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HCV monitoring protocol
for oil palm landscapes

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HCV Threat Monitoring Protocol

Michal Zrust, Laura D'arcy, Lili Sadikin, Achmad Suhada,
Edwin Hermawan, Laurio Leonald, Rudiyanto, Sugeng Wahyudi,
Raj Amin, Olivia Needham & Dolly Priatna

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The Zoological Society of London

Outer Circle
Regent's Park
London, NW1 4RY
United Kingdom

The Zoological Society of London Indonesia Programme

Jl. Gunung Gede 1 No.11A
Bogor 16151 West Java
Indonesia

www.zsl.org

www.sustainablepalmoil.org

www.smartconservationsoftware.org

1. Threat Monitoring Protocol

1.1 Background

This HCV Threat Monitoring Protocol was designed and field trialled by The Zoological Society of London's (ZSL) Biodiversity and Palm Oil Project in Indonesia to standardise the monitoring of anthropogenic threats to High Conservation Value (HCV) areas within oil palm landscapes.

The system has been fully field trialled at two sites in Sumatra and Kalimantan on both large and medium sized producer-company concessions and the system described here was adapted following trial results. Company staff at both companies were fully trained to enable the successful implementation of the system design, data collection and data storage. Following data collection by company field teams, data was used to provide training on data analysis, reporting and evaluation.

This protocol is to be used in conjunction with the Spatial Monitoring and Reporting Tool (SMART) software (available at: http://www.smartconservationsoftware.org) developed by a partnership of conservation agencies, conservation organizations and individuals; including ZSL.

ZSL has developed a palm oil context-specific data model for SMART along with Threat Monitoring Training Modules for practical data collection and SMART Software Training Modules for the palm oil specific data model and advanced SMART user training.

1.2 Justification

The correct use of the High Conservation Value (HCV) concept (see www.hcvnetwork.org) should guarantee that forested areas of conservation value remain intact and maintain the values held within, even in oil palm concession areas. However, the transformation of large areas of land for agricultural purposes creates a number of threats to the areas that still remain.

The reduced availability of forest resources and ecosystem services for local communities that results from large-scale land conversion to agriculture directly increases the pressure on these remaining resources. Access roads created for agricultural or industrial purposes also provide access to HCV areas and their resources, which are exploited for logging, hunting, mining, fishing, agriculture and the collection of non-timber forest products (NTFP). As a result of this increased resource extraction pressure per unit of area, the threats to the maintenance of these HCVs are also substantially increased.

Growers certified under the RSPO scheme are subject to RSPO Principles and Criteria 5.2 and 7.3, obliging plantation owners to maintain and protect HCVs within their concessions. Responsibility therefore falls on the plantation owners to prevent or minimise these threats.

To meet this responsibility, regular patrol monitoring provides managers with an understanding of the threats present; identifies threat 'hotspots'; demonstrates changes in threat activity over time; prioritises areas for management activities; and ultimately provides a mechanism for evaluating the impact of these management activities on the natural environment. In addition, regular patrols can provide valuable incidental data on faunal species' presence, which can be used to monitor the impact of various activities on wildlife.

Using patrol-based monitoring requires a basic level of staff training and education; little additional equipment; and can utilise existing plantation patrol teams and reporting frameworks. Patrols can provide monitoring data generating indices for day-to-day decision making by managers, without the need for gathering expensive baseline data. Following data collection, these indices can be used within the accompanying software to draw inferences about relative prevalence of human activities over time and area and how these are linked to biodiversity. In addition, a systematic data input framework helps to minimise data inconsistencies due to limited resources and technical training.

"The correct use of the High Conservation Value concept should guarantee that forested areas of conservation value remain intact..."

1.3 Aims

- To systematically monitor all HCV area using standardised patrol methods to identify anthropogenic threats to priority areas.
- To record the nature and intensity of anthropogenic activities in order to document trends, prevalence and spatial distribution of legal and illegal disturbances.
- To record incidental encounters with fauna in order to understand presence/absence and population, and habitat use trends over time.
- To systematically store and analyse anthropogenic threat and incidental fauna data.
- To develop a regular and standardised monitoring, reporting and verification system.
- To provide an informative tool for adaptive, efficient and successful management of HCVs.

1.4 Methods

The following methods section is an overview of the methods used to allow for flexibility and provide recommendations. Further detailed guidance is available in the Threat Monitoring Training Modules as well as The Zoological Society of London's SMART Software Training Modules.

1.4.1 Establishment of patrol teams

Sourcing of staff: Wherever possible, some staff within a patrol team should be sourced from reliable, local community members with extensive forest and field experience. Teams should be hired on a permanent basis and included in relevant professional development training programmes whenever possible.

Number of team members: Patrol teams should consist of at least two suitably trained personnel. In special circumstances, where a safety threat exists (such as land conflict), the team should include an extra member sourced from the plantation security personnel. If the patrol team plans to survey a distant HCV block that cannot be circumnavigated in a single day, for safety and efficiency, a separate driver should be provided to drop off and pick up the team.

Number of teams: The number of patrol teams required on each estate will depend on the size and location of HCV areas. As a guide, one team should be allocated to each 2,500ha of HCV forest area. However, the final number will depend not only on the size of the HCV area to be surveyed, but also on the length of the HCV forest boundary, the time required to reach the HCV areas, the type of HCVs present, the intensity of the threats present, the endangered species present, and the number of forest trails present (see 'Patrol Location' section) within that given area. Thus the above figure is a very rough indicator only; the actual number of units required will be determined through experience over time.

Maintaining capacity and constancy: The equipment each patrol team is given must be recorded and maintained. In addition, each patrol team should be allocated a unique ID code consisting of one letter and a number (e.g. D4) to distinguish surveys that they undertake. The members of each patrol team should ideally always stay constant in order to maintain standardised survey effort. New employees should always spend at least a month with an established and trained unit in order to learn the necessary skills in a practical setting.

1.4.2 Training of patrol teams

Training is essential in order to ensure that both field teams and management have the required skills to carry out standardised data collection, analysis and follow the reporting guidelines. Training modules and materials necessary to carry out such training can be found in the accompanying document "Threat Monitoring Training Modules".

1.4.3 Patrol location

Daily survey effort: Whilst some flexibility must be maintained to allow for unforeseen circumstances, on average, a patrol team should cover approximately 1.5km/hour by patrolling on foot around HCV border areas and approximately 1km/hour on forest trails. Therefore, a patrol unit should be able to survey between 6km and 9km in any 6 hour work day (not including travelling time to reach each site). Whether an area can or cannot be covered in any one day, is largely dependent on what threats are identified during the survey. Therefore a definite prescription of where to survey each day is not feasible. However during staff training a survey plan can be estimated and adapted when necessary.

Use of vehicles: When accessible by road or good trails, HCV boundary areas can be surveyed from a car or a motorbike, significantly increasing the area that can be monitored. It is important however to ensure that the data collected are of the same quality by driving slowly and at a constant speed, always stopping to explore forest trails entering the HCV areas. All HCV boundaries and areas should be monitored irrespective of their size (see Safety section for more information).

Location of surveys: Patrols are conducted in accessible sections of HCV areas as close to the HCV boundary as possible without creating new trails. It is assumed that if the patrol teams cannot enter the HCV area due to dense vegetation, neither will others who intend to conduct illegal or other activities. Therefore, patrol teams are not required to establish new trails into HCV forest areas given the perceived greater threat posed by opening up of additional access routes into the forest[1]. It is recommended that patrols do not take place at a distance further than 20m from the HCV forest boundary. If this is not possible on existing pathways, any new trail established should be as close as possible to the HCV boundary.

In highly disturbed areas, where invasive creepers have invaded, access routes deeper into HCV areas may not be clearly visible. A patrol should investigate such areas more closely for signs of trails.

Old trails: Clearly visible trails are often found where activity takes place. Therefore, if a patrol team comes across a path leading into an HCV area, they are required to follow it (see Figure 1). During the initial 'baseline' survey, teams are

1 This only refers to patrol-based monitoring. New transects or access routes may need to be created for the purpose of periodic biodiversity or habitat surveys.

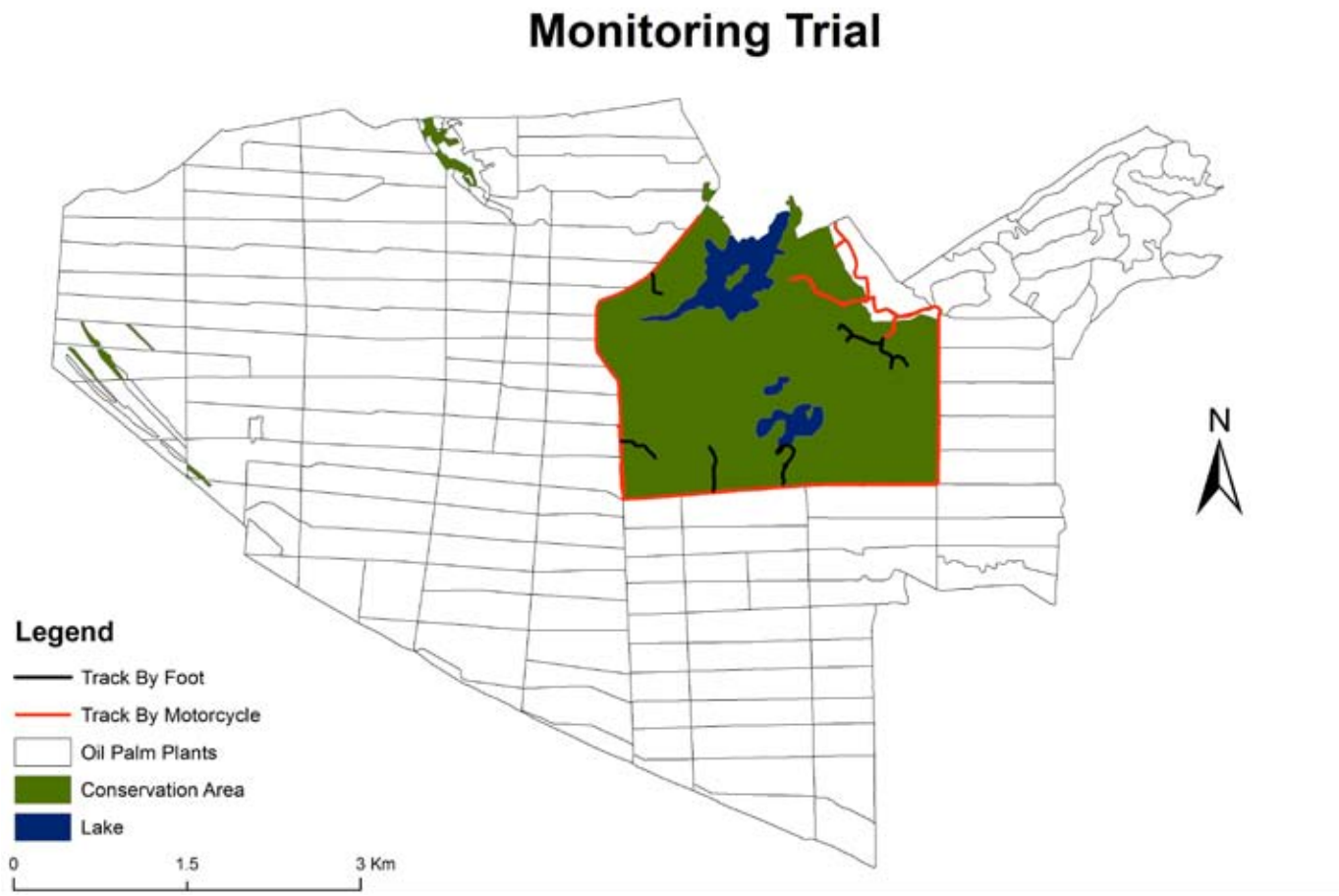


Figure 1 Planning of monitoring patrols by both vehicle and foot surveys.

required to follow all trails in HCV areas until the trail ends to map and assess the conduct of illegal and other activities.

Due to time constraints, subsequent surveys are required only to patrol trails for a minimum distance and make a judgement as to the continued use of the trail and whether the trail needs to be investigated further. Trails in small riparian HCV areas should be followed for a recommended minimum of 100m. Trails in larger HCV blocks require more in-depth surveys and should be followed for a minimum of 300m or until the end of the trail. Should a trail branch, all branches should be followed for a minimum of 100m (or until it ends) on top of the minimum 300m for the main trail.

Creation of new trails for monitoring: In certain circumstances, the creation of new trails is unavoidable. New trails may be required to establish vegetation structure monitoring transects, reach camera trap locations, or to undertake biodiversity surveys. As habitat structure and biodiversity monitoring are likely to take place on an infrequent basis, any new trails established should remain unused and are therefore likely to close up rapidly. The patrol teams should however monitor these areas carefully as newly opened HCV areas are more vulnerable to exploitation. If exploitation does occur, the costs and benefits of undertaking vegetation or biodiversity monitoring need to be weighed up carefully.

HCV areas on plantation boundaries: HCV areas may be located on the border with other plantations, community areas or other areas outside of the control of the company (i.e. outside the HGU). In such cases, a path should be sought as close to the outer boundary (inside the HCV area) as possible in order to map whether human activity is encroaching from outside of the plantation. Access issues need to be explored on a case by case basis as it may be possible to visit the outer boundary of the forest from outside the concession if permission is granted by the land title-holder.

River surveys: Large rivers that cut through extensive blocks of HCV forest allow for access to forest areas by boat and therefore the associated trails not otherwise visible from the terrestrial side. Boat patrol should survey along river banks and take data as according to the standard routine patrol protocols, but should also carefully check for access paths leading from mooring points and also survey such paths.

Access to HCV area via existing trail
Image © ZSL

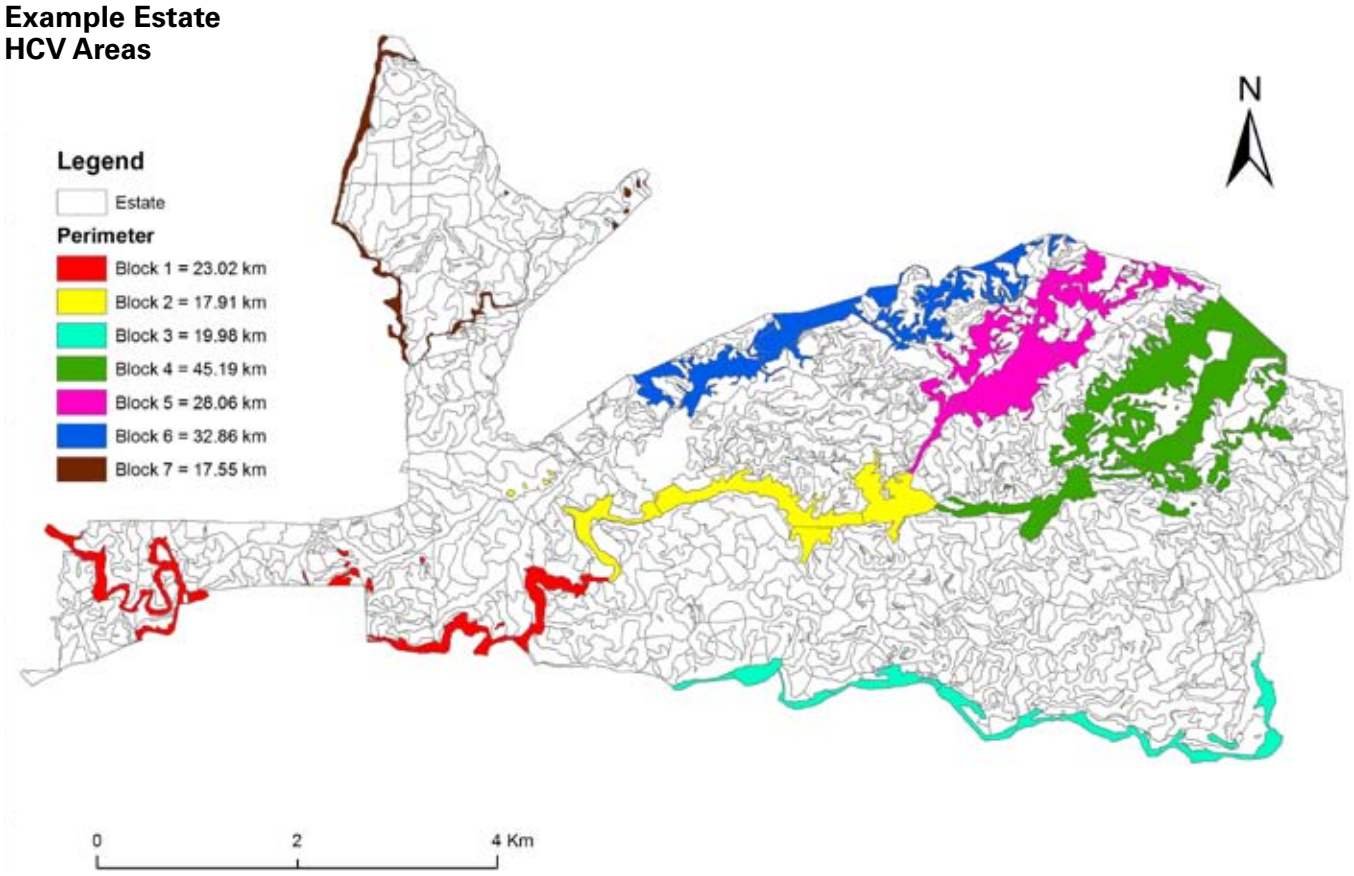


Figure 2 HCV block separation into monitoring units with distance estimates

1.4.4 Setting up patrol transects

Baselines: Human threat-intensity maps created using the SMART software, can be used to prioritise which areas need to be patrolled more frequently. This can be used as a tool for adapting management practices to address the different threat levels in various locations. As it may take a number of visits to build up this information, it is recommended that a standardised patrol system is developed first, which can then be adapted following data analysis and feedback. Areas with high levels of human activity may require more frequent monitoring. Priority should also be given to other areas of significance, for example those known to hold populations of rare, threatened or endangered species, or those known as potential sources of pollution.

HCV block code allocation: Initially, HCV areas should be grouped into 'survey units' which can be patrolled within a given period. The survey unit groupings need to be developed following an assessment based on a number of factors: distance from the base/office, the ease with which they can be reached, their distribution relative to one another, and how larger blocks can be split for systematic survey. Please see the example in Figure 2 and the Threat Monitoring Training Modules for further details.

Access to patrol location via waterways
Image © ZSL/Iding Haidir

Getting to and from patrol locations: Transport to and from the patrol transect is an important consideration when designing patrol routes. Some HCV areas can be patrolled on foot as a circuit, allowing the unit to return to the starting point and rejoin their vehicle following the completion of the patrol. However, larger patrol blocks may require the patrol unit to double-back on itself, thus limiting the number of survey kilometres that can be covered in one day. In consideration of this, a third person may be required to drive the units to the starting point and pick up the team at the different end point.

1.4.5 Patrol frequency

Resource limitations: Anthropogenic (man-made) threats have a potentially immediate and irreversible impact upon HCVs. However, given various restrictions and differences in resource availability in different plantations, it is often not possible to monitor all HCV areas at all times, or to prescribe definite timelines. Determining the frequency with which patrols visit each HCV will depend on a number of factors: the number of teams; length of the HCV boundaries; the number of HCV areas; the distance and difficulty of access to each area; and the number of anthropogenic activities found.

Logistics: Theoretically, each patrol team should be able to survey between 120 and 180km of trails, on foot, each month (based on a six hour working day and five day working week). This number can be greatly increased if using other forms of transport. However, it is assumed that the quality of data will be higher when using foot patrols due to the increased observation levels and the absence of noise from the vehicle. Outputs from the SMART Software will be able to report patrol intensity by: the length of time spent, length of transect within each patrol block, and the number of incidental faunal and illegal human activity encounters. Thus, managers should be able to decide whether the use of vehicles is having a detrimental effect on survey intensity and correlate this to the anthropogenic pressure found. This allows management to decide, on a case by case basis, which transportation mode is preferable.

Although it is recommended that each HCV boundary is walked a minimum of once per month, the more frequent the patrols, the more reliable the data and likelihood of encountering threats to HCV areas. Despite this, field staff may have other responsibilities and require time for data input or follow-up actions. Therefore, the time available for patrols (and thus the area that can be covered) needs to be adjusted to suit local situations.

1.5 Safety

- Although conflict in or adjacent to HCV areas are one of the key locations of interest for threat monitoring, staff safety must be paramount in all cases. Locations in which patrol staff feel threatened or intimidated, should be patrolled with caution until the situation is resolved.
- Local people found in HCV areas should be approached in a friendly, non-confrontational, manner. In hostile situations, it is best to talk politely, offer to share cigarettes, and explain the reasons for patrolling.
- In cases where the situation does not allow for data collection, the level of human activity (such as the size of a mining operation) can be estimated from afar or monitored using aerial photography. If estimates are used, this must be noted within the 'notes' section of the datasheet and during data input into software.
- Hunters, loggers, miners and others may be aggressive towards patrol staff. Under no circumstances should the patrol teams put themselves into a conflict situation with people involved in land disputes or illegal activity if they perceive a threat to their safety. Under these conditions, staff should follow company protocol e.g. file a report about the incident to their line manager. Such issues must be dealt with by specially trained government enforcement teams.
- Appropriate field clothes (dark green or blue coloured long sleeved shirt, sturdy boots, long trousers, and hat) must be worn at all times when in the field. It is preferable that the company provides a clearly identifiable uniform to all field staff.
- It is recommended that patrols arrive in the field by 6am and return to base by 12pm in order to avoid hot weather conditions and reduce the chances of heatstroke and dehydration. It will also increase the likelihood that wildlife may be observed. However keeping to a predictable timetable may reduce the probability of encountering illegal activities. It is therefore recommended that this is changed from time to time; still avoiding the hours of 12pm until 3pm. Timelines are site specific and will also depend on the remoteness of survey areas and access routes.
- Enough water (minimum 2 litres/person/patrol transect) should be taken into the field. Lunchboxes or snacks should always be taken on patrol in case of delays or injuries.
- First aid training should be provided by the company to its entire field team along with details of emergency evacuation protocols.
- First aid kits must be carried during each survey and regularly checked to ensure they are complete and equipment has not passed expiry dates. A suggested list of items for the first aid kits is included in the Threat Monitoring Training Modules. No medication, even medicinal alcohol, should be included in the first aid kits. Betadine should be used as anti-septic until medical treatment can be found.
- Staff should be trained in fire awareness and evacuation procedures.
- A Standard Operating Procedure (SOP) should be created, which includes recording daily schedule of where each patrol team will survey each morning and left with senior staff in an agreed, visible and accessible place, in case of emergency or breakdown. As a minimum, at least one person must be informed (e.g. HCV Officer) of the location of the patrols each day and field teams must inform this person should their route change.

"The use of a GPS unit in a waterproof case with patrol monitoring data sheets is probably the most rugged and cost effective way of collecting patrol data."

- Communication lines including radio or other remote communication devices should be established.
- All members taking part in river surveys should be able to swim and given a life vest/preserver. Rivers should not be surveyed in times of flood.
- Forested areas should not be surveyed during thunderstorms or high winds.
- Vehicles must be well maintained and only driven by a licensed driver.

1.6 Equipment for each patrol team

- GPS unit with high sensitivity receiver (e.g. minimum specification Garmin 60 Csx or above).
- Datasheets and stationary, including spares.
- Binoculars.
- Wet weather gear (poncho, waterproof case for datasheets, dry-bags for electronic devices with prepared silica gel beads in punctured zip lock bags).
- Digital camera (resolution >5MP, with date, time and GPS recorder if possible), spare memory card and batteries.
- Plantation and HCV area map. Map should feature road information, block numbers, river and land cover.
- Whistle (optional).
- Basic First Aid kit.
- Compass.
- Torch.
- Parang/machete.

The use of a GPS unit in a waterproof case with patrol monitoring data sheets is probably the most rugged and cost effective way of collecting patrol data. Depending on patrol skills and budget, Personal Digital Assistants (PDAs) with an integrated GPS receiver can be used to replace paper datasheets. Data entry forms can easily be created for the PDA device or existing software, such as Cybertracker, can be used. In addition, data loggers can provide a tamper-proof way of monitoring patrol effort and location, and be used to provide data support to the GPS unit.

1.7 Inputs

1.7.1 GPS units and waypoints

Use of GPS: All patrol units are required to use a GPS (see Threat Monitoring Training Modules for further details on GPS training) to create individual track logs and mark waypoints for each patrol survey.

A GPS point is taken at the start and at the end point of each patrol. Start points should be pre-determined by management when designing HCV patrol blocks or follow on from the last end point recorded if continuing on from a previous patrol.

GPS track logs should be set to record points no fewer than once every two minutes. If teams are retracing their steps back to their vehicle, they must remember to turn tracking off at the end point of the survey.

GPS unit coding: Each GPS unit should be allocated its own unique code consisting of the estate acronym and an additional and individual letter (e.g. MSM-A). This is important to ensure that at the point of data download and data entry, waypoints from two different teams (and therefore GPS units and datasheets) are not confused. Even if only one patrol team is present (and therefore only one GPS unit used), it is beneficial to allocate a letter to the unit in case the situation changes in the future and another unit is introduced. It is therefore preferable that each estate has its own GPS unit even if a patrol team moves across estates

Threat and encounter marking: A GPS waypoint is taken every time any of the threats or biodiversity indicators described in section 1.13.3 is encountered. One GPS point is to be taken for each anthropogenic threat found and/or each biodiversity encounter. A point is taken every time the patrol passes the area even if data was collected on a previous occasion. This is to allow for the evaluation of changes over time (e.g. mining areas becoming inactive or increasing in size).

Track and waypoint coding: A waypoint must be taken at the start and finish of each patrol route and GPS units automatically allocate waypoint codes when new waypoints are marked. This waypoint code should be recorded on the datasheet and "patrol start" or "patrol finish" should be written in the available space (see Appendix B). This allows the person responsible for data entry to allocate these waypoints as the start and end of patrol tracks within the SMART software in order to calculate patrol unit survey effort.

Waypoint codes allocated automatically by the GPS unit are also used to mark threat or biodiversity encounters and recorded on the datasheet under "waypoint ID".

A track log must be started immediately after the 'patrol start' waypoint is taken so that track timings are accurate. At the end of the patrol, after the 'patrol end' waypoint is taken, the track log function should be disabled and the day's patrol track should be saved in the GPS according to Table 1.

GPS POINT	CODING
Patrol start	Waypoint code automatically allocated by the GPS unit is saved in the GPS and used as "Waypoint ID" on datasheet along with a note "**PATROL START**".
Patrol finished	As above. Replacing "**PATROL START**" with "**PATROL END**".
Track log	Estate code (e.g. **MSM**), date in DD-MM-YY format (e.g. **23-11-12**), and (if more than one GPS is used on an estate) the GPS code (e.g. **B**) Therefore the code would be as follows: **MSM231112B**.

Table 1 Waypoint and track codes

Track and waypoint download: Tracks and waypoints from GPS units should be ideally downloaded into the SMART software by the field teams at the end of each day or a least twice a week to reduce the risk of data being lost. Data storage on each estate should be done on a dedicated computer and backed up monthly. Data should be checked quarterly to review the quality of what is being collected (see Verification section 1.17).

GPS Maintenance: It is necessary that GPS unit memory is only cleared following GPS data download into the SMART software, otherwise geographical reference data will be lost. Teams must therefore ensure to have enough free memory before setting out on patrol. Thus, GPS memory is best cleared following download and (ideally) entry of the datasheet data. To avoid mistakes or confusion, it is preferable to perform datasheet data entry immediately following GPS data download.

1.8 Data Collection

Threats and sub-threats: The location of every threat and biodiversity encounter is marked by a GPS waypoint. At each waypoint, the paper datasheet should be filled in for each encounter (example of which can be found in Appendix B and training on the use of these datasheets is included within the Threat Monitoring Training Modules). Threats are divided by general IUCN Threat Category (ITC) types (as defined by the IUCN Threat List: http://www.iucnredlist.org) and then into recommended sub-types, which have been developed specifically for the oil palm sector and provide more detail of the threat present. Certain threats require a greater level of data collection than others (see Appendix A).

Waypoint collection: During data analysis, each month is considered as a separate survey, thus a new waypoint must be made during every survey even if the threat had been identified the previous month; data must therefore also be collected again. Whilst this system does not allow for statistical analysis of changes within individual points, it will allow the user to visually analyse persistence of a threat without the added complication of returning to dozens of individual waypoints that had been taken in previous surveys.

Further data collection: After assessing the type of threat present, patrol teams should assess the "state", "intensity", "action taken", and write up notes on the threat found (according to the suggested guidelines on the crib sheets). The information requirement under each threat varies between types; in some cases information is not required because it may be implied by the type of threat present (e.g. if livestock is encountered, it can be assumed to be "active").

Collecting data in the field
Image © ZSL

Multiple threats: In some cases, two or more threat types may be seen at any given location. This may be two sub-threats (e.g. steel snares set and glue traps present) or two ITC types (e.g. agricultural incursion and logging). Only one GPS waypoint need be taken at such locations, however in both cases the datasheets should still be filled in according to the standard protocol, yet the waypoint column code will be the same.

1.8.1 Recommendations

The following section provides recommendations on the type of data that should be monitored, however flexibility does exist within the SMART software to adapt this data model to local conditions. Thus the user is able to input further threats (or adapt those below) to suit plantation-level circumstances. However it is recommended to follow the data model below for data comparability between companies and concessions and it is important to maintain the same data model if data is to be amalgamated at a later stage (e.g. for group performance comparisons).

Appendix A provides a general overview of all the data to be collected within the Threat Monitoring Protocol. Section 1.13.3 provides a brief justification for the monitoring of each specific threat and provides an overview within each type on the data to be collected by the user and the selection process during data entry.

In-depth guidance on how to distinguish and assess each threat is given within the Threat Monitoring Training Module.

NOTE: Further information on overcoming threats to HCV areas along with practical case studies can be found on the ZSL Sustainable Palm Oil website (www.sustainablepalmoil.org) where ZSL's "A Practical Handbook for Conserving High Conservation Value Species and Habitats within Oil Palm Landscapes" can also be found.

1.8.2 General data collection

The specific data collected will depend on the type of activity encountered, however each individual patrol should have the following general data collected (Further see datasheet in Appendix B Appendix B: Field datasheet):

- Estate
- HCV block number
- Patrol team ID code
- Names of other patrol members present
- GPS ID
- Track log code and
- Date.

Each waypoint/threat should have the following information recorded:

- Waypoint code (as given by the GPS unit)
- Patrol type (e.g. foot, car, motorbike, bicycle, boat)
- Time
- Photo ID code (if one is taken)
- Coordinates (should GPS data be lost)
- Observation code (dictated by the Field Crib Sheet used)
- State of the threat
- Intensity of threat and
- Action taken by field staff.

1.8.3 Specific ITC Types and sub-types

1.8.3.1 Residential and commercial development

This category refers to any unplanned buildings found within an HCV area. This category includes a temporary camp, shelter, a hut, a house for permanent lodging, or any other structure designed for habitation. The intensity refers to the number of habitable buildings or structures. Smaller associated structures such as outhouses should be included as part of one structure.

"Permanent habitation may indicate migration into HCV areas."

The presence of habitable buildings can indicate current or past utilization of the area by people. Permanent habitation may indicate migration into HCV areas and monitoring provides a tool for not only assessing the spatial distribution of such migration, but also any changes in the intensity of this threat. Permanent habitation can be linked to mining and other encroachment, whilst temporary settlements may indicate hunting or logging areas.

The identification of present and new developments of habitable structures, allows managers to identify potential threats to HCV areas that may be linked to increases in local populations and commercial activity and analyse how these move through the landscape over time. Managers can then decide on the appropriate measures (e.g. mitigation, removal, socialization) and estimate whether their actions have had the desired effect.

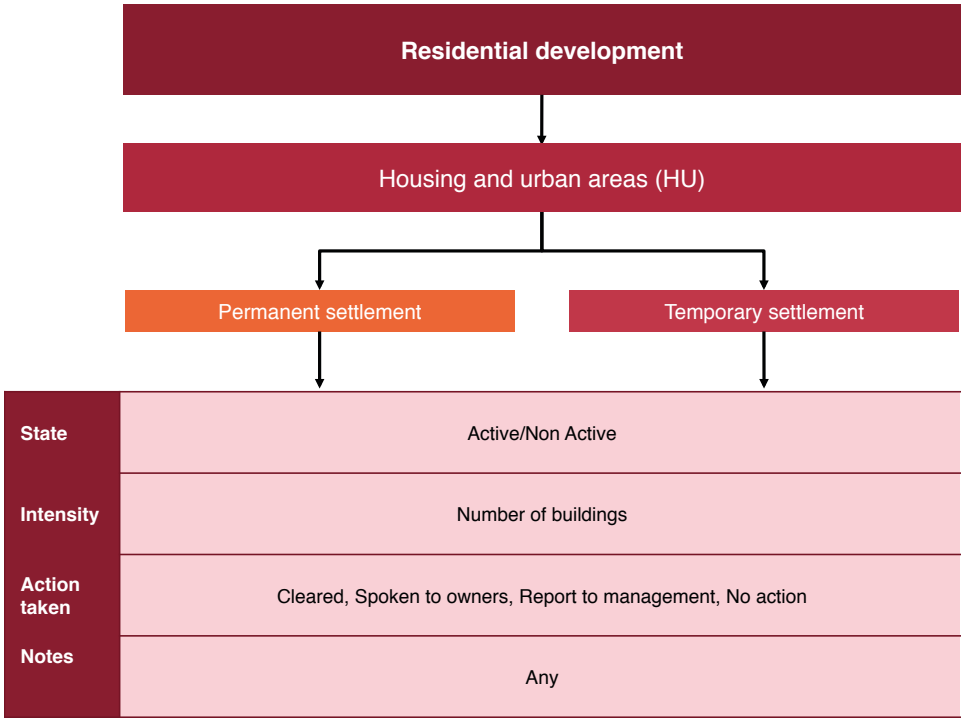


Figure 3 Residential and commercial development flowchart

1.8.3.2 Agriculture and aquaculture

Agriculture has been sub-divided into crop agriculture and livestock farming (see Figure 4). In order to manage this form of encroachment, it is important to understand whether this impact is the result of a larger scale producer or small scale encroachment. In addition, it is important to understand the type of produce being grown in order to develop management strategies (e.g. suggest alternative sources of income or provide alternative areas for planting). It is important to also identify cases where the company itself may be encroaching on HCV land in contravention of certification standards.

1.8.3.3 Energy production and mining

Mining and quarrying activities (see Figure 5) can have a significant negative effect on HCV areas resulting from land conversion, river sedimentation and water and soil pollution through the use of chemicals during the mining process. It is important to identify the type of mining to give managers an indication of the potential spread of mining activities, of the areas likely to be impacted, and of the presence of market demand. The use of chemicals in the mining process also indicates a requirement for increased water quality monitoring in rivers downstream.

In addition, data on the state of mining operations can give an indication of areas being explored or about to be brought into operation. This provides managers with an early warning signal and allows the company to overcome movement of mining into HCV areas before mining operations begin.

1.8.3.4 Transportation and service corridors

Roads can be mistakenly built through HCV areas. Checking for the presence of new and old roads (See Figure 5) is important as such roads provide further, and easier, access into HCV areas leading to an increase in activities which threaten HCVs. Roads are categorised as "in construction", "new" or "old" in order to allow management to adopt specific activities to reduce these threats, such as halting construction, enforcement of boundaries and road closure, and reforestation. New footpaths also demonstrate further opening up of HCV areas to exploitation and are therefore included within this threat.

Monitoring transportation corridors
Image © ZSL

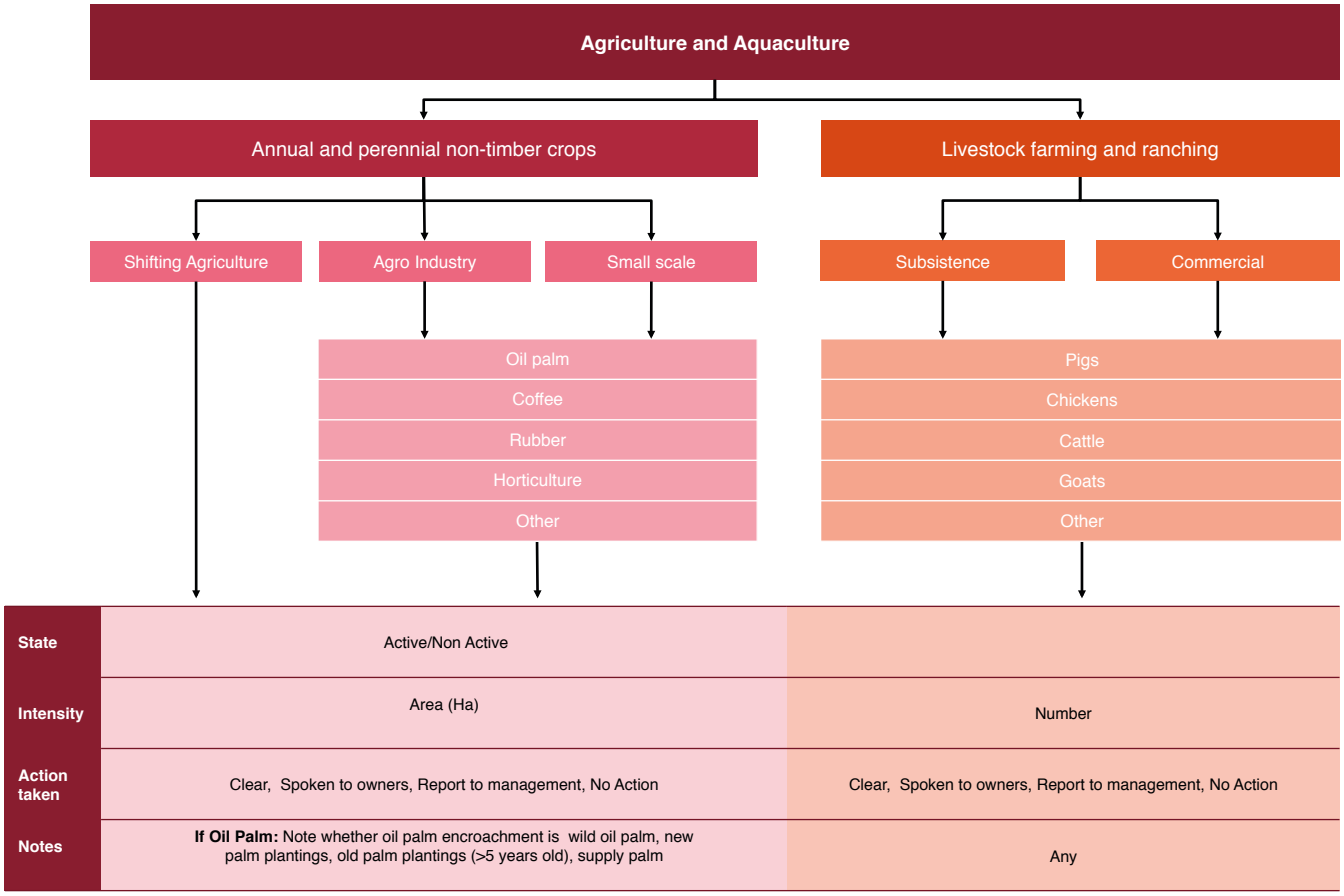


Figure 4 Agriculture and Aquaculture flowchart

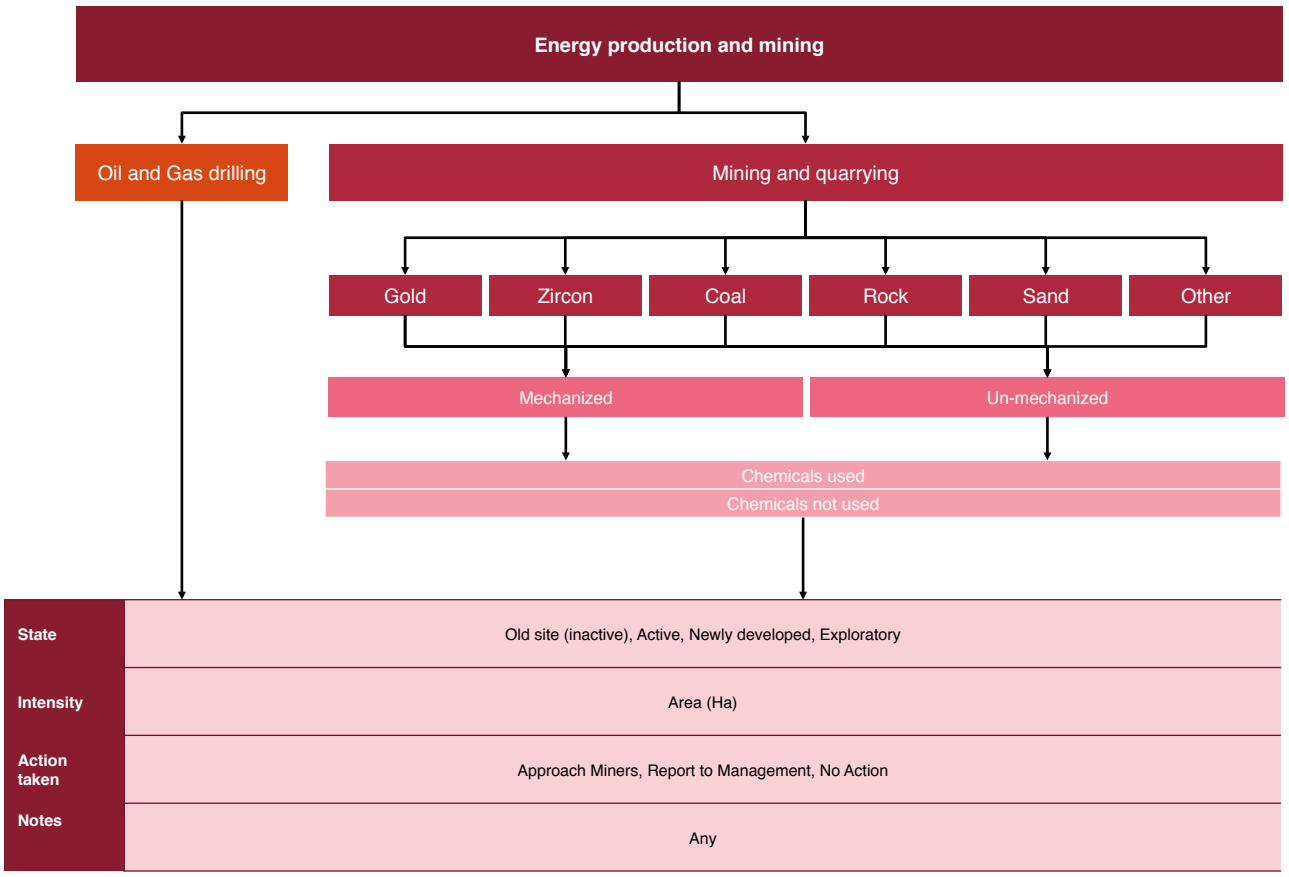
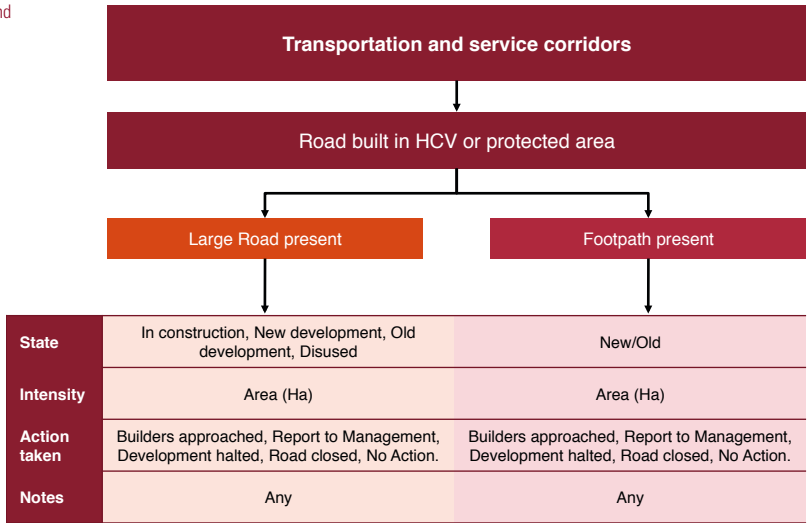


Figure 5 Energy production and mining flowchart

Figure 6 Transportation and service corridors flowchart



State	In construction, New development, Old development, Disused	New/Old
Intensity	Area (Ha)	Area (Ha)
Action taken	Builders approached, Report to Management, Development halted, Road closed, No Action.	Builders approached, Report to Management, Development halted, Road closed, No Action.
Notes	Any	Any

1.8.3.5 Biological resource use

This is the largest and most in-depth section of the patrol monitoring protocol. It covers hunting, resource gathering, logging and fishing (see Figure 7, Figure 8 & Figure 9).

Hunting and fishing: The presence of hunting or fishing can create pressure on HCV or economically important species, and may lead to extinctions of local populations that are struggling to survive in sub-optimal numbers in an already fragmented landscape. Therefore it is important to identify the hunting locations, the type of hunting present and the target wildlife species (along with seasonal changes etc.). Such information is vital to feed into adaptive population management activities such as snare collection, socialisation activities, increased patrol activity etc. The intensity of this threat can also be analysed to prioritise areas for enforcement activities.

Any animal body parts found should also be recorded under Biodiversity Encounters (see page 18).

Gathering of terrestrial plants: The gathering of NTFP on a small subsistence scale does not necessarily result in the degradation of HCVs, however the reduction of large areas of forest into fragments restricts the forest available to local populations for resource use. Thus the pressure on the remaining forest fragments increases, leading to higher probability that these activities are no longer sustainable. It is therefore important to understand the levels of harvesting, in order to assess whether it is being carried out sustainably. Management can then decide how to tackle these issues, whether through resource provisioning, creating better access to markets, or increasing alternative livelihood opportunities.

Biological resource use within an HCV area. Image © ZSL/Mike Zrust

Logging: Timber extraction for housing, boats and sale, is a principal resource use by many local communities and one of the most visible threats to HCVs remaining in forest fragments within oil palm landscapes. The scale of the issue must be monitored to mitigate local extinction of a few targeted species. It is also possible through data analysis to understand the negative impact presence of logging has on faunal species' presence. Large trees are defined as those >20cm DBH.

1.8.3.6 Natural System modifications

Fire: Fire can occur either naturally, accidentally, or be set on purpose. In many cases however, it is difficult to distinguish the exact cause of fire and, in the case of peatlands, whether the fire is even active or not. Thus the scope of this threat for management is limited to only whether the fire is currently active (and therefore "action taken" takes on high importance for management purposes and staff training) and, once contained, the size of the area impacted so that follow-up actions can be decided.

Dams: Modification of the surrounding natural hydrological system is already at a high level in oil palm plantations and regulation of the water table is common practice in intensive agriculture. However, the water table must also be regulated in such a way as to comply with legal and certification requirements in order to protect HCV areas as far as possible. Development of dams can have a profound impact not only on HCVs, but also on the ability of management to control the **water table and other issues such as sedimentation in the surrounding areas. Identification of any** new unplanned dams and hydrological ground works needs to be considered by management.

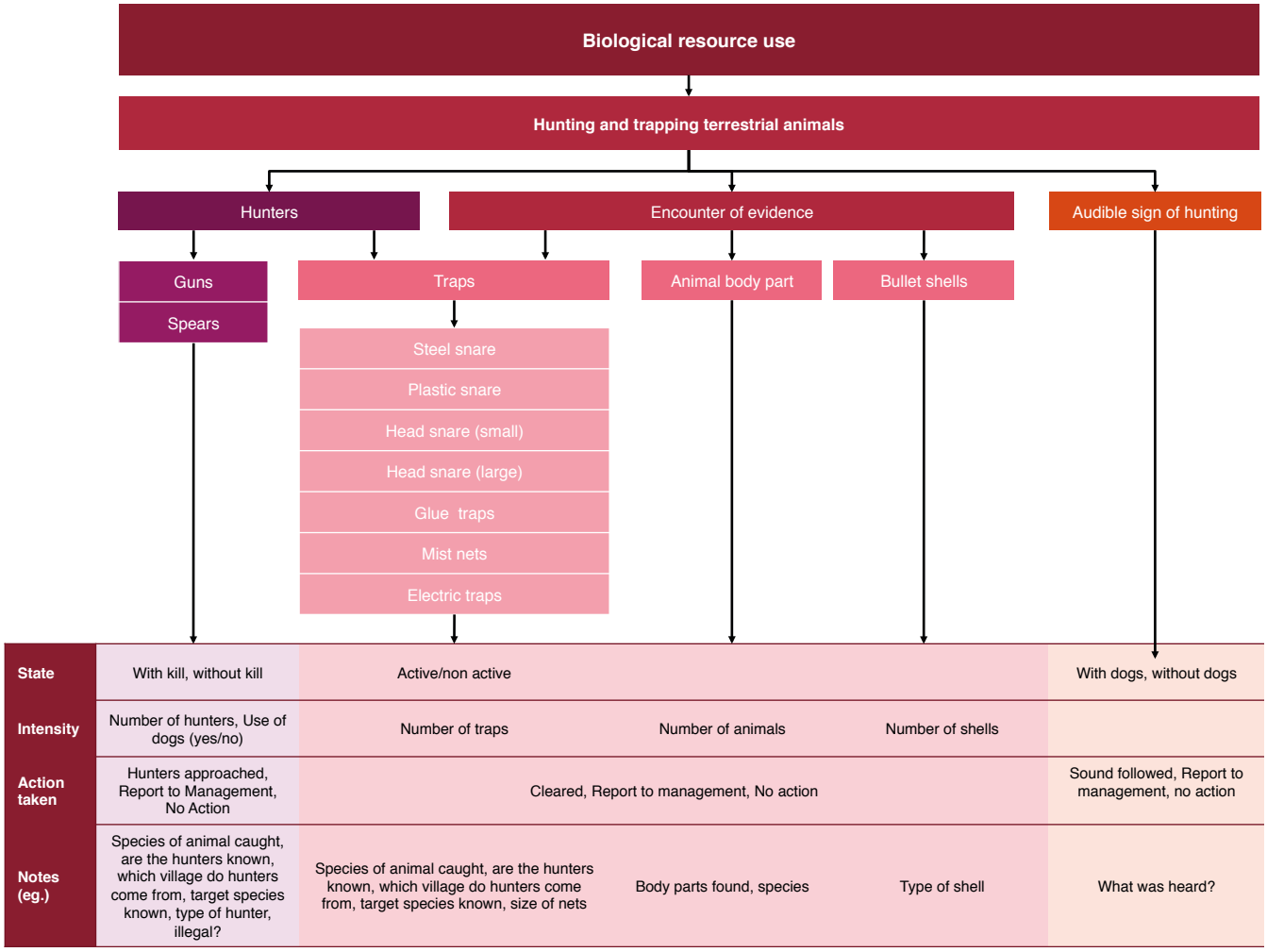


Figure 7 Hunting and trapping terrestrial animals flowchart

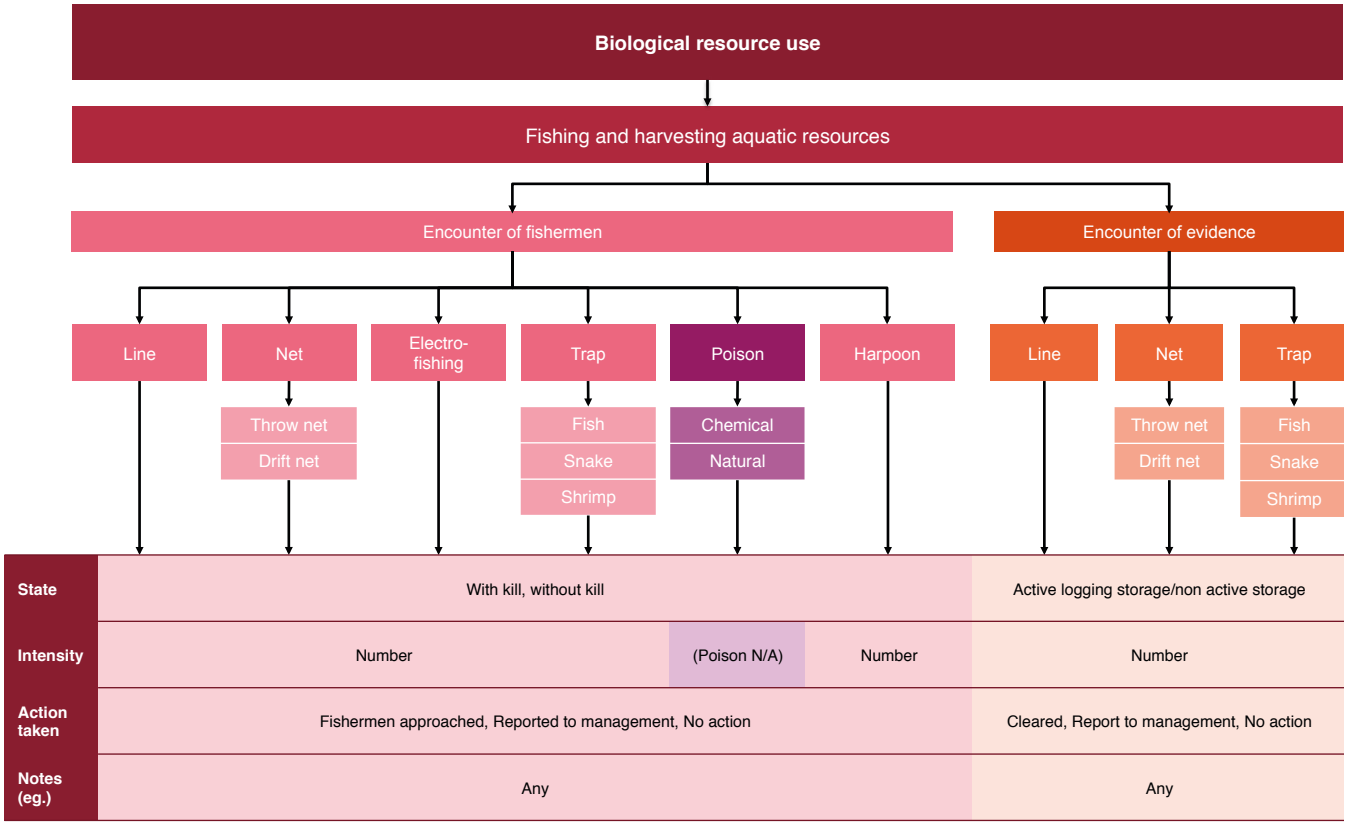


Figure 8 Fishing and harvesting aquatic resources flowchart

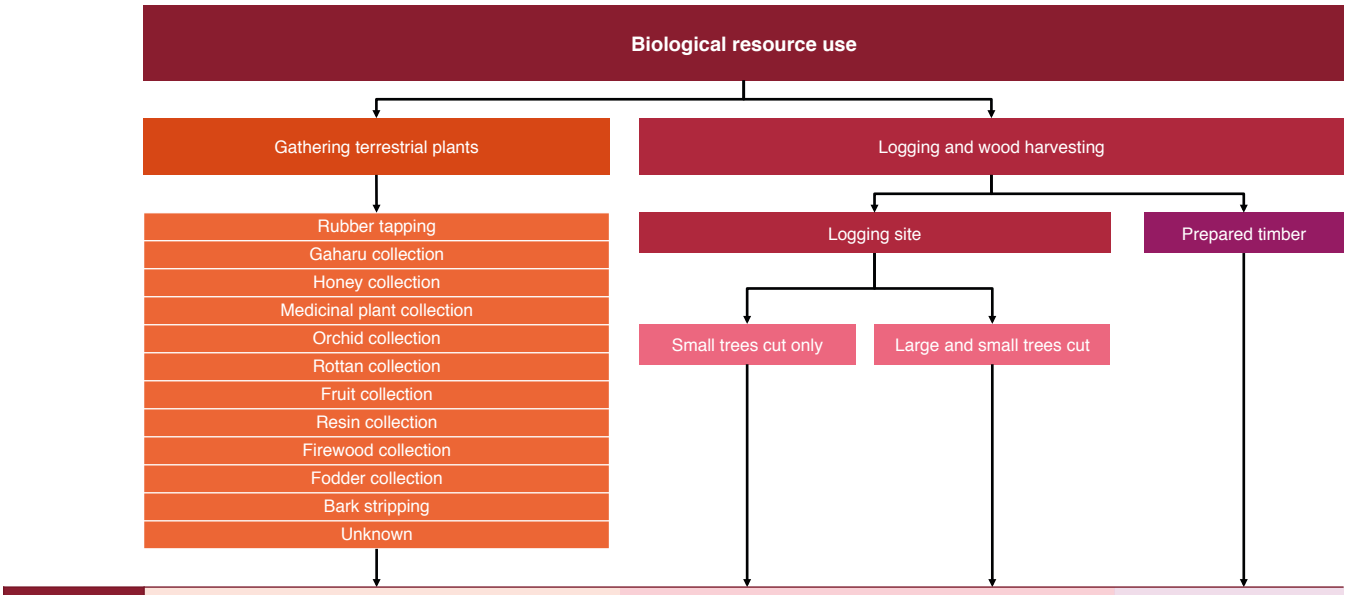


Figure 9 NTFP gathering and Logging flowchart

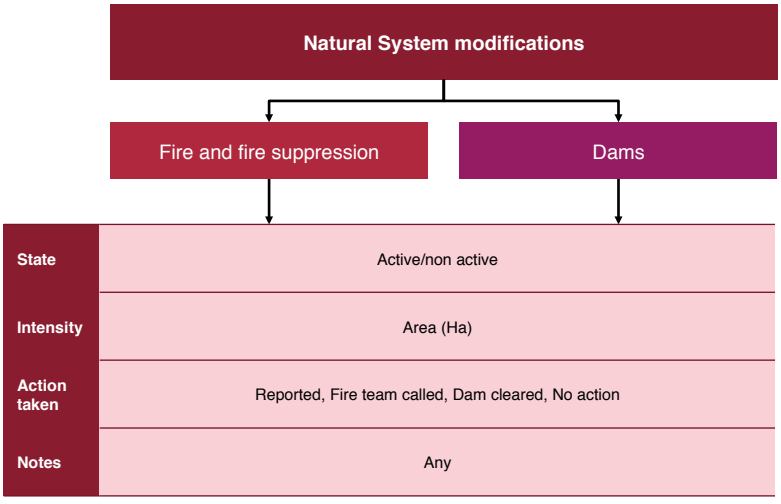
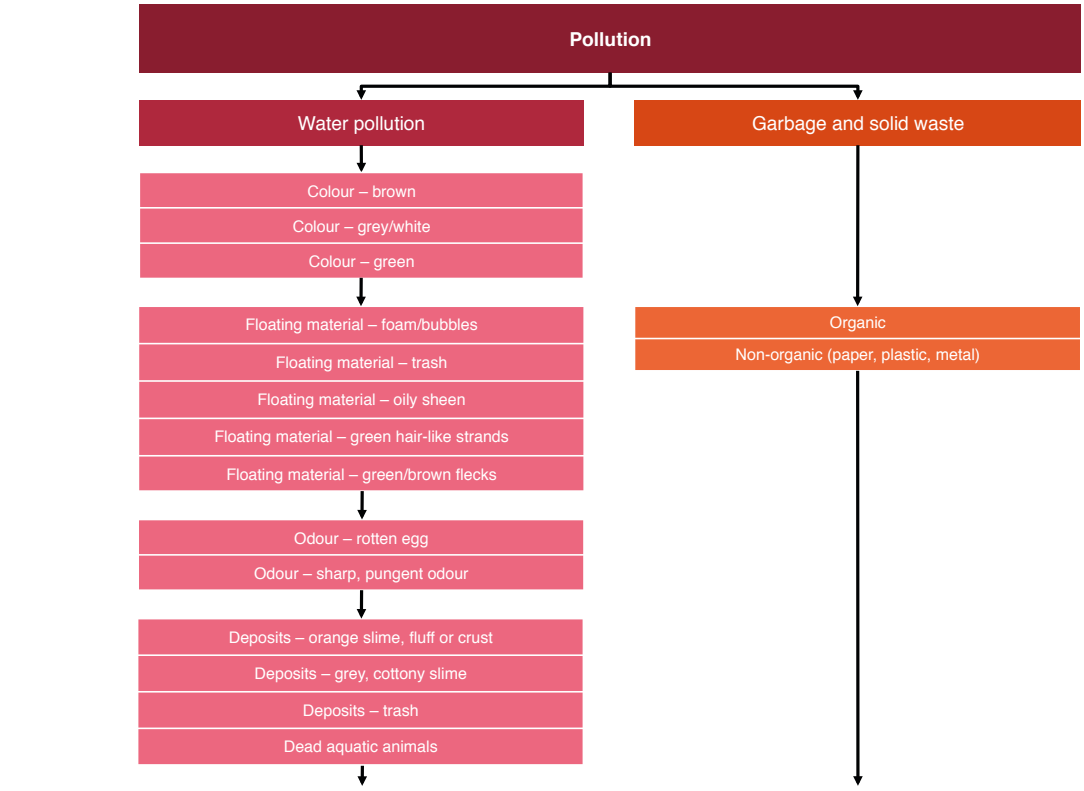


Figure 10 Natural system modification flowchart

Patrol team member taking a GPS point at a logging site inside a HCV area

Image © ZSL/Mike Zrust

Figure 11 Pollution flowchart



State	N/A	New, Old
Intensity	N/A	Area (Ha)
Action taken	Followed to source, Reported to management, Checked sewage and domestic waste water system, Set up water monitoring point, Requested further investigation by laboratory, No Action	Cleared, not cleared, reported
Notes	Potential source, severity, are there enough bins? Is a rubbish trap/cage needed? Socialisation needed?	Potential source, severity, are there enough bins? Is a rubbish trap/cage needed? Socialisation needed?

1.8.3.7 Pollution

Water: Water pollution is of high priority in any landscape due to potential detrimental effect on production, on populations of aquatic life, and on the livelihoods and health of local communities. Patrol teams do not have the capacity to scientifically analyse water samples in the field. Nevertheless, signs of water pollution can be used in order to raise a "red flag" to identify locations where further investigation, according to company SOPs, must take place. Failure to act on these "red flags" can cause significant negative impact on water quality and thus such signs must be reported to management for further follow up using trained water monitoring staff and laboratories. For further input, please see Freshwater Monitoring Module. For an explanation of possible sources of pollution, please see New Hampshire Estuaries Project (2007), available at: *http://www.prep.unh.edu/resources/pdf/identify_and_report-nhep-07.pdf.*

Monitoring pollution
Image © ZSL/Mike Zrust

Solid waste: The dumping of solid waste can be both unsightly and dangerous to local populations and fauna. The use of HCV areas as a dumping ground is often seen when local communities do not have access to rubbish disposal facilities. Unless waste is dumped in plantation HCV areas by company workers, correction of such issues may be beyond the remit of the company. It is recommended that steps be taken to mitigate this impact and since waste may also be dumped by workers not following company SOPs correctly, it is important to investigate these appropriately.

1.8.3.8 Invasive species (cover crops)

In-depth analysis of the presence and extent of invasive species within HCV areas requires specialised plant identification skills and field patrol teams rarely have such capacity. Despite this, it is important to prioritise invasive outbreaks to prevent the spread of cover crops used in agriculture into HCV areas.

Cover crop establishment and management is an integral part of oil palm plantation agriculture. It has numerous highly beneficial characteristics for use within plantations such as fast growth, nitrogen fixation, prevention of soil erosion and weed growth, drought tolerance, and freedom from pest and disease incidence. However, the non-native status, fast growth, tolerance of negative environmental conditions, and non palatability to local wildlife species, also makes non-native cover crops ideally placed to become invasive, if not properly controlled. Given the close proximity of oil palm plantation areas utilising cover crops to HCV areas, cover crops can quickly invade, over-grow, and kill HCV forests.

Under RSPO guidelines, spraying of herbicides in HCV areas is not permitted and since manual weeding can be costly, prevention of invasion outbreaks through prioritisation of problem areas is the most cost efficient and effective way to address this threat. Monitoring of cover crop invasion using a basic observation system allows managers to identify problem areas, prioritise areas for intervention management, and assess the success of intervention activities.

Each patch of cover crop incursion is assessed and scored according to Table 2. The highest score for any attribute for an individual patch is recorded as the final score on the datasheet. A patch (or a group of patches, see below) is scored at the point at which it has impacted the HCV area the most (i.e. a patch that has mostly incurred into a HCV area mostly below 5 metres wide, but has a small area that has incurred 7 metres wide, is scored as 7 metre, not as an average). For example, at its worst, a patch may be 126 metres in length (medium threat), less than 5 metres wide into the HCV area (low threat), and be seen to be >5m away from the base of a living tree (low threat). The threat score recorded for the patch is therefore 'medium'.

Patrol units may, from time to time, come across patches of cover crop that are separated by only a small clear area not containing the cover crop. For ease of data collection, patches which are separated by less than 15 metres are considered as one patch. In this case the total length of the group of patches is used to identify the threat category (i.e. the outer edges of the end patches including the area in between is counted for the length assessment), due to the likelihood of the plants rapidly closing the gaps.

Each patch (or group of patches) is marked by a GPS waypoint approximately in the middle of the patch or 'patch group'.

	Threat Level			
	Low	**Medium**	**High**	**Urgent**
Length	< 100m	100-199m	200-300m	>300m
Width	< 5m	6-10m	11-15m	> 15m
Relation to tree	> 5m from base of living tree	On the ground < 5m from living tree	Half way up living tree	On canopy of living tree

Table 2 Cover crop threat-grading diagram

Invasive species. Image © ZSL

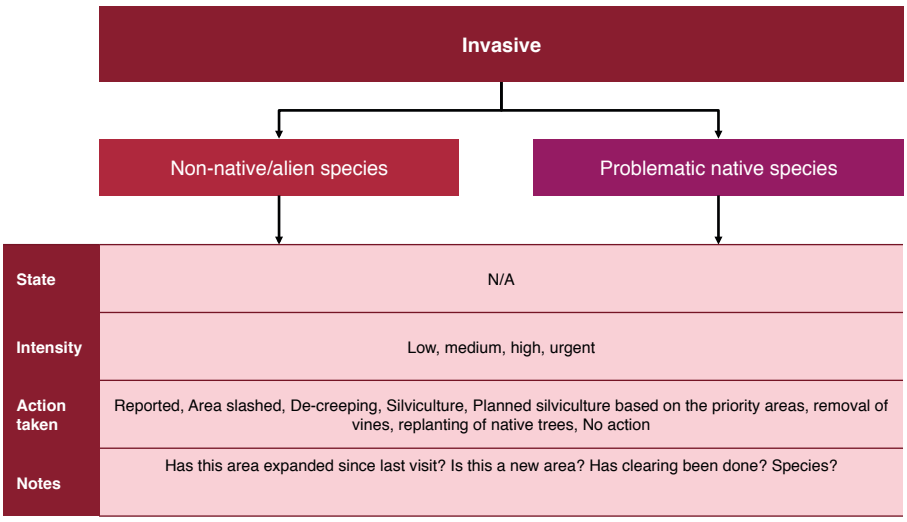


Figure 12 Invasive species flowchart

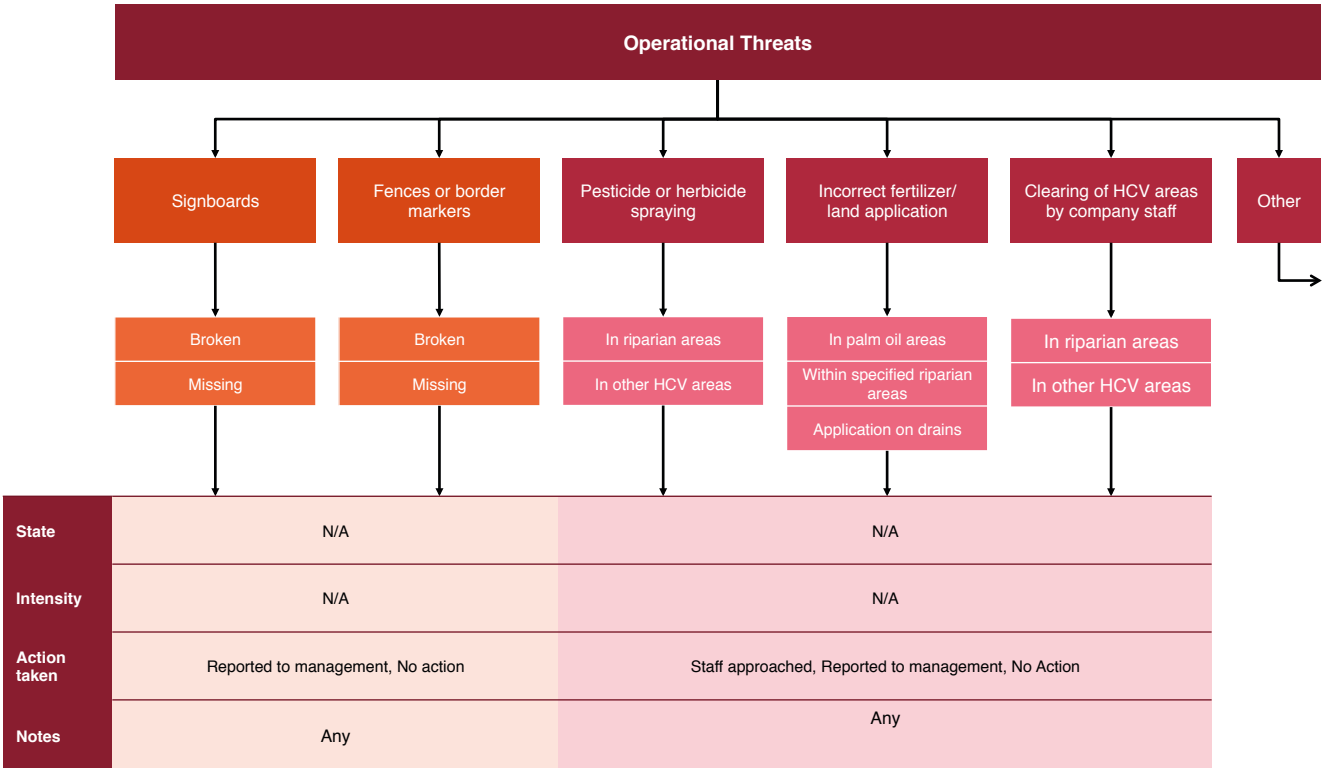


Figure 13 Operational threats flowchart part 1

1.8.3.9 Operational Threats

A number of threats to HCV areas can originate from the internal operations of the plantation. These may be due to lack of communication between company staff, lack of understanding of methods such as fertilizer application, lack of understanding of SOPs, or wilful disregard of company rules or local legislation. This threat indicator allows the management to identify areas where sub-optimal practices have taken place and rectify them accordingly.

1.8.3.10 Biodiversity Encounter

Even without planned biodiversity assessments, much information can be gathered from incidental encounters with wildlife. This information can be used to understand presence of certain species, infer absence, analyse distribution against anthropogenic threat, and analyse species' persistence. This basic biodiversity assessment tool allows the patrol team to log encounters with wildlife in order to give a broad and general overview of the biodiversity present and its distribution. In addition, data can be correlated with anthropogenic threats to analyse how presence of such threats affects wildlife (see SMART Software Training Module).

1.8.3.11 Photographs

Photographs may be added together with captions into the SMART Software and attached to individual waypoint codes. Cameras should be set to embed time and date onto each individual photograph so that images can be associated with waypoints at a later time. GPS cameras will also provide location data and are useful to ensure that photographs do not get mixed up.

As a rule, at least one photograph should be taken at each waypoint of the identified threat. The file name of the photograph should be noted on the datasheet. At a minimum, a note of the time it was taken should be written in 'notes' section.

Photographs should be stored and backed up systematically on specific computers in specifically designed system. Further recommendations on the design of such a system can be found in the Threat Monitoring Training Modules.

1.8.3.12 Notes

Notes for threats: The datasheets (see Appendix B) allow for the input of notes from the field staff under each waypoint. Recommendations for the type of notes to take are shown in certain ITC types above, however HCV managers should determine whether other specific information

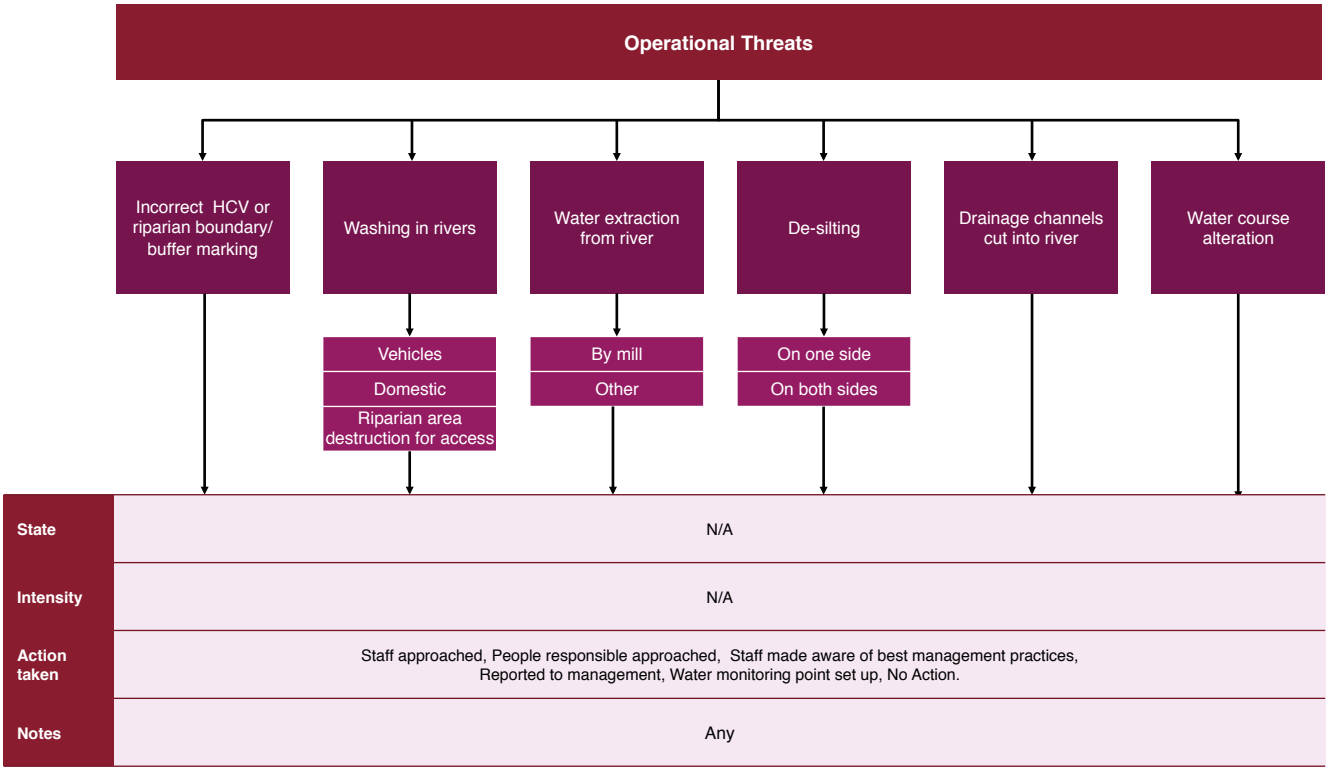


Figure 13 Operational threats flowchart part 2

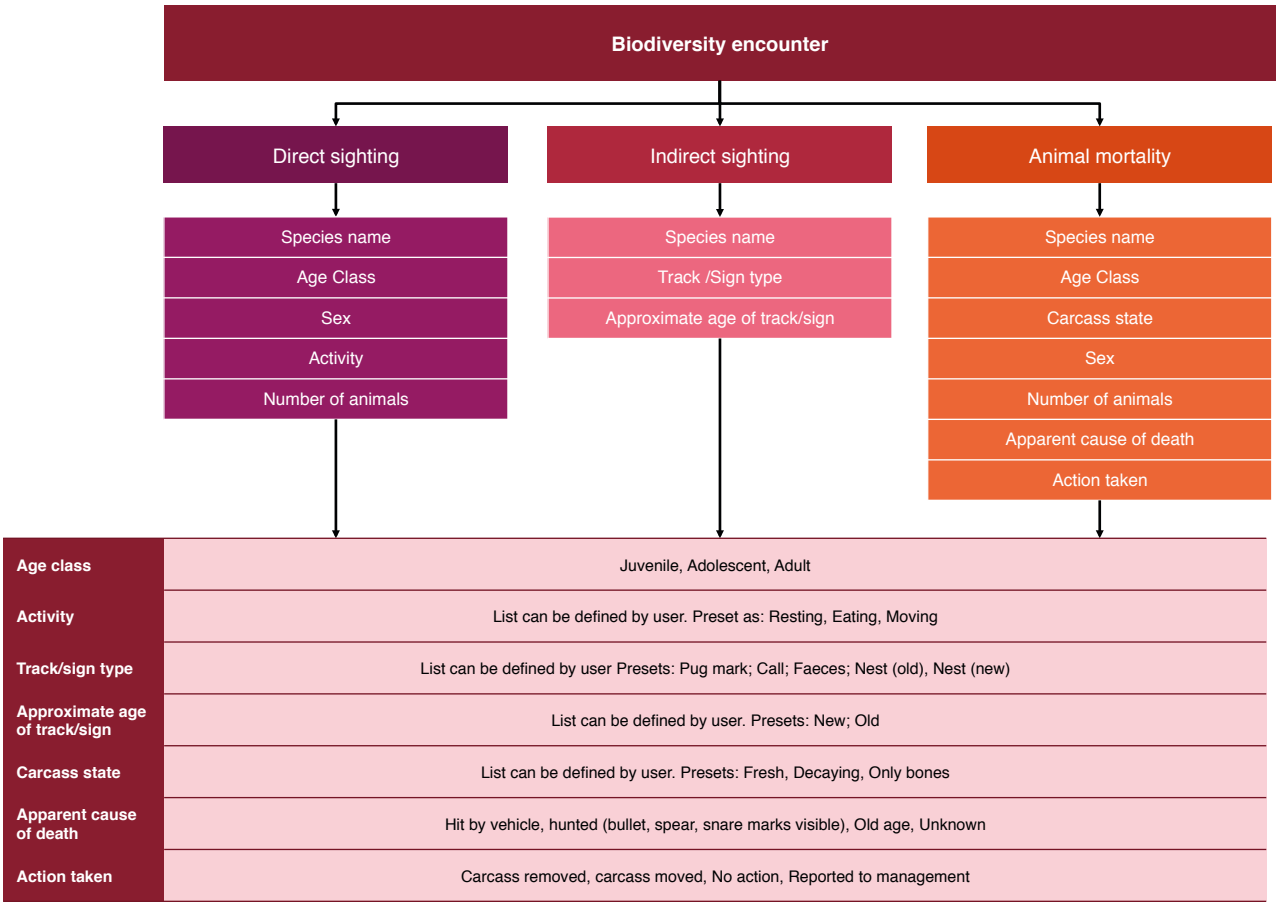


Figure 14 Biodiversity encounter

"Data input should be done on a daily basis following the day's patrol..."

is required under company SOPs and train staff to take them. Notes cannot be analysed by the software, however they can be displayed in the information tables to help the decision making process and provide evidence thereof.

Actions taken by field staff: Field staff should use the notes section to also record their "actions taken" in accordance with SOPs. For example, the type of additional information written here could include whether snares found were collected or how the request for fire units to attend a burning fire was made.

Actions taken by management: Monthly datasheets allow for the recording of notes from the field staff and these should be recorded both in soft copies of the raw data in Excel and the SMART software. Managers are encouraged to make use of this facility in order to track actions taken by management and if resolution has been achieved. Decision on what information is to be included as part of the "actions taken by management" should be made by management above the plantation level (e.g. HCV Conservation Manager). However it is strongly recommended that managers include details (with reference codes) of reports written and submitted, how situations were dealt with on the estate or plantation level, and give approximate timelines for resolving issues. This can then be used by management to demonstrate to auditors that appropriate actions have been taken and what progress has been made.

1.8.3.13 Data storage

Data storage for GPS data, track log data, and datasheets must be systematic, organized and easily retrievable. A recommended system is provided in the Threat Monitoring Training Module, however each company may wish to use their own adaptation.

As a first step, raw data from datasheets should be copied into a daily/weekly Excel sheet. This sheet should then be amalgamated into a monthly Excel sheet for managers. This step ensures that data is stored in three locations, namely; hard copy, soft copy and the SMART software. This ensures that data is secure and available for use in numerous forms. Weekly and monthly Excel sheets can resemble field datasheets exactly.

1.9 Data Input

Detailed information is provided in the step-by-step SMART Software Training Module, which can be used in combination with the Threat Monitoring Training Module, in order to train staff the required skills.

Data input should be done on a daily basis following the day's patrol where possible. It is recommended that field teams are trained to download GPS and input data into the SMART Software at the 'User Level', in order to prevent mistakes in data entry and later interpretation.

1.10 Outputs

The SMART Software is highly flexible and can generate, amongst others, the following outputs that can be used by HCV managers:

- Graphic display of each patrol together with waypoints of the threats found
- Threat and biodiversity encounter distribution maps
- Threat and biodiversity encounter intensity maps
- Key Performance Indicators for patrol staff
- Summary tables
- Queries for any variable or groups of indicators with correlation information
- Reports with maps, tables, charts, encounter rate trends, graphs and changes over time.

A full list of outputs and an overview of training on the use of SMART software for data analysis and reporting can be found on the SMART website (*www.smartconservationsoftware.org*) and detailed training on generating outputs and analysis can be found in the SMART Software Training Modules.

1.11 Reporting

Team structures: Reporting structures vary from one company to the next and it is not within the scope of this document to cover specific procedures. However any adaptation of a specific reporting structure (if needed) should be undertaken as part of the planning phase, and reviewed under the implementation phase of adopting this monitoring protocol into company operational practices. It is that current reporting structures are maintained (or not altered significantly), where possible, so as not to cause confusion amongst current staff and procedures. If new field teams are created in order to accommodate a monitoring protocol within a company's operations, these teams should, be integrated into the current reporting structure. Such structure must have clear lines of responsibilities and hierarchical reporting mechanisms with agreed SOPs. It is recommended that a reporting structure follows similar lines as Figure 16 An example organizational structure below. It is preferable that some reporting overlap exists between estate management and HCV management to ensure that the two structures are harmonised and able to overcome any issues together.

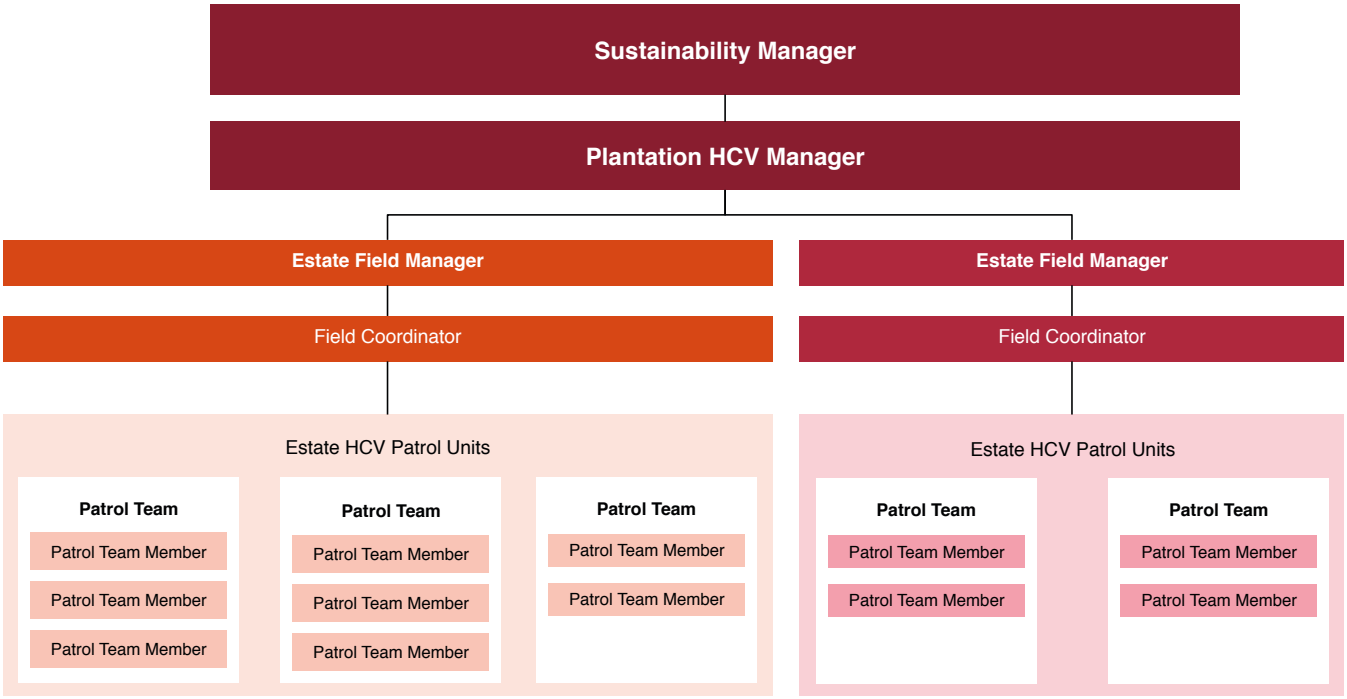


Figure 16 An example organizational structure

Reporting timelines: Reporting to higher management (e.g. HCV Manager, Group Manager etc.) should take place after each patrol cycle, which preferably should not last for more than one month (although this may be site dependent).

Report format: Reports within the SMART software are highly flexible, adaptable and can provide overviews, tables, graphs, maps, charts and summaries. Reporting format should be designed according to the specific questions which need to be answered as well as the requirements of higher management and auditors. Therefore it is out of the scope of this document to provide recommendations for specific report format templates; however the SMART Software Training Modules and the SMART website can be consulted on the building of report templates.

Report content: It is recommended that a list of the required report content is developed with the participation of Sustainability managers, HCV managers and field staff with the requirements of auditors in mind. As a minimum a monthly report should show the following in a table:

- Waypoint ID
- Date of waypoint
- Coordinates
- Three levels of threat category
- Intensity
- Status
- Action taken by managers

However a much wider level of content and visual content can be produced by the SMART software.

Report outcomes: Wherever possible, reports generated by regular patrols should be fed into the reporting requirements of the RSPO and AMDAL. This tool allows managers to work together with auditors to clearly demonstrate their management activities to maintain and improve HCVs within plantation areas in accordance with certification standards. The outputs generated can empirically show whether management activities have had a positive impact on HCV areas and provide a historical record of management decisions, as well as a record of the difficulties faced by plantation managers.

Reporting for audits: Reports for auditors should be prepared in much a similar way as for company managers. Month by month records of the threats found should be shown on maps of HCV areas together with the accompanying waypoint table; the plantation is thus able to show trends in threats. It also allows the plantation to demonstrate that it is carrying out steps to address the issues identified and show that HCV areas are being actively managed by the plantation.

1.12 Verification

Verification of patrol movement: All teams are required to track their movements by GPS and this data should be stored and downloaded regularly as per training. Field Coordinators or HCV Managers can therefore check (ideally on a daily basis) whether patrol teams have followed their prescribed paths; have spent the required time in the field; and have completed their patrols easily using the SMART software.

Time spent within the field can be used to verify whether the teams have actually walked the designated transects or simply driven around the HCV boundary. Whilst this data is difficult to tamper with, data loggers can be used to prevent any possible alteration or fictitious data being used.

Verification of data: The quality of the data collected will largely depend on continual staff training and verification of what is being collected by the patrols. It is recommended that Field Managers check patrol data on a regular basis and look for inconsistencies. Given that data is collected on a regular basis and that each patrol cycle is considered an independent survey, managers can compare data monthly and question when particular threats are in different states (or even missing) from one month to the next. Managers should conduct 'spot checks' in the field on a regular basis and compare the data collected by patrol units to the reality in the field. Should discrepancies arise, these should be addressed immediately and should include further training and or sanctions to be put in place to ensure that they are not repeated. These verification checks and subsequent actions should be recorded to show clearly to management and assessors that internal verification is being undertaken, with ideally external verifiers or auditors being brought in twice per year (or at the mostly annually) to review the data being generated.

1.13 Resources

SMART Software
www.smartconservationsoftware.org

Sustainable Palm Oil Portal
www.sustainablepalmoil.org

N**ew Hampshire Estuaries Project (2007**)
http://www.prep.unh.edu/resources/pdf/identify_and_report-nhep-07.pdf.

1.14 Appendix A: Threat analysis data model overview

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
Residential development	Housing and urban areas	Temporary settlement				Active/Non active	Number of buildings	Cleared Spoken to owners Report to management No Action	Notes	What action was taken by management? To whom was the report passed to? Has the police or other authority been contacted? What is the date and reference number of the report given to the authorities? Has there been a follow up to the report? What was the outcome? Has the report been passed on to higher management?	Ability to produce outputs based on any level of the threat category and to any state. Distribution map of observed threat, intensity map (number of locations, number of houses), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, number of houses). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Permanent settlement									
Agriculture and aquaculture	Annual and perennial non-timber crops	Shifting agriculture	Shifting agriculture			Active/Non active	Area (Ha)	Clear Spoken to Owners Report to management No Action			Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, size of encroachment), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, size of encroachment). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Smallholder	Oil palm								
			Coffee								
			Rubber								
			Horticulture								
			Other								
		Agro-industry	Oil palm in HCV/Riparian areas	Supply palm							
				New development							
				Existing							
			Coffee								
			Rubber								
			Horticulture								
			Other								
	Livestock farming and ranching	Subsistence	Pigs				Number				Ability to define to any level. Distribution map of observed threat,
			Chickens								

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
			Cattle								intensity map (number of locations, number of animals), summary table of waypoints (including state, intensity, action taken, notes), trend report. Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
			Goats								
			Other								
		Commercial	Pigs				Number				
			Chickens								
			Cattle								
			Goats								
			Other								
Energy production and mining	Mining and quarrying	Zircon	Mechanised	Chemicals used		Old site (inactive) Active Newly developed Exploratory	Area (Ha)	Approach Miners Report to Management No Action			Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, size of encroachment), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, size of encroachment). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
				Chemicals not used							
			Unmechanised	Chemicals used							
				Chemicals not used							
		Gold	Mechanised	Chemicals used							
				Chemicals not used							
			Unmechanised	Chemicals used							
				Chemicals not used							
		Sand	Mechanised	Chemicals used							
				Chemicals not used							
			Unmechanised	Chemicals used							
				Chemicals not used							
		Rock	Mechanised	Chemicals used							
				Chemicals not used							
			Unmechanised	Chemicals used							
				Chemicals not used							
		Coal	Mechanised	Chemicals used							
				Chemicals not used							

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
			Unmechanised	Chemicals used							
				Chemicals not used							
		Other	Mechanised	Chemicals used							
				Chemicals not used							
			Unmechanised	Chemicals used							
				Chemicals not used							
	Oil and gas drilling										
Transportation and service corridors	Road built in HCV or protected area	Large Road				In construction, New development, Old development, Disused	Area (Ha)	Builders approached, Report to Management, Development halted, Road closed No Action			Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (including state, action taken, notes), trend report (number of locations). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Footpath				New					
Biological resource use	Hunting and trapping terrestrial animals	Hunters	Traps	Snare	Steel snare	With kill, without kill	Number of hunters, Use of dogs (yes/no), Number of traps	Hunters approached, Report to Management, No Action	Notes (what species of animal, are the hunters known, which village do hunters come from, if target species known: Target species: IUCN Category Vulnerable or higher?, type of hunter, illegal? Size of nets)		Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, number of hunters), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
					Plastic snare						
					Head snare (small)						
					Head snare (large)						
				Mist nets							
				Glue traps							
				Electric traps							
			Spears								
			Guns								
			Unknown								

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
		Audible sign of hunting				With dogs, without dogs		Sound followed, Report to management, No action	Notes (what was heard)		Ability to define to any level. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (including action taken, notes), trend report (number of locations). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Encounter of evidence	Traps	Snare	Steel snare	Active/non active	Number of traps	Cleared, Report to management, No action	Target species: IUCN Category Vulnerable or higher? Notes		Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, number of snares), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
					Plastic snare						
					Head snare (small)						
					Head snare (large)						
				Mist nets							
				Glue traps							
				Electric traps							
			Bullet shells				Number				
			Animal Body part				Number of animals				
			Other				Number				
	Gathering terrestrial plants	Rubber tapping						Collectors approached, Report to management, No action	Notes (how many people, how much is collected, mortality of hives, number of trees killed etc.)		Ability to define to any level. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (action taken, notes), trend report (number of locations). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Gaharu collection									
		Honey collection									
		Medicinal plant collection									
		Orchid collection									
		Rottan collection									
		Fruit collection									
		Resin collection									
		Firewood collection									
		Fodder									

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
		collection									
		Bark stripping									
		Unknown									
	Logging and wood harvesting	Logging site	Small trees cut only			New area, Expansion of existing area, Old logging area	Use of chainsaw? Number of large trees cut Number of small trees cut	Loggers approached, Logs removed, Report to management, No action	Notes (are the loggers known, species impacted, type of loggers, was main stem cut, has wood been removed, presence of logging skids/canals,)		Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, intensity), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
			Large and small trees cut								
		Prepared timber				Active logging storage/non active storage	Choice: Small scale <5m3, Large scale >5m3	Wood removed, Reported to management, No action	Notes		
	Fishing and harvesting aquatic resources	Encounter of fishermen	Line			With kill, without kill	Number	Fishermen approached Reported to management No action	Notes		Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations, Intensity), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
			Net	Throw net							
				Drift net							
			Traps	Fish							
				Snake							
				Shrimp							
			Harpoon								
			Electrofishing								
			Poison	Chemical							Ability to define to any level and to any state. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations). PDF or other versions of outputs for printing
				Natural							
		Encounter of evidence	Line			Active/non active	Number	Cleared, Report to management,			Ability to define to any level and to any state.
			Net	Throw net							

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
				Drift net				No action			Distribution map of observed threat, intensity map (number of locations, Intensity), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
			Traps	Fish							
				Snake							
				Shrimp							
Natural System modifications	Fire and fire suppression					Active/non active	Area (Ha)	Reported No action			
	Dams					Active/non active	Area (Ha)				
Pollution	Water pollution	Colour – brown						Followed to source, Reported to management, Checked sewage and domestic waste water system, Set up water monitoring point, Requested further investigation by laboratory, No Action	Notes (Potential source, severity, are there enough bins? Is a rubbish trap/cage needed? Socialisation needed?)		Ability to define to any level. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (including notes), trend report (number of locations). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Colour – grey/white									
		Colour – green									
		Colour – multi-coloured									
		Floating material – foam/bubbles									
		Floating material – trash									
		Floating material – oily sheen									
		Floating material – green hair-like strands									
		Floating material – green flecks									
		Deposits – orange slime, fluff or crust									
		Deposits – grey, cottony slime									
		Deposits – trash									
		Odour – rotten egg									
		Odour – chlorine									
		Odour – sharp, pungent odour									
		Sedimentation									
		Dead aquatic animals									

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
	Garbage and solid waste	Organic				New, Old	Area (Ha)	Cleared, not cleared	Notes (Potential source)		Ability to define to any level. Distribution map of observed threat, intensity map (number of locations, Intensity), summary table of waypoints (including state, intensity, action taken, notes), trend report (number of locations, intensity). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Non-organic (paper, plastic, metal)					Area (Ha)				
Invasives	Non-native/alien species	Patch					Low	Reported, Area slashed, De-creeping, Silviculture, Planned silviculture based on the priority areas, removal of vines, replanting of native trees, No action	Notes. Has this area expanded since last visit? Is this a new area? Has clearing been done?		
							Medium				
		Single Characteristic					High				
							Urgent				
	Problematic native species	Patch					Low				
							Medium				
		Single Characteristic					High				
							Urgent				
Operational Threats	Signboards	Broken						Reported to management No action	Notes		Ability to define to any level. Distribution map of observed threat, intensity map (number of locations), summary table of waypoints (including state, action taken, notes), trend report (number of locations). Waypoints in tables correspond to name given on GPS. PDF or other versions of outputs for printing
		Missing									
	Fences or border markers	Broken									
		Missing									
	Pesticide or herbicide spraying	In riparian areas						Staff approached Reported to management No Action			
		In other HCV areas									
	Incorrect fertilizer/land application	In palm oil areas									
		Application on drains									
		Within specified riparian areas									
	Clearing of HCV areas by company staff	In riparian areas									
		In other HCV areas									

Appendix A: Threat analysis data model overview

Continued

IUCN THREAT CATEGORY	SUB IUCN THREAT CATEGORY	THREAT	TYPE	SUB TYPE	SUB TYPE	STATE	INTENSITY	ACTION TAKEN	NOTES FROM FIELD STAFF	NOTES FROM MANAGEMENT	OUTPUT
	Incorrect HCV or riparian boundary/ buffer marking										
	Washing in rivers	Vehicles									
		Domestic									
		Riparian area destruction for access									
	Water extraction from river	By mill									
		Other									
	De-silting	On one side									
		On both sides									
	Drainage channels cut into river										
	Water course alteration										
	Other										
Biodiversity encounter	Direct sighting	Species name							Notes	Notes	Maps of animal/sign/mortality distribution
		Age class									
		Sex									
		Activity									
		Number of animals									
	Indirect sighting	Species name									
		Track/sign type									
		Approximate age of track/sign									
	Animal mortality	Species name									
		Age class									
		Sex									
		Number of animals									

1.15 Appendix B: Field datasheet

ZSL LIVING CONSERVATION **HCV AREA PATROL DATASHEET 1**	ESTATE:	HCV BLOCK NO.:	PATROL TEAM ID: OTHER STAFF:	GPS ID:	TRACK LOG CODE:	DATE:

WAYPOINT CODE	PATROL TYPE	TIME	PHOTO ID	COORDINATES N	COORDINATES W	OBSERVATION CODE					STATE	INTENSITY	ACTION TAKEN

Notes:

Patrol Team Code: Each team should have their own code assigned (e.g. U7), please record presence of other staff outside the unit.

Waypoint code: Please see Waypoint Crib Sheet. Not all fields must be filled if not required by threat ID.

Patrol type: Foot (F), Car (C), Motorbike (M), Bicycle (BI), Boat (BO).

State, Intensity, and action taken: Please see Waypoint Crib Sheet.

Diperiksa Oleh :

Estate :

Nama dan tanda tangan Estate Manager

ZSL LIVING CONSERVATION **HCV AREA PATROL DATASHEET 2**	ESTATE:	HCV BLOCK NO.:	PATROL TEAM ID: OTHER STAFF:	GPS ID:	TRACK LOG CODE:	DATE:

WAYPOINT CODE	NOTES	ACTION TAKEN BY MANAGERS

Notes:

Waypoint codes should be re-written here as on Sheet 1. For guidance on the recording of notes for specific threats, please see the Waypoint Crib Sheet. These are not exhaustive and can be supplemented with additional information. Action taken by managers can be marked on this sheet as well as within the software.