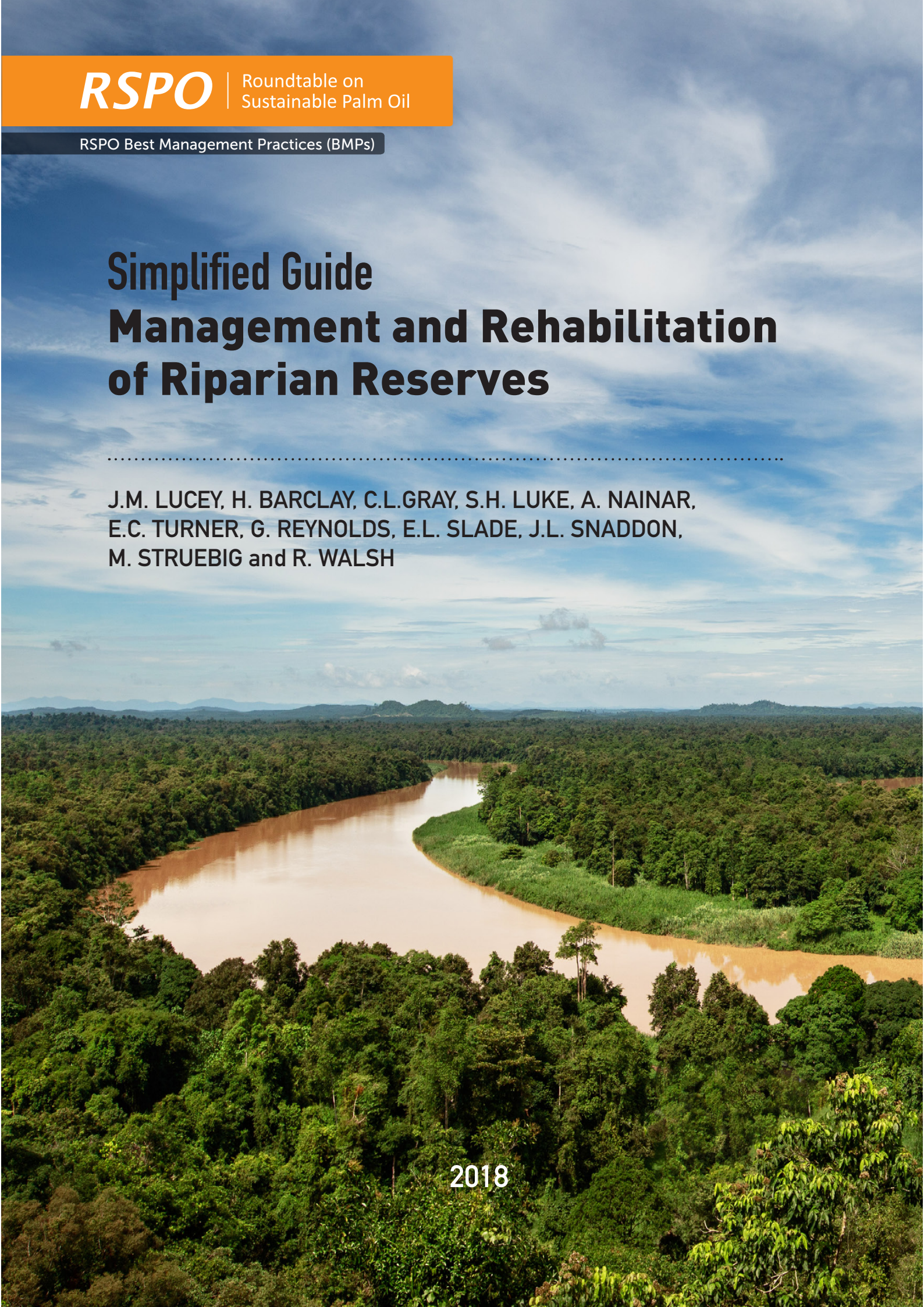
RSPO | Roundtable on Sustainable Palm Oil

RSPO Best Management Practices (BMPs)

Simplified Guide
Management and Rehabilitation of Riparian Reserves

J.M. LUCEY, H. BARCLAY, C.L.GRAY, S.H. LUKE, A. NAINAR, E.C. TURNER, G. REYNOLDS, E.L. SLADE, J.L. SNADDON, M. STRUEBIG and R. WALSH



2018

This is a summary companion document to the Full Guidelines document: “RSPO Manual on Best Management Practices (BMPs) for the Management and Rehabilitation of Riparian Reserves” originally prepared by Holly Barclay, Claudia L. Gray, Sarah H. Luke, Anand Nainar, Jake L. Snaddon and Edgar C. Turner. The Simplified Guide is intended to present a concise step-by-step guide to the key procedures for establishing and managing riparian reserves to meet RSPO standards. Detailed information and resources on all aspects can be found in the Full Guidelines which are located at www.rspo.org/key-documents/supplementary-materials.

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Glossary

Aquatic	Found in water
Biodiversity	The variety of species (including plants, animals and fungi) existing in a given area
Canopy	The high branches of trees that form a continuous layer of foliage
Erosion	Loss of soil and rocks through natural or processes
Full Guidelines	Referring to "the RSPO Manual on Best Management Practices (BMPs) for the Management and Rehabilitation of Riparian Reserves" by Barclay *et al*. 2014 at: http://www.rspo.org/key-documents/supplementary-materials
HCV	High Conservation Value. The RSPO P&Cs require that members retain HCVs as identified through HCV assessments (http://www.hcvnetwork.net; http://www.rspo.org/key-documents/certification/rspo-new-planting-procedure)
Leaf litter	Dead plant material and fallen leaves on the forest floor and in waterways
Native species	Species that occur naturally in the wild in the local area
NGO	Non-governmental organisations: charities and civil society organisations
P&Cs	The Principles and Criteria for sustainability as set out by the RSPO
Riparian reserve	Area of natural vegetation that is retained along rivers, streams, wetlands, springs and lakes in human modified landscapes such as oil palm plantations. Riparian reserves are also known as buffers or strips
RSPO	Roundtable on Sustainable Palm Oil
Run-off	Sediments and pollutants contained in water flowing off the land into waterways
Sedimentation	Eroded soil and rocks collected in waterways
Smallholdings	Plantations less than 50 ha in size
Terrestrial	Found on land

Acknowledgements

The authors would like to thank all members of the RSPO Biodiversity and High Conservation Value Working Group (BHCVWG) for providing valuable comments during the drafting of this document. In particular – Dato' Henry Barlow, John Payne, Anders Lindhe, Faizal Parish, Richard Kan, Audrey Lee and Will Unsworth all provided detailed feedback on early drafts of the report. We would also like to thank Sime Darby, Musim Mas, Olam Gabon and New Britain Palm Oil for sharing practical information about how to manage oil palm riparian reserves, and HUTAN and MESCOT reforestation teams in Sabah who took the time to discuss and demonstrate their extensive experience in restoring degraded riparian habitats along the Kinabatangan River.

Introduction

Riparian reserves are strips of natural or non-harvested vegetation located along rivers, streams, springs, wetlands and lakes, surrounded by agricultural areas, such as oil palm plantations or other crops. The conservation of riparian reserves is a requirement of the RSPO. It is also a legal requirement in many countries.

Riparian reserves have a number of environmental benefits for the water system, including filtering water before it flows into rivers, river bank stabilisation, and flood protection. Riparian reserves are also beneficial for biodiversity conservation, both in the waterway and on land, and for carbon storage (Figure 1). These in turn, provide social benefits in the form of clean water and natural resources for plantation workers and local communities.

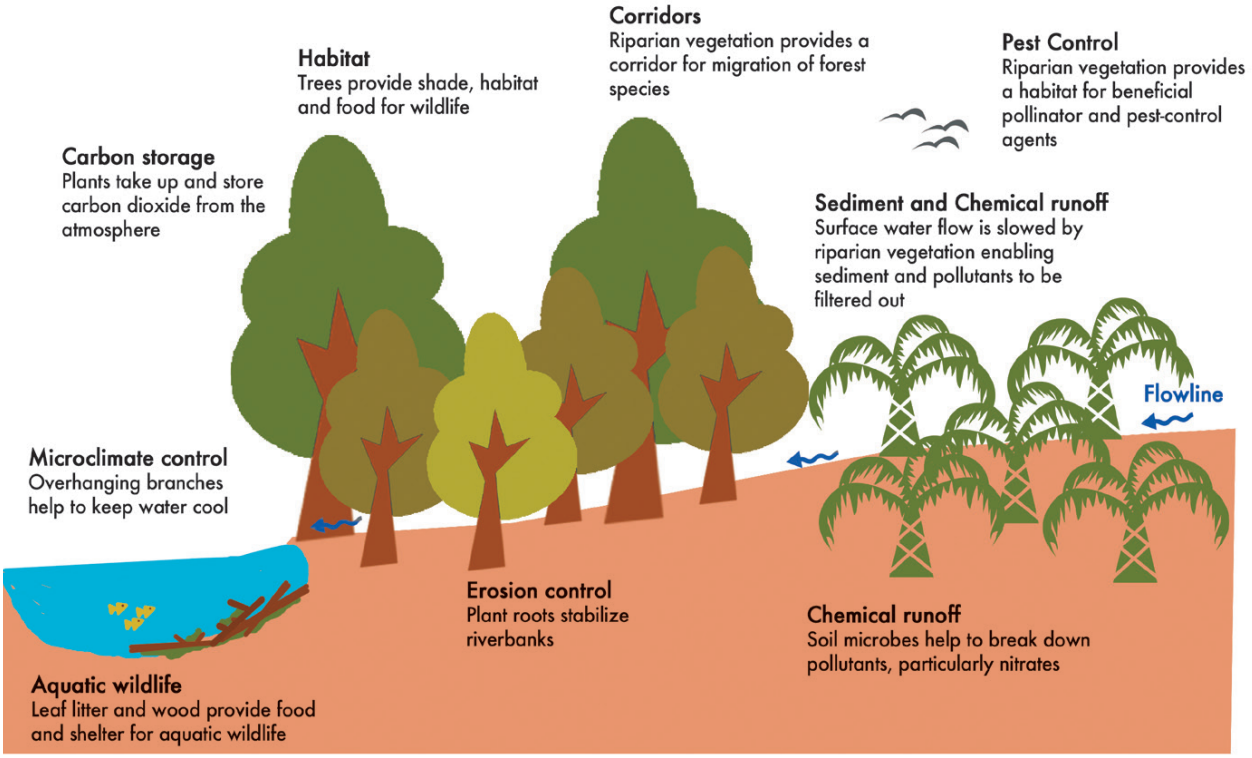


Figure 1. How riparian reserves create environmental benefits to the river, plantation and wider landscape. Adapted from a graphic kindly supplied by Tajang Jinggut.

The overall process for establishing and managing riparian reserves in compliance with the RSPO Principles and Criteria is illustrated in Figure 2.

Establishing and managing riparian reserves

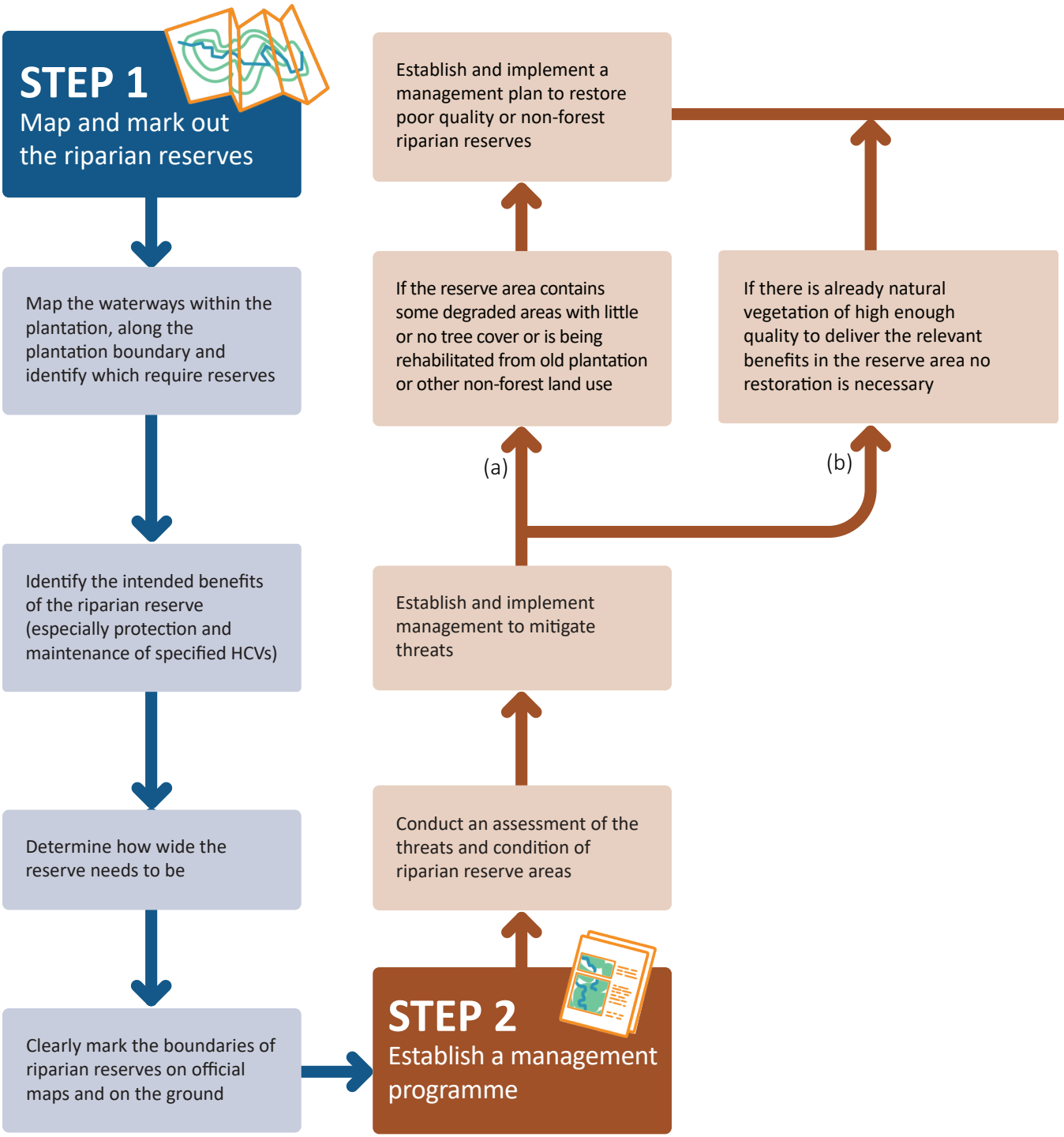
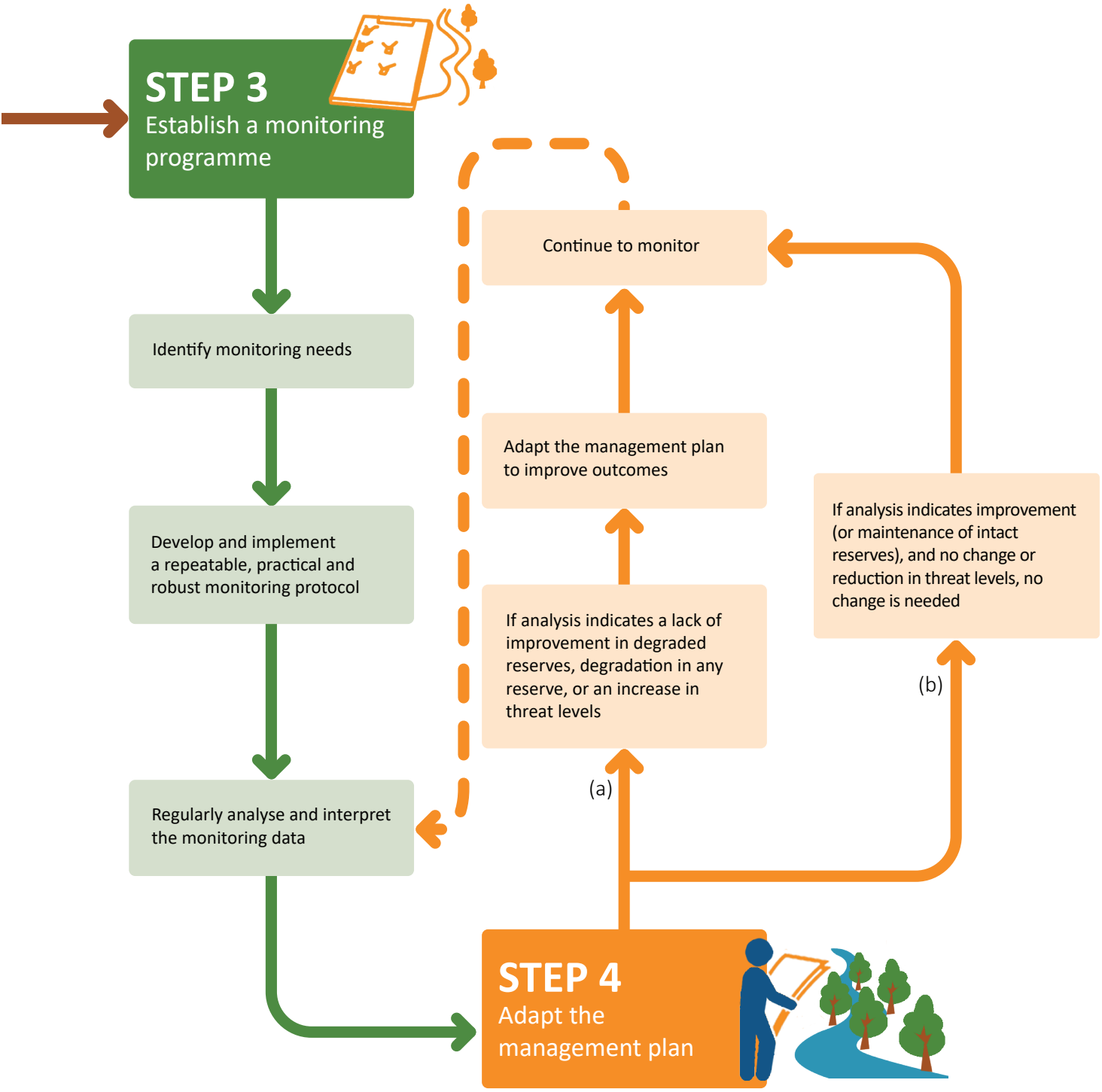


Figure 2. The overall process for establishing and managing riparian reserves in compliance with the RSPO Principles and Criteria.


STEP 3
Establish a monitoring programme
Identify monitoring needs
Develop and implement a repeatable, practical and robust monitoring protocol
Regularly analyse and interpret the monitoring data
STEP 4
Adapt the management plan
(a)
If analysis indicates a lack of improvement in degraded reserves, degradation in any reserve, or an increase in threat levels
Adapt the management plan to improve outcomes
Continue to monitor
(b)
If analysis indicates improvement (or maintenance of intact reserves), and no change or reduction in threat levels, no change is needed

Step 1:
Map and mark the riparian reserve

The first step of the process (see Figure 2) is to map and mark the locations where riparian reserves are required within the plantation area and its boundaries. It is always better to retain existing natural vegetation than to reinstate it at a later date. Therefore, mapping the size and location of riparian reserves should be conducted before any clearing, planting, road development or replanting takes place. Contractors involved in these activities should adhere to the map boundaries so that disturbance to the riparian reserve is minimised. The process of mapping is presented in Figure 3.

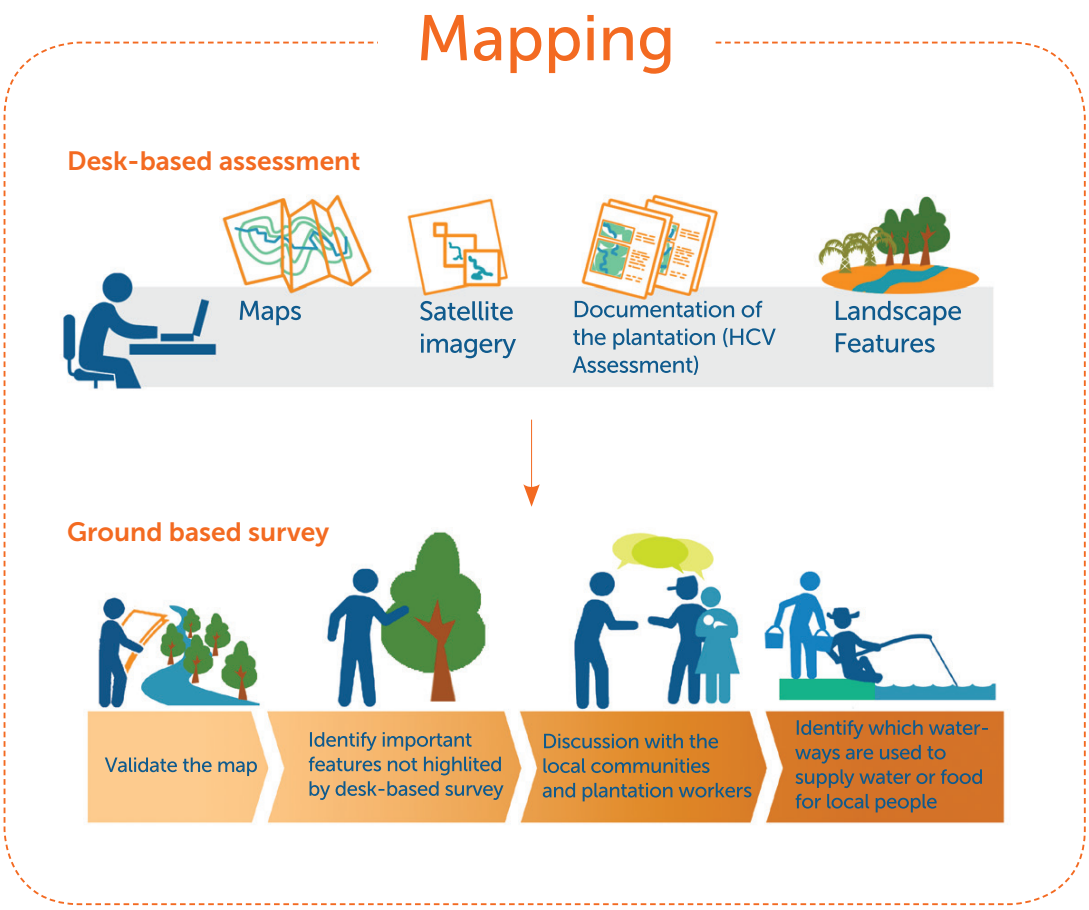


Figure 3. Mapping out riparian reserves starting with desk-based assessment, and followed by ground-based survey.

Note: During the mapping exercise it is important to establish the intended benefits of the riparian reserve. For example, if the riparian reserve is intended to protect specific HCVs such as endangered species or natural resources for communities, wider reserves may be needed and these will need to be mapped and marked from the outset (see Table 1 on page 11 for more guidance).

1.1 Where to establish riparian reserves?

Riparian reserves should be established along natural waterways that are located within or along the boundaries of oil palm plantations. Natural waterways include rivers, streams, lakes, wetlands and springs. Follow the decision tree below (Figure 4) to determine where riparian reserves should be established in the focal management area. These indicate minimum RSPO requirements for the establishment of riparian reserves. Companies may decide to establish reserves in other areas as well, to gain additional environmental benefits such as soil or water quality protection or to enhance wildlife.

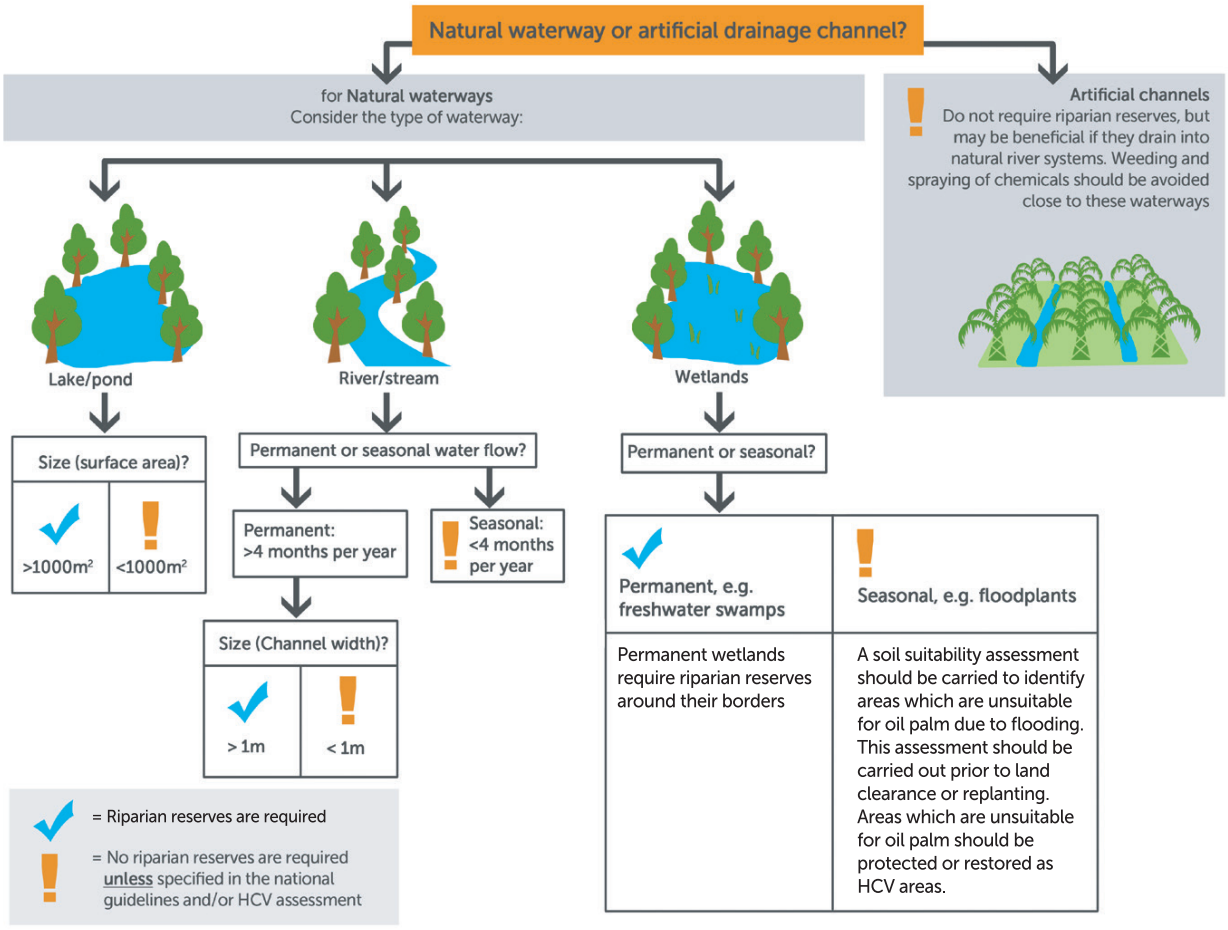


Figure 4. Decision tree for identifying where to locate riparian reserves.

While planning riparian reserves, it is also important to carefully plan roads and drainage channels because these two features of plantations are significant sources of sediment and pollutions. They can therefore undermine the benefits of riparian reserves if not designed and managed appropriately. See Box 1 for details.

Box 1: Considerations for protecting waterways when constructing roads and drainage channels

Roads:

- Construct during dry weather.
- Locate as far away as possible from streams and rivers, always above the maximum extent of flood waters and outside riparian reserves (except when river crossings are absolutely necessary).
- On slopes, build artificial ponds or channels downhill from unpaved roads, to capture sediments before it reaches natural waterways.
- Wherever roads need to cross through riparian reserves, the crossings should be maintained at right angles to waterways to minimise disturbance.

Drainage channels:

- Design drainage channels so they do not direct water from plantations straight into rivers and lakes.
- Place sedimentation basins or silt ponds at the end of drainage channels, before the water flows into a natural waterway.
- Locate drainage channels outside of riparian reserves to minimise gaps in the reserve.

1.2 Determining the appropriate width of riparian reserves

Once the locations and intended benefits of the reserves have been identified, the appropriate width for the reserve should be determined. Consult the appropriate RSPO national interpretation for country-specific guidelines (available on the RSPO website www.rspo.org). In the absence of specific national guidelines, RSPO requires certified oil palm plantations to adopt the RSPO generic management practices for natural waterways (Table 1).

Riparian reserves serve a number of purposes. The **minimum requirements** have been designed **primarily to stabilise the river bank and reduce flows of water, sediment and pollutants** from oil palm plantations into the watercourses during rainstorm events.

Depending on the **additional intended benefits** of the riparian reserve and especially when other **HCVs** have been identified in the area for which the reserve is intended to provide protection, **it may be beneficial to increase the size of the reserve beyond minimum requirements in certain key locations.**

- Where rivers provide important water and food supplies for local and downstream communities (HCV 5), reserve width will need to be increased to maintain the HCV.
- To maintain biodiversity HCVs, riparian reserves usually need to be wider than reserves intended only for controlling erosion and runoff.
- Aquatic biodiversity will benefit from increasing riparian widths to at least 30 m for all waterways, while terrestrial biodiversity may need substantially wider reserves. Species experts should be consulted to establish the needs of specific HCV species that have been identified.
- Waterways that receive surface water runoff from steep or moderately steep slopes of more than 9° will require wider reserves to protect rivers from higher levels of sediment run-off in more steeply cultivated areas.

The recommended reserve width indicated in national interpretations and RSPO generic guidelines should be established on both banks of the river. For lakes or wetlands, the reserve width should be established around the entire border (or as much as is under the management and/or influence of the plantation).

Table 1. Recommended width for riparian buffers, including the RSPO generic guidelines for minimum riparian width (m) and recommended increases in riparian width for specific situations.

River width	1-5 m	5-10 m	10-20 m	20-40 m	40-50 m	>50 m	All other permanent water bodies
RSPO generic guidelines for minimum width of riparian reserve on both banks	5 m	10 m	20 m	40 m	50 m	100 m	100 m
Waterways which supply the water and food needs of local communities and plantation workers (HCV5)	30 m	30 m	30 m	40 m	50 m	100 m	100 m
Reserves that are upstream of conservation areas or are significant breeding grounds for fish and aquatic life (HCV1/5)	30 m	30 m	30 m	40 m	50 m	100 m	100 m
Reserves that are important wildlife corridors, support rare, threatened and endangered species of economic important to local communities (HCV5)	30 m	70 m	>200 m	>200 m	>200 m	>200 m	>200 m
Waterways including small streams <1 m wide, which receive surface water runoff from steep and moderately steep oil palm cultivated slopes (9-25°, HCV4)	Increase the width of any adjacent riparian reserves by 1 m for every 0.5° increase above 9° in the slope. Slopes >25° should not be planted under RSPO requirements.						
Seasonally flooded or unsuitable soil types for cultivating oil palm	It is recommended that these areas are not planted with oil palm or are reforested if planting has already taken place.						

Note: Refer to Section 2.2 of RSPO Manual on Best Management Practices (BMPs) for the Management and Rehabilitation of Riparian Reserves, henceforward referred to as Full Guidelines, for more information on riparian reserve width.

Box 2: Requirements for smallholders

Smallholders are required to abide by national legal requirements for riparian reserve width, or in the absence of these, by RSPO requirements. Smallholders are not expected to protect reserves beyond the minimum size requirements (see Section 2.3 of the Full Guidelines for more details about how to establish riparian reserves in smallholdings).

1.3 Measuring the width of riparian reserves

River width should be measured from the top of each river bank at the highest water level, i.e. the highest point the water level reaches before it floods. River width can vary along a single channel, therefore a number of river width measurements need to be taken to obtain an average from which to establish the correct reserve width. See Figure 5 on how and where to measure river width (see opposite page).

1.4 Mark out boundaries

Once the locations and widths of riparian reserves have been determined, the reserve boundaries should be marked out clearly on official maps and documents, and on the ground to prevent accidental disturbance, clearing or encroachment. It is especially important that this is done prior to clearing and planting activities so that contractors involved in preparing the plantation have minimal impact on the reserve (see Section 3.2 of the Full Guidelines for methods for marking of boundaries).

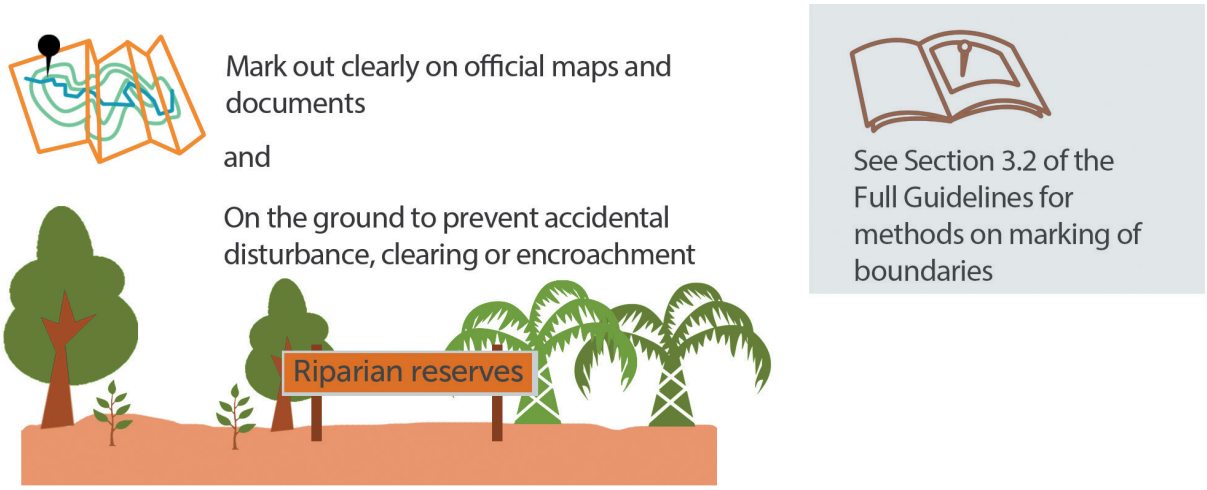
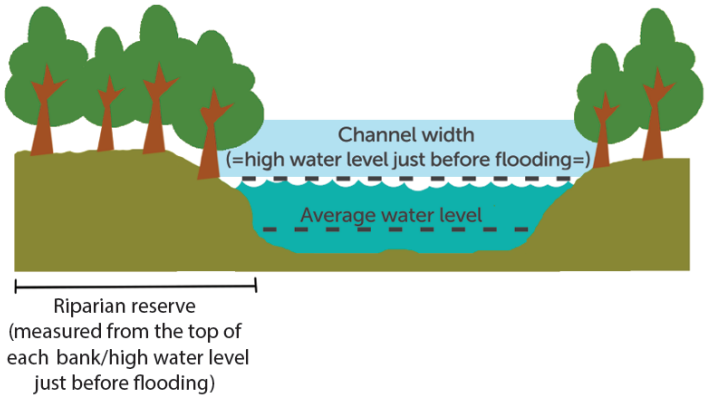
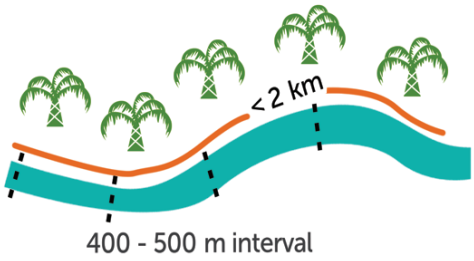


Figure 6. Boundaries of riparian reserves should be marked out clearly to prevent accidental disturbance, clearing or encroachment.

Measuring river width



Rivers flowing for < 2 km within oil palm plantation:
4 – 5 measuring points at 400 – 500 m intervals



River width transects should be perpendicular to the river bank

Rivers flowing for > 2 km within oil palm plantation:
10 measuring points at a distances of 1/10th of the total river length

River width transects should be perpendicular to the river bank

Figure 5. How to measure river width and the sampling sites for rivers of different lengths.

Step 2:
Establish a management programme for the reserves

There are two main components to the management programme for riparian reserves:

1. Manage threats to the riparian reserve.
2. Restore degraded areas that contain vegetation of insufficient quality to perform effectively as a riparian reserve.

2.1 Conduct an assessment of the threats and condition of the reserve area

To develop an effective management plan, the first activity should be to conduct a field assessment of the threats and the condition of the marked reserve. Threats to the reserve may be human (e.g. hunting, logging or encroachment) or environmental (e.g. fire or erosion). The assessment should cover both the reserve area itself and the surrounding landscape, and combine both field investigation and interviews or surveys with the local communities where they may be affected.

The **condition of the reserve** is the **most important indicator** of whether it will perform effectively to deliver the intended benefits such as protecting water quality, reducing bank erosion and conserving biodiversity. Therefore, an **assessment of the vegetation characteristics** is necessary to determine whether interventions are needed. Box 3 describes the key vegetation characteristics of a fully functional riparian reserve.

Box 3: Characteristics of a fully functional riparian reserve

1. **A high density of large trees and a closed canopy.** Important for providing shade, protecting soils and supporting biodiversity.

2. **A complex structure** (a wide variety of sizes, shapes and heights of vegetation: as well as big trees, effective reserves need small trees, shrubs and ground vegetation). Important for performing multiple functions, e.g. large trees provide habitat for biodiversity while young trees are essential for intercepting fertiliser runoff.

3. **A high diversity of native tree and plant species.** Important for encouraging high animal biodiversity.

4. **A high quantity of leaf litter and dead wood**. Important for both terrestrial and aquatic biodiversity.

5. **Low vegetation, such as grasses and ferns, between the forested riparian reserve and the oil palm (additional to minimum required reserve width).** Important for filtering sediments and reducing runoff of nutrients and pesticides before they reach the river.

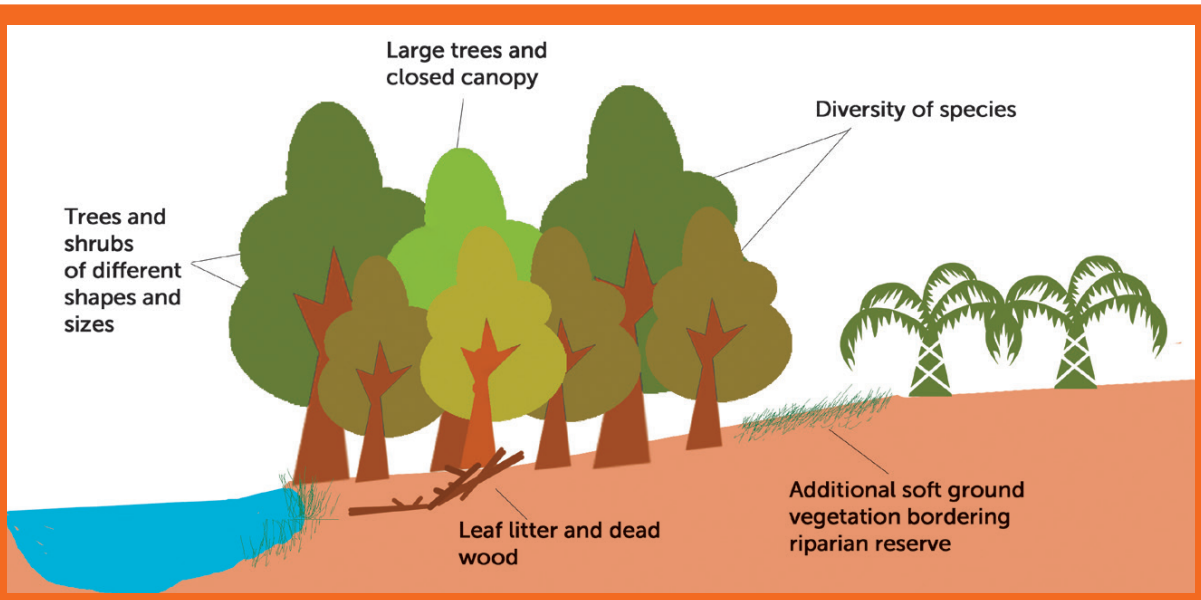


Figure 7. Key vegetation characteristics.

2.2 Managing threats

Different threats may be more prominent in different situations or locations. For example, in a high quality forested riparian reserve, threats such as illegal logging or poaching may be prominent, whereas in a degraded area undergoing replanting (see next section), there may be little wildlife but the area will be under higher risk from fire and soil erosion. Therefore, threats should be identified and managed on a case-by-case basis.

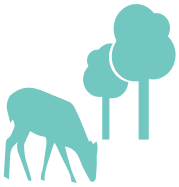
A. Human encroachment

This can include illegal logging, poaching, land-clearing, fishing, or settling in the riparian reserve. If workers or communities who live nearby could pose threats to the integrity of the riparian reserves, this should be managed through identification of motivations for encroachment, early engagement and outreach, involvement of users of the riparian areas with management activities where appropriate, clear signage, and patrols in problem areas.

B. Fire prevention

Fire can be a particular threat in degraded open areas, after prolonged dry periods and on drained organic soils such as peat. Fires are often caused by people, and so strategies similar to those for human encroachment should be employed to reduce the risk of fires starting. Some forest management activities such as climber cutting and weed clearing can increase fire risk, and if these activities are necessary in fire prone areas, the dead plant material should be removed from the area. Early response

to fires is important for minimising damage and maximising recovery. Therefore, monitoring and a rehearsed response system should be put in place for fire prone locations.



C. Protecting wildlife

Wildlife in riparian areas may be particularly vulnerable to poaching because of the ease of access by boat and from surrounding plantations. Engagement with communities as well as local law enforcement and wildlife departments, especially for protected species, should be incorporated into the management plan. As with managing other types of human encroachment, patrols and signage that deter poachers can be employed in problem areas.

D. Soil and bank erosion

Soil and bank erosion is a naturally occurring process along rivers, but this may be exacerbated by human disturbance including regular plantation activities. Encouraging the growth of thick, low growing vegetation along the river bank, and discouraging activities that excessively disturb banks such as accessing the river edge to wash vehicles, could reduce some of these impacts.

2.3 Guidance for restoration

If the reserve meets all the characteristics described in Box 3, and the vegetation quality is relatively consistent throughout the reserve, the management plan should focus on managing threats and restoration is not necessary. However, if the designated reserve area contains patches of degraded natural vegetation, bare soil, or is undergoing rehabilitation from an established plantation or other agricultural land use, then the restoration of degraded areas should also be addressed in the management plan. In some cases, the reserve may be in generally good condition but small patches could benefit from additional restoration activities.

1. **Prioritise**. If large areas of the riparian reserve network within a plantation are degraded, or have been planted with oil palm in earlier planting cycles and require restoration, the first step in developing a restoration management plan is to prioritise areas for restoration that fulfil one or more of the following (listed in order of highest urgency):

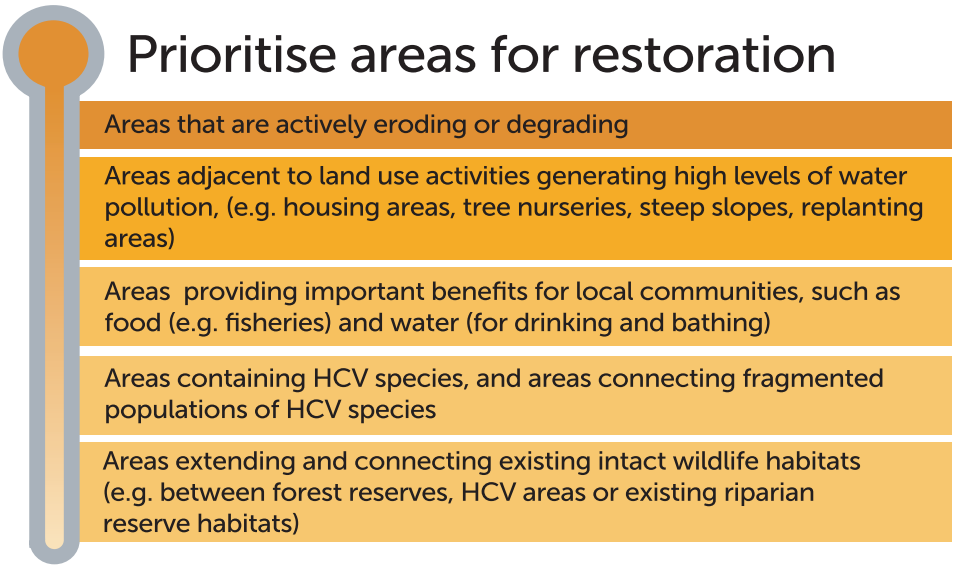


Figure 8. Priority areas for restoration.

Note: Newly planted trees take at least 3-5 years (much longer for some species) to grow into a relatively closed canopy and start generating environmental benefits such as soil protection. Thus, the restoration of degraded riparian reserve areas, particularly in areas dominated by bare soils, should, if at all possible, be started several years prior to activities such as replanting of oil palms which cause substantial soil disturbance. Areas of existing forest should always be protected as a priority, not least because this is a more cost-effective option than restoration.

2. **Engage**. It is important to involve local stakeholders in the development of the restoration plan. These could include plantation workers or local communities who use the riparian reserve area or the river, governmental forestry and wildlife departments, and environmental and social NGOs operating in the region.

3. **Choose a restoration approach.** There are two possible approaches to restoration, and are as below:
   i. The **natural regeneration approach** leaves the area to regenerate on its own, sometimes with some management intervention such as weed removal to encourage faster recovery.
   ii. The **active replanting** approach involves replanting the area with tree seedlings, and is necessary when the site is too degraded to recover on its own.

   Use Figure 9 to choose between:

   a) A natural regeneration approach (reserve site most like the first column), or
   b) A replanting approach (reserve site most like the second column, or
   c) A combination of both approaches (the reserve site has similar numbers of characteristics from both columns or the site is patchy).

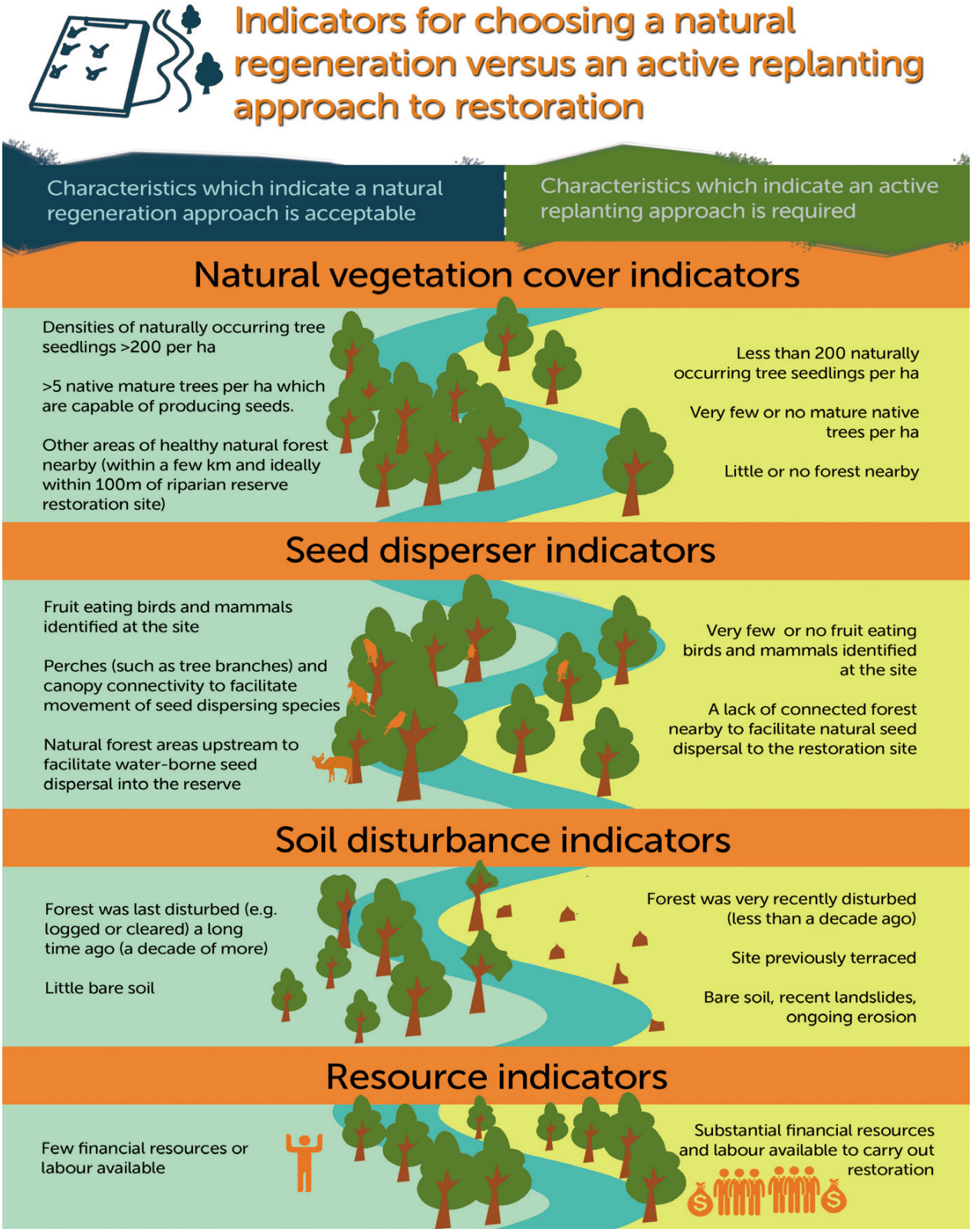


Figure 9. Indicators for choosing a natural regeneration versus an active replanting approach to restoration.

2.4 Considerations for a natural regeneration management plan

This is the cheapest and simplest approach to restoration if the environmental conditions (see Figure 9) are adequately met.

Some active management activities in the area could encourage faster recovery. These activities include:

1. Providing perches for fruit eating birds to enhance seed dispersal
2. Removing weeds around naturally occurring seedlings
3. Cutting back climbing plants to encourage growth of young trees
4. Planting some native species that are not present or naturally regenerating in the reserve to enhance biodiversity

Natural regeneration should be monitored regularly to assess if the tree seedlings are growing healthily in the riparian reserves. If the recovery of the riparian reserve does not begin to occur within a year of attempting natural restoration, active planting of tree seedling should begin.

Consult Section 4.3.1 of the Full Guidelines for more information on management of natural regeneration in riparian reserves.

2.5 Developing an active replanting management plan

An active replanting plan should include the following key steps:

1. **Select the appropriate native species for the replanting site**
   Riparian reserve replanting programmes should use native species that grow naturally in the region and in the riparian reserve areas. The planting of non-native species is strongly discouraged unless site degradation is so bad that native species would not be able to establish. Consult the local forestry department, NGOs or academic institutions to determine the best species to use for the site in question (a list of country-based resources for choosing species is available in Table 4.2 of the Full Guidelines). Canopy cover, soil fertility, soil type, flooding extent, and duration and presence of nearby forests are important considerations when determining the correct suite of species to replant. More details can be found in section 4.3.3 of the Full Guidelines.

2. **Acquire the seedlings**
   The number of seedlings needed per ha will depend on the situation. Placing seedlings at 3-5 m apart is considered appropriate for riparian reserves although higher densities of 1.8 m apart might be appropriate if there is high incidence of seedling mortality, e.g. due to weed smothering or fire. Lower densities of 1 seedling per 10 m may be suitable if there is some shade cover or natural regeneration.

Refer to Figure 10 for the graphical illustration on the replanting densities on various environmental conditions of the riparian reserves.

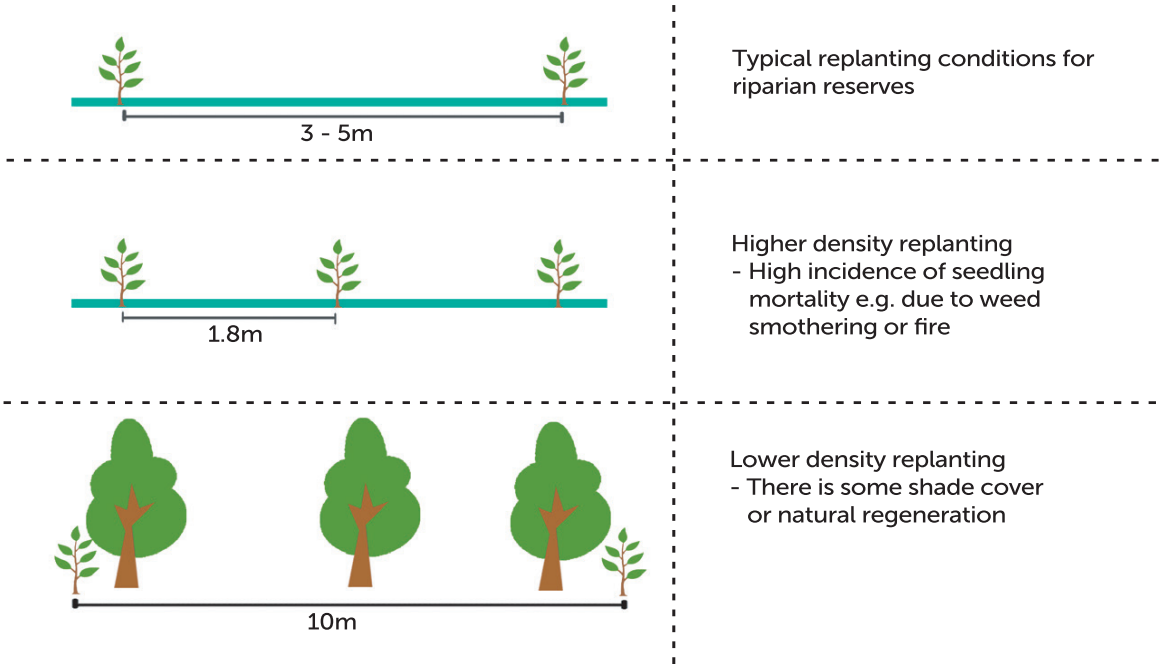


Figure 10. Replanting densities on various environmental conditions of the riparian reserves.

There are a variety of options for acquiring seedlings for replanting including buying seedlings from nearby nurseries, growing your own from seed or cuttings, collecting wild seedlings, or planting collected seed directly into the riparian area. More information about the various approaches and their advantages and disadvantages is available in the Full Guidelines in Section 4.4.3.

3. Prepare the site

For riparian reserve areas that contain oil palms, once the reserve area has been demarcated, all applications of chemicals and fertilisers should cease. There are both advantages and disadvantages to leaving versus removing oil palms from riparian areas prior to replanting with native tree seedlings; consult the Full Guidelines and local regulations to determine the best approach for the specific situation (Section 4.5.1).
It should be noted, however, that once an area has been designated a riparian reserve, the **aim should be to restore to natural forest to comply with RSPO P&Cs.**

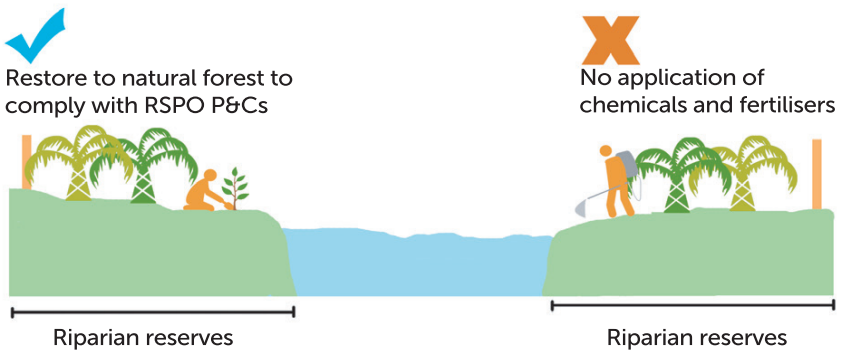


Figure 11. All applications of chemicals and fertilisers within the riparian reserves should stop and the area be restored to natural vegetation.

It may be necessary to improve the soil, particularly if it is heavily compacted or eroded. Methods include planting fast growing and/or nitrogen fixing “nurse trees”, or mulching around seedlings. Weed removal may also be necessary, taking care not to remove naturally regenerating tree seedlings. Weed debris should be left in the riparian reserve to return nutrients to the soil and reduce soil erosion, unless the area is fire prone. Further details on site preparation can be found in Section 4.5 of the Full Guidelines.

4. Plant the seedlings

Trees should be planted in mixtures rather than blocks. Replanting is best carried out during the wettest times of the year, although planting times may need to be adjusted in flood prone areas. Seedlings 30-60 cm tall should be planted in holes of approximately 45 cm depth, although for very degraded soils, digging holes up to 1 m deep and filling with topsoil can help to reduce seedling mortality. Mixing compacted soil with new topsoil and organic matter will further improve seedling survival. Seedlings should be loosely tied (using a biodegradable material) with a clearly marked pole to help them grow straight and avoid accidental removal.

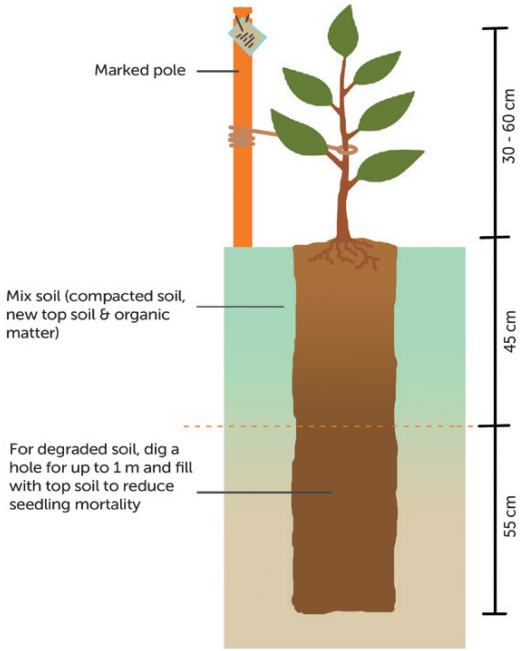


Figure 12. Planting of seedling.

A weeded circle of around half a metre around the seedling should be covered with mulch, leaving a gap around the stem to reduce fungal rot. Where there is no shade cover, oil palm fronds can be used to provide shade for newly planted seedlings. A subset of seedlings should be tagged to facilitate monitoring (see Step 4).

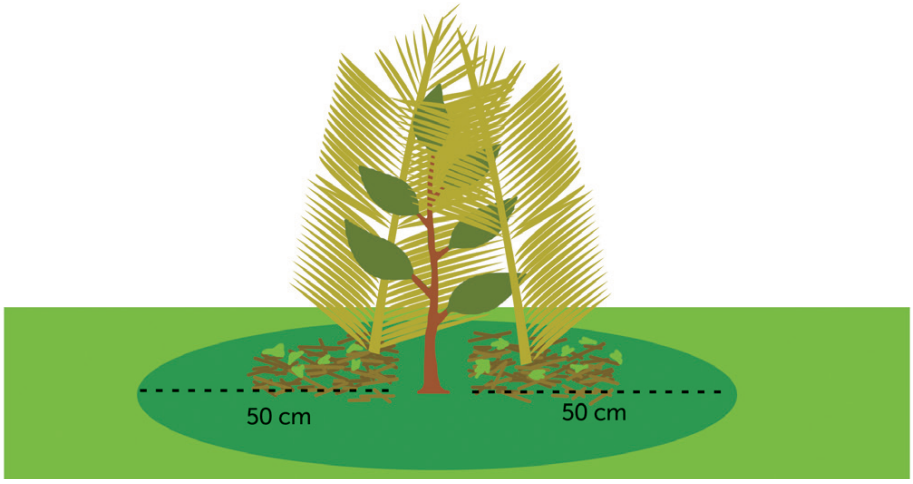


Figure 13. Weeded circle of 50 cm around the seedling should be covered with mulch and oil palm fronds can be used to provide shade if there is no shade cover.

5. Maintain the replanted area

Maintenance of the replanted area can be more time and cost intensive than the initial planting, and this should be clearly accounted for in the budget and management plan. Maintaining restoration sites after tree planting is essential to ensure the restoration programme is successful.

Key activities include:

- Continued weed clearance.
- Application of natural organic matter to boost soil nutrients if necessary (chemical fertilisers should not be applied).
- Control of wildlife and livestock to minimise damage to seedlings.
- Replanting if significant numbers of seedlings die.

More information on performing site maintenance is available in Section 4.8 of the Full Guidelines.

Step 3:
Establish a monitoring procedure

All riparian reserves should be monitored regularly to assess whether the intended benefits of the reserve are being maintained or enhanced over time.

There are two main reasons for monitoring:
1. To check whether the management plan is being carried out correctly.
2. To check whether the management plan is effective in delivering the desired outcomes.

Dedicated staff should visit the riparian reserve regularly to conduct monitoring activities. Monitoring data provides evidence to RSPO auditors that standards regarding riparian reserves are being met. Frequent monitoring enables early detection of emerging threats.

3.1 Deciding what to monitor

It is not necessary or feasible to measure every aspect of the riparian reserve. The decision of which metrics to measure will depend on the intended benefits of the riparian reserve that have been identified in the initial mapping of the reserve.

Monitoring 1) reserve boundaries (signage and to check for signs of encroachment), 2) threats to riparian reserves and 3) (where appropriate) seedling size/survival in restoration sites are the key aspects that should be monitored by all plantations. The frequency of monitoring will depend on what is monitored and the threat level. Where threats are serious and likely to cause rapid deterioration of the reserve, biodiversity or water quality, monitoring should occur often (e.g. weekly / monthly/bi-monthly), whereas as where there are no major threats identified, monitoring may occur on a six month or annual basis.

Monitoring threats is important for anticipating potential negative impacts on target benefits such as biodiversity (e.g. hunting) and vegetation quality (e.g. logging or clearing). Patrols engaged to protect the reserves should also monitor threats by recording evidence of logging, hunting, clearing and other human activities in or nearby the riparian area.

Maintaining and improving water quality is a primary goal for all riparian reserves. Water quality is affected by activities upstream of the plantation, and so measurements should be taken both at the point at which the river water enters the plantation and where it exits to determine the impact the plantation and the riparian reserves are having on water quality. Parameters for monitoring water quality include suspended sediment concentration, pesticides, and nitrates, sulphates and phosphates related to fertiliser runoff.

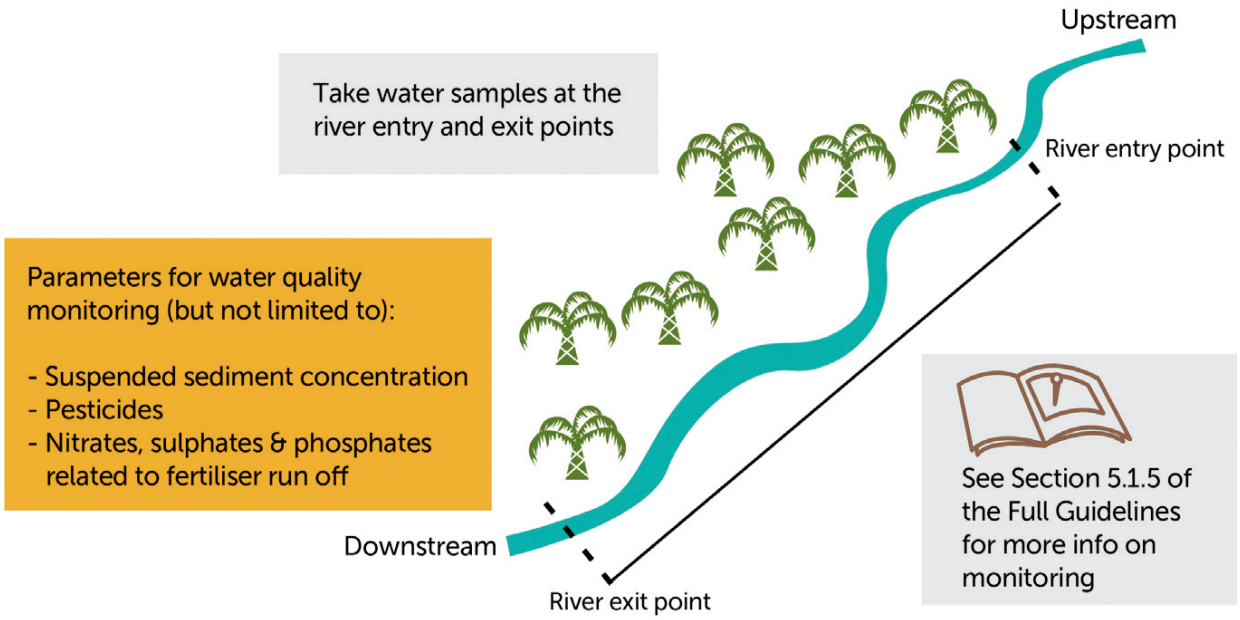


Figure 14. Monitoring water quality.

National water quality guidelines should be consulted to determine which factors should be measured and target levels. Water quality is affected by a wide range of management practices on plantations, such as soil stabilisation, pesticide and fertiliser regimes, roads, mill effluent treatment and drainage. If monitoring indicates that water quality needs to be improved, steps should be taken to improve plantation operating procedures as well as improving the riparian reserves. More information can be found in section 5.1.5 of the Full Guidelines.

Vegetation structure is key to the effectiveness of riparian reserves for delivering the full range of benefits, and so monitoring of metrics such as canopy height and ground cover are important for measuring the overall health of the riparian reserve. Riparian reserves undergoing restoration (active or natural) will require more intensive monitoring in the first 5 years of the programme, becoming less frequent as the forest becomes established. Intact forest reserves will require less frequent or involved monitoring (see Section 5.1.3 of the Full Guidelines for detailed procedures on monitoring restoration programmes, and section 5.1.4 for monitoring vegetation in established reserves). A simplified forest integrity assessment tool is available at: www.hcvnetwork.org/resources/forest-integrity-assessment-tool

Biodiversity is closely related to vegetation quality, and so monitoring vegetation structure parameters is likely to be the most cost-effective means of assessing the biodiversity impacts of riparian reserves. However, if biodiversity is a specific target benefit of the riparian reserve, for example if it supports or facilitates dispersal for HCV species, or specific threats to biodiversity have been identified (such as hunting) then additional biodiversity monitoring may be necessary. Consult the relevant local wildlife department, academic institution or NGO for advice.

3.2 Analysing the monitoring data

A system for reporting and responding to the monitoring data should be in place before the monitoring has begun, including a named individual within the oil palm company responsible for ensuring that the monitoring results are properly stored, analysed, reported, and acted upon when necessary. A review of the monitoring data should be conducted at least once a year.

One method for tracking changes in quantitative data is to plot a graph of the chosen indicator over time, and to examine whether its general trend observed was positive, negative or neutral, as indicated in Figure 15.

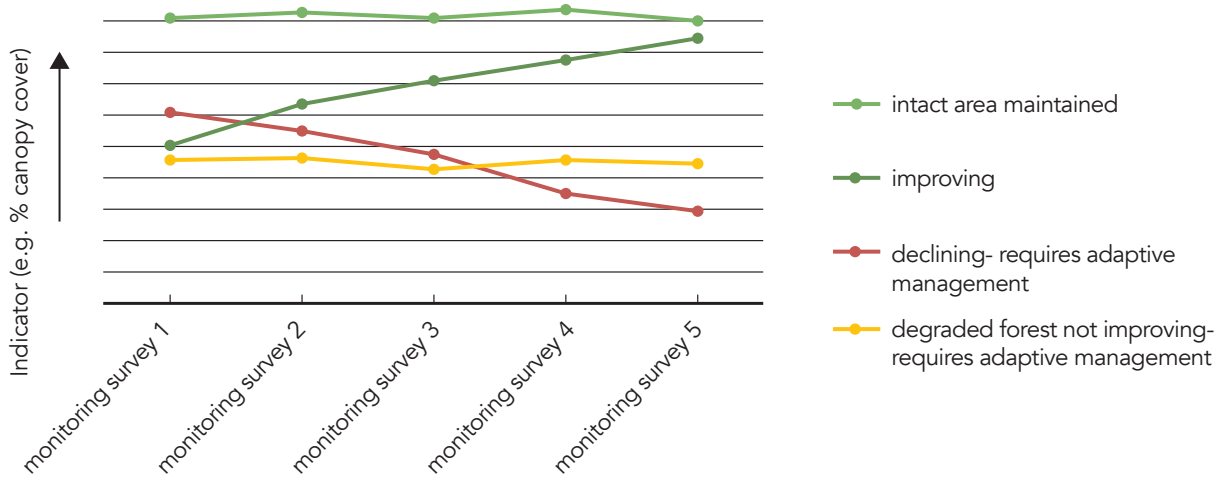


Figure 15. How to plot monitoring survey data to assess change over time. If intact areas are being maintained or if degraded areas are improving (light and dark green lines), management is working and no changes need to be made. If indicators are declining (red line) or if degraded areas are not improving (yellow line), the management plan needs to be adapted.

The ZSL Spatial Monitoring and Reporting Tool (SMART) (www.smartconservation.org) is one resource that can be used to analyse and interpret threats. This includes mapping the locations of the recorded threats collected during patrols.

Step 4:
Adaptive management

If monitoring indicates that a threat needs to be addressed, that the riparian reserve vegetation is degrading or not improving, or if intended benefits to biodiversity or water quality are not being met, then the management plan should be adapted.

As well as identifying problems or successes, monitoring data can also be used to determine improvements. For example, spatial information can enable patrols to be targeted to parts of the reserve that are most used by poachers, or to enable targeted planting of ground cover to reduce soil erosion from a vulnerable area such as a recent land slide.

Following updates to management plans, monitoring should continue. It is important that the monitoring procedure remains consistent so that later surveys can be directly compared to earlier data. Additional monitoring procedures could be added if new threats emerge that are not monitored effectively by existing procedures.

Summary

The maintenance and management of riparian reserves is a requirement of the RSPO. Well managed riparian reserves provide a range of benefits including water protection, bank stabilisation, carbon storage, biodiversity conservation and protection or improvements to livelihoods and wellbeing.

The Simplified Guide provides a condensed overview of the best management practices for riparian reserves.

There are four major steps involved in managing riparian reserves in compliance with RSPO Principles and Criteria.

- Step 1 explains the procedures for establishing riparian reserves, including where to locate reserves and how wide they need to be.
- In Step 2, the process for developing and executing an effective management plan are explained. The vegetation characteristics affect how well the riparian reserve will perform in delivering its intended environmental and social benefits. This is therefore the key determinant for the type and level of management that the reserve needs.
- Step 3 deals with developing and executing an effective monitoring procedure, and
- Step 4 explains how monitoring data should be used to inform adaptive management of the riparian reserve.

By following the steps and ensuring that management is adaptive to changing conditions, riparian reserves will generate benefits for plantations, the wider environment and community.

The RSPO is an international non-profit organization formed in 2004 with the objective to promote the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders.

www.rspo.org

RSPO SECRETARIAT SDN BHD
(787510-K)

Unit A-37-1, Level 37, Tower A,
Menara UOA Bangsar
No. 5 Jalan Bangsar Utama 1,
59000 Kuala Lumpur

T +603 2302 1500 (ext 102)
E info@rspo.org
F +603 2302 1542

RSPO
Roundtable on Sustainable Palm Oil

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