The Zoological Society of London
Biodiversity & Oil Palm Project

ZSL
LIVING CONSERVATION

A PRACTICAL TOOLKIT FOR

IDENTIFYING AND MONITORING BIODIVERSITY IN OIL PALM LANDSCAPES

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INTRODUCTION

The expansion of oil palm plantations across Indonesia and Malaysia has resulted in the loss and fragmentation of biodiverse tropical lowland forests. This has had serious consequences for biodiversity, as the majority of forest species are unable to adapt to survive within oil palm monocultures. In an effort to reduce the negative environmental and social impacts of palm oil production, the Roundtable on Sustainable Palm Oil has established a set of Principles and Criteria (RSPO P&C) that define a standard for more responsible palm oil production. If a palm oil producer wishes to say that the palm oil they produce is sustainable, they must first undergo an independent audit to certify that they comply with the RSPO standard.

The main provisions of the RSPO P&C to mitigate impacts on biodiversity are the requirements to identify, maintain and enhance High Conservation Values (HCVs) which could be affected by either existing oil palm concessions or areas proposed for oil palm expansion (Box 1). To achieve this, it is necessary for an assessment of the oil palm concession (HGU) to be carried out to identify which of the six HCVs are present (Box 2), and in turn the management actions required to ensure these values are maintained or enhanced.

In many cases, this involves designating areas of natural habitat that support HCVs which must not be converted to oil palm or where actions to avoid further negative impacts should be targeted. These areas are known as HCV management areas.

Box 1. The RSPO Principles and Criteria relating to biodiversity (Based on the National Interpretation for Indonesia)

Criterion 2.1. There is compliance with all applicable local, national and ratified international laws and regulations.

Criterion 5.2. The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and their conservation taken into account in management plans and operations.

Criterion 7.3. New plantings since November 2005, have not replaced primary forest or any area required to maintain or enhance one or more High Conservation Values*.

*) Where the HCV status of land developed between November 2005-2007 is unknown, this can be excluded from the RSPO certification programme until an acceptable solution for HCV compensation has been developed.

The quality of the data used to inform such decisions is critical to determining the impacts of palm oil production on biodiversity, particularly in areas of expansion.

It is therefore essential that effective methods for assessing the presence and status of species and natural habitats that could be affected by either existing or new oil palm concessions are employed during HCV assessments.

In order to determine whether the actions taken to maintain and enhance the HCVs identified are effective, it is necessary to monitor and evaluate changes in these values over time.

Box 2. 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

HOW TO USE THIS TOOLKIT

The aim of this toolkit is to assist HCV assessors in conducting scientifically sound biodiversity assessments within and around oil palm concessions, as one component of an HCV assessment. It will also serve as a useful resource for RSPO, Conservation or HCV managers from palm oil companies who are tasked with developing and implementing protocols for monitoring HCV species and habitats that may be affected by an area of palm oil production.

This toolkit is designed to assist practitioners to plan and implement biodiversity assessments accurately and efficiently and to obtain high quality and useful primary data concerning the presence, distribution and status of HCV species in and around oil palm concessions (Box 3). Included in Annexes 1 and 2 are tables which list all of the mammal, bird, reptile, amphibian, fish and tree HCV species found in key current and future areas of palm oil production in Indonesia, namely in the regions of Sumatra, Kalimantan and Papua. This is an updated version of the list which appears in the 'Toolkit for Identification of High Conservation Values in Indonesia, June 2008' These tables include information regarding the conservation status of each species, their ecology and habitat requirements, as well as recommended methods for conducting either a rapid assessment or longer term monitoring of each species. For each method listed, there is a section within the toolkit which provides a detailed description of the protocol, the resources required to implement it, the biodiversity data that can be generated, guidance on how this data can be analysed, and a review of the overall strengths and weaknesses of each method.

The range of methods suitable for collecting primary biodiversity data as part of an HCV assessment will vary depending on;

- Size and location of the concession,
- Types of habitats that persist within and around the concession,
- Season,
- Quality of the secondary data available for the region,
- Time available to the assessor,
- Experience and level of expertise of the assessor.

In some cases, several different methods may be equally suitable for obtaining the data required. However, ensuring that the assessor has the necessary expertise to implement the methods used, is critical to the quality of the data collected and should therefore be one of the key factors considered when deciding which methods to use.

The information in this toolkit is based on ZSL's experience of conducting biodiversity assessments on oil palm concessions in Sumatra and Kalimantan. It also incorporates recommendations from a workshop organised by ZSL and the Indonesian Institute of

Sciences (LIPI), which aimed to '*Determine effective methods for rapid biodiversity assessments in oil palm landscapes*'. This workshop was held on the 20th July 2011 in Bogor, Indonesia, and was attended by 47 scientists, NGO representatives, HCV assessors and conservation managers from palm oil companies all with experience of conducting biodiversity assessments in oil palm concessions. This information is supported by recommendations from existing literature and guidance.

Box 3. Defining 'High Conservation Value' species in Indonesia

HCV 1.2. Species that are listed as Critically Endangered on the IUCN Red List

HCV 1.3. Species that are listed as Endangered or Vulnerable on the IUCN Red List, listed on Appendix 1 and 2 under the Convention on International Trade in Endangered Species, protected by the Government of Indonesia, or have ranges that are restricted to a single island (or one part of it).

IUCN Red List of Threatened Species - www.iucnredlist.org

The IUCN Red List prioritises species for conservation attention based on its risk of extinction, which is determined using a scientifically rigorous approach. This list is regularly updated so it is important to refer to the latest version. Species categorised as Critically Endangered, Endangered or Vulnerable are all considered to be threatened. (Detailed information about the criteria for each of these categories can be found at the following link: http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria

Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) - www.cites.org

This is an international agreement between 175 governments which aims to ensure the international trade of plants and animals, does not result species being exploited, to the extent that it becomes a threat to their survival. CITES categorises species into 3 lists, known as Appendix 1, 2 and 3, depending on the level of protection they require.

Appendix 1. Species are threatened with extinction, so international trade (import and export) of these species and derived parts are prohibited except in exceptional circumstances.

Appendix 2. Species trade is strictly controlled by a quota system to avoid unsustainable exploitation.

Appendix 3. Species are listed at the request of a member country to assist in controlling international trade in a species that is protected by national laws. To date, over 5000 animals and 28000 plants are listed by CITES, details of which can be found on the CITES website.

Protected by the Government of Indonesia

Species protected by the Government of Indonesia are listed in an appendix to Conservation Law No 5, 1990 and also Government Regulation No 7, 1999 regarding protected species of flora and fauna. These species are selected based on the following criteria;

1. Species with a small population,
2. Species suffering rapid population declines in the wild,
3. Endemic or restricted range species.

Endemic

Endemic species are those whose distribution is restricted to a geographically isolated area, such as a single island or part of that island.

Restricted Range

Restricted range species are those whose historical range is less than 50.000 km^2.

PROCESS FOR IDENTIFYING HCV SPECIES (HCV 1.2, 1.3 & 1.4) AND THEIR HABITATS AS PART OF AN HCV ASSESSMENT IN OIL PALM

In this section we will highlight how this toolkit can assist in the process of planning and implementing the biodiversity component of an HCV assessment (see Fig 1). This is in line with the recommended process for conducting an HCV assessment, as described on p25 of the 'Toolkit for Identification of High Conservation Values in Indonesia, June 2008'.

Step 1: Secondary Data Collection

It is essential to collect from pre-existing sources as much background information as possible about the species and habitats present in the area where the HCV assessment will take place. This includes information regarding habitat type, cover and quality, as well as the distribution and conservation status of species, all of which assist the assessor to determine the biodiversity that is likely to be identified during the assessment. This is the first step in designing an efficient and effective field assessment to verify the presence of HCV species and determine the area of natural habitat required to maintain and enhance viable populations of these species (HCV Management Areas).

Examples of sources of secondary biodiversity data include:

- **Information from the company:** The company may be able to provide maps or aerial images of their concession. Plantation workers who spend large amounts of time in the field may also be a useful source of information about the presence and distribution of species they have observed within the concession.
- **Information from previous research carried out in the area**: Contact universities, research institutions and NGOs working in the region of the concession as they may have valuable information about the species present and their status.
- **Information from local people:** people living in and around the oil palm concession can provide valuable information about the presence, distribution and abundance of species in the area. This can be extremely helpful in identifying areas where biodiversity assessments should be targeted and the HCV species likely to be recorded. However, this information should be interpreted with caution, as it may not be based on first hand experience and can therefore be unreliable. Please see the section on Community Interviews for further information.
- **Websites:** There are a number of websites that provide valuable information regarding land cover and species distribution, particularly for threatened species.

Please see the list of useful links and resources at the back of the toolkit for further information.

- **List of HCV species for Indonesia:** Appendices 1 and 2 of this toolkit lists the mammal, bird, amphibian, reptile, fish and tree species found in Sumatra, Kalimantan and Papua that are categorised as HCV 1.2 (Critically Endangered) or HCV 1.3 (Endangered or Vulnerable IUCN Red List, CITES Appendix 1 or 2, endemic or protected by the Indonesian Government). This information can be used to determine which species indicated to be present within or around the concession are considered to be HCV species. See Box 3 for further details.
- **The HCV Toolkit for Indonesia:** This includes a comprehensive list of secondary data relating to all of the HCVs (http://www.hcvnetwork.org/resources/national-hcv-interpretations).

Step 2: Determining suitable methods of primary data collection

Practitioners conducting HCV assessments often have a limited amount of time on the concession to collect primary data. In order to maximise the time spent on the concession, it is important that a field assessment is well planned and has clear objectives. This includes defining the range of habitats and taxa that must be sampled to ensure all of the important habitats and HCV species that may be impacted by palm oil production in the area are identified. It should be recognised that the data obtained during a rapid assessment is likely to be limited to; species inventories that consist primarily of more conspicuous and abundant species, basic information about species distribution, indicators of the diversity of certain habitats and possibly estimates of the relative abundance of key species.

In order to obtain accurate estimations of the size, range and viability of the population of HCV species, targeted biodiversity assessments repeated on a regular basis will be required. Appendix 1 and 2 of this toolkit provides information regarding the ecology and habitat of each HCV species, as well as recommended methods for conducting rapid assessments of each species. This will assist the assessor in determining the range of methods that can be employed and the habitats to target in order to verify the presence of HCV species indicated to be in the area by the secondary data obtained in Step 1.

Step 3: Field Data Collection

It is important that the protocols used to collect the primary data, as well as the expertise, equipment and sampling effort required, are decided well in advance of heading into the field. This toolkit provides a detailed description of the protocols for the methods most commonly used for conducting biodiversity assessments of mammals, birds, reptiles & amphibians, fish and vegetation. These methods are listed in Table 1. This includes information regarding the equipment and skills required to implement each protocol, as well as an indication of the approximate level of sampling effort necessary to meet the objectives of the assessment (e.g. species inventory or estimate of population size). However, these are only guidelines and the protocols described will need to be adjusted and tailored to the habitat and field conditions in the area being assessed.

Step 4: Data Analysis

Often one of the most difficult aspects of conducting an HCV assessment is analysing and interpreting the data collected. This toolkit contains guidance on how the data collected should be treated in order to obtain certain information (e.g. relative abundance vs. absolute population density). More detailed guidance on the more complex methods of analysis required to estimate absolute population density can be found in the references and useful resources/links section. The digital version of this toolkit also includes templates of excel spreadsheets that can be used to tabulate the data collected prior to analysis.

Table 1. Summary of all the methods of primary data collection described in this toolkit

Taxa	Method/Equipment	Target species	Page
Medium and large mammals and primates	Reconnaissance transects	All species, including primates	20
	Line transect sampling	All species, including primates	22
Medium and large mammals	Occupancy surveys	Mammals in general	26
	Camera trapping	Elusive, low density mammals	27
Primates	Orangutan nest counts	Orangutan	31
	Triangulation of gibbon calls	Gibbons	32
Small terrestrial mammals	Box traps	Rats and small terrestrial mammals	36
Bats	Mist netting	Fruit bats	38
	Harp traps	Insectivorous bats	40
Birds	Species inventory	All species	45
	MacKinnon lists	All species	46
	Line transect sampling	Mobile, conspicuous birds	48
	Point transect sampling	Cryptic, skulking birds	49
	Mist netting	Small, elusive birds	51
Reptiles and Amphibians	Visual encounter surveys with timed searches	All terrestrial amphibians and reptiles	57
	Line transects with visual encounter surveys	Terrestrial amphibians and reptiles except canopy species	58
	Quadrat/patch sampling	Litter frogs and reptiles	60
Fish	Live capture	Different nets and traps can be used to survey different habitats	64
Vegetation	Quadrat method		69
	Distance methods		70

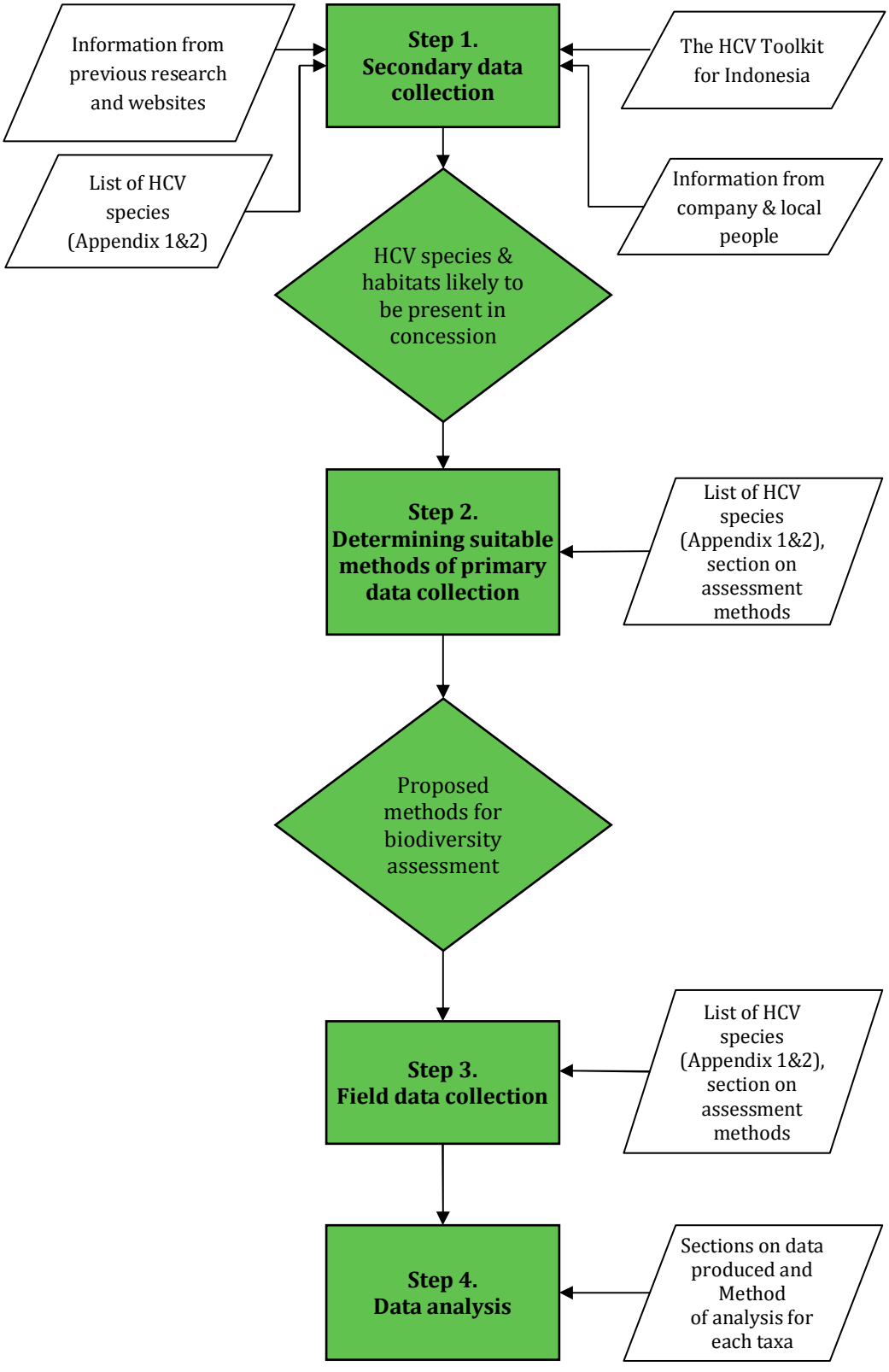

Figure 1. Flow chart highlighting how each section of this toolkit can assist planning and carrying out a biodiversity assessment

MONITORING BIODIVERSITY TO DETERMINE THE EFFICACY OF HCV MANAGEMENT

Biodiversity monitoring can be used to determine whether the management interventions designed and implemented to maintain and enhance species and habitats of High Conservation Value are effective. If not, the information gained as a result of this monitoring can provide insight into how these management interventions need be adapted and improved in order to conserve these values.

Monitoring biodiversity involves conducting repeat assessments over time to identify the trends in the status of target species or habitats that are the focus of management interventions. Due to limitations of time and resources, it is not practical to monitor changes in the status of all species present within or around a concession. It is therefore important to identify measurable indicators that show whether the efforts to maintain and enhance biodiversity within the concession are having the desired impact. A variety of different species are suitable indicator species for long term monitoring.

Good indicators should be relatively cheap and simple to measure, provide useful information about whether management objectives are being met and ideally provide quantitative results. Ecological indicators are species that are sensitive to changes in their environment, and have different responses to natural or anthropogenic stresses (Sewell & Griffiths, 2009; Lindenmayer et al 2000). Often short lived species groups such as butterflies, birds and insectivorous bats provide suitable indicators of the quality of HCV areas being maintained within oil palm concessions. However, these species groups often require a high level of expertise to identify and monitor them.

An alternative to monitoring ecological indicator species is to monitor changes in the population of umbrella or keystone species, which are species that are highly dependent on particular attributes of a landscape. This includes species with large home ranges, species reliant on a common food source such as fruit or a certain prey species, or those dependent on cavities in large trees for nesting or roosting. As these species are highly dependent on the characteristics of an intact natural ecosystem, their presence suggests a wide range of other species with similar habitat requirements may also be able to persist in that landscape. Examples of such species found in Indonesia include Gibbons, Hornbills, Orangutans and the Sumatran tiger. However, ecological indicator or umbrella species selected for monitoring programmes need to be closely linked to the HCVs present and the measures adopted to maintain and enhance them. A range of species that could provide suitable indicators are highlighted in Appendix 1 and 2.

Finally the type, cover and quality of habitats and the vegetation it comprises of, are important factors in determining the biodiversity that the habitat is able to support. This data can also provide indicators of the effectiveness of management interventions. There are a large number of different habitat variables, so it is important to assess and monitor those most relevant to the management objectives. Examples of habitat variables that could be monitoring are listed in table 2.

Table 2. Examples of habitat variables

No	Element	Variables
1	Vegetation	Structural complexity; species composition, tree density, tree dbh (diameter at breast height), tree height, tree architecture, canopy cover, canopy connectivity, biomass, forest health and productivity (Leaf litter/phenology). Fragmentation
2	Aquatic	Water current, turbidity, stream width and gradient, flood potential, pH, water temperature
3	Physical	Slope, aspect, soil -depth, type, contaminant loads

References

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Lindenmayer, D. B. (1999). Future directions for biodiversity conservation in managed forests: indicator species, impact studies and monitoring programs. *Forest Ecology and Management , 115*, 277-287.

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RECOMMENDED METHODS FOR RAPID ASSESSMENT AND LONG TERM MONITORING

COMMUNITY INTERVIEWS

Community interviews regularly form a major component of HCV assessments in oil palm concessions. Often people living in and around areas of forest are relatively aware of the biodiversity around them, so they are considered to be a good source of information about the biodiversity value of these habitats. Key informants for community interviews include local hunters and fishermen, who are usually very knowledgeable about the species present in the area and can provide information about the extent to which different species are exploited. Obtaining such information from these people can be a quick and valuable way to find out which species are likely to be present in the area, their distribution and the threats they face, particularly as a result of human activities.

In some circumstances surveys of local communities can provide valuable insights into the population status of certain target species, such as a recent study into the extent of orangutan poaching in Kalimantan (Meijaard *et al*. 2011). The process of interviewing communities, can also help raise awareness about the importance of conserving biodiversity amongst people whose activities may threaten HCV species and habitats.

When carrying out interviews, it is vital to use visual aids, ideally photographs, to make sure that the person conducting the interview and the respondent are talking about the same species. This is particularly important when a number of different local names exist for the same species. Pictorial guides of species that may be present within or around the survey location can be made by scanning or downloading royalty free pictures or using existing field guides if available (e.g. Mammals of Borneo, Birds of Sumatra, Java and Kalimantan). However, pictorial guides must be used with caution to ensure that they do not encourage the respondent to positively identify a species that they have little or no information about in order to please the interviewer.

The following methods can be used to conduct community interviews:

1. Semi structured interviews

This method involves carrying out informal interviews which aim to cover certain topics but are not guided by a pre-prepared questionnaire. However, it is important to standardise the way in which the information obtained from the interview is recorded, so as to facilitate analysis. This method allows the interviewer greater flexibility to respond to the answers given by the respondents, which lends itself to being used to interview large groups of people. However, as the majority of the data produced is often qualitative, interpretation of the results can be time consuming and subject to bias.

2. Questionnaires

This method involves preparing a set of specific questions, which either form the structure of an interview or a document that respondents can be given to complete independently if they have the ability to do so. The lifestyle and type of interaction with wildlife of the people you wish to target should be taken into account when designing the questionnaire. It is important that the questions asked are concise (to encourage participation) and self explanatory (to reduce bias). This method can be used to produce quantitative results. However, inaccuracies in the data produced may arise from the respondents feeling obliged to answer all the questions even if they do not know the answer. Therefore, questionnaires should ideally be combined with semi-structured interviews, so as to gain good quality results.

Whilst it can be very useful, the information obtained through community interviews should be used with caution to guide decision making, as this knowledge is often not based on first hand accounts, so may be exaggerated or mixed with myth. It should not be considered as a substitute to conducting a field assessment of the presence, distribution and status of HCV species within and around the concession being assessed.

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MAMMALS

Methods Suitable for Medium and Large Mammals and Primates

1. Reconnaisance Transects (Recce)

Equipment

- Binoculars
- Field guide of mammals (see references)
- GPS
- Hand held Camera (with macro setting)
- Ruler
- Spot lights/head torches if at night
- Data sheets, clipboard and pencil

Description of protocol

This method involves the observer moving through a habitat in a specified direction, but unlike line transects they are not restricted to following a specific route and are free to take the path of least resistance. Recce transects can be carried out on foot, or by using boats or cars to move slowly along rivers or roads that pass through or alongside habitats of interest. The length of each transect will vary depending on the mode of transport used, but should be at least between 1 and 2km.

The time and GPS position should be recorded for the start and finish of each transect. Ideally a GPS track log should also be taken to record the length and exact route of the recce transect. Both direct and indirect observations, such as dung, nests or sign, can be recorded. For each direct or indirect species observation, the species name, type of observation (direct sighting, sign etc), location and time of observation should be recorded. For indirect sightings, the age of the sign should also be estimated where possible. In order to accurately identify animal tracks a photo should be taken of each individual print with a ruler placed beside it to give an indication of the scale.

Transects should be carried out when the target species groups are most likely to be active, which for most diurnal mammals is early morning or late afternoon, but for nocturnal mammals is after sunset.

If the aim of the survey is to produce a comprehensive species inventory, the areas sampled must be representative of habitat types present. If the aim is to compare species richness between different habitats then sampling effort in each habitat type should be standardised.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type sampled to

determine the proportion of the species present in the habitat (species richness) likely to have been identified. This is calculated by plotting the cumulative number of new species recorded after each recce walk against sampling effort (length of transect or number of hours of observations). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of encounters of a particular species by the total sampling effort in that habitat type.

[X] Absolute density

DISTANCE software can be used to estimate the absolute density of a species.

[√] Habitat use and distribution

If the GPS location of each species is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Can be used to quickly and easily cover large areas. • More flexible and less labour intensive than line transects. • Causes less disturbance to the area being surveyed than line transects as transects follow existing paths or trails.	• Results may be biased towards species that favour open habitats. • Species that live in dense vegetation are rarely recorded using this method. • Low density or elusive species are rarely recorded. • Species recorded will depend on the experience of the observer.

2. Line Transect Sampling

Equipment

- Binoculars
- Field guide of mammals (see references)
- Camera
- GPS
- Spot lights/head torches if at night
- Tape measure or laser sighter
- Data sheets, clipboard and pencil

Description of Protocol

Line transect sampling involves recording all species encountered (seen or heard) by observers walking along a pre-defined linear route. The location of the transects should be chosen randomly within each habitat type available to the assessors and monitoring

team to reduce bias and increase accuracy, especially if distance analysis is to be carried out. When positioning the transect the distance to the edge of the habitat should also be taken into account.

Transects should be sufficiently far apart to ensure that the same individual is unlikely to be recorded on two adjacent transects. The minimum distance between transects will vary depending on the species being surveyed, but should be no less than 250m. On average transects should be between 1km-2km in length, depending on the terrain and area of each habitat type.

Ideally each transect path should be cleared in advance of walking the transect to reduce the likelihood that the disturbance caused effects the presence of species. If the transects are for monitoring purposes permanent markers should be put in place. A compass should be used to ensure that the transects are straight.

The time and GPS position should be recorded for the start and finish of each transect. Ideally a GPS track log should also be taken to record the exact length and route of the transect. Both direct and indirect observations, including orangutan nests, tracks or dung, can be recorded. For each direct or indirect species observation, the species name, type of observation (direct sighting, sign etc), location and time of observation should be recorded.

For direct sightings, the sex and age class of the individual, and the size of the group should be recorded. For indirect sightings, the age of the sign should be estimated where possible. In order to accurately identify animal tracks a photo should be taken of each individual print with a ruler placed beside it to give an indication of the scale.

If the objective is to estimate population density then the perpendicular distance and height above the ground of the species on first sighting should also be recorded. Indirect signs, with the exception of orang-utan nests, cannot be used to estimate density.

Transects should be carried out when the target species group is likely to be most active. For diurnal mammals this is usually early morning or late afternoon, but for nocturnal mammals after sunset. Observers should aim to walk at a slow and consistent pace (approx 1 km/hour).

To reduce observer bias at least two observers and one data recorder should survey each transect. If the transects are to be used for monitoring, blank data sheets should be used each time the transect is repeated to reduce the reliance of observers on the previous data recorded.

Data produced and method of analysis

[√] Species inventory and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of the species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded after each transect against sampling effort (length of transect or

number of hours of observations). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of encounters of a particular species by the total sampling effort in that habitat type.

[√] Absolute density

Distance software can be used to estimate population density. The results can be compared between locations or over time to measure trends in population density.

[√] Habitat use and distribution

If the GPS location of each species is recorded then this can provide limited information about the distribution of this species within the areas sampled but this should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Suitable for surveying a wide range of mammal species. Conspicuous and bold species can be surveyed using direct observations whereas indirect observations can be used to survey elusive or nocturnal species. • This method can be used to estimate absolute density and is an efficient way of monitoring changes in the population of a target species over time.	• The encounter rate for rare and elusive species may not be sufficient to estimate population size unless sampling effort is very high. • Inactive, small or timid species are often missed. • The species detected will vary depending on the level of experience of the observer. • Analysing the data to estimate population density can be time consuming and difficult

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Table 3. Summary of methods for rapid assessment and monitoring of medium and large mammals and primates

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Reconnais-sance Transect (Recce walk)	Common species of medium & large mammals, including primates. Not suitable for rare & elusive species or small mammals.	All habitat types	Species inventory, relative abundance	N/A	Ability to identify mammal species from direct observations and indirect signs.	Suitable	Suitable
Line Transect Sampling	Common species of medium & large mammals, including primates. Not suitable for rare & elusive species or small mammals.	Habitats with consistent, easy terrain, each transect should be confined to a single habitat type	Absolute density	At least 40 sightings of a single species are needed, though 60-80 gives better precision. Need at least 20 transects in each habitat type	Ability to identify mammal species from direct observations and indirect signs. Ability to estimate distance.	Suitable	Suitable

Methods Suitable for Medium and Large Mammals

1. Occupancy Surveys

Equipment

- GPS and map of survey location
- Field guide of mammal (see references)
- Hand held Camera
- Data sheets, clipboard and pencil

Description of Protocol

This method involves dividing the area to be surveyed into 1km x 1km grids, then randomly selecting a number of grids to be searched. The proportion of grids that it will be possible to survey will vary depending on the habitat type and time available. Ideally at least 30% of the grids should be sampled. Each grid selected for sampling should be thoroughly searched for a standardised number of man hours, recording the GPS position and species name for all wildlife sign and direct observations. In order to accurately identify animal tracks a photo should be taken of each individual print with a ruler placed beside it to give an indication of the scale. Ideally each grid should be surveyed more than once to avoid bias created by weather conditions or other disturbances.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded against sampling effort (number of man hours searching). The point where the curve plateaus indicates the species richness for that habitat.

[X] Relative abundance

[X] Absolute density

DISTANCE software can be used to estimate the absolute density of a species.

[√] Habitat use and distribution

The presence or absence of each species within each grid can be used to determine the habitat usage by each species. The percentage habitat usage can be estimated using Presence software, which will take into account the detection probability for each species.

Strengths	Weaknesses
• Cheap, easy and suitable for identifying elusive species (indirectly). • Doesn't require high levels of skill. • Provides information about habitat use.	• Labour intensive. • The species and signs detected will vary depending on the level of experience of the observer. • Data analysis can be time consuming and difficult

2. Camera Trapping

Equipment

- Camera traps (Infra red recommended)
- Field guide of mammals (see references)
- GPS
- Memory cards
- Security boxes & locks
- Silica Gel
- Data sheets, clipboard and pencil

Description of protocol

Cameras should be checked prior to use to ensure they are in good working order (sensor, time and date settings). Each camera trap should also be given a unique code in permanent marker in order to simplify identification of the location at which pictures were taken during analysis. Memory cards should also be labelled with the ID number of the camera trap they belong to. Including sachets of silica gel inside the cameras itself can help to reduce the risk of breakage due to moisture. These should be replaced regularly.

The placement of the camera traps depends on the purpose of the survey. If the aim of the survey is to produce a species inventory, cameras should be placed in locations that are representative of the range of habitat types present on paths or forest trails that are likely to be used by medium and large mammals. Bias towards a particular species can be avoided by placing cameras within 1km x 1km grids, to ensure that they are evenly spaced throughout the habitat being surveyed. Ideally each habitat type should receive the same survey effort.

If the purpose is to determine the presence of a target species in an area, such as the Sumatran tiger, then the area should be surveyed for signs and cameras placed in locations suspected to be used by this species in order to increase the likelihood of capturing an individual of this species. If the aim of the survey is to estimate the density of a species which can be identified to the level of the individual, such as tigers or clouded leopards, cameras should ideally be placed in pairs on either side of the path so that each side of the individual is photographed to assist in identification.

Once the location for each camera trap has been selected, the camera trap should be attached to a tree about 1-2m from the path and 30-70cm above the ground. Cameras should be angled to face towards the path. Understorey vegetation in the surrounding area should be cleared to prevent it from triggering the camera. For each camera set, the

GPS location, ID number, time and date it was set should be recorded. In addition to this, features of the surrounding habitat (micro and macro) should also be noted.

Camera traps should be checked at least once a month, although it may be necessary to check them more regularly to ensure that they are still functioning effectively (batteries remain charged, space available on the memory card etc). It is useful to have a two memory cards for each camera so that these can be switched to allow data to be periodically transferred to a computer. For each picture taken it is necessary to record the date and time it was taken, the species visible in the photo and the number of individuals. If the aim of the survey is to estimate population density then the sex and age of each individual identified should also be recorded if possible. Camera base is a free software application that can be used to manage the pictures captured and the associated data.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded against sampling effort (number of trap nights). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

Relative abundance of species in a certain habitat is estimated by dividing the number of encounters by the total sampling effort (trap nights) in each habitat.

[√] Absolute density

CAPTURE software can be used to estimate the density of species that can be identified to individual level from photos (e.g. Sumatran tiger). More recent methods include Spatially Explicit Capture Recapture again both required training in analysis techniques.

[√] Habitat use and distribution

If the GPS location of the cameras which captured photos of a certain species is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Highly suitable for confirming the presence of species for which direct observations are very rare (most large mammals). • Causes very little disturbance to wildlife. • Ability to collect large amounts of data with limited human resources .	• The equipment is expensive ($200-$500 per unit) and there is a risk of them being stolen in areas close to human populations. • This method can only be used to estimate population size for the very limited number of species where individuals can be identified from photos. • Primarily arboreal species are rarely detected.

Table 4. Summary of methods of rapid assessment and monitoring of medium and large mammals

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Occupancy surveys	Particularly effective for low density, wide ranging, elusive large mammals but can also be used to survey more common species.	All habitat types, except wetland areas	Species inventory and richness, habitat use and distribution	Grids searched should cover 30% of the area of interest	Ability to identify species by indirect and direct sightings	Highly suitable	Highly suitable
Camera Trapping	All species	All habitat types.	Species list, relative abundance, absolute density	350 trap nights per 100km^2	Ability to identify species, experience of using the equipment	Suitable	Highly suitable

Methods Suitable for Primates

1. Orangutan Nest Counts

Equipment

- Binoculars
- GPS
- Tape measure or laser sighter
- Clinometer
- Data sheets, clipboard and pencil

Description of Protocol

Counts of orangutan nests are carried out along pre-defined linear transects. These transects should be no less than 500m apart and are on average between 1-2km in length, depending on the terrain and area of the habitat being surveyed. Ideally a path along each transect should be cleared in advance of walking the transect to ensure that any disturbance caused does not effect the results. If the transects will be used for periodic monitoring they should also be marked with permanent markers.

Transects should be walked during the day. Observers should aim to walk at a slow and consistent pace (approx. 1 km/hour). The time and GPS position at the beginning and end of the transect should be recorded. For every orangutan nest that is visible from the transect, the perpendicular distance of the nest from the transect, as well as the height of the nest in the tree should be recorded (GPS). It is also necessary to quantify the age of each nest observed, based on the level of decay (see Mathewson et al. 2008 or Johnson et a.l 2005), as well as the height and species name of the tree that the nest is built in.

As with all of the transect methods the location of the transects must be representative of the range of habitats being surveyed. Several transects should be surveyed in each habitat sampled to obtain an accurate estimate of the nest density and therefore the size of the population.

Data produced and method of analysis

[X] Species list and richness

[X] Relative abundance

[√] Absolute density

Distance software can be used to estimate nest density, but this should take into account the rate of decay of the nests. The results can be compared between locations or over time to measure trends in population density.

[√] Habitat use and distribution

If the GPS location of each nest is recorded this can provide limited information about orang-utan distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Does not rely on observing the orangutans directly. • This method can be used to estimate absolute density and is an efficient way of comparing changes in the size of an orangutan population over time	• Estimates of absolute density from indirect signs can be inaccurate due to uncertainties in decay rates. For example, nest decay rates can vary between different habitats and geographical regions.

2. Triangulation of Gibbon Calls

Equipment

- Stop watches
- GPS
- Compass
- Map of survey location
- Data sheets, clipboard and pencil

Description of protocol

Three points (listening posts), that are between 300-600m apart and form a right handed triangle must be selected in advance. This method requires two observers to stand at each listening post between 4.30am until 10am, or until there is a period of at least 30 minutes where no calls are heard. It is important that all observers synchronise their watches before the survey begins. Every time a call is heard, each observer must estimate and record the distance (metres) and compass bearing between their position and the calling group. They must also record the length of the call, using a stopwatch, and the time that it started and finished. The call is deemed to have ended if the gibbons are silent for more than 2 minutes. However if they continue to call, a new bearing should be taken every three minutes to determine whether the group is moving. If there is a break in the call of more than two minutes then subsequent singing should be counted as a new call, even if it is the same group that calls. If possible, it should be noted whether the call is a duet or a solo.

If gibbons are sighted whilst observers are standing at the listening posts then the time of sighting, direction of travel, number of animals, and estimated age class should be recorded. Weather has been shown to effect singing frequency, so one researcher should record the weather at ten minute intervals (% cloud cover, rain, sunshine, wind). Surveys should not be carried out in heavy rain.

Data produced and method of analysis

[X] Species list and richness

[X] Relative abundance

[√] Absolute density

Mapping will indicate the number of groups and the approximate home range of the groups present.

[√] Habitat use and distribution

If the sites sampled are representative of all the habitat types present then the GPS locations of each nest or individual recorded can be plotted to produce a distribution map.

Strengths	Weaknesses
• Does not rely on direct observation of the Gibbons. • This method can be used to estimate absolute density and is an efficient way of comparing changes in the size of a gibbon population over time. • Repeated surveys will allow you to map the movement of gibbons through the landscape and identify breeding pairs.	• Labour intensive and time consuming. • Underestimates may be produced in bad weather or disturbed habitats due to low singing frequency. • In some cases the compass bearings from all observers do not intersect so it is difficult to estimate the exact location of the gibbon.

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Table 5. Summary of methods of rapid assessment and monitoring of primates

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Line transect sampling	All species	Wide range of habitat	Species inventory and richness, relative abundance, absolute density	20 km transects per habitat; stratified sampling	Ability to identify primates, ability to estimate distance	Suitable	Highly suitable
Orangutan nest counts	Orangutans	Wide range of habitat	Absolute density	20 km transects/ habitat; stratified sampling	Knowledge of Orangutan ecology and tree species	Suitable	Highly suitable
Triangulation of gibbon calls	Gibbons	Wide range of habitat	Absolute density, distribution	1 site sampled for 3 days in each habitat type	Ability to estimate distance to calls and take compass bearings	Suitable	Highly suitable

Methods Suitable for Small Terrestrial Mammals

1. Box Traps

Equipment

- Either Sherman traps or locally made wire traps of dimension 25cm x 10cm x 10cm (Kasmin traps)
- GPS
- Field guide of mammals (see references)
- Gloves for handling mammals
- Marking material/scissors if using mark and recapture technique
- Data sheets, clipboard and pencil

Description of Protocol

Traps should be placed either in lines or a grid, at least 10m apart. Ideally at least 100 traps should be set for 3 or 4 days in each habitat type for a rapid assessment. Each trap should be numbered and secured, and the position should be recorded with a GPS and marked so that it can be easily located and checked. Wherever possible traps should be placed along fallen logs, habitat edges or potential runs to improve trapping success. Traps must be baited each time they are set. Suitable baits include peanut butter mixed with shrimp paste and oats, salted fish, roasted coconut or banana.

The type of bait used will affect the species trapped so a wide variety of bait should be used over the course of a survey in a particular habitat if the aim is to produce a species inventory. However, if the aim is to assess or monitor the population of a certain species the bait used in each survey should be standardised. Traps should be checked early each morning and re-baited and washed if an animal was captured. For each individual trapped, the species name and trap number should be recorded. If the objective of the survey is to estimate population density then each individual trapped should be marked, and recaptured individuals recorded. A larger sampling effort will be necessary in order to obtain sufficient data to estimate absolute density.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded against sampling effort (number of trap nights). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of encounters by the total sampling effort (trap nights) in that habitat.

[√] Absolute density

If the capture mark recapture method has been used the data can be analysed using CAPTURE or MARK software to estimate density. This can be used to compare population size over time or between locations.

[√] Habitat use and distribution

If the GPS location of the trap in which each individual of a certain species was captured is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• This method can be used to estimate absolute density if capture mark recapture methods are used and the data is analysed using distance software.	• Labour intensive • There is a risk of small mammals dying in the traps if they are captured for too long in poor weather conditions • Small mammals must be handled with care as they carry diseases that can be transmitted to humans

Methods Suitable for Bats

1. Mist Netting

Equipment

- Mist nets (12.6m x 2.1m and 12.0 x 2.7m) with 30mm fine mesh and 4 pockets.
- Field guide of mammals (see references)
- GPS
- Cotton bags
- Head torch
- Data sheets, clipboard and pencil

Description of Protocol

Mist nets should be opened before dusk and closed when the capture rate starts to decrease. They should then be opened again before dawn. Ideally mist nets should be manned constantly, but at the very least they should be checked every 20 minutes. They should not be left unmanned for long periods of time as there is a high risk of bats becoming overly stressed or entangled and dying in the nets. The nets should be closed during the day to prevent birds from being caught in them. For each bat captured, the

species name, sex, age, and breeding stage should be recorded. All bats captured should be released at the site where they were trapped as soon as possible.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded after each night of trapping against sampling effort (number of mist net hours). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of individuals captured by the total sampling effort (mist net hours).

[√] Absolute density

If the wings of bats captured are marked and surveys repeated at regular intervals the data can potentially be analysed using MARK or CAPTURE software to estimate population size. This can be used to monitor trends in population size over time.

[√] Habitat use and distribution

If the GPS location of the mist net in which each individual of a certain species was captured is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Mist nets are light weight and easy to set up. • Suitable for surveying open areas where it is usually difficult to capture bats. • The most suitable technique for sampling fruit bats.	• Mist nets should not be operated in Indonesia without a license from a scientific authority. • Mist nets are expensive and can quickly be destroyed if bats become overly entangled. • Requires a high level of skill to release bats entangled in the mist net and handle them safely. • Risk of bat mortality if the nets are not checked frequently enough. • In Southeast Asia, the vast majority of species are rarely captured using mist nets as a large number of insectivorous bats can detect and avoid the nets.

3. Harp Traps

Equipment

- Harp traps
- Field guide of mammals (see references)
- GPS
- Cloth bags
- Head torch
- Data sheets, clipboard and pencil

Description of Protocol

Harp traps are most effective when they are set up across potential flight paths of bats, including forest trails, the entrance of caves or small rivers. Ideally there should be dense vegetation above and on either side of the site chosen to set up the harp trap, otherwise bats will likely fly around the trap. Experience has shown that positioning harp traps randomly usually results in very low capture rates. Traps should be placed approximately 50m apart. In order to improve the efficacy of the trap vegetation can be used to block gaps beneath or to the sides of the traps that may otherwise allow the bats using these flight paths to avoid the traps. Traps should be set up before dusk and checked 2-3 hours after sunset and in the morning at dawn. If capture rate is high harp traps should be checked every 20-30 minutes until the capture rate starts to decrease. When conducting a rapid assessment traps should be moved to a new location every day, as bats quickly learn the trap positions. All bats captured should be transferred to individual cloth bags for identification. For each bat captured, the species name, age, sex, and breeding stage should be recorded. Bats should be released as quickly as possible at the site where they were captured to avoid undue stress to the animals.

Data produced and method of analysis

[√] Species list and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded against the total sampling effort (number of trap nights). The point where the curve plateaus indicates the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of individuals captured by the total sampling effort (trap nights) in that habitat.

[√] Absolute density

If the wings of bats captured are marked and surveys repeated at regular intervals the data can be analysis using MARK or CAPTURE software to estimate population size. This can be used to monitor trends in population size over time

[√] Habitat use and distribution

If the GPS location of the harp trap in which each individual of a certain species was captured is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• This method can be used to estimate absolute density if capture mark recapture methods are used and the data is analysed using distance software. • This method is very effective for capturing insectivorous bats, which account for the majority of bat species in South East Asian forests.	• Harp traps can be difficult to obtain and are cumbersome to transport between survey sites . • Harp traps are not effective for surveying open areas, including oil palm monoculture.

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Table 6. Summary of methods for rapid assessment and monitoring of small mammals

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Box trap	Small terrestrial mammals	All habitat types	Species inventory and richness, relative abundance, absolute density	300-400 trap nights in every habitat type	Ability to identify species, experience of using the equipment	Suitable	Suitable
Mist netting	Fruit bats. Insectivorous bats are rarely caught in mist nets in South East Asia	All habitat types, but most effective in forested habitats, caves	Species inventory and richness, relative abundance, absolute density	Using 3 mist nets for 4 nights, in every habitat type	Ability to identify species, experience of using the equipment	Suitable	Suitable
Harp trap	Insectivorous bats	Forest/scrub, not effective in open habitats	Species inventory and richness, relative abundance, absolute density	16 trap nights (4 days in every habitat type using 4 harp traps)	Ability to identify species, experience of using the equipment	Suitable	Suitable
Recce transect	Squirrels, Otters	All habitat types	Species inventory and richness	N/A	Ability to identify species	Suitable	Suitable
Line Transect Sampling	Squirrels, Otters (close to water)	Habitats with consistent, easy terrain, each transect should be confined to a single habitat type	Species inventory, relative abundance, absolute density	At least 40 sightings of a single species are needed to calculate absolute density, though 60-80 gives better precision. Need at least 20 transects in each habitat type	Ability to identify species, ability to estimate distance	Suitable in some circumstances	Suitable

BIRD

1. Species Inventory

Equipment

- Binoculars
- Field guide for species identification (see references)
- GPS
- Sound recorder (optional)
- Data sheets, clipboard and pencil

Description of Protocol

A simple inventory of the species present within and around the concession can be produced by recording all bird species identified by sound or visual observation. Observations do not need to be confined to a specific sampling area or time period unless the objective is to compare the biodiversity value of different habitats.

Data produced and method of analysis

[√] Species inventory and richness

See above

[√] Relative abundance

The relative abundance of species in certain habitat can be produced by dividing the number of encounters of each species by the total sampling effort.

[X] Absolute density

[√] Habitat use and distribution

If the observer records their GPS location whenever they encounter a particular species this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Simple methodology. • Suitable for surveying any habitat type.	• Data obtained is limited to species presence/absence unless sampling effort is standardised. • Difficult to use this method to compare the biodiversity value of different habitats. • Cryptic and elusive bird species are rarely recorded.

2. MacKinnon Lists

Equipment

- Binoculars
- Field guide for species identification (see references)
- GPS
- Sound recorder (optional)
- Data sheets, clipboard and pencil

Description of Protocol

The observer walks slowly around the study area over an unlimited period of time, recording each new bird species encountered until a fixed number of species have been recorded. The length of each list can be adjusted depending on the bird species richness of the study area. A limit of 20 species is usually appropriate for good quality habitats and 10 species in poor quality habitats. Once the limit for a list has been reached, this process should be repeated until at least 15 lists have been produced. Each species can only be recorded once in each list, however it can be recorded on more than one list. Ideally each list should be composed of encounters from within a single habitat type, rather than a mixture of habitat types. This will allow the species richness or relative abundance of a particular bird species within a specific habitat type to be compared with other habitat types or over time.

Data produced and method of analysis

[√] Species inventory and richness

A species accumulation can be produced by plotting the cumulative number of new species recorded in each list. This curve will reach a plateau when the majority of the species present in a habitat have been recorded. This can be used to compare the species richness between different habitat.

[√] Relative abundance

The relative abundance of each species can be calculated by dividing the number of lists a particular species appears in by the total number of lists from a particular habitat type e.g. a species appears in 6 out of the 10 lists made in a particular habitat type so the relative abundance of that species is 6/10 or 0.6.

[X] Absolute density

[√] Habitat use and distribution

If the observer records their GPS location whenever they encounter a particular species this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Simple methodology. • Rapid method for comparing species richness of different habitats	• If the length of the list is too long it may be difficult to produce a sufficient number of lists in poor quality habitats • Cryptic and elusive bird species are rarely recorded.

3. Line Transect Sampling

Equipment

- Binoculars
- Field guide for species identification (see references)
- GPS
- Sound recorder (optional)
- Data sheets, clipboard and pencil

Description of Protocol

Line transect sampling involves recording all species seen or heard along a pre-defined route. Ideally transects would be positioned randomly to avoid bias but this is not always practical. However, it is important to ensure that transects are placed in locations that are representative of the habitat being surveyed. Transects should be no less than 200-250m apart and should be around 1-2 km in length.

The time and GPS position of the start and finish of each transect should be recorded. The optimal time for walking transects is between half an hour before sunrise and 9am, or late afternoon. Observers should aim to walk at a slow and consistent pace (approx 1 km/ hour). For each species seen or heard, the species name, number of individuals and time of observation should be recorded. If the objective is to estimate population density then the perpendicular distance of the bird from the transect on first sighting should also be recorded. Transects can be either variable distance, where the exact distance of the bird from the transect is estimated, or fixed width, where the birds are assigned to the most appropriate distance band (eg. 0-5m, 5-10m etc) from the transect. Birds flying over the transect should be recorded separately.

Data produced and method of analysis

[√] Species inventory and richness

A species accumulation can be produced by plotting the cumulative number of new species recorded against the sampling effort (eg. Number of transects). This curve will reach a plateau when the majority of the species present in a habitat have been recorded. This can be used to compare the species richness between different habitats .

[√] Relative abundance

The relative abundance of species in a certain habitat can be calculated by dividing the number of encounters of each species by the total sampling effort in that habitat type.

[√] Absolute density

Distance software can be used to estimate absolute density. This can be compared over time to monitor trends if surveys of the same habitat are repeated and sampling effort is kept constant.

[√] Habitat use and distribution

If the GPS location of each species is recorded then this can provide limited information about the distribution of these species within the areas sampled but this should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Can be adapted to almost any habitat type. • Highly suitable for rapid assessments of large areas • Can be used to estimate absolute density	• Errors in distance estimation can result in unreliable estimates of population density • Can be challenging to follow a transect line in habitats where the terrain is difficult

4. Point Transect Sampling

Equipment

- Binoculars
- Field guide for species identification
- GPS
- Sound recorder (optional)
- Data sheets, clipboard and pencil

Description of Protocol

Point Transect Sampling involves recording all of the birds seen and heard when the observer stands at a fixed point for a fixed period of time. If the aim is to estimate population density then only species observed within a circle of a fixed radius from the point should be recorded. The points sampled may be positioned at regular intervals along a transect or randomly within the habitat being surveyed. Each point should be at least 200m apart. 10 minutes is suggested as an appropriate length of time to carry out observations at each point.

The time at which each point count is started and its position (GPS) should be recorded. For each bird seen or heard, the species name, number of individuals and time of observation should be recorded. If distance sampling is being used, then either the actual

distance of the bird from the observer should be recorded, or the area surrounding the point should be divided into concentric circles and each bird observed assigned to the circle of appropriate radius. It is important to make sure that the same individuals are not recorded twice. The optimal time for walking transects is between half an hour before sunrise and 9am, or late afternoon.

Data produced and method of analysis

[√] Species inventory and richness

A species accumulation can be produced by plotting the cumulative number of new species recorded against sampling effort (eg. the number of points). This curve will reach a plateau when the majority of the species present in a habitat have been recorded. This can be used to compare the species richness between different habitats.

[√] Relative abundance

The relative abundance of species in a certain habitat can be calculated by dividing the number of encounters for each species by the total sampling effort in that habitat type.

[√] Absolute density

Distance software can be used to estimate absolute density. This can be compared over time to monitor trends if surveys of the same habitat are repeated and sampling effort is kept constant.

[√] Habitat use and distribution

The presence and absence of species at each of the points can be used as a source of data about the habitat use of this species. This data can be analysed using Presence software to estimate the percentage habitat use. For further detail please see the description of the patch occupancy method in the section on medium and large mammals.

Strengths	Weaknesses
• Can be adapted to almost any habitat type. • Highly suitable for rapid assessments of large areas. • Can be used to estimate absolute density. • Better suited to patchy habitats with difficult terrain and limited access than line transects. • Suitable for detecting inactive birds.	• Risk of double counting individuals. • Not effective for detecting birds that live in open areas. • The observation period is reduced by the time spent moving between points.

5. Mist Netting

Equipment

- Mist nets (mesh size 25 – 30mm)
- Field guide for species identification (see references)
- GPS
- Cloth bags
- Camera (optional)
- Data sheets, clipboard and pencil
- If capture-mark-recapture methods are being used banding pliers and unique numbered bands issued by scientific authority (LIPI/IBBS) will also be required

Description of Protocol

For best results, mist nets should be set up close to fruiting/flowering trees or in gaps in the forest. The most effective time to operate mist nets is between half an hour before sunrise and around 9am, as well as 3 hours before sunset, as this is when birds are most active. Ideally mist nets should be manned constantly. If this is not possible each net must be checked at least every hour to ensure that birds do not become overly entangled in the nets, which may result in death. Captured birds should be transferred into cloth bags to be identified and banded (if applicable). The species name, age, sex and breeding stage should be recorded. Birds should be released as quickly as possible close to the location where they were trapped. Birds that cannot be released before sunset should be released the next morning to avoid disorientation. In order to estimate population size and trends over time it is essential to standardise sampling effort by using the same number, length and mesh size of mist nets in each habitat type and ensuring that they are operated for the same period of time.

Data produced and method of analysis

[√] Species inventory and richness

A species accumulation can be produced by plotting the cumulative number of species recorded against sampling effort (number of mist net hours). This curve will reach a plateau when the majority of the species present in a habitat have been recorded. This can be used to compare the species richness between different habitats.

[√] Relative abundance

The relative abundance of species in a certain habitat can be calculated by dividing the number of individuals captured for each species and dividing it by the total sampling effort in that habitat type (mist net hours).

[√] Absolute density

MARK or CAPTURE software can be used to estimate absolute density. This can be compared over time to monitor trends

[√] Habitat use and distribution

If the GPS location of the mist net in which each individual of a certain species was captured is recorded this can provide limited information about species distribution within the areas sampled but should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• Less reliant on the ability of the observer to identify birds quickly from a distance or by call as individuals are captured, allowing photos to be taken for later identification if necessary. • Ability to capture forest canopy or ground dwelling species that are rarely recorded using methods that rely on seeing or hearing the birds present. • The data collected can be used to estimate population size.	• Mist nets should not be operated in Indonesia without a license from a scientific authority. • Requires a high level of skill to ensure that birds are captured and handled safely. • Time consuming as the net must be manned constantly whilst it is open. • Mist nets are relatively expensive. • This is not a reliable method for surveying aerial birds.

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Table 7. Summary of methods for rapid assessment and monitoring of birds

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Species inventory	All species	Wide variety of habitats	species inventory, relative abundance	N/A	Ability to identify species sighted from a distance or by sound	Highly suitable	Suitable
MacKinnon List	All species	Wide variety of habitats	Species inventory, relative abundance	At least 15 lists per habitat	Ability to identify species sighted from a distance or by sound	Highly suitable	Suitable
Line transect sampling	Mobile , conspicuous birds	Habitats with consistent, easy terrain, each transect should be confined to a single habitat type	Species inventory, absolute density	10At least 40 sightings of a single species though 60-80 gives better precision.	Ability to identify species sighted from a distance or by sound, ability to estimate distance, ability to use distance software	Suitable	Highly suitable
Point transect sampling	Cryptic, skulking birds	Wide variety of habitats but most effective in dense habitats such as forest	Species inventory, absolute density	50 points per habitat, or 80-100 encounters per species	Ability to identify species sighted from a distance or by sound, ability to estimate distance, ability to use distance software	Suitable	Highly suitable
Mist netting	Small, elusive, bird species	Wide variety of habitats	Relative abundance, absolute density, breeding condition	7,200 net hours per habitat	Ability to identify species based on morphology, License to use mist net from scientific authority	Not suitable	Highly suitable

REPTILES AND AMPHIBIANS

1. Visual Encounter Surveys with Timed Searches

Equipment

- Torches
- Field guide for species identification (see references)
- GPS
- Sound recorder (if available)
- Data sheets, clipboard and pencil

Description of Protocol

The observer is free to search any environment or structure that may provide suitable habitats for amphibians or reptiles, such as streams, pools of standing water, holes or underneath decaying logs or large stones. For each species observed and heard the name of the species, time observed, number of individuals and the type of habitat where it was found should be recorded. Care should be taken not to record the same individual twice. If individuals are captured in order to identify them, they should be released as soon as possible at the same site. Although searches do not need to be confined to a specific area, the length of time spent searching a particular site should be standardised (number of person hours) if the aim is to compare the relative abundance of a certain species between sites or over time. Searches can be carried out during the day or night, depending on when the species targeted are most active.

Data produced and method of analysis

[√] Species inventory and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded after each search against sampling effort (person hours). The point where the curve plateaus is the species richness for that habitat.

[√] Relative abundance

Relative abundance species in certain habitat can be produce by dividing species encounter rate by total of effort.

[X] Absolute density

[√] Habitat use and distribution

The GPS locations where a certain species was recorded can be plotted to produce a distribution map for that species within the areas that were sampled but this should not be extrapolated to other areas.

Strengths	Weaknesses
• A rapid, effective and cheap way of surveying a large area. • Requires little equipment	• Burrowing species and canopy species are rarely detected using this method.

2. Line Transects with Visual Encounter Surveys

Equipment

- Torches
- Field guide for species identification (see references)
- GPS
- Sound recorder (if available)
- Data sheets, clipboard and pencil

Description of Protocol

Identify the site to be surveyed and mark the transect, ideally during the day, using a rope marked every 10m by flags labeled with consecutive numbers. It is recommended that transects are at least 200m in length. The area 20m either site of transect is slowly and systematically searched. The amount of time spent searching each transect should be limited (for example to 1 hour) in order to standardize sampling effort. If the transect follows a stream or river, at least one observer should walk in the river, with another observer on each bank. For each frog, lizard or snake observed record the species name, the number of the closest transect marker, the distance of the individual from the transect line (waters edge) and the substrate it was found on (for example, on rock, on leaf of shrub, etc.).

Data produced and method of analysis

[√] Species inventory and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded after each transect against sampling effort (length of transects, number of man hours spent searching or number of transects). The point where the curve plateaus indicates the species richness for that habitat .

[√] Relative abundance

The relative abundance of species in a certain habitat can be produce by dividing the number of encounters of a particular species by total sampling effort.

[√] Absolute density

Distance software can be used to estimate absolute population density. This can be compared over time to monitor trends if surveys of the same habitat are repeated and sampling effort is kept constant.

[√] Habitat use and distribution

If the GPS location of each species is recorded then this can provide limited information about the distribution of this species within the areas sampled but this should not be extrapolated to the whole habitat.

Strengths	Weaknesses
• A cheap, simple and easy method to assess a large area.	• This method may not be suitable to cover the whole range of amphibian and reptile habitats. • Very active species may not be recorded.

3. Quadrat/Patch Sampling

Equipment

- Field guide for species identification (see references)
- GPS
- Data sheets, clipboard and pencil.

Description of Protocol

Quadrats should be laid out either at regular intervals along a transect or randomly within the study site, ideally using brightly coloured rope so that the boundaries are highly visible. 10m x 10m is considered to be a practical size of quadrat to position and search for amphibians and reptiles in tropical forests. The lack of leaf litter and placement of palm fronds make this method impractical for surveying oil palm monoculture. Quadrats should be searched systematically from the edges inwards by removing the leaf litter and turning over logs and stones. For every amphibian or reptile encountered, the species name and the habitat it was found on (eg. Under dead leaves, on log etc) should be recorded. For each quadrat surveyed, the slope, % canopy cover, % leaf litter cover, % herbaceous plants, diameter of trees > 10cm, and the presence of dead logs and climbers should be recorded. Ideally 25-30 quadrats should be searched in each habitat type.

Data produced and method of analysis

[√] Species inventory and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded after each quadrat against sampling effort (number of quadrat). The point where the curve plateaus is the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be produce by dividing the number of encounters of a particular species by the total sampling effort.

[√] Absolute density

Absolute density can be estimated by dividing the number of individuals of a particular species by the total size of the quadrat.

[√] Habitat use and distribution

The species inventory from each location sampled can be used to infer habitat use. Data can be analysed using Presence software to estimate percentage of habitat use. For further information please see the guidance on data analysis for the patch occupancy method in the section on medium-large mammals.

Strengths	Weaknesses
• Very effective for detecting leaf litter species.	• Labour intensive. • Only suitable for leaf litter species.

References

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Table 8. Summary of methods for rapid assessment and monitoring of Reptiles and Amphibians

Method	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Visual Encounter Surveys (with time search)	All terrestrial amphibians and reptiles	Terrestrial, riparian, ponds, forest	Species inventory and richness, relative abundance,	A two hour search per day for 4-6 days in each habitat type	Ability to identify species	Suitable	Suitable
Line transect with VES	All terrestrial amphibians and reptiles except canopy species	Terrestrial, riparian, ponds, forest	Absolute density	15-20 transects in each habitat type	Ability to identify species	Highly suitable	Highly suitable
Quadrat/Patch sampling	Litter frogs and reptiles	Leaf litter on forest floors	Species list and richness, absolute density	25-30 Quadrats in each habitat type	Ability to identify species	Not suitable	Suitable

FISH

1. Live Capture

Equipment

- Appropriate nets or traps (see table 9)
- Field guide for species identification (see references)
- GPS
- Water bucket
- Data sheets, clipboard and pencil

Description of Protocol

Live capture is the most common method used for surveying fish biodiversity. If the purpose of the assessment is to produce a species inventory then a variety of different nets and traps should be used in order to effectively survey the range of habitats present. The most appropriate tool to use in each location depends on the characteristics of the body of water being surveyed. The best nets and traps to use may be those being used by the local fisherman in the area.

If the purpose of the survey is to compare the species richness of different habitats or monitor changes in relative abundance over time it is essential to standardise the survey effort with each tool in each sampling location (the number of nets, the length of time they were active for).

Table 9. List of nets and traps that can be used to assess and monitor fish

Name of net/trap	Characteristics of water bodies suitable for surveying	Protocol
Scoop nets	Vegetated habitats along the edges of streams and rivers, rocky and muddy substrates on the bottom of streams	Use the net to disturb vegetation and rocks. Scoop up the water in the area disturbed and transfer any fish captured to a bucket for identification.
Cast nets	Large fast flowing rivers	These nets are pyramid shaped and operated by throwing them into open areas of water.
Gill nets	Relatively large, deep bodies of water with slow currents	The gill net is deployed by attaching one side to a fixed point, stretching it out across the body of water that will be surveyed, and then securing it to another fixed point. The buoys should be at the top of the net and the lead weights on the bottom. The weight can be varied to adjust the vertical position of the net in the water. The nets should be checked on a regular basis (every few hours or over night) to prevent fish from becoming entangled and dying.
Locally made traps	Standing pools of water, swampy areas and relatively small but deep streams	Traps should be baited (oil palm is a suitable bait), secured and left over night. If used in streams, the opening of the trap should face upstream,

Data produced and method of analysis

[√] Species inventory and richness

Species accumulation curves can be produced for each habitat type to determine the proportion of species present in the habitat (species richness) that are likely to have been identified. This is produced by plotting the cumulative number of new species recorded against sampling effort (eg. number of man hours spent sampling or length of time a net or trap was left in place). The point where the curve plateaus is the species richness for that habitat.

[√] Relative abundance

The relative abundance of species in a certain habitat can be estimated by dividing the number of individuals of a particular species that were captured by the total sampling effort in that habitat type.

[X] Absolute density

[√] Habitat use and distribution

If the GPS location of each species is recorded then this can provide limited information about the distribution of this species within the areas sampled but this should not be extrapolated to the whole habitat.

Name of net/ trap	Strengths	Weaknesses
• **Scoop nets**	• Cheap & easy.	• The efficiency and selectivity of this method is unknown
• **Cast nets**	• Highly portable	• Requires skill to use effectively • Not suitable for water bodies with lots of debris or natural obstructions
• **Gill nets**	• Relatively cheap; very selective as the size of the mesh determines the body size of fish that it will capture	• Effective only for lake and river with little current and the species very mobile.
• **Locally made traps**	• Cheap & easy	• The efficiency and selectivity of this method is unknown

References

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Table 10. Summary of equipment used for rapid assessment and monitoring of fish

Equipment	Target species group	Target habitat type	Type of data produced	Minimum sampling Effort	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Scoop net	Small fish	Shallow water	Species inventory, relative abundance	10 scoops per site sampled	Ability to identify species	Suitable, however a range of different equipment should be used to survey the full range of habitats present	Suitable, however the equipment best suited to capturing the focal species or species group should be used
Cast net	All species	Deep water with lack natural obstruction on the bottom	Species inventory, relative abundance	10 casts of the net per site sampled	Ability to identify species		
Gill net	Mobile fish	Deep water, calm or slow moving	Species inventory, relative abundance	1 day per site sampled,	Ability to identify species		
Seine net	Demersal or pelagic fish	Shallow water with lack of natural obstruction	Species inventory, relative abundance	10 scoops per site sampled	Ability to identify species		
Electro fishing	All species	All type of shallow water	Species inventory, relative abundance	1 hour per site sampled	Ability to identify species		

VEGETATION

1. Quadrat Method

Equipment

- Tape measure (>20 m)
- GPS
- Rope to mark out quadrats
- Range finder (optional)
- Chalk (for marking trees)
- Data sheets, clipboard and pencil.

Description of Protocol

Quadrats can either be positioned randomly within the target habitat or regularly along a transect. Alternating between placing the quadrat on the left and right hand side of the transect is an effective way of distributing the quadrats. The size of the quadrat sampled depends on the type of vegetation being assessed. Appropriate sizes are 20m x 20m for trees (>20cm dbh), 10m x 10m for poles (>10cm dbh), 5m x 5m for saplings (>1 m high and <10cm dbh) and 1m x 1m for seedlings (<1 m high). Density is measured by counting the number of individuals within each vegetation category that fall within the quadrat. For every adult tree and pole present record the species name (if possible), the diameter at breast height (dbh) and the height. For saplings and seedlings it is only necessary to record the species name and height. A process for determining whether trees that fall on the edge of the quadrat should be counted must be decided before sampling begins.

Data produced and method of analysis

Different formulas should be used to obtain different types of data:

$$\textbf{Relative Density} = \frac{\#\ individual\ \ of\ \ a\ \ Species}{Total\ \ \#\ \ of\ \ individual\ \ (all\ \ spec ies)} \times 100$$

$$\textbf{Total Density} = \frac{Number\ \ of\ \ tree}{Sampling\ \ area}$$

$$\textbf{Species Density} = \frac{Relative\ \ density\ \ of\ \ a\ \ species\ \times\ Density\ \ (all\ \ spec ies)}{100}$$

$$\textbf{Dominance} = Density\ of\ \ a\ \ species \times Average\ Basal\ \ Area\ \ for\ \ species$$

$$\textbf{Relative Dominance} = \frac{Dominance}{Total\ dominance\ of\ \ all\ \ species} \times 100$$

$$\textbf{Frequency} = \frac{Number\ of\ \ plot\ at\ \ which\ \ species\ occurs}{Number\ all\ \ plot} \times 100$$

Strengths	Weaknesses
• Relatively easy methodology	• Labour intensive. • Difficult to carry out in areas with rough terrain.

2. Distance Methods (Plot-less)

Equipment

- Tape measure (>20m)
- GPS
- Range finder (optional)
- Chalk (for marking trees)
- Data sheets, clipboard and pencil

Description of Protocol

These methods involve sampling a fixed number of trees within an unlimited area. There are several different variations on this method:

A. Point centered quarter method

Points within the habitat being sampled are selected either randomly or systematically, for example at regular intervals along a transect. Divide the area around each point into four quadrants. This can be done by drawing a perpendicular line to the transect, or using a compass bearing. In each quadrant, measure the distance to the nearest tree. For each tree, record the diameter at breast height (dbh) and height. If possible, record the species name of the tree. However, accurate identification of tree species in Indonesia is very difficult and will require an experienced botanist.

B. Nearest individual method

This is a simplified version of the point centered quarter method which involves measuring the nearest tree to the sampling point, without dividing the area surrounding the point into quadrants.

Data produced and analysis

Different formulas should be used to obtain different types of data:

$$\textbf{Relative Density} = \frac{\#\ individual\ of\ a\ Species}{Total\ \#\ of\ individual\ (all\ species)} \times 100$$

$$\textbf{Total Density} = \frac{1}{(Mean\ point\text{-}to\text{-}plant\ distance)^2}$$

$$\textbf{Species Density} = \frac{Relative\ density\ of\ a\ species \times Density\ (all\ species)}{100}$$

Dominance = *Density of a species × Average Basal Area for species*

$$\textbf{Relative Dominance} = \frac{Dominance}{Total\ dominance\ of\ all\ species} \times 100$$

$$\textbf{Frequency} = \frac{Number\ of\ plot\ at\ which\ species\ occurs}{Number\ all\ plot} \times 100$$

Strengths	Weaknesses
• Less time consuming and labour intensive than quadrats • Suitable for rapid assessments of large areas	• Not suitable for habitats with sparse vegetation. • Not possible to combine surveys of different growth stages eg. Trees, saplings etc

References

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Table 11. Summary of methods used for rapid assessments and monitoring of vegetation

Method	Vegetation variable	Target habitat type	Minimum sampling effort	Type of data produced	Type of expertise required	Suitability for rapid assessment	Suitability for long term monitoring
Quadrat method	Tree density, species richness	Forest in general	Quadrats should ideally cover 10% of the area of interest	absolute density, species richness	species identification	Suitable	Highly suitable
Distance method (plot-less)	Tree density	Forest in general, but not suitable for open woodland	50 points minimum per habitat type	absolute density, species richness	species identification	Suitable	Suitable

USEFUL LINKS/RESOURCES

Species Conservation Status

Website for the Convention on International Trade in Endangered Species of Wild Flora and Fauna

Link: www.cites.org/

Website for the IUCN Red List of Threatened Species

Link: www.iucnredlist.org/

Website of Burung Indonesia, which contains information about the conservation status and habitat requirements of birds in Indonesia.

Link: www.burung.org/

Website for Arkive, contains information about the conservation status, distribution, ecology and habitat of a wide range of species

Link: www.arkive.org/

Website containing information about mammals, birds, reptiles, amphibians and fish in South East Asia. Includes Papua.

Link: www.ecologyasia.com/

Guidance on field survey methods for a range of taxa

Website of the Royal Geographic Society. Contains information regarding survey techniques for several taxa.

Link: www.rgs.org/OurWork/Publications/EAC+publications/

Website of Tropical Ecology and Monitoring Network. Contains protocols for monitoring vegetation and various vertebrate taxa, as well as data management.

Link: www.teamnetwork.org/en/protocols

Mammals

A guide to the tracks of the mammals of Western Indonesia Produced by the School of Environmental Conservation Management, Ciawi, Indonesia, 1983.

Link: www.rhinoresourcecenter.com/pdf_files/118/1180259204.pdf

Website containing information about mammals in Papua

Link: www.mammals-of-papua.webs.com/

Website of the Kalimantan Bat Conservation Project

Link: www.webspace.qmul.ac.uk/mstruebig/Training.htm

Birds

Website containing information regarding the current conservation status of birds all over the world, including Indonesia.

Link: www.birdlife.org/datazone/species/search

Bird sounds from South Asia website. Search for and download recordings of bird calls from Indonesia, including Sumatra and Kalimantan.

Link: www.xeno-canto.org/asia/

Contains a large collection of photographs of birds found in the Oriental region. The database can be searched by Scientific or English names.

Link: www.orientalbirdimages.org/

Reptiles & Amphibians

Website of the Asian Turtle Conservation Network. Contains information regarding the distribution of Asian turtles.

Link: www.asianturtlenetwork.org

Website of the IUCN/SCC Tortoise and Freshwater Turtle Specialist Group. Contains up to date information about the conservation status of these species.

Link: www.iucn-tftsg.org/

Website containing information about the turtles and crocodiles of Borneo

Link: www.arbec.com.my/crocodilesturtles/

Turtles of the World website. Contains information about how to identify different species of turtles from around the world, their distribution, habitat and ecology.

Link: www.nlbif.eti.uva.nl/bis/turtles.php

Fish

Biofresh data portal. Contains a searchable database of data regarding the distribution of freshwater species.

Link: www.data.freshwaterbiodiversity.eu/

Search engine containing general information about fish

Link: www.fishbase.org

Data management and analysis

Estimate S software. Available for free download. Useful for analyzing species richness and diversity.

Link: www.viceroy.eeb.uconn.edu/estimates

Camera Base software. A Microsoft access database add in available for free download that can be used to manage and analyse data from camera traps

Link: www.atrium-biodiversity.org/tools/camerabase/

Distance software. Available for free download. Includes tutorials about how to conduct distance analysis to estimate population density. (Current version 9)

Link: www.ruwpa.st-and.ac.uk/distance

Presence software. Available for free download. Includes a user manual and worked examples of how to conduct occupancy analysis.

Link: http://137.227.242.23/software/presence.html

Mark software. Available for free down. Includes explanation of how to analyse capture mark recapture data to estimate population density.

Link: www.warnercnr.colostate.edu/~gwhite/mark/mark.htm

The High Conservation Value Approach

HCV Resource Network website. The HCV Toolkit for Indonesia is available for download.

Link: www.hcvnetwork.org/

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APPENDIX 1: HCV Species (Criteria 1.2)

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
Mammals																		
1	Cercopithecidae	*Macaca pagensis*	Pagai Island Macaque	Beruk Mentawai, Bokkoi	CR				E	1.2	1	0	0	Frugivorous, forages in fig trees and sometimes roams coconut plantations for food. Inhabits primary and disturbed forest, preferred habitat is primary riverine coastal swamp forest. Found in groups of between 5 to 25 individuals.	1	0	Recce transect, Line transect sampling	Line transect sampling
2	Cercopithecidae	*Presbytis chrysomelas*	Sarawak Surili	Kokah	CR					1.2	0	1	0	Folivorous, inhabits swamp and lowland forests, as well as mangroves.	1	0	Recce transect, Line transect sampling	Line transect sampling
3	Cercopithecidae	*Simias concolor*	Pig-tailed Langur	Bekantan Mentawai, Simakobu	CR	I	P		E	1.2	1	0	0	Folivorous, semi terestrial, inhabits swamp forests and lowland rainforests, as well as primary forests on the hillsides of the interior region of Mentawai.	1	0	Recce transect, Line transect sampling	Line transect sampling
4	Felidae	*Panthera tigris ssp. sumatrae*	Sumatran Tiger	Harimau Sumatera	CR	I			E	1.2	1	0	0	Carnivorous, main diet consists of medium to large ungulates including wild boar and deer. Its primary habitat is primary and secondary lowland forest, but it is also found in mountainous regions. Its home range is approximately 150—300km^2 for males and 50—100km^2 for females. Most active during the day, but also known to be active at night, particularly at dawn and dusk.	1	0	Camera trapping, Patch occupancy	Camera trapping, Patch occupancy
5	Macropodidae	*Dendrolagus mayri*	Wondiwoi Tree-kangaroo	Kangguru pohon Wondiwoi	CR					1.2	0	0	1	Inhabits mossy montane forests. Only known from a single speciment which was collected in 1928. Its ecology remains	-	-	Recce transect, Line transect sampling	Line transect sampling

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
														unknown.				
6	Muridae	*Uromys boeadii*	Biak Giant Rat	Keneta Biak	CR				E	1.2	0	0	1	Collected in 1963 in Biak and its ecology remains unknown but it is thought to inhabit moist tropical forests	-	-	Box traps	Box traps
7	Muridae	*Uromys emmae*	Emma's Giant Rat	Keneta Emma	CR				E	1.2	0	0	1	Found in Owi Island in the Paidaido Islands east of Supiori-Biak. Its ecology remain unknown but it is thought to inhabit tropical moist forest	-	-	Box traps	Box traps
8	Phalangeridae	*Spilocuscus rufoniger*	Black Spotted Cuscus	Kuskus bohal	CR		P			1.2	0	0	1	Wide, patchy distributed in the northern part of papua from sea level to 1200 masl. Threatened by over hunting and sensitive to human disturbance	-	-	Recce transect, Line transect sampling	Line transect sampling
9	Phalangeridae	*Spilocuscus wilsoni*	Blue Eyed Spotted Cuscus	Kuskus Tutul Bermata Biru	CR		P		E	1.2	0	0	1	Endemic to Biak and Supiori in Cendrawasih bay. Its ecology remains unknown.	-	-	Recce transect, Line transect sampling	Line transect sampling
10	Rhinocerotidae	*Dicerorhinus sumatrensis*	Sumatran Rhinoceros	Badak Sumatera	CR	I	P			1.2	1	1	0	Herbivorous, main diet fruits, bamboo, leaves, twigs and bark. Inhabits tropical and montane moss forests, occasionally occurs at forest margins and in secondary forest. Spends most of its time wallowing in pools of rainwater during the day, more active at night. Feeds before dawn and sunset. Home range approx. 1000 ha for females and 5000 ha for males. Occurs to over 2500 asl.	1	0	Camera trapping, Patch occupancy	Camera trapping
11	Tachyglossidae	*Zaglossus attenboroughi*	Sir David's Long Beaked Echidna	Ekidna moncong panjang	CR	II			E	1.2	0	0	1	Nocturnal species, inhabits Cyclops mountain. Occurs 1600asl. Not recorded since 1961	-	-	Recce transect, Line transect sampling	Line transect sampling

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
12	Tachyglossidae	*Zaglossus bartoni*	Eastern Long Beaked Echidna	Ekidna mocong panjang timur	CR	II			E	1.2	0	0	1	The largest monotreme, widespread through out the central mountains of New Guinea . It occurs at elevations up to 4150 asl	-	-	Recce transect, Line transect sampling	Line transect sampling
13	Tachyglossidae	*Zaglossus bruijnii*	Western Long Beaked Echidna	Nokdiak Nata Fem	CR	II	P			1.2	0	0	1	Found from sea level to 2500 masl. Restricted to Vogelkop Peninsula, salawati, banata and waigo islands. on the northern part of papua. Not recorded since 1980, main diet is worms.	-	-	Line transect sampling	Line transect sampling
Birds																		
14	Cuculidae	*Carpococcyx viridis*	Sumatran Ground Cuckoo	Tohtor Sumatera	CR			RR	E	1.2	1	0	0	Omnivorous. Diet consists mainly of invertebrates, reptiles and small mammals found on the forest floor (based on study in captivity). Inhabits lower montane forest from 800-1300 masl. Population estimate = 0.05-0.1 Individuals km²/2500 km²Ground dweller. Endemic to Sumatra	1	0	Camera trapping	Camera trapping
15	Threskiornitidae	*Pseudibis davisoni*	White-Shouldered Ibis	Ibis karau	CR		P			1.2	1	0	0	Omnivorous. Diet consists of forest floor invertebrates, reptiles and small mammals. Ground dweller. Inhabits lower montane forest from 800-1300 masl.	1	0	Camera trapping	Camera trapping
16	Columbidae	*Columba argentina*	Silvery Wood-pigeon	Merpati-hutan Perak	CR			RR		1.2	1	1	0	Frugivorous, restricted range, inhabits mangroves, woodland and coconut groves in the lowlands and hills. Found Sumatra and Borneo. Wanders seasonally or disperses in response to food availability.	0	0	MacKinnon List in forested areas along the coastline	Line transect sampling

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
17	Muscicapidae	*Cyornis ruckii*	Rueck's Blue Flycatcher	Sikatan Aceh	CR	II	P	RR		1.2	1	0	0	Only specimen collected in Aceh in Secondary forest, ecology is unknown. Not recorded since 1918 likely to be migratory present Jan—April	0	1	Mistnet, Line transect sampling	Mistnet, Line transect sampling
18	Fregatidae	*Fregata andrewsi*	Christmas Island Frigatebird	Cikalang Christmas	CR	I	P		E	1.2	1	1	1	Seabird, endemic breeding on Christmas island, found in many parts of Indonesia. 1171 breeding pairs.	0	0	MacKinnon List	MacKinnon List
19	Threskiornithidae	*Pseudibis davisoni*	White Shouldered Ibis	Ibis karau	CR		P			1.2	0	1	0	Remaining population in Indonesia found in East Kalimantan. Diet mainly consists of inverterbrates, lizards, milipedes. Breeding season September to December. Builds nests in tall trees, around 30 - 40m above ground level. Found near water bodies.	0	0	Recce transect or Line transect sampling along river	Line transect sampling along river
Rerptiles & Amphibians																		
20	Cheloniidae	*Eretmochelys imbricata*	Hawksbill turtle	Penyu sisik	CR	I	P			1.2	1	1	1	Aquatic. Globally distributed. Migratory in open oceans and shallow seas except to deposit eggs on sandy in beaches.	1	0	total count on the nesting beach	Total counts on beaches used for nesting
21	Geoemydidae	*Batagur baska*	Four toed terrapin, Batagur, River terrapin		CR	II				1.2	1	0	0	Purely aquatic. Inhabits rivers, estuaries and mangrove forest, sometime wanders upstream	0	1	Visual encounter survey along waterbody	Line transect sampling with VES along rivers
22	Geoemydidae	*Batagur borneoensis*	Painted Batagur, Painted Terrapin, Saw-jawed Terrapin, Three-striped Batagur	Beluku	CR	II				1.2	1	1	0	Inhabits estuaries, mangrove creeks and other tidal areas	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
23	Crocodylidae	*Crocodylus siamensis*	Siamese Crocodile	Buaya air tawar	CR	II	P			1.2	0	1	0	Carnivorous, inhabits lowland wetlands with slow moving water including swamps, rivers and lakes. Breeds during the rainy season, clutches 20-80 eggs	1	0	Recce transect or Line transect sampling along rivers at night using spotlight to find its glittering eyes	Line transect sampling
24	Bufonidae	*Bufo sumatranus*	Sumatran Toad	-	CR				E	1.2	1	0	0	Aquatic, inhabits small streams with clear water in secondary forest	0	1	Visual encounter survey	Line transects with Visual Encounter Surveys
Fish																		
25	Pristidae	*Pristis microdon*	Largetooth Sawfish	Hiu gergaji	CR					1.2	1	1	0	Occurs near the mouth of rivers and in freshwater lakes throughout its range	0	0	Live capture, Seine net	Live capture, Seine net
26	Pristidae	*Pristis zijsron*	Narrowsnout Sawfish, Long comb sawfish	Hiu gergaji	CR					1.2	0	1	0	Inhabits muddy bottom habitats in estuaries, coastal lakes and sometimes inshore marine waters up to 40 m deep. Diet mainly consists of slow-moving shoaling fish such as mullet, molluscs and small crustaceans	0	0	Live capture, Seine net	Live capture, Seine net
Vegetation																		
27	Anacardiaceae	*Mangifera campnospermoides*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
28	Dipterocarpaceae	*Anisoptera curtisii*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
29	Dipterocarpaceae	*Dipterocarpus applanatus*	-	-	CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method
30	Dipterocarpaceae	*Dipterocarpus baudii*	-	-	CR		P			1.2	1	0	0	-	-	-	Distance method	Quadrat method
31	Dipterocarpaceae	*Dipterocarpus concavus*	-		CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method
32	Dipterocarpaceae	*Dipterocarpus coriaceus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method

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33	Dipterocarpaceae	*Dipterocarpus cornutus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
34	Dipterocarpaceae	*Dipterocarpus costulatus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
35	Dipterocarpaceae	*Dipterocarpus elongatus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
36	Dipterocarpaceae	*Dipterocarpus eurynchus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
37	Dipterocarpaceae	*Dipterocarpus fagineus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
38	Dipterocarpaceae	*Dipterocarpus fusiformis*	-	-	CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method
39	Dipterocarpaceae	*Dipterocarpus glabrigemmatus*	-	-	CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method
40	Dipterocarpaceae	*Dipterocarpus globosus*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
41	Dipterocarpaceae	*Dipterocarpus gracilis*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
42	Dipterocarpaceae	*Dipterocarpus grandiflorus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
43	Dipterocarpaceae	*Dipterocarpus hasseltii*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
44	Dipterocarpaceae	*Dipterocarpus kerrii*	-	-	CR		P			1.2	1	0	0	-	-	-	Distance method	Quadrat method
45	Dipterocarpaceae	*Dipterocarpus kunstleri*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
46	Dipterocarpaceae	*Dipterocarpus lowii*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
47	Dipterocarpaceae	*Dipterocarpus rigidus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
48	Dipterocarpaceae	*Dipterocarpus semivestitus*	-	-	CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method
49	Dipterocarpaceae	*Dipterocarpus tempehes*	-	-	CR		P			1.2	0	1	0	-	-	-	Distance method	Quadrat method

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50	Dipterocarpaceae	*Dipterocarpus validus*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
51	Dipterocarpaceae	*Dryobalanops aromatica*		-	CR		P			1.2	1	1	0	Found in mixed dipterocarp forests on deep humic yellow sandy soils. A heavy hardwood sold under the trade name Kapur.	-	-	Distance method	Quadrat method
52	Dipterocarpaceae	*Dryobalanops fusca*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
53	Dipterocarpaceae	*Dryobalanops keithii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
54	Dipterocarpaceae	*Hopea bancana*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
55	Dipterocarpaceae	*Hopea beccariana*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
56	Dipterocarpaceae	*Hopea bilitonensis*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
57	Dipterocarpaceae	*Hopea coriacea*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
58	Dipterocarpaceae	*Hopea ferruginea*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
59	Dipterocarpaceae	*Hopea kerangasensis*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
60	Dipterocarpaceae	*Hopea mengerawan*	-	-	CR					1.2	1	1	0	Found from sea-level to 1650 masl. Found in evergreen or seasonal, semi-evergreen forests. It mainly occurs within the main canopy or understorey, rarely as an emergent tree.	-	-	Distance method	Quadrat method
61	Dipterocarpaceae	*Hopea micrantha*	-	-	CR					1.2	0	1	0	Found in heath forest	-	-	Distance method	Quadrat method
62	Dipterocarpaceae	*Hopea montana*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
63	Dipterocarpaceae	*Hopea nervosa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
64	Dipterocarpaceae	*Hopea nigra*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
65	Dipterocarpaceae	*Hopea nutans*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
66	Dipterocarpaceae	*Hopea ovoidea*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
67	Dipterocarpaceae	*Hopea sangal*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
68	Dipterocarpaceae	*Hopea semicuneata*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method

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69	Dipterocarpaceae	*Hopea sphaerocarpa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
70	Dipterocarpaceae	*Hopea wyatt-smithii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
71	Dipterocarpaceae	*Parashorea aptera*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
72	Dipterocarpaceae	*Parashorea lucida*	-	-	CR					1.2	1	1	0	Found in mixed dipterocap forests on clay and clay soils	-	-	Distance method	Quadrat method
73	Dipterocarpaceae	*Parashorea macrophylla*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
74	Dipterocarpaceae	*Parashorea malaanonan*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
75	Dipterocarpaceae	*Shorea acuminata*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
76	Dipterocarpaceae	*Shorea acuminatissima*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
77	Dipterocarpaceae	*Shorea acuta*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
78	Dipterocarpaceae	*Shorea almon*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
79	Dipterocarpaceae	*Shorea asahii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
80	Dipterocarpaceae	*Shorea balangeran*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
81	Dipterocarpaceae	*Shorea blumutensis*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
82	Dipterocarpaceae	*Shorea conica*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
83	Dipterocarpaceae	*Shorea cordata*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
84	Dipterocarpaceae	*Shorea dealbata*	-	-	CR					1.2	1	1	0	Mostly found in heath forest on white sand terraces, as emergent trees (up to 30 m)	-	-	Distance method	Quadrat method
85	Dipterocarpaceae	*Shorea elliptica*	-	-	CR					1.2	0	1	0	Found in mixed lowland dipterocarp forest	-	-	Distance method	Quadrat method
86	Dipterocarpaceae	*Shorea falciferoides*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
87	Dipterocarpaceae	*Shorea foxworthyi*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
88	Dipterocarpaceae	*Shorea gibbosa*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
89	Dipterocarpaceae	*Shorea guiso*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
90	Dipterocarpaceae	*Shorea hopeifolia*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method

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91	Dipterocarpaceae	*Shorea hypochra*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
92	Dipterocarpaceae	*Shorea hypoleuca*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
93	Dipterocarpaceae	*Shorea inaequilateralis*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
94	Dipterocarpaceae	*Shorea inappendiculata*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
95	Dipterocarpaceae	*Shorea induplicata*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
96	Dipterocarpaceae	*Shorea isoptera*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
97	Dipterocarpaceae	*Shorea johorensis*	-	-	CR					1.2	1	1	0	Typically occurs as an emergent tree and can reach up to 65 m.	-	-	Distance method	Quadrat method
98	Dipterocarpaceae	*Shorea kunstleri*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
99	Dipterocarpaceae	*Shorea lamellata*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
100	Dipterocarpaceae	*Shorea lepidota*	-	-	CR		P			1.2	1	0	0	-	-	-	Distance method	Quadrat method
101	Dipterocarpaceae	*Shorea leptoderma*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
102	Dipterocarpaceae	*Shorea longiflora*	-	-	CR					1.2	0	1	0	Mostly found in lowland rainforest	-	-	Distance method	Quadrat method
103	Dipterocarpaceae	*Shorea longisperma*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
104	Dipterocarpaceae	*Shorea lumutensis*	-	-	CR					1.2	1	0	0	Mostly occur as sub canopy to emergent tree in small patches in dry coastal hill dipterocarp forest, usually above 100 masl.	-	-	Distance method	Quadrat method
105	Dipterocarpaceae	*Shorea macrantha*	-	-	CR		P			1.2	1	1	0	-	-	-	Distance method	Quadrat method
106	Dipterocarpaceae	*Shorea macrobalanos*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
107	Dipterocarpaceae	*Shorea materialis*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
108	Dipterocarpaceae	*Shorea mujogensis*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
109	Dipterocarpaceae	*Shorea myrionerva*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
110	Dipterocarpaceae	*Shorea ochrophloia*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
111	Dipterocarpaceae	*Shorea pachyphylla*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
112	Dipterocarpaceae	*Shorea palembanica*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method

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113	Dipterocarpaceae	*Shorea pallidifolia*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
114	Dipterocarpaceae	*Shorea peltata*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
115	Dipterocarpaceae	*Shorea platycarpa*	-	-	CR					1.2	1	1	0	Restricted to swamp forest,can reach 40 m height	-	-	Distance method	Quadrat method
116	Dipterocarpaceae	*Shorea polyandra*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
117	Dipterocarpaceae	*Shorea pubistyla*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
118	Dipterocarpaceae	*Shorea resinosa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
119	Dipterocarpaceae	*Shorea revoluta*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
120	Dipterocarpaceae	*Shorea richetia*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
121	Dipterocarpaceae	*Shorea rugosa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
122	Dipterocarpaceae	*Shorea sagitata*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
123	Dipterocarpaceae	*Shorea seminis*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
124	Dipterocarpaceae	*Shorea singkawang*	-	-	CR		P			1.2	1	0	0	-	-	-	Distance method	Quadrat method
125	Dipterocarpaceae	*Shorea slootenii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
126	Dipterocarpaceae	*Shorea smithiana*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
127	Dipterocarpaceae	*Shorea sumatrana*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
128	Dipterocarpaceae	*Shorea superba*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
129	Dipterocarpaceae	*Shorea symingtonii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
130	Dipterocarpaceae	*Shorea xanthophylla*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
131	Dipterocarpaceae	*Vatica brunigii*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
132	Dipterocarpaceae	*Vatica cauliflora*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
133	Dipterocarpaceae	*Vatica chartacea*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
134	Dipterocarpaceae	*Vatica compressa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
135	Dipterocarpaceae	*Vatica globosa*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
136	Dipterocarpaceae	*Vatica havilandii*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
137	Dipterocarpaceae	*Vatica maingayi*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
138	Dipterocarpaceae	*Vatica obovata*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method

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139	Dipterocarpaceae	*Vatica pentandra*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
140	Dipterocarpaceae	*Vatica ridleyana*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
141	Dipterocarpaceae	*Vatica rotata*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
142	Dipterocarpaceae	*Vatica sarawakensis*	-	-	CR					1.2	0	1	0	-	-	-	Distance method	Quadrat method
143	Dipterocarpaceae	*Vatica soepadmoi*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
144	Dipterocarpaceae	*Vatica teysmanniana*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
145	Dipterocarpaceae	*Vatica venulosa*	-	-	CR					1.2	1	1	0	-	-	-	Distance method	Quadrat method
146	Dipterocarpaceae	*Vatica venulosa (simalurensis)*	-	-	CR					1.2	1	0	0	-	-	-	Distance method	Quadrat method
147	Nepenthaceae	*Nepenthes clipeata*	-	-	CR					1.2	0	1	0	Recorded from Mount Kelam, a granite cliff in Kalimantan. Main ditribution probably between 600-800 masl.	-	-	Distance method	Quadrat method

APPENDIX 2: HCV Species (Criteria 1.3)

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
Mammals																		
1	Cercopithecidae	*Macaca fascicularis*	Crab-eating Macaque, Cynomolgus Monkey, Long-tailed Macaque	Monyet ekor panjang	LC	II				1.3	1	1	0	Oportunistic omnivore, eating a variety of animals, plants, and other materials. Semi-arboreal, inhabits a wide range of habitats, but mostly found in disturbed forest. In some places it is considered to be a pest since it raids crops. It is a very social animal and lives in groups of	0	0	Recce transect, Line transect sampling	Line transect sampling

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
														between 5 and up to 60 individuals.				
2	Cercopithecidae	*Macaca nemestrina*	Southern Pig-tailed Macaque, Pig-tailed Macaque, Pigtail Macaque, Sundaland Pig-tail Macaque, Sunda Pig-tailed Macaque	Beruk	VU	II				1.3	1	1	0	Frugivorous, terestrial with ability to exploit canopy resources, prefers dense forest although it can exploit disturbed forest in lowland areas, Sometimes hunted for food	0	0	Recce transect, Line transect sampling	Line transect sampling
3	Cercopithecidae	*Presbytis melalophos*	Sumatran Surili, Mitred Leaf Monkey	Simpai	EN	II				1.3	1	0	0	Folivorous, its diet mainly consists of seeds, fruit, flowers and roots. It eats over 55 different plant species. Inhabits primary forest but adapted to forest disturbance. It prefers to live in the forest understory, but can sometimes be found in the highest elevations of the rainforest canopy	1	0	Recce transect, Line transect sampling	Line transect sampling
4	Cercopithecidae	*Presbytis rubicunda*	Maroon Leaf Monkey, Maroon Langur, Maroon Sureli, Red Leaf Monkey	Kelasi, Lutung Merah	LC		P			1.3	0	1	0	Folivorous, its diet consists of approx 40% young leaf parts, 30% seeds, 19% whole fruits, and 11% flowers. Arboreal, moves through the forest quadrupedally. It is mainly found in primary and secondary lowland forests, not above 2,000 masl.	1	0	Recce transect, Line transect sampling	Line transect sampling
5	Cercopithecidae	*Presbytis frontata*	White-fronted Langur, White-faced Langur, White-fronted Leaf Monkey	Lutung Dahi Putih	VU	II	P		E	1.3	0	1	0	Inhabits primary lowland rainforest, and riverine and hill forest, but occasionally found in secondary and plantation habitats. Its population density is around 1.5-1.7 individuals/km	1	0	Recce transect, Line transect sampling	Line transect sampling

No	Family	Scientific name	English Name	Indonesia Name	IUCN	CITES Appendix	PROTECTED	Restricted range	ENDEMIC	HCV	SUMATRA	BORNEO	PAPUA	Ecology and Habitat	Key species	Indicator species	Recommended method of rapid assessment	Recommended method of long term monitoring
6	Cercopithecidae	*Presbytis hosei*	Hose's Langur, Gray Leaf Monkey, Grey Leaf Monkey, Hose's Leaf Monkey	Lutung Banggat	VU	II	P		E	1.3	0	1	0	Folivorous, diet consists mainly of fruits, seeds and flowers, as well as the eggs and nestlings of birds. It occurs in lowland to hill dipterocarp rainforest from sea-level up to approximately 1,000 masl.	1	0	Recce transect, Line transect sampling	Line transect sampling
7	Cercopithecidae	*Trachypithecus auratus*	Javan Lutung, Ebony Leaf Monkey, Javan Langur	Lutung Budeng	VU	II	P			1.3	1	1	0	Folivorous. Inhabits mangroves, beaches, freshwater swamp forests, ever-wet lowland and hill forests, dry deciduous forests, and montane forest up to 3,000-3,500 masl	1	0	Recce transect, Line transect sampling	Line transect sampling
8	Cercopithecidae	*Nasalis larvatus*	Proboscis Monkey, Long-nosed Monkey	Bekantan	EN	I			E	1.3	0	1	0	Folivorous and frugivorous. Inhabits riparian-riverine forests and coastal lowland forests, including mangroves, peat swamp, and freshwater swamp forest	1	0	Recce transect, Line transect sampling	Line transect sampling along rivers
9	Hylobatidae	*Hylobates agilis*	Agile Gibbon, Dark-handed Gibbon	Ungko	EN	I	P			1.3	1	0	0	Frugivorous but reported to consume immature leaves and insects as well. Highly arboreal. Occurs at highest densities in dipterocarp-dominated forests but also ranges from swamp and lowland forests to hill, submontane, and montane forests around 1400 masl. Active during the day, its average home range is 29 ha	1	0	Recce transect sampling, Triangulation of calls	Line transect sampling, triangulation of calls
10	Hylobatidae	*Hylobates syndactylus*	Siamang	Siamang	EN	I	P			1.3	1	0	0	Folivorous and frugivorous, it eats at least 160 species of plants, from vines to woody plants. Inhabits primary and secondary semi-deciduous and tropical evergreen forest from lowland until up to 1500 masl. Average home range is 23 ha. Monogamous and teritorial species.	1	0	Recce transect sampling, Triangulation of calls	line transect sampling
11	Hylobatidae	*Hylobates lar*	White-handed gibbon	Owa serudung	EN	I	P			1.3	1	0	0	Found in Northern Sumatra in evergreen, semi-evergreen, and mixed evergreen-deciduous forest. Frugivorous, diet consists mainly of figs, young shoots, leaves, some flowers, and insects	1	0	Recce transect sampling, Triangulation of calls	line transect sampling

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12	Hylobatidae	*Hylobates albibarbis*	Bornean White-bearded Gibbon, Bornean Agile Gibbon	Owa ungko	EN		p			1.3	0	1	0	Frugivorous, the species is found in primary, secondary and selectively logged tropical evergreen forests, as well as peat swamp forest	1	0	Recce transect sampling, Triangulation of calls	line transect sampling
13	Hylobatidae	*Hylobates muelleri*	Müller's Bornean Gibbon, Bornean Gibbon, Bornean Grey Gibbon, Borneo Gibbon, Grey Gibbon, Müller's Gibbon	Owa Kelawait, klampiau	EN	I	P		E	1.3	0	1	0	Frugivorous, diet consists mainly of fruit with high sugar content, immature leaves and insects. Inhabits primary, secondary and selectively logged tropical lowland evergreen forests up to 1700 masl. Highly arboreal and active during day. Average home range is around 36 ha.	1	0	Recce transect sampling, Triangulation of calls	line transect sampling
14	Pongidae	*Pongo pygmaeus*	Bornean Orangutan	Orangutan kalimantan	EN		p		E	1.3	0	1	0	Arboreal, although sometime travels along the ground. Its diet consists mainly of fruit, flowers and insects. Its inhabits tropical and subtropical moist broadleaf forests in the Bornean lowlands as well as mountainous areas up to 1,500 metres masl. Female home ranges are between 250 - 300ha, while the male home range is thought to be between 500 - 700ha	1	0	Nest counts, camera trapping	Nest counts, camera trapping
15	Pongidae	*Pongo abelii*	Sumatran Orangutan	Orangutan sumatera	EN	I	P		E	1.3	1	0	0	Exclusively arboreal. Diet consists mainly of fruit, flowers and insects. Active during the day and builds nests from fresh leaves. Female home ranges are between 150 to 400 ha. The true extent of male home range size is not fully known, although this is estimated to be around 2,500 ha.	1	0	Nest counts	Nest counts
16	Hystricidae	*Hystrix brachyura*	Malayan Porcupine, Himalayan Crestless Porcupine, Common Porcupine	Landak Raya	LC	III	P			1.3	1	1	0	Omnivorous, diet consists mainly of tubers, roots, insects and carrion. Inhabits a wide range habitats from forest to agricultural. Nocturnal.	0	0	Camera trapping, patch occupancy	Camera trapping

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17	Lorisidae	*Nycticebus coucang*	Greater Slow Loris, Slow Loris, Sunda Slow Loris	Kukang bukang, Kukang Sumatera	VU	I	P			1.3	1	1	0	Frugivorous, but will also eat insects, leaves, and bird eggs. Almost entirely arboreal. It occurs in primary and secondary lowland forest, gardens, and plantations, prefers forest edges. Nocturnal	1	0	Recce transects, Line transect sampling, Community Interviews	Line transect sampling
18	Lorisidae	*Nycticebus menagensis*	Bornean Slow Loris	Kukang Kalimantan	VU	I	P			1.3	1	1	0	Considered insectivorous, but has been observed feeding on gum from an unidentified liana. Arboreal. Occurs in low densities in primary and secondary lowland forest, gardens and plantations up to 100 masl. Nocturnal. In Sumatra found in Bangka and Belitung island	1	0	Recce transects, Line transect sampling, Community Interviews	Line transect sampling
19	Tarsiidae	*Tarsius bancanus*	Horsfield's Tarsier, Horsfield's Tarsier, Western Tarsier	Tarsius, tangkasi	VU	II	P			1.3	1	0	0	Carnivorous, mainly eats insects such as beetles and butterflies. Inhabits lowland primary and secondary forest. Nocturnal. It marks its territory with scents from urine and glandular secretions on a substrate while scratching the surface with its hind limb toe claws. Density has been calculated variously between 15-20 individuals/km^2 with two studies reporting up to 80 individuals/km^2.	1	0	Recce transects, Line transect sampling, Community Interviews	Line transect sampling
20	Macropodidae	*Dendrolagus inustus*	Grizzled Tree-kangaroo	Kangguru pohon wakera	VU	II				1.3	0	0	1	Distributed between 100-1400 masl in Northern Papua including the islands of Yapen, Waigeo, Misool, Salawati, and possibly Batanta.	1	0	Recce transect, Line transect sampling	Line transect sampling
21	Macropodidae	*Phalanger mimicus*	Southern Common Cuscus, Australian Cuscus	Kuskus Australia, Kuskus Abu-Abu, Phalanger Abu-Abu, atau To-ili	LC	II				1.3	0	0	1	Found in the southern lowlands of the island of New Guinea and possibly in the Aru islands.	1	0	Recce transect, Line transect sampling	Line transect sampling
22	Macropodidae	*Dendrolagus goodfellowi*	Goodfellow's tree kangaroo, Ornate tree kangaroo	Kangguru pohon hias	EN		P		E	1.3	0	0	1	Distribution restricted to montane tropical forest up to 2860 masl; previously found in lowland areas. Endemic to New Guinea.	1	0	Recce transect, Line transect sampling	Line transect sampling

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23	Macropodidae	*Dendrolagus stellarum*	Seri's Tree Kangaroo	-	VU		P		E	1.3	0	0	1	Inhabits primary upper montane tropical forests in the middle of Papua. It naturally occurs at low densities.	1	0	Recce transect, Line transect sampling	Line transect sampling
24	Macropodidae	*Dendrolagus ursinus*	Vogelkop Tree Kangaroo	Kangguru pohon Hemena	VU	II	P		E	1.3	0	0	1	Inhabits montane forest from 1000-2500 masl, though it has been recorded in lowland forest. Its distribution is restricted to the Vogelkop Peninsula, and possibly the Fak Fak Peninsula of Papua Province, Indonesia. Uncommon species.	1	0	Recce transect, Line transect sampling	Line transect sampling
25	Macropodidae	*Dendrolagus mbaiso*	Dingiso	Kangguru pohon Mbaiso	EN					1.3	0	0	1	Restricted to Tembagapura and Kwiyawagi mountains. Found between 2700-3500 masl. Known to be very docile. Very rare.	1	0	Recce transect, Line transect sampling	Line transect sampling
26	Macropodidae	*Dorcopsis luctuosa*	Grey Dorcopsis	Walabi kelabu	VU				E	1.3	0	0	1	Distributed in the Southern part of Papua. Inhabits primary and secondary tropical forests from sea level to 400 masl, but capable of adapting to inhabit disturbed habitats.	1	0	Recce transect, Line transect sampling	Line transect sampling
27	Macropodidae	*Thylogale browni*	New Guinea Pademelon	Pelandu Nugini	VU		P		E	1.3	0	0	1	Distributed in the northern and north-eastern part of Papua. Inhabits primary and secondary tropical moist forest from sea level until 2100 masl, but capable of adapting to disturbed habitats.	1	0	Recce transect, Line transect sampling	Line transect sampling
28	Macropodidae	*Thylogale brunii*	Dusky pademelon, Dusky wallaby	Pelandu Aru	VU		P			1.3	0	0	1	Distributed in the Trans Fly region and Aru and Kai islands in Southern Papua. Only occurs in lowland primary tropical moist forest, forest-savanna mosaic and degraded forest at sea level.	1	0	Recce transect, Line transect sampling	Line transect sampling
29	Felidae	*Prionailurus bengalensis*	Leopard Cat	Kucing hutan	LC	II	P			1.3	1	1	0	Carnivorous. Inhabits a wide range of habitats including shrub forest and successional grassland from lowlands until 3,000 masl. Common in plantations.	0	1	Camera trapping	Camera trapping

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30	Felidae	*Prionailurus planiceps*	Flat-headed Cat	Kucing kepala datar, Kucing Tandang	EN	I	P			1.3	1	1	0	Carnivorous, diet consists mainly of fish and shrimp, but it has been suggested that this species is able to persist in oil palm plantations by preying on rats. Inhabits lowland areas, mostly around swampy forest, lakes and streams.	0	1	Camera trapping,	Camera trapping
31	Felidae	*Neofelis diardi*	Sunda Clouded Leopard, Enkuli Clouded Leopard, Sunda Islands Clouded Leopard, Sundaland Clouded Leopard	Macan Dahan	VU	I	P			1.3	1	1	0	Carnivorous, diet consists of medium to large mammals and fish. In Sumatra it is mostly found in hilly forests ; in Borneo mostly in lowland forest. Density is estimated at 9 individuals per 100 km^2 in Borneo and 2.9 per 100 km^2 in Sumatra.	1	1	Camera trapping, patch occupancy	Camera trapping
32	Felidae	*Pardofelis badia*	Borneo Bay Cat, Bay Cat, Bornean Bay Cat, Bornean Marbled Cat	Kucing merah	EN	II	P		E	1.3	0	1	0	Carnivorous. Inhabits lowland forest including swampy areas. There are very few records of this species.	1	1	Camera trapping	Camera trapping
33	Felidae	*Pardofelis marmorata*	Marbled Cat	Kucing batu	VU	I	P			1.3	1	1	0	Carnivorous, known to eat rats, squirrels, birds and frogs. Arboreal. The majority of records are from lowland tropical forests, however it has also been recorded in hill forests. Mostly active during the night, dusk and dawn, although recent findings indicate that this species is also active during the day.	1	1	Camera trapping,	Camera trapping
34	Felidae	*Pardofelis temminckii*	Asiatic golden cat, Golden cat, Temminck's cat	Kucing emas	NT	I				1.3	1	0	0	Primarily found in forest habitats from dry deciduous, subtropical evergreen and tropical rainforests. Densities may be roughly similar to Neofelis diardii. Not primarily nocturnal.	1	1	Camera trapping	Camera trapping
35	Ursidae	*Helarctos malayanus*	Sun Bear, Malayan Sun Bear	Beruang madu	VU	I	P			1.3	1	1	0	Omnivorous. Found mainly in evergreen lowland rainforest. Use plantations, but no evidence of survival without nearby forest.	1	0	Camera trapping, patch occupancy	Camera trapping

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36	Viverridae	*Arctictis binturong*	Binturong, Bearcat, Palawan Binturong	Binturung	VU	III	P			1.3	1	1	0	Diet consists mainly of fruit and small animals (birds, rodents etc). Primarily arboreal. Nocturnal and crepuscular (active at dawn and dusk)	1	0	Camera trapping, patch occupancy	Camera trapping
37	Viverridae	*Prionodon linsang*	Banded Linsang	Linsang	LC	II	P			1.3	1	1	0	Carnivorous, diet consists mainly of birds, tree rats and snakes. Inhabits secondary and primary forest up to 2400 masl. Nocturnal. Nowhere common.	0	1	Camera trapping, recce transects, patch occupancy	Camera trapping
38	Viverridae	*Cynogale bennettii*	Otter-civet, Otter Civet, Sunda Otter Civet	Musang air	EN	II	P			1.3	1	1	0	Diet consists mainly of fish, molluscs, small mammals and birds. Semi-aquatic, mostly found close to swampy areas, but also recorded in lowland dry forest.	0	1	Camera trapping, recce transects, patch occupancy	Camera trapping
39	Viverridae	*Hemigalus derbyanus*	Banded Civet, Banded Palm Civet	Musang belang	VU	II	P			1.3	1	1	0	Insectivorous. Primary habitat is primary lowland forest but it is also found in disturbed forest.	0	1	Camera trapping, recce transects, patch occupancy	Camera trapping
40	Mustelidae	*Mydaus javanensis*	Sunda Stink-badger, Indonesian Stink Badger, Malayan Stink Badger, Malay Badger Or Teledu, Sunda Stink Badger	Teledu sigung	LC		P			1.3	1	1	0	Carnivorous, diet consists mainly of eggs, carrion, insects and worms. Mostly found in secondary forest and disturbed habitats. Diurnal.	0	0	Camera trapping, recce transects, patch occupancy	Camera trapping
41	Mustelidae	*Aonyx cinerea*	Asian Small-clawed Otter, Oriental Small-clawed Otter, Small-clawed Otter	Sero ambrang	VU	II				1.3	1	1	0	Diet consists mainly of crabs. Inhabits wetland areas.	0	1	Camera trapping, recce transects, patch occupancy	Camera trapping
42	Mustelidae	*Lutrogale perspicillata*	Smooth-coated Otter, Indian Smooth-coated Otter	Berang-berang wregul	VU	II				1.3	1	1	0	Diet consists mainly of fish, but supplements diet with crabs, molluscs, frogs, rats and birds. Aquatic, mostly inhabits wetlands including big rivers, peatswamp forests, rice fields and lakes.	0	1	Camera trapping, recce transects, patch occupancy	Camera trapping

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43	Hipposideridae	*Hipposideros ridleyi*	Ridley's Leaf-nosed Bat, Ridley's Roundleaf Bat, Singapore Roundleaf Horseshoe Bat	Barong hidung-lebar	VU					1.3	1	1	0	Insectivorous. Inhabits primary lowland forest. Roosts in fallen trees and deep hollows during the day.	0	1	Harp traps	Harp traps
44	Hipposideridae	*Coelops robinsoni*	Lesser tailess roundleaf bat	Barong ekor buntung malaya	VU					1.3	0	1	0	Insectivorous. Inhabits primary and tall secondary forests.	0	1	Harp traps	Harp traps
45	Mollosidae	*Mormopterus doriae*	Sumatra Mastiff bat		DD					1.3	1	0	0	Insectivorous. Only known from northern Sumatra. Not recorded since 1907.	0	1	Mist netting	Mist netting
46	Vespertilionidae	*Murina rozendaali*	Gilded tube nosed bat	Ripo Rozendaal	VU					1.3	0	1	0	Insectivorous. Likely dependent on lowland forest, caught over streams.	0	1	Harp traps	Harp traps
47	Vespertilionidae	*Murina aenea*	Bronze Tube-nosed Bat	Ripo Perunggu	VU					1.3	0	1	0	Insectivorous, inhabits lowland dipterocarp forest and also heath forest.	0	1	Harp traps	Harp traps
48	Vespertilionidae	*Nyctimene draconilla*	Lesser Tube-nosed Bat, Dragon Tube-nosed Bat, Dragon Tube-nosed Fruit Bat	Paniki kecil	DD				E	1.3	0	0	1	Frugivorous. Mostly found close to freswater swamps or rivers. Recorded from sea level up to 100 m asl on either side of the highlands of central Guinea.	0	1	Mist netting	Mist netting
49	Vespertilionidae	*Kerivoula flora*	Flores Woolly Bat	Lenawai flores	VU					1.3	0	1	0	Insectivorous. Inhabits primary lowland forest. Distribution potentially disjunct.	0	1	Harp traps	Harp traps
50	Vespertilionidae	*Hesperoptenus tomesi*	Tomes' false serotine	Bangkalit besar	VU					1.3	1	1	0	Inhabits lowland forest, considered to be forest dependent.	0	1	Mist netting	Mist netting
51	Pteropodidae	*Rousettus spinalatus*	Bare backed Rousette	Nyap Biasa	VU					1.3	1	1	0	Frugivorous. Inhabits primary and tall secondary forest. Very rare.	0	1	Mist netting	Mist netting
52	Pteropodidae	*Megaerops wetmorei*	White collared fruit bat	Codot kerah putih	VU					1.3	0	1	0	Frugivorous. Only known from primary and lightly disturbed lowland forests.	0	1	Mist netting	Mist netting
53	Pteropodidae	*Pteropus vampyrus*	Large Flying Fox	Kalong besar	NT	II				1.3	1	1	0	Frugivorous. Forages over forested and non-forested areas. Roosts hanging from trees in large colonies.	0	0	Community Interviews	Community Interviews
54	Pteropodidae	*Pteropus hypomelanus*	Island Flying Fox	Kalong kecil	LC	II				1.3	1	1	0	Frugivorous. Forages over forested and non-forested areas. Roosts hanging from trees in large colonies. Island species.	0	0	Community Interviews	Community Interviews
55	Pteropodidae	*Pteropus melanotus*	Blyth's flying fox	Kalong enggano	VU	II				1.3	1	0	0	Frugivorous. Found on Mentawai islands off west coast of Sumatra.	0	0	Community Interviews	Community Interviews

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56	Pteropodidae	*Pteropus pohlei*	Geelvink Bay flying fox, Geelvink Bay fruit bat	Kalong manguai	EN	II			E	1.3	0	0	1	Restricted to West Papuan islands of Numfoor, Rani, and Yapen. Inhabits lowland areas in primary tropical forest and disturbed forest.	1	0	Mist netting	Mist netting
57	Pteropodidae	*Syconycteris hobbit*	Moss-forest blossom bat	Codot Bunga Gunung	VU				E	1.3	0	0	1	It is restricted to higher altitude montane forests between 1,860 and 2,700 masl on the Central Cordillera, Papua, Indonesia.	1	0	Mist netting	Mist netting
58	Muridae	*Maxomys rajah*	Rajah Sundaic Maxomys, Rajah Spiny Rat, Brown Spiny Rat	Tikus duri coklat	VU					1.3	1	1	0	Inhabits primary and disturbed lowland evergreen forests, mostly found on the ground but will occasionally climb trees. Not found outside forested areas.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
59	Muridae	*Maxomys whiteheadi*	Whitehead's Rat, Whitehead's Sundaic Maxomys, Whitehead's Spiny Rat	Tikus Duri Ekor Pendek	VU					1.3	1	1	0	Inhabits lowland forests up to 2100 masl (although mostly lowland species) and paddy fields close to forest.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
60	Muridae	*Haeromys pusillus*	Sundaic Haeromys, Lesser Ranee Mouse	Tikus Ranai Kecil	VU					1.3	0	1	0	Inhabits lowland forest. Rare; possibly only remaining in Borneo.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
61	Muridae	*Pogonomelomys bruijnii*	Lowland Brush Mouse	Pogonolomis salawati	NT				E	1.3	0	0	1	Arboreal species. Presumed to inhabit lowland tropical moist forests. Specimens have been collected from tree-hollows, and it is suspected that this species is dependent on the availability of tree hollows.	0	0	Recce transects, Line transect sampling, Community Interviews	Line transect sampling
62	Muridae	*Niviventer cremoriventer*	Sundaic Arboreal Niviventer, Dark-tailed Tree Rat	Tikus-Pohon Ekor-Polos	VU					1.3	1	1	0	Inhabits primary forest, but tolerant to forest disturbance. Found on the forest floor and in the canopy.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
63	Muridae	*Mallomys gunung*	Alpine Woolly Rat	Naikmanung Adimbo	EN				E	1.3	0	0	1	Occurs in the alpine grasslands of the Maokop section of Central Cordillera Mountain, Papua, Indonesia. It has only recorded from 3,500 to 4,050 masl.	0	0	Box traps (Kasmin)	Box traps (Kasmin)

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64	Muridae	*Paraleptomys rufilatus*	Northern Hydromyine,Northern Rat, Northern Water Rat	Tikus-air Pinggang-merah	EN				E	1.3	0	0	1	Found in the Cyclops mountains. Inhabits high mountains of mossy and non-mossy tropical montane forest from between 1200-1700 masl.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
65	Muridae	*Rattus richardsoni*	Richardson's Mountain Rat	-	VU				E	1.3	0	0	1	Found in the Central Cordillera Mountains of Papua Province. Inhabits high mountains from 3,225 to 4,500 masl within areas with glacial cover.	0	0	Box traps (Kasmin)	Box traps (Kasmin)
66	Sciuridae	*Exilisciurus exilis*	Least pygmy squirrel, Plain pygmy squirrel	Bajing-Kerdil Dataran-Rendah	DD				E	1.3	0	1	0	Inhabits lowlands and lower hill forest. Endemic to Borneo.	0	0	Recce transects	Line transect sampling
67	Sciuridae	*Exilisciurus whiteheadi*	Tufted Pygmy Squirrel, Whitehead's pygmy squirrel	Bajing-Kerdil Telinga-Kuncung	LC				E	1.3	1	1	0	Inhabits lower sub-montane forest up to 3,000 masl, but has also been recorded in peat swamp forest. Endemic to Borneo.	0	0	Recce transects	Line transect sampling
68	Sciuridae	*Rheithrosciurus macrotis*	Tufted Ground Squirrel	Bajing-Tanah Ekor-Tegak	VU				E	1.3	0	1	0	Inhabits primary lowland forest; potentially elsewhere. Endemic to Borneo.	0	0	Recce transects	Line transect sampling
69	Sciuridae	*Ratufa affinis*	Pale Giant Squirrel, Cream-coloured Giant Squirrel, Giant Squirrel	Jelarang Bilalang	NT	II				1.3	1	1	0	Inhabits lower montane, secondary and dipterocarp forest. Arboreal; dependent on closed canopy. Tolerates plantations. Density 1.3-5.18 individuals per 100km^2.	0	0	Recce transects	Line transect sampling
70	Sciuridae	*Lariscus insignis*	Three-striped Ground Squirrel	Bajing-Tanah Bergaris-Tiga	LC		P			1.3	1	1	0	Inhabits primary evergreen lowland forest until up to 1500 masl. Diurnal.	0	0	Recce transects	Line transect sampling
71	Sciuridae	*Petinomys genibarbis*	Whiskered Flying Squirrel	Bajing-Terbang Berjambang	VU					1.3	1	1	0	Inhabits lowland primary and secondary forest. May also occur on plantations. Arboreal and Nocturnal.	0	0	Recce transects	Line transect sampling
72	Sciuridae	*Petinomys vordermanni*	Vordermann's Flying Squirrel	Bajing-Terbang Pipi-Jingga	VU				E	1.3	0	1	0	Likely prefers lowland forest. Nocturnal species and arboreal.	0	0	Recce transects	Line transect sampling
73	Sciuridae	*Pteromyscus pulverulentus*	Smoky Flying Squirrel	Bajing-Terbang Berbedak	EN					1.3	1	1	0	Arboreal and relies on hollows in tall trees in undisturbed primary forest. Nocturnal species.	0	0	Recce transects	Line transect sampling
74	Sciuridae	*Rheithrosciurus macrotis*	Tufted Ground Squirrel	Bajing-Tanah Ekor-Tegak	VU				E	1.3	0	1	0	Inhabits primary forest in hilly areas although probably occurs elsewhere.	0	0	Recce transects	Line transect sampling

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75	Tupaiidae	*Tupaia glis*	Common Treeshrew, Common Tree Shrew	Tupai akar	LC	II	-			1.3	1	1	0	Inhabits old primary lowland forest, but possibly tolerant of disturbance. Diurnal.	0	0	Recce transects	Line transect sampling
76	Soricidae	*Chimarrogale phaeura*	Bornean Water Shrew, Borneo Water Shrew, Sunda Water Shrew	Cucurut-Air Borneo	EN				E	1.3	0	1	0	Diet consists mainly of invertebrates. Semi-aquatic. Endemic to Borneo. Prefers moist habitat in montane forest.	0	0	Recce transects	Line transect sampling
77	Manidae	*Manis javanica*	Sunda Pangolin, Malayan Pangolin	Trenggiling	EN	II	P			1.3	1	1	0	Insectivorous. Inhabits primary and secondary forest, sometimes found in gardens and plantations. Nocturnal.	0	0	Recce transects	Line transect sampling
78	Cervidae	*Muntiacus muntjak*	Southern Red Muntjac, Barking Deer, Bornean Red Muntjac, Indian Muntjac, Red Muntjac, Sundaland Red Muntjac	Kijang	LC		P			1.3	1	1	0	Herbivorous; diet mainly consists of fruits, buds, tender leaves, flowers, herbs and young grass. Inhabits lowland forest , from natural forest to degraded forest, forest edge and coffee plantations. Active during the day. Densities shown between 3.2-25 individuals per 100 km^2.	1	0	Camera trapping, Recce transects, Community Interviews	Camera trapping, Line transect sampling
79	Cervidae	*Rusa unicolor*	Sambar, Sambar Deer	Rusa	VU		P			1.3	1	1	0	Herbivorous. Found in a wide range of habitats including natural and degraded forest. It is considered to be mostly nocturnal. Densities estimated between 0.89—10.7 individuals per km^2.	1	0	Camera trapping, Recce transects, Community Interviews	Camera trapping, Line transect sampling
80	Elephantidae	*Elephas maximus*	Asian Elephant, Indian Elephant	Gajah Sumatra	EN	I	P			1.3	1	1	0	Herbivorous. Inhabits a wide range of habitats including grassland, tropical evergreen forest, semi-evergreen forest, moist deciduous forest, dry deciduous forested and dry thorn forest, in addition to cultivated and secondary forests and scrublands in lowlands until up to 3,000 masl. Its home range is around 53 km^2 for females and up to 600 km^2 for males.	1	0	Camera trapping, patch occupancy	Camera trapping

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81	Suidae	*Sus barbatus*	Bearded Pig, Western Bearded Pig	Babi berjenggot	VU					1.3	1	1	0	Diet consists mainly of roots, fungi, invertebrates in soil and rotting wood, small vertebrates, turtle eggs, carrion. Inhabits a wide range of habitats, but occurs naturally in primary forest.	1	0	Camera trapping, Patch occupancy	Camera trapping
82	Bovidae	*Bos javanicus*	Banteng, Tembadau	Banteng	EN		P			1.3	0	1	0	Herbivorous. Diet consists mainly of grasses, sedges, herbs, bamboo, as well as the leaves, fruits, flowers, bark, and young branches of woody shrubs and trees including palms. Inhabits lowland forest up to at least 2,100 masl. Active during the day in areas with little human disturbance, but may become nocturnal in areas with heavy human disturbance.	1	0	Camera trapping, Patch occupancy	Line transect sampling
83	Tragulidae	*Tragulus napu*	Greater Oriental Chevrotain, Balabac Chevrotain, Greater Mousedeer, Larger Malay Chevrotain, Larger Mousedeer, Napu	Pelanduk napu	LC		P			1.3	1	1	0	Herbivorous. Occurs in lowland forest, mainly in riverine areas up to 1000 masl. Considered to be nocturnal but often active during the day. Densities: 32-72 individuals/100 km^2 in primary habitat and 6-16 individuals/100 km^2 in logged.	1	0	Camera trapping, Patch occupancy	Camera trapping
84	Tragulidae	*Tragulus kanchil*	Lesser Oriental Chevrotain, Lesser Malay Chevrotain, Lesser Mousedeer, Mouse Deer	Pelanduk Kancil	LC		P			1.3	1	1	0	Herbivorous. Inhabits lowland habitats up to 600 masl. Densities estimated at 21-39 individuals/100km^2 in primary forest and 10-15 individuals/100km^2 in selectively logged areas.	0	0	Camera trapping, Patch occupancy	Camera trapping
Birds																		
85	Accipitridae	*Megatriorchis doriae*	Doria's Goshawk	Elangalap Doria	NT	II	P		E	1.3	0	0	1	Forest species, sometimes found in mangrove and semi-deciduous forests up to 1400 masl. Endemic to New Guinea.	1	0	Mackinnon Lists	Line transect sampling
86	Accipitridae	*Accipiter fasciatus*	Brown Goshawk	Elangalap Coklat	LC	II	P			1.3	0	0	1	Large range across Indonesia.	1	0	Mackinnon Lists	Line transect sampling

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87	Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk	Elangalap Kelabu	LC	II	P			1.3	0	0	1	Large range. Inhabits forest environments including mangroves above the tide-line.	1	0	Mackinnon Lists	Line transect sampling
88	Accipitridae	*Accipiter poliocephalus*	Grey-headed Goshawk	Elangalap Pucat-sosonokan	LC	II	P			1.3	0	0	1	Feeds on small lizards and arthropods. Inhabits forest interior and edge habitats. Widely distributed on the islands around Papua, from coastal habitats up to 1500 masl.	1	0	Mackinnon Lists	Line transect sampling
89	Accipitridae	*Accipiter soloensis*	Chinese Sparowhawk	Elangalap Cina	LC	II	P			1.4	1	1	1	Migratory, visits Indonesia in October. Inhabits forest, shrubland, and wetlands as well as disturbed habitats.	1	0	Mackinnon Lists	Line transect sampling
90	Accipitridae	*Accipiter trivirgatus*	Crested Goshawk	Elang-alap jambul	LC	II	P			1.3	1	1	0	Widely distributed in lowland, montane, and disturbed forests at low density.	1	0	Mackinnon Lists	Line transect sampling
91	Accipitridae	*Aquila audax*	Wedge-tailed Eagle	Rajawali Ekor-baji	LC	II	P			1.3	0	0	1	Diet consists mainly of small mammals. Widely distributed. Inhabits lowland and montane forests, shrubland and grassland.	1	0	Mackinnon Lists	Line transect sampling
92	Accipitridae	*Aquila gurneyi*	Gurney's Eagle	Rajawali Kuskus	NT	II	P			1.3	0	0	1	Inhabits lowland forest including swamp forest and coastal areas up to 1500 masl.	1	0	Mackinnon Lists	Line transect sampling
93	Accipitridae	*Aviceda subcristata*	Pacific Baza	Baza Pasifik	LC	II	P			1.3	0	0	1	Diet consists mainly of snakes, small vertebrates and frogs. It is found from lowlands up to 1,250 masl. Wide range.	1	0	Mackinnon Lists	Line transect sampling
94	Accipitridae	*Butastur indicus*	Grey-faced Buzzard	Elang Kelabu	LC	II	P			1.3	1	1	1	Migratory bird. Inhabits a wide range of lowland habitats up to 1500 masl.	1	0	Mackinnon Lists	Line transect sampling
95	Accipitridae	*Elanus caeruleus*	Black-shouldered Kite	Elang Tikus	LC	II	P			1.3	1	1	1	Raptor. Widely distributed in lowland forest, rice paddy fields and pastures at sea level. Tolerates heavy disturbance.	1	0	Mackinnon Lists	Line transect sampling
96	Accipitridae	*Haliastur indus*	Brahminy Kite	Elang Bondol	LC	II	P			1.3	1	1	1	Opportunistic scavenger, diet includes fish and crustacea. Raptor. Widely distributed in lowland forest, mostly found close to water bodies.	1	0	Mackinnon Lists	Line transect sampling
97	Accipitridae	*Haliastur sphenurus*	Whistling Kite	Elang Siul		II	P			1.3	0	0	1	Diet consists mainly of small mammals, birds, fish, reptiles, amphibians, crustaceans, insects and carrion. Widely distributed from lowlands up to 1,400 masl.	1	0	Mackinnon Lists	Line transect sampling

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98	Accipitridae	*Harpyopsis novaeguineae*	Papuan Eagle	Rajawali Papua	VU	II				1.3	0	0	1	Diet consists mainly of mammals, mostly marsupials and rats, but also pigs and dogs. Widespread in papua from lowlands until high mountains.The feather is used as part of traditional ceremonies	1	0	Mackinnon Lists	Line transect sampling
99	Accipitridae	*Henicopernis longicauda*	Long-tailed Honey Buzzard	Elang Ekor-panjang		II	P			1.3	0	0	1	Widely distributed from lowlands up to 3,000 masl.	1	0	Mackinnon Lists	Line transect sampling
100	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	Elang Kecil		II	P			1.3	0	0	1	Widely distributed at low densities from lowlands up to 1,950 masl.	1	0	Mackinnon Lists	Line transect sampling
101	Accipitridae	*Ichthyophaga humilis*	Lesser Fish Eagle	Elangikan Kecil	NT	II	P			1.3	1	1	0	Raptor. Inhabits undisturbed forests from lowlands up to 1,000 masl	1	0	Mackinnon Lists	Line transect sampling
102	Accipitridae	*Ictinaetus malayensis*	Black Eagle	Elang Hitam	LC	II	P			1.3	1	1	0	Raptor. Widely distributed in lowland forests at low densities	1	0	Mackinnon Lists	Line transect sampling
103	Accipitridae	*Macheiramphus alcinus*	Bat Hawk	Elang Kelelawar		II	P			1.3	1	1	1	Inhabits lowland forest up to 1,000 masl. Active at dusk.	1	0	Mackinnon Lists	Line transect sampling
104	Accipitridae	*Milvus migrans*	Black Kite	Elang Paria		II	P			1.4	1	1	1	Migratory. Uses man made buildings to wait for prey	1	0	Mackinnon Lists	Line transect sampling
105	Accipitridae	*Spilornis cheela*	Crested Serpent Eagle	Elangular Bido	LC	II	P			1.3	1	1	0	Diet consists mainly of reptiles and small mammals. Raptor.	1	0	Mackinnon Lists	Line transect sampling
106	Accipitridae	*Spizaetus cirrhatus*	Changeable Hawk Eagle	Elang brontok	LC	II	P			1.3	1	1	0	Diet consists mainly of birds, bats and lizards. Widely distributed in lowland forests up to 500 masl. Raptor. Sedentary. Breeds from November to February.	1	0	Mackinnon Lists	Line transect sampling
107	Accipitridae	*Spizaetus nanus*	Wallace's Hawk Eagle	Elang Wallace	VU	II	P			1.3	1	1	0	Diet consists mainly of small birds, bats and reptiles. Widely distributed in lowland forests up to 1,000 masl. Raptor.	1	0	Mackinnon Lists	Line transect sampling
108	Falconidae	*Falco longipennis*	Australian Hobby	Alapalap Australia		II	P			1.4.	0	0	1	Migrates from Australia to lowland habitats of Southern Papua	1	0	Mackinnon Lists	Line transect sampling
109	Falconidae	*Falco severus*	Oriental Hobby	Alapalap Macan		II	P			1.3	1	1	1	Widely distributed from lowlands up to1,500 masl	1	0	Mackinnon Lists	Line transect sampling
110	Falconidae	*Falco tinnunculus*	Common Kestrel	Alapalap Erasia	LC	II	P			1.4.	1	1	0	Diet consists mainly of small mammals, lizards and large insects. Migrates to lowland areas of Northern Kalimantan	1	0	Mackinnon Lists	Line transect sampling

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111	Falconidae	*Microhierax fringillarius*	Black-thighed Falconet	Alapalap Capung	LC	II	p			1.3	1	1	1	Diet consists mainly of large insects, small birds, and lizards. Widely distributed in lowland forests. Raptor.	1	0	Mackinnon Lists	Line transect sampling
112	Pandionidae	*Pandion haliaetus*	Osprey	Elang Tiram		II	P			1.3	1	1	1	Diet consists mainly of fish and snakes. Distributed in coastal areas, and along inland rivers and lakes	1	0	Mackinnon Lists	Line transect sampling
113	Phalacrocoracidae	*Anhinga melanogaster*	Oriental Darter	Pecuk ular	NT		P			1.3	0	1	1	Fisciporous. inhabits shallow inland wetlands including lakes, rivers, swamps and reservoirs	0	0	MacKinnon Lists in wetlands including swamps and lakes	MacKinnon Lists
114	Ardeidae	*Ardeola speciosa*	Javan Pond Heron	Blekok Sawah	LC		P			1.3	1	1	1	Fisciporous. Mostly found in lowlands close to wetlands including paddy fields, fish ponds, mangrove forests and marshes. Nests in colonies.	0	0	Mackinnon Lists	MacKinnon Lists
115	Ardeidae	*Egretta eulophotes*	Chinese Egret	Kuntul Cina	VU		P			1.3	1	1	1	Fisciporous. Mostly found in coastal areas. Migratory.	0	0	MacKinnon Lists in coastal wetlands	MacKinnon Lists
116	Alcedinidae	*Alcedo euryzona*	Blue-banded Kingfisher	Rajaudang Kalung-biru	VU		P			1.3	1	1	0	Diet consists mainly of small fish and lizards. Inhabits lowland forests along rivers and streams	0	0	MacKinnon Lists	Line transect sampling
117	Alcedinidae	*Alcedo meninting*	Blue-eared Kingfisher	Rajaudang Meninting	LC		P			1.3	1	1	0	Inhabits primary and secondary lowland forest, mostly found close to water bodies	0	0	MacKinnon Lists	Line transect sampling
118	Alcedinidae	*Ceyx rufidorsa*	Oriental Dwarf Kingfisher	Udang Punggung-merah	LC		P			1.3	1	1	0	Mostly found in lowlands	0	0	MacKinnon Lists	Line transect sampling
119	Alcedinidae	*Halcyon smyrnensis*	White-throated Kingfisher	Cekakak belukar	LC		P			1.3	1	1	0	Diet consists mainly of fish. Found close to waterbodies	0	0	MacKinnon Lists	Line transect sampling
120	Alcedinidae	*Lacedo pulchella*	Banded Kingfisher	Cekakak Batu	LC		P			1.3	1	1	0	Inhabits primary and secondary lowland forest, mostly found close to water bodies	0	0	MacKinnon Lists	Line transect sampling
121	Alcedinidae	*Pelargopsis capensis*	Stork-billed Kingfisher	Pekaka Emas	LC		P			1.3	1	1	0	Inhabits primary and secondary lowland forest, mostly found close to water bodies	0	0	MacKinnon Lists	Line transect sampling

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123	Bucerotidae	*Anthracoceros albirostris*	Oriental Pied Hornbill	Kangkareng Perut-putih	LC	II	P			1.3	1	1	0	Frugivorous, frequently visits fig trees. Inhabits secondary and logged over forests, mostly found in lowland areas	1	1	MacKinnon Lists	Line transect sampling
124	Bucerotidae	*Anthracoceros malayanus*	Black Hornbill	Kangkareng Hitam	NT		P			1.3	1	1	0	Frugivore, frequently visits fig trees. Inhabits secondary and logged over forests, mostly found in lowlands below 500 masl	1	1	MacKinnon Lists	Line transect sampling
125	Bucerotidae	*Berenicornis comatus*	White-crowned Hornbill	Enggang Jambul	NT	II	P			1.3	1	1	0	Frugivorous. Inhabits the top and middle canopy of good quality forests. Mostly found in lowland areas	1	1	MacKinnon Lists	Line transect sampling
126	Bucerotidae	*Buceros bicornis*	Great Hornbill	Enggang papan	NT	I	P			1.3	1	0	0	Frugivorous. Inhabits the canopy of primary and logged over forests. Mostly found in lowland areas.	1	1	MacKinnon Lists	Line transect sampling
127	Bucerotidae	*Buceros rhinoceros*	Rhinoceros Hornbill	Enggang Cula	NT	II	P			1.3	1	1	0	Frugivore. Inhabits good quality forest, mostly found in lowland areas	1	1	MacKinnon Lists	Line transect sampling
128	Bucerotidae	*Rhinoplax vigil*	Helmeted Hornbill	Rangkong Gading	NT	I	P			1.3	1	1	0	Frugivorous. Inhabits the canopy of primary and logged over forests. Mostly found in lowland areas up to 1,500 masl	1	1	MacKinnon Lists	Line transect sampling
129	Bucerotidae	*Rhyticeros plicatus*	Blyth's Hornbill	Julang Irian	LC	II	P		E	1.3	0	0	1	Frugivorous, diet consists mainly of figs. Widely distributed from lowlands up to 1,200 masl. Uses natural hollow to breed.	1	0	MacKinnon Lists	Line transect sampling
130	Bucerotidae	*Rhyticeros undulatus*	Wreathed Hornbill	Julang Emas	LC	II	P			1.3	1	1	0	Frugivorous. Inhabiits good quality forest, mostly found in lowland areas below 2,000 masl	1	1	MacKinnon Lists	Line transect sampling
131	Caprimulgidae	*Caprimulgus concretus*	Bonaparte's Nightjar	Cabak Kolong	VU	II				1.3	1	1	0	Inhabits lowland forest up to 900 masl, prefers heath forest and forest edges	0	0	MacKinnon Lists	line transect sampling
132	Casuaridae	*Casuarius bennetti*	Dwarf Cassowary	Kasuari Kerdil	NT		P			1.3	0	0	1	Diet consists mainly of fruits and small vertebrates. Inhabits lowland forest up to 3,300 masl	1	0	MacKinnon Lists	Line transect sampling
133	Casuaridae	*Casuarius casuarius*	Southern Cassowary	Kasuari Gelambir-ganda	VU		P			1.3	0	0	1	Diet consists mainly of fruits and small vertebrates. Widely distributed in lowland forests up to 500 masl except in South West Sepik Ramu	1	0	MacKinnon Lists	Line transect sampling

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134	Casuaridae	*Casuarius unappendiculatus*	Northern Cassowary	Kasuari Gelambir-tunggal	VU		P			1.3	0	0	1	Diet consists mainly of fruits and small vertebrates. Found in the North of Papua from lowland areas up to 700 masl.	1	0	MacKinnon Lists	Line transect sampling
135	Ciconiidae	*Ciconia stormi*	Storm's Stork	Bangau storm	EN		P			1.3	1	1	0	Fisciporous. Inhabits freshwater and peat-swamp forests and the floodplains of large rivers.	1	0	Camera trapping	Camera trapping
136	Ciconiidae	*Ciconia episcopus*	Woolly-necked Stork	Bangau Sandang-lawe	LC		P			1.3	1	0	0	Fisciporous. Mostly found close to wetlands including man made wetlands e.g. rice paddy fields	1	0	Mackinnon Lists	Mackinnon Lists
137	Columbidae	*Goura cristata*	Western Crowned Pigeon	Mambruk Ubiaat	VU	II				1.3	0	0	1	Inhabits marshy and partly flooded forest, usually undisturbed alluvial forest, but also hill forest, dense secondary growth forest and mangroves, up to 350 masl. Found in North West Papua including Waigeo, Misool and Salawati.	1	0	Mackinnon Lists	Line transect sampling
138	Columbidae	*Ducula pickeringii*	Grey Imperial Pigeon	Pergam Kelabu	VU					1.3	0	1	0	Frugivorous, forages in fruiting trees such as *Ficus procera* and *Cananga odorata.* Inhabits lowland primary forest. Found mostly in small islands in the North of Borneo (Malaysia) and East Kalimantan (Indonesia). Considered to be a small island specialist and wanders in response of food availability	0	0	Mackinnon Lists	Line transect sampling
139	Columbidae	*Goura scheepmakeri*	Southern Crowned Pigeon	Mambruk Selatan	VU	II				1.3	0	0	1	Inhabits undisturbed dry and flooded forest, including alluvial forest, between lowland areas to 500 masl. Distributed in the South of Papua	1	0	Mackinnon Lists	Line transect sampling
140	Columbidae	*Goura victoria*	Victoria Crowned Pigeon	Mambruk Victoria	VU	II				1.3	0	0	1	Inhabits lowland forest, including swamp-forest, mostly in the extreme lowlands, but sometimes up to 600 masl. Distributed in the North of Papua including Biak and Yapen island	1	0	Mackinnon Lists	Line transect sampling
141	Columbidae	*Treron capellei*	Large Green Pigeon	Punai Besar	VU					1.3	1	1	0	Frugivorous, forages in small flocks in fruiting trees, usually emergent fig trees. It inhabits primary and logged evergreen rainforest up to 1500 masl. Thought to breed throughout the year.	0	0	Mackinnon Lists	Line transect sampling

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142	Estrildidae	*Lonchura fuscans*	Dusky Munia	Bondol Kalimantan	LC				E	1.3	0	1	0	Granivorous, Inhabitats secondary forest and edge habitats, found from lowland areas up to 500 masl	0	1	MacKinnon Lists	Mist netting, Line transect sampling
143	Laniidae	*Pityriasis gymnocephala*	Bornean Bristlehead	Tiongbatu Kalimantan	NT				E	1.3	0	1	0	Diet consists mainly of large insects and small invertebrates. Found mostly in lowland forests up to 1,000 masl, including peat swamp, secondary and primary forest	0	1	MacKinnon Lists	Mist netting, Line transect sampling
144	Megapodidae	*Aepypodius bruijnii*	Bruijn's brush-turkey		EN		P		E	1.3	0	0	1	Inhabits mountain forests above 620 masl on Waigeo island Papua. Males build mounds for the incubation of the eggs	1	0	MacKinnon Lists	Line transect sampling
145	Megapodidae	*Eulipoa wallacei*	Moluccan Megapode	Gosong Maluku	VU					1.3	0	0	1	Inhabits lowland evergreen forests up to 2,000 masl. Its main distribution is South mollucas with extralimital is Misool of Papua.	1	0	MacKinnon Lists	Line transect sampling
146	Megapodidae	*Macrocephalon maleo*	Maleo	Maleo Senkawor	EN	I				1.3	0	0	0	Distributed mainly in Central Celebes. Deposits eggs on sandy beaches and relies on natural heat to incubate eggs	1	0	Line transect sampling	Total counts on beaches used for nesting, Line transect sampling
147	Megapodidae	*Megapodius geelvinkianus*	Biak Megapode	Gosong Biak	VU					1.3	0	0	1	Endemic to Biak. Inhabits forest, logged forest, secondary growth, dry scrub and scrub near rivers. Builds nests which are mounds on the decaying root of trees	1	0	MacKinnon Lists	Line transect sampling
148	Monarchidae	*Monarcha brehmii*	Biak Monarch	Kehicap Biak	EN		P		E	1.3	0	0	1	Endemic to Biak. Insectivorous, inhabits lowland forest up to 60 masl	0	1	MacKinnon Lists	Line transect sampling
149	Muscicapidae	*Cyornis caerulatus*	Large-billed Blue Flycatcher	Sikatan Sunda	VU		P			1.3	1	1	0	Insectivorous. Inhabits primary, selectively logged and mature secondary dryland rainforest	0	1	Mist netting, Line transect sampling	Mist netting
150	Nectariniidae	*Arachnothera longirostra*	Little Spiderhunter	Pijantung Kecil	LC		P			1.3	1	1	0	Nectarivorous, visits flowering plants for nectar. Common in open areas	0	1	MacKinnon Lists	Mist netting, Line transect sampling
151	Nectariniidae	*Aethopyga siparaja*	Crimson Sunbird	Burungmadu Sepah-raja	LC		P			1.3	1	1	0	Nectarivorous birds, visits plants for nectar. Common in open areas upt to 1,300 masl in Kalimantan	0	1	MacKinnon Lists	Mist netting, Line transect sampling

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152	Nectariniidae	*Anthreptes malacensis*	Brown-throated Sunbird	Burungmadu kelapa	LC		P			1.3	1	1	0	Nectarivorous, vists flowering plants for nectar. Common in open areas up to 1,300 masl in Kalimantan	0	1	MacKinnon Lists	Mist netting, Line transect sampling
153	Nectariniidae	*Anthreptes simplex*	Plain Sunbird	Burungmadu Polos	LC		P			1.3	1	1	0	Nectarivorous, visits flowering plants for nectar. Inhabits forest edge and open areas from lowlands up to 1,300 masl in Kalimantan	0	1	MacKinnon Lists	Mist netting, Line transect sampling
154	Nectariniidae	*Anthreptes singalensis*	Ruby-cheeked Sunbird	Burungmadu Belukar	LC		P			1.3	1	1	0	Nectarivorous, visits flowering plants for nectar. Inhabits forest edge and open areas	0	1	MacKinnon Lists	Mist netting, Line transect sampling
155	Phasianidae	*Lophura erythrophthalma*	Crestless Fireback	Sempidan merah	VU					1.3	1	1	0	Insectivorous, diet consists mainly of berries, termites, ticks and grubs. Inhabits lowland forest with dense and closed canopy. Ground dweller. Feeds frequently along animal trails during the day and visits rivers and other water bodies in the early morning to drink.	1	0	Camera trapping, Community Interviews	Camera trapping
156	Phasianidae	*Lophura bulweri*	Bulwer's Pheasant	Sempidan Kalimantan	VU		p		E	1.3	0	1	0	Insectivorous, diet consists mainly fruits, worms, and insects. Suggested that this species may rely on forest fruit masting in Kalimantan. Ground dweller. Inhabits primary hill and lower montane forest, from around 300 up to at least 1,500 masl and occasionally down to around 150 masl	1	0	Camera trapping, Community Interviews	Camera trapping
157	Phasianidae	*Melanoperdix nigra*	Black Partridge	Puyuh Hitam	VU					1.3	1	1	0	Inhabits lowland forest up to 1,200 masl, also recorded in peatswamp forest. Ground dweller. Breeding season occurs from July until December. Builds simple nests lined by dead leaves on the forest floor.	0	0	Mist netting	Mist netting
158	Phasianidae	*Polyplectron schleiermacheri*	Bornean Peacock Pheasant	Kuau-kerdil kalimantan	EN	II			E	1.3	0	1	0	Thought to be insectivorous and frugivorous. Local people in Kalimantan reported that it also consumes fallen fruit, rattan fruit and ants. Inhabits lowland dipterocarp forests up to 1,000 masl, often found close to small rivers or	1	0	Camera trapping, Community Interviews	Camera trappin, Line transect sampling

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														streams. Ground dweller.				
159	Phasianidae	*Argusianus argus*	Great Argus	Kuau Raja	NT	II	P			1.3	1	1	0	Inhabits tall, dry, lowland primary and logged forests up to 1,300 masl. Absent from peat swamp forest and heath forest. During the breeding season, males will exhibit courtship dances on the forest floor	1	0	Camera trapping, Community Interviews	Camera trapping
160	Picidae	*Mulleripicus pulverulentus*	Great Slaty Woodpecker	Pelatuk Kelabu-besar	VU					1.3	1	1	0	Insectivorous. Inhabits primary semi-open moist deciduous and tropical evergreen forests, as well as adjacent secondary forest in lowland area until 1,000 masl	0	1	MacKinnon Lists	Line transect sampling
161	Pittidae	*Pitta granatina*	Garnet Pitta	Paok delima	NT		P			1.3	1	1	0	Insectivorous, forages for insect on the forest floor. Mainly found in dense lowland evergreen forests up to 600 masl. It has also been recorded in secondary and heavily logged forest, particularly in swampy areas	0	1	Mist netting	Mist netting
162	Pittidae	*Pitta baudii*	Blue-headed Pitta	Paok kepala-biru	VU				E	1.3	1	1	0	Insectivorous, forages on insect on the forest floor. It is mainly found in dense lowland evergreen forest. It is also recorded from secondary and heavily logged forest, particularly in swampy areas,	0	1	Mist netting	Mist netting
163	Psittacidae	*Eos cyanogenia*	Black-winged Lory	Nuri Sayap-hitam	VU	II				1.3	0	0	1	Inhabits lowland forests up to 500 masl in Biak and Supiori	1	0	Mackinnon Lists	Line transect sampling
164	Psittacidae	*Psittaculirostris salvadorii*	Yellow-cheeked Fig Parrot	Nuriara Pipi-kuning	VU	II			E	1.3	0	0	1	Frugivorous. Inhabits the canopy of lowland forests, including forest edge and swamp-forest, from sea-level up to 400 masl. Endemic to Northern of Papua	1	0	Mackinnon Lists	Line transect sampling

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165	Psittacidae	*Psittrichas fulgidus*	Pesquet's Parrot	Nuri Kabare	VU	II				1.3	0	0	1	Frugivorous, dependent on a small number of fig species. Inhabits hill and lower montane forest. Uses natural holes for breeding	1	0	Mackinnon Lists	Line transect sampling
166	Psittacidae	*Loriculus galgulus*	Blue-crowned Hanging Parrot	Serindit Melayu		II				1.3	1	1	0	Frugivorous, visits fruiting trees in small flocks to consume flowers, buds and fruit. Inhabits lowland forest. Clings to the underside of tree branches. Traded as a pet	0	1	Mackinnon Lists	Line transect sampling
167	Psittacidae	*Psittacula longicauda*	Long-tailed Parakeet	Betet Ekor-panjang	NT	II				1.3	1	1	0	Inhabits coastal and lowland areas up to 300 masl. Preffered habitat is lowland swamp. Uses natural holes for nesting	0	1	Mackinnon Lists	Line transect sampling
168	Psittacidae	*Tanygnathus lucionensis*	Blue-naped Parrot	Betetkelapa Filipina	NT	II				1.3	0	1	0	Inhabits closed and open forest formations, including secondary growth and coconut plantations up to 1,000 masl. Uses natural holes for nesting	0	1	Mackinnon Lists	Line transect sampling
169	Pycnonotidae	*Pycnonotus zeylanicus*	Straw-headed Bulbul	Cucak rawa	VU	II				1.3	1	1	0	Insectivorous and frugivorous. Its diet consists mainly of large beetles, dragonflies, mantises, grasshoppers, green berries, figs and wild cherry. Inhabits secondary forest and forest edge, particularly close to river bodies or streams. It is found from lowland areas up to 1,800 masl. Usually found in small groups of three to six individuals.	0	1	Mackinnon Lists	Line transect sampling
170	Pycnonotidae	*Setornis criniger*	Hook-billed Bulbul	Empuloh Paruh-kait	VU					1.3	1	1	0	Insectivorous and frugivorous. Its diet consists of small fruits, berries, small beetles, dragonflies and their nymphs, ants, spiders and spider, associated with nutrient-poor vegetation on acid soils including peat swamp and heat forest. Use every forest stratum from top until the lower canopy.	1	1	Mackinnon Lists	Mist netting, Line transect sampling
171	Rhipiduridae	*Rhipidura javanica*	Pied Fantail	Kipasan Belang	LC		P			1.3	1	1	0	Insectivorous. Inhabits open areas and secondary forest from lowland up to 1,500 masl	0	1	MacKinnon List	Mist netting, Line transect sampling

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172	Strigidae	*Otus beccarii*	Biak Island Scops Owl	Celepuk Biak	EN		P			1.3	0	0	1	Inhabits forest from coastal areas up to 300 masl. Not tolerant to forest disturbance, Only found in Biak island.	1	0	Mackinnon List	Line transect sampling
173	Sturnidae	*Gracula religiosa*	Hill Myna	Tiong Emas	LC	II	p			1.3	1	1	0	Frugivorous and insectivorous, diet consists mainly of figs, cultivated fruit, ants and termites. Mainly found in forest edge habitats. Visits tall trees and gathers in small flocks. Breeds in natural holes. Traded as a pet.	0	1	MacKinnon List	Line transect sampling
174	Timaliidae	*Malacocincla sepiarium*	Horsfield's Babbler	Pelanduk Semak	LC				E	1.3	0	1	0	Insectivorous. Found in forest understory and canopy. Inhabits forest understorey and canopy. Found from 300-1,400 masl	0	1	Mist netting	Mist netting
175	Timaliidae	*Ptilocichla leucogrammica*	Bornean Wren Babbler	Berencet kalimantan	VU				E	1.3	0	1	0	Insectivorous. Forages on the forest floor and uses dense understorey canopy as habitat. Found from lowland areas up to 600 masl. Breeds between June and October. Exhibits territorial behaviour throughout the year	0	1	Mist netting	Mist netting
176	Trogonidae	*Harpactes kasumba*	Red-naped Trogon	Luntur Kasumba	NT		p			1.3	1	1	0	Primary habitat is primary or lightly logged lowland evergreen forests up to 1,200 masl. Also found in montane dipterocarp forests in Borneo, peatswamp forests, as well as logged areas.	0	0	MacKinnon Lists, Mist netting	Line transect sampling
177	Tytonidae	*Tyto alba*	Barn Owl	Serak Jawa	LC	II				1.3	1	0	0	Inhabits a broad range of habitats including man made buildings, natural holes, caves and dense forest. Nocturnal, Introduced in several places as biocontrol for rats in oil palm plantations	0	0	MacKinnon Lists, Community Interviews	Line transect sampling at night
Reptiles & Amphibians																		
178	Cheloniidae	*Caretta caretta*	Loggerhead Turtle	Penyu tempayan	EN	I	P			1.3	0	1	1	Aquatic. Widely distributed. Wanders open oceans and shallow seas except to deposit eggs on sandy beaches	1	0	total count on the nesting beach	Total counts on beaches used for nesting

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179	Cheloniidae	*Chelonia mydas*	Green Turtle	Penyu hijau	EN	I	P			1.3	1	1	1	Aquatic. Widely distributed. Wanders open oceans and shallow seas except to deposit eggs on sandy beaches	1	0	total count on the nesting beach	Total counts on beaches used for nesting
180	Cheloniidae	*Lepidochelys olivacea*	Olive ridley, Pacific ridley	Penyu lekang	VU	I	P			1.3	0	1	1	Aquatic. Widely distributed. Wanders open oceans and shallow seas except to deposit eggs on sandy beaches	1	0	total count on the nesting beach	Total counts on beaches used for nesting
181	Chelidae	*Manouria emys*	Asian Brown Tortoise, Asian Giant Tortoise, Asian Tortoise, Black Giant Tortoise, Burmese Brown Tortoise, Burmese Mountain Tortoise, Six-legged Tortoise	Baning Coklat	EN	II				1.3	1	1	0	Aquatic. Inhabits freshwater habitat in upland areas	0	1	Visual encounter survey along waterbody	line transect sampling with VES along river
182	Chelidae	*Chelodina parkeri*	Parker's Snake-necked Turtle	kura-kura aramia	VU					1.3	0	0	1	Inhabits rivers with vegetated banks in South Papua including the Trans fly and Wasur National Park	0	1	Visual encounter survey along waterbody	Line transect sampling with VES along rivers
183	Chelidae	*Chelodina reimanni*	Reimann's Snake-necked Turtle	kura-kura digul	DD				E	1.3	0	0	1	Inhabit slow moving water with muddy substrate. Discovered in 1990 in Digul area, Southern Papua.	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers
184	Chelidae	*Elseya branderhorsti*	White Oval Tortoise	Kura-kura perut putih	VU					1.3	0	0	1	Distribution restricted to lowland areas in Southern part of Papua	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers
185	Trionychidae	*Amyda cartilaginea*	Asiatic Softshell Turtle, Southeast Asian Softshell Turtle	Bulus	VU	II				1.3	1	1	0	Semi aquatic. Inhabits a variety of freshwater habitats from ponds and lakes to rivers and canals	0	1	Visual encounter survey along waterbodies	Line transect sampling with VES along rivers
186	Trionychidae	*Pelochelys cantorii*	Asian Giant Softshell Turtle, Cantor's Giant Softshell, Frog-faced Softshell	labi-labi raksasa	EN	II				1.3	1	1	1	Primarily carnivorous, feeding on fish, molluscs and crustaceans. Aquatic, found in slow moving freshwater streams like estuaries. Spends time motionless in the water.	0	1	Visual encounter survey along waterbodies	Line transect sampling with VES along rivers

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			Turtle															
187	Trionychidae	*Pelochelys bibroni*	Asian Giant Softshell Turtle, Striped New Guinea Softshell Turtle	Labi-labi papua	VU					1.3	0	0	1	Diet consists mainly of fish and aquatic vegetation. Distributed in the Southern part of Papua.	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers
188	Carettochelydae	*Carettochelys insculpta*	Pig-nosed Turtle, Fly River Turtle, New Guinea Plateless Turtle, Pig-nose Turtle, Pitted-shell Turtle	Labi-labi moncong babi	VU	II				1.3	0	0	1	Inhabits big rivers, freshwater streams and lagoons	0	1	Visual encounter survey along waterbodies	Line transect sampling with VES along rivers
189	Geoemydidae	*Cuora amboinensis*	South Asian Box Turtle, Southeast Asian Box Turtle	Kuya batok	VU					1.3	1	1	0	Herbivorous. Semi aquatic. Inhabits a variety of freshwater lowland habitats, including marshes and rice paddy fields	0	1	Visual encounter survey along waterbodies	Line transect sampling with VES along rivers
190	Geoemydidae	*Heosemys spinosa*	Spiny Terrapin, Spiny Turtle, Sunburst Turtle	Kura-kura duri	EN	II			E	1.3	1	1	0	Herbivorous. Semi aquatic. Inhabits slow moving freshwater rivers and forest floor	0	1	Visual encounter surveys along small rivers and leaf litter areas	Line transect sampling with VES along rivers
191	Geoemydidae	*Notochelys platynota*	Malayan Flat-shelled Turtle	Beiyogo	VU	II				1.3	1	1	0	Herbivorous. Inhabits streams and shallow water bodies in freshwater swamp forest habitats	0	1	Visual encounter survey small river and leaf litter	Line transect sampling with VES along rivers
192	Geoemydidae	*Orlitia borneensis*	Bornean River Turtle, Malaysian Giant Turtle	Bajuku	EN	II				1.3	1	1	0	Herbivorous. Inhabits estuaries of big rivers	0	1	Visual encounter survey small river and leaf litter	Line transect sampling with VES along rivers
193	Geoemydidae	*Malayemys subtrijuga*	Snail-eating Turtle	Kura-kura pemakan siput	VU					1.3	1	0	0	Diet consists almost exclusively of freshwater aquatic snails. Inhabits freshwater habitats with little current, muddy bottoms and plenty of aquatic vegetation	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers

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194	Geoemydidae	*Siebenrockiella crassicollis*	Black marsh turtle	Kura-kura Pipi putih	VU	II				1.3	1	1	0	Herbivorous. Inhabits slow moving freshwater areas and marshes in lowland areas	0	1	Visual encounter survey small river	Line transect sampling with VES along rivers
195	Crocodylidae	*Crocodylus novaeguinea*	New Guinea Crocodile	Buaya papua		II				1.3	0	0	1	Distributed in Northern Papua, mainly in Mamberamo River	1	0	Visual encounter survey along the river at night using spot light	Line transect sampling with VES along rivers
196	Crocodylidae	*Tomistoma schlegelii*	False gavial, False gharial, Malayan gharia, Tomistoma	Buaya senyulong	EN	II	P			1.3	1	1	0	Carnivorous. Inhabits swamps, rivers and lakes in lowland areas. Deposits eggs close to river banks in mounds made of leaf litter. Clutch size of 20-60 eggs	1	0	Visual encounter survey along the river at night using spot light	Line transect sampling with VES along rivers
197	Typhlopidae	*Typhlops koekkoeki*	Boenjoe Island Worm Snake						E	1.3	0	1	0	Feeds on larvae and pupae	0	0	Visual encounter survey small river and leaf litter	Quadrat method
198	Elapidae	*Naja sumatrana*	Equatorial Spitting Cobra	Ular senduk		II				1.3	1	1	0	Highly venomous. Carnivorous. Inhabits primary and secondary forests from lowlands up to 1,000 masl	0	0	Visual encounter survey	Line transect sampling with VES along rivers
199	Varanidae	*Varanus salvator*	Water Monitor, Common Water Monitor	Biawak air	LC	II				1.3	1	1	0	Carnivorous. Inhabits a wide range of habitats including swamps, mangrove forest and lakes. Mostly found close to water bodies.Terrestrial with ability to climb trees.	1	1	Visual encounter survey	Line transect sampling with VES along rivers
200	Varanidae	*Varanus nebulosus*	Clouded monitor			II	P			1.3	1	0	0	Terestrial. Inhabits a wide range of habitats from rainforest to scrubland, quite often observed digging leaf litter to find food	0	1	Visual encounter survey	Line transect sampling with VES along rivers
201	Pythonidae	*Python reticulatus*	Reticulated Python	Ular Sawah, Sanca Batik		II				1.3	1	1	0	Carnivorous, kills prey by strangling. Inhabits a wide range of habitats including rainforest, grassland and woodland	0	0	Visual encounter survey small river and leaf litter	Visual Encounter Surveys
202	Pythonidae	*Apodora papuana*	Papuan Python	Sanca papua		II				1.3	0	0	1	-	0	0	Visual encounter survey	Visual encounter surveys
203	Pythonidae	*Candoia aspera*	New Guinea Ground Boa	Ular mono tanah		II				1.3	0	0	1	-	0	0	Visual encounter survey	Visual encounter surveys

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204	Pythonidae	*Candoia carinata*	Solomon Island Ground Boa	Ular mono pohon		II				1.3	0	0	1	Nocturnal. Arboreal.	0	0	Visual encounter survey	Visual encounter surveys
205	Pythonidae	*Morelia amethistina*	Scrub Python	Sanca permata		II				1.3	0	0	1	Diet consists mainly of bats, possums, fruit bats and tree kangaroos. Inhabits closed and open forest.	0	0	Visual encounter survey	Visual encounter surveys
206	Pythonidae	*Morelia boeleni*	Boelen's Python	-		II				1.3	0	0	1	Diet consists mainly of mammals and lizards. Inhabits montane forest over 1,000 masl. Although mostly found on the forest floor, it also uses trees to climb	0	0	Visual encounter survey	Visual encounter surveys
207	Pythonidae	*Morelia spilota*	Carpet Python	ular karpet piton		II				1.3	0	0	1	Inhabit wide range of habitat including rainforest and grassland. Main diet including mammals, rat and birds which is killed by strangling it until suffocate	0	0	Visual encounter survey	Visual encounter surveys
208	Pythonidae	*Morelia viridis*	Green Tree Python	Sanca hijau		II	P			1.3	0	0	1	Arboreal. Mostly found in rainforest, shrub and bush	0	0	Visual encounter survey	Visual encounter surveys
209	Pythonidae	*Python breitensteini*	Borneo Short-tailed Python	Sanca darah		II				1.3	1	1	0	Inhabits a wide range of habitats including man made irrigation channels in farmland. Mostly found at lower elevations.	0	0	Visual encounter survey	Visual encounter surveys
210	Pythonidae	*Python reticulatus*	Reticulated Python	Sanca batik		II				1.3	1	1	0	Diet includes mammals and birds which are killed by strangling. Inhabits rainforest and also associates with rivers and streams. Good swimmer.	0	0	Visual encounter survey	Visual encounter surveys
211	Colubridae	*Enhydris gyii*	Kapuas Mud Snake	Ular lumpur kapuas					E	1.3	0	1	0	Carnivorous. Discovered during a survey of the Kapuas River in 1996	0	0	Visual encounter survey small river and leaf litter	Visual Encounter Surveys
212	Colubridae	*Amphiesma flavifrons*	Sabah Keelback	-					E	1.3	0	1	0	Diet consists mainly of frog eggs and tadpoles. Inhabits rivers, frequently seen swimming with its head out of the water	0	0	Visual encounter survey	Visual encounter surveys
213	Colubridae	*Amphiesma frenatum*	-	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter surveys
214	Colubridae	*Calamaria borneensis*	-	-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling
215	Colubridae	*Calamaria grabowskyi*	-	-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling

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216	Colubridae	*Calamaria hilleniusi*	-						E	1.3	0	1	0	Inhabit lowland forest and wide spread across Kalimantan, semi fossorial.	0	0	Quadrat sampling	Quadrat sampling
217	Colubridae	*Calamaria lumholtzi*	-	-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling
218	Colubridae	*Calamaria melanota*	-	-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling
219	Colubridae	*Calamaria rebentischi*	-	-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling
220	Colubridae	*Hydrablabes periops*	Olive Small-eyed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
221	Colubridae	*Hydrablabes praefrontalis*	Mocquard's Small-eyed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
222	Colubridae	*Iguanognathus werneri*	Spatula-toothed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
223	Colubridae	*Oligodon everetti*	Everett's Kukri Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
224	Colubridae	*Pareas nuchalis*		-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
225	Colubridae	*Stoliczkaia borneensis*	Borneo Red Snake	-					E		0	1	0		0	0	Visual encounter survey	Visual encounter survey
226	Colubridae	*Calamaria rebentischi*		-					E	1.3	0	1	0		0	0	Quadrat sampling	Quadrat sampling
227	Colubridae	*Hydrablabes periops*	Olive Small-eyed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
228	Colubridae	*Hydrablabes praefrontalis*	Mocquard's Small-eyed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
229	Colubridae	*Iguanognathus werneri*	Spatula-toothed Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
230	Colubridae	*Oligodon everetti*	Everett's Kukri Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
231	Colubridae	*Pareas nuchalis*	-	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey
232	Colubridae	*Stoliczkaia borneensis*	Borneo Red Snake	-					E	1.3	0	1	0		0	0	Visual encounter survey	Visual encounter survey

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233	Hylidae	*Litoria quadrilineata*	-	-	VU				E	1.3	0	0	1	Inhabits grassy and swampy areas at sea level in the South of Papua	0	0	Visual encounter survey	Visual encounter survey
234	Hylidae	*Litoria wisselensis*	-	-	VU				E	1.3	0	0	1	Only recorded from several lakes in the Enarotali area of Papua. Inhabits rocky shorelines of lakes.	0	0	Visual encounter survey	Visual encounter survey
235	Bombinatoridae	*Barbourula kalimantanensis*	Bornean flat-headed frog	Katak Berkepala Pipih Borneo	EN				E	1.3	0	1	0	Aquatic. Preffered habitat is clear fresh water streams 0.5 - 5m deep within primary rainforest	0	1	Visual encounter survey	Line transect sampling with VES
236	Bufonidae	*Pelophryne guentheri*	Gunther's Flathead Toad	-	VU				E	1.3	0	1	0	Terestrial. Inhabits leaf litter of primary forest. Deposits eggs in rain pools	0	1	Visual encounter survey	Line transect sampling with VES
237	Bufonidae	*Ansonia latidisca*	Bornean rainbow frog	Katak pelangi borneo	EN				E	1.3	0	1	0	Terestrial. Inhabits hilly primary forest. Adults lay eggs in forest streams. Was recorded again recently, 87 years after the first record in 1924	0	1	Visual encounter survey	Line transect sampling with VES
Fish																		
238	Siluridae	*Scleropages formosus*	Asian Arowana, Asian Bonytongue, Golden Arowana, Golden Dragon Fish, Kelesa	Arwana	EN	I				1.3	1	1	0	Inhabit lakes, deep parts of swamps, flooded forests and stretches of deep rivers with slow currents and dense, overhanging vegetation	0	1	Live capture, gill net	Live capture, gill net
239	Siluridae	*Kryptopterus minor*	Phantom Catfish, Ghost Fish	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
240	Siluridae	*Kryptopterus parvanalis*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
241	Siluridae	*Kryptopterus sp1*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
242	Hemirhamphidae	*Hemirhamphodon sp1*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
243	Hemirhamphidae	*Hemirhamphodon sp2*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
244	Cobitidae	*Vaillantella sp*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net

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245	Cyprinidae	*Puntius rhomboocellatus*	Snakeskin Barb	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
246	Cyprinidae	*Mystacoleucus cf padangensis*	-	-					E	1.3	1	0	0	Aquatic. Inhabits small rivers, swamps and lakes	0	1	Live capture, scoop net	Live capture, scoop net
247	Belontiidae	*Parosphromenus sp*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
248	Belontiidae	*Sphaerichthys sp*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
249	Belontiidae	*Sphaerichthys selatanensis*	Chocolate Gourami	Gurame					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
250	Bagridae	*Leiocassis sp*	-	-					E	1.3	0	1	0	Aquatic. Inhabits peatswamp forest	0	1	Live capture, scoop net	Live capture, scoop net
Vegetation																		
251	Myristicaceae	*Myristica arfakensis*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
252	Myristicaceae	*Myristica inaequalis*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
253	Myristicaceae	*Myristica sarcantha*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
254	Myristicaceae	*Myristica tamrauensis*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
255	Myristicaceae	*Myristica trianthera*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
256	Myristicaceae	*Myristica verruculosa*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
257	Alangiaceae	*Alangium havilandii*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
258	Alangiaceae	*Alangium longiflorum*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
259	Anacardiaceae	*Mangifera altissima*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
260	Anacardiaceae	*Mangifera blommesteinii*	-	-	EN					1.3	0	1	0	-			Distance method	Quadrat method
261	Anacardiaceae	*Mangifera dewildei*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method

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262	Anacardiaceae	*Mangifera macrocarpa*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
263	Anacardiaceae	*Mangifera pajang*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
264	Anacardiaceae	*Mangifera paludosa*	-	-	EN					1.3	1	0	0	-			Distance method	Quadrat method
265	Anacardiaceae	*Mangifera rufocostata*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
266	Anacardiaceae	*Mangifera similis*	-	-	VU					1.3	1	1	0	-			Distance method	Quadrat method
267	Anisophylaceae	*Anisophyllea ferruginea*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
268	Anisophylaceae	*Anisophyllea rhomboidea*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
269	Anisophylaceae	*Combretocarpus rotundatus*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
270	Apocynaceae	*Alstonia beatricis*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
271	Apocynaceae	*Dyera costulata*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
272	Apocynaceae	*Dyera polyphylla*	-	-	VU					1.3	1	1	0	-			Distance method	Quadrat method
273	Apocynaceae	*Kibatalia villosa*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
274	Apocynaceae	*Tabernaemontana remota*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
275	Araceae	*Amorphophallus decus-silvae*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
276	Araceae	*Amorphophallus titanum*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
277	Araliaceae	*Schefflera capitulifera*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
278	Araliaceae	*Schefflera multifoliolata*	-	-	EN					1.3	1	0	0	-			Distance method	Quadrat method
279	Arecaceae	*Arenga pinnata*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
280	Arecaceae	*Borassodendron borneensis*	-	-			P			1.3	0	0	1	-			Distance method	Quadrat method
281	Arecaceae	*Caryota no*	-	-			P			1.3	0	0	1	-			Distance method	Quadrat method

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282	Arecaceae	*Cyrtostachys lakka*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
283	Arecaceae	*Cyrtostachys renda*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
284	Arecaceae	*Eugeissonia utilis*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
285	Arecaceae	*Johannesteijsmania altifrons*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
286	Arecaceae	*Livistonia hasseltii*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
287	Arecaceae	*Nenga gajah*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
288	Arecaceae	*Phoenix paludosa*	-	-			P			1.3	1	0	0	-			Distance method	Quadrat method
289	Arecaceae	*Phoenix filaris*	-	-			P			1.3	0	0	1	-			Distance method	Quadrat method
290	Asclepidiaceae	*Ceropegia borneensis*	-	-		II				1.3				-			Distance method	Quadrat method
291	Asclepidiaceae	*Ceropegia cumingiana ssp. horsfieldiana*	-	-		II				1.3	-	-	-	-			Distance method	Quadrat method
292	Araucariaceae	*Agathis labillardieri*	-	-			P			1.3	0	0	1	-			Distance method	Quadrat method
293	Bombacaceae	*Durio acutifolius*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
294	Bombacaceae	*Durio dulcis*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
295	Bombacaceae	*Durio kutejensis*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
296	Bombacaceae	*Durio testudinarum*	-	-	VU					1.3	0	1	0	-			Distance method	Quadrat method
297	Bombacaceae	*Durio zibethinus*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
298	Boraginiaceae	*Corida subcordata*	-	-			P			1.3				-			Distance method	Quadrat method
299	Burseraceae	*Canarium pseudodecumanum*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
300	Burseraceae	*Canarium pseudopatentinervium*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
301	Byblidaceae	*Byblis liniflora*	-	-		II				1.3				-			Distance method	Quadrat method

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302	Cactaceae	*Cereus huilunchu*	-	-		II				1.3	1	0	0	-			Distance method	Quadrat method
303	Cunoniaceae	*Ceratopetalum succirubrum*	-	-	VU					1.3	0	0	1	-			Distance method	Quadrat method
304	Cyatheaceae	*Cyathea spp. (78 taxa)*	-	-		II				1.3	1	1	0	-			Distance method	Quadrat method
305	Cycadaceae	*Cycas apoa*	-	-		II				1.3	0	0	1	-			Distance method	Quadrat method
306	Cycadaceae	*Cycas campestris*	-	-		II				1.3	0	0	1	-			Distance method	Quadrat method
307	Cycadaceae	*Cycas circinalis*	-	-		II				1.3	1	0	1	-			Distance method	Quadrat method
308	Cycadaceae	*Cycas javana*	-	-		II				1.3	1	0	0	-			Distance method	Quadrat method
309	Cycadaceae	*Cycas papuana*	-	-		II				1.3	0	0	1	-			Distance method	Quadrat method
310	Cycadaceae	*Cycas rumphii*	-	-		II				1.3	0	0	1	-			Distance method	Quadrat method
311	Cycadaceae	*Cycas schumanniana*	-	-		II				1.3	0	0	1	-			Distance method	Quadrat method
312	Dicksoniaceae	*Calochlaena javanica*	-	-		II				1.3				-			Distance method	Quadrat method
313	Dicksoniaceae	*Calochlaena villosa*	-	-		II				1.3				-			Distance method	Quadrat method
314	Dicksoniaceae	*Cibotium barometz*	-	-		II				1.3	1	0	1	-			Distance method	Quadrat method
315	Dicksoniaceae	*Culcita javanica*	-	-		II				1.3				-			Distance method	Quadrat method
316	Dicksoniaceae	*Culcita villosa*	-	-		II				1.3				-			Distance method	Quadrat method
317	Dicksoniaceae	*Cystodium sorbifolium*	-	-		II				1.3				-			Distance method	Quadrat method
318	Dicksoniaceae	*Dicksonia blumei*	-	-		II				1.3				-			Distance method	Quadrat method
319	Dicksoniaceae	*Dicksonia mollis*	-	-		II				1.3				-			Distance method	Quadrat method
320	Dipterocarpaceae	*Anisoptera costata*	-	-	EN					1.3	1	1	0	-			Distance method	Quadrat method
321	Dipterocarpaceae	*Anisoptera grossivenia*	-	-	EN					1.3	0	1	0	-			Distance method	Quadrat method
322	Dipterocarpaceae	*Anisoptera laevis*	-	-	EN					1.3	0	1	0	-			Distance method	Quadrat method
323	Dipterocarpaceae	*Anisoptera marginata*	-	-	EN					1.3	1	1	0	-			Distance method	Quadrat method

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324	Dipterocarpaceae	*Cotylelobium lanceolatum*	-	-	VU					1.3	1	0	0	-			Distance method	Quadrat method
325	Dipterocarpaceae	*Cotylelobium melanoxylon*	-	-	EN					1.3	1	0	0	-			Distance method	Quadrat method
326	Dipterocarpaceae	*Dipterocarpus acutangulus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
327	Dipterocarpaceae	*Dipterocarpus borneensis*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
328	Dipterocarpaceae	*Dipterocarpus caudatus ssp. penganianus*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
329	Dipterocarpaceae	*Dipterocarpus caudiferus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
330	Dipterocarpaceae	*Dipterocarpus confertus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
331	Dipterocarpaceae	*Dipterocarpus conformis ssp. borneensis*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
332	Dipterocarpaceae	*Dipterocarpus conformis ssp. conformis*	-	-			P			1.3				-			Distance method	Quadrat method
333	Dipterocarpaceae	*Dipterocarpu crinitus*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
334	Dipterocarpaceae	*Dipterocarpus cuspidatus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
335	Dipterocarpaceae	*Dipterocarpus geniculatus ssp. geniculatus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
336	Dipterocarpaceae	*Dipterocarpus humeratus*	-	-			P			1.3	1	1	0	-			Distance method	Quadrat method
337	Dipterocarpaceae	*Dipterocarpus lamellatus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
338	Dipterocarpaceae	*Dipterocarpus mundus*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
339	Dipterocarpaceae	*Dipterocarpus*	-	-			P			1.3				-			Distance method	Quadrat method

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		nudus																
340	Dipterocarpaceae	*Dipterocarpus oblongifolius*	-	-			P			1.3	0	1	0	-			Distance method	Quadrat method
341	Dipterocarpaceae	*Dipterocarpus ochraceus*	-	-			P			1.3				-			Distance method	Quadrat method
342	Dipterocarpaceae	*Dipterocarpus pachyphyllus*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
343	Dipterocarpaceae	*Dipterocarpus palembanicus spp. borneensis*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
344	Dipterocarpaceae	*Dipterocarpus palembanicus spp. palembanicus*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
345	Dipterocarpaceae	*Dipterocarpus sarawakensis*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
346	Dipterocarpaceae	*Dipterocarpus stellatus spp. stellatus*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
347	Dipterocarpaceae	*Dipterocarpus stellatus spp. parvus*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
348	Dipterocarpaceae	*Dipterocarpus sublamellatus*	-	-	EN		P			1.3	1	1	0				Distance method	Quadrat method
349	Dipterocarpaceae	*Dipterocarpus verrucosus*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
350	Dipterocarpaceae	*Dryobalanops beccarii*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
351	Dipterocarpaceae	*Dryobalanops lanceolata*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
352	Dipterocarpaceae	*Hopea dasyrrhachia*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
353	Dipterocarpaceae	*Hopea fluvialis*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
354	Dipterocarpaceae	*Hopea gregaria*	-	-	EN					1.3	1	1	1				Distance method	Quadrat method

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355	Dipterocarpaceae	*Hopea pachycarpa*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
356	Dipterocarpaceae	*Hopea pedicellata*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
357	Dipterocarpaceae	*Parashorea globosa*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
358	Dipterocarpaceae	*Shorea agami*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
359	Dipterocarpaceae	*Shorea albida*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
360	Dipterocarpaceae	*Shorea argentifolia*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
361	Dipterocarpaceae	*Shorea balanocarpoides*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
362	Dipterocarpaceae	*Shorea beccariana*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
363	Dipterocarpaceae	*Shorea bracteolata*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
364	Dipterocarpaceae	*Shorea dasyphylla*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
365	Dipterocarpaceae	*Shorea domatiosa*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
366	Dipterocarpaceae	*Shorea faguetiana*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
367	Dipterocarpaceae	*Shorea falcifera*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
368	Dipterocarpaceae	*Shorea glauca*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
369	Dipterocarpaceae	*Shorea gratissima*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
370	Dipterocarpaceae	*Shorea leprosula*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
371	Dipterocarpaceae	*Shorea macrophylla*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
372	Dipterocarpaceae	*Shorea maxwelliana*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
373	Dipterocarpaceae	*Shorea mecisopteryx*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
374	Dipterocarpaceae	*Shorea obscura*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
375	Dipterocarpaceae	*Shorea ovata*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
376	Dipterocarpaceae	*Shorea palembanica*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
377	Dipterocarpaceae	*Shorea pauciflora*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method

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378	Dipterocarpaceae	*Shorea pinanga*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
379	Dipterocarpaceae	*Shorea platyclados*	-	-	EN					1.3	1	1	0				Distance method	Quadrat method
380	Dipterocarpaceae	*Shorea seminis*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
381	Dipterocarpaceae	*Shorea splendida*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
382	Dipterocarpaceae	*Shorea stenoptera*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
383	Dipterocarpaceae	*Shorea teysmanniana*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
384	Dipterocarpaceae	*Shorea uliginosa*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
385	Dipterocarpaceae	*Upuna borneensis*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
386	Dipterocarpaceae	*Vatica brunigii*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
387	Dipterocarpaceae	*Vatica lowii*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
388	Dipterocarpaceae	*Vatica maritima*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
389	Dipterocarpaceae	*Vatica pauciflora*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
389	Dipterocarpaceae	*Vatica pauciflora*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
390	Dipterocarpaceae	*Vatica stapfiana*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
391	Elaeocarpaceae	*Elaeocarpus brigittae*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
392	Elaeocarpaceae	*Elaeocarpus royenii*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
393	Elaeocarpaceae	*Elaeocarpus simaluensis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
394	Euphorbiaceae	*Euphorbia tirucalli*	-	-		II				1.3	1	0	0				Distance method	Quadrat method
395	Fagaceae	*Nothofagus stylosa*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
396	Guttiferae	*Calophyllum bifurcatum*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
397	Guttiferae	*Calophyllum caudatum*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
398	Guttiferae	*Calophyllum havilandii*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method

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399	Guttiferae	*Calophyllum insularum*	-	-	EN					1.3	0	0	1				Distance method	Quadrat method
400	Guttiferae	*Calophyllum parvifolium*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
401	Guttiferae	*Calophyllum rufinerve*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
402	Guttiferae	*Calophyllum savannarum*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
403	Guttiferae	*Kayea macrophylla*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
404	Icacinaceae	*Cantleya corniculata*	-	-	VU					1.3	1	1	0	Found in freshwater swamp forest			Distance method	Quadrat method
405	Lauraceae	*Cinnamomum culilawan*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
406	Lauraceae	*Cinnamomum massoy*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
407	Lauraceae	*Eusideroxylon zwageri*	-	-	VU		P			1.3	1	1	0				Distance method	Quadrat method
408	Leguminosae	*Afzelia bijuga*	-	-			P			1.3							Distance method	Quadrat method
409	Leguminosae	*Afzelia rhomboidea*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
410	Leguminosae	*Caesalpinia sappan*	-	-			P			1.3							Distance method	Quadrat method
411	Leguminosae	*Crudia splendens*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
412	Leguminosae	*Intsia bijuga*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
413	Leguminosae	*Koompassia grandiflora*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
414	Leguminosae	*Pericopsis mooniana*	-	-	VU					1.3	1	1	0				Distance method	Quadrat method
415	Leguminosae	*Pterocarpus indicus*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
416	Leguminosae	*Sindora inermis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
417	Loganiaceae	*Fagraea fragrans*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
418	Loganiaceae	*Myristica argentea*	-	-			P			1.3							Distance method	Quadrat method

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419	Meliaceae	*Aglaia angustifolia*	-	-	VU					1.3	1	1	0				Distance method	Quadrat method
420	Meliaceae	*Aglaia barbanthera*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
421	Meliaceae	*Aglaia brassii*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
422	Meliaceae	*Aglaia brownii*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
423	Meliaceae	*Aglaia cinnamomea*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
424	Meliaceae	*Aglaia coriacea*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
425	Meliaceae	*Aglaia flavescens*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
426	Meliaceae	*Aglaia laxiflora*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
427	Meliaceae	*Aglaia lepiorrhachis*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
428	Meliaceae	*Aglaia membranifolia*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
429	Meliaceae	*Aglaia polyneura*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
430	Meliaceae	*Aglaia puberulanthera*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
431	Meliaceae	*Aglaia ramotricha*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
432	Meliaceae	*Aglaia rivularis*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
433	Meliaceae	*Aglaia scortechinii*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
434	Meliaceae	*Aglaia smithii*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
435	Meliaceae	*Aglaia speciosa*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
436	Meliaceae	*Aglaia tenuicaulis*	-	-	VU					1.3	1	1	1				Distance method	Quadrat method
437	Meliaceae	*Aglaia variisquama*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
438	Meliaceae	*Aglaia yzermannii*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
439	Meliaceae	*Chisocheton stellatus*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
440	Myristicaceae	*Endocomia canarioides*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method

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441	Myristicaceae	*Horsfieldia atjehensis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
442	Myristicaceae	*Horsfieldia borneensis*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
443	Myristicaceae	*Horsfieldia fragillima*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
444	Myristicaceae	*Horsfieldia fulva*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
445	Myristicaceae	*Horsfieldia hirtiflora*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
446	Myristicaceae	*Horsfieldia iriana*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
447	Myristicaceae	*Horsfieldia macilenta*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
448	Myristicaceae	*Horsfieldia motleyi*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
449	Myristicaceae	*Horsfieldia obscura*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
450	Myristicaceae	*Horsfieldia pachyrachis*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
451	Myristicaceae	*Horsfieldia pulcherrima*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
452	Myristicaceae	*Horsfieldia triandra*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
453	Myristicaceae	*Horsfieldia tristis*	-	-	VU					1.3	1	1	0				Distance method	Quadrat method
454	Myristicaceae	*Horsfieldia valida*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
455	Myristicaceae	*Knema emmae*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
456	Myristicaceae	*Knema hookerana*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
457	Myristicaceae	*Knema kostermansiana*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
458	Myristicaceae	*Knema krusemaniana*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
459	Myristicaceae	*Knema lampongensis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
460	Myristicaceae	*Knema longepilosa*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method

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461	Myristicaceae	*Knema mamillata*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
462	Myristicaceae	*Knema mogeana*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
463	Myristicaceae	*Knema psilantha*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
464	Myristicaceae	*Knema riangensis*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
465	Myristicaceae	*Knema sericea*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
466	Myristicaceae	*Knema uliginosa*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
467	Myristicaceae	*Myristica arfakensis*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
468	Myristicaceae	*Myristica argentea*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
469	Myristicaceae	*Myristica extensa*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
470	Myristicaceae	*Myristica inaequalis*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
471	Myristicaceae	*Myristica sarcantha*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
472	Myristicaceae	*Myristica tamrauensis*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
473	Myristicaceae	*Myristica trianthera*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
474	Myristicaceae	*Myristica verruculosa*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
475	Myrtaceae	*Eucalyptus alba*	-	-			P			1.3							Distance method	Quadrat method
476	Myrtaceae	*Eucalyptus deglupta*	-	-			P			1.3							Distance method	Quadrat method
477	Nepenthaceae	*Nepenthes ampullaria*	-	-			P			1.3	1	1	1				Distance method	Quadrat method
478	Nepenthaceae	*Nepenthes bicalcarata*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
479	Nepenthaceae	*Nepenthes bongso*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
480	Nepenthaceae	*Nepenthes boschiana*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
481	Nepenthaceae	*Nepenthes danseri*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method

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482	Nepenthaceae	*Nepenthes ephippiata*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
483	Nepenthaceae	*Nepenthes fusca*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
484	Nepenthaceae	*Nepenthes inermis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
485	Nepenthaceae	*Nepenthes insignis*	-	-	VU		P			1.3	0	0	1				Distance method	Quadrat method
486	Nepenthaceae	*Nepenthes klossii*	-	-	VU		P			1.3	0	0	1				Distance method	Quadrat method
487	Nepenthaceae	*Nepenthes maxima*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
488	Nepenthaceae	*Nepenthes mikei*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
489	Nepenthaceae	*Nepenthes neoguineensis*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
490	Nepenthaceae	*Nepenthes ovata*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
491	Nepenthaceae	*Nepenthes paniculata*	-	-	EN					1.3	0	0	1				Distance method	Quadrat method
492	Nepenthaceae	*Nepenthes papuana*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
493	Nepenthaceae	*Nepenthes pilosa*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
494	Nepenthaceae	*Nepenthes rhombicaulis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
495	Nepenthaceae	*Nepenthes singalana*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
496	Nepenthaceae	*Nepenthes spathulata*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
497	Nepenthaceae	*Nepenthes spectabilis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
498	Nepenthaceae	*Nepenthes talangensis*	-	-	EN					1.3	1	0	0				Distance method	Quadrat method
499	Nepenthaceae	*Nepenthes treubiana*	-	-	VU		P			1.3	1	0	1				Distance method	Quadrat method
500	Nepenthaceae	*Nepenthes vieillardii*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
501	Olacaceae	*Scorodarpus borneensis*	-	-			P			1.3	1	1	0				Distance method	Quadrat method

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502	Orchidaceae	*Ascocentrum miniatum*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
503	Orchidaceae	*Coelogyne pandurata*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
504	Orchidaceae	*Cymbidium hartinahianum*	-	-			P			1.3							Distance method	Quadrat method
505	Orchidaceae	*Dendrobium antennatum*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
506	Orchidaceae	*Dendrobium lasianthera*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
507	Orchidaceae	*Dendrobium macrophyllum*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
508	Orchidaceae	*Dendrobium phalaenopsis*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
509	Orchidaceae	*Gramatophyllum specieosum*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
510	Orchidaceae	*Macodes petola*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
511	Orchidaceae	*Paphiopedilum liemianum*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
512	Orchidaceae	*Paphiopedilum glanduliferum*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
513	Orchidaceae	*Paphiopedilum wilhelminiae*	-	-			P			1.3	0	0	1				Distance method	Quadrat method
514	Orchidaceae	*Paraphalaenopsis denevei*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
515	Orchidaceae	*Paraphalaenopsis laycockii*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
516	Orchidaceae	*Paraphalaenopsis serpentilingua*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
517	Orchidaceae	*Phalaenopsis gigantea*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
518	Orchidaceae	*Phalaenopsis sumatrana*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
519	Orchidaceae	*Phalaenopsis*	-	-			P			1.3	0	1	0				Distance method	Quadrat method

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		violacea																
520	Orchidaceae	*Rhenanthera matutina*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
521	Orchidaceae	*Spathoglottis aurea*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
522	Orchidaceae	*Paphiolanthe hookeriana*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
523	Orchidaceae	*Vanada Sumatrana*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
524	Orchidaceae	*Paphiopedilum spp.*	-	-		I				1.3	1	1	1				Distance method	Quadrat method
525	Papilionaceae	*Afzalia bijuga*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
526	Protaceae	*Alloxylon brachycarpum*	-	-	EN					1.3	0	0	1				Distance method	Quadrat method
527	Proteaceae	*Bleasdalea papuana*	-	-	EN					1.3	0	0	1				Distance method	Quadrat method
528	Proteaceae	*Heliciopsis lanceolata*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
529	Rafflesiaceae	*Rafflesia arnoldii*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
530	Rafflesiaceae	*Rafflesia atjehensis*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
531	Rafflesiaceae	*Rafflesia borneensis*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
532	Rafflesiaceae	*Rafflesia gadutensis*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
533	Rafflesiaceae	*Rafflesia hasseltii*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
534	Rafflesiaceae	*Rafflesia micropylora*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
535	Rafflesiaceae	*Rafflesia witkampii*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
536	Rosaceae	*Prunus laxinervis*	-	-	VU					1.3	0	1	0				Distance method	Quadrat method
537	Rosaceae	*Prunus turfosa*	-	-	EN					1.3	0	1	0				Distance method	Quadrat method
538	Rubiaceae	*Timonius sericeus*	-	-			P			1.3							Distance method	Quadrat method

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539	Rutaceae	*Burkillanthus malaccensis*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
540	Rutaceae	*Flindersia laevicarpa*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
541	Rutaceae	*Flindersia pimenteliana*	-	-	EN					1.3	0	0	1				Distance method	Quadrat method
542	Rutaceae	*Merrillia caloxylon*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
543	Sapindaceae	*Guioa melanopoda*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
544	Sapindaceae	*Guioa multijuga*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
545	Sapindaceae	*Guioa oligotricha*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
546	Sapindaceae	*Guioa pauciflora*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
547	Sapindaceae	*Guioa venusta*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
548	Sapindaceae	*Guioa waigeoensis*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method
549	Sapotaceae	*Ganua motleyana*	-	-			P			1.3	0	1	0				Distance method	Quadrat method
550	Sapotaceae	*Palaquium bataanense*	-	-	VU					1.3	1	1	1				Distance method	Quadrat method
551	Sapotaceae	*Palaquium burckii*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
552	Sapotaceae	*Palaquium gutta*	-	-						1.3	1	0	0				Distance method	Quadrat method
553	Sapotaceae	*Palaquium leiocarpum*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
554	Sapotaceae	*Palaquium walsuraefolium*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
555	Sonneratiaceae	*Duabanga moluccana*	-	-			P			1.3	1	1	0				Distance method	Quadrat method
556	Styraceae	*Styrax benzoin*	-	-			P			1.3	1	0	0				Distance method	Quadrat method
557	Symplocaceae	*Symplocos costata*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method
558	Theaceae	*Ternstroemia penangiana*	-	-	VU					1.3	1	0	0				Distance method	Quadrat method

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559	Thymelaeaceae	*Aquilaria beccariana*	Gaharu, Agarwood, Eagle wood, Aloe wood, Lign-aloes	-	VU	II				1.3	1	0	0				Distance method	Quadrat method
560	Thymelaeaceae	*Aquilaria cumingiana*	Gaharu, Agarwood, Eagle wood, Aloe wood, Lign-aloes	-	VU	II				1.3	0	1	0				Distance method	Quadrat method
561	Thymelaeaceae	*Aquilaria hirta*	Gaharu, Agarwood, Eagle wood, Aloe wood, Lign-aloes	-	VU	II				1.3	1	0	0				Distance method	Quadrat method
562	Thymelaeaceae	*Aquilaria malaccensis*	Gaharu, Agarwood, Eagle wood, Aloe wood, Lign-aloes	-	VU	II				1.3	1	0	0				Distance method	Quadrat method
563	Thymelaeaceae	*Aquilaria microcarpa*	Gaharu, Agarwood, Eagle wood, Aloe wood, Lign-aloes	-	VU	II				1.3	1	0	0				Distance method	Quadrat method
564	Thymelaeaceae	*Gonystylus bancanus*	-	-	VU	II	P			1.3	1	0	0				Distance method	Quadrat method
565	Thymelaeaceae	*Gonystylus consanguineus*	-	-	VU	II				1.3	0	1	0				Distance method	Quadrat method
566	Thymelaeaceae	*Gonystylus glaucescens*	-	-	VU	II				1.3	0	1	0				Distance method	Quadrat method
567	Thymelaeaceae	*Gonystylus keithii*	-	-	VU	II				1.3	0	1	0				Distance method	Quadrat method
568	Thymelaeaceae	*Gonystylus macrophyllus*	-	-	VU	II				1.3	0	0	1				Distance method	Quadrat method
569	Thymelaeaceae	*Gonystylus xylocarpus*	-	-	VU	II				1.3	0	1	0				Distance method	Quadrat method
570	Verbenaceae	*Vitex parviflora*	-	-	VU					1.3	0	0	1				Distance method	Quadrat method