of production forests across the globe are certified by FSC; FSC 2011a). There is, in short, minimal economic justification for permitting the conversion of larger patches of forest under a sustainability label.

Modifying HCV: moving forward for greener agricultural products

We urge agriculture interests and conservationists to take a precautionary approach to the application of HCV to agriculture. We do not yet know (and may never know with certainty) which precise areas of forest merit HCV1 and/or HCV3 designation. For instance, the best available resource on critically endangered species—the IUCN range maps—shows the maximum extent of each species'

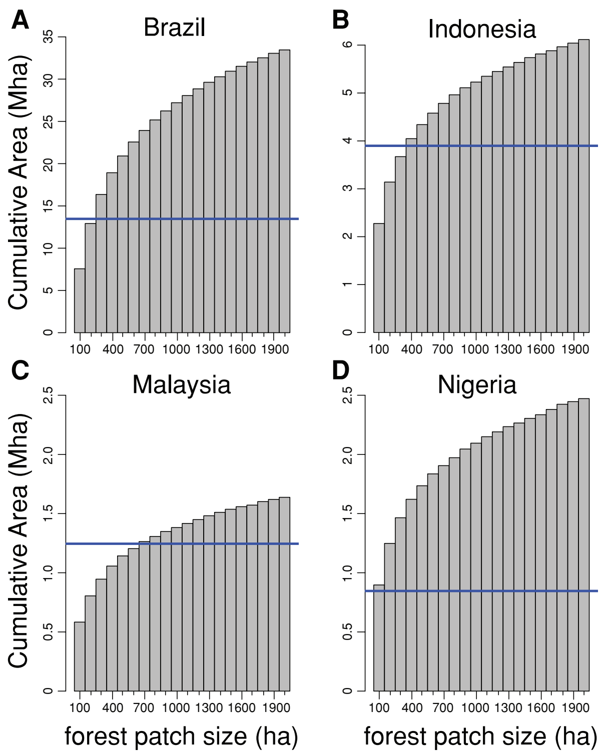

Figure 2 Cumulative area of unprotected forest patches (*y*-axis) in (A) Brazil, (B) Indonesia, (C) Malaysia and (D) Nigeria as a function of forest patch size (*x*-axis). Each of the *x*-axis columns represents 100 ha increments, ranging up to include forest patches <2000 ha. The *y*-axis is in millions of hectares (Mha). The blue line represents the breakeven point where the total 2020 demand (based on current growth rate of crop expansion) for the four Roundtable crops (oil palm, soy, sugar cane, cacao) could be met on by forest patches below a given threshold.

range and is not suitable for finer-scale designations. HCV1 and HCV3 will certainly protect some forests (particularly those in Sundaland and Southeastern Brazil), but precisely how much is impossible to determine. We thus see HCV criteria based upon area thresholds, which are easily measured and policed using satellite imagery, as the frontline in the battle to guarantee the protection of valuable forests from conversion to sustainable agricultural plantations.

Large, landscape-level habitats above thresholds of 20,000–500,000 ha are protected under HCV2. However, there is currently no HCV criterion designed to protect the important biodiversity and habitat connectivity that are provided by large patches of forest within the agricultural matrix. We highlight this as a major shortfall in the application of HCV to environmentally friendly agriculture. Without tackling this issue, it is plausible that we could lose vast amounts of biodiverse forest (e.g., Figure 1) to agricultural plantations under a green label. We thus promote the creation of an additional HCV criteria designed specifically to help ensure sustainability within agricultural plantation settings. In particular, we recommend the inclusion of:

> HCV7: Maintenance of agricultural matrix-level biodiversity and connectivity.

We can be confident that the threshold for forest patches protected under HCV7 can be set at 1,000 ha (or less) and still permit sufficient expansion of certified crops. Such a threshold would certainly guarantee the protection of much biodiversity and the retention of connectivity within the agricultural matrix. However, in many locations, such a threshold would inevitably still leave much (or even all) forest without any protection. What must be decided is which, if any, of these smaller forest fragments can be sustainably converted.

Although it is tempting to argue for the protection of all smaller forest patches (Ehrlich & Wilson 1991), such an argument could undermine the HCV concept because as fragment size declines so does conservation value. Furthermore, thresholds that are too stringent might prevent the economies of scale required by large plantation companies to warrant investment in infrastructure (e.g., to build processing plants). To this end, in addition to a threshold size that protects large forest patches (≥1,000 ha), HCV7 should also protect a proportion of fragment area that falls below 1,000 ha. As a hypothetical illustration, perhaps 25% of forest area within a plantation should be protected, which could be targeted to larger fragments (hundreds of hectares in size) and/or fragments that create stepping-stones between larger blocks of forest. An alternative would be to permit the conversion of forest patches below 1,000 ha conditional on setting aside an even larger area of land in a Biodiversity Bank that protects large, contiguous blocks of forest (Edwards *et al.* 2010). Of course, HCV1 would still apply, providing protection to any critically endangered species in even the smallest patches.

We believe the most appropriate way forward is for the HCV Resource Network supported by ProForest—the independent organization that produced the global HCV toolkit (Jennings *et al*. 2003)—to create a revised HCV toolkit that includes HCV7 for the production certified plantation crops. It would then be the responsibility of all of the sustainability councils (including the FSC in the context of tree plantations) to adopt this expanded toolkit to ensure that green-labeled agricultural products are comparable in their environmental promise. The reason why all of the councils should abide by the same size threshold is to ensure consistency: it would make little sense to prohibit certified-sustainable soy growers from clearing forest fragments greater than 1,000 ha, but to then allow certified-sustainable sugarcane growers to do so. Such complications would confuse consumers and devalue green labels.

As noted earlier, certified crops currently represent only a small, but rapidly expanding, part of the global market for each of these commodities. We suggest that it is important that all certified crops demonstrate a very high standard of environmental responsibility, lest consumers feel betrayed or lose trust in the certification process.

Conclusion

We urge the Roundtables for oil palm, soy, sugarcane, and cacao to go beyond the current HCV guidelines and adopt a stricter standard for forest conservation. Doing so will avoid perverse outcomes wherein crops that are produced at great harm to biodiversity nonetheless receive certification as sustainable. Although the HCV concept holds clear promise for conserving biodiversity in the contexts of sustainable logging and national strategies for managing the agricultural sector, backing it as written for sustainable agricultural plantations seems counterproductive. We, therefore, encourage stakeholders to work with the HCV Resource Network and ProForest in the creation of a new HCV criterion (HCV7) that ensures the protection of large forest fragments of roughly 1,000 ha in size or larger within the agricultural matrix.

Recently, 400 of the world's largest retailers, which have a total turnover of $2.8 trillion, pledged to phase out all deforestation in their supply chains by the year 2020 (Consumer Goods Forum 2010). Their ability to fulfill that promise is closely tied to the sustainability Roundtables and the HCV concept. It would be unfortunate if a large portion of the business community sought to ban deforestation from their own supply chains, but were thwarted in their effort to do so by flaws in the HCV concept as applied to agriculture. It would also be unfortunate if the business community were to champion the inadequacies of the current HCV concept, while the environmental community continued to accept the potential for large-scale conversions of tropical forests for the production of 'sustainable' agriculture.

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Supporting Information

The following supporting information is available for this article:

Text S1: Definitions of HCVs 4–6.

Text S2: Demand and threshold calculations.

Table S1: Future demand, breakeven threshold and potential extra production of four Roundtable crops in targeted countries.

Figure S1: Global Production of palm oil fruit, soybeans, cacao beans, and sugar cane from 1984 to 2008.

Figure S2: Percent of global growth in target crops that occurred in the world's megadiverse countries between 1999 and 2008.

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