ZSL

LIVING CONSERVATION

A Practical Handbook for Conserving High Conservation Value Species and Habitats within oil palm landscapes

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Version 1, English

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Chapter 1: Introduction

The challenging task of conserving species and habitats of High Conservation Value (HCV) is relatively new for many within the palm oil industry and may be viewed by some as tangential to the primary goal of producing palm oil. However, there are strong arguments for efforts to conserve biodiversity and ecosystem services to be incorporated within the core operations of every business, particularly those that depend on natural resources.

1. Protecting your natural capital
Palm oil production is dependent on many natural resources and ecological processes, the majority of which are free meaning that their true value frequently goes unnoticed. This includes, but is not limited to, pest control, pollination, nutrient cycling, climate control and the provision of clean water. These ecological services are the result of a complex web of interactions within, and between, a huge variety of different species (biological diversity or biodiversity) and the air, water and soil around them. The natural ecosystems formed by these interactions are like delicately balanced machines, which may function less efficiently or cease to function at all if some parts of the machinery are lost or broken, or the interactions between these parts are changed or disrupted. Therefore, it is essential that every possible measure is taken to reduce the extent to which the expansion and operation of oil palm plantations disturbs or damages these natural ecosystems.

2. Compliance with regulations
Working to reduce negative impacts on HCV species and habitats is integral to meeting national level commitments to international conventions, including the UN Convention on Biological Diversity (UN CBD), the Convention on International Trade in Endangered Species (CITES) and the UN Framework Convention on Climate Change (UNFCC). Palm oil producers also have a responsibility to comply with a series of national and local regulations designed to protect the environment.

3. Compliance with the Roundtable on Sustainable Palm Oil (RSPO) certification scheme
For palm oil producers that wish to obtain RSPO certification (www.rspo.org) there is an additional incentive to mitigate adverse impacts on HCV species and habitats as this is a key requirement of the RSPO Principles and Criteria (RSPO P&C). The RSPO P&C demand that High Conservation Values (HCVs) which may be affected by existing oil palm concessions (P&C 5.2) or new developments (P&C 7.3) are identified, maintained and enhanced. The HCV approach is based on 6 Criteria, which encompass

biodiversity (HCV 1-3), environmental services (HCV 4) and social values (HCV 5&6) considered to be of outstanding or critical importance.

Table 1. HCV Criteria for Indonesia

HCV 1	**Areas with Important Levels of Biodiversity**
1.1	Areas that Contain or Provide Biodiversity Support Function to Protection or Conservation Areas
1.2	Critically Endangered Species
1.3	Areas that Contain Habitat for Viable Populations of Endangered, Restricted Range or Protected Species
1.4	Areas that Contain Habitat of Temporary Use by Species or Congregations of Species
HCV 2	**Natural Landscapes & Dynamics**
2.1	Large Natural Landscapes with Capacity to Maintain Natural Ecological Processes and Dynamics
2.2	Areas that Contain Two or More Contiguous Ecosystems
2.3	Areas that Contain Representative Populations of Most Naturally Occurring Species
HCV 3	**Rare or Endangered Ecosystems**
HCV 4	**Environmental Services**
4.1	Areas or Ecosystems Important for the Provision of Water and Prevention of Floods for Downstream communities
4.2	Areas Important for the Prevention of Erosion and Sedimentation
4.3	Areas that Function as Natural Barriers to the Spread of Forest or Ground Fire
HCV 5	**Natural Areas Critical for Meeting the Basic Needs of Local People**
HCV 6	**Areas Critical for Maintaining the Cultural Identity of Local Communities**

The Purpose of this Handbook

Implementing effective measures to maintain and enhance HCVs that persist within oil palm landscapes has been frequently identified as one of the most challenging aspects of the RSPO P&C to comply with.

Although national toolkits have been developed to assist in *identifying* HCVs, at present there is little guidance available to

assist in implementing *management interventions* to ensure that HCVs are maintained and enhanced. What is more, the majority of the guidance available has been tailored to the identification and management of HCVs within selectively harvested forests. This is not sufficient to address the challenges and issues associated with implementing effective measures to maintain and enhance HCVs within oil palm landscapes, largely due to that fact that oil palm development involves land use change.

The aim of this handbook is to provide practitioners responsible for conserving HCV species and habitats within oil palm concessions with the necessary knowledge, understanding and practical examples of *how* this can be achieved. This includes accessible summaries of the research available to inform management decisions, case studies of measures that are currently being implemented by members of the palm oil industry in an effort to maintain and enhance biodiversity within oil palm landscapes, as well as links to available resources to assist in tackling key challenges. This information will also assist HCV assessors to produce practical HCV management plans.

The primary focus of this handbook is the conservation of species and habitats of High Conservation Value, and it is therefore not intended to provide comprehensive guidance on the management of all six HCVs, although the ecological and social values are often inextricably linked. Furthermore, for HCV management to be effective it must be tailored to the local situation, as the values and threats present will vary between locations. Therefore, this guidance is not designed to be prescriptive, but is instead intended to enable practitioners responsible for conserving HCV species and habitats to design and implement context specific management interventions that will be effective at achieving this goal within the oil palm concession they are responsible for.

The majority of the practical experience that has contributed to the production of this handbook is drawn from Indonesia, due to the fact that, along with Malaysia, this has been the geographical focus for the majority of work to maintain and enhance HCVs within oil palm landscapes to date. However, much of the theory and guidance contained within this handbook will be applicable to other key regions of oil palm expansion.

Chapter 2: Delineating HCV Management Areas

Once an HCV assessment has been carried out to identify the values and threats present within and around an oil palm concession, the first step is to decide *what* must be done to ensure that these HCVs are maintained and enhanced. The second step is to decide *where* this action must be taken. This is known as the HCV Management Area (HCV MA). In some cases the extent of the area that needs to be managed in order to maintain and enhance a particular HCV (HCV MA) will differ from the area where the HCV is identified to be present (HCV A) (See Box 1). For example, the fact that an HCV species, such as a leopard cat, is detected within the oil palm monoculture does not automatically mean that this area requires special management. Instead, it is necessary to determine the natural habitat required to support a viable population of this species and designate this as an HCV MA.

Box 1. Definition of HCV Area vs HCV Management Area

High Conservation Value Area (HCVA): An area that possesses one or more high conservation values. This may comprise forest and non-forest areas.

High Conservation Value Management Area (HCV MA): The area over which one or more forms of management is undertaken to ensure maintenance or enhancement of one or more HCV in the area. The HCVMA for a particular HCV may be larger or smaller than the corresponding HCVA.

Clearly and accurately defining HCV MAs at the planning stage is critical in the context of oil palm, as in many cases the HCVs that persist within and around the concession will be lost if the areas of natural habitat that support these values are converted to oil palm. Identifying HCV MAs once oil palm development has taken place will be constrained to areas of natural habitat that have been set-aside based on suitability for oil palm cultivation or in order to comply with regulations. It is highly unlikely that these areas will be as effective or efficient at supporting HCVs that persist within the landscape as areas that are designed specifically for this purpose.

The optimal size, shape and location of an HCV MA will depend on the values it is aiming to support, the type and severity of ecological and social pressures on the value, as well as the status and distribution of these values within the wider landscape. In many situations an HCV MA will aim to support a number of different values so a compromise will need to be reached between the

parameters that will optimise the ability of the HCV MA to fulfil each of these functions. The recommendations below are based on existing scientific research and current best practice, but should always be adjusted to take into account the local environment (eg. soil type, habitat type), regulations and threats.

Aerial imagery and GIS are extremely useful tools for delineating HCV MAs.

Table 2. Management objectives for HCV 1-4 (adapted from the toolkit for the identification of HCV Values in Indonesia, 2008)

HCV Value	Management objective
HCV 1.1: Areas that Contain or Provide Biodiversity Support Function to Protection or Conservation Areas	Maintain the integrity of the conservation area by minimising any direct or indirect impacts from the plantation operations. It may be necessary for the HCV MA to incorporate a buffer zone around the legally designated protection or conservation area.
HCV 1.2: Critically Endangered Species	Ensure the protection of each individual of this species.
HCV 1.3: Areas that Contain Habitat for Viable Populations of Endangered, Restricted Range or Protected Species	Ensure that sufficient habitat is conserved within the concession and the wider landscape to support a viable population of the species.
HCV 1.4: Areas that Contain Habitat of Temporary Use by Species or Congregations of Species	Ensure that these keystone habitats are accessible and continue to fulfil their function eg. As a breeding or nesting site, refuge from fire or flood, or as a corridor for movement.
HCV 2.1: Large Natural Landscapes with Capacity to Maintain Natural Ecological Processes and Dynamics	Ensure that a core area of > 20,000ha as well as a buffer zone of at least 3km from the forest edge remains as forest or other natural vegetation and that human and ecological disturbance within this area is minimised.
HCV 2.2: Areas that Contain Two or More Contiguous Ecosystems	To maintain connectivity between different ecosystem types that co-occur within the same landscape.
HCV 2.3: Areas that Contain Representative Populations of Most Naturally Occurring Species	See HCV 2.1

HCV 3: Rare or Endangered Ecosystems	Maintain the current condition of the ecosystem by reducing the direct or indirect impact of plantation operations. If the area of this ecosystem is too small to retain a core area of >20,000ha, then it will be necessary to delineate a buffer zone of at least 1km where operational activities are kept to a minimum.
HCV 4.1: Areas or Ecosystems Important for the Provision of Water and Prevention of Floods for Downstream communities	Ideally these areas would be protected from operations. If this is not possible, then management should ensure that the watershed and its hydrological function is maintained.
HCV 4.2: Areas Important for the Prevention of Erosion and Sedimentation	Wherever possible the natural vegetation cover should be maintained in these areas. If operations must be carried out, steps should be taken to ensure that this does not lead to increased soil erosion.
HCV 4.3: Areas that Function as Natural Barriers to the Spread of Forest or Ground Fire	These areas should be protected to ensure that they continue to fulfil this function.

Important factors to take into consideration when delineating HCV Management areas that aim to maintain and enhance biodiversity (HCV 1-3)

1. Legal requirements

All areas that are designated as areas for conservation or protection by Government regulations should automatically be set-aside from oil palm cultivation.

2. Species' habitat requirements

Species will only survive in the long term if the population is big enough to be self-sustaining. This is known as a viable population. The minimum number of individuals required for the population to be viable will vary greatly between species, as this depends on the sex ratio, age at sexual maturity, mating system, distribution and ecology. In the tropics, there are very few species that have been studied in sufficient detail to accurately determine the minimum number of individuals required for a population to be viable. What is more, detailed biodiversity assessments are required to estimate the population size of a particular species, particularly for rare and

elusive species that are rarely encountered. This is made even more difficult by the fact that the population size of a species will fluctuate over time and the individuals present within the area being surveyed may be a sub-population of a larger population whose habitat extends over a much larger area than the concession being surveyed. It is therefore very difficult to determine over the course of an HCV assessment whether or not the population of a certain species is viable.

It is therefore much more practical to assess whether or not the habitat available to a particular species is sufficient to enable it to survive and reproduce within the area being assessed and the wider landscape. Factors to take into account include:

- **Access to food and water:** this must be of the correct type and quantity to meet the dietary requirements of a sufficient number of individuals for the population to be viable

- **Shelter from predators and the environment:** this could include access to suitable roosting or nesting sites, as well as sufficient vegetation cover to hide from predators or prey

- **Mates:** the area of habitat required to ensure access to a suitable mate will vary depending on whether the species is solitary or lives in groups.

As a general rule, the area required to support a viable population of a species is greater for large bodied species, as well as for carnivorous species that require large areas of habitat in order to obtain sufficient prey.

Due to the difficulties in estimating the size of a population and whether or not it is viable, the HCV Toolkit for Indonesia recommends that if one or more individuals of an HCV 1.3[*] species are present then the population is assumed to be viable until there is strong evidence that this is not the case. For Critically Endangered species (HCV 1.2) it is considered essential to protect every individual, irrespective of whether the population is thought to be viable.

[*] Species listed as Endangered or Vulnerable by IUCN Red List, Appendix 1 or 2 by CITES, restricted range, or protected by the Indonesian Government.

Table 3: Specific habitat requirements of key HCV species in Indonesia

Species	Habitat preference	Diet	Home range	References
Elephant	Primary and secondary forest, riparian zones. Mostly found in lowland areas up to 3,000 masl.	100 – 180 kg of grasses, roots, leaves, trees, shoots, bark, bamboo, branches and shrubs per day. During the dry season 70% of its food is obtained by browsing, in the wet season 55% of its diet is obtained by grazing on grass. Drinks 150 litres of water per day.	Female home range is between 184–326 km², male home range is between 188–407 km². A study of the Sumatran elephant found it to have a home range of 97km^2	Choudhury *et al*. 2011, Sitompul, 2011, Sukumar, 2003
Borneo orangutan	Inhabits peat swamp and lowland dipterocarp forest. Not found above 1,000 masl	Eats 400 different types of food. Diet consists of mainly of fruit, but when scarce will feed on bark, leaves and termites. Usually found in forest where strangler figs are found at a density of around 2 individuals/ha	Female home range is between 40-600 ha, male home range is between 60-700 ha	Singleton *et al.* 2009
Sumatran orangutan	Inhabits lowland forest, including swamp forest, up to 1,500 masl	Diet consists mainly of fruits, but they also consume leaves, insects (termites and ants), bark, shoots and flowers.	Female home range is between 150-400 ha, male home range is around 2,500 ha,	Atmoko *et al.* 2009
Proboscis monkey	Inhabits riverine forest, mangrove forest, peat forest and fresh water forest in the lowland areas	It consumes 900g of food per day and 188 different plant species. Diet consists of around 65% leaves and 25% fruit. The remainder is made up of flowers, bark, insects and crabs. It prefers unripe fruit.	Non territorial species. The size of its home range varies depending on food availability but can reach between 1.37 km^2 and 3.15 km^2	Sha *et al.* 2011, Meijaard *et al.* 2011, Bismark 2010.

Siamang	Inhabits lowland forest up to 1,500 masl	Frugivorous, however can shift its food preference to leaves if necessary	Home range varies from 19.75ha in fragmented forest to 21.5 ha in contiguous forest	Yanuar & Chivers 2010.
Bornean white-bearded gibbon	Inhabits lowland primary forest, ranging from peat swamp to montane forest	Prefers fruit with a high sugar content	Home range is between 28ha and 45 ha	Nijman *et al.* 2008.
Malayan sunbear	Inhabits tropical evergreen forest from lowlands up to 2,000 masl	Diet consists mainly of invertebrates (termites, ants), vertebrates (reptiles), honey, birds eggs and plants (fruit, figs and flowers).	Home range is between 1.2 km^2 and 5.1 km^2	Wong *et al.* 2002, Fredriksson *et al.* 2008, Normua *et al.* 2004
Malayan tapir	Inhabits primary and secondary tropical moist forest from lowlands up to 2,300 masl. Prefers well drained lowland forests	Diet consists mainly of leaves, seedlings, herbs, twigs and fruits. Consumes up to 115 plant species.	Solitary, estimated home range is 13 km^2	Zainal Zhari *et al.* 2001. Khan 1997.
Sumatran tiger	Inhabits primary and secondary forest, prefers riparian habitats. Distributed from lowland up to sub montane forest.	Preys mainly on larger ungulates like wild boar, deer and sometimes also smaller animals such as fowl, monkeys and fish. Requires 5-6kg of meat per day.	Male Home range is between 25-66 km^2, female home range is between 11-46 km^2, depending on prey density	Tilson & Nyhus 2010.

3. Landscape connectivity

For many species, single HCV MAs within oil palm concessions will not be of sufficient size or quality to meet their habitat requirements. It is therefore important to consider how easily animals can move between the patches of suitable habitat that persist within the landscape. Maintaining and enhancing landscape connectivity is important to ensure that the habitat requirements of species that persist within oil palm landscapes are met and they are able to survive and reproduce. This includes ensuring that animals have sufficient access to food, water and mates, and are able to disperse, expand their range or migrate as necessary. Improved landscape connectivity also helps to enhance a number of different ecological processes, including pollination and seed dispersal which are important to maintain plant communities.

Conserving linear wildlife corridors or stepping stones of suitable habitat within the oil palm monoculture are approaches that can be taken to facilitate movement of wildlife across landscapes dominated by oil palm. Riparian zones will often function as wildlife corridors and can help to improve connectivity between larger areas of suitable habitat within the landscape. Certain species have also been observed to move between fragments of forest that remain within the oil palm monoculture as long as they are in close proximity to each other.

The effectiveness of corridors and stepping stones in improving landscape connectivity will depend on the following factors:

- **Target species:** different species have different habitat requirements, so the width, length, location and habitat quality of the corridor will determine which species are able to use the corridor. Corridors should therefore be designed to meet the requirements of several keystone species, as this should ensure that the corridor will support a wide range of other species and ecological processes.

- **Width of corridor:** Edge effects will reduce the quality of the habitat within the corridor (see section on human and ecological edge effects below for further explanation). This in turn will reduce the likelihood of the corridor being used by wildlife to move across the landscape, particularly forest dependent species, which are often the most adversely affected by habitat fragmentation. Research in the Amazon has suggested that corridors that are at least 400m wide will be necessary to provide suitable habitat for the majority of forest dependent vertebrate species. For forest dependent species with large habitat

requirements such as the Sumatran rhino, clouded leopard, orangutan and gibbon the width of corridor required may be up to 800m. As a general rule, the longer the corridor is, the wider it will need to be in order to effectively connect two areas of natural habitat.

- **Size of gap between stepping stones:** there will be a threshold beyond which the distance between stepping stones will prevent a species from moving between patches. Smaller and more specialist species are generally less tolerant of large gaps than larger species which are more tolerant of disturbed habitats. The loss of a small patch of habitat that acts as a stepping stone can therefore significantly reduce landscape connectivity.

Table 4. Potential effectiveness of linear corridors vs stepping stones for increasing landscape connectivity.

Type of use	Type of linkage	
	Stepping stone	**Habitat corridor**
Less-disturbed landscapes		
Species tolerant of habitat disturbance	***	-
Species intolerant of habitat disturbance	*	***
Wide ranging and mobile species	***	*
Community and ecological processes	*	***
Greatly disturbed landscape		
Species tolerant of habitat disturbance	***	*
Species intolerant of habitat disturbance	*	***
Wide ranging and mobile species	***	*
Community and ecological processes	-	***

*** an effective approach, * somewhat effective, - unlikely to be an effective approach. (From Bennett 2003).

4. Human and ecological edge effects

The proximity of an area of natural habitat to human settlements or access routes, including roads and rivers, will determine the risk of encroachment, hunting, logging and mining occurring within the area. This should be taken into consideration when delineating HCV MAs, as in some cases it may be necessary to leave buffers of either natural habitat or oil palm around the HCV MAs in order to limit their exposure to human disturbance. Similarly, forests that are adjacent to areas that have been cleared or planted with oil palm are also more exposed to a number of environmental factors that can reduce the quality of the habitat and its ability to support biodiversity. This includes increased exposure to sunlight and wind, which can result in the edge of the forest becoming hotter, lighter and drier than in natural forest. Further damage can be caused by increased exposure to invasive and pest species that thrive within the oil palm monoculture.

The shape of the HCV MA will determine the proportion of the habitat that is exposed to both human and ecological edge effects. Circular or square patches of habitat have a smaller perimeter: area ratio than long thin patches of habitat which reduces the area of forest that is exposed to harmful edge effects relative to the core area of good quality habitat. Therefore, circular or square patches of habitat are likely to be more effective at conserving biodiversity than long thin patches.

In some cases it may be necessary to leave buffer zones of natural vegetation beyond the boundary of the area considered to be of High Conservation Value in order to reduce the impact of harmful edge effects. Research in the Amazon suggests that buffer zones of natural vegetation at least 100m wide would be necessary to prevent the most extreme edge effects from having a negative impact on HCV habitats, although this would ideally be 400m to avoid these completely.

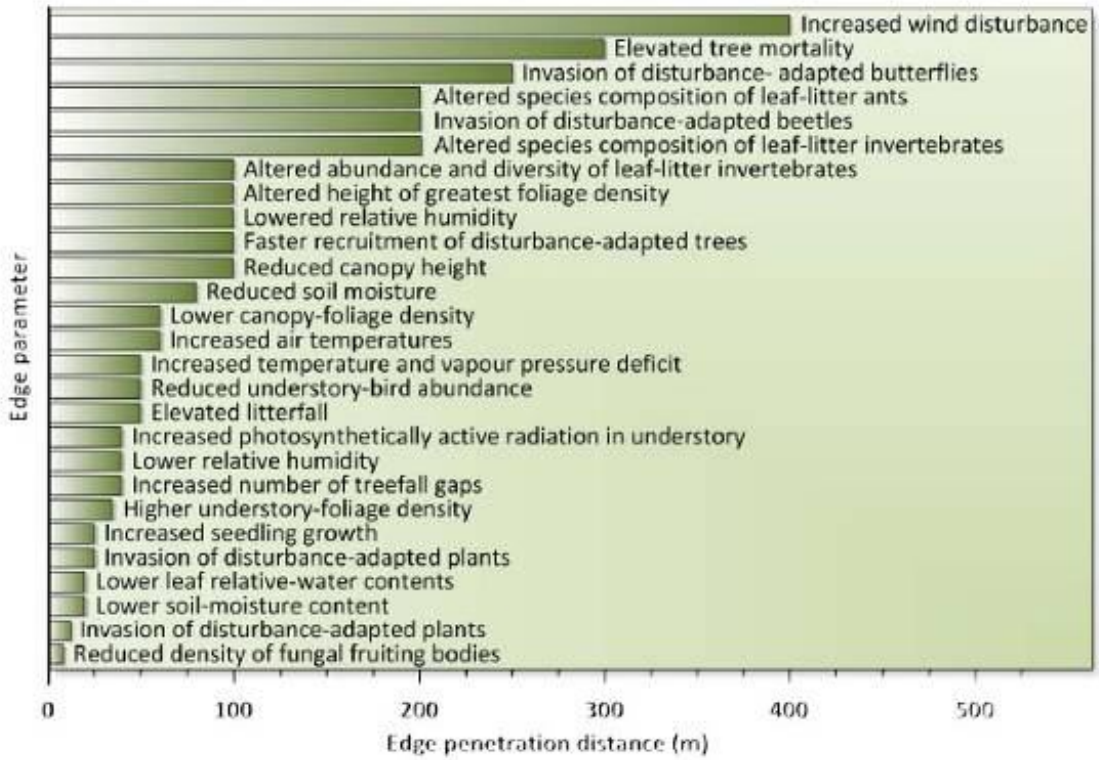


Figure 1. Results from a 22-year investigation into the decay of forest fragments reveals penetration distances of different edge effects in the *Biological Dynamics of Forest Fragments Project* in the Brazilian Amazon. (*From Managing Biodiversity in the Landscape. Guidelines for Planners, Decision Makers and Practitioners. Government of Malaysia. 2009).*

Important factors to take into consideration when delineating HCV MAs and Riparian Zones that aim to prevent water pollution, soil erosion and downstream flooding

1. Legal requirements

The existence of regulations which require buffer zones to be maintained around water bodies or steep areas to be left unplanted should be considered the minimum requirement when delineating riparian buffer zones and areas of natural habitat which aim to maintain and enhance HCV 4. However, this may not be sufficient to ensure that the areas of natural habitat set-aside are sufficient to prevent water pollution, soil erosion and down-stream flooding.

In Indonesia, for example, forest land dominated by 40% (or 18 degree) slopes, and peat soils of 3 m depth or more, is protected by law and should be set-aside. The law also states that small rivers/creeks require a watershed area of 50 m width on each side, and larger rivers require a watershed area of 100 m width on each side.

Box 2: Legal requirements for buffer zones around water bodies in Indonesia

Indonesian law (*Keputusan Presiden No 32/1990*) requires buffer zones of natural vegetation along rivers and around surface springs to be protected as follows:

Category	Width of buffer zone
Small rivers	50m on both sides of the river
Large rivers	100m on both sides of the river
Surface springs	200m radius

2. Preventing water pollution from run off containing soil sediments, pesticides, fertilisers or other chemicals

Buffer zones of natural vegetation can help to slow surface run off, meaning that there is more time for the soil and vegetation to trap soil sediments, excess nutrients and chemicals carried in the water. However, they will not be sufficient to remove all pollutants, so should be considered as a final defence rather than an alternative to preventing soil erosion and water pollution.

The ability of buffer zones of natural vegetation to filter and absorb soil sediments and pollutants will depend on:

- **Position:** Priority areas for buffer zones include watercourses and areas where ground water and surface run off collects which are close to sources of pollution, such as oil palm seedling nurseries where large volumes of fertilisers and pesticides are used. Low order streams are also important to buffer as this is where run off from upland areas first enters the river system. Wherever possible buffer zones should follow contours to try and reduce the speed of the flow of water across the buffer, which will make it more effective at removing pollutants.

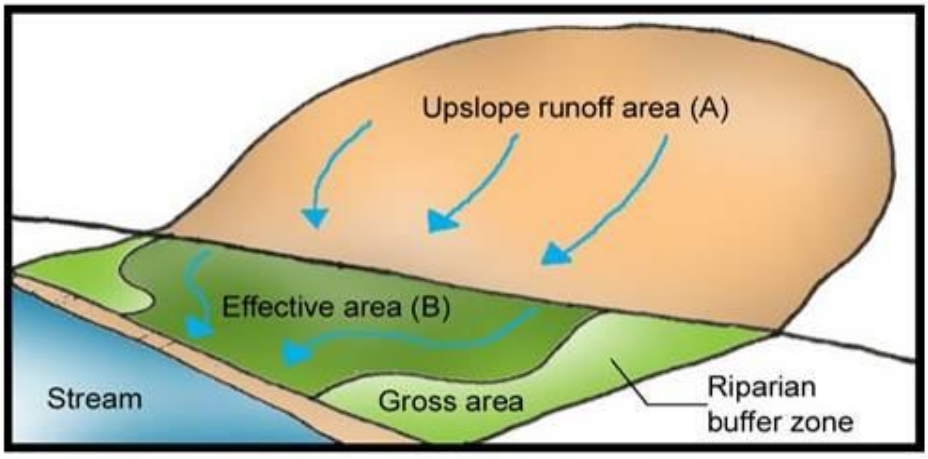
- **Width:** Research carried out in America has suggested that buffer zones of between 5m – 110m are required in order to remove nutrients and pesticides from surface run off. However, this will need to be adjusted based on:
    - **Topography:** wider buffer zones will be required in steeper areas (defined as slope > 10% - 40%) to slow surface run off and allow sufficient time for sediments and pollutants to be removed. It has been suggested that very

steep areas should be excluded when calculating the effective width of a riparian buffer zone (See figure 2).

- **Soil type:** The soil type will affect the ability of the soil to absorb water and pollutants. More permeable soils absorb water more easily, so will help to reduce the volume of surface run off. However, less permeable soils will be more effective at removing nitrogen from the water, as they provide the anaerobic conditions necessary for the denitrifying bacteria. Wider buffer zones will be needed where the soil is less permeable (finer textured) to allow time for surface run off to be absorbed and pollutants to be trapped.

It should be noted that since little research has been conducted on the width of buffer zones required to prevent sedimentation and pollution in the tropical regions where oil palm is cultivated it is important to monitor the quality of the water on a regular basis to ensure that the buffer zones retained are effective (See Chapter 8).

- **Vegetation:** Structurally diverse vegetation, which comprises of trees, shrubs and grasses that are native to the area and suited to the local environment, will be most effective in absorbing various pollutants, trapping sediments and stabilising the soil.



The amount of runoff through an area of buffer should be low to achieve high pollutant removal. One consideration is to base the design on a ratio of upslope runoff area (A) to effective buffer area (B). Lower ratios (e.g., 20:1) can provide substantially greater pollutant removal than higher ratios (e.g., 50:1) in many cases. Note that the effective buffer area is the actual pathway that runoff travels to the stream and it may be smaller than the overall gross area of the buffer.

Figure 2. Effective width of buffer zones. (From Bentrup, G. (2008))

3. Preventing soil erosion, river sedimentation and downstream flooding

The risk of soil erosion is greatest in steep areas, where the soil has low surface permeability, or where the natural vegetation within the watershed has been cleared or degraded, because this increases the speed and volume of surface run off. This also increases the risk of downstream floods. Retaining natural vegetation within river catchments and riparian buffer zones will both help to reduce the speed of surface run off and stabilise the soil. This should help to reduce soil erosion.

Research in temperate regions has suggested that the minimum width of riparian zone required to prevent soil erosion is between 10m – 30m on either side of the river. Buffer zones of up to 150m on either side of the river are recommended to reduce downstream floods. However, this will need to be adjusted based on:

- **Slope:** wider buffer zones will be required in steep areas (defined as slope > 10% - 40%) to slow surface run off and reduce the risk of flood events. It has been suggested that very steep areas of land contribute little to reducing soil erosion and should be excluded when calculating the effective width of a riparian buffer zone.

- **Soil type:** wider buffer zones will be required in areas where the soil is less permeable. Finer-textured soils are typically less permeable than sandy soils.

- **Vegetation:** if the vegetation in the riparian zone is degraded or has yet to mature then the width of the riparian buffer delineated should be increased to allow for erosion of the river bank that will be expected to occur before the vegetation is capable of stabilising the soil. This can be estimated based on the approximate rate of erosion and the period of time it will take for the vegetation to mature. If significant areas of natural habitat have been cleared within the watershed, the width of the riparian zone will need to be increased in order to counteract the increased volume and speed of surface run off.

Table 5: Recommended widths of riparian buffer zones from an HCV assessment in an oil palm concession in West Kalimantan, Indonesia (From Daemeter Consulting (2009))

River width (metres)	Width of buffer on each side (metres)
>30m	100m
20-30m	50m
8-20m	20m
5-8m	10m
<5m	5m

Useful references and resources
Guidance for conducting HCV assessments
Konsorsium Revisi HCV Toolkit Indonesia;. (2009). *Panduan Identifikasi Kawasan Bernilai Konservasi Tinggi di Indonesia.* Balikpapan: Tropenbos International Indonesia Programme. Link: www.tropenbos.org/file.php/63/hcv-toolkit-indonesi-bahasa-version.pdf
The Consortium for Revision of the HCV Toolkit for Indonesia. (2009). *Guidelines for the Identification of High Conservation Value in Indonesia (HCV Toolkit Indonesia).* The Consortium for Revision of the HCV Toolkit Indonesia. Link: www.tropenbos.org/file.php/132/toolkit-hcvf-english-version_final.pdf
Daemeter Consulting. (2009). *High Conservation Value Full Assessment for PT. Perkebunan Anak Negeri Pasaman Oil Palm Estate Landak District, West Kalimantan, Indonesia.* Bogor: Daemeter Consulting. Link: www.hcvnetwork.org/resources/assessments/PANP_HCV_full_assess_FINAL.pdf
Wells, P. L., Paoli, G. D., & Suryadi, I. (2010). *Landscape High Conservation Values in East Kalimantan: Mapping & Recommended Management, with special focus on Berau and East Kutai Regencies.* Jakarta: The Nature Conservancy. Link: www.hcvnetwork.org/resources/assessments/Daemeter_Berau_Kutim_HCV_Exec_Summary_Final.pdf
Guidance on designing conservation areas for biodiversity, wildlife corridors & riparian zones
Bentrup, G. (2008). *Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways.* Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. Link: www.unl.edu/nac/bufferguidelines/docs/conservation_buffers.pdf

The Ministry of Natural Resources and Environment, Government of Malaysia. (2009). *Managing Biodiversity in the Landscape: Guidelines for planners, decision makers and practitioners.* Putrajaya: The Ministry of Natural Resources and Environment, Government of Malaysia.
Link:
www.hcvnetwork.org/resources/folder.2006-09-29.6584228415/Guideline_Man_BioD_landscape_090519.pdf

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Chapter 3: Developing an HCV management plan

Process

To ensure that an HCV management plan is practical and well suited to the oil palm concession where it will be implemented, it is important that the following stakeholders are involved in the process of developing it:

- **HCV assessment team**
- **Plantation managers and staff who will be responsible for implementing the management plan**
- **Adjacent land users**
- **Local government**
- **Local communities**
- **NGOs and researchers working in the area**

It is recommended that the following steps are taken to develop an HCV management plan:

Step 1: Review current or planned management practices

Review current (existing concessions) or planned (new plantings) plantation management practices to identify activities which may conflict with the goal of maintaining and enhancing HCVs, as well as areas where additional management interventions will be required to achieve this. Existing practices which need to be changed, or additional safeguards and actions required in order to ensure that HCVs are maintaining and enhanced should then be identified.

This should be carried out jointly by the **HCV assessment team** and **the plantation management and the staff that will be involved in implementing the HCV management plan**

Step 2: Draft HCV Management Plan

This should include; Objective, Indicator, Baseline value of indicator, Time bound target for the indicator, Management activity, Monitoring activity, Person in Charge and Budget required (see table 6).

This should be lead by the **HCV assessment team** but will require input from the **plantation management and staff that will be involved in implementing the HCV management plan**

Step 3: Public consultation

The management activities proposed in the draft HCV management plan should be explained to all stakeholder groups that will be involved in or affected by its implementation during a public consultation. This could be done by holding a workshop or arranging meetings with representatives from key stakeholder groups. It is important that the reason for implementing the management activity, and the relevance of this to the stakeholder group participating is clearly explained.

Important stakeholder groups to involve include **company employees**, **adjacent land users**, **local communities** and **NGOs or researchers working in the area surrounding the plantation**

Step 4: Revise and finalise HCV management plan

This should be lead by the HCV assessment team but the final version must be signed off by the plantation management. To ensure that the HCV management plan is of sufficiently high quality, the company may wish to have the management plan peer reviewed. This can be done by members of the HCV Resource Network Technical Panel or Regional Networks (such as the Jaringan NKT)

This should be lead by the **HCV assessment team** but with close involvement, and final approval, from the **plantation management and the staff that will be responsible for implementing the HCV management plan**

Table 6: Example of the structure of an HCV Management Plan for an oil palm concession (adapted from an HCV management plan developed by Wilmar International and Aksenta Socio-Environmental Consulting for an oil palm plantation in Indonesia)

Objective	Indicator	Baseline	Target	Time	Management activity	Monitoring activity	Person In Charge	Budget (Rp)
To improve the habitat quality in the key areas used by wildlife	% natural vegetation cover	Need to collect data on the % natural vegetation cover in areas that provide key habitats for wildlife	100% natural vegetation cover in areas that provide key habitat for wildlife	2020	• Measure the % natural vegetation cover in areas that provide key habitats for wildlife • Clearly mark the boundary of the HCV areas and put up sign boards • Raise awareness amongst plantation workers and local communities about the importance of protecting these areas • Carry out regular patrols to deter and detect encroachment, illegal mining and illegal logging.	Measure the % natural vegetation cover annually	The division manager for each area	20 million

Useful references and resources
Publicly available examples of HCV Management Plans for oil palm concessions
Proforest (2011). Public Summary of HCV Management Plan for an OLAM oil palm concession in Gabon. Link: http://www.hcvnetwork.org/resources/assessments/Summary%20Report%20of%20Planning%20and%20Management%20Olam%20NPP.pdf
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Chapter 4: Implementing an HCV management plan

To succeed in implementing an HCV management plan effectively, the following is necessary:

1. Budget
The resources needed to establish an HCV team and implement the activities outlined in the HCV management plan should be allocated from the plantation's operational budget as soon as the HCV management plan is finalised, if not before.

2. Human resources
The company should establish a member of staff, or team of staff, who will be responsible for implementing the HCV monitoring and management activities. To do this effectively, they should be based on the plantation or very nearby and have sufficient time available to implement the activities outlined in the HCV management plan. In some situations it may be beneficial for neighbouring palm oil companies to establish a joint HCV management team. This would reduce the cost and help to promote a landscape level approach to HCV management, which is likely to be more effective. Existing plantation security guards may be able to assist in HCV monitoring and management by patrolling the HCV areas. However, the security team alone are unlikely to have the necessary skills required to maintain and enhance HCVs within the concession effectively. It may be beneficial to collaborate with members of the local communities or government departments in order to carry out HCV monitoring and management (see Chapter 7: Engaging stakeholders).

The team responsible for HCV monitoring and management should have the following skills and abilities between them:

- Ability to engage with local communities
- At least a basic understanding of biodiversity conservation/forestry
- Authority to enforce company policies and ideally also local, regional and national regulations

3. Standard Operating Procedures
The management and monitoring activities outlined in the HCV management plan should be translated into Standard Operating Procedures to ensure that they become part of routine plantation management and that mechanisms are in place to make sure these activities are implemented. It is important to make sure that all company employees are aware of these Standard Operating Procedures (see Chapter 7: Engaging stakeholders)

4. Support from plantation management and staff

It is essential that the actions of plantation managers and staff are supportive of the work being carried out by the HCV management team to conserve HCVs. To achieve this, it is essential that all company staff understand *why* these areas are being conserved and *what* needs to be done to achieve this (see Chapter 7: Engaging stakeholders). If possible, the effectiveness of efforts to maintain and enhance HCVs should be linked to the Key Performance Indicators or bonus structures for all plantation managers and staff. This will help to promote a collective responsibility for conserving HCVs within the concession. Examples of simple indicators that could be incorporated include the annual change in the intact HCV MA or the difference between the quality of water when it enters and exits the plantation boundaries.

CASE STUDY

What? We have established a Conservation Department (REA KON), which consists of 11 full time staff who oversee all activities relating to biodiversity conservation on the estate. In addition to this we have recently built a field research station in one of the larger conservation areas where the oil palm, natural wetland and dryland forests exist side by side.

Where? REA Kaltim, HuluBelayan, East Kalimantan, Indonesia

Aim: REA KON is divided into 3 divisions:

1.) Plantations Unit: This division of REA KON focuses on activities relating to the maintenance of environmental quality and ecological services. The staff member in charge currently monitors water quality in five rivers that pass through the Conservation Reserves. The Plantation unit staff also conduct regular pest assessments in sample blocks of oil palm, photograph invertebrate pests and the damage that they cause (for later monitoring), and set camera traps in order to identify vertebrate pests or commensals (those feeding on fallen fruitlets). The Plantations unit also conducts experiments on the use of by-products such as sludge and kernel shell as compost for growing vegetables or improving

productivity in oil palm blocks. They are also responsible for recycling, which includes setting practical models for collection and resale/re-use of paper, plastics and metals from estate rubbish.

2.) Biodiversity Unit: This division of REA KON focuses on determining the biodiversity "content" (flora and fauna) of the Conservation Reserves and the surrounding landscape. Continuous biodiversity assessments are carried out (including camera trapping, pit fall trapping, point transects, and inventories of specific botanical and zoological groups) with scientific partners from museums, herbariums and institutions of higher learning in order to build up an inventory of species living in and around the estate. Additional information recorded includes species' habitat use and distribution, their current status in the area (eg. rare or common) and any changes detected over time. This database, which we call "Species Triage", forms the basis for prioritising which species are most in need of active management and what type of intervention may be appropriate.

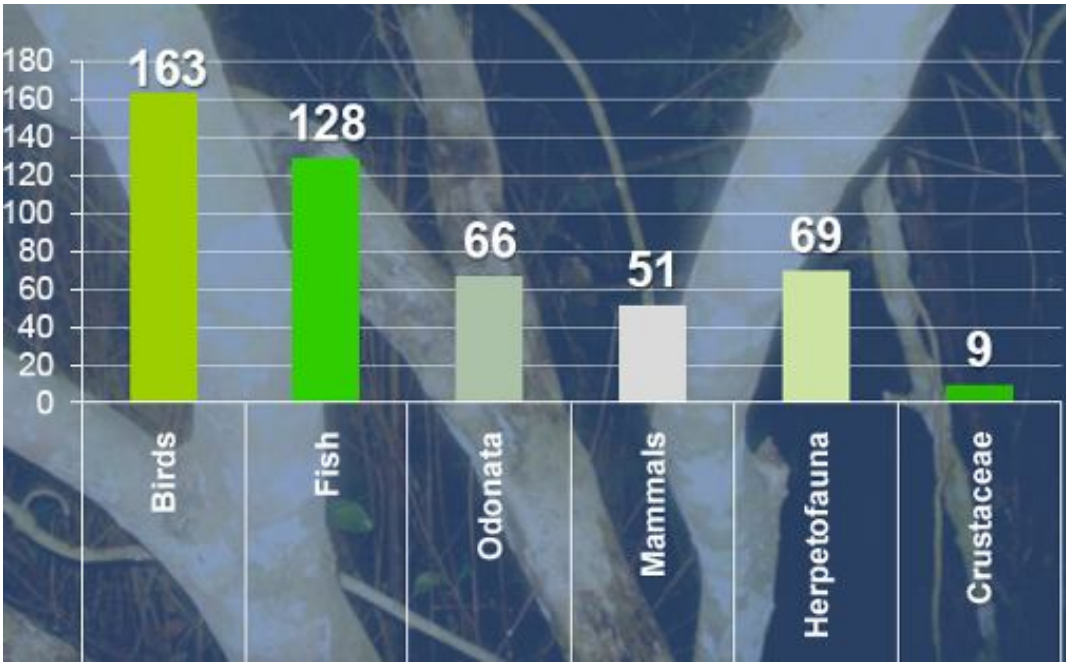
3.) Community Unit: This division of REA KON works with local communities to encourage the conservation of biodiversity, including the maintenance of sustainable hunting, fishing, water use and protection of rare, threatened or endangered (RTE) species, such as orangutans.

How?

- Resources needed: development and running costs of around US $300,000 annually, not including the Technical Advisor. Costs tend to drop after the first 2-3 years, once the programme is already outfitted and stabilised.

Progress to date – Successes & Challenges:

- The success of REA KON is highly dependent on support from our senior plantation management, but also depends on our efforts to provide useful information and services that assist the company to not only improve its environmental performance and enhance its reputation as a good corporate citizen, but also to reduce waste (and cost) and improve productivity through enlightened management practices.
- Plantation staff, workers and local villagers have started to show an increasing level of awareness about the need for conservation (of water, forests and species diversity), and since 2009, have begun to report sightings of species such as orangutans or illegal harvesting of fish or other species to REA KON staff.
- By the end of 2010, we had identified more than 400 species of local Flora, 163 bird species, 51 mammals, 69 species of herpetofauna (amphibians and reptiles) and 128 fish.



Chapter 5: Habitat management

5.1: Avoiding clearance of HCV MAs during oil palm development

1. Produce GIS based map of HCV MAs that clearly identify 'Go', 'Go with caution' and 'No Go areas' for land preparation

GPS co-ordinates of the boundaries of the HCV MAs should be taken, and this data used to produce a GIS based map that clearly identifies 'Go', 'Go with caution' and 'No Go areas' for land preparation. Production of such a map could be included within the Terms of Reference for the HCV assessment team.

2. Clearly mark the boundaries of HCV MAs in the field

A GPS should be used to identify the position of the boundary, with reference to the GIS based map of the HCV MAs. The boundary of these areas should be marked out using stakes or by using brightly coloured paint to mark trees. These boundaries should then be marked with signs to inform plantation employees and members of the local community that these are areas set-aside for conservation (see section below on preventing encroachment).

3. Control the activities of contractors

Contractors involved in clearing and preparing land for planting should be given clear maps, co-ordinates of boundaries and instructions regarding the location of areas that are off limits for planting. Sanctions for clearing land within 'No Go' areas should be written into their contract with the company. The company employees responsible for overseeing the work of contractors should also be penalised if this occurs.

4. Avoid fragmenting HCV MAs and Riparian Buffer zones with roads wherever possible

Where this is absolutely necessary, every effort should be made to reduce the impact on surrounding vegetation.

5. Do not use fire for land preparation

The company must enforce a zero burning policy for land preparation.

5.2: Securing the right to manage the HCV Management Areas

Local communities: wherever possible, the company should try to obtain the same rights to manage the HCV MAs as the land that will be planted with oil palm. This may involve undergoing a process of land release and compensating people with existing land use rights to these areas. If these people do not give their Free, Prior and Informed Consent to release their land to the company, the company should try to manage these areas in collaboration with the people or community with land use rights to the HCV MAs. As a first step, it may be beneficial to establish a Memorandum of Understanding between the company and the group of people with land use rights to the area which outlines the objective of the co-operation (see Chapter 7: Engaging stakeholders).

Local government: in Indonesia, there have been cases where HCV MAs have been excised from the initial location permit *(Izin Lokasi)*, or even the final land use title *(Hak Guna Usaha)*, because this land is not being developed for oil palm.

In order to protect HCV MAs effectively, it is essential that they remain within the boundaries of the company's concession *(HGU)*. To prevent these areas from being excised by the local government, the company should be pro-active in explaining to the relevant government departments why these areas have been set-aside and to demonstrate that they are being actively managed. This could include providing the relevant government departments with a copy of the HCV assessment and HCV management plan, explaining the function that each HCV MA fulfils and why it is important, as well as informing these departments about the results of HCV monitoring (see Chapter 7: Engaging stakeholders).

5.3: Preventing encroachment

People living in and around oil palm concessions will often be under the impression that uncultivated areas are not being used by the company and are therefore available to exploit. This frequently results in encroachment, illegal logging, gold or zircon mining and cultivation occurring within HCV MAs which are set-aside for conservation. Areas that are highly accessible by river or road are particularly vulnerable. The following measures can be taken to try and reduce these threats in order to maintain the quality of natural habitats within oil palm concessions:

- **Limit access:** in cases where local people do not have the right to use the HCV MAs, it may be appropriate to limit access to these areas. Options for achieving this include requesting the security guards to closely monitor traffic entering the access routes, or positioning electric fences or trenches around the borders.

- **Signboards:** signboards can be used to clearly explain that certain areas have been set-aside for conservation and the activities, if any, which are prohibited. These signboards should be in the local language, ideally accompanied by visual explanations for people who can't read. It is important to use simple concepts that local communities are likely to understand. It should be assumed that the majority of people will not know what an HCV MA is.

- **Plant 'useful' trees:** planting native tree species that are of value to local communities at low densities within HCV MAs can help to demonstrate that the area is being actively managed by the company. Allowing local communities to harvest these trees can provide resources that may increase the incentive to protect these areas of natural habitat from damaging activities. However, it is important to maintain a balance between trees that are planted because they are of value to humans, and natural vegetation, particularly fruiting species, that are important for wildlife. Trees recommended in West Kalimantan include the native illipe nut trees *(Shorea stenoptera & Shorea splendida)*(not suitable for peat soils), fruit trees including mango, durian, rambutan, mangosteen, petai and keranji, honey bee nest trees (*Koompassia excelsa and Koompassia malaccensis*), coffee, local medicinal plants, and perhaps even rubber at low densities if mixed with native species *(Daemeter consulting (2009))*.

- **Patrols:** regular patrols of the borders and interior of HCV MAs are the best way of deterring people from encroaching and carrying out activities that are prohibited, such as logging or mining. Ideally, each HCV MA should be visited by a patrol at least once a week. Patrols are likely to be more effective if they involve people with the authority to tackle anyone found to be undertaking activities that are prohibited. This could mean forming joint patrols with representatives from the local forestry (*Dinas Kehutanan)* or conservation department *(BKSDA)*. Alternatively, these departments may be able to provide the company's patrol team with training to provide them with some authority to enforce legal and company regulations. In addition to company staff, it may be beneficial to involve local people in

patrols as this can help to raise awareness within local communities about the presence and purpose of the conservation areas, as well as the activities that are prohibited.

5.4: Forest restoration & enhancement

Restoration is the process of returning a disturbed or degraded ecosystem to a condition that is closer to its undisturbed state. In many cases detailed information about the previous condition of forest at the site being restored is not available. In these situations, nearby areas of undisturbed forest with similar soil, climate and elevation should be identified as the target for restoration.

In the case of tropical forests, which are very diverse and complex ecosystems, it will take decades or even centuries before the structure and species composition is comparable to the target ecosystem. However, in the short term the aim is to re-create a structure and species composition that will allow the ecosystem to perform its natural ecological functions. This includes providing habitat for wildlife, protecting watersheds from flooding and pollution, preventing soil erosion and contributing to nutrient cycling.

In addition to planting vegetation, forest restoration may also involve controlling or removing invasive species and protecting the site from harmful disturbances.

In what situations is it necessary to restore or enrich natural habitats within oil palm concessions?

1. Restoring natural vegetation in riparian zones or steep areas that have been planted with oil palm

Regulations in Indonesia state that riparian zones (50m either side of small rivers and 100m either side of large rivers) and steep areas (>40%) should not be planted with oil palm. Where planting has occurred, steps should be taken to restore the natural vegetation in these areas for the following reasons:

- To bring the plantation into compliance with national regulations
- To comply with the RSPO Principles & Criteria (2.1)
- To restore the ecological function of these areas, which includes preventing soil erosion and reducing pollution

2. Restoring HCV MAs that have been cleared

In situations where HCV MAs have been cleared, either because an HCV assessment was not carried out prior to development or due to

encroachment, steps should be taken to restore the natural vegetation for the following reasons:

- To comply with the RSPO Principles & Criteria (5.2 & 7.3). This may form part of an HCV compensation strategy
- To restore the ecological function of these areas

3. Enhancing degraded areas of natural habitat

Areas of natural habitat that remain within oil palm landscapes will often be degraded by human and ecological edge effects. Reasons for enhancing these areas of habitat include:

- To comply with RSPO P&C 5.2
- To increase the suitability of the habitat for wildlife
- To improve connectivity between remaining patches of natural habitat within the landscape
- To provide resources for local people
- To reduce soil erosion and pollution

Strategies for restoring and enhancing natural habitats

The most appropriate strategy for restoring a particular site will vary depending on how degraded it is and the type of vegetation and wildlife that remains within the landscape. Factors to take into account when deciding on the best strategy for restoration include:

- **Remaining vegetation** – is the site dominated by weeds, grasses or vines that would out-compete tree seedlings?

- **Level of soil erosion** – is the soil still fertile enough to allow tree seedlings to grow?

- **Seed bank** – are there enough mature trees, seedlings or seeds present in the soil at the site for natural regeneration to take place?

- **Remnants of the 'target' forest within the landscape –** is coverage of good quality 'target' forest within dispersal distance of the site being restored sufficient to provide a source of seeds for natural regeneration?

- **Presence of seed dispersing animals –** are the remaining populations of seed dispersing animals still capable of transporting seeds to the site being restored?

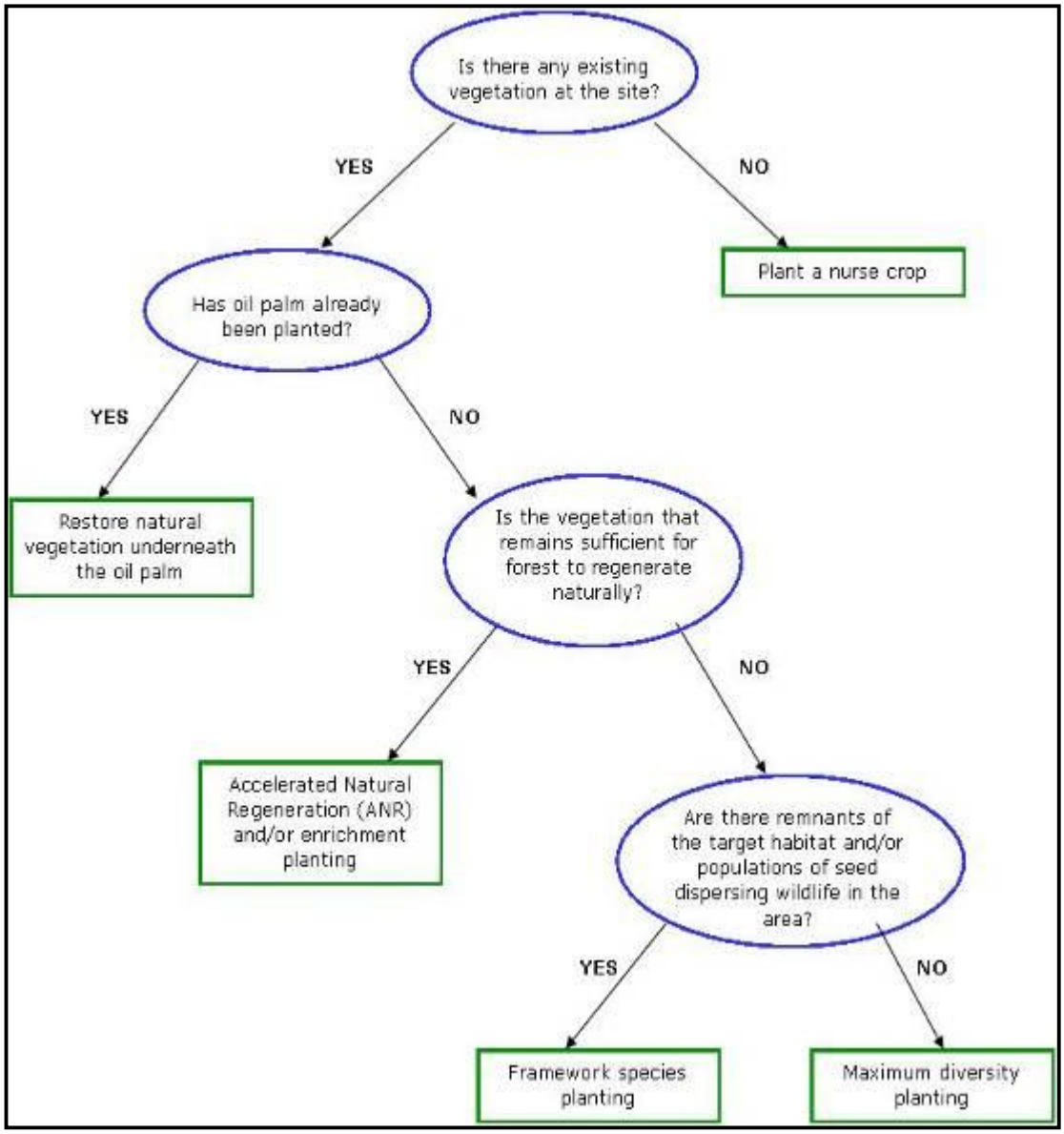


Figure 3: Decision tree for deciding when each strategy for forest restoration and enhancement is appropriate

Strategies:

1. Restoring natural vegetation in riparian zones or steep areas that have been planted with oil palm

- If the oil palms are well established they should be left in place to avoid soil erosion that would be caused if they were cleared. If the oil palms are still very young they should be removed.
- The use of pesticides, herbicides and chemical fertilisers should be stopped immediately. Ideally, these palms should not be harvested to avoid disturbing natural regeneration below the oil palms.
- Plant native, shade tolerant tree species between the oil palms. These seedlings should be tended on a regular basis by removing

creepers, grass and weeds around the base of the tree. Herbicides should not be used under any circumstances.
- Any oil palm seedlings that germinate from fallen fruits should be removed.
- Oil palms should be removed when they reach the end of their life cycle, or when they start to shade out growth of natural vegetation. Care should be taken not to damage the vegetation that has regenerated.

2. Accelerated Natural Regeneration (ANR)

This method aims to speed up the natural process of forest regeneration by removing weeds that may compete with regenerating seedlings, adding fertilisers to seedlings, mulching around existing trees and limiting disturbance which would slow the regeneration process. This method should only be applied in areas where there is evidence that natural regeneration is already underway. This includes high densities of tree saplings, live tree stumps, and mature seed trees close to the site. It may be necessary to combine ANR with enrichment planting or framework forestry in order to restore the natural species composition of the target ecosystem.

3. Enrichment planting

This involves planting trees with the aim of either increasing the population density of a tree species that has an important ecological function or is particularly valuable to the local community, such as *ficus spp* or Ulin respectively, or to increase the diversity of tree species in the habitat being restored.

4. Framework species planting

The aim of this method is to plant a relatively limited variety of key species (perhaps 20 – 30 species) that will be capable of catalysing the natural process of forest regeneration in order to restore the target ecosystem so that further tree planting will not be necessary. For this to be effective, it is important that there are sources of seeds in the surrounding area, including mature seed trees and populations of seed dispersing wildlife. The species planted should be a mixture of pioneer, mid succession and mature forest species which have the following characteristics:

- Native to the area
- High survival rate in disturbed areas
- Rapid germination and growth
- Produce flowers/fruit that attract seed dispersing wildlife at a young age eg. *Ficus spp*
- Vigorous production of branches to create a dense canopy and leaf litter

5. Maximum diversity species planting
This method involves planting as many of the different species found in the target ecosystem as possible. This is a very expensive and labour intensive method, but may be the only option for restoring the habitat to pre-disturbance conditions in areas where mature seed trees and seed dispersing wildlife in the surrounding area are not sufficient for regeneration to take place naturally.

6. Nurse tree crop planting
This method is necessary in areas where the soil has been heavily degraded and the majority of tree seedlings will be unable to grow. To overcome this, fast growing pioneer species, such as leguminous or disturbance tolerant trees, are planted to 'nurse' the soil back to health. A good example is *Macaranga spp*. Since these tree species will be removed from the final ecosystem, these can be exotic species as long as it is not an invasive species. Once established the nurse crop should be thinned and the area should be planted with either a framework of species or a maximum diversity of species, depending on the potential for natural regeneration to take place. The nurse tree crop should eventually be removed, taking care not to harm the understory vegetation it has helped to foster.

CASE STUDY

What? The Sumatran Orangutan Society (SOS) and the Orangutan Information Centre (OIC) are carrying out forest restoration in areas of the Gunung Leuser National Park that have been illegally converted to oil palm monoculture

Where? Gunung Leuser National Park, Langkat district, North Sumatra

Aim:
1. To restore areas of Gunung Leuser National Park that have been illegally planted with oil palm monoculture by planting indigenous tree species
2. To work in close partnership with local stakeholders to encourage them to become stewards of the restoration programme
3. To provide an on-going supply of seedlings to support

restoration efforts in the Gunung Leuser National Park
4. To monitor biodiversity levels in the restoration site

How?

- A local farmers' group was established, who were provided with training in the creation of tree nurseries and forest restoration techniques
- Tree nurseries were set up on community land surrounding the national park.
- Seeds are collected both from local community farmlands and, with permission from the national park government authority, from the primary forests.
- Since 2007, 254,000 seedlings from 57 indigenous tree species have been cultivated and planted on degraded national park land.
- 6,000 oil palms have been removed from 75 hectares of national park land.
- Restoration has been carried out both in areas where the oil palm has been removed, as well as in areas where the oil palm still remains. However, the intention is to remove all of the oil palms eventually in order to restore the natural biodiverse rainforest.
- Only endemic tree species are planted at the restoration sites, which have been selected according to their suitability for the soil and climatic conditions. In the first stage of replanting, we focused on pioneer species such as *macaranga spp*, to improve the soil condition and establish a young forest canopy. In the second year slower growing, shade dependent trees such as *shorea spp* and *agathis spp* were also planted. Fruiting pioneer species, such as *Bridelia monoica* and *Macaranga gigantean,* were also planted to attract birds and mammals. In addition to this, tree species know to be used by orangutans for both food and nesting were also planted.

How to carry out forest restoration or enhancement

1. Selecting species to use for restoration

The most appropriate species to use for each stage of forest restoration will depend on which of the strategies described above has been adopted. People living in and around the forest will often be a good source of information about the characteristics and functions of different tree species. Wherever possible, species with the following characteristics should be prioritised for inclusion in a forest restoration programme:

- **Native species:** species native to the region known to grow under similar environmental conditions to that of the site being restored (ie. elevation, level of rainfall, soil type).

- **Keystone species:** this includes tree species with fleshy fruits or nectar rich flowers that will attract a wide variety of wildlife, many of which will be pollinators and seed dispersers. Examples include native durian, mangosteen, rambutan, mango and *ficus spp*. If the aim of forest restoration is to restore habitat for a specific species, the diet of this species should be taken into account when selecting the tree species to use for restoration.

- **Economically valuable species:** identifying species which provide resources for people living in or around the forest, for example rattan, Ulin, and fruiting tree species, can help to improve the livelihoods of local communities and provide a greater incentive for them to support restoration efforts.

2. Sourcing seeds and seedlings

In order to ensure a continuous supply of suitable seeds and seedlings for forest restoration the best option may be to establish a nursery on the plantation. Some companies have combined this with the oil palm seedling nursery. The advantage of this is that the initial cost of establishing the nursery will be lower. However, it may be preferable for the nursery to be established closer to the sites targeted for restoration.

Building a nursery

The site for the nursery should have ***vehicle access*** and a ***reliable water supply***. If possible, it should be located close to the sites that will be restored. The nursery should have the following features:

- ***Shaded area*** for seed preparation, sowing and germination. Shade can be created using netting.
- ***Enclosure made of wire mesh or fencing*** to prevent seedlings from predation by rats and other wildlife

- ***Raised beds or troughs of soil*** to plant very small seeds such as *Ficus spp.* The soil should be well aerated and 0.5 – 1m deep
- ***Open area*** where potted seedlings can be grown on and hardened ready for planting out

Collecting seeds and seedlings

- Seeds should be collected from local examples of the target ecosystem, where environmental conditions are similar to the site that is being restored.
- Wherever possible, seeds and seedlings should be collected from the edges of forest habitats and along trails or roads so that this doesn't have a negative impact on natural forest regeneration.
- Seeds can be collected from ripe fruits, ideally by cutting them from branches. If this is not possible, they can be collected from the forest floor but it is important to avoid collecting fruits and seeds that are rotten, or which show signs of fungal infection or predation by animals or insects. Determining the fruiting season for key species is useful so that seed collection can be carried out at the right time of year.
- Seedlings or saplings growing close to the parent tree can also be collected to grow in the nursery.
- For each seed or seedling collected, the parent tree should ideally be marked and a specimen of the leaf and fruit collected in order to identify the species. In many cases it will not be

possible to identify the name of the species accurately, so the different species can be assigned a number instead. If possible, the GPS location of each tree should also be recorded.

- Seeds and seedlings of each species should be collected from as many different parent trees as possible to maximise genetic diversity. This will result in a healthier population, meaning this species will have a better chance of surviving when it is planted out.

Growing seeds and seedlings in the nursery

- **Germinating seeds**: the seeds of most rainforest tree species do not survive for very long after they are mature and are difficult to store. Seeds are more likely to germinate if they are collected when they are mature and planted out soon after they are collected. Some seeds may remain dormant (unable to germinate) for long periods of time, or require specific environmental conditions to allow them to germinate. These species may be difficult or take a long time to germinate in the nursery.

- **Planting seedlings:** once the seeds have germinated, they can be planted out into individual polybags. These should be filled with a mixture of 50% forest soil (if accessible without causing damage) and 50% organic matter, such as oil palm mulch or coconut husk. This helps to ensure that water, oxygen and nutrients reaches the roots. Seeds should be planted so they are only half covered by the soil to try and prevent fungal attack.

- **Caring for seedlings:** seedlings should be weeded and watered regularly, but the plastic sleeves should not become water logged. When very young seedlings need to be watered every day, but this should be reduced in the 3-4 months prior to planting them out. During this period seedlings should also be regularly exposed to direct sunlight. Seedlings should not be planted out until they are between 30 – 60cm tall.

CASE STUDY

What? We have established several seedling nurseries of fruit trees, rattan, ulin (ironwood) and timber trees, which we regularly give away to plantation workers and local farmers to encourage them to enrich the forest and create a more pleasant and productive environment within the workers' emplacements.

Where? REA Kaltim, Hulu Belayan, East Kalimantan, Indonesia

Aim:

1.) By encouraging plantation staff to plant a variety of fruit trees around their houses and the plantation school this will improve the biodiversity & general environment of the estate emplacements.
2.) If local people wish to plant the forest fruit trees in the Conservation Reserves, they are encouraged to make use of this valuable and sustainable resource. We hope this will increase the incentive for them to support and participate in the conservation of these reserves, particularly by avoiding slashing and burning areas for cultivation.
3.) Enriching the Conservation Reserves with species of local/indigenous fruit trees supports higher densities of certain biodiversity in these forest areas. Conservation of existing fruit trees such as "bendang" palms (*Borassodendron spp*) maintains food availability in the short term, while allowing old ladang fruit trees to mature and enrichment planting of durian (*Durio spp*) and other species in the Conservation Reserves will provide longer term food resources for orangutans, gibbons, large frugivorous birds (such as hornbills and pigeons) and fruit bats that are important forest pollinaters.

How?

- **Sourcing the seeds:** the staff of REA KON regularly carry out 'Seed cleaning' (the staff enjoy eating the fruits, but save and prepare all seeds for planting), including rambutan, nangka, lai (similar to Durian but endemic to Kalimantan), cempedak, sirsak and papaya. Seeds are also collected from trees in the forest such as ulin and jelmuk (*Irvingia malayana*). High quality rattan seedlings have been purchased from Samarinda and distributed to local villagers. Seeds are germinated in polybags in a mixture of soil and old palm sludge for 6 -12 months, depending on the species until they are big enough to survive. They are then distributed. Watering is done by the gardener.

- **Distributing the seeds:** staff and local people who visit or attend meetings/presentations on the estate are encouraged to visit the nursery and take some fruit tree seedlings home with them. Occasionally, important visitors are provided with a tree that they will themselves plant, either at the REA KON office or Field Station, where the seedling will the be permanently identified with a small plaque indicating their name and the date of their visit.

Resources needed:

1.) **Equipment:** Seeds (see above), polybags, soil and oil palm sludge
2.) **Labour:** Gotong royong by REA KON staff & daily maintenance by the gardener
3.) **Cost:** Approx cost: USD 15,000

Planting out seedlings

- The optimal time for planting out seedlings is 4-6 weeks into the rainy season.
- Only vigorous, disease free seedlings should be selected for planting.
- Prior to planting, the site being restored should be cleared of weeds and grasses that may limit the growth of the seedlings.
- Seedlings should be planted in holes of around 10cm – 15cm in diameter and 45cm depth. This hole should be filled with a

mixture of soil and organic fertiliser. Each seedling planted should be tagged to enable their survival to be monitored.

- Seedlings should be planted at least 1.5 – 3m apart, although this will vary depending on the density of existing seedlings and trees at the site being restored, the number of seedlings available for planting and the area of the site being restored.
- The species to be planted in each location should be selected based on the environmental conditions ie. sunlight, soil type and quality and water availability.
- For the first year after planting, the areas where seedlings have been planted out should be weeded on a monthly basis to prevent them from being over grown by weeds. In areas used by elephants, wild boars or deer it may be necessary to erect electric fencing for the first two years to prevent the seedlings from being eaten, trampled or uprooted.

Monitoring the success of forest restoration

Monitoring the success of forest restoration is important to improve the efficiency and effectiveness of future restoration efforts. For example, monitoring the survival of seedlings of different species both in the nursery and once they have been planted out can provide valuable information about which species germinate and survive best under different environmental conditions.

A very simple way of monitoring the progress of restoration efforts is to establish several locations from which photos are taken from the same angle every 6 months.

However, to determine whether or not the restoration effort is successful in the longer term it is necessary to monitor changes in the ecological attributes and functions that the restoration effort is aiming to restore or enhance (please see Chapter 8)

Involving the local community in forest restoration

Involving people who live in and around the oil palm concession in forest restoration can both provide local communities with an additional source of income and help to create a greater incentive for them to support the restoration efforts, meaning it is likely to be more successful.

People who live in or around the forest often have a good knowledge of which tree species have particular characteristics and functions, so involving local communities in seed collection can be very beneficial for both parties.

Another way of involving local communities would be for the company to assist the local community to establish a seedling nursery, perhaps as part of their community development programme. The local community would be responsible for collecting the seeds and managing the nursery, although some technical assistance from the company or local NGOs may be required. The company would then be committed to purchasing the seedlings from the local community.

Useful references and resources
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Chapter 6: Species management

6.1: Population management

In many cases simply setting aside areas of natural habitat will not be sufficient to ensure the long term survival of HCV species that remain within and around the oil palm concession.

In order to achieve this, some species will require active management.

To determine which species require active management it is necessary to:

- Identify threats to the survival of particular species
- Gather more information about the population status of key species in the area (ie. common, rare) and how this is changing over time to identify species that are a priority for active management

1. Identifying threats

The first step is to find out more about the extent to which different species are being hunted or captured for trade within and around the oil palm concession. This information can be gathered by:

- **Searching areas of natural habitat within the concession for signs of snares, traps or nets.** Each time a trap is found, the type of trap, its location and the date it was found should be recorded. If possible, the species it was aiming to capture should also be noted. This information can be used to estimate the pattern of hunting and fishing and the key areas and species that are being targeted. If hunting or fishing is prohibited in the area where the snare, trap or net is found then it should also be removed.

- **Asking plantation staff, particularly security guards, to report hunters or fisherman sighted within the concession.** The report should include the area of the plantation they were sighted in, who was involved (ie. plantation workers, people from a particular village) and how they were hunting or fishing. For example, if they are using dogs or electro fishing.

- **Visiting local markets to see which species are being sold**. If any rare, endangered or protected species are being sold the observer should try and find out as much information as possible; where the species was captured, what it is being sold for (eg. for food, as a pet, for export), the price, how many

individuals are available for sale and how often they are captured or sold.

- **Carrying out informal interviews with people living in and around the concession to find out which species are being hunted, fished and traded.** Interviews should ideally be carried out by someone who the interviewees will feel comfortable talking to openly and has good knowledge of the local area and culture. It is important to make it clear that the information provided will not be given to the government or police. It is a good idea to prepare a list of questions that cover all the information required prior to carrying out interviews.

2. Determining the population status

The number of individuals of each species living in and around the concession will fluctuate naturally between seasons and between years. Therefore, it will be necessary to monitor a species for a few years to say with certainty that the population is declining, increasing, or remaining constant (See Chapter 8).

Initially, priority for active management should be given to:

- **Species that are being hunted or traded at levels which are suspected to be unsustainable**

Management: See Section 6.2

- **Species for which it is known that the population in the area is very small and isolated from other populations of the same species**

Management: if a few individuals of a particular species are confined to an area of natural habitat surrounded by oil palm and there are strong indications that they would be unable to reproduce (ie. all individuals are of the same sex, too old to reproduce etc) or travel to find mates and additional areas of their natural habitat then it may be necessary to arrange for these individuals to be translocated. This measure should only be considered if there is no chance of re-establishing connectivity with other individuals of the same species. Translocation is expensive, stressful for the animals involved and habitat suitable for releasing animals in is limited in many regions. In Indonesia, it is necessary to obtain permission from the Director General of Forest Protection and Nature Conservation (PHKA) to translocate a protected species. It is a good idea to contact the local wildlife department (BKSDA) and local NGOs with expertise regarding the species in question for advice before deciding whether or not to translocate an animal.

- **Species with very specific habitat requirements**

Management: in situations where species are surviving in habitats that do not fulfil the requirements for the long term survival of this species effort should be made to make the habitat more suitable. This could include:

- Planting plant species which form an important component of the species' diet
- Increasing the availability of features of the habitat that the species depends on for roosting, nesting or mating
- Making it easier for wide ranging species with large habitat requirements or species that migrate to move between areas of suitable habitat by establishing corridors, stepping stones or rope bridges for arboreal species

- **Species that are having a negative impact on ecosystem function eg. invasive species or pests**

Management: in the case of invasive plant species such as *Lantana camara* it may be possible to remove individual plants manually from habitats where they are having a negative impact. For invasive animals or insects, the best option is to identify a predator which could act as a suitable biological control agent. If this species is not present within the landscape or not at high enough densities to control the population of the pest species then it may be necessary to introduce individuals of this species. It is imperative to make sure that the species being introduced will not have a negative impact on the ecosystem. This is particularly important if it is not an indigenous species.

6.2: Management of hunting, fishing and the use of natural resources

Communities who live within or around tropical forests have traditionally been dependent on hunting, fishing and the collection of non-timber forest products for subsistence. In some places, this continues to be the case and in most situations this is generally considered to be sustainable, although there are some exceptions. However, in other situations, access to more efficient equipment for hunting, changing lifestyles and a growing trade in various species of wildlife has made a significant contribution to the decline of many of the species which are now considered to be threatened with extinction. Therefore, in many situations it is necessary to control hunting, fishing and the use of non-timber forest products to some extent to ensure that this does not result in the species exploited becoming locally extinct.

The measures required to control hunting and fishing will depend on:

- **Who is involved?** This may be plantation staff, people living in local villages, nomadic tribes, a hunting club *(Perbakin)* or wildlife traders.

- **Why are they hunting/fishing/collecting non-timber forest products (NTFP)?** This may be for subsistence, as a hobby, for commercial purposes or because the species is considered to be a pest.

- **Which species are they targeting?** Wildlife that is commonly hunted, fished or trapped within oil palm concessions in Indonesia includes; large mammals (wild boar and barking deer), birds (zebra doves and songbirds), reptiles (pythons, turtles and monitor lizards) and fish (particularly catfish). Non-timber forest products (NTFP) commonly harvested include rattan, honey, medicinal plants, ornamental plants (orchids) and forest fruits (durian, mangosteen).

- **What equipment are they using?** Methods used to hunt and fish in Indonesia include traps, snares, shot guns, dogs, spears, poison, electro fishing, fishing rods and nets.

There are a range of measures that can be used to control hunting and fishing. A combination of these measures will usually be required:

1. **Signboards** – these should clearly state the company's policy on hunting, fishing and harvesting of NTFP in the local language, ideally accompanied by visual explanations.

2. **Patrols and check points -** patrols of HCV MAs and riparian zones should be carried out to demonstrate to hunters, fisherman and people collecting NTFP that the company has a ground presence in these areas, which should act as a deterrent. The timing of these patrols should be varied, and would ideally span the periods of day and night when hunters and fisherman are thought to be most active. Company security guards, or ex-poachers from local villages, may be the most appropriate people to carry out these patrols. It may also be possible to set up and man check points at the major access routes into the concession where people suspected to be entering for the purpose of hunting, fishing or capturing wildlife should be questioned (eg. carrying a weapon, late at night).

3. **Enforcement** - both the company's policy and all relevant international, national and local regulations should be enforced. For example, snares or traps found in areas where this is prohibited by the company should be removed. In Indonesia, people found to in possession of or hunting protected species should be reported to the local wildlife department (BKSDA).

4. **Include a clause which prohibits hunting, fishing or collection of NTFP in the code of conduct for all plantation employees –** this could either apply to any area within the concession or just the HCV MAs and/or riparian buffer zones. Employees who break this code of conduct should be punished accordingly.

5. **Prohibit hunting and fishing of certain species during their breeding season**

6. **Prohibit or limit the use of weapons which are unselective or result in very high yields** - techniques such as electro fishing and snaring which are not species specific could be prohibited or strictly controlled. People could still be allowed to hunt using more traditional methods which are more selective and result in lower yields, such as spear fishing, dart guns or bows and arrows.

7. **Provide local people with licenses & quotas –** this could be a way of allowing people who live close to the plantation who have a history of hunting, fishing and harvesting NTFP within the boundaries of the concession to continue to do so, whilst at the same time limiting people who are carrying out these activities for commercial purposes. However, it can be extremely challenging to determine who has a legitimate right to hunt, fish and collect NTFP within the concession, to decide upon an appropriate quota and to enforce this.

8. **Establish hunting and no hunting zones** – information regarding the distribution of species that are regularly hunted can be used to designate important areas of their habitat as 'No Hunting Zones' in order to provide these species with a refuge from hunters. For example, for species like wild boar it may be appropriate to allow hunting within the oil palm monoculture but not within the HCV MAs. The impact of such a strategy on the population should be closely monitored and the 'Hunting' and 'No Hunting Zones' adapted accordingly (See Chapter 8)

9. **Provide local people with alternative resources** – for people who depend on hunting, fishing and the collection of NTFP for subsistence, providing these communities with alternative resources is likely to be the only way to reduce levels of harvesting. It is important that these alternative resources are sustainable and the communities involved would be willing to switch to using them. This could form part of the company's community development programme.

10. **Raising awareness** – both plantation staff and people living within and around the concession should be made aware of both the company's policy on hunting, the relevant international, national and local regulations, as well as the importance of conserving biodiversity (See Chapter 7). However, it is important to be aware that alerting potential hunters/fishers/traders to the presence of rare, threatened or endangered species in the local area may result in increased levels of exploitation.

Box 3: Indonesian laws relating to protected species (From Desilets, M)

In Indonesia, it is prohibited to:

1. Catch, injure, keep as a pet, transport, and trade any live protected animal
2. Keep, possess, look after, transport, and trade any dead protected animal
3. Transfer any protected animal from one place to another, within or outside Indonesia
4. Trade, keep or possess skin, bodies, or other parts of any protected animal or the goods made of parts of the animal, or transfer said parts or goods from one place in Indonesia to another, within or outside Indonesia.

Anyone who violates the above article as a consequence of projects/company activities, whether on purpose or by accident, will receive a maximum of 5 years in prison or a penalty of IDR 100 million.

CASE STUDY

What? A compensate, mark and release scheme for softshell turtles (*Amyda cartilaginea, IUCN Vulnerable)* and Siamese Crocodiles *(Crocodylus siamensis,* IUCN Critically Endangered*)*

Where? REA Kaltim, Hulu Belayan, East Kalimantan, Indonesia

Aim:

1. To provide fishermen with a sustainable source of income which we hope will compete with the one off gain that can be made by selling individuals captured for export.
2. To assist us to monitor the population status of these species by enabling us to collect data on population structure (no. of adults vs juveniles, males vs females caught) and population size (this can be estimated from the frequency that marked individuals are recaptured).

How?

- We have arranged for local fisherman to inform us if they capture a softshell turtle or Siamese crocodile. Where possible we then weigh and measure the individual, record the sex, mark it with a small resilient tag, and record the GPS co-ordinates of the location where it was captured.
- We then pay the fisherman 10,000 – 20,000 IDR and release the animal at the point of capture.
- Even if the individual caught has already been marked, we will compensate the fisherman as this provides important data for monitoring the population.

Resources needed:

1. **Cost:** this scheme has been running for 1 year and we have received 30 reports of softshell turtle sightings and 15 Siamese crocodile sightings, which in total has cost around 900,000 IDR in compensation.
2. **Equipment:** GPS unit, scales, tape measure, a small allowance for a local assistant at the site (IDR 300,000/month).
3. **Staff time:** scheduled visits to sites to photograph, measure, weigh and tag the individuals captured

Progress to date – Successes & Challenges:

- Of the 30 softshell turtle individuals that have been captured, only 1 has been recaptured, which suggests a reasonably large population.
- There is no effective way to estimate the number being traded, but there are indications that the level at which the softshell turtles are harvested is sustainable at present.

Useful references and resources
TRAFFIC Southeast Asia (2009) Identification sheets for wildlife species traded in South East Asia. Link: http://www.traffic.org/id-reports/traffic_pub_identification3.pdf
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6.3: Human Wildlife Conflict (HWC)

What is human-wildlife conflict?

Human-Wildlife Conflict (HWC) relates to both negative impacts of human activities on wildlife, ranging from deliberately killing or capturing animals to converting or polluting their natural habitat, as well as negative impacts of wildlife on humans, such as damage to property or physical attacks.

Why does it occur?

The primary cause of human-wildlife conflict is competition between humans and wildlife for access to natural resources. A key reason for this is the loss and fragmentation of forests due to land use change, which has significantly reduced the area of suitable habitat available to many forest dependent species. The consequences of this are particularly serious for large mammals which require extensive areas of habitat to meet their needs. If the forest available to these species is not sufficient or is highly fragmented this can force these species to search for food or pass through human dominated areas more frequently. Combined with increasing levels of human encroachment into forests this has resulted in more frequent encounters between humans and wildlife, increasing the probability of conflict.

Which species are most commonly involved?

In oil palm plantations in Indonesia and Malaysia, the majority of cases of HWC involve tigers, elephants and orangutans. In addition to this, conflict can also occur between humans and sun bears, tapirs, wild boar, porcupines, macaques, muntjack, sambar deer and crocodiles.

Table 7: The species most frequently involved in Human-Wildlife Conflict in and around oil palm concessions

Species	Ecology	Impact of HWC	Cause of HWC
Tigers	• Carnivore • Nocturnal	• Do not damage oil palm crop • Can cause serious injury and death to humans	• Loss & fragmentation of habitat • Decline of prey populations, including pigs
Elephants	• Herbivores • Raid oil palm crop at night	• Young oil palms (2-4 years) targeted by crop raiding. • Also eat trunk hearts and unfolded fronts of older trees (6-8 years) • Do not eat oil palm fruit	• Loss & fragmentation of habitat, particularly when overlaps with migration routes
Orangutan	• Frugivores	• Young oil palms targeted by crop raiding (under 3 years) • Oil palms older than 5 years unlikely to be eaten. • Occassionally eat oil palm fruits	• Loss and fragmentation of habitat

Why does Human-Wildlife Conflict (HWC) need to be managed?

HWC can result in injury or death for both humans and wildlife. It can also cause significant damage to oil palms and consequently have a high economic cost. Whilst some of the measures required to avoid or reduce human-wildlife conflict may be expensive, they may be more cost effective in the long term. This is also crucial to enable humans and wildlife to co-exist within landscapes dominated by oil palm. The most successful, long-lasting and most cost-effective measures tend to be preventative, while curative measures seek to address problems when they occur or afterwards, or when preventative measures have failed.

How can it be managed?

In general, HWC can be avoided and reduced by understanding the behaviour, movement and ecology of wildlife. The first step in developing any HWC management plan is to determine which species are actually responsible for the damage caused.

Preventing Human-Wildlife Conflict (HWC)

Habitat protection

Protecting sufficiently large, connected and suitable areas of natural habitat within oil palm landscapes is widely considered to be the most effective way to avoid HWC, since this most frequently occurs in areas where populations of a certain species do not have access to sufficient habitat to meet their requirements. The best way to achieve this is to ensure that sufficient, contiguous areas of forest are protected during both regional and site level land use planning processes. In areas where oil palm development has already taken place, effort should be made to maintain and enhance connectivity between suitable areas of natural habitat. Enriching remaining areas of natural habitat with plant species that are used by the species known to be causing damage to the oil palm crop, for example by planting fruiting tree species which provide food for orangutans, may also help to reduce HWC by reducing crop raiding (Chapter 5.4)

Buffer zones

Leaving cleared or shrubby areas 20m – 30m wide along the border between areas of oil palm monoculture and forest may help to discourage orang-utans from leaving the forest as they do not like being exposed. However, if they are desperate for food, or they are attracted by plant species growing in the buffer zone, they will still leave the forest. A buffer zone should be in addition to, rather than part of, the remaining areas of natural forest. This measure will be most effective when combined with repellents, barriers and patrols. Buffer zones are not an effective means of discouraging elephants or tigers from leaving the forest.

Barriers

Both natural and manmade barriers have proved to be an effective way of reducing HWC. Different types of barriers will be required to limit the movement of different species. It is important to consider how this will alter the movement of this species and the impact this may have on both the population of wildlife (ie. would it fragment their habitat?) and other human populations (ie. would this simply displace the risk of HWC to another area?). Constructing man made barriers can be very expensive, particularly if they need to cover large distances, but this may be cost effective in the longer term. Priority should be given to protecting young oil palm, as this is most vulnerable to being damaged by wildlife.

The following are the most commonly used barriers within oil palm concessions:

- **Trenches –** building trenches that are at least 1.8m deep and 2.4m wide at the surface (they may get narrower as you get deeper) around the oil palm can help to prevent elephants entering and damaging the crop. However, trenches are not suitable in areas prone to soil erosion or in wetland areas, as elephants can swim. Trenches require regular maintenance to prevent erosion and can be very expensive to construct. According to a company in Riau, Sumatra, construction of such a barrier may cost up to 50 million IDR (US$ 5,495) per km.

- **Canals –** trenches filled with water can be an effective means of preventing orangutans from entering the oil palm if they are at least 3m wide. Although orangutans cannot swim, they have been know to wade up to their necks in water to cross water, so the canals should be deep enough to prevent this. Canals also require regular maintenance to keep them free of debris that may help orangutans to cross them, maintain the water level and ensure that the water doesn't become stagnant and pose a disease risk.

- **Electric fences –** these are considered by many plantation managers to be the most effective way of deterring wildlife that may cause damage to the oil palm, including elephants, orangutans, wild boar and deer. As long as the voltage is limited to 12 volts, the risk of injury to both humans and wildlife is low. However, large elephants may be able to endure the pain in order to push down the fence and orangutans may dig under the fence, learn when the electricity is off, or pole vault over it. Putting mesh under the ground can help to prevent orangutans from digging under the fence and make it more effective.

Repellents

A variety of different repellents can be used to try and discourage wildlife from leaving the forest and entering the oil palm crop:

- **Loud noises** – firecrackers, drums, shouting, vehicle horns and gun shots can be a reasonably effective way of deterring elephants and orangutans. However, if noises are made at regular intervals then wildlife can become habituated to it and will start to ignore it.
- **Chillies *(Capsicum spp)*** – these plants are avoided by elephants and may also help to deter orangutans so planting them around the edge of the oil palm may help to deter these species from entering the crop
- **Light** – this can be used to deter wildlife that is known to raid the oil palm at night, including elephants, but is not thought to be particularly effective

Patrols

Patrols in areas where there is a high risk of HWC is one of the simplest, cheapest and most effective ways of preventing conflict between humans and a wide range of species. At the same time, these patrols can also help to reduce hunting, which will help to increase the prey available to carnivorous species like tigers and reduce the need for tigers to search for food beyond the forest. Patrols should be carried out at night to prevent conflict between humans and elephants or tigers, but during the day to prevent orangutans from entering the oil palm. The use of vehicles will enable the people carrying out the patrol to scare away any animals sighted using the lights, sound of the engine and horn.

Raising awareness

Training and awareness raising programmes can help to educate both plantation staff and people living in around the concession about HWC and how to behave if an animal that is considered to be a threat is encountered in order to minimise the damage caused to both people and wildlife. Such programmes should also aim to educate people about the causes of HWC, including habitat loss and reduced availability of prey, as well as the importance of conserving these species (See Chapter 7).

CASE STUDY

In 2004, the Governor of North Sumatra, Indonesia, issued a decree to establish a task force and co-ordinating teams to address Human-Wildlife Conflict (HWC) issues within each district. The HWC Mitigation Task Force consists of relevant government agencies, such as the local wildlife department (BKSDA), as well as conservation NGOs working to conserve orangutans, tigers and elephants in the region, as these are the species most frequently involved in HWC.

In line with this decree, the Orangutan Information Centre formed a species-specific task force for the Sumatran orangutan.

To date this task force has:

1. Gathered data about the types and patterns of Human Orangutan Conflict (HOC) in North Sumatra and Aceh, as well as the methods already being used by farmers in this area to cope with it.

2. Drafted a Standard Operating Procedure for HOC, which is due to be endorsed by the government.

3. In April 2010, a Human Orangutan Conflict Response Unit was established, which is responsible for responding to and alleviating instances of HOC in agricultural and other human developed areas around the Gunung Leuser National Park in North Sumatra. This team consists of 5 members of staff, which are equipped with a vehicle, uniforms, GPS units, cameras and educational materials. To date this unit has:
   - Trained over 500 farmers in 35 villages how to make hand-held firecracker bamboo noise cannons and how to use them to scare orangutans away from their crops. It has also trained them in passive methods for conflict mitigation.
   - Conducted education and awareness raising activities regarding conservation and HOC mitigation methods in local communities.
   - Responded to 45 reports of HOC over a 12 month period. This has resulted in one orangutan that was being kept captive being confiscated and sent to a re-introduction programme. It has also lead to two wild orangutans that were isolated in a patch of agricultural land 20km from the National Park being transferred to a quarantine centre before they can enter the re-introduction programme.
   - The team runs a free SMS service **(+62813-977-20000)** for reporting instances of HOC.

Mitigating Human-Wildlife Conflict (HWC)

Compensation

People who are injured, or whose property is lost or damaged by HWC, will often expect compensation of some kind. However, whilst this can be valuable in the short term, it will not help to solve the problem in the long term and can create conflict both within communities and between the company and the community.

Translocation

The translocation of individual animals involved in HWC should be a last resort as this will not solve the problem in the long term and may simply move the problem to another area. It should only be considered if there is no other option for the survival of the animal or it has frequently been involved in attacks on humans. Capturing and translocating animals is risky for both the animal and people involved and should only be carried out by experienced and well equipped professionals from relevant NGOs or rehabilitation centres. In Indonesia it is necessary to obtain permission to translocate an individual from the local wildlife authority (BKSDA). It is also a very expensive procedure. For example, the cost of translocating an elephant in Malaysia can be as much as US$8,000, whereas on average it costs US$ 4,000 to translocate an orang-utan. It is important to monitor translocated individuals once they have been released to ensure that they find a suitable territory or area of habitat and do not try and return to the location from which they were translocated. If successful, translocated individuals can help to enhance the viability of a population of the species in a more suitable area of habitat in a different area.

Table 8: Advantages and disadvantages of the different approaches for managing Human Wildlife Conflict

Measure	Advantages	Disadvantages	Tigers	Elephants	Orangutan
Habitat protection	• Addresses the root cause • Long term solution	• Ultimately depends on landscape level land use planning which can be difficult to influence			
Buffer zones	• Relatively cheap	• Orangutans will still cross buffer zones if desperate for food • Can cause HWC in other areas			
Barriers: Trenches	• Semi-permanent	• Expensive to construct • Only suitable for flat and dry terrain • Heavy maintenance needed to prevent erosion • Can cause HWC in other areas			
Barriers: Canals	• Semi-permanent	• Expensive to construct • Can be difficult to maintain water level in the dry season • Stagnant water is a disease risk • Can cause HWC in other areas			
Barriers: Electric fences	• Semi permanent • Versatile • Lower risk of injury than barbed wire fence	• Expensive to construct • Not always effective eg. orangutans can dig under the fence • Can cause HWC in other areas			
Repellents	• Cheap	• Habituation			
Patrols	• Relatively inexpensive • Can be put into action immediately	• Temporary effect • Dangerous • Labour intensive			
Raising	• Preventative	• Not necessarily effective.			

awareness	• In-expensive • Applicable for all species involved in HWC	• Labour intensive			
Translocation	• Long term effect if whole herd translocated	• Very expensive • Temporary effect if only some individuals are translocated • Requires trained personnel • Dangerous for both the animals & people involved • Shortage of suitable locations to release translocated individuals			
Compensation	• Immediate relief to victims	• Does not solve the problem • Can create social conflict			

Useful references and resources
The Borneo Orangutan Survival and Sumatran Orangutan Society have produced a short DVD which aims to advise plantation workers about how to deal with human-Orangutan conflict.
The Orangutan Information Centre Standard Operating Procedures with Best Practice Mitigation Methods for Orangutans Link: http://orangutancentre.org
Hockings, K. and Humle, T. (2009). Best Practice Guidelines for the Prevention and Mitigation of Conflict Between Humans and Great Apes. Gland, Switzerland: IUCN/SSC Primate Specialist Group (PSG). Links: http://www.primate-sg.org/PDF/BP.English.Guidelines.pdf http://www.primate-sg.org/PDF/BP.Bhasa.pdf
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Distefano E. (undated). Human-Wildlife conflict around the world: collection of case studies, analysis of management strategies and good practices. Link: http://www.fao.org/SARD/common/ecg/1357/en/HWC_final.pdf
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Sukumar R. 2003. *The living elephants: evolutionary ecology, behaviour, and conservation*. New York : Oxford University Press.

Nyhus PJ & R Tilson. 2004. Characterizing human-tiger conflict in Sumatra, Indonesia:implications for conservation. Oryx 38 (1):68-74.
Link:
http://www.colby.edu/personal/p/pjnyhus/documents/nyhus%202004%20characterizing%20humantiger%20conflict%20in%20Sumatra%20oryx%20v38n1%20jan04.pdf

Chapter 7: Engaging stakeholders

7.1: Raising awareness

If efforts to conserve HCV species and habitats within and around oil palm concessions are to be successful, it is essential that management interventions are supported by all of the stakeholder groups that will be involved in or impacted by their implementation. This includes:

- Local government
- Plantation management
- Plantation workers
- People living in or around the plantation, particularly those involved in activities that have a negative impact on forest and wildlife, such as hunting, logging, mining etc

These stakeholder groups are more likely to be supportive of the measures needed to maintain and enhance HCV species and habitats if they are well informed about what is being done and understand why it is important. For example, people are more likely to accept and obey instructions which limit their freedom to hunt if they understand that it is illegal and/or is risking the local extinction of a particular species, meaning that the benefits it provides to both humans and the environment would be lost.

For an awareness raising programme to be successful it must have a clear and specific aim. For example, this could be to educate potential hunters or wildlife traders from local communities about both the company's policy and national regulations relating to these activities. Alternatively, the aim could be to educate plantation workers and local communities about the importance of maintaining water quality, highlighting activities that cause pollution and how this can be avoided. It is important that the programme has a specific and ideally measurable objective, against which the success of the programme can be evaluated. For example, the participants will be able to name 10 protected species in Indonesia or be able to recite the key components of a particular Standard Operating Procedure if questioned. This will help to decide whether it is worthwhile to repeat the activity designed to raise awareness, or whether a different approach may be more effective.

CASE STUDY

What? Orangutan education and awareness programme

Where? Wilmar Central Kalimantan Project, Indonesia

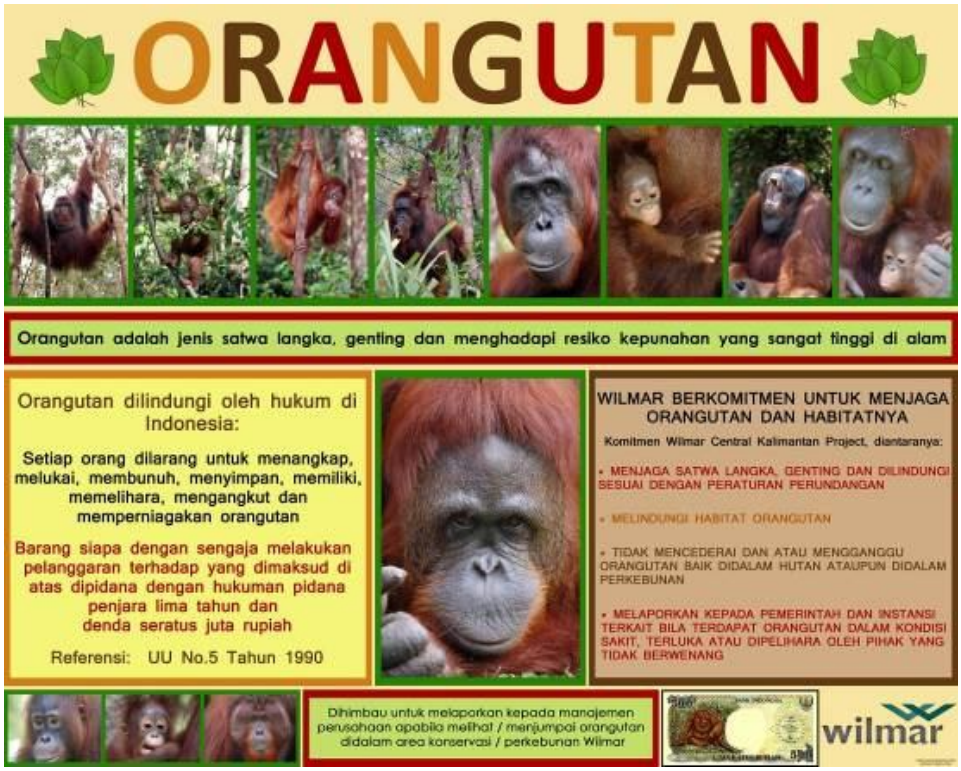
Aim:

1. To educate plantation staff about orangutans, including their ecology, the threats they face and the measures needed to conserve them.
2. To raise awareness amongst plantation staff about the company's Standard Operating Procedure relating to the conservation of orangutans and their habitat

How?

- A series of Orangutan Education Events were arranged on different estates. Events were held during the day for plantation management and in the evening for plantation workers and their families. A register of attendance was taken for the plantation staff and workers invited to attend each event.
- Evening events for workers and their families were held outside on a groundsheet in front of a projector set up near the workers' accommodation. Each evening session was attended by up to 400 people.

- Each event lasted 2-3 hours and consisted of several presentations, interactive songs and games, and a short film about orangutans and forest destruction. This was facilitated by 3 people from Yayorin's Education Team, an Orangutan Conservation NGO based in Pangkalan Bun, Central Kalimantan.
- Each event was opened by the company's Conservation Manager, who explained the necessity of raising awareness about orangutans, the importance of conserving High Conservation Values within oil palm concessions, as well as the company's Standard Operating Procedure (SOP) relating to the conservation of orangutans and their habitat. This was followed by presentations from Yayorin, who provided further information about orangutans, their habitat and ecology and the threats to the survival of this species. The final presentation was given by a representative from the BKSDA (the local wildlife department), who explained the Indonesian laws and regulations relating to orangutans, which is a protected species in Indonesia, as well as measures that can be taken to avoid Human-Wildife conflict.
- At the end of each event, the audience was given orangutan stickers to put up in their homes. Posters summarising the key messages from the presentations, in particular the company's SOP relating to the conservation of organgutans and their habitats and the national laws that protect orangutans, were also put up in communal areas across the plantation estates, including offices and housing complexes.



Resources needed:

- Transport, food and accommodation for representatives from Yayorin and the BKSDA.
- Groundsheets, an overhead projector and refreshments
- Orangutan stickers – 12,500,000 Rp for 6,000 stickers
- Orangutan posters - 62,500 Rp to print a 1m x 1.25m poster

The methods and materials used as part of an awareness raising programme, as well as the content, should be carefully tailored to the target audience. Factors to consider include:

- What is their existing level of knowledge and understanding of the issue?
- What is the most appropriate forum or media for engaging them?
- What is the best language in which to communicate?
- Can they read and write?
- Who would be able to engage with them most effectively?

There are a wide variety of methods and materials that could be used to raise awareness. These include:

- Signboards
- Producing and distributing leaflets, stickers, posters or calendars
- Road shows or presentations
- Lessons in plantation schools
- Field trips to the HCV MAs
- Discussions during community meetings
- Explanation of particular SOPs during the morning roll call for plantation workers

CASE STUDY

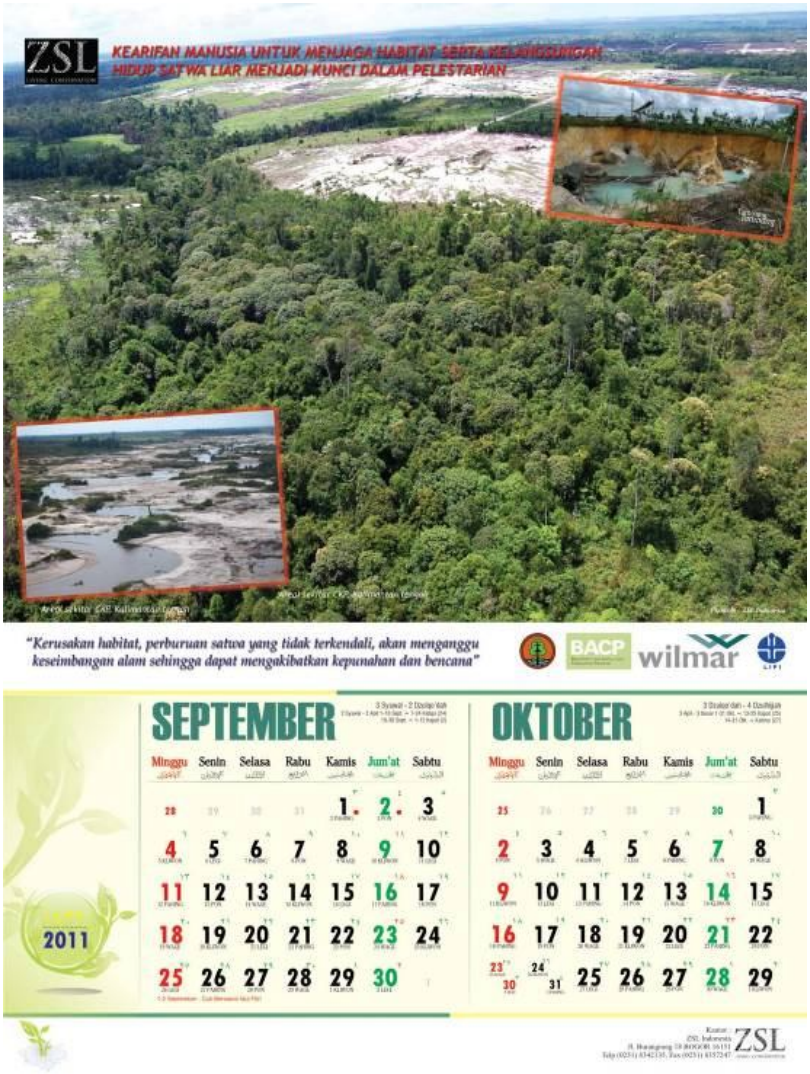
What? A calendar to raise awareness about HCV species and habitats

Where? Wilmar plantations throughout Sumatra and Kalimantan

Aim: To raise awareness amongst plantation staff and communities living in and around the plantation about High Conservation Value species and habitats, the major threats and the importance of conservation

How?

- Each page of the calendar was designed to explain what High Conservation Values are, the role of different species and habitats, as well as the importance of conserving them within oil palm landscapes.



- The messages contained within the calendar included:
    - The importance of conserving areas of natural habitat within oil palm concessions for wildlife, the provision of ecosystem services and people
    - Pictures of species found within and around the plantations that are protected by the Government of Indonesia, listed as Critically Endangered, Endangered or Vulnerable by the IUCN, or listed as Appendix 1 or Appendix 2 by CITES
    - Pictures of species found within and around the plantations that play an important role in seed dispersal and pest control
    - The importance of clean water for both people and the environment
    - The impact of mining and logging on natural habitats and the potential long term consequences of this
- The calendars were distributed to plantation staff and workers, as well as villages within and around the estates, at a variety of events. This included a series of environmental education events arranged by the company for plantation staff, signings of MoUs with local villages, as well as any other interactions with people living in or around the estates.

Resources needed:

- Cost of printing 4,800 Calendars (45 x 60cm) was approximately 52,000,000 Indonesian Rupiah
- Transporting calendars from printers to the various plantations

Progress to date – successes & challenges

- The calendars were received enthusiastically by plantation staff and people living in and around the plantations and in the majority of cases hung up in their homes
- The calendars provided a useful entry point for more detailed discussions between the company and people living in and around the estates about High Conservation Values and the actions that must be taken to conserve them.

- It is difficult to tell whether the people who received the calendars have fully understood the information contained in them. It would be necessary to measure this in some way in order to gauge the effectiveness of the calendars as a means of raising awareness.

CASE STUDY

What? Regular Conservation Education Camps for local school children

Where? REA Kaltim, HuluBelayan, East Kalimantan, Indonesia

Aim:

1.) To provide education in forest biology and practical conservation tips for children and teachers of emplacement and local village schools in the hope of inspiring a greater appreciation and respect for their natural surroundings.
2.) We hope that the children who participate in these nature camps will also educate and inspire their parents to appreciate and respect the forest and wildlife that remains within and around the oil palm plantation.

How?

1.) Conservation Edu-Camps are held 4-6 times per year
2.) Each Nature Camp is run by at least 4 – 6 staff from REA KON staff (lead by the Community Unit) and 4 school teachers.

3.) For each Nature Camp we invited from 15-60 children from one of the plantation schools, aged 9 – 12 (SMD Class), to spend 2 nights and nearly 3 days at our field station on the edge of the forest.
4.) During the weekend the children are divided into groups of 4 - 5. Each group is given a different topic to focus on, such as trees, flowers, spiders, beetles, which they spend time in the forest searching for. With help from the REA KON staff the children then try and identify everything they have collected or taken photos of. At the end of the weekend, one person from each group gives a presentation to the whole group, explaining what they found and learnt. The weekend finishes with a Question & Answer session with all the staff.
5.) The weekend activities also included various games and films relating to the environment.

Resources needed:

1.) **Staff:** at least 4-6 staff and 4 teachers to lead the group of children
2.) **Logistics:** usually the children bring their own tarps or tents and food. Transport is provided by the estate for children from the emplacement schools. REA KON provides the transport for children from the village.
3.) **Cost:** additional costs of holding the camps is small; usually limited to food for the staff and prizes for games or competition winners.

Progress to date – Successes & Challenges:

- Approximately half of the school children invited were not allowed to attend the Nature Camps as their parents were

nervous about letting them spend time in the forest. However, when these children heard stories from their friends who did participate, we found that they put pressure on their parents to allow them to attend the next one.

- So far our Nature Camps have mainly involved children from the plantation schools, as it is more difficult and expensive to arrange transport to the field station for children from the village schools.

7.2: Collaborative management of HCV Management Areas

In many cases the effectiveness of efforts by a single palm oil producer to maintain and enhance HCV species and habitats will depend on the actions of neighbouring land users, both companies and local communities, as well as government authorities. One reason for this is that the conservation of large contiguous areas of natural habitats, species with large habitat requirements and ecosystem functions such as the maintenance of water quality for downstream communities requires action at a larger spatial scale than a single oil palm concession.

A further reason is that the decisions and activities of other stakeholders operating within the landscape have the potential to undermine efforts being made to conserve HCV species and habitats within a single oil palm concession. A notable example of this in Indonesia is the ability of local government authorities to excise areas that have been set-aside for conservation from a company's location permit (Izin Lokasi) or land use title (HGU) because this land is considered to be idle.

Working collaboratively with neighbouring companies, local communities, local governments and NGOs to manage HCV Management Areas has great potential to overcome these issues.

How to work with…

1. Neighbouring companies

In situations where neighbouring companies already have collaborative agreements in place to build and maintain roads and other infrastructure, this can provide a good starting point for developing a collaboration concerning the management of HCV species and habitats. Communication between consultants prior to, during and after conducting HCV assessments on neighbouring oil palm concessions is another way of helping to promote collaborative management of HCV species and habitats. This is particularly important if the HCV MAs delineated border or extend into the

neighbouring concession. For example, if the riparian zone of a river which flows through more than one concession is identified as providing a corridor for wildlife this will only continue to perform this function effectively if the riparian zone is maintained in the adjacent concession as well. Several of the collaborations that have been established between neighbouring oil palm concessions so far have been facilitated by third parties, particularly NGOs that are working in the region.

Ways in which neighbouring companies could collaborate in terms of managing HCV species and habitats include:

- Establish a joint team to patrol the HCV MAs and enforce policies and regulations relating to hunting, fishing, encroachment, logging etc
- Establish joint teams to monitor the condition of HCV species and habitats (See Chapter 8)
- Establish a joint nursery for forest restoration and enhancement
- Share the cost of purchasing aerial photography or satellite imagery to identify the potential for enhancing connectivity between remaining areas of natural habitat within the concession and the surrounding landscape

Collaborating on these activities would help to reduce the cost of implementing effective HCV management. This may enable people with specific skills to be employed to perform certain tasks, such as managing a nursery or conducting wildlife monitoring, which a single company may be unable to justify. It can also help to improve communication between adjacent companies with regards to the presence of key species and threats within the surrounding area.

It may be necessary to establish a MoU between all of the parties involved which clearly states the objective of the collaboration and the role of each party.

2. Local communities

In situations where local communities have the right to use areas that have been designated as HCV MAs it will be essential to involve them in managing these areas if this is to be successful. In order to establish a collaborative management agreement the first step is to identify which stakeholders have a right to use the area in question, how they are using it, and how this may conflict with the company's management objectives for the area. This process of stakeholder consultation should be used as an opportunity to ensure that people living in and around the oil palm concession are fully aware of any

actions that the company is taking or planning to take in order to maintain and enhance HCV species and habitats. It should also aim to identify potential solutions to any conflicts between the way in which the company and the local community wish to manage the area. For example, it may be necessary for the company to establish community development programmes to provide an alternative source of income for people that have previously relied on extracting resources from the HCV MAs if these activities are considered to be a threat to the persistence of the HCVs it supports. However, it is generally acknowledged that allowing local people to continue to use forest resources, but perhaps less intensively than before, is less likely to lead to conflict between the company and the community than if attempts are made to prevent these people from entering the HCV MAs. This process of stakeholder consultation is likely to be more successful if it is facilitated by a third party.

It may be necessary to formalise any agreements reached between the company and the local community about how the area in question will be managed with a Memorandum of Understanding (MoU) which outlines the responsibilities and commitments of each party.

3. Local governments

Demonstrating to local government authorities that areas of natural habitat set-aside for conservation are being actively managed and are therefore not 'idle land' is essential to prevent these areas from being excised from the company's location permit (Izin lokasi) or land use title (HGU) and allocated to another company for oil palm cultivation. It is therefore important to share the HCV assessment and HCV management plan with the relevant government authorities in order that they understand why these areas are not being cultivated with oil palm and how they are being managed. It may also be beneficial to invite representatives from relevant local government departments to visit the HCV MAs so they can gain first hand experience of this. Providing these departments with regular verbal or written reports containing updates on the condition of HCV species and habitats within the concession should help to maintain government support for the conservation of HCV MAs. If it is possible to establish a MoU with the relevant government department which outlines a commitment by both parties to conserve a habitat of particular importance then this may also help to secure these areas in the long term.

In certain circumstances it may also be very valuable to collaborate with local government authorities with expertise in wildlife and

forest management, such as the BKSDA and Dinas Kehutanan. This is particularly important when tackling issues such as Human-Wildlife Conflict and encroachment. These departments may also be able to provide advice, expertise and resources to assist in implementing training for patrol teams, conducting awareness raising events and carrying out forest restoration.

4. NGOs & scientific research institutions

NGOs working to conserve species and habitats in the region of the oil palm concession, as well as universities and scientific research institutions can be a useful source of technical advice regarding the measures which need to be taken to maintain and enhance HCV species and habitats more effectively. Examples of ways in which they may be able to assist include:

- Monitoring the condition of HCV species and habitats on a periodic basis
- Assisting in training company employees or local communities to carry out HCV monitoring
- Developing resources for and assisting to implement awareness raising campaigns
- Advising on and responding to cases of Human Wildlife Conflict
- Providing technical and practical assistance with forest restoration

Chapter 8: HCV monitoring & adaptive management

Purpose of HCV monitoring

Monitoring is essential to allow managers to answer two key questions:

1. Are the management interventions and Standard Operating Procedures designed to maintain and enhance HCV species and habitats being implemented properly?

2. Are these management interventions having the desired outcome? This is important, as it tell managers when the current management interventions are not being effective and need to be adjusted.

How to establish a monitoring programme

In order to answer the questions above, HCV monitoring should incorporate:

1. **Operational monitoring:** this involves carrying out simple checks on a regular basis to ensure that management interventions are being implemented as agreed. This does not require specific expertise and so can usually be carried out by existing plantation employees on a weekly or monthly basis as considered appropriate. This may involve:
    - Checking that signboards are in place
    - Checking that boundaries of the HCV MAs are clearly demarcated
    - Checking that pesticides and fertilisers are not being applied in riparian zones or other sensitive habitats where this is prohibited
    - Checking that patrols to deter and detect hunting, fishing, encroachment and illegal logging are being carried out according to the agreed schedule

2. **Effectiveness monitoring:** this involves periodically assessing the condition of HCV species and habitats targeted by management interventions to determine whether management objectives are being achieved. Conducting such assessments will require at least a basic level of expertise in biodiversity, ecosystem services and anthropology, so it may be necessary for the company to employ scientists or consultants specifically for this purpose. However, effectiveness monitoring will only need to be undertaken seasonally or annually, depending on what is being measured. This may involve:

- Biodiversity assessments to estimate the population size of a rare, threatened or endangered species for which measures are being taken to improve the habitat or reduce a threat, such as hunting
- Obtaining aerial photographs or satellite imagery to assess changes in the condition and area of natural habitat within the concession
- Conducting vegetation assessments in areas which are being restored
- Water quality testing
- Socio-economic surveys to assess whether or not local communities basic needs continue to be fulfilled by the HCV MAs

What should be monitored?

The purpose of monitoring is to provide managers with guidance about whether or not the measures being implemented to maintain and enhance HCV species and habitats are achieving this goal. It is therefore essential that the species or habitats monitored are directly linked to the management objectives. Ideally, monitoring should also be linked to a specific management intervention, so it can easily be determined whether or not this is having the desired impact. In some cases it will be possible to monitor the condition of the HCV species and habitats that form the focus of management interventions directly. However, in many cases it may be more effective to monitor indicators of this. For example, it can be very difficult to accurately monitor changes in the population size of rare, threatened or endangered species. Therefore, it may be more useful to monitor changes in habitat quality or availability of suitable prey or nesting sites.

For an indicator to be useful it must be:

- **Measurable** – quantitative results are necessary to accurately detect change over time
- **Relevant** – changes in the condition of the indicator must provide useful information about whether or not management objectives are being met
- **Simple and cost effective to measure**

Once it has been decided what will be monitored in relation to each management objective, this should be incorporated into the management plan.

Table 9: Examples of indicators which could be used to monitor whether or not specific management objectives are being achieved

Management objective	Indicators
Reduce levels of hunting	• Number of snares/traps found during regular patrols of HCV MAs • Annual estimates of the size of the target population • Number of hunters entering the plantation
Restore an area of degraded forest to its undisturbed state	• Annual photos taken from the same angle at the same point • Permanent vegetation plots where tree density can be measured on an annual basis • Annual biodiversity surveys to assess the ability of wildlife to use the restored area
Reduce water pollution from the plantation operations	• Measure the difference between the water quality at inlets and outlets from the plantation.

What methods should be used to monitor and how frequently should this be carried out?

A variety of different methods may be involved in monitoring. This may include:

- Patrols
- Biodiversity assessments
- Water quality monitoring
- Socio-economic surveys
- Periodically taking photographs

The frequency that monitoring should be carried out depends on how quickly a response to the management intervention is expected, how sensitive a particular indicator is to change and the severity of the threat which a management intervention is aiming to reduce.

It is essential that once a protocol for monitoring has been decided upon it is used consistently to monitor changes in the indicator being assessed. If not, there is a risk that changes detected in the indicator being measured are a result of differences in the methodology used to measure it and do not accurately reflect a change in the condition of the species or habitat that is being targeted by a particular management intervention.

Who will be responsible for monitoring?

Implementing an HCV monitoring plan may involve a wide variety of different people. This could include:

- General plantation managers
- A dedicated HCV management team
- Security teams
- Members of the local community
- NGOs, consultants or scientists
- Local government authorities

The HCV monitoring and management plan should clearly identify a company employee who is responsible for ensuring that each component of the HCV monitoring programme is implemented. This should include any preparation required for monitoring, such as training the staff who will carry out patrols, purchasing equipment or engaging consultants, as well as reporting, analysing and acting upon the results of the monitoring.

How will the data will be managed and analysed?

A system for reporting and managing the data collected as a result of monitoring should be established before monitoring begins. For example, data may initially be recorded using paper data sheets, but could then be transferred to an electronic database to facilitate data analysis and make it easier to keep long term records. It is also important to decide how the data will be analysed in order to determine whether management objectives are being achieved and management interventions are effective.

The data should be analysed in sufficient time for a management response to be made quickly enough to address any negative changes detected in the condition of the species or habitats being targeted by management interventions.

When will a management response be necessary?

The overall purpose of monitoring is to provide feedback on whether the current management interventions are having the desired impact so that where this is not the case, these interventions can be adjusted to become more effective. This is known as adaptive management.

Box 4: Definition of adaptive management

> Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project.

When deciding which indicators are going to be measured as part of a monitoring programme, it is also necessary to determine what result would suggest that the interventions are effective and the management objective is being achieved ie. the level of the indicator decreases, increases or remains constant in comparison to the baseline established by the first few measurements. If possible, it is also useful to set a threshold beyond which the level of change observed is considered to be significant enough for action to be required. This could be either a positive change, which may suggest that a particular management intervention is no longer necessary, or a negative change, which may suggest that additional actions may be needed to mitigate this negative impact on the species or habitat in question.

Useful references and resources
HCV Resource Network website Link: http://www.hcvnetwork.org/about-hcvf/the-hcv-process-folder/monitoring-high-conservation-values
Gardner, T. 2010. *Monitoring forest biodiversity. Improving conservation through ecologically responsible management*. London, Washington DC: Earthscan.