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HIGH CARBON STOCK APPROACH

THE HCS APPROACH TOOLKIT

MODULE 5

VERSION 2.0
MAY 2017

THE HCS APPROACH
PUTTING NO DEFORESTATION INTO PRACTICE

High Carbon Stock Forest Patch Analysis and Protection

HIGH CARBON STOCK APPROACH

THE HCS APPROACH TOOLKIT V2.0 MAY 2017

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HIGH CARBON STOCK APPROACH

UKaid from the British people

MODULE 5

High Carbon Stock Forest Patch Analysis and Protection

Note: This module is a beta version undergoing some final technical clarifications.

MODULE CONTENTS

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SECTION A

Conservation science background and principles

By Grant Rosoman (Greenpeace) and Jennifer Lucey (University of Oxford)

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INTRODUCTION

Most plantation development in the tropics occurs in forest landscapes that include a mixture of forested, degraded and open areas, including other ecosystem types such as wetlands. The image analysis and field plots undertaken in the first vegetation stratification phase of an HCS assessment thus generally result in identifying patches of HCS forest areas that vary in size, shape, and quality. The objective of protecting HCS forest areas is to maximise ecological and social viability, as well as optimise benefits for conservation, local community livelihoods and plantation development. Therefore, the HCS Approach assesses the value and viability of these forest patches to ensure net benefits for all stakeholders. A central premise of this prioritisation step is that even small forest patches can provide important wildlife habitat, connectivity and carbon storage, especially in landscapes with low forest cover, but sometimes the costs of protecting and maintaining small forest patches may outweigh any conservation benefit. Therefore, an appropriate focus should be on conserving forest areas that are of most conservation importance.

The HCS Approach patch analysis process draws on scientific evidence to inform the HCS Forest Patch Analysis Decision Tree, which helps identify and prioritise viable and valuable forest patches within the production landscape. The resulting Integrated Conservation and Land Use Plan requires the support and consent of local communities along with legal protection.

Over the last 35 years a large number of research publications have been generated on the environmental consequences of forest fragmentation. Much of this work has been focused in Central and South America, and more recently in Asia. It is important to recognise that a variety of complicated interacting factors make observing and predicting the impacts of fragmentation difficult. There are many confounding factors, such as landscape history and species' ecological traits, that can mask the effects of fragmentation (Ewers and Didham 2006) and are somewhat mediated by how the surrounding landscape is managed (Laurance 2004). Therefore, it remains challenging to derive specific thresholds that can be used to make land use decisions for forest fragments in tropical forest landscapes. Nevertheless, the wealth of research does provide some scientific guidance on how biodiversity and ecosystem functioning (by which we mean the many processes, such as nutrient cycling, seed dispersal and predator-prey interactions, that keep the ecosystem healthy) are expected to respond to fragmentation. This helps us determine the key characteristics that affect the ability of a HCS patch to support and maintain these conservation values.

This section provides an overview of the conservation science that informs the HCS patch analysis process. We explain how we used this information to develop simple and practical thresholds from which to base HCS management decisions alongside other landscape considerations, such as HCV, peatland, riparian zones and other areas for protection. It should also be noted that there are a large number of Geographic Information System (GIS) tools that have been developed to analyse forest patches, although these are not explored here.


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FACTORS AFFECTING THE VIABILITY OF FOREST PATCHES

A review of 35 years of fragmentation research found that habitat fragmentation reduces biodiversity by between 13% and 17% and impairs key ecosystem functions by decreasing biomass and altering nutrient cycles. The same study found that 70% of the world's remaining forest is now less than 1 km from a forest edge (Haddad et al. 2015), indicating the extent of fragmentation experienced by forests globally. A fragmented and isolated forest patch differs markedly in ecology and composition, and does not support the same level of biodiversity or ecosystem functioning as the same area of forest set within a large forest tract (Laurance et al. 2011).

The key impacts of fragmentation are resource limitation, edge effects and reduction in population size and genetic diversity. These are elaborated below:

Resource limitation

Tropical rainforest ecosystems are characterised by high biodiversity and spatial heterogeneity and low densities of individuals within species. Many tropical forest species range widely to find food, mates and other resources. When forest is fragmented and isolated, there is an immediate reduction in resources such as space, food, shelter and mates due to the removal of the surrounding forest habitat. Naturally rare species, predators, and species with specialist diets or resource needs, are most affected by resource limitation created by fragmentation. If too many species are lost, particularly 'keystone' species that perform important roles within the forest, this can lead to effects on the functioning of the ecosystem and a cascade of linked species losses (Terborgh et al. 2001; Bregman et al. 2015).

The most important patch characteristics linked to species losses associated with resource limitations are:

a) **The size of the patch**. The smaller the area, the fewer the resources available in terms of both abundance and variety. This encourages species losses.

b) **The connectivity of the patch**. If the patch is connected or in close proximity to other areas of forest, individuals may be able to move between patches to find the resources they need. This reduces species losses.

c) **The quality of the patch**. The higher the quality of the remaining forest in the patch, the more resources are likely to be available. Degraded forest patches (e.g. resulting from previous logging and disturbance, or edge effects, see below) have been shown to support fewer – and different – species and a simplified forest structure (Laurance et al. 2000; Laurance et al. 2011; Tawatao et al. 2014). The reduced habitat complexity decreases the variety of different 'niches' that species can occupy. Forest patches with higher quality forest will be able to support more species and better ecosystem functioning for longer.

Edge effects

Another important consequence of forest fragmentation is the increase in edge relative to interior habitat. Forest edges are more exposed to microclimatic changes than interior habitat, which leads to 'edge effects'. These are very diverse and include changes in light, temperature, soil moisture content and wind turbulence, all with far-reaching impacts on forest ecology. Some of the detrimental changes at forest edges include:

- Hotter and drier conditions with increased wind and storm exposure (Laurance et al. 2011).
- Altered species composition and reduced biodiversity (Laurance et al. 2011; Magnago et al. 2014).
- Increased tree mortality, especially of large trees (Laurance et al. 2000).
- Reduced seed germination (Bruna 1999; Gascon 2000).
- Changes in forest structure, leaf fall and turnover in the plant community (Magnago et al. 2014).
- Reduced carbon storage capacity (Chaplin-Kramer et al. 2015).
- Encroachment of invasive species (Holway 2005).
- Encroachment of humans and associated detrimental activities, such as logging and hunting (Woodroffe and Ginsberg 1998), and clearing and fires (Cochrane and Laurance 2002).

"Forest edges are more exposed to microclimatic changes than interior habitat, which leads to 'edge effects'. These are very diverse and include changes in light, temperature, soil moisture content and wind turbulence, all with far-reaching impacts on forest ecology."

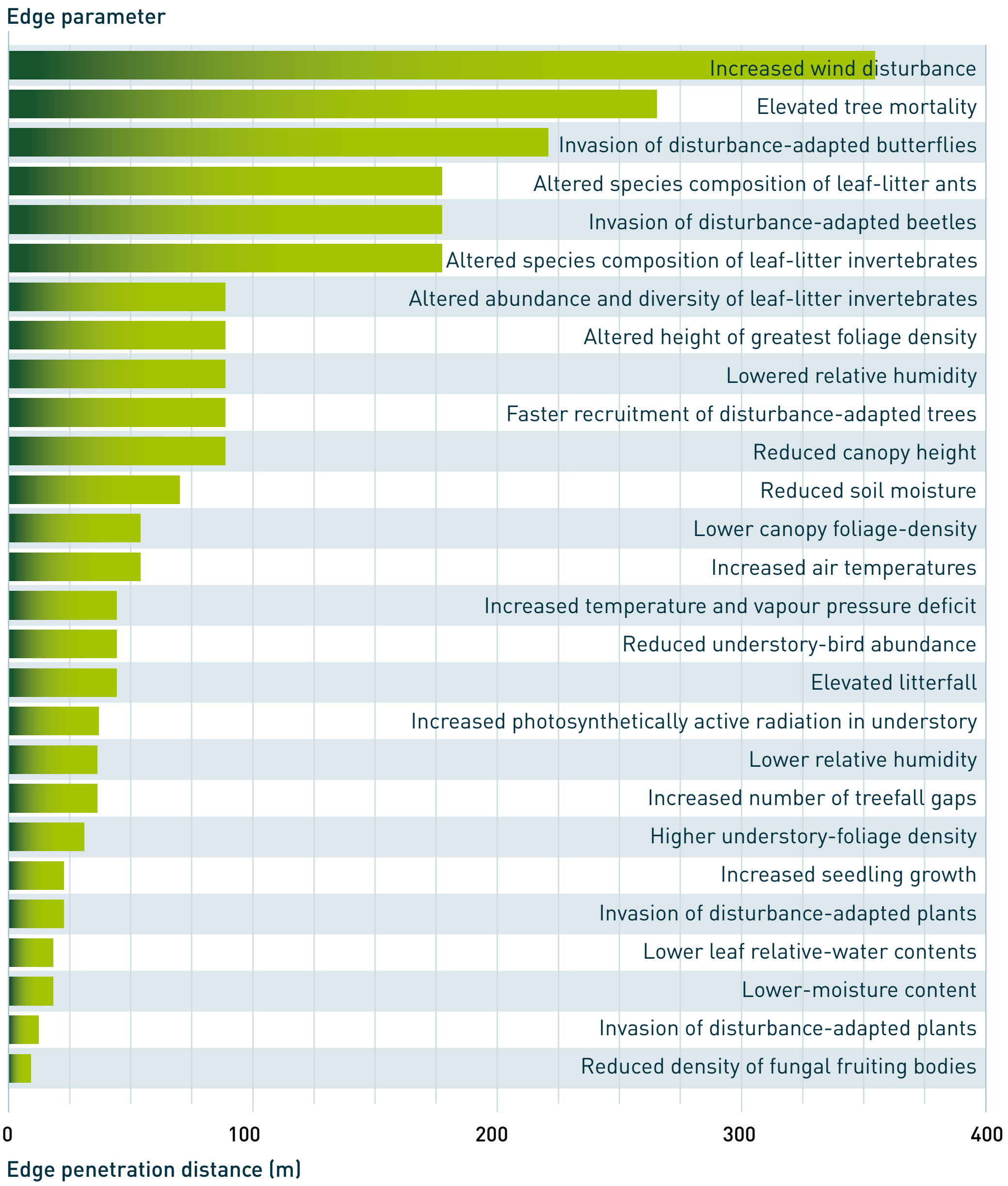

Figure 1: Results from a 22-year investigation into the impacts of fragmentation on the Amazon rainforest and biota showing the penetration distances of different edge effects. Adapted from a figure by Laurance et al. (2002)

The impact of edge effects is influenced by several forest patch characteristics:

a) **The size of the patch**. The larger a fragment, the smaller the proportion of its area will be affected by edge, meaning less of the forest will be unstable and prone to degradation, and more of it will be suitable habitat for forest species. A very small patch may be entirely affected by edges resulting in there being no interior forest suitable for forest specialists.

b) **The shape of the patch**. The above statement only holds if the patch is relatively rounded in shape. If a patch is long and thin, or very complex or convoluted in shape, the amount of edge to area will increase and the amount of the relatively unaffected interior 'core' area will be reduced (Figure 2) meaning it will be more unstable and have less capacity to support biodiversity and ecosystem functioning (Ewers and Didham 2007).

c) **The structure and management of the surrounding landscape**. The severity of edge effects depends on the type of production area surrounding a patch (Harper et al. 2005). If the vegetation structure of the production area has many of the characteristics of a forest (for example, a mixed timber plantation with understorey crops), some edge effects, such as changes in temperature, moisture and wind, may be reduced. If, however, the production area is highly contrasting, such as a short rotation annual crop, edge effects would be expected to be more severe (Arroyo-Rodríguez et al. 2016). Long rotation, intensive monocrops such as rubber or oil palm are likely to fit somewhere in between. Additional management practices, such as allowing thicker undergrowth, reduced pesticide spraying or retaining old palms near forest patches to form a buffer, may help to reduce some edge effects and stabilise the forest patch.

d) **Forest quality**. If the forest patch is very degraded, this could also exacerbate edge effects and increase the distance over which they are felt. For example, Loveridge et al. (2016) showed that invasion by non-native rodents was higher in degraded forest.

Figure 2: The influence of shape on the proportion (%) of edge of a patch (patches are the same size) (adapted from Government of Malaysia 2009)

"The larger a fragment, the smaller the proportion of its area will be affected by edge, meaning less of the forest will be unstable and prone to degradation, and more of it will be suitable habitat for forest species."

Reduction in population size and genetic diversity

Fragmentation immediately reduces population sizes by reducing the area available for individuals to live. Additionally, classic metapopulation ecology (Hanski 1999) tells us that when forest is separated into multiple patches surrounded by inhospitable habitat, populations of species living in the forest patch become isolated. This population isolation is defined by individuals having limited opportunities to breed with other individuals from outside of their forest patch because crossing intervening habitat is difficult or impossible. The combination of very small populations and limited ability to mate with individuals from outside the patch leads to inbreeding which causes genetic diversity to decline. Low genetic diversity within a population reduces its ability to adapt to environmental change and makes the population highly vulnerable to factors such as extreme weather or disease outbreaks (Keyghobadi 2007). Therefore, conservation planning should seek to maintain high levels of genetic diversity in wildlife populations.

There are two key patch characteristics that affect population size and genetic diversity:

a) **The size of the patch**. Larger patches will support larger populations of species due to greater resource availability (see above). Having a larger number of individuals within a population increases the likelihood that reproducing individuals will be distantly related, and hence inbreeding is minimal and genetic diversity is maintained (Laurance et al. 2011; Struebig et al. 2011). The size of habitat needed to maintain genetically viable populations varies widely depending on the species. A genetic study of butterflies in forest fragments in Sabah, Malaysia, found that population genetic viability was maintained in fragments as small as 120 ha and would take around one hundred years to experience declines in genetic diversity (Benedick et al. 2007). Elsewhere in Malaysia, Struebig et al. (2011) demonstrated genetic losses in forest fragment bats, and found that patches would need to be 5,000–10,000 ha in order to maintain populations with similar levels of genetic diversity to that recorded in continuous forest. At larger spatial scales, population viability analyses indicate that orangutans require areas of 50,000–100,000 ha in order for genetically viable populations to be maintained (Marshall et al. 2009). Thus, to maintain populations and genetic diversity, the focus should be on maintaining or restoring large patches of forest.

   The shape and quality of the patch can influence the effective size of the patch (i.e. the area that can actually support individuals of a population), as can the quality of the habitat in the surrounding landscape (see previous section on edge effects for details).

b) **The connectivity of the patch**. If individuals are able to move in and out of a patch and mix with other individuals in the landscape easily, more genetic diversity will be maintained making the population more resilient and less likely to go locally extinct (Laurance 2004). Therefore, the more connected the patch is, the more likely it will be able to sustain levels of population viability and hence biodiversity over time. It has been shown that connectivity can sometimes be more important than fragment size for maintaining populations (Matesanz et al. 2015), and increasing connectivity may overcome some of the risks to populations associated with small patch size. However, degrading effects in small-sized patches (see previous section on edge effects) may mean that these fragments still lose species because they cease to support the right conditions and resources. Greater connectivity can be achieved by (1) proximity to other areas of forest, (2) linking with corridors or stepping stones of natural habitat, and (3) making the surrounding landscape more permeable (i.e. less hostile to forest species; for instance, by making intervening agricultural areas more similar to forest in structure and composition).

c) **Time since fragmentation**. Declines in populations and genetic diversity take time to manifest, and numerous studies have shown that there is a time lag between when a patch is isolated, and population extinctions that result in biodiversity loss. This is known as the 'extinction debt' (e.g. Tilman et al. 1994; Vellend et al. 2006; Haddad et al. 2015). Therefore, the length of time a patch has been fragmented has important implications for the levels of biodiversity it supports. Larger and/or more connected forest patches will take longer to lose their species for the reasons mentioned above.

Summary of factors affecting the ecological viability of forest patches

As described previously, fragmented forest is less biodiverse, and has greatly altered ecosystem functions, making it prone to continued degradation and less able to perform critical ecosystem services such as carbon storage (Magnago et al. 2015) or water and soil conservation. Many of these impacts do not occur immediately after a patch is fragmented but manifest gradually over time (Brooks et al. 1999; Laurance et al. 2011; Haddad et al. 2015). In general, large patches are of higher importance for biodiversity and ecosystem functioning. The smaller, thinner, more convoluted in shape, more isolated and more degraded a forest patch is, the faster it will deteriorate and the less conservation value it will have. However, at landscape scales, forest patches of this type may provide added connectivity or permeability through the production area to improve the conservation value of other larger fragments.

DETERMINING THE THRESHOLDS FOR KEY CHARACTERISTICS OF VIABLE FOREST PATCHES

Core area

The size of a forest patch is critical for determining its viability, but its 'viable' size is also influenced by its shape due to edge effects. For this reason, the patch interior or core area is used as a primary indicator to determine priority (High, Medium or Low) in the HCS Forest Patch Analysis Decision Tree. To determine the core area of each patch, a 'negative buffer' is used to exclude the most edge-affected area of the patch (see Figure 2). Edge effects occur over scales of approximately 10 m through to >1 km from the edge (see Figure 1). Based on the range of distances for different edge effects in Brazilian Amazonia, collated from one of the longest running and most intensively studied fragmentation experiments (Broadbent et al. 2008; Laurence et al. 2011), most edge effects (around 75% of measured effects based on Laurance et al. 2002) are experienced within 100 m of the edge and so an edge effect distance and negative buffer of 100 m is adopted here.

Once the core area has been determined, the priority of the patch can be assigned. Because the Decision Tree is designed largely for use in highly diverse forested landscapes, generic and round-number values need to be used even while noting that minimum habitat size varies considerably with the type of species, habitat quality, and the surrounding landscape.

A synthesis of research on a range of taxa found in forest fragments within oil palm landscapes indicates that a core area of the order of a few hundred hectares is required for keystone canopy tree species to regenerate naturally, and that an area of this size would have substantial biodiversity value (60% or more of species found in the same area of continuous forest) (Lucey et al. 2016). In contrast, forest patches of only a few tens of hectares in core area had greatly reduced or absent regeneration of these tree species, and biodiversity levels were not much higher than the surrounding oil palm planted area (Benedick et al. 2006; Edwards et al. 2010; Lucey et al. 2014; Tawatao et al. 2015; Lucey et al. 2016). Research from across the tropics broadly agrees with these general size categories. For example, for studies in the Amazon, fragments of total size smaller than 25 ha (~10 ha core area for a circular patch) were unlikely to support many species[1] (Peres 2001), while 100 ha (~70 ha core area) could be considered viable for a substantial percentage of the species (Bierregard and Dale 1996). A meta-analysis of 53 studies documenting the time taken for species to be lost in forest fragments found a strong extinction rate for patches up to 60 ha (~40 ha core area) (Wearn et al. 2013). Further, a study of bats in peninsular Malaysia also asserts that forest patches of several hundred hectares in (total) size have significant biodiversity value (Struebig et al. 2011). Identifying a specific ecological threshold for core area is not possible because size is not the only influence: forest quality, connectivity/isolation, local topography, soils and other environmental conditions, all contribute to how well a particular forest patch is able to support biodiversity and ecosystem services. However, the available scientific evidence suggests that forest patches of the order of at least a few hundred hectares in core area have substantial conservation importance, while patches in the region of a few tens of hectares core area support few species, are prone to degradation and are unlikely to be viable in the mid to long term. These small patches may, in some cases, still serve other important landscape functions, such as connectivity. They may also act as short-term refuges for species, especially where there is very little forest available.

Based on the above and taking a pragmatic but precautionary approach, a 10 ha minimum core area (corresponding to a minimum total 25 ha of well-rounded patch including edge areas) was selected as the minimum threshold size for protection, with patches of less than 10 ha considered to be Low Priority Patches (LPP – not recommended for conservation in the Decision Tree). Medium Priority Patches (MPP) are those between 10 ha and 100 ha core area, and High Priority Patches (HPP) are those with over 100 ha core area.

[1] Based on extinctions of 46 species of vertebrates

Connectivity

Connectivity is the second key indicator for assessing the importance of individual patches. This is because corridors, linkages and 'stepping stone' areas are critical for allowing the movement of flora and fauna through the landscape to maintain biodiversity and ecosystem functioning. Key corridor features that facilitate faunal movements and plant dispersal include habitat quality, corridor width, corridor length, and the degree of canopy and corridor continuity (Laurance 2004). Even where there is no intact corridor, forest fragments can act as 'stepping stones' for dispersal as long as species are able to move through the intervening production area for short distances (Falcy and Estades 2007; Uezu et al. 2008; Saura et al. 2014).

In considering connectivity, it is important to evaluate and consider many patches at the same time as well as linkages to the broader landscape. This ensures that decisions are not made about patches individually or in isolation from other patches or clusters of patches. While the focus of the HCS Approach is on conserving remaining viable forests, eventually reconnecting any isolated fragments through forest restoration will be an effective way of creating areas large enough to slow the rate of species loss (Laurance et al. 2011; Bentrup 2008; Peres 2001). To assess the connectivity of HCS forest patches, a simple proximity distance of 200 m between patches has been adopted. This is based on research in the Amazon which indicates that dispersal rates drop off after a distance of 200 m from the forest edge (Laurance et al. 2006). Thus, if the distance is less than 200 m (measured edge-to-edge), it is assumed that the patches are close enough to be considered connected. If the configuration is conducive it is also considered as a cluster of patches that could provide stepping stones to larger patches. For instance, animals might move through a plantation if they can see a patch of natural forest up to 200 m away. This 200 m threshold is also used to determine the connectivity of a patch to other forest areas, such as riparian areas, pre-existing protected areas, or forest that is external but adjacent to the focal assessment area. Forest areas that have been divided into different HCS classes but are contiguous with each other are considered to be physically connected.

Other conservation considerations

Habitat quality (specifically related to forest structure) is an important factor for determining both the biodiversity value and resilience of a forest patch (Tawatao et al. 2014; Yeong et al. 2016), and a small patch of high quality forest may support more species than would be expected from its size. However, quality is very closely related to patch size because of degrading edge effects; therefore, the quality of a patch may often be an artefact of how long ago the patch was isolated. An older patch will therefore be more degraded than a newly isolated patch of the same size (Laurance et al. 2011), although its quality will also depend on previous logging or degradation prior to fragmentation (Tawatao et al. 2014). Other important factors, such as the presence of rare and endangered species, or the rarity of the habitat type, are already considered in the HCV assessment. For these reasons, and to minimise the unnecessary costs of surveying large areas that will be assigned protection anyway, the Decision Tree only requires a Rapid Biodiversity Assessment (RBA) for some Low and Medium Priority Patches that are shortlisted for clearance, including those that are high risk. This allows for a precautionary check of habitat quality and any special conservation attributes before being finally assigned for clearance. The RBA step and methodology are described in the following section.

A number of other physical factors were considered, including patch density, length of patch edge, and patch shape indices (Noss 1999). However, for efficiency and practicality, only the two primary factors of core area and connectivity are included in the Decision Tree.

Corridors and stepping stones

A biodiversity or wildlife corridor is an area of habitat that connects wildlife populations that are otherwise separated by human activities (e.g. agricultural developments or settlements). By allowing an exchange of individuals between these otherwise isolated populations, corridors reduce the likelihood of inbreeding, promote genetic diversity and thus increase species resilience (see previous section on reductions in population size and genetic diversity). Corridors can also facilitate migration by enabling wildlife to avoid the risks of having to traverse roads, settlements or farms. Patches of habitat that are close enough together to allow wildlife to use them when moving through a landscape are referred to as 'stepping stones' and perform similar ecological functions to fully connected corridors. Depending on the size of the corridor or stepping stone, it might even provide habitat for key species and not just a transit path.

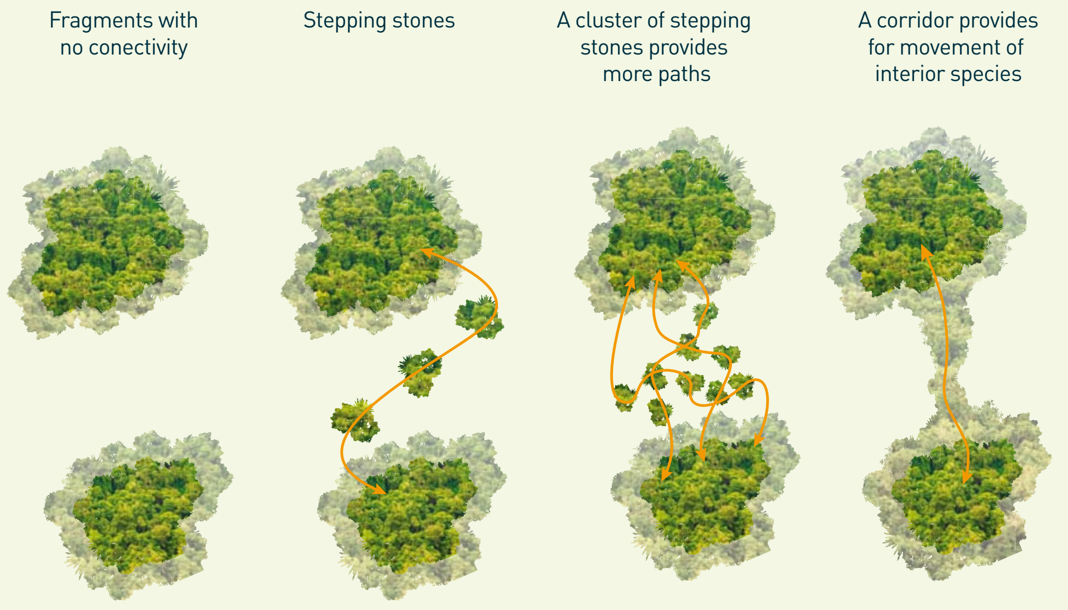

Figure 3: The functionality of corridors and stepping stones in a fragmented forest landscape (adapted from Government of Malaysia 2009)

Photo: Ardiles Rante ©

DEFINING HIGH, MEDIUM AND LOW FOREST COVER LANDSCAPES

A landscape is defined here as, 'A geographical mosaic composed of interacting ecosystems resulting from the influence of geological, topographical, soil, climatic, biotic and human interactions in a given area', based on the definition used by the International Union for Conservation of Nature (IUCN).[2] Published definitions of what a landscape is vary from less than 1 ha through to more than 200,000 ha (Ahmed 2009). However, it is generally considered a larger scale land unit.

The size of a landscape may be determined by (a) identifying the watershed or the geographical land unit containing a cluster of interacting ecosystems; (b) selecting a unit size that encompasses the plantation concession and a buffer of the surrounding area (e.g. 50,000 or 100,000 ha); or (c) using a radius of 5 km from the area of interest (for instance, the planned concession).[3]

Forest cover varies considerably across the landscapes in which the HCS Approach will be applied and has an impact on the level of importance placed on small forest fragments. Research on landscape-level impacts of deforestation in the Amazon suggests that once approximately 20% of the forest cover has been removed (and hence less than 80% of forest cover remains), the mean patch size rapidly reduces and the patches are more isolated (Oliveira de Filho and Metzger 2006). Once total habitat drops below 30%, habitat fragmentation (patch size and isolation) begins to outweigh the direct effects of habitat loss (Andren 1994). In other words, while only 30% of the habitat remains, even more value has been lost because the quality of the remaining forest is much lower due to the effects of forest fragmentation increasing exponentially.

As the importance of conserving particular remnant forest patches differs depending on the level of forest in the landscape, the Decision Tree has a decision point in relation to whether that landscape is designated as Medium or Low Forest Cover. For categorising the forest cover level, more than 80% forest cover in a landscape is considered High Forest Cover, less than 30% is considered Low Forest Cover, and between 30% and 80% is considered Medium Forest Cover. An adapted approach for High Forest Cover Landscapes (HFCLs) is being considered by a working group of the HCS Approach Steering Group (see HCS toolkit Module 6).

[2] See: http://cmsdata.iucn.org/downloads/en_iucn__glossary_definitions.pdf (accessed 1 May 2017)

[3] Based on maximum key dispersal distances. For example, Amazon forest birds were found to rarely disperse beyond distances of approximately 5 km (Van Houtan et al. 2007).

SUMMARY

The conservation science underpinning the HCS Forest Patch Analysis Decision Tree has been discussed and the thresholds have been defined. The next section describes the Decision Tree in detail. A summary of the key thresholds is provided in the table below.

Key Forest Patch Factor	Threshold
1. Edge effect distance	100 m
2. Minimum viable HCS forest patch core area	10 ha
3. High Priority Patch (HPP)	> 100 ha core area
4. Medium Priority Patch (MPP)	Between 10–100 ha core area
5. Low Priority Patch (LPP)	< 10 ha core area
6. Patch connectivity between HPPs (including outside development area)	200 m
7. Patch connectivity to HPPs (including outside development area)	200 m
8. Patch connectivity to HCV 1-4 areas (including outside development area)	200 m
9. HCS forest analysis external buffer	1 km around the development area
10. High risk zone	< 2 km from a village or settlement
11. High risk zone	< 1 km from road or other risk factor
12. MPP or LPP patch priority for conservation	> 10 ha of High, Medium or Low Density Forest
13. High Forest Cover Landscape	> 80% forest cover
14. Medium Forest Cover Landscape	30 to 80% forest cover
15. Low Forest Cover Landscape	< 30% forest cover
16. Minimum distance for consideration of landscape connectivity	5 km from development area boundary

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SECTION B

HCS Forest Patch Analysis Decision Tree 2.0

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INTRODUCTION

Phase One of the HCS Approach uses remote sensing and ground survey data to develop a map of potential HCS forest areas in a particular concession or area. Most landscapes where the HCS Approach will be applied are fragmented, where forest is present in patches of various sizes and proximity, intermingled in a mosaic with any existing plantations or other land uses. The HCS Approach uses a HCS Forest Patch Analysis Decision Tree to determine the importance and prioritisation of each forest patch and whether it needs to be included in the conservation plan, given its size, shape, and connectivity to other patches, riparian zones, peat areas, or High Conservation Value (HCV) areas. The overriding objectives are ecological and social viability, and optimisation of the resulting Integrated Conservation and Land Use Plan (ICLUP) for conservation, livelihoods and plantation development outcomes.

The Decision Tree has been revised to address the elements of 'convergence' with the HCS+ methodology, in particular with regards to decisions on Medium Priority Patches of Young Regenerating Forest. While the Decision Tree also makes some allowances for the degree of forest cover in the landscape, it is currently only applicable in fragmented landscapes with less that 80% forest cover. A separate working group process is underway to address No Deforestation and HCS forest in High Forest Cover Landscapes. Likewise, there is a working group of the HCSA Steering Group that will address application of the HCS Approach with smallholders and small farmers.

This section presents the Decision Tree in full alongside explanatory notes and multiple examples. The Decision Tree is the second phase of the HCS Approach, and results in an output of a proposed ICLUP within the context of fragmented tropical landscapes proposed for industrial development.


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Photo: Ardiles Rante ©

Guiding principles for the HCS Forest Patch Analysis Decision Tree

The previous section gave an overview of the relevant conservation science and research on forest fragmentation and the basis for the Decision Tree. Incorporating this conservation science into an integrated planning approach to conserving HSC forest along with HCV 1–4 areas, peatlands, and areas important for community purposes (including HCV 5–6) results in the following principles for analysing the value of each HCS forest patch:

1. Ensure that areas which are part of an active subsistence food production cycle to meet the food security needs of local customary communities are enclaved from consideration as HCS forest (or for plantation development) as part of an integrated land use planning process.
2. Prioritise large forest patches.
3. Prioritise conservation of primary and advanced secondary forest areas.
4. Prioritise forest patches and conservation area design that minimise landscape fragmentation and maximise ecological and social viability.[1]
5. Prioritise forest patch shape that has the larger 'core area' and minimises the area of forest subject to edge effects and degradation.
6. Maximise the degree of connectedness between patches through the creation of corridors, linkages and stepping stones in the landscape.
7. Prioritise patches located away from existing or potential threats and risk factors that might lead to degradation, thus reducing mitigation and management efforts and increasing their chances of viability.
8. Ensure HCS forest conservation complements the protection of HCV areas, peatlands and riparian zones, and land use history and the landscape matrix are considered when finalising conservation plans.
9. Ensure that HCS forest conservation considers land use trends and factors affecting the risk of future developments to the viability of protection.
10. Ensure that the assessment and the conservation of local customary communities and that communities are active participants and co-managers in the conservation of HCS forests.
11. Ensure the HCS forest conservation plan considers practical design and management issues for plantation development, including access and minimum planted block size and shape, towards optimising[2] and equitably managing trade-offs among carbon and biodiversity conservation, community livelihoods and social requirements,[3] and feasible plantation development.
13. The higher the forest cover in the landscape, the lower the priority for conservation of individual small and medium-sized forest patches, and the higher the priority for protecting large patches and landscape-level forest conservation.

These principles have been incorporated into the design of the Decision Tree. They also provide important context for preparing the ICLUP, and subsequent management and monitoring.

[1] *Ecological viability*: forest patches with a composition and structure that indicates an active phase of regeneration, and of sufficient size, shape, connectivity, configuration and level of risk that will ensure they can regenerate or maintain themselves.
Social viability: forest patches integrated and harmonised with communities' current and future land use, in particular farmland for food security, where land and use rights have been respected through FPIC, and where risks to clearance have been mitigated via co-management and incentives/benefits.

[2] *Ecological optimisation:* conservation area design maximises the area and a conducive shape/connectivity for long-term conservation.
Social optimisation: sufficient land for use by community and benefits obtained from HCS forest conservation.
Economic optimisation: potential development area maximised and shape and size of blocks are practical and promote efficient management.

[3] As per the strengthened social requirements that are in development following the HCS Convergence Agreement.

[4] Noting that it is likely that all HCV forest areas will also be HCS forest areas.

[5] A minimum range of 0.5 to 4 ha per person living in the community depending on the local context.

Integrating information beyond HCS forest assessments into the Decision Tree

As stated above and elsewhere in the toolkit, the HCS Approach integrates not only HCS forest but also a number of other areas identified for conservation, including HCV areas, peatlands, and areas important for communities' social and economic needs. Before the Decision Tree analysis can be completed, a mapping of data layers must be made which includes:

- Any **HCV areas** including riparian zones within the proposed development area and areas that are adjacent in the broader landscape including, for instance, protected areas. At a minimum, an overview of HCV forest areas within 200 m of the proposed development area is necessary for using the Decision Tree, as 200 m is the standard distance used to assess connectivity of HCS forest patches to nearby HCS or HCV forest areas.[4] The content of the HCV analysis (i.e. the HCVs that were identified, especially HCVs 1–4) will also be important at certain steps in the Decision Tree.
- An up-to-date map of **peatlands**. As the peat soil maps that are currently available are imperfect, if peat soils are known to occur in the region then the proposed development area management must also have a detailed identification procedure for peat of any depth, as well as converting this into spatial data (a map). While in practice some peatland forest areas may be identified as HCS forest, the current HCS Approach methodology is not calibrated for peatland vegetation types that have different vegetation densities and canopy heights. The Decision Tree as it is currently formulated thus cannot be used to analyse the status of peatland areas other than to include all peatland areas for protection. However, it is still useful information for identifying forested peatland areas that may be potentially viable areas and that would be a high priority for protection; this information can be integrated via Step 11 of the Decision Tree.
- A map of **the boundaries and customary land use of local communities**, created through a participatory process as outlined in Module 2 of this toolkit. Forest gardens 'swidden fallows' and future farm lands that are areas fundamental to meeting basic food security[5] are identified and recorded on maps, both for communal lands and individually claimed and used areas.
  If these areas are located within the proposed development area for plantation, then they will be enclaved and excluded from being categorised as HCS forest and from plantation development, unless they are negotiated to have a different status as part of the 'give and take' process (see Step 13 of the Decision Tree). Community protected or conservation areas will also be enclaved and integrated into the ICLUP.
- Maps of any **other areas that are legally required to be protected**.

All of these areas will in general be enclaved and excluded from HCS analysis and plantation development, but it is nonetheless important to have these data prepared and overlay them as early as possible with the map of HCS patches in order to facilitate the use of the Decision Tree. If these analyses and mapping processes have not occurred, or if it is found during field visits that the participatory mapping or HCV studies were of poor quality, then the Decision Tree process will not be able to be finalised until these other processes are completed satisfactorily. Completion of the ICLUP in the Decision Tree requires all critical layers of information to be available. For example, it is necessary to ensure community gardens or farmlands that are areas fundamental to meeting basic food security are not classified as HCS forest, and that conservation planning optimises conservation area shape and connectivity. Other community lands that are not identified as HCS forest and are not any of the above categories – including farmlands and fallows beyond that required for fundamental needs, community orchard and plantation areas (e.g. rubber, durian, etc.), areas dominated by non-native or invasive species, and bare or degraded lands – may be available for development if the community consents.

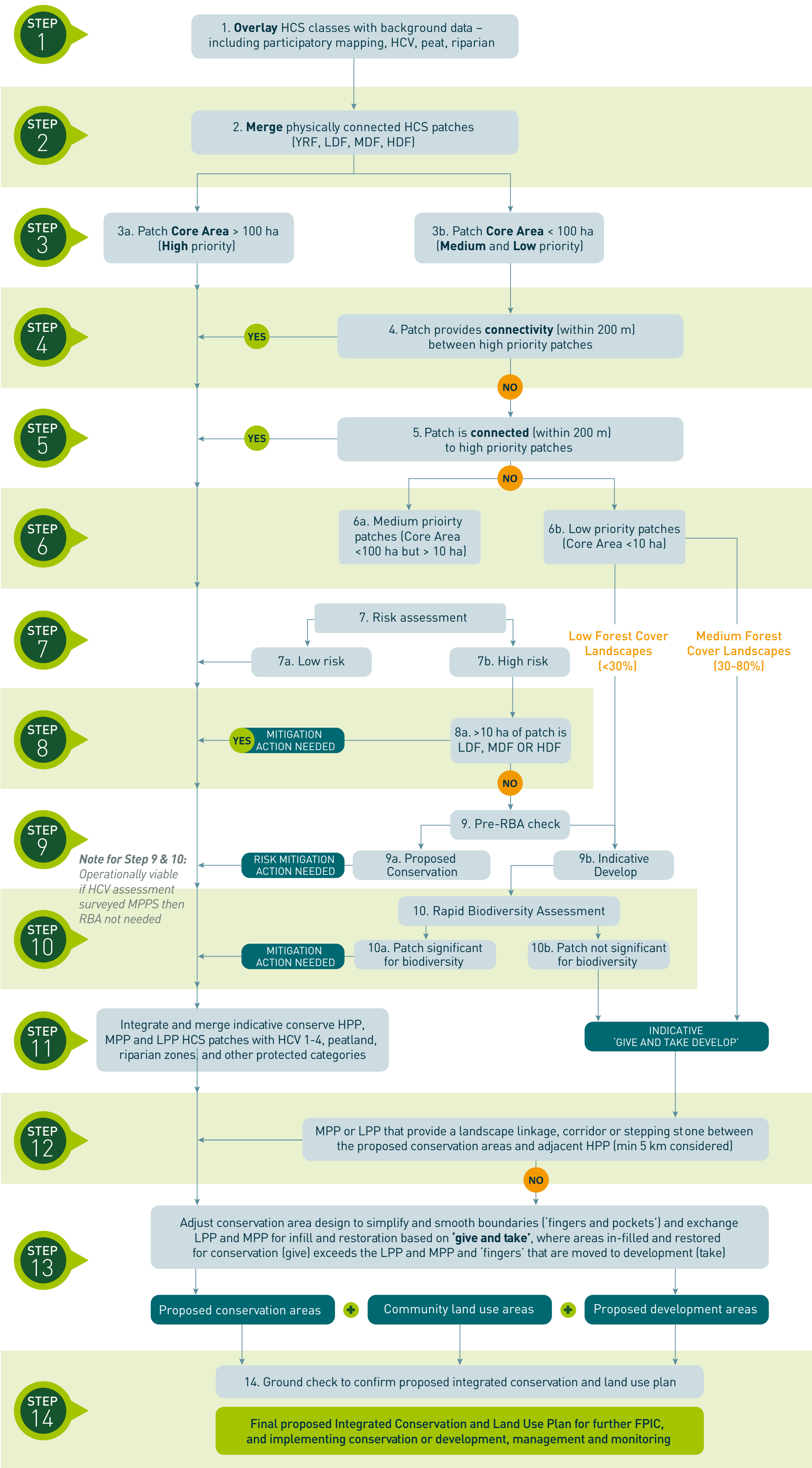

Figure 4: HCS Patch Analysis Decision Tree. (RBA = Rapid Biodiversity Assessment).

For communities that agree to assess their lands using the HCS Approach, identified HCS forest will be proposed for conservation as part of the ICLUP for the area. Determining the conservation and management of these areas will require the support and participation of the communities, including consideration of the range of benefits and incentives (similar to areas of HCV), that can potentially assist them in managing and maintaining these areas. It is expected that every effort will be made to address community concerns on and their forgone use of their forest lands that are proposed for conservation. Thus local communities with customary rights to forests have the right to determine whether to participate in the HCS Approach and which of their forest lands are conserved. If a community does not agree to having their lands assessed using the HCS Approach then they can not be considered as complying with the HCS Approach. Further if a forest area is both high, medium or low density forest and is not part of the community's extended shifting cultivation cycle, and is cleared by the community or another party (such as a local company) following agreed HCS assessments (and the community has been fully informed of the HCS forest status), this would be considered deforestation, and also not complying with the HCS Approach.

Documenting the steps in the Decision Tree

Finally, each distinct step and decision taken in this process should be documented by the organisation completing it. The results must be transparent and available to be reviewed by external experts. The HCS Approach Steering Group has a quality assurance process to provide an expert review of the Decision Tree results to ensure that the interpretations and decisions are in line with the full HCS Approach process. The final conservation and land use plan must reflect the integrated planning approach, which requires that habitat connectivity and the importance of each forest patch be assessed within the broader landscape

"... it is necessary to ensure community gardens or farmlands that are areas fundamental to meeting basic food security are not classified as HCS forest"

Photo: Ulet Ifansasti ©

THE HCS FOREST PATCH ANALYSIS DECISION TREE

The Decision Tree provides a way to analyse the conservation value of each HCS forest patch based on the conservation principles outlined above, 'short-listing' each patch for conservation or development. Some Medium Priority Patches (MPP) and Low Priority Patches (LPP) may change categories or boundaries in the conservation and land use planning stages of the Decision Tree when the forest patch viability and optimisation aspects are considered.

Each step in the Decision Tree will be detailed in this section. To illustrate the concepts, maps of a real proposed development area are used with HCS forest patches of varying size and shape to illustrate the steps and process.

Step 1. Identify customary land use areas, community garden areas or future farm land and overlay data for other areas if available, including HCV areas, peatland, and riparian zones

The proposed development area map with the potential HCS forest areas must[6] also include other data that spatially delineate areas proposed to be enclaved (e.g. community subsistence garden areas) or protected, including: community protected areas, HCV areas if already known (separated by HCV 1–3, HCV 4 and HCV 5–6), peatlands of any depth, and areas that cannot be developed due to government regulation or company commitments. The garden/farm lands and community economic use areas (such as rubber or cocoa plantations) are removed from consideration as potential HCS forest and thus not processed further via the Decision Tree until Step 13, where, with the consent of the community, they can be considered as part of 'give and take' providing that minimum garden / future farm area requirements are met. Where community customary use (HCV 5) and HCS forest overlap, such as in Non-Timber Forest Product (NTFP) areas, they will be proposed for conservation with continued customary use, management and agreed rules for use that maintain the values, and enclaved from plantation development.

The data on the other areas are included **for information only** at this stage to show the full mosaic of already-protected / protectable areas in relation to any potential HCS forest areas. Step 11 will fully integrate HCS patches with HCV areas and other areas to be conserved.

Outside of the proposed development area, indicative land cover classification must be carried out (using remote sensing data) over an external buffer of at least 1 km around the proposed development area to identify any indicative HCS forest areas, and any known HCV forest and/or protected areas identified within 200 m of the proposed development area borders (see section 1.2 above). This wider area consideration allows the user to properly assess patch size for patches that overlap the development area boundary, or identify patches considered to be close enough to be considered connected.

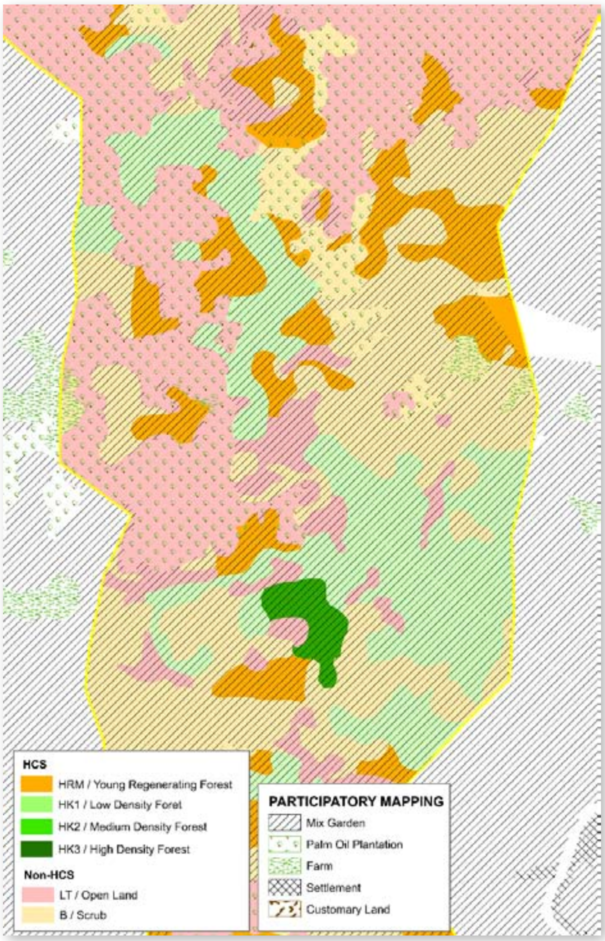

Figure 5: Potential HCS forest and non-HCS forest classes, and participatory mapping data.

Step 2. Extract all HCS forest classes and merge physically-connected patches

High Density Forest (HDF) areas through to Young Regenerating Forest (YRF) areas identified in Phase One of the methodology on vegetation classification are extracted from non-HCS classes to form one HCS layer, while keeping the distinctions regarding type of class (HDF, MDF, LDF, or YRF) for consideration later in the Decision Tree. This includes patches that extend beyond the proposed development area boundary. Where HCS patches are physically connected (patch edges abut or are shared[7]) to each other they are merged to form one patch. This merge function influences the patch size and shape needed in Step 3.

[6] Unless the Decision Tree is being used on a preliminary basis to identify Medium Priority Patches for RBA as part of an HCV assessment.

[7] For instance, when patches of different vegetation strata/classes abut or are continuous with each other.

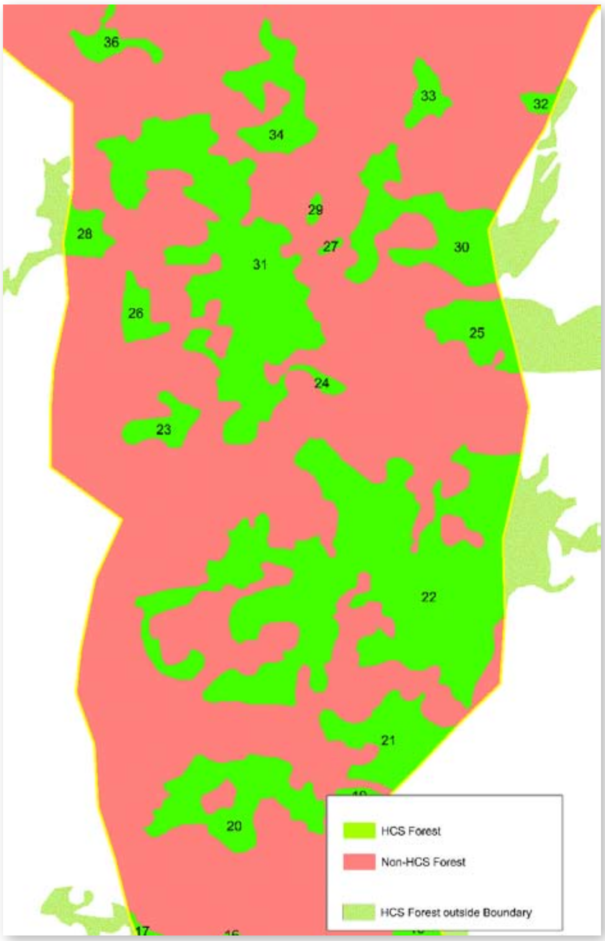

Figure 6: Merging of vegetation classes to form one potential HCS forest layer and one non-HCS forest layer.

Step 3. Identify patch core and prioritise patches

Each HCS patch can now be assessed according to the conservation science principles. The HCS forest patches are first assessed for their core area using an internal (negative) buffer of 100 m. This is the primary filter for selecting patches for conservation, because patches with a larger core area will be more viable in the long term as they have fewer edge effects.

The larger the patch core, the higher the likelihood of being able to maintain or recover its ecological function as a forest, including conserving carbon and biodiversity values. Patches are therefore prioritised accordingly:

3a. A patch that contains a total core of more than 100 ha of HCS forest is considered a **High Priority Patch (HPP)** and will be marked for conservation. HCS forest patches that extend outside the boundaries of the proposed development area are assessed for their full size irrespective of the concession boundary (i.e. they are considered HPP if their total core area is greater than 100 ha and any part of the patch area is within the concession).

3b. A patch that contains a total core of 10–100 ha of HCS forest is considered a **Medium Priority Patch (MPP)**.

3c. A patch that contains a core of less than 10 ha of forest is considered a **Low Priority Patch (LPP)**.

MPPs and LPPs will be further assessed for connectivity between HPPs (Step 4) and proximity to large patches (Step 5).

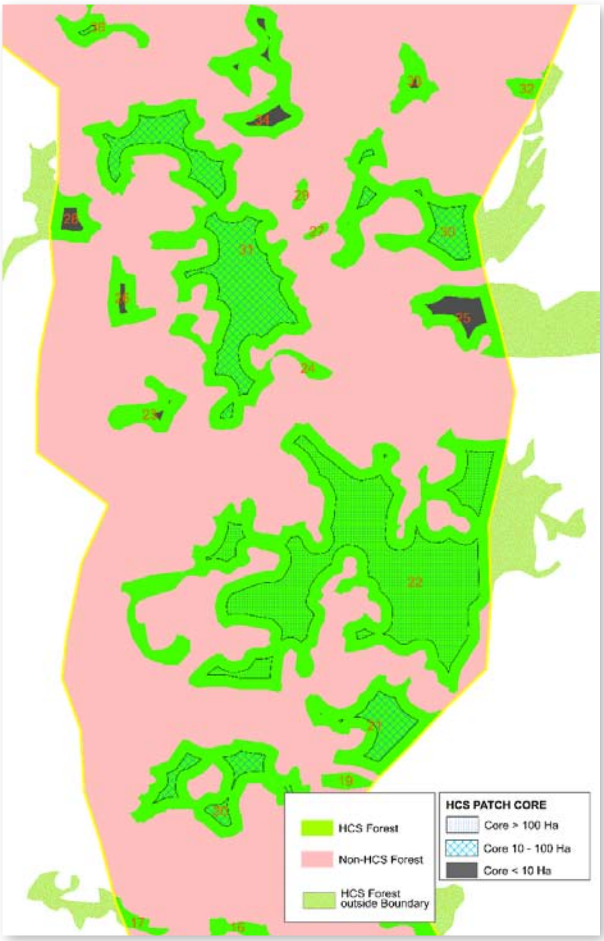

Figure 7: HCS forest patches after core analysis and identification of HPP, MPP and LPP based on the size of their core area. High priority patches are identified for conservation.

Step 4. Connect High Priority Patches

Connectivity facilitates the dispersal of biodiversity between patches and therefore the medium to long-term viability of the forest. Importance is therefore given to firstly identifying any **Low Priority Patches** and **Medium Priority Patches** that create connectivity between **High Priority Patches**.

Connectivity is defined as two patches whose edges are within 200 m of each other, measured from actual edge to edge[8] (connectivity does not consider patch core size, position or configuration). Any **MPPs and LPPs** that provide connectivity between **HPPs** are marked for indicative conservation. Importantly, connectivity can be provided by multiple patches between HPPs and are thus collectively marked 'indicative conserve'. GIS 'aggregate' tools may be used to assist in identifying connectivity, and 'Nearest Neighbour' in ArcGIS.

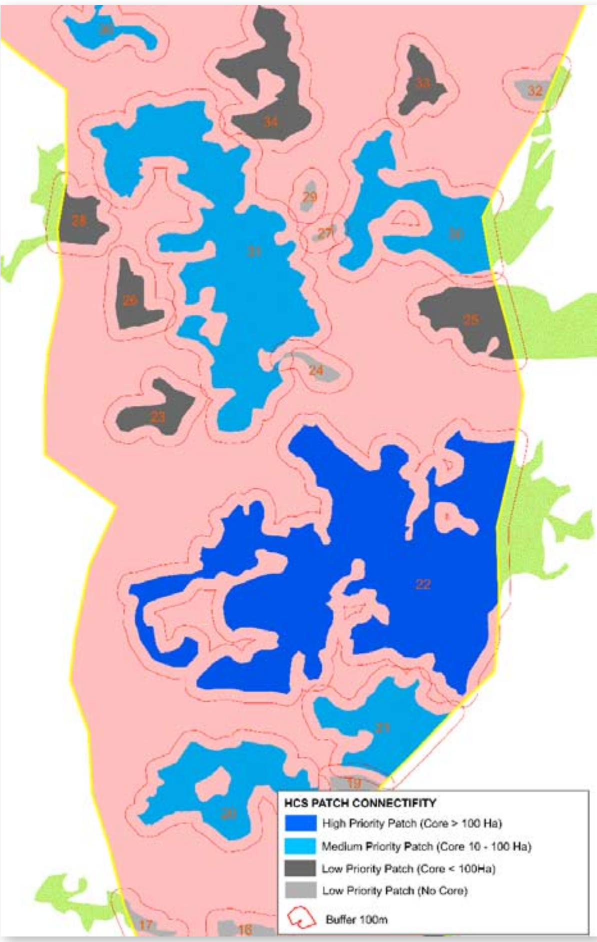

Figure 8: MPPs (20 & 21) and LPPs (19) that are considered connected to a HPP and marked for proposed conservation.

[8] That is, in GIS, 100 m external buffers overlapping.

[9] See footnote 8 above.

Step 5. Connect Medium and Low Priority patches to High Priority Patches

MPPs and **LPPs** that do not provide connectivity between **HPPs** but are connected (i.e. within 200 m measured between closest patch edges[9]) to **HPPs** or any large (>100 ha core) HCS forest or HCV forest areas, peatlands, or riparian areas within or adjacent to the proposed development area, are marked for conservation.

LPPs and **MPPs** identified as connected are provisionally marked 'give and take conservation', and can later be considered for the 'give and take' process in Step 13 in order to contribute to the objective of simplifying the shape and boundaries of the conservation areas and improving connectivity. In Figure 8, patches 19, 20 and 21 fall into this category.

All **MPPs** that do not have an immediate connectivity to **HPPs** (see Figure 8, patches 30 and 31) are reviewed in Step 8 ('Risk assessment'). **LPPs** that do not have immediate connectivity to **HPPs**, or to HCV, riparian, peatland, or external HCS forests (see Figure 8, patches 23, 26, and 34) are shortlisted for development and reviewed in Step 13 (Integration and Conservation Planning).

Step 6. Separate Medium and Low Priority Patches

In this step, all **MPPs** (i.e. those with a 10–100 ha core) that have not yet been designated for conservation are subjected to a risk assessment (Step 7). Remaining **LPPs** in Medium Forest Cover Landscapes are not analysed further nor shortlisted for conservation; they are classed as indicative 'give and take develop' and held for consideration during the final boundary adjustment, 'give and take' process, and land use planning phase. In Low Forest Cover Landscapes, small patches are likely to have greater importance for conservation of biodiversity as they will be the last refuges, thus LPPs in Low Forest Cover Landscapes move to a pre-Rapid Biodiversity Assessment check (Step 9).

Step 7. Risk assessment

This step involves a risk assessment on MPPs that have not yet been identified for conservation. The risk assessment is based on the proximity of the forest areas to public roads, settlements, waterways used for navigation/transportation, and other anthropogenic activities such as mining, logging, or plantations. Consideration can be given to any potential or future risks if they are known. A set of external buffers – 2 km from settlements and 1 km from other risk factors – is placed in the map using GIS software to assess the indicative level of potential threat arising from human activities. We recognise that risks may extend well beyond these distances, but this close proximity presents a high risk of degradation or clearance. If there is finer resolution or more spatially accurate data on risks then this may be used. The risk classifications are:

7a. **MPPs outside these high-risk zones** are identified as **lower-risk** and are marked as 'indicative conserve'.

7b. **MPPs located inside these risk** zones are identified as **higher-risk** and unlikely to be viable. They are further assessed in Step 8 ('Review of HDF, MDF and LDF in MPPs'), Step 9 and Step 13.

Where a patch is part high risk and part low risk, the risk classification is determined by the dominant (largest overlap) level of risk. For instance, if 75% of the patch lies within 1 km of a road, it is considered high risk; if only 10% does, the patch is considered low risk.

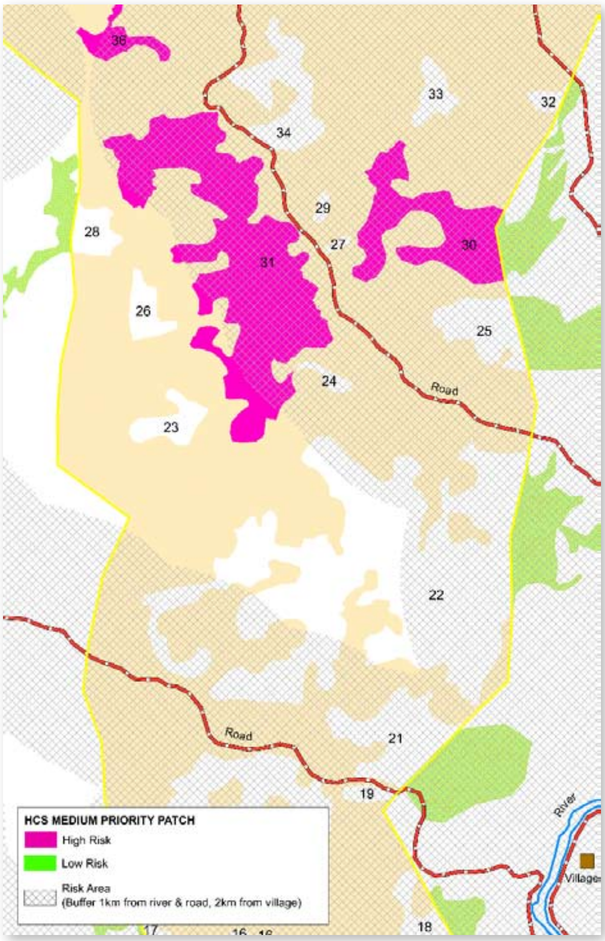

Figure 9: Patches 30 and 31 are within 1 km of the road, and are thus an example of high-risk MPPs.

Step 8. Review for the presence of Low Density Forest, Medium Density Forest or High Density Forest in Medium Priority Patches

A review for the presence of LDF, MDF or HDF is performed for any high-risk MPPs identified in step 7b. If such a patch contains more than 10 ha of continuous core area of LDF, MDF or HDF (i.e. not Young Regenerating Forest (YRF), but rather better-quality secondary forest), it is marked for potential conservation with mitigation measures to address the threat to these forests (see Section 3 in this module).

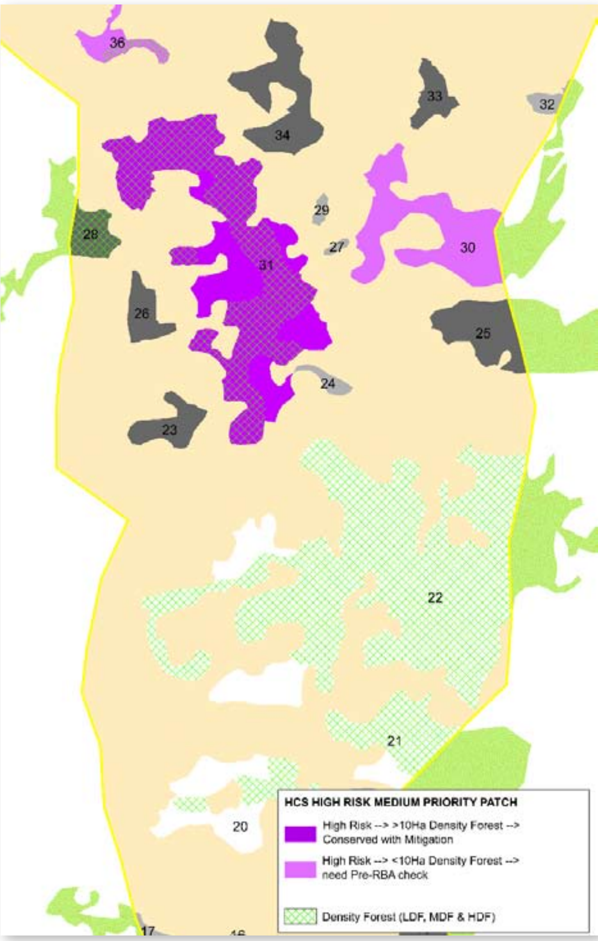

Figure 10: Patch number 31 is a high-risk MPP with >10 ha of LDF, MDF or HDF and would be classified as 'conserve with mitigation'. Patch No 30 does not have LDF, MDF or HDF and would thus move to a pre-RBA check.

Step 9. Pre-Rapid Biodiversity Assessment check

The steps described already will have identified many patches as 'indicative conserve' and some that are indicated for development. For the patches that remain to be classified, a Rapid Biodiversity Assessment (RBA) may need to be conducted before shortlisting them for development. A brief operational check (Pre-RBA) is carried out first in order to quickly disqualify areas inappropriate for development and avoid the need for a full RBA.

The aim of the Pre-RBA is to identify any impediments to development and operations. These could include excessive slope and wetland areas, as well as easily identifiable characteristics that would indicate a need to conserve the area, for instance they overlap with areas identified as HCV (check HCV layer), or the presence of streams or permanently wet areas. The methodology for the pre-RBA is included in the Appendix.

Any areas found to have impediments are moved to either conservation (e.g. for riparian areas, swamp areas or steep slopes) or enclaved from development (e.g. mining areas or community garden areas). Other areas move to Step 10.

Step 10. Rapid Biodiversity Assessment (RBA)

The RBA is the final precautionary step for assessing MPPs and LPPs that have not yet been shortlisted for conservation and would thus be indicated for development. The purpose of the RBA is to ensure that the patch does not contain biodiversity values such as important species, populations or habitat, or representative areas that were not identified in the HCV assessment but should nonetheless be conserved.

Note on new assessments: *If an integrated HCV/HCS Approach (including ALS and quality assurance) was used for the assessment, and field surveys for biodiversity values have already been carried out in these MPPs (particularly for representative areas and aggregations/concentrations of local species and their habitat), then an RBA is not required. In such cases, the target MPPs can be evaluated using existing information for these biodiversity values and either moved to 'indicative conserve' or 'indicative give and take develop'.*

The RBA relies heavily on data from a pre-existing HCV assessment in order to know which relevant species and habitat are likely to be found. If an HCV assessment has not been completed, it should be concluded before or during the RBA. It may be the case that the fieldwork done during the RBA finds important HCVs that were not captured in the HCV assessment. This could trigger a review of the HCV assessment, as it would be an indication that the original assessment was not done satisfactorily.

The purpose of the RBA is to identify:

1. Species that are:
   1.1. On the IUCN Red List as Near-Threatened, Vulnerable, Endangered, or Critically Endangered.
   1.2. Listed under the CITES convention.
   1.3. On any national or regional list of rare, threatened or endangered species or species that are protected by local, regional or national law.
   1.4. Identified in the HCV assessment as being of concern.

2. High-quality habitat of one of the species listed under point 1 above, even if the species was not recorded during the HCV or the RBA itself. The importance of such habitat should be considered in relation to the level of habitat in the landscape and the likelihood of being able to restore it for the species' use in the future (this should be considered together with steps 11–13).

3. Any concentrations of, or habitat of, regionally or locally rare or uncommon species, species protected by law, or simply representative areas of ecosystems that contain concentrations or combinations of local species and their habitat.

4. Rare habitat as identified in the HCV assessment.

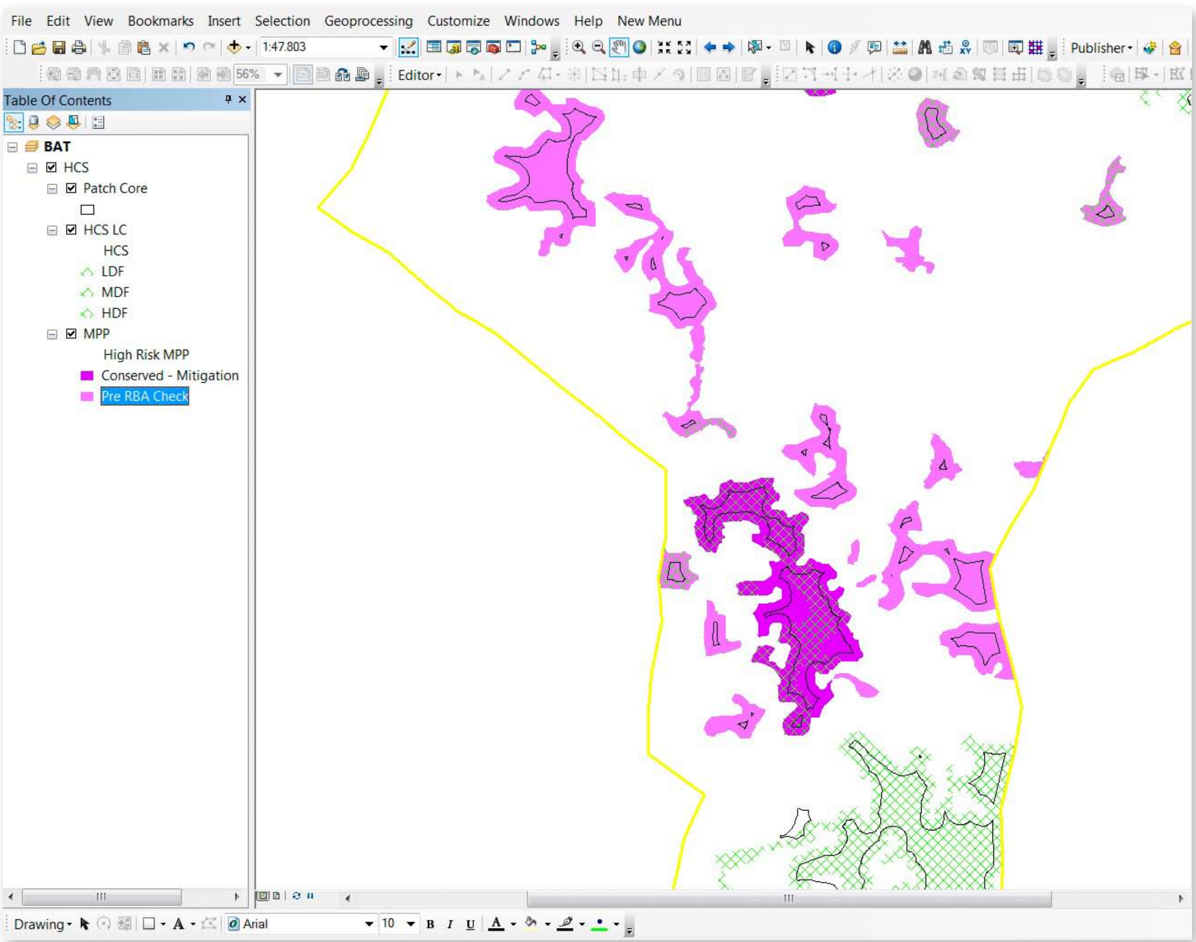

Figure 11: HCS patches identified for pre-RBA check.

The RBA is thus not a full biodiversity assessment of all plants and animals in the patch, but rather a focused assessment of whether important species, habitat and representative areas are found in the patch. The assessment should be based around as much existing information as possible and be conducted by qualified biodiversity assessors and experts using appropriate sample techniques based on the species of concern, which may vary according to whether mammals, birds, flora, reptiles or invertebrates are relevant. While there is no one prescribed methodology for the RBA, the Zoological Society of London has developed a toolkit that includes guidance on undertaking RBAs in oil palm landscapes that will be relevant for many HCS assessments.[10] As stated above, it is preferred that sufficient checks and assessments are carried out on patches during the HCV assessment in order to avoid having to carry out an RBA.

If the RBA does not identify any of the values listed above, the forest patch may be included for 'indicative give and take develop' (Step 10b of the Decision Tree). If there are important biodiversity values present, they will move to the HCV protection process if they also qualify as HCV 1–4; if non-HCV, the areas will be conserved. This latter process can be incorporated into the final conservation planning process, following advice from appropriate experts including local community representatives.

[10] Imanuddin, Sophie Persey, Dolly Priatna, Laura D'Arcy, Lili Sadikin, and Michael Zrust (2013). A practical toolkit for identifying and monitoring biodiversity in oil palm landscapes. Zoological Society of London. Available at: https://www.hcvnetwork.org/resources/folder.2006-09-29.6584228415/ZSL%20Practical%20Toolkit%20for%20identifying%20and%20monitoring%20biodiversity%20within%20oil%20palm%20landscapes.pdf (accessed 24 April 2017).

Steps 11–14. Integrated conservation and land use planning

In this phase, potential conservation areas are evaluated from both a proposed development area level and a landscape perspective to ensure connectivity of patches, corridors between forest areas (including those outside of the concession), stepping stone forest patches to provide connectivity, and coherence of shape. The aim is to produce a conservation plan that integrates all set-aside categories (community protected areas, HCV, HCS, riparian, peatlands, etc.) and has the highest likelihood of ecological and social viability. Optimisation of conservation, social and economic outcomes is also addressed in this phase. Economic optimisation is addressed through operational concerns based primarily on maximising the area available for potential development and the shape and size of plantation blocks and accessibility, or if a patch is of a configuration and shape that makes the establishment of planting blocks impossible.

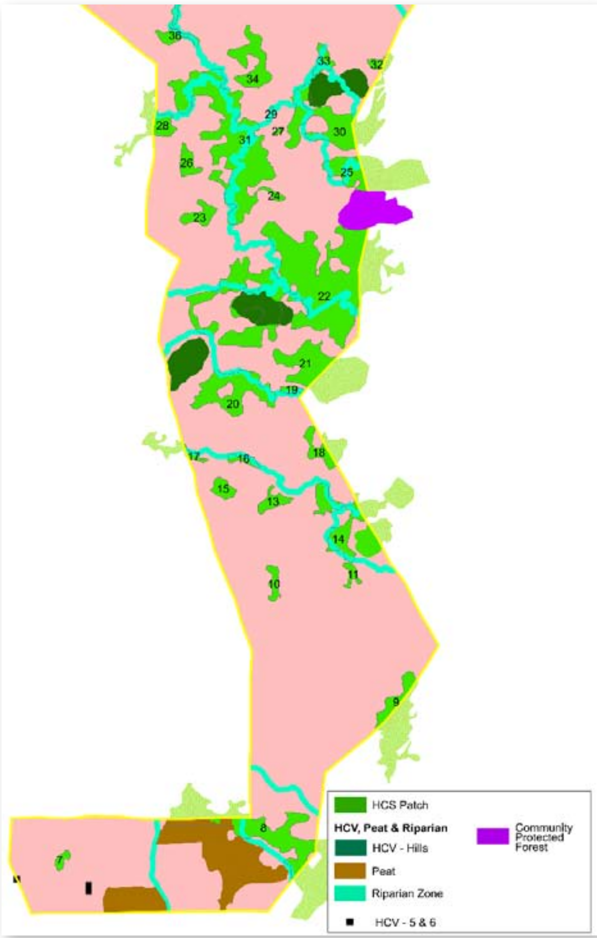

Figure 12: Adding all data layers - HCV 1–4, peatland areas, riparian zones and other protection or conservation areas and HCS forest patches, in preparation for merging.

Step 11. Integrate and merge

Merge HCVs 1–4, peatland areas, riparian zones, and any other protection or conservation areas with all HPPs, MPPs and LPPs that have either been identified as 'indicative conserve' from steps 1 to 10 in the Decision Tree. This gives an aggregated 'indicative conserve' area that will form the basis of the following steps to maximise viability and optimisation.

Step 12. Consideration of forest and conservation area connectivity within the broader landscape (recommended step only)

Indicative 'give and take develop' patches will range in size and position in relation to other patches, and as well land cover in landscapes will differ. First the landscape needs to be defined (see options for this in section 5a). The minimum distance for considering broad connectivity with other large forest areas within the surrounding landscape is 5 km from the boundary of the proposed development area. Using a large-scale or 'wide view' of the forest cover of the proposed development area and surrounding landscape, ascertain if there are any obvious corridors or linked patches that create likely dispersal or movement routes for species in the landscape. Where these areas of connectivity cross or join the proposed development area, see if there are any indicative 'give and take develop' patches that offer linkages or stepping stones that improve this connectivity. GIS tools may be used in this step to identify the best connection. Decisions on corridors versus stepping stones can be made in relation to the species present in the landscape and their habitat needs, their dispersal characteristics and pattern, as well as the quality of the habitat in the patches.

Step 13. Finalising the proposed ICLUP

To complete the HCS forest patch analysis process, a key process is adjusting the conservation area design through simplifying boundaries and exchanging 'give and take develop' MPPs and LPPs that have not been recommended for conservation after Step 12, and 'give and take conserve' patches from Step 5. This involves the infill and restoration of areas that improve the shape, size, core area and connectivity of the proposed conservation areas, in exchange for isolated MPPs and LPPs being developed to maximise the size, shape and configuration of areas for potential development. MPPs that have fragmented cores (i.e. an unsuitable shape for viable conservation) would qualify for being exchanged from 'conserve' to 'develop'. LPPs that have been identified as 'indicative give and take conserve' in step 5 may be included in this exchange process to achieve the goals of viability and optimisation. Consideration will be given to access to both development (operational efficiency) and conservation areas (risk).

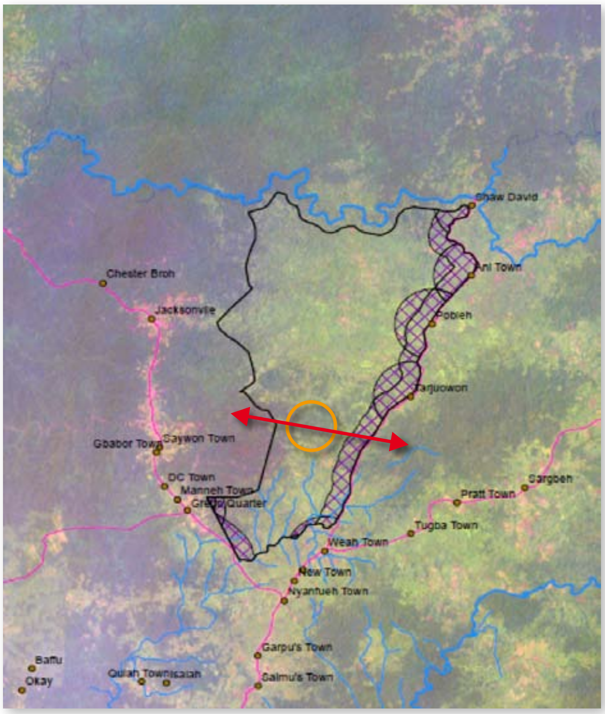

Figure 13: Example prioritisation of patches for conservation due to them providing a corridor and stepping stones, and improving landscape level connectivity.

It should be emphasised that while the full 'give and take' process is preferable because it increases viability and optimisation, it is not a mandatory requirement. However, it is a requirement that any of the 'indicative give and take develop' areas (MPP and LPP forest patches not identified as priority for conservation) that will actually be developed (i.e. forest converted) are exchanged for other infill and restoration ('give') areas to ensure a demonstrable positive benefit for conservation (at a minimum on an area basis).

Connectivity and infill areas should be a minimum of 200 m wide. Narrow 'fingers' of YRF (<200m with no core) that extrude from HPP or MPP patches may be excised ('take') and exchanged for pockets in patches ('give') to 'smooth' the boundary or for areas to bridge or connect to HPPs, providing there are no other values (for instance riparian zones) being compromised in the process. The primary aim here is to increase core size and reduce the length of the edge, as well as provide larger and better-configured areas for development. These exchanges must provide demonstrable positive benefits for conservation – in other words, the 'give' areas must exceed the 'take' – as well as improve the optimisation of the development. A calculation will be made on an area basis for this exchange process.
Where an area is to be restored/conserved either inside or outside a concession ('give') in exchange for conversion of an equivalent area of LPP or MPP ('take'), the following principles apply (note that these also apply to step 12 above):

a. The restoration/conservation aims for **equivalence** through being implemented as close as possible to the place where the conversion occurs, ideally in the same water catchment and ecosystem type or in places with similar historical ecosystem structure, and at least the same size.
b. The areas restored/conserved are clearly **additional** and the 'take' component does not involve HCV areas or peatland.
c. With the free, prior and informed **consent** of communities, the restoration/conservation may occur on community-owned land, and/or create employment or income-earning opportunities for community members.
d. The process should involve the **collaboration** of other stakeholders, including local government and adjacent land managers if relevant.
e. The company must ensure there is a commitment and clear steps towards the **permanent** protection and funding of conservation and restoration sites as long as it is operating in the area. The transparent reporting, monitoring and restoration of the area is to be incorporated into a management plan along with the management of HCV areas.
f. The selection of areas for conservation/restoration considers the risks to the viability of these areas and the ability to achieve permanent protection via legal or other mechanisms.
g. A decision on whether active restoration is required is based on site suitability and likelihood of natural regeneration within the next 5 years.

Step 14. Ground check

Ground checks are conducted to confirm that the proposed conservation area and the potential development areas are pragmatic, and that there are no factors observed in the field that have not been taken into account which might have a major impact on the viability of the plan. To avoid multiple field visits, these ground checks can be incorporated earlier in the Decision Tree, such as at step 9, or as part of the integrated HCV/HCS assessment process.

While the integrated map created for the Decision Tree analysis separates out enclaved garden areas and identified customary and economic use areas, it may be that some areas were missed, especially if the quality of the participatory mapping was poor. Therefore, after performing all the steps above, a final ground check needs to be performed to:

1. Provide an additional check of any potential HCS forest areas for conservation, and exclude from HCS areas any community orchards or plantations, community gardens or future farm land not previously identified.
2. Check the location and boundaries of any community protected areas, and then incorporate them into the ICLUP and management plans.
3. Check other development constraint to areas marked 'develop', such as mining activities or other situations unfavourable for plantation development (e.g riparian zone, flooded area, steep slopes, unsuitable soils including peatland, etc.)

The ground check can be done using a combination of low-level fly-overs or drones and walk-throughs in the concession.

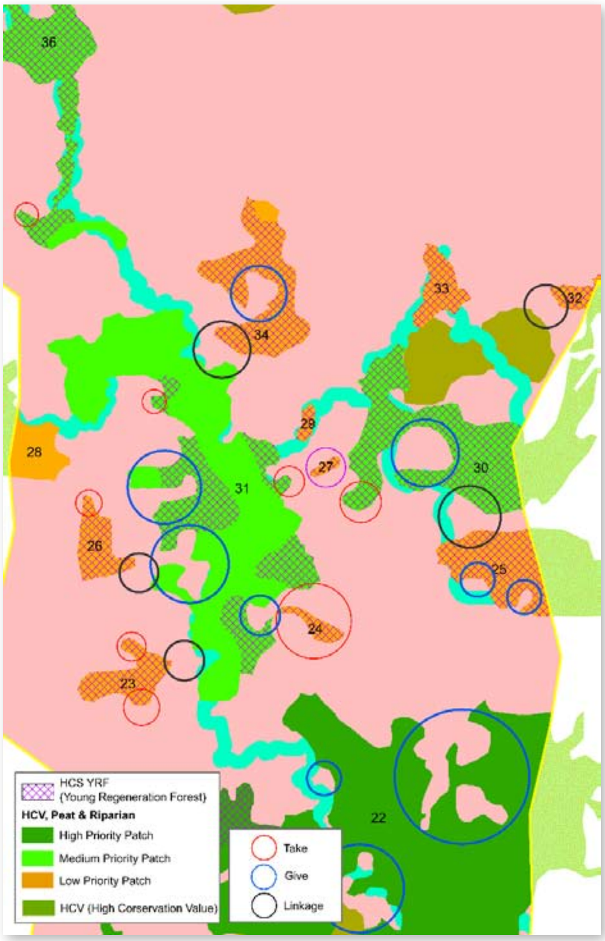

Figure 14: Examples of exchanges of 'give and take' patches, and infill and restoration, including different types of exchanges.

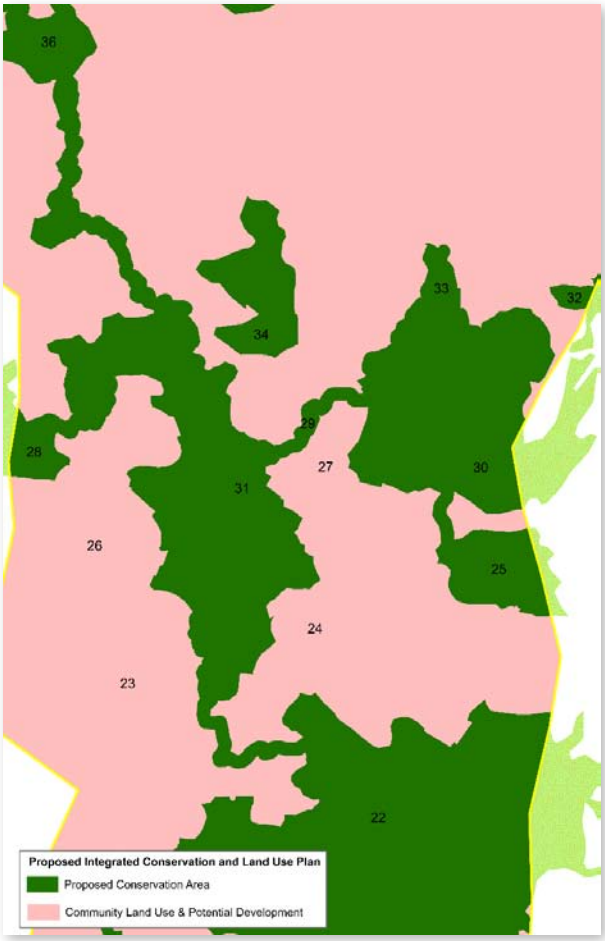

Figure 15: Proposed Integrated Conservation and Land Use Plan (ICLUP) after completion of the Decision Tree.

The proposed ICLUP is required to be vetted by an independent conservation science expert as well as through the HCS Approach Steering Group quality assurance procedure (see Module 7) to ensure that the steps outlined in this phase of the HCS Approach methodology are properly followed. Many resources exist to help develop such a conservation plan, including:

- Bentrup, G. (2008) Conservation buffers: design guidelines for buffers, corridors, and greenways. General Technical Report SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. Available at: http://www.srs.fs.usda.gov/pubs/33522
- Ministry of Natural Resources and Environment of the Government of Malaysia (2009). "Managing Biodiversity in the Landscape: Guidelines for planners, decision-makers and practitioners." Available at: http://www.hcvnetwork.org/resources/folder.2006-09- 29.6584228415/Guideline_Man_BioD_landscape_090519.pdf
- Zoological Society of London. (2011). A Practical Handbook for Conserving High Conservation Value Species and Habitats within oil palm landscapes. Available at: https://www.hcvnetwork.org/resources/folder.2006-09-29.6584228415/ZSL%20Practical%20Handbook%20for%20Conserving%20HCV%20species%20-%20habitats%20within%20oil%20palm%20landscapes_Dec%202011.pdf

Appendix 1: Pre-Rapid Biodiversity Assessment check methodology

By Rob McWilliam (TFT) and Grant Rosoman (Greenpeace).

INTRODUCTION

The Rapid Biodiversity Assessment (RBA) is designed to be precautionary towards important biodiversity values that may not have been captured in an individual patch through either the HCV assessment or the thresholds used in the Decision Tree. The first step then is to check the HCV layer against the patches identified for the pre-RBA check to see if they have already been categorised either partially or fully as an HCV area, or check if the integrated HCV/HCS assessment has already carried out field surveys in the patches. The assessment aids in deciding whether smaller forest patches should be conserved or made available for development.

Because conducting a full RBA requires a certain degree of specialised resources, before undertaking an RBA it is recommended to conduct a rapid Pre-RBA check to determine if there are any environmental or social constraints to developing the patch. Where such constraints exist, then the patch is shortlisted for conservation and no further assessment work would be required. The core objective of the Pre-RBA check is thus to ensure that only key patches move on to the full RBA process.

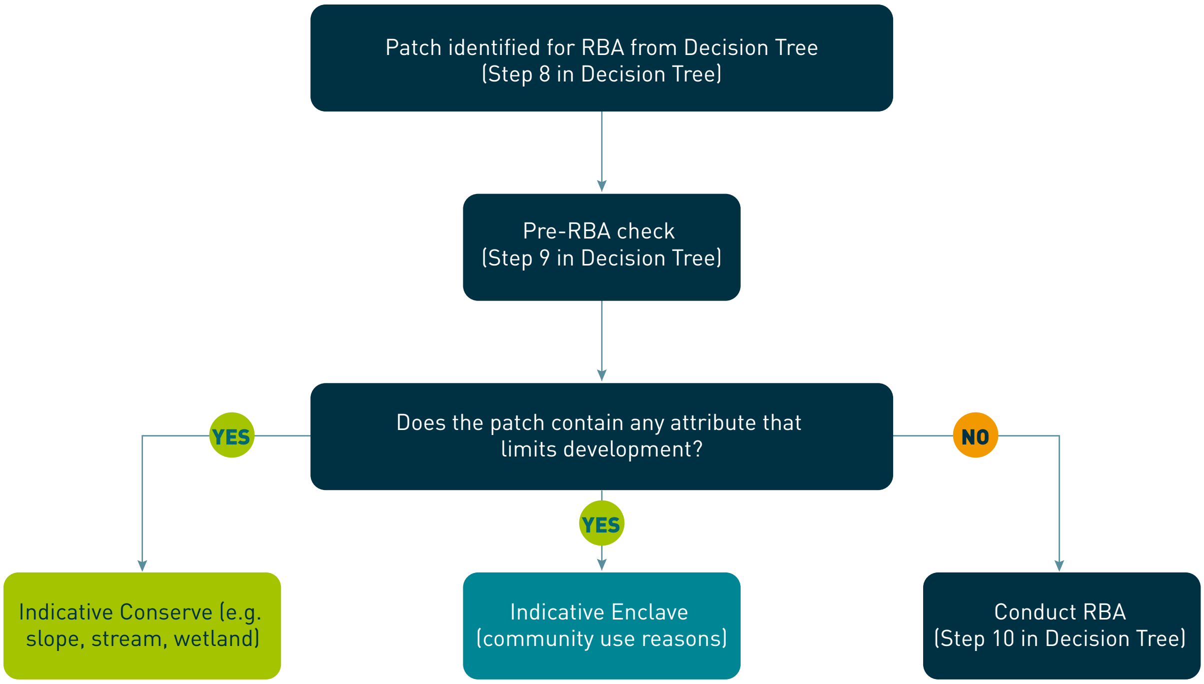

Figure 16: Pre-RBA decision making process

CONDUCTING A PRE-RBA CHECK

The pre-RBA is normally conducted by the company's operational staff, typically based at the site of development. The attributes selected for reviewing during the pre-RBA are easily identified and therefore experts are not required to conduct the assessment.

The pre-RBA is conducted via a walk-through of the patch, such as along the axis of longest distance or around the patch to increase the chance of capturing the largest variation, as shown in the figure below. The route for the walk-through should be determined using GIS, with the route uploaded to a GPS for the assessor to follow.

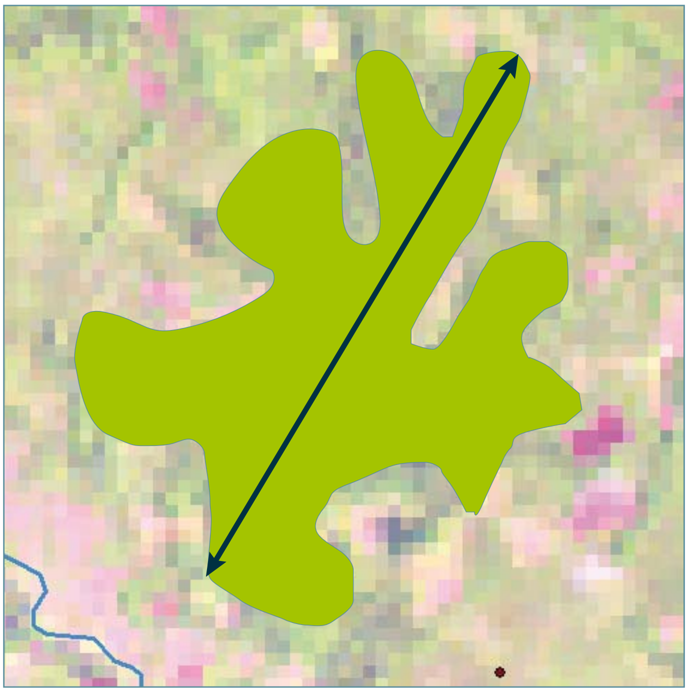

Figure 17: Example selection of the long axis through a patch

IDENTIFYING AND DOCUMENTING KEY ATTRIBUTES

During the walk-through, the assessor observes and documents the presence of key attributes, including:

- Characteristics of the environment within the patch, including the presence of water features or slope.
- Evidence of recent local community activity, such as the harvesting of forest products.
- Presence of access paths, such as roads or daily-use walking paths.
- Infrastructure such as housing.
- Other land use, for instance semi-permanent use such as farms or forest gardens.
- Accessibility issues.

During the walk-through the assessors should photograph any key attributes and record their GPS coordinates along with any observations in the form presented at the end of this section.

ANALYSING THE RESULTS OF THE PRE-RBA CHECK

The decision process outlined in the figure below is used to process the findings documented during the pre-RBA. The attributes addressed at each step are ranked by importance. For example, if a patch has a stream running through the area then it is of highest importance and shall be conserved.

"The aim of the Pre-RBA is to identify any impediments to development and operations. These could include excessive slope and wetland areas, as well as easily identifiable characteristics that would indicate a need to conserve the area"

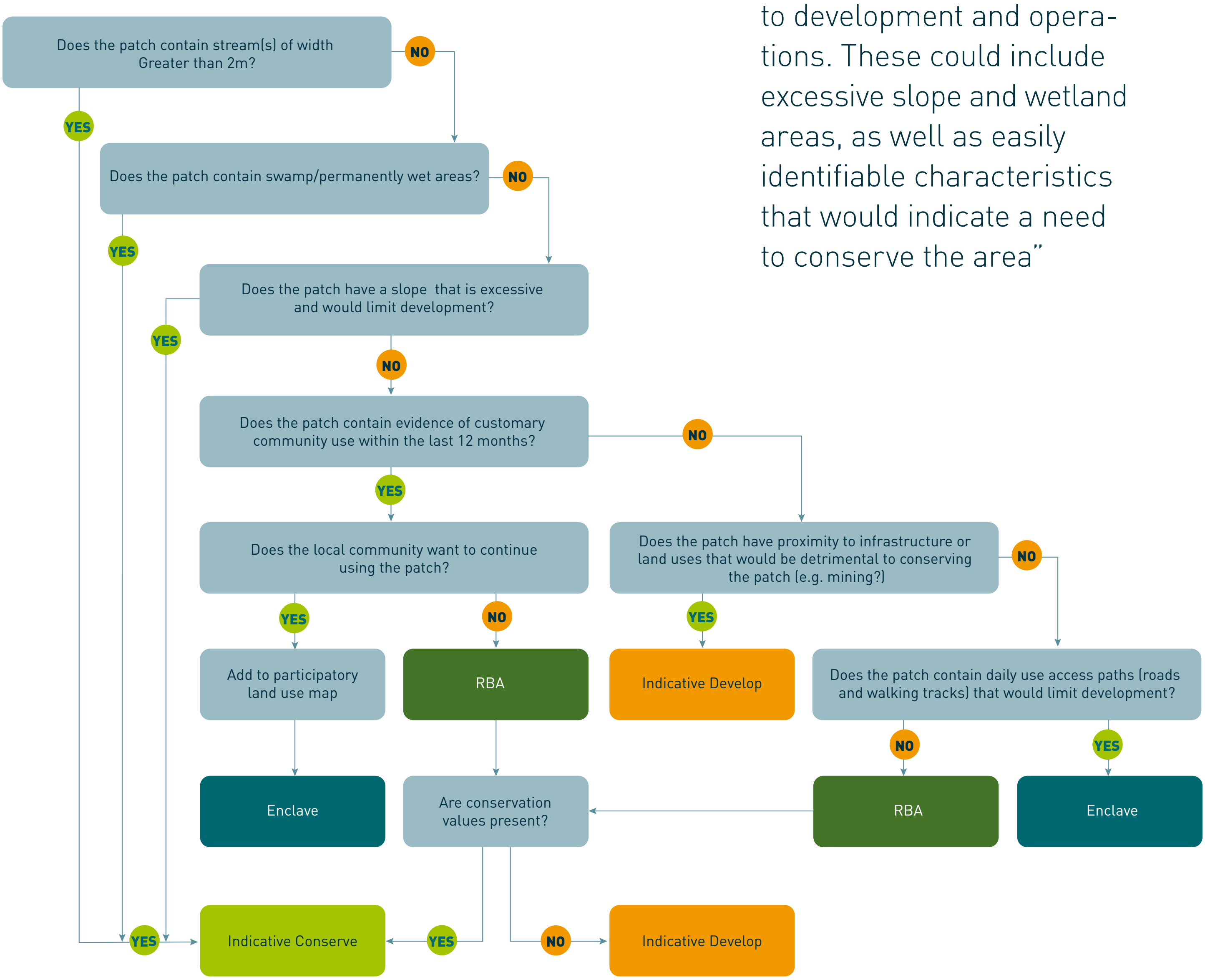

Figure 18: Pre-RBA decision making process

Pre-RBA Check Assessment Form

Attribute	Presence (Yes/No)	GPS Location		Photo Number	Comments and observations
		Latitude	Longitude		
Presence of perennial stream >2 m width					A perennial stream is one that has continuous flow in parts of its stream bed for at least six months of the year.
Presence of ephemeral stream >2 m width					An ephemeral stream is one that only exists for a short period following precipitation.
Presence of spring					A spring is defined as any natural situation where water flows to the surface of the earth from underground.
Presence of swamp or permanently waterlogged areas					A swamp is an area that is saturated with water, either permanently or seasonally, and surrounded by forest.
Presence of excessive slope that limits development					The definition of 'excessive slope' will vary by crop and should be determined with input from the concession holder. For palm oil concessions, the RSPO standard defines excessive slope as a gradient of 25 degrees or greater.
Evidence of community use within the last 12 months					Examples include areas communities have used for gardens, or for collection of materials for housing.
Presence of regularly-used access paths					For instance, roads or walking tracks that are used frequently for access to the area or other areas.
Presence of other land use that is detrimental to either conservation or development					For instance if the patch is in the middle of a mining area
Location aspects and accessibility					If the patch is inaccessible and is thus not going to be developed, then there is no point assessing – rather just add to conservation or leave as community lands if they have identified it as such.
Other observations (including wildlife and plants)					

Photo: Ulet Ifansasti ©

"To achieve the long-term conservation of HCS forest areas there are a number of important considerations to take into account: the management and monitoring of these areas; the benefits and incentives for communities; and the financing of both conservation area management and community incentives."

SECTION C

Protecting HCS forest and HCV areas: introducing Phase 3 of the HCSA process

By David Hoyle (Proforest), Grant Rosoman (Greenpeace), Paulina Villalpando (HCVRN) and Patrick Anderson (FPP), with input from further members of the Integration/HCS forest-HCV protection Working Group.

Following completion of the HCS Forest Patch Decision Tree, the next output is a proposed Integrated Conservation and Land Use Plan (ICLUP). At this stage it remains a 'proposed' plan, as the free, prior and informed consent (FPIC) of customary rights holders for all the categories of land use – whether conservation or plantation – still needs to be finalised. However, as participatory processes have been used in the preparation of the proposed ICLUP, including integration with community land use plans, understanding and initial support for the overall plan is expected and the boundaries of the different land use categories will also have been agreed and mapped. Final community and local government consent and support for the ICLUP is likely to hinge on the benefits and incentives provided for in the 'package' or social contract that comes with the plan. The social contract (production - protection agreement) needs to encompass the entire ICLUP and include planted areas, community farms, community lands and conservation areas.

To achieve the long-term conservation of HCS forest areas there are a number of important considerations to take into account: the management and monitoring of these areas; the benefits and incentives for communities; and the financing of both conservation area management and community incentives. It should be noted that from this point on there is integration with HCV areas (including peatland and riparian zones) and community protection and use areas, to ensure their conservation, management and monitoring. While this section does not constitute technical guidance, it does provide an overview of HCS forest and HCV area protection for further discussion.

MANAGEMENT AND MONITORING OF HCS FOREST-HCV CONSERVATION AREAS

HCS forests and HCV areas within plantation developments are conservation areas that must be actively managed and monitored by the company and/or the community and should neither be neglected nor excised. There are a number of key steps to be followed:

- Community awareness and building capacity around the need for and function of HCV-HCS conservation areas (to address potential community concerns about conservation).
- Clear agreement and communication on the tenure and boundaries of these conservation areas.
- Site demarcation (conducted jointly with communities).
- Preparation of a straightforward and practicable management and monitoring plan developed through conservation planning with the full participation of local communities.
- Clarification of the roles and capacities of relevant company staff, independent or contracted experts, communities and other stakeholders, in the development and implementation of the management and monitoring plan.


Photo: Ulet Ifansasti ©

The management plan should include:

- A set of objectives and targets.
- The description and location of the values present, their threats and an outline of the actions that will be taken to protect, maintain and/or enhance each value.
- Clearly mapped zones or areas for conservation, restricted use, livelihoods and agricultural plantings.
- Clarification on activities that are permitted or prohibited in each area, as well as the measures adopted to encourage them or enforce their prohibition.
- Clarification on who will be allowed or prohibited from engaging in each activity and/or have access rights to certain areas.
- Assurance/clarity that these norms and rules apply to all parties, including the developer.
- A management structure that identifies the appropriate body to manage or co-manage the conservation areas.
- A simple grievance mechanism (so that any disagreements over the status and management objectives of conservation areas in the ICLUP are resolved).
- Agreement on how benefits will be shared.
- Agreement on who will monitor adherence to the plan.

There are likely to be at least three types of conservation area: those that overlap with community lands and are co-managed with the community; those that the community has ceded to the developer (albeit for conservation); and areas that do not overlap with community lands. However, it is recommended in all cases that the management plan is agreed by all affected local communities (including rights holders and those adjacent) and other key stakeholders such as local governments. The management plan should stem from and be integrated into the social contract between the community and the developer.

The management and monitoring plan will also clarify roles and responsibilities, including which areas and activities will be under community control and management; which areas and activities will be under the control and management of the external developer; which areas and activities will be controlled and managed by third parties, such as government agencies or NGOs; and what, if any, arrangements will be made for co-management. The plan will also describe how tenures are to be applied to secure this management, as well as the legal, livelihood, cultural and rights implications of these arrangements.

Subject to a community's free, prior and informed consent to the implementation of the participatory management and monitoring plan, culturally appropriate measures shall be taken to:

- Train community members and company staff in monitoring techniques.
- Jointly define baselines.
- Measure changes in relation to baselines.
- Identify threats jointly.
- Define steps for encouraging and enforcing agreed plans and maintaining or enhancing identified values.

The developer shall also share information derived from remote sensing and other off-site monitoring with the other stakeholders.

This toolkit does not go into further details on HCS forest-HCV conservation area management and monitoring as there is already a great deal of guidance[1] and specialist literature on the management of protected areas.[2] An HCS Approach working group, in collaboration with the HCV Resource Network, will deliberate further and recommend additional guidance if necessary.

BENEFITS AND INCENTIVES

The incentives and benefits package offered to communities will need to address key preconditions regarding substitution and compensatory measures for foregoing uses and benefits (including potential future benefits) from conservation areas. It should be recognised that protection of HCS forest and HCV areas in the landscape is not solely the responsibility of local actors but also part of a much broader global responsibility. This package will need to be flexible to meet the needs of different landscapes and communities. It should also include incentives and benefits targeted at the communal level, as well as for families depending on customary ownership and land use rights status.

Depending on a participating community's needs and preferences, an incentives and benefits package should be agreed as an integral part of the social contract (production-protection). Potential benefits and incentives may include the following:

- Support for tenure security and recognition of customary land rights.
- Support for community livelihoods, including for harvesting Non-Timber Forest Products, alternative economic activities and strengthened food security.
- Supporting farm and plantation areas to increase productivity in existing areas and prevent the need to expand into HCS forest lands.
- Market and supply chain access support, including certification, premiums and preferential access.
- Social and infrastructural support to improve health, education and community institutions.
- Enabling the long-term protection of the areas by securing legal status, supporting village regulations and establishing community conservation agreements.
- Providing employment as part of securing and managing the HCS forest-HCV conservation areas (e.g. forest guardians or monitors).
- Direct payments for conservation, including leases, payments for ecosystem services (PES) and payments from Reduced Emissions from Deforestation and Degradation (REDD+) schemes.
- Monitoring of performance indicators and, as a last resort, penalties for breaches of the social contract (agreements) by any parties (including companies, communities, etc.).

The Integration/HCS forest-HCV area Protection Working Group is overseeing the development of tools, mechanisms and measures to ensure that HCS forest-HCV area protection and management can be achieved.

As HCS forest-HCV area protection is implemented, developers, communities and other stakeholders (including local authorities) will need to work together to develop agreed participatory management and monitoring plans (see above). These plans should be subject to specified review cycles and be adaptive to learn from implementation experience.

[1] e.g. HCVRN Common Guidance for the Management and Monitoring of High Conservation Values https://www.hcvnetwork.org/resources/cg-management-and-monitoring-2014-english

[2] e.g. IUCN best practice guidelines for protected areas - https://www.iucn.org/theme/protected-areas/publications/best-practice-guidelines

FINANCING PROTECTION OF HCS FOREST AND HCV CONSERVATION AREAS

HCV-HCS conservation requires considerable resources – not only for the management of protected areas, but also to ensure that the community benefits and incentives set out in the social contract can be delivered.

The company or project developer will need to cover some of the costs related to achieving and supporting conservation, as well as the cost of securing robust management and monitoring of conservation sites. However, if the important values found at these sites are to be protected and enhanced, then mechanisms need to be found to provide supplementary financing. The Working Group will collaborate with a wide range of expert stakeholders, including social, protected area and conservation finance specialists, to examine and evaluate the most appropriate opportunities to secure additional finance. Sources to be explored include:

- Revenue generated from the site from tourism, NTFP collection, and Payment from Ecosystem Services (PES).
- Contributions from supply chain actors, including traders, manufacturers, retailers and consumers.
- Climate finance, the Green Climate Fund and REDD+.
- Bilateral and multilateral donors.
- Investors and financial institutions.
- Government national parks / conservation authorities.
- Development owners and managers.

Considerable new finance and delivery mechanisms are needed if we are to go beyond simply identifying HCS-HCV areas and start securing their long-term preservation and protection. The Working Group is open and committed to exploring all options.

HCSA HIGH CARBON STOCK APPROACH

HIGH CARBON STOCK APPROACH

FURTHER INFORMATION

Contact the HCS Approach
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