Environmental Risk Assessment for FSC certification in the *Selva Maya* (Maya Forest)

Revision for 31 May 2009

Timothy Synnott

Matthew Wenban-Smith

A project supported by ICCO, The Netherlands

www.oneworldstandards.com/ERA.html

Environmental Risk Assessment for FSC certification in the *Selva Maya* (Maya Forest)

Timothy Synnott
Estudios Forestales Synnott S.C. timsynnott@prodigy.net.mx
Matthew Wenban-Smith
OneWorldStandards Ltd. mwenbansmith@oneworldstandards.com

Table of Contents:

Acronyms

ASI	**Accreditation Services International, FSC**
CATIE	**Centro Agronómico Tropical de Investigación y Enseñanza, Costa Rica**
CB	**Certification Body**
CONABIO	**Comisión Nacional para el Conocimiento y Uso de la Biodiversidad**
CONAP	**Comisión Nacional para Áreas Protegidas, Guatemala**
ERA	**Environmental Risk Assessment**
FMU	**Forest Management Unit**
FSC	**Forest Stewardship Council**
GMO	**Genetically Modified Organism**
HCV	**High Conservation Value**
ICCO	**Interchurch Organization for Development Cooperation**
ITTO	**International Tropical Timber Organization**
MSC	**Marine Stewardship Council**
NGO	**Non-Government Organization**
NI	**National Initiative**
NOM	**Norma Oficial Mexicana**
P&C	**Principles and Criteria of the FSC**
RTE	**Rare, Threatened and Endangered species**
SLIMF	**Small and/or Low Intensity Managed Forest**
WWF	**WorldWide Fund for Nature**

Thanks

The authors of this report wish especially to thank the staff of ICCO for making it possible for us to carry out this study, and the numerous forestry and community stakeholders in Quintana Roo, Mexico and Petén, Guatemala, who have participated in meetings and discussions during the development and testing of the ERA system. In particular we thank Inga. Victoria Santos Jiménez (Organization of Ejido Forest Producers of the Zona Maya, Felipe Carrillo Puerto, Quintana Roo), Ing. Hugo Galletti (Society of Ejido Forest Producers of Quintana Roo, Chetumal), and Ing. Walter Ponce (FORESCOM, Community Service Enterprise, San Benito, Petén) who personally convened the meetings with regional stakeholders.

In addition, we are very grateful to the following members of the project Reference Group who provided comments, corrections and suggestions at various stages of the project, based on their perspectives of forest management and certification, to help ensure that the ERA system will serve as a useful tool for supporting FSC certification: Mauricio de Almeida (IMAFLORA, Brazil), Peter Dam (FORCERT, Papua New Guinea), Richard Donovan (Smartwood, Rainforest Alliance, USA), Fabián Fernández (Fundación VIBO, Mexico), Andre de Freitas (FSC, Germany), Hugo Galletti (SPFEQR, Mexico), Sergio Madrid (FSC Mexico), Bruno Martinelli (FSC Brazil), Eric Palola (National Wildlife Federation, USA), Walter Ponce (FORESCOM, Guatemala), Victoria Santos (OEPFM, Mexico).

The authors would be grateful for any suggestions and corrections to this report.

Summary

The objectives of environmental monitoring as an element of responsible forest management at the forest management unit (FMU) level are different to those of environmental monitoring for the purposes of scientific research.

At the FMU level, monitoring aims to make a direct contribution to responsible forest management, for example by identifying when management is having a negative impact on key environmental values, so that management can be modified to reduce or avoid such impacts in future, and so that the success of such modifications can be verified. In the FSC context, community forest managers have a responsibility to ensure that their management is not causing unacceptable environmental impacts. Where management has been having a significant negative impact, it may be necessary to monitor whether management changes are effective in reducing the impact. But community forest managers should not be expected to undertake primary scientific research.

Monitoring can be a significant cost, as well as requiring considerable technical expertise. The allocation of such resources to the detailed monitoring of environmental values that are not at risk is not necessary, and is actually harmful if this means that scarce resources are diverted from more important tasks, or if it creates a barrier to achieve certification and consequent market access.

Environmental Risk Assessment (ERA) provides a methodology for considering relationships between different stress factors and their impacts on specified environmental values. The ERA approach can help identify those environmental values that may be at risk in a particular situation, and, conversely, those that are unlikely to be at risk. Resources can then be focused on monitoring of values that may be at risk and the management of the factors that have most affect on them, rather than being misallocated to the monitoring of values that are not at risk, or to potentially costly controls on activities that have no significant environmental impact.

The ERA approach can be especially useful where there is a shortage of scientific data and where it is difficult, time-consuming or costly to collect such data. In such cases management decisions must be based on the readily available information.

This project describes an ERA system designed specifically to support implementation of the *FSC Principles and Criteria for Forest Stewardship* for community managed forests in the tropics. In these forests, detailed information about specific environmental values at the level of the Forest Management Unit is typically lacking, and FMU-specific data which would be meaningful for management purposes is difficult to collect. Resources (in terms of time, money and technical support) are scarce, and the allocation of these resources must be considered very carefully. However, there is often substantial information and knowledge available at the regional level, relating to the impacts that different stress factors have on a wide range of environmental values. This regional level information can be used to determine whether environmental values are likely to be at risk at the FMU level, and therefore whether environmental monitoring is or is not necessary.

A key element of the proposed ERA system is the statement of environmental objectives or goals for all the environmental values that have been identified by FSC as criteria for the assessment of responsible forest management. These objectives correspond to acceptable consequences of responsible forest management, compatible with FSC requirements.

The ERA then focuses on the risk of not achieving these goals, based on the identification and evaluation of potentially damaging "stress factors" that are present in the forest management unit, and the relations between these stress factors and the identified environmental values.

The system takes account of the scale and intensity of the stress factors, special vulnerabilities that may be relevant at the level of the Forest Management Unit, and the possibility of mitigating measures that may reduce the impact of the stress factors on the environmental values.

ERA thereby provides a simple but robust method for identifying those environmental values that may be at risk so that they may be monitored, or so that the impacts on them may be reduced through management. At the same time it aims to justify appropriate decisions *not* to devote scarce resources to monitor environmental values that are clearly not at risk.

In meeting these objectives this ERA aims to reduce the costs of achieving FSC certification for community managed forests in the tropics, and so promote uptake in line with FSC's strategic goals to support community forest management in the tropics.

An ERA in practice

This project developed an ERA for the *Selva Maya* (Maya Forest) of south-east Mexico, northern Guatemala and Belize. This is the second largest block of tropical forest in the Americas, containing over 200 community-managed forests, as well as private and public forests. 30 of these forests have been FSC-certified or are in the process of evaluation. However, the ERA has been designed so far as possible as a generic system which can be used with relatively minor adaptations in individual community or private forests, or in other regions of the world.

ERA has been designed to be simple enough for use by any community forestry organization, but also to be sufficiently detailed, comprehensive and transparent to be accepted by certification organizations, NGOs and scientists. To achieve these conflicting aims, ERA is designed as a checklist system based on the use of Microsoft Excel spreadsheets.

For a *community forestry organization*, the requirements for implementation are:

- access to a computer that can run the Microsoft Excel software, version 2003 or later
- the ability to navigate between worksheets and enter 'ticks' or numbers into the cells as indicated
- a good technical knowledge of their own forest and forest management practices.

Our experience in the *Selva Maya* is that these requirements and skills are readily available to the community forestry organizations and their technical advisers, the intended primary users of the system, at no additional cost.

Once the ERA system has been set up for any region, it is used as follows:

1. The community managers tick boxes on a worksheet, providing basic information about some of the key environmental elements in their own forest management unit. For example, whether specified species are known to be present; what are the key harvested species of trees or Non-timber Forest Products; whether key habitats occure within the FMU. The terminology used has been designed to be readily understandable by community forest technicians with little or no external assistance. Our experience is that it should take about 10 minutes to complete this checklist.

2. The community managers specify a score of 0, 1, 2 or 3 for the 'scale' and 'intensity' of a list of previously specified stress factors. For example, managers would specify the intensity of harvesting of timber within the FMU as follows:

low (score 1)
Harvesting is estimated to remove less than 2 cubic metres per hectare per year in the harvested areas.

medium (score 2)
Harvesting is estimated to remove between 2 and 5 cubic metres per hectare per year in the harvested areas.

high (score 3)
Harvesting is estimated to remove between more than 5 cubic metres per hectare per year in the harvested areas.

This is the most technically demanding aspect of the ERA implementation. It requires a sound knowledge of local management practices, as well as understanding of the terminology used to define the different levels of scale and intensity for the ERA. The terminology used has been developed and tested in the *Selva Maya*, and we believe it is readily understandable and usable by community forestry technicians in the region. Our experience is that it should take about one hour to complete this checklist.

3. The community forest managers tick boxes on the third worksheet, providing information about the presence or absence of specified 'mitigating measures', for example whether at least 10% of the FMU has been allocated to protected areas (yes or no). Completing this checklist should take about 10 minutes to complete.

4. Once the information described above has been entered, the system shows the results of the ERA on the 4th worksheet. The system has been set up to highlight (in red) environmental values which may be at risk, and the stress factors that are having the greatest impacts.

5. Using the results:
If the ERA results show that no environmental values appear to be at risk, this information can be used by the forest managers to justify their decision to undertake no, or extremely minimal, environmental monitoring within their FMU.

If the ERA results show that some environmental values may be at risk, the system can then be used interactively. The effects of reducing the scale and intensity of management or other risk factors, or introducing additional mitigating measures can be readily evaluated. Alternatively, the managers may decide to develop effective monitoring systems focusing on these environmental values, to establish the actual impacts of management, and either confirm the level of risk or show that, in practice, any impacts are at an acceptable level. We would expect forest managers to decide the best course of action taking account of the costs of monitoring compared to the costs of mitigating their management practices.

To set up the ERA system for a new region of the world requires a relatively high level of expertise. Before the system is used in a new region, we recommend that it be revised through a consultative process including ecological experts and community forest managers, so that a broad range of local expertise and experience can be incorporated. Minimum requirements would be:

- a good understanding of forest characteristics and management practices in the region as a whole, sufficient to be able to identify the key 'stress factors', 'mitigating measures' and 'potential environmental vulnerabilities' for forest management units in the region.

- sufficient understanding and familiarity with scientific findings in relation to impacts of forest management on important environmental values to be able to provide realistic estimates of the 'linkages' between the identified stress factors and environmental values, and how these are likely to be modified depending on the presence of mitigating measures and/or environmental vulnerabilities.

- a good understanding of the algorithms on which this ERA is based, so that new variables can be entered correctly when the environmental values, stress factors, etc are changed, and the ERA baselines can be updated correctly.

- strong skills in using Microsoft Excel software, so that changes can be made and then saved for use in the field, without further need for modification.

However, once the system has been set up for a specific region, its use is designed to be as simple as possible.

The project documents are available for download from:
http://www.oneworldstandards.com/ERA.html

AN ENVIRONMENTAL RISK ASSESSMENT (ERA) SYSTEM FOR THE *SELVA MAYA*

Part 1: Introduction

1.1 Background and Justification

Uptake of certification, through FSC and competing schemes, has been strong in boreal and temperate forests. In the tropics, almost one third of the forest area that ITTO considers to be sustainably managed is also FSC-certified, and FSC certification appears to be an important factor supporting improvements in forest management (40, 90). Nonetheless, in absolute terms progress in the tropics remains slow. And although FSC certification in both the tropics and temperate regions has grown rapidly for large-scale industrial producers, it has not acquired the same relevance to small forest owners or community forest managers.

FSC recognises these challenges, and has identified 'equitable access' as one of five key goals driving FSC's strategy for the future (FSC 2007). To achieve this goal, FSC aims to: i) to reduce barriers and create incentives for increased implementation of FSC standards in natural forest operations throughout the tropics, and ii) to ensure that local stakeholders, communities and indigenous people have equitable access to the benefits of FSC certification.

To meet these goals the cost and difficulty of achieving certification, beyond the costs associated with achieving responsible forest management, must be minimised. Any extra requirements needed to satisfy the certifiers, the accreditors and the FSC members are transaction costs that create a barrier to the uptake of certification, and should be limited to the necessary minimum. Unfortunately, some of the requirements currently applied to community forests to comply with FSC criteria for environmental monitoring and impact assessments go well beyond the necessary minimum, and have become a barrier to the achievement of FSC's objectives.

The dangers of requiring unrealistic amounts of monitoring are recognised in the guidelines for ecological monitoring published by CATIE and WWF-Centroamérica (25, 100, 100a): *"The Guide takes into account the basic point that monitoring should be appropriate to the scale and intensity of the management; monitoring costs should increase appropriately in relation to the scale, intensity and conservation value of the forest. We think that if the management impacts in the forest appear to be very low, managers and certifiers should consider the possibility of not monitoring. … In general, in a framework with limited resources, the possibility of investment and its magnitude should be evaluated in relation to other aspects in the broad context of management, such as the necessity of fire control or the control of encroachment. In other words, it might be more prudent to invest funds to prevent forest conversion, and later, once all the immediate threats have been eliminated, invest those funds in monitoring*" (25, 100, 100a, Step 5). This position, endorsed by WWF and CATIE, matches the ERA concept entirely.

In the same vein, the concept of matching the monitoring intensity to the degree of risk is also built into the FSC-accredited Forest Management Standard for Spain, for Criterion 6.1: "*Small and low-impact forest management properties could comply with this criterion by means of a simple, more or less informal evaluation. In larger properties, or those with more intensive management, a broader and more detailed evaluation will be needed*".

FSC's environmental monitoring requirements are given in Criteria 6.1, 8.1, 8.2, 8.4, 8.5 and 9.4 (Annex 1). Our analysis of the conditions and pre-conditions applied during certification in the *Selva Maya* suggests that the difficulties are not caused by the requirements of the FSC Principles and Criteria, but rather by the lack of locally recognised, efficient and cost effective

methodologies for implementing them to the satisfaction of the certification bodies. 100% of FSC-certified community managed forests in Mexico have been issued with pre-conditions or conditions specifying biological surveys. The high cost of complying with these requirements in each separate certified forest is typically beyond the resources of the community forest managers. Forest managers are faced with requirements that exceed their capabilities and go beyond the essential needs of good, low-impact forest management. Monitoring requirements have thus become a barrier to FSC certification for community managed forests.

1.2 An Environmental Risk Assessment (ERA) System for the *Selva Maya*

The objective of monitoring in the context of FSC certification is to ensure that environmental objectives are being met. Monitoring effort should therefore be focussed on environmental values which are potentially at risk. Where managers can show that their management is of such low scale and/or intensity that there is little or no risk of failing to meet key environmental objectives, then monitoring may be greatly reduced, and/or may take place at the regional level rather than the FMU level.

Techniques of Environmental Risk Assessment (ERA) have been developed to understand which actions or activities are likely to be most important in relation to achieving or failing to achieve specified environmental outcomes, and therefore to focus management or monitoring effort on those actions or activities that are most significant.

ERA techniques have been used for the certification of fisheries where data may be missing or deficient, and it has applications in forestry, fisheries and other fields (1, 3, 36, 37, 46, 82). Implementing a full ERA can be highly complex. However, we propose that the principles can be adapted in a simplified form to forest certification, and can provide a scientifically valid, practical and cost-effective tool to help community forest managers and certification bodies determine when environmental monitoring is, or is not, justified.

To design an ERA for use in FSC certification, we have assumed that some environmental values are more vulnerable to some stress factors than others, and that these linkages can be estimated based on generic information about the impacts of forest management, supplemented by additional regional research and expertise.

In the *Selva Maya*, numerous scientific assessments have been carried out during the past twenty years to evaluate the impacts of logging and other disturbances on elements ranging from tree seedlings to jaguars. Communities and NGOs have invested in environmental impact appraisals and biological monitoring, to comply with national regulations and FSC requirements (5, 14, 15, 18, 32, 56, 57, 75, 87 and other references in Annex 8). Many of these studies have shown that typical low-intensity selective logging has minor or acceptable levels of impact on ecosystems and biodiversity, but that some impacts can be serious.

There is a high level of uncertainty and complexity in relation to exactly *how* management or other factors affect different environmental values. It is very hard to define the boundary at which increasing management intensity leads to unacceptable impacts on environmental values. However, we propose that by adopting a precautionary approach it is possible, based on the existing technical and scientific literature, for an ERA system to identify with a high degree of confidence when management is of sufficiently low intensity that it is *very unlikely* to be having unacceptable environmental impacts.

Accordingly, this project was designed to create a cheap and simple ERA tool that could be readily used by community forestry managers to help them determine whether their management is of such a low intensity that it is unnecessary for them to carry out detailed monitoring assessments in their own FMUs.

Where monitoring is advisable publications by CATIE, WWF and others (25, 100, 100a and Section 3.2) provide advice on practical approaches for cost-effective monitoring.

1.3 Application outside the *Selva Maya*

The ERA approach described in this report is specifically adapted to reduce the cost and complexity of FSC certification for certified community-managed tropical forests in the *Selva Maya* region.

Once the ERA framework has been established for a region or a forest type, it can be used repeatedly and consistently by different managers and certifiers in the region without significant additional effort.

However, the generic ERA system should be applicable in any region of the world, with relatively minor adaptations based on local expertise and testing. A second phase of the project proposes to adapt and test the ERA technique for use in other regions, including the Amazon basin, Congo basin and SE Asia (see Part 5).

Part 2: The *Selva Maya* ERA

2.1 Overview

The Selva Maya Environmental Risk Assessment (ERA) system is designed to determine whether key environmental values that must be maintained in order to achieve FSC certification are at risk within a Forest Management Unit (FMU) under management.

The key environmental values have been identified, based on the requirements of the FSC Principles and Criteria. For each environmental value, objectives or goals are specified that would need to be met to achieve FSC certification.

Regionally significant stress factors are then identified in relation to these environmental values. Stress factors may be directly related to management (e.g. timber harvesting), or may be primarily external (e.g. fire, or agricultural encroachment).

The impact of these stress factors on the maintenance of the environmental values is then determined by specifying the scale and intensity of each stress factor, estimating the extent to which each stress factor is *linked* to each environmental value, identifying any additional reasons that might make the environmental value particularly vulnerable, and, finally, identifying what mitigation measures are in place that should help to protect the environmental values from the identified impacts.

The result of this analysis is a simple table which identifies the overall level of risk associated with each environmental value. The managers can then use the ERA results to help them decide whether additional mitigation measures should be implemented, and/or whether resources should be allocated to monitoring impacts on specific environmental values to ensure that the related management objectives are, in fact, being achieved.

The following sections describe each of these aspects of the ERA in more detail.

2.2 Environmental Values and Objectives

A fundamental aspect of the ERA system is the identification of the critical environmental values or components that may be affected by forest management, and the associated goals or objectives of management.

This ERA aims to cover all the key environmental values that are referred to in relation to the monitoring requirements of the *FSC Principles and Criteria* (Annex 1). For each environmental value, the system specifies the objectives or goals that are sufficient to achieve FSC certification and comply with the P&C.

The environmental values and objectives presented are based on an understanding of FSC international requirements and on subsequent consultations with stakeholders in the *Selva Maya*. The environmental values have been organised into four groups: Fauna & Flora, Habitat Features, Ecosystems, and Environmental Elements.

Figure 1 shows a small sample of the Values and Objectives. The full list is in Annex 2.

Environmental Value 1.1 Target species (the species selectively removed by harvesting or by silvicultural treatments. Target species may be subdivided into timber trees, pole trees, fuelwood, NTFPs and animals. They may be subdivided further by species or groups).

Objectives*:* *All target species maintain long-term viable populations within the FMU. The*

population of each tree species within the FMU includes seedlings, immature trees and mature trees in sufficient quantities to ensure regeneration in the long term. Conditions for their successful regeneration occur within the FMU over time.

Environmental Value 1.2 Non-target species (All species of flora and fauna that are not harvested. May be subdivided into trees, shrubs, climbers, herbs, and animal families, and further subdivided into species).

Objective: *All species maintain viable and self-sustaining populations within the FMU in the long term*

Environmental Value 3.4 The Forest in the Landscape

Objective: *Forest management has insignificant negative impacts on the landscape, and no impact on key landscape features.*

Figure 1. A sample of environmental values and Objectives: environmental values that may be affected by stress factors in the forest, and the objectives or goals of management that are considered acceptable in the context of FSC certification. The full list for the generic ERA system is in Annex 2.

2.3 Stress Factors

The second critical aspect of the ERA system is the identification of the main stress factors in the region which might have a significant impact on these environmental values. *Stress factors are any activities or actions in the FMU caused by human intervention that may have a significant negative impact on the environmental values or objectives.*

For the purposes of ERA, the FMU is considered to be the area subject to operational forest management, including protection and conservation. In Mexican ejidos, the FMU is considered to be the Área Forestal Permanente (Permanent Forest Area) designated in the Management Plan. In the Petén, the FMU is that part of the concession area which has not been cleared for agriculture or grazing.

The stress factors may be part of forest management (e.g. skidding, silvicultural techniques), or they may be the responsibility of other parties (e.g. illegal harvesting, agricultural encroachment, or hunting). For the purposes of this ERA, they do not include natural and uncontrollable events such as hurricanes, floods and droughts.

This ERA system specifies a two-step process for the identification of regionally significant stress factors. In the first step, a generic list was prepared with all stress factors that might be relevant to communities within the region, and which are likely (on the basis of general experience, local knowledge and stakeholder consultations) to have at least some negative environmental impacts (Annex 3). In the Excel Worksheets, these are called "Potentially Significant Stress Factors".

This generic list (Annex 3) is designed to be complete and inclusive, including some factors which are very unusual, or may not currently be applicable (such as the use of the poisoning of non-commercial tree species as a silvicultural treatment). However, stress factors which never take place, or which would clearly have inconsequential impacts such as botanical collecting are not included. (These very minor stress factors may be listed separately, to show that they have been considered and have not simply been forgotten or ignored. If subsequent research suggests that such stress factors in fact have significant impacts, they can then be included in future revisions of the system.)

In the second step, those stress factors that are recognised by regional experts as having *significant* impacts on the specified environmental values are identified, and these *regionally significant* stress factors are included for more detailed consideration.

For this ERA system, the stress factors have been organised in five groups:

1. Roads, transport and access,
2. Silviculture and site management,
3. Harvesting forest products
4. Processing forest products
5. Other stress factors in the forest

1. Roads, transport and access
Construction and maintenance of permanent roads and tracks
Construction and maintenance of temporary roads, tracks and log-loading areas
2. Silviculture and site management
Felling of non-target species as a silvicultural treatment
Poisoning of non-target species as a silvicultural treatment
Thinning and weeding
Pruning
Planting
Climber cutting
Pesticide use (including insecticides, herbicides, etc)

Figure 2. Partial list of stress factors that may have a negative impact on the identified environmental values or objectives. Factors in *italics* are the Regionally Significant Stress Factors (SF) that are likely to be of significance in the *Selva Maya*. Annex 3 presents the complete list.

The full list in Annex 3 has been reviewed by regional experts and stakeholders to identify only those stress factors that are likely to have significant negative impacts on some environmental values in at least some community managed FMUs in the *Selva Maya*. This short list is indicated *in italics* in Annex 3, and is called the "Regionally Significant Stress Factors" (SF) in the Worksheet 2.2.

Note: Stress factors are activities or actions which have environmental impacts. Each one may have a wide range of impacts, major and minor, including not only the visible impact of cutting plants, killing animals or moving soil, but also the associated impacts of disturbance, noise, rubbish, increased solar radiation at soil level, etc. This collection of impacts is partially addressed by indicating the linkages between Stress Factors and Environmental Values (Section 2.4) and by classifying the Scale and Intensity of each Stress Factor in each FMU (Section 2.5).

2.4 Linkage between Stress Factors and Environmental Values.

After identifying the stress factors which may have significant environmental impacts in the region, the next step is to analyse these stress factors and impacts in more detail. In particular, it is necessary to identify the linkages between them, showing which environmental values are most likely to be directly impacted by each stress factor.

The linkages describe the relationship between each environmental value and each stress factor. A strong linkage indicates that if the stress factor exists in any situation where the environmental value occurs or is relevant, then there is a significant risk of damage to that value. The damage may range from direct physical impacts including destruction to indirect ecological impacts on rates of regeneration, predation, soil temperatures etc.

Each linkage is given a score from 0 to 2, depending on the strength of the linkage. A linkage score of 2 implies that that the environmental value may be highly vulnerable to the stress factor. A linkage of 0 implies that the stress factor has essentially no measurable impact on that environmental value.

> **Linkage score 0:** No significant relationship between the stress factor and the environmental value. Even if the scale and intensity of the stress factor were high (as defined in Section 2.5 and Annex 4), one would not expect a negative impact on the value. (Example: hunting probably has no impact on landscape values)
>
> **Linkage score 1:** Weak or low relationship between the stress factor and environmental value: the stress factor may have a significant negative impact on the value if its scale and intensity is high, but generally the stress factor has little negative impact. (Example: harvesting of NTFPs would generally have only a small impact on sites and ecosystems of special value; the presence of rubbish generally has little impact on species viability within the FMU).
>
> **Linkage score 2:** Moderate or strong relationship between stress factor and the environmental value: the stress factor would commonly have a significant negative impact on the environmental value, even at low or moderate levels of scale and intensity. Management may be required to control or reduce the impacts of stress factors on these values. (Example: selective logging, agricultural encroachment or uncontrolled hunting may have major impacts on the viability of certain species)

The ERA system should be set up with linkage scores that consider 'worst case scenarios', as a precaution. If there is doubt about the risks involved in a particular linkage, it should be given a higher score. The linkage score may subsequently be reduced when better information is available.

The linkage scores are approximate, and to some extent subjective. However, the scores are also transparent and may be reviewed and revised over time. The linkages may be assigned by one individual but would preferably be assigned by collecting and combining the independent opinions of a range of experts and regional stakeholders, or by discussing and agreeing the values during a workshop of experts and regional stakeholders.

For the *Selva Maya* ERA, a Reference Group was established including a range of individuals with expert knowledge of FSC certification and/or of the *Selva Maya*. Each member of the Reference Group was asked to estimate the linkages between each environmental value and stress factor. The results were then combined with the estimates of the authors to provide an average linkage value between 0 and 2 for each pair. These average values, reflecting the

combined knowledge and experience of all Reference Group members, were used for the application of the ERA in the *Selva Maya*[1].

Worksheet 2.3 presents the complete table of linkage scores for all the regionally significant stress factors (RS). Figure 3 is an extract of the complete table, showing the linkages between a sample of stress factors and environmental values.

Linkages between stress factors and environmental values	1.1 Target species					1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1)					1.4 Large landscape level forest-dependent species (HCV2)	2.1 Small scale sites or features of high ecological value	2.2 Habitat areas of importance to rare, threatened and endangered species	2.3 Forest structure	3.1 Ecosystems in their natural state	3.2 Natural population patterns (HCV2)	3.3 Rare, threatened or endangered ecosystems (HCV2)	3.4 Forest in the landscape (HCV2)	4.1 Soil quality	4.2 Soil stability	4.3 Water flow	4.4 Water quality
	Target species group 1 (trees)	Target species group 2 (fauna)	Target species group 3 (NTFPs)	0	0		Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)												
RS1 - Construction and maintenance of permanent roads and tracks	0.7	0.3	0.7	0.0	0.0	0.7	1.0	0.7	0.3	0.3	0.3	0.9	1.4	1.6	0.7	1.6	1.0	1.4	1.0	1.0	1.3	1.3	1.1
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	0.6	0.6	0.3	0.0	0.0	0.7	0.6	0.6	0.6	0.6	0.7	0.6	1.3	1.4	0.3	1.4	0.7	1.3	0.4	0.6	1.1	1.3	1.1
RS3 - Cutting fire breaks	0.4	0.3	0.4	0.0	0.0	0.3	0.4	0.3	0.3	0.3	0.6	0.3	0.4	0.6	0.4	0.6	0.6	0.7	0.7	0.1	0.4	0.4	0.3
RS4 - Felling of target tree species (timber, pole, fuelwood)	1.4	0.9	0.9	0.0	0.0	0.4	1.0	1.0	0.3	0.3	0.3	0.6	1.3	1.4	1.6	1.6	1.4	1.4	0.7	0.7	0.7	1.1	0.4
RS5 - Skidding	1.0	0.3	0.3	0.0	0.0	0.3	0.3	0.7	0.7	0.6	0.3	0.7	1.4	1.3	1.1	1.1	1.1	1.1	0.7	1.4	1.7	1.7	1.4
RS6 - NTFP harvesting (plants only)	0.6	1.0	1.7	0.0	0.0	0.4	1.0	0.7	0.6	0.6	1.1	0.9	1.0	1.1	0.6	1.3	1.3	1.3	0.1	0.1	0.3	0.1	0.1
RS7 - Establishment of infrastructure associated with on site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)	0.7	0.6	0.4	0.0	0.0	0.3	0.6	0.4	0.4	0.4	0.6	0.6	0.9	0.7	0.4	1.1	1.0	0.9	1.1	0.7	0.6	0.7	1.0
RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)		1.0					1.0	1.0				1.0			1.0	1.0	1.0	1.0	1.0	1.0			1.0
RS9 - Hunting, fishing and/or collecting of fauna (authorised and unauthorised)	0.1	1.9	0.3	0.0	0.0	0.4	2.0	1.9	1.1	1.0	0.7	1.9	1.3	1.1	0.1	1.6	1.7	1.4	0.1	0.0	0.0	0.0	0.1
RS10 - Fires	1.9	1.9	1.9	0.0	0.0	1.4	1.9	1.9	1.9	1.9	1.9	1.7	1.9	1.9	2.0	1.9	1.9	2.0	1.9	1.6	1.1	1.1	1.6
RS11 - Agricultural encroachment/ conversion	1.9	1.6	1.7	0.0	0.0	1.3	1.9	1.9	1.9	1.9	1.9	2.0	1.9	1.9	1.7	2.0	2.0	2.0	2.0	1.7	1.7	1.7	1.7
RS12 - Unauthorised harvesting of timber or NTFPs	1.9	1.4	2.0	0.0	0.0	0.4	1.4	1.1	1.1	1.1	1.4	1.1	1.7	1.7	1.4	1.7	1.6	1.7	1.3	0.9	1.1	1.1	0.9

Figure 3: Examples of linkage scores for Regionally Significant Stress Factors (RS) and environmental values. The strength or importance of each linkage is scored on a scale from 0 (no significant linkage) to 2 (strong linkage). The scores in this illustration are the averages of the scores proposed by a number of different experts. The complete table of linkage scores is presented in Worksheet 2.3.

2.5 Scale and Intensity of Stress Factors

The FSC Principles and Criteria refer many times to the need to take account of the scale and intensity of forest management operations when deciding whether a Forest Management Unit complies with the FSC Principles and Criteria. The introduction to the FSC Principles and Criteria notes that the "scale and intensity of forest management operations... will be considered in all certification assessments". Criteria 6.1 and 6.2 refer to the need to take account of the scale and intensity of forest management when assessing environmental impacts and establishing safeguards for the protection of rare, threatened and endangered species. Criterion 6.4 specifies that scale and intensity of operations should be taken into account when deciding how to protect representative samples of existing ecosystems in the landscape, and Criterion 8.1 notes that the frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations.

The linkage scores described in Section 2.4 identify the relationships between stress factors and environmental values, but do not consider how impacts on environmental values are affected by the scale and intensity of the stress factors. This is now built into ERA in a

[1] Reference Group averages were used for final testing. As a result of testing some of the regionally significant stressors were modified. Where this was the case replacement linkage values have been entered by the authors.

systematic way to take account of the fact that the impacts will obviously depend on the spatial scale (e.g. hectares per year), temporal scale (e.g. once every year or only once every 25 years), and the intensity (e.g. selective harvesting or clear-felling) of each stress factor.

Descriptions corresponding to low, medium or high levels of scale and intensity for each of the stress factors are presented in Annex 4. An example for the stress factor 'Road Construction and Maintenance of permanent roads and tracks' is shown in Figure 4.

Stress factor 1.1 Construction and maintenance of permanent roads and tracks	
SCALE (area and/ or frequency)	**INTENSITY**
Scale score 1: low Less than 50% of the management divisions (compartments) of the FMU contain a permanent road **Scale score 2: medium** 50 - 80% of the management divisions of the FMU contain a permanent road **Scale score 3: high** More than 80% of the management divisions of the FMU contain a permanent road**.**	**Intensity score 1: low** Less than 2% of the surface area of the FMU is taken up by permanent roads and associated constructions **Intensity score 2: medium** 2 - 5% of the surface area of the FMU is taken up by permanent roads and associated constructions **Intensity score3: high** More than 5% of the surface area of the FMU is taken up by permanent roads and associated constructions

Figure 4: An example of the definition of 'low', 'medium' and 'high' levels in relation to the scale and intensity of impact of the stress factors 1.1, Construction & Maintenance of Permanent Roads & Tracks. See Annex 4 for a complete table of Scales and Intensities for stress factors significant in this region.

The descriptions consider the scale (within the FMU) and intensity for each stress factor separately. These two separate attributes are then used to create a combined scale/intensity score for each stress factor in a particular Forest Management Unit. The combined scores are designed to reflect the likelihood that a stress factor will have a high level of impact on affected environmental values, *in the regional context.*

Consideration of the 'regional context' in this case applies to the likely impacts on environmental values in the regional context, rather than the scale/ intensity of the stress factor compared to regional norms. In other words, if the scale or intensity of harvesting within an FMU is likely to have a major impact on environmental values, it should be rated as 'high' intensity or scale, even when this intensity or scale is common throughout the region. It would not be rated as 'medium' simply because it was normal for the region.

This analysis requires significant local knowledge, and should be applied only to the stress factors that were previously identified as being significant in relation to the key environmental values in the region to which the ERA will be applied. A complete set of scales and intensity descriptions for stress factors of significance in the Selva Maya is shown in Annex 4.

When a particular Forest Management Unit is evaluated using the ERA, the scale and intensity of each stress factor that occurs in that FMU is assigned a score of 0 (not present, or not applicable) , 1 (low), 2 (medium) or 3 (high). The separate scores for scale and intensity are then multiplied together, giving a range from 1 (for low scale and low intensity) to 9 (for large scale and high intensity) (or 0 if the factor is not present or is not applicable) (see Figure 5)

A combined score of 1 to 3 (no shading in Figure 5) means that the combination of scale and intensity is considered low risk to all but the most vulnerable environmental values. At this level of stress, it will probably not be necessary to monitor the impact of the stress factor

on the value, unless the value is also being affected by other stresses. Mitigating actions may be desirable, but would not be considered essential.

A combined score of 4 (light shading in Figure 5) means that the combination of scale and intensity of the stress factor is likely to have significant negative impacts on affected values, but relatively simple mitigating actions should reduce the impacts to a level at which achievement of the environmental objectives is not threatened, and site specific monitoring is not necessary to verify this.

A total of 6 or 9 (dark shading in Figure 5) means that the combination of scale and intensity of the stress factor creates a high likelihood of negative impacts on affected environmental values. Major mitigating actions are likely to be required, and monitoring may also be necessary to confirm that the environmental objectives are being achieved.

Scale: **Intensity:**	Small (1)	Medium (2)	Large (3):
Low (1)	1	2	3
Medium (2)	2	4	6
High (3)	3	6	9

Figure 5. Scoring for the scale and intensity of stress factors. This table shows how scores for spatial or temporal scale and intensity can be combined, to give a combined score, ranging from 1 (low risk) to 9 (high risk).

The descriptions of low, medium and high scale and intensity need to be prepared together, taking account of their use in this way in the scoring system.

The basic approach of the ERA should now be clear. The combination of scale and intensity of the stress factor, together with the strength of the linkage to a particular environmental value then gives an indication of the risk of a negative impact on that value at the FMU level. The ERA allows for the impacts for all significant stress factors to be combined, to give an indication of the overall level of risk associated with each individual environmental value.

However, the ERA system provides for this evaluation of likely impact to be modified, depending on the presence of FMU-specific 'mitigating measures' or vulnerabilities.

2.6 Mitigating Measures

The mitigating measures are the measures taken by the forest operators, or by others, which help to reduce the negative impacts caused by stress factors in the forest. It is necessary to consider mitigating measures only for those stress factors that have previously been identified as being of significance in the region (i.e., those *in italics* in Annex 3).

As in the case of linkages between stress factors and environmental values, the strength of mitigation may vary depending on the particular environmental value under consideration. It is therefore necessary to consider the potential for mitigation for each environmental value separately. In order to simplify the analysis, whether a particular measure mitigates the impact of a stressor on an environmental value is evaluated as a 'yes' or 'no' decision at the FMU level. A significant mitigating effect it is scored as a '1', and an insignificant (or no) mitigating effect is scored as a '0'.

The use of mitigating measures is based on the following considerations:

a Each mitigating measure must be recognised in the region as making a real and significant contribution to achieving the objectives for each linked environmental value, and to reducing the actual or potential negative impacts of the linked stress factors. The evidence may be empirical (based on practical experience) or more scientific (based on research or demonstrations).

b If more than one mitigating measure is identified as reducing the impacts of a particular stress factor, then these mitigating measures must be additive, (i.e. mitigating measure 1 plus mitigating measure 2 would be expected to have a greater mitigating impact than just mitigating measure 1 on its own). If this is so, then it is reasonable to assume that a large number of mitigating measures will result in "safe" management, even if the intensities of several stress factors are relatively high.

c It is not necessary or realistic to make sure that all mitigating measures are roughly equal in terms of magnitude, since any given mitigating measure will have different effects in different environmental circumstances and in different management situations. Nor is it necessary or feasible to aim for the same number of mitigating measures for all stress factors, since in reality a manager has a variable number of mitigating options for different potential stress factors.

d Each mitigating measure has an effect on only the paired stress factors and environmental values identified in Excel sheet 2.5. It has a major mitigating effect only where there is a strong linkage between the stress factor and the environmental value. The existence of many mitigating measures does not necessarily reduce the impacts of many stress factors on many environmental values.

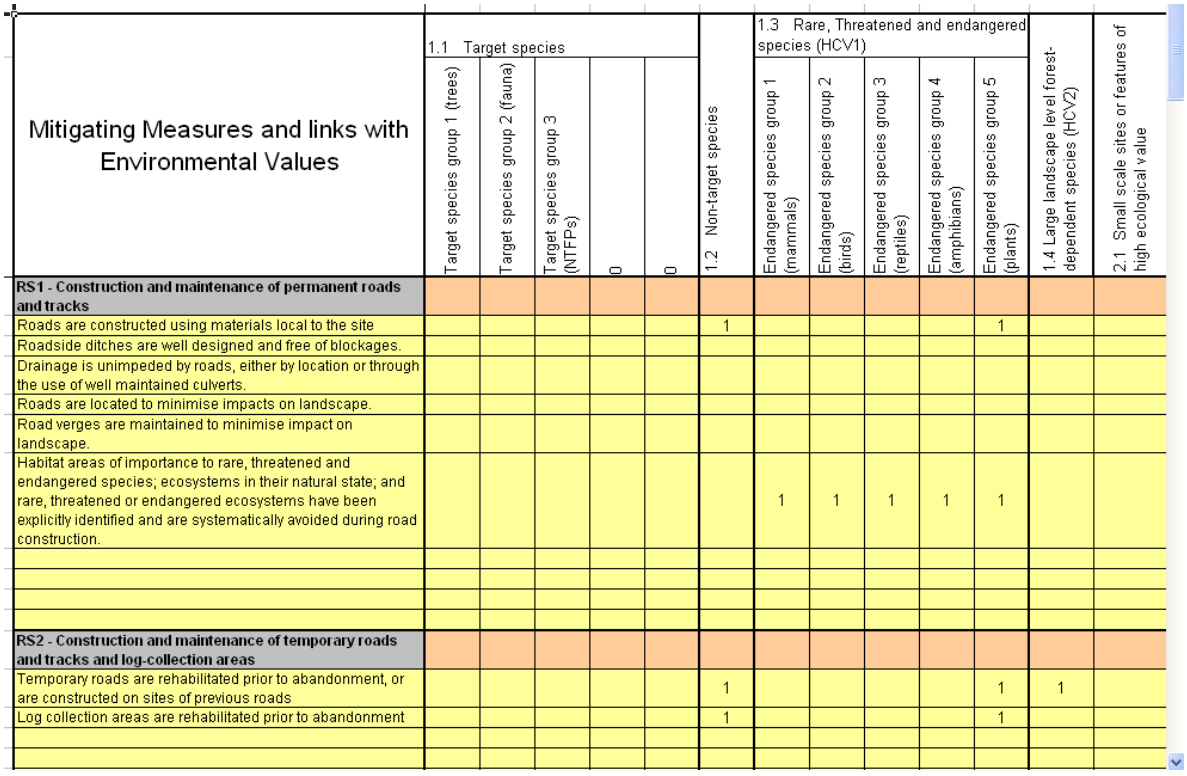
e It is recognised that some stress factors operated at relatively high intensities can have their Risk Values (Excel sheet 1.4) reduced to apparently "safe" levels if a sufficient number of appropriate mitigating measures are applied. This matches empirical experience,

f For some stress factors, few or no mitigating measures have so far been identified. This matches empirical experience, and indicates that in order to reduce the impact of these stress factors (and the Risk Values) it is necessary to reduce the scale or intensity of the stress factor.

Under these circumstances the ERA system makes a valid use of the mitigating measures. The exact impact of 'Mitigating Measures' on the final ERA results will depend on how the mitigating measures are linked to particular environmental values. In the *Selva Maya* ERA, when the Scale x Intensity for all stress factors was set to 4, it was not possible to reduce the risk value for all environmental values to 'safe' levels, even when all the mitigating measures were implemented.

Annex 5 shows the complete list of mitigating measures associated with regionally significant stress factors in the *Selva Maya.* Worksheet 2.5 shows the associated scores relating these mitigating measures to particular environmental values. An extract is presented in Figure 6, below.

As for the analysis of scale and intensity of stress factors, the presence or absence of mitigating measures needs to be evaluated for a particular Forest Management Unit when the ERA is used. This process is described in Part 4.



Mitigating Measures and links with Environmental Values	1.1 Target species					1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1)					1.4 Large landscape level forest-dependent species (HCV2)	2.1 Small scale sites or features of high ecological value
	Target species group 1 (trees)	Target species group 2 (fauna)	Target species group 3 (NTFPs)	0	0		Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)		
RS1 - Construction and maintenance of permanent roads and tracks													
Roads are constructed using materials local to the site						1					1		
Roadside ditches are well designed and free of blockages.													
Drainage is unimpeded by roads, either by location or through the use of well maintained culverts.													
Roads are located to minimise impacts on landscape.													
Road verges are maintained to minimise impact on landscape.													
Habitat areas of importance to rare, threatened and endangered species; ecosystems in their natural state; and rare, threatened or endangered ecosystems have been explicitly identified and are systematically avoided during road construction.							1	1	1	1	1		
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas													
Temporary roads are rehabilitated prior to abandonment, or are constructed on sites of previous roads						1					1	1	
Log collection areas are rehabilitated prior to abandonment						1					1		

Figure 6. Extract from Worksheet 2.5 showing how the mitigating measures are associated with each linked stress factor and environmental value, for one stress factor (Construction and maintenance of permanent roads and tracks) and a selection of associated Environmental Values.

2.7 Vulnerabilities

The introduction to the *FSC Principles and Criteria* indicates that "the uniqueness of the affected resources and the relative ecological fragility of the forest" should be taken into account in all certification assessments. FSC Criteria 6.1 and 6.2 refer to assessment of environmental impacts (6.1) and the safeguards to protect rare, threatened and endangered species (6.2) being "appropriate to... the uniqueness of the affected resources". Criterion 8.1 says that the frequency and intensity of monitoring should be 'determined by the scale and intensity of management operations as well as by the relative complexity and fragility of the affected environment".

The proposed ERA takes these elements into account at two levels. Firstly, the ERA needs to be modified for use at the regional level: thus, in this example it is specifically designed for application in the *Selva Maya* region. However, secondly, the ERA also recognises that there may be particular factors of uniqueness or fragility at the level of a Forest Management Unit. This may mean that there is an especially high risk that the defined Environmental Objectives would not be achieved in these FMUs. The ERA therefore incorporates an additional assessment of the '*vulnerability*' of the identified environmental values at the FMU level.

The identification of vulnerabilities is equivalent to the identification of mitigating measures, but whereas mitigating measures *reduce* the risk that the environmental objectives will not be met, vulnerabilities *increase* this risk for particular environmental values.

As for the identification of mitigating measures, the identification of potential vulnerabilities should be carried out by experts and regional stakeholders during the development of the ERA for the region.

The requirement is to consider each of the generic environmental values (i.e. those listed in Annex 2), and then to consider, for each value, whether there are specific examples which are of significance in the region, and which may be *particularly vulnerable* to the kinds of stress factors that are considered to be significant in the region.

For example, one of the environmental values which is of importance is the maintenance of populations of target tree species. The experts are then asked to consider whether there are any specific tree species which might be *particularly* vulnerable to the key stress factors (e.g. harvesting, illegal harvesting, fire, etc). If so, these specific tree species should be listed. For example, for the *Selva Maya* ERA we have listed mahogany and cedar as vulnerable, because they have a reputation for being especially vulnerable to commercial logging, and for having scarce natural regeneration. We have also included up to five species of mammals, birds, reptiles, amphibians and plants that are legally classified as *Endangered* in Mexico. Similarly, the experts are asked to identify any specific examples of rare, threatened or endangered ecosystems present in the region that might be *particularly vulnerable*.

This regional ERA system allows for the specification of up to five 'vulnerabilities' in relation to each generic environmental value. This may appear to be a small number, but does allow for up to 120[2] specific vulnerabilities in total to be identified. It should be noted that one of the constraints on specification of such vulnerabilities is that their presence or absence must be readily identifiable by community forest managers, which tends to reduce the number that it is practical to include. It is also recommended that examples are selected which are the most vulnerable of any alternatives - this will ensure that the system as a whole takes a precautionary stance in relation to the overall assessment of risk (a similar approach is taken in the application of the ERA to marine ecosystems).

Once such specific examples have been identified, the particular vulnerabilities are specified in relation to each stress factor. As is the case for the scoring of 'mitigating measures' vulnerabilities are scored as 'present' (1) or 'absent' (0). So if mahogany were considered to be particularly vulnerable to fire as a stress factor, there would be a score of '1' in the column for 'fire'.

The association of a vulnerability with an environmental value has an equal and opposite effect to the association of a mitigating measure with a stress factor, as described in Section 2.8. See also Section 4.1.2.g.

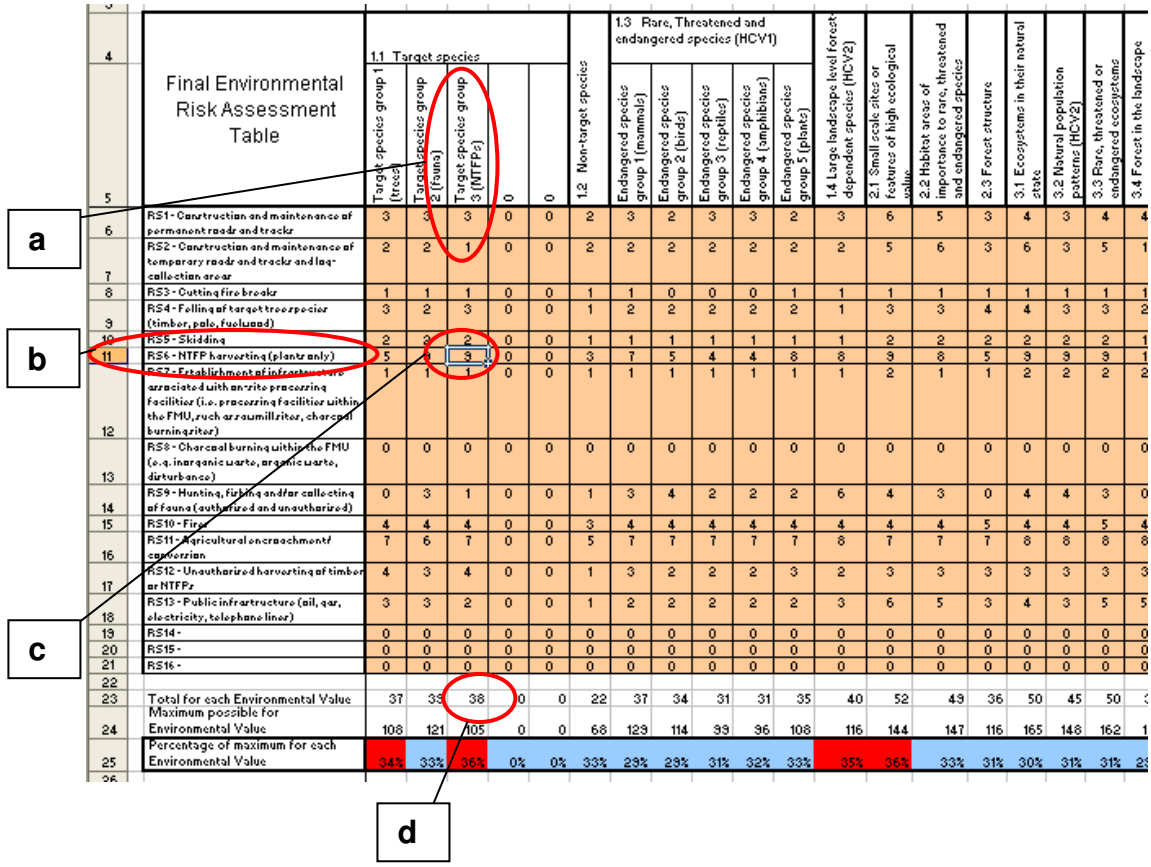
2.8 Calculation of Final Risk Values

To implement the ERA within a forest management unit, a forest manager specifies the scale and intensity of each stress factor, and the presence or absence of each mitigating measure and vulnerability within the forest management unit. The ERA system then automatically calculates the level of 'risk' affecting each environmental value.

The illustration shows an extract of such a final risk evaluation result. An explanation of the figures is provided below.

Figure 7 shows the calculation of the total 'risk' **(d)** associated with the environmental value of "Target Species Group 3: NTFPs" **(a).**

[2] There are twenty four (24) separate environmental values or sub-divided values, each of which may be associated with up to five (5) vulnerabilities.



	Final Environmental Risk Assessment Table	1.1 Target species					1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1)					1.4 Large landscape level forest dependent species (HCV2)	2.1 Small scale sites or features of high ecological value	2.2 Habitat areas of importance to rare, threatened and endangered species	2.3 Forest structure	3.1 Ecosystems in their natural state	3.2 Natural population patterns (HCV2)	3.3 Rare, threatened or endangered ecosystems	3.4 Forest in the landscape
		Target species group 1 (trees)	Target species group 2 (fauna)	Target species group 3 (NTFPs)	0	0		Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)								
6	RS1 - Construction and maintenance of permanent roads and tracks	3	3	3	0	0	2	3	2	3	3	2	3	6	5	3	4	3	4	4
7	RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	2	2	1	0	0	2	2	2	2	2	2	2	5	6	3	6	3	5	1
8	RS3 - Cutting fire breaks	1	1	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1
9	RS4 - Felling of target tree species (timber, pole, fuelwood)	3	2	3	0	0	1	2	2	2	2	2	1	3	3	4	4	3	3	2
10	RS5 - Skidding	2	3	2	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	1
11	RS6 - NTFP harvesting (plants only)	5	3	3	0	0	3	7	5	4	4	8	8	3	8	5	3	3	3	1
12	RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmills or, charcoal burning sites)	1	1	1	0	0	1	1	1	1	1	1	1	2	1	1	2	2	2	2
13	RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	RS9 - Hunting, fishing and/or collecting of fauna (authorised and unauthorised)	0	3	1	0	0	1	3	4	2	2	2	6	4	3	0	4	4	3	0
15	RS10 - Fire	4	4	4	0	0	3	4	4	4	4	4	4	4	4	5	4	4	5	4
16	RS11 - Agricultural encroachment/ conversion	7	6	7	0	0	5	7	7	7	7	7	8	7	7	7	8	8	8	8
17	RS12 - Unauthorised harvesting of timber or NTFPs	4	3	4	0	0	1	3	2	2	2	3	2	3	3	3	3	3	3	3
18	RS13 - Public infrastructure (oil, gas, electricity, telephone lines)	3	3	2	0	0	1	2	2	2	2	2	3	6	5	3	4	3	5	5
19	RS14 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	RS15 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	RS16 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22																				
23	Total for each Environmental Value	37	33	38	0	0	22	37	34	31	31	35	40	52	49	36	50	45	50	3
24	Maximum possible for Environmental Value	108	121	105	0	0	66	129	114	99	96	108	116	144	147	116	165	148	162	1
25	Percentage of maximum for each Environmental Value	34%	33%	36%	0%	0%	33%	29%	29%	31%	32%	33%	35%	36%	33%	31%	30%	31%	31%	2

Figure 7. Extract of final ERA Risk Assessment Table

For any individual pair of environmental values (in this case, Target Species Group 3: NTFPs **(a)**) and stress factors (in this case "NTFP harvesting" **(b)**), the calculation of risk is specified by the following equation:

$$RV = (S \times I) \times (L) \times (0.75^{m}) / (0.75^{v})$$

Where:

RV = Risk Value for a particular pair of environmental values and stress factors

S = the Scale of the stress factor at the Forest Management Unit level

I = the Intensity of the stress factor at the Forest Management Unit level

L = the Linkage between the environmental value and the stress factor

M = the number of mitigating measures which affect the particular pair of environmental values and stress factors

V = the number of Vulnerabilities which affect the particular pair of environmental values and stress factors

As an example, we consider the effect of stress factor RS6 “NTFP harvesting” **(b)** on one category of environmental value 1.1 “Target Species Group 3: NTFPs” **(a).** For this example, the 'risk value' **(d)** would be calculated as follows:

1. The scale and intensity of " NTFP harvesting" **(b)** is evaluated at the FMU level. For this example both 'scale' and 'intensity were specified as '3' (high), so the combined scale and intensity was 9.

2. The linkage value between " NTFP harvesting" **(b)** and the environmental value "Target Species Group 3: NTFPs" **(a)** is specified at the regional level. For this example the average of values proposed by the regional experts group was 1.71 (a high linkage value).

3. The impacts of mitigating measures are also specified at the regional level. Each mitigating measure is marked as 'present' or 'absent' at the FMU level. If a particular mitigating measure is present *and* that mitigating measure reduces the impact of "NTFP harvesting" **(b)** on "Target species Group 3: NTFPs" **(a),** then the number of mitigating measures for that cell is increased by one.

In this example, we suppose that two mitigating measures which had an impact on the linkage were also present in the FMU:

i) Harvesting technique is regulated to minimise reduction in reproductive potential of affected species, and
ii) at least 10% of the FMU was protected from harvesting.

The overall risk value is therefore multiplied by 0.75^2 (=0.5625) and so the risk level is correspondingly reduced.

4. Finally, 'vulnerabilities' that might increase (rather than decrease) the impact of stress factors on particular environmental values are specified. At the FMU level such potential vulnerabilities are simply marked as being 'present' or 'absent'. In this case no specific vulnerabilities (e.g. an NTFP that is known to be especially vulnerable to harvesting) were identified as being present within the FMU. The overall risk level would therefore be *divided* by 0.75^0 (= 1), with no effect on the overall level of risk. If vulnerabilities had been present, the risk value would have increased.

In summary, for this particular pair of stress factors and environmental values the associated risk would be:

$$RV = (3 \times 3) \times (1.71) \times (0.75^2) / (0.75^0)$$

$$RV = 9 \times 1.71 \times 0.5625 / 1$$

RV= 8.66 (rounded to 9 in the illustration) **(c)**

The simultaneous calculation and summing for all environmental values and all stress factors would be time-consuming and complex if done manually, but is carried out automatically by the Excel spreadsheet. No knowledge of the underlying equation is required to use the ERA or to interpret its results. In this case the total Environmental Risk Value for "Target Species Group 3: NTFPs" was calculated as 38 (**'d'** in the illustration).

2.9 Interpretation of Results

Implementation of the ERA results in a final table (Excel worksheet 1.4), is illustrated in Figure 7.

An environmental value is considered safe when the overall risk value is below 33.3% of the maximum possible level. This maximum level corresponds to the level of stress that would be applicable in the absence of any mitigating measures or vulnerabilities, if the scale and intensity of the stress factor were 3 or less.

Environmental values that score above 33.3% *may* be at risk, and are readily identifiable by the red colour of the applicable cell of Row 25 of the table. It should be stressed that these values are not *necessarily* being affected in a way that would be incompatible with the FSC P&C. Rather, these are the values where the risk is highest. In this case the manager has a range of options. The options are not exclusive - a combination of options is likely to be necessary.

a) The manager may choose to monitor the environmental value to determine whether it is being affected in practice (see section 3.2, below, for more detail in relation to monitoring options). Monitoring results will then tell the manager whether any further action is required.

b) The manager may choose to reduce the scale and/or intensity of the stress factors that have an impact on that environmental value. The implications can be tested by entering new, hypothetical values in Worksheet 1.2 and then seeing whether these reduce the risk value for a particular environmental value to below the 33.3% level.

c) The manager may choose to implement one or more mitigating measures. Again, the implications can be tested by entering the proposed measures on Worksheet 1.3.

As well as highlighting any environmental values that score more than 33.3% of the maximum total value, the table highlights stress factors that score more than 33.3% of their maximum value, and individual cells with a value of more than 13.5 (out of a maximum of 18 in the absence of additional vulnerabilities). This information should help the manager quickly identify those stress factors that are having the greatest negative impact on a range of environmental values. Management measures to mitigate or reduce the scale or intensity of these stress factors will have the greatest impact. However, the system does not require that the impact of every stress factor is brought below a particular level.

The implications for FSC certification are considered in more detail in Part 3.

Part 3: The Role of the ERA in Support of FSC Certification

3.1 Overview

This ERA system is designed to help evaluate compliance with the environmental monitoring requirements of the FSC Principles and Criteria (FSC P&C), and associated elements relating to the environmental and biological impacts of forest management and operations.

The FSC Principles and Criteria emphasise that the 'scale and intensity of management', and the 'relatively fragility of the forest' must be taken into account in the interpretation of the FSC Principles and Criteria in general, and in relation to a number of Criteria in particular. FSC further emphasises this approach in its policy for Small and Low Intensity Managed Forests (SLIMFs).

Certification bodies have considerable discretion in their interpretation of the FSC P&C, subject to compliance with all applicable FSC international policies and standards. In countries without an endorsed FSC national standard, certification bodies may, if they consider it appropriate, adapt their generic sets of indicators to take account of locally developed standards and approaches to the interpretation of the FSC Principles and Criteria.

The authors propose that this ERA may be used by certification bodies to justify their decisions in relation to satisfaction of FSC's requirements relating to environmental monitoring for FSC certification in the *Selva Maya* region. The basis for this justification is given in sections 3.2 and 3.3, below.

However, this ERA is not a formal FSC document. To formalise the use of this ERA and *guarantee* that its results would be accepted by FSC as meeting the requirements for FSC certification would require that the ERA be included in an FSC accredited certification body's accredited certification methodology, be referenced in an FSC accredited national or regional forest stewardship standard, and/or be referenced in a formal FSC International Policy or Guidance document. These possibilities are considered in more detail in section 3.4.

3.2 The ERA and Environmental Monitoring

Implementation of this ERA gives managers and certification bodies information about the environmental values that appear to be most at risk within a forest management unit. It also provides a tool to help the manager decide whether the best option is to reduce the scale or intensity of some aspect of management, to implement measures to mitigate the negative impact of stress factors on the environmental value, or simply to monitor the environmental value to determine the actual level of impact, and identify any changes over time.

It is up to the manager to decide on the most cost effective approach in their particular situation.

In some cases, managers may decide that the most cost effective approach is to modify their management practices to reduce the level of impact on most or all environmental values to the safe level defined by the ERA. *In this case it should not be necessary to allocate additional resources to environmental monitoring*. The managers, their certification body, and the public should be confident that because of the low intensity of management, in combination with appropriate mitigating measures, the chance that the environmental goals defined by FSC will not be met are very low indeed. Allocating scarce resources to prove this would be counterproductive.

However, where the ERA indicates that one or more environmental values may be at risk, monitoring may be justified. It remains for the forest managers to determine the most appropriate monitoring system.

Detailed guidelines for ecological monitoring have been prepared by a team coordinated by CATIE and WWF-Centroamérica (25, 100, 100a) (cf. the quotation in Section 1.1 in this report). These guidelines are designed specifically for certified tropical forests with High Conservation Values. They pay particular attention to the requirements of FSC, and to the necessities of keeping costs and scientific complexity to a necessary minimum. These qualities make the guidelines especially suitable for the *Selva Maya* region, in preference to other guidelines that concentrate rather on full coverage of environmental and biological variables.

The CATIE-WWF guidelines include a Decision Tree to help decide the design of an ecological monitoring programme. This decision tree indicates that detailed monitoring may be considered necessary under the following circumstances:

Monitoring of the structure and composition of the stand, when:
- The timber harvest amounts to more than 5 trees/ha, or more than 10 m3/ha, as an average over the actual harvested area;
- Silvicultural treatments are applied over the harvested area, after harvesting;
- Harvesting may provoke a change of at least 20% in the abundance of palms (chosen for their relatively easy identification);
- There are other plant species in the harvested area known to play a key role in the survival of threatened or endangered species, or with crucial ecological, economic or socio-cultural values.

Monitoring of species, when:
- The impacts of management on individual species of ecological or conservation importance are high;
- The response of a species is not highly correlated with aspects of the composition and structure of the forest (i.e. the ecological behaviour of the species is not easily predictable);
- When there is a clear application of the data collected which could allow modifications to the management plan or activities, or when the information could be useful to demonstrate the impacts of management on key groups of interest;
- A scientifically rigorous monitoring programme is feasible given the availability of resources and professional experience;
- The monitoring activities are economically possible given the size of the forest management operation.

These measures are guidelines, rather than prescriptions, but they match the ERA concept that investments in monitoring should be applied where the risks and impacts are greatest. Monitoring programmes must also take account of the economic realities of the enterprise; if they don't, they prejudice the success of the enterprise, and/or produce useless results. Many aspects of monitoring may be better carried out at a regional level by other agencies, rather than at every FMU level separately by individual forest managers.

The guidelines include protocols for monitoring the following elements:

1.1 Horizontal and vertical structure, especially density, abundance, canopy openings, vertical structure.
1.2 Other key elements of structure and composition, including lianas, keystone species and palms.

1.3 Composition of tree species, including abundance and population structures of forest-dependent species.
2.1 Mammals and medium and large birds.
2.2 Species directly impacted by management operations.
2.3 Animals that are indicators of disturbance, especially birds, butterflies and dung beetles.

This list of protocols is designed to be relatively practical and feasible, in comparison to the range of techniques used in well-funded research projects. They will be extremely helpful in cases where rigorous biological monitoring is clearly required. The techniques used for monitoring the structure and composition of the forest can sometimes be applied by adding to the existing protocols for forest inventories.

Nevertheless, they are technically and financially significant activities, not easily carried out by community forest management enterprises. In many cases, it will be preferable to reduce the scale or intensity of forest operations, or apply more mitigation measures, to avoid the need for applying new biological monitoring programmes.

The full guideline document in Spanish is available from CATIE, from www.wwfca.org and from www.hcvnetwork.org/resources. A translation into English of most of the document is available from www.hcvnetwork.org/resources.

This guideline document covers only biological monitoring. It is focused mainly on forest management impacts, but many of the same protocols could be used for monitoring the effects of hunting, fires and infrastructure. The guidelines do not cover soils, water or drainage (which are included in the ERA system). For these elements, many techniques are available, and outside professional input is usually necessary.

3.3 The ERA and the FSC Principles and Criteria

Implementation of the ERA is designed to help managers determine whether or not environmental monitoring is necessary, in accordance with a simple but objective assessment of the level of risk associated with each key environmental objective.

This approach should help managers decide whether it is worth investing in environmental monitoring, whether or not they want to achieve FSC certification. However, the specific purpose of developing this ERA was to reduce the costs of monitoring for managers who want their forests to be certified as complying with FSC's requirements. To achieve this objective, it must be shown how implementation of the ERA meets the requirements of the FSC Principles and Criteria (FSC P&C).

A full analysis showing the relation between the ERA components and the FSC P&C is given in Annex 9. Annex 10 then uses this analysis to propose draft 'generic indicators' and associated 'Means of Verification' that could be incorporated into FSC national standards, or certification bodies' generic standards.

The criteria that refer directly to monitoring are: 6.1, 7.1, 8.1 - 8.5 and 9.4. With the exception of Criterion 9.4, all of these Criteria explicitly state that the level of monitoring should be 'appropriate to the scale and intensity' of management.

In addition, Criteria 6.2, 6.3 and 6.4, and 9.3 refer to the need to protect/ maintain/ or enhance certain environmental aspects of the forest - appropriate, again, to the scale and intensity of management. Actions to meet the requirements of Criteria 9.1 and 9.2 can be incorporated into the process to develop a regionally adapted ERA.

The ERA system provides a consistent basis for determining the frequency and intensity of monitoring, explicitly and objectively taking account of the scale and intensity of management, as specified by Criterion 8.1. The result of the ERA analysis may suggest that environmental monitoring (or some other measure) is necessary. However, where the scale and intensity of management is sufficiently low, the ERA analysis may suggest that environmental monitoring at the FMU level is *not* necessary. It is proposed that in the case of community managed forests regular (e.g. annual) implementation of the ERA itself should be considered to satisfy FSC's requirements in relation to environmental monitoring - including those cases where no further environmental monitoring is recommended because the scale and intensity of management is so low that impacts on key environmental values are very unlikely.

By repeating the ERA on an annual basis, community forest managers can take account of any changes in management practices, and ensure that the level of monitoring remains appropriate. By documenting such annual application and the use of the results to update the forest management plan, forest managers should be able to demonstrate to certification bodies that they meet FSC's monitoring requirements, appropriate to the scale and intensity of their management.

In summary, it is proposed that in the case of community managed forests, implementation of a regionally adapted ERA should be considered to satisfy several FSC requirements, in whole or in part. When the community's operational management plan includes annual use of the ERA, and recording and publication of the ERA results, we propose that:

- implementation of the ERA satisfies the requirements of FSC Criterion 6.1;

- where implementation of the ERA shows a safe level of risk in relation to all the environmental values of Group 1 (species-specific values) no further measures should be required at the FMU level to satisfy the requirements of FSC Criterion 6.2;

- where implementation of the ERA shows a safe level of risk in relation to all the environmental values of Group 2 (habitat features) and Group 3 (ecosystem elements) no further measures should be required at the FMU level to satisfy the requirements of FSC Criteria 6.3 and 6.4;

- where implementation of the ERA shows a safe level of risk in relation to environmental value Groups 1, 2 and 3, the annual implementation of the ERA should be considered to satisfy in full the requirements to provide "provisions for monitoring of forest growth and dynamics" (FSC Criterion 7.1e), to specify "Environmental safeguards based on environmental assessments" (7.1f) and "Plans for the identification and protection of rare, threatened and endangered species" (7.1g).

- implementation of the ERA should be considered the basis for determining the 'frequency and intensity of monitoring', as specified in the first part of Criterion 8.1, and where such implementation of the ERA shows a safe level of risk in relation to an environmental value, further monitoring of that environmental value is not required at the FMU level.

- where implementation of the ERA shows a safe level of risk in relation to environmental value Groups 2 and 3, no additional research or data collection is required at the forest management unit (FMU) level in relation to monitoring "growth rates, regeneration and condition of the forest" (Criterion 8.2b) or the "composition and observed changes in flora and fauna" (Criterion 8.2c)

- where implementation of the ERA shows a safe level of risk in relation to environmental value Group 4, no additional research or data collection is required *at* the forest

management unit (FMU) level in relation to monitoring "Environmental impacts of harvesting and other operations" (Environmental aspects of Criterion 8.2d).

- where implementation of the ERA has been used to justify reduced levels of monitoring, as above:

    - the public availability of the completed ERA worksheets 1.1, 1.2, 1.3 and 1.4 should be considered to meet the applicable requirements of FSC Criteria 8.4 and 8.5.

The *Selva Maya* ERA has been designed so that its environmental values incorporate the *environmental* HCVs (i.e. HCV 1, 2, 3 and 4, but *not* HCV 5 or HCV 6) covered by FSC Principle 9. However, the development process for the current *Selva Maya* ERA did not include an explicit regional HCV identification exercise, as this was considered to be beyond the project's resources. As such, whilst it is likely that this first iteration of the Selva Maya ERA captures most of the values that might be considered environmental HCVs, it may not capture all of them.

In future, when a regional ERA is developed, it is recommended that the development process should include an explicit exercise to define values that would be considered environmental 'HCVs' at the regional level. Some of these values (e.g. large landscape level forests) will already be incorporated in the ERA as generic environmental values. However, other HCVs may be very specific (e.g. particular species, or habitat types). It is recommended that any such specific HCVs be included in the list of 'vulnerabilities' (worksheet 2.4). Similarly, the development process should explicitly consider what management actions could be implemented to protect or maintain the identified HCVs. These management actions should then be included as 'mitigating measures' on worksheet 2.5. If this process is followed as part of the ERA development process, then it should meet most of the requirements for identifying *environmental* HCVs and their appropriate management (Criteria 9.1 and 9.2). Where subsequent implementation of the ERA shows a 'safe' level of impact, this should also meet the requirements of Criteria 9.3 and 9.4 in relation to monitoring and reporting of these HCVs. So long as any HCVs that are present at the regional level have been included in the ERA in this way, it is proposed that:

- implementation of the ERA, and its inclusion in the publicly available management plan summary should be considered to meet the requirements of FSC Criterion 9.3 in relation HCV 1, 2, 3 and 4; and

- annual implementation of the ERA should be considered to meet the requirements of FSC Criterion 9.4 in relation to HCV 1, 2, 3 and 4.

Annex 10 presents a draft set of generic indicators and means of verification which show how an approved ERA could be used to demonstrate compliance with FSC Criteria as applied to SLIMFs, and greatly reduce the potential burden of environmental monitoring for forests which are managed with low intensity management practices. Annex 11 then shows how these 'generic' recommendations could be used to reduce the cost of meeting the draft FSC national standard for Mexico.

Understanding of the impacts of forest management on environmental values will increase over time. FSC requirements may change, leading to the identification of newly recognised key environmental values. New management techniques may result in the identification of new regional stress factors. A regionally adapted ERA will need to be updated to take account of such changes. In the longer term, updating the regional ERA itself on a regular basis (e.g. every five years) should ensure that such advances in knowledge can be incorporated over time.

3.4 Formalising ERA Use for FSC Certification

It must be stressed that the proposed uses of the ERA to satisfy FSC requirements have not been endorsed by FSC at the international level. At the time of writing, ERA has not been incorporated into the certification system of any FSC-accredited certification body, nor written in to an endorsed FSC national standard. Until the ERA is formally included in the FSC system in such a way, the proposals in the preceding section are proposals. It would be at the discretion of a certification body, case by case, to decide whether it accepts the results of an ERA as justification for a reduced level of environmental monitoring.

Clearly it would give more confidence to forest managers and certification bodies if the ERA approach were formally recognised within the FSC system. This section proposes specific mechanisms by which this could be achieved.

Three mechanisms are considered: inclusion within a formal FSC international policy; inclusion within specific FSC national or sub-national standards; inclusion within a certification body's own operating system and/or generic standards. These options are not exclusive of each other.

3.4.1 Inclusion within formal FSC international policy

FSC international policy explicitly requires that scale and intensity be taken into account in the interpretation of the FSC Principles and Criteria. *FSC-STD-20-002 Structure and Content of Forest Stewardship Standards,* for example, states that:

"4.1 The standard shall be cost effective and practical for use in small-scale and low intensity forest management units.

"4.2 Small and/or low intensity managed forests may be made exempt from some indicators which are applicable to other forests, and/or alternative indicators may be developed for application to small and/or low intensity managed forests. In such cases this shall be clearly indicated in the standard."

The ERA approach would support the implementation of these requirements. However, explicit reference within a formal FSC international policy would give the clearest indication of endorsement of the ERA approach. A variety of vehicles could potentially be used, some of which are indicated below. Development would obviously be at the discretion of the FSC International Center.

a) FSC-GUI-60-100 "*Guidance on the Interpretation of FSC Principles and Criteria to take account of scale and intensity*"

This document provides general guidance for FSC National Initiatives and certification bodies on interpretation of the FSC Principles and Criteria in relation to SLIMFS. Annex 1 is a table entitled "*Specific Guidance on Interpreting the FSC Principles and Criteria for Small Scale and Low Intensity Forest Management Units*." FSC could approve a process to revise FSC-GUI-60-100 to incorporate explicit references to the ERA approach, for example as 'generic indicators' included in Annex 1, or as a more general endorsement of the approach within the body of the document.

b) Development of a new FSC policy or guidance document

A more specific approach would be to develop a new FSC document (e.g. an international policy or guidance document) to provide guidance on the interpretation of FSC requirements in relation to environmental monitoring. A guidance document could provide guidance on the

general implementation of FSC Principle 8, which could address a variety of issues in addition to the use of the ERA approach, or it could focus specifically on the use of ERA. The former would have the advantage of embedding any guidance within a review of FSC monitoring requirements in general. The latter would likely allow for more detailed consideration of the ERA approach itself.

A variety of implementation mechanisms could be envisaged. The simplest would be a recommendation to FSC national initiatives that the ERA approach be considered for inclusion in FSC national standards and/or certification body generic standards.

c) Development of an FSC Advice Note

A simpler approach could be to develop an FSC 'Advice Note' on the use of the ERA in relation to the monitoring requirements of the FSC Principles and Criteria. Such notes are normally issued in response to a specific query from a certification body or FSC National Initiative. This could have the advantage of encouraging a relatively fast response to a specific question. Conversely, the Advice Note process is designed to respond to questions of a specific nature with a narrow scope, which could limit its applicability.

This approach would probably require a 'test case' to be put forward: a candidate for certification, or a previously certified FMU undergoing monitoring would propose that their use of the ERA meets FSC requirements. The certification body could either accept the proposal without further consideration, or could seek guidance from FSC in the form of a request for the development of an Advice Note.

d) FSC Generic Indicators

Another possibility would be to incorporate references to the ERA approach within the proposed set of "FSC Generic Indicators". As previously envisaged, such a set of generic indicators would initially be adopted by all FSC accredited certification bodies, and replace the use of each certification body's own unique set of indicators. The resulting standards would be used when there is no FSC national standard applicable in a country or region. In addition, the 'FSC Generic Standard' would be used as a 'draft 0' standard by all FSC national initiatives. It would then be reviewed and revised through national consultation. Resulting FSC national standards would be expected to incorporate many of the generic indicators with relatively little modification, if they are considered appropriate in the national or regional context. Referencing the ERA approach in such a set of Generic Indicators would give a clear endorsement for the approach, and should encourage relatively fast uptake.

Annex 10 presents a set of possible 'generic indicators' and associated 'Means of Verification' referencing the ERA approach. These could be taken up by FSC, used by an FSC National Initiative within a national standard (see section 3.4.2) or be incorporated into an FSC-accredited certification body's generic standard (see section 3.4.3).

Any of these approaches could be used by FSC to provide formal endorsement of the ERA approach. They could be pursued together with, or independently of, the more 'bottom up' approaches outlined in Sections 3.4.2 and 3.4.3.

3.4.2 Inclusion within an FSC national or subnational standard

FSC has developed detailed procedures for the development of national standards, including processes for stakeholder identification and consultation, and balanced, consensus-based decision making.

These processes allow for FSC national initiatives to develop national indicators and means of verification, providing an interpretation of the FSC P&C which is both fine-tuned to national or regional conditions, and is endorsed by national or regional stakeholders.

Any national initiative developing such standards would be able to incorporate reference to a regionally adapted ERA in its standard, if this were supported by the national stakeholders.

In the case of the *Selva Maya* region, for example, the FSC Mexico National Initiative is currently in the process of developing a national standard, including specific requirements relating to Small and Low Intensity Managed Forests (SLIMFs). If the ERA approach is supported by the FSC National Initiative and national stakeholders, it would be relatively simple to incorporate appropriate references into the draft national standard.

After the usual national consultation process the resulting standard would be submitted to the FSC International Center for approval. Approval would provide formal endorsement for the approach within Mexico. It would mean that the approach would automatically be acceptable for all certification bodies operating within Mexico. In addition, it would create a powerful precedent for its uptake elsewhere.

Annex 11 presents FSC Mexico's most recent draft standard for SLIMFs (December 2008), together with suggested means of verification referencing the *Selva Maya* ERA.

3.4.3 Inclusion within a certification body's operating system

Finally, the ERA approach could be incorporated into a certification body's own operating system. Where a regionally adapted ERA has already been developed with stakeholder input (e.g. as for the *Selva Maya*) a certification body could incorporate reference to the ERA in its locally adapted generic standard, through the usual local adaptation process.

Alternatively, a certification body could incorporate reference to the ERA approach within its set of generic indicators. The means of verification presented in Annex 10 would provide an 'off the peg' model for this.

Most simply, a certification body could review the use of specific ERAs and issue guidance to its inspectors to the effect that the use of the ERA, appropriately verified, would be considered an acceptable 'means of verification' in relation to specific indicators for national evaluation.

Part 4: How to use the ERA

The ERA system described in Part Two is generic to the Maya Forest region, and is fairly complex. It incorporates expert knowledge and consultations, and is referenced to relevant published materials, providing a justification for the key assumptions. Part 3 explains how the ERA may be used, in principle, to support FSC certification. This Part, Part 4, explains how to use the ERA. Guidance is provided for three different uses and groups of users.

The first section, 4.1, explains how to modify the ERA for use in a new region. This section is aimed at certification bodies and community forestry support groups.

The second section, 4.2, provides guidance on how the ERA can be used by community forest managers in a region, once a regionally specific version has been set up. This section is aimed at community forest technicians, and has also been made available as a free-standing booklet, which may be downloaded from www.oneworldstandards.com/ERA.html.

The final section, 4.3, is aimed specifically at certification bodies, and provides guidance as to how the results of an ERA can be used in support of FSC certification.

4.1 Modifying the ERA for Use in a Region

The main output of the Phase One project is an ERA system that is ready to be used in the *Selva Maya*, without further modification. However, one of the project goals was to design a system which could be readily modified for use in other regions of the world. This section describes how to modify the *Selva Maya* ERA for use in other regions. Whereas use of the *Selva Maya* ERA has been designed to be simple enough for use with very little knowledge of the Excel database system, and only very local knowledge of the forest management unit, modification of the system for use in new regions assumes a strong working knowledge of Excel, and access to regional expertise in relation to forest ecology, forest management activities and the reaction of the forests to those activities.

This work can be carried out in three steps:
- Pre-selection of the principal elements, by a group of 5 -10 selected stakeholders;
- A workshop of other stakeholders to discuss and agree on these and other elements;
- A field trial with at least one community.

This process is described in more detail in the Guide for Regional Adaptations of ERA, which is being tested during 2009 – 2010.

4.1.1 Overview

In order to modify the ERA for use in a new region, several aspects of the system need to be reviewed and revised by people with expert knowledge of forest ecology and forest management within the region. The following steps are required:

a Review the list of potentially significant stress factors (Annex 3), identify those stress factors that are regionally significant, and enter them into the spread sheet.

b Specify the linkage values between environmental values and the new set of regionally significant stress factors.

c Review and revise the list of potential environmental vulnerabilities. Delete the vulnerabilities that are not relevant to the region, and add new vulnerabilities as appropriate. The process should include the explicit identification of any High Conservation Values that are not already incorporated into the ERA.

d Once the new vulnerabilities have been identified, specify the 'linkages' between these new vulnerabilities and the stress factors.

e Review and revise the list of mitigating measures. Delete any mitigating measures that are not relevant to the region, and add new mitigating measures as appropriate. Mitigating measures that are relevant to the management of HCVs should be explicitly included.

f Finally, specify the 'linkages' between any new mitigating measures and the stress factors.

As mentioned, reviewing and revising these elements of the ERA is best done by integrating the knowledge of a range of experts. We propose that this should be done through two basic approaches. Firstly, by convening an 'experts review group' of a dozen or so ecologists and local forest managers/ technicians who are prepared to review documentation, suggest changes, and, if possible, attend one or two technical working group meetings. Secondly, by convening meetings of local forest managers/ technicians to carry out a 'hands on' review of a set of draft proposals, so that the regionally adapted ERA can be given a 'reality check' before it is finalised for use in the field.

It will also be necessary to have at least one person involved in the revision who is confident in using the Excel program, so as to be able to make the necessary changes, and trouble shoot if required.

4.1.2 Revision process

The following outline process is suggested, though the details may of course be modified depending on local circumstances.

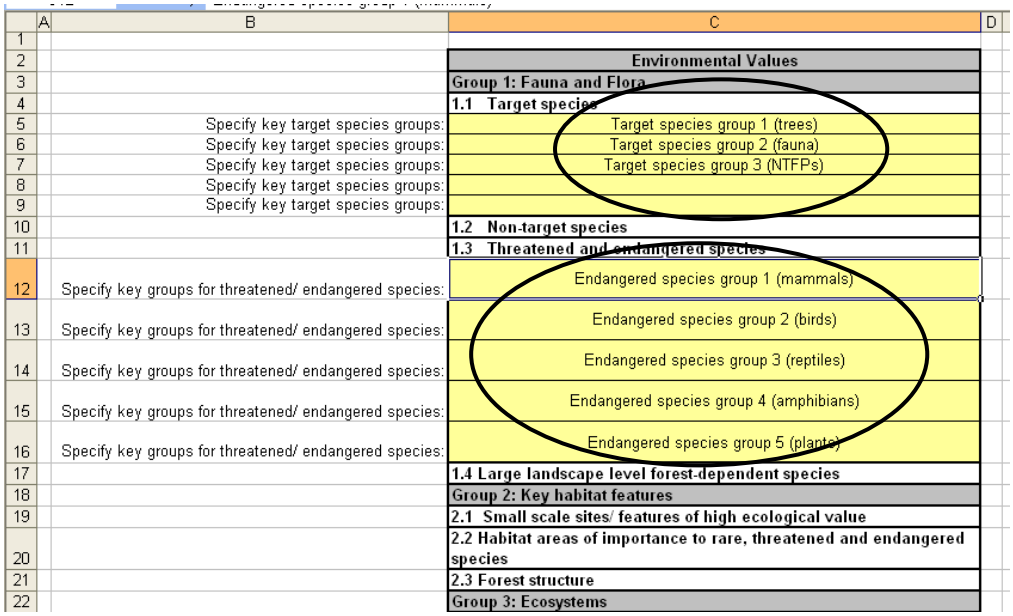
The whole process could be implemented initially by one individual, and then be circulated for review by the 'experts group'. However, it may be more efficient and effective to convene the 'experts group' and provide an introductory training session before working through the adaptation process with the group members in person. The resulting regionally modified ERA can then be 'reality checked' with forest technicians prior to field testing and final revision. The whole process could potentially be completed in 2 or 3 days.

a Start with the 'template' version of the ERA Excel spreadsheets. This version:

- has no stress factors identified as 'regionally significant' on worksheet 2.2 (and as a consequence, shows no regionally significant stress factors on worksheets 1.2, 1.4, 2.3, 2.4 or 2.5);
- has no linkage values entered on worksheet 2.3;
- has no vulnerabilities or associated linkages entered on worksheet 2.4;
- has no mitigating measures or associated linkages entered on worksheet 2.5.

b Review the specified environmental values (see Annex 2, and worksheet 2.1). The main categories of environmental values (described in Annex 2) are derived from the FSC Principles and Criteria, and the system is not designed for these to be changed. However, it is possible to change the names and contents of the sub-categories for Environmental Values 1.1 (key target species groups) and 1.3 (rare, endangered or threatened species groups), by changing the sub-categories listed in worksheet 2.1. For example, it is possible to divide Environmental Value 1.1 “Target Species” into Group 1 (large trees), Group 2 (small trees), Group 3 (fruit trees) etc., according to local

circumstances. We cannot yet give guidance about when that may be necessary or useful. There is also space here to add additional environmental values within 'Group 4' Environmental Elements (Rows 34 - 37) if required.



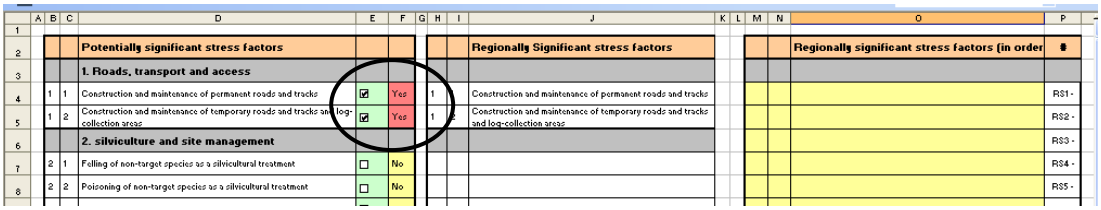
	A	B	C	D
1				
2			**Environmental Values**	
3			**Group 1: Fauna and Flora**	
4			**1.1 Target species**	
5		Specify key target species groups:	Target species group 1 (trees)	
6		Specify key target species groups:	Target species group 2 (fauna)	
7		Specify key target species groups:	Target species group 3 (NTFPs)	
8		Specify key target species groups:		
9		Specify key target species groups:		
10			**1.2 Non-target species**	
11			**1.3 Threatened and endangered species**	
12		Specify key groups for threatened/ endangered species:	Endangered species group 1 (mammals)	
13		Specify key groups for threatened/ endangered species:	Endangered species group 2 (birds)	
14		Specify key groups for threatened/ endangered species:	Endangered species group 3 (reptiles)	
15		Specify key groups for threatened/ endangered species:	Endangered species group 4 (amphibians)	
16		Specify key groups for threatened/ endangered species:	Endangered species group 5 (plants)	
17			**1.4 Large landscape level forest-dependent species**	
18			**Group 2: Key habitat features**	
19			**2.1 Small scale sites/ features of high ecological value**	
20			**2.2 Habitat areas of importance to rare, threatened and endangered species**	
21			**2.3 Forest structure**	
22			**Group 3: Ecosystems**	

Figure 8. Extract from Worksheet 2.1 indicating where sub-categories can be added to the specified environmental values.

c Identify the regionally significant stress factors and enter them on the Worksheet 2.2:

- check the list of potentially significant stress factors (Annex 3) and identify those stress factors that are likely to be significant in at least some FMUs in the region.

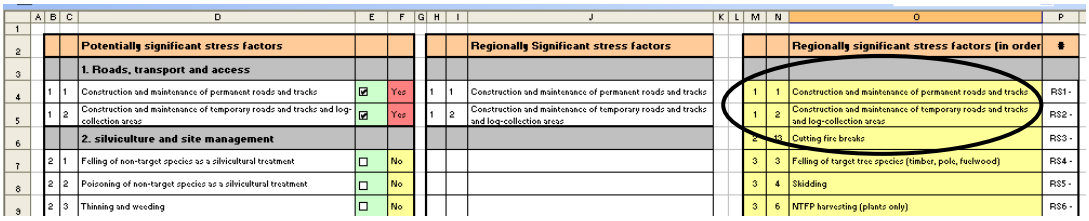
- once the regionally significant stress factors have been identified, enter checkmarks against these stress factors in column E on worksheet 2.2, as illustrated below. Those factors which are checked will appear automatically in column J.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2				**Potentially significant stress factors**						**Regionally Significant stress factors**					**Regionally significant stress factors (in order**	
3				**1. Roads, transport and access**												
4	1	1		Construction and maintenance of permanent roads and tracks	☑	Yes		1		Construction and maintenance of permanent roads and tracks						RS1 -
5	1	2		Construction and maintenance of temporary roads and tracks and log-collection areas	☑	Yes		1		Construction and maintenance of temporary roads and tracks and log-collection areas						RS2 -
6				**2. silviculture and site management**												RS3 -
7	2	1		Felling of non-target species as a silvicultural treatment	☐	No										RS4 -
8	2	2		Poisoning of non-target species as a silvicultural treatment	☐	No										RS5 -

Figure 9. Extract from Worksheet 2.2 showing a number of potentially significant stress factors identified as being of regional significance

- now copy and paste all the regionally significant stress factors from Columns H-J to Columns M-O, using the 'paste special, values only' function of Excel. Once the values are entered in Columns M-O, use the 'data, sort' function to organise them in ascending order, ordered first by Column M and then by Column N. The illustration below shows this operation as completed for two stress factors.



			Potentially significant stress factors					Regionally Significant stress factors					Regionally significant stress factors (in order	
			1. Roads, transport and access											
	1	1	Construction and maintenance of permanent roads and tracks	☑	Yes		1	1	Construction and maintenance of permanent roads and tracks		1	1	Construction and maintenance of permanent roads and tracks	RS1 -
	1	2	Construction and maintenance of temporary roads and tracks and log-collection areas	☑	Yes		1	2	Construction and maintenance of temporary roads and tracks and log-collection areas		1	2	Construction and maintenance of temporary roads and tracks and log-collection areas	RS2 -
			2. silviculture and site management								2	13	Cutting fire breaks	RS3 -
	2	1	Felling of non-target species as a silvicultural treatment	☐	No						3	3	Felling of target tree species (timber, pole, fuelwood)	RS4 -
	2	2	Poisoning of non-target species as a silvicultural treatment	☐	No						3	4	Skidding	RS5 -
	2	3	Thinning and weeding	☐	No						3	6	NTFP harvesting (plants only)	RS6 -

Figure 10. Extract from Worksheet 2.2 showing the regionally significant stress factors pasted into Column O and sorted by Column M and N.

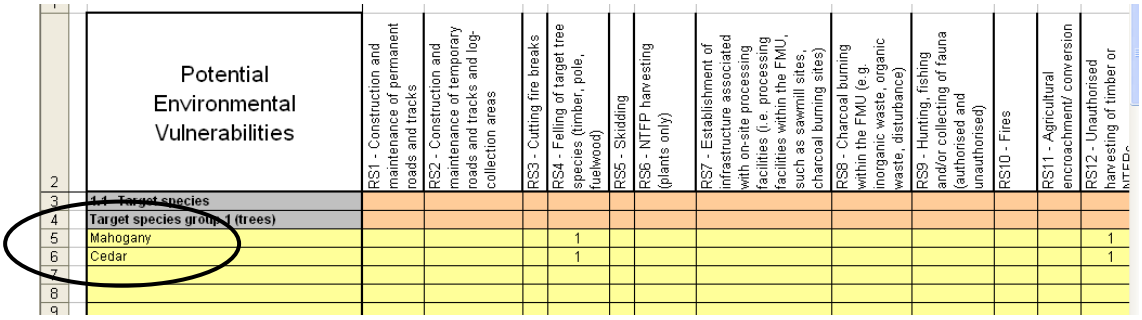
- The selected stress factors will now automatically appear in all the other Excel worksheets.

d Now identify the 'mitigating measures' that could be associated with these stress factors. Section 2.6 gives a description of mitigating measures and their role in the ERA. Annex 5 lists the mitigating measures for the stress factors that were considered significant in the *Selva Maya* region. This may be used as a model, adding or deleting mitigating measures as appropriate. New mitigating measures will need to be identified for any stress factors that were not considered significant in the Selva Maya. Once mitigating measures have been identified, these should be entered as appropriate on Worksheet 2.5 (Figure 11).

	Mitigating Measures and links with Environmental Values	1.1 Target species					1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1)					1.4 Large landscape level forest-dependent species (HCV2)	2.1 Small scale sites or features of high ecological value
		Target species group 1 (trees)	Target species group 2 (fauna)	Target species group 3 (NTFPs)	0	0		Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)		
	RS1 - Construction and maintenance of permanent roads and tracks													
	Roads are constructed using materials local to the site.						1					1		
	Roadside ditches are well designed and free of blockages.													
	Drainage is unimpeded by roads, either by location or through the use of well maintained culverts.													
	Roads are located to minimise impacts on landscape.													
	Road verges are maintained to minimise impact on landscape.													
	Habitat areas of importance to rare, threatened and endangered species; ecosystems in their natural state; and rare, threatened or endangered ecosystems have been explicitly identified and are systematically avoided during road construction.							1	1	1	1	1		

Figure 11. Extract from Worksheet 2.5 showing a number of potential mitigating measures in relation to the construction and maintenance of permanent roads and tracks.

e Next, identify on Excel sheet 2.4 the potential 'vulnerabilities' that could be associated with the environmental values at the regional level. These entries then appar automatically on sheet 3.1. Section 2.7 gives a description of 'vulnerabilities' and their role in the ERA.



	Potential Environmental Vulnerabilities	RS1 - Construction and maintenance of permanent roads and tracks	RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	RS3 - Cutting fire breaks	RS4 - Felling of target tree species (timber, pole, fuelwood)	RS5 - Skidding	RS6 - NTFP harvesting (plants only)	RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)	RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)	RS9 - Hunting, fishing and/or collecting of fauna (authorised and unauthorised)	RS10 - Fires	RS11 - Agricultural encroachment/ conversion	RS12 - Unauthorised harvesting of timber or NTFPs
3	1.1 Target species												
4	Target species group 1 (trees)												
5	Mahogany				1								1
6	Cedar				1								1
7													
8													

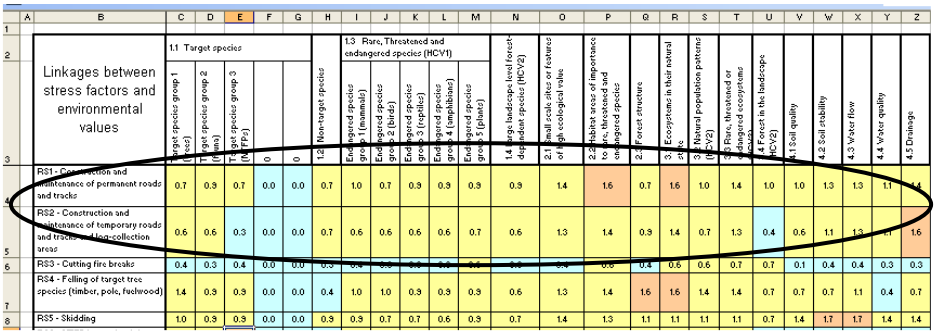
Figure 12. Extract from Worksheet 2.4 showing a number of potential 'vulnerabilities' associated with environmental value 1.1 'Target Species' Group 1 (trees).

Just as for the 'mitigating measures', the vulnerabilities of the *Selva Maya* ERA may be used as a model. However, given that vulnerabilities are highly regionally specific, it is likely that the actual regional vulnerabilities identified will be specific to the region. In the case of the Selva Maya, regional lists of rare, threatened and endangered species (according to national definitions) were collated and reviewed to identify those species that might be considered particularly vulnerable to the identified stress factors.

f The next task is one of the most demanding ones for the development of the regional ERA. For each stress factor listed in sheet 2.2, it is necessary to define levels for 'high', 'medium' and 'low' levels of scale and intensity of implementation within the forest management unit (see Annex 4 for the results of this exercise for the *Selva Maya*). Section 2.5 gives a more detailed description of factors to be taken into consideration in defining the different levels for scale and intensity of the identified stress factors.

g The next three tasks are quite similar, and relate to specifying the 'linkages' between environmental values and stress factors. Linkages need to be entered for Worksheets 2.3 (Figure 13), 2.4 (Figure 14), and 2.5 (Figure 15).

In the case of main table of linkages between stress factors and environmental values, spreadsheet 2.3 linkages are specified as '1' or '2' (or left blank, if there is no linkage). An explanation together with guidance on the different values is given in Section 2.4. In the illustration linkage values are shown as the average of values given by a regional 'experts group' so they are not whole number values, but rather values between '0' (the minimum possible and '2' (the maximum possible).



	Linkages between stress factors and environmental values	1.1 Target species: Target species group 1 (trees)	1.1 Target species: Target species group 2 (fauna)	1.1 Target species: Target species group 3 (NTFPs)	1.1 Target species: 0	1.1 Target species: 0	1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 1 (mammals)	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 2 (birds)	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 3 (reptiles)	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 4 (amphibians)	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 5 (plants)	1.4 Large landscape-level forest-dependent species (HCV2)	2.1 Small scale sites or features of high ecological value	2.2 Habitat areas of importance to rare, threatened and endangered species	2.3 Forest structure	3.1 Ecosystems in their natural state	3.2 Natural population patterns (HCV2)	3.3 Rare, threatened or endangered ecosystems (HCV1)	4.1 Forest in the landscape (HCV2)	4.1 Soil quality	4.2 Soil stability	4.3 Water flow	4.4 Water quality	4.5 Drainage
4	RS1 - Construction and maintenance of permanent roads and tracks	0.7	0.3	0.7	0.0	0.0	0.7	1.0	0.7	0.3	0.3	0.3	0.3	1.4	1.6	0.7	1.6	1.0	1.4	1.0	1.0	1.3	1.3	1.1	1.4
5	RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	0.6	0.6	0.3	0.0	0.0	0.7	0.6	0.6	0.6	0.6	0.7	0.6	1.3	1.4	0.9	1.4	0.7	1.3	0.4	0.6	1.1	1.3	1.1	1.6
6	RS3 - Cutting fire breaks	0.4	0.3	0.4	0.0	0.0	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.6	0.6	0.7	0.7	0.1	0.4	0.4	0.3	0.3
7	RS4 - Felling of target tree species (timber, pole, fuelwood)	1.4	0.3	0.3	0.0	0.0	0.4	1.0	1.0	0.3	0.3	0.3	0.6	1.3	1.4	1.6	1.6	1.4	1.4	0.7	0.7	0.7	1.1	0.4	0.7
8	RS5 - Skidding	1.0	0.3	0.3	0.0	0.0	0.3	0.3	0.7	0.7	0.6	0.3	0.7	1.4	1.3	1.1	1.1	1.1	1.1	0.7	1.4	1.7	1.7	1.4	1.4

Figure 13. Extract from Worksheet 2.3 showing linkage values for a selection of environmental values and stress factors.

For the vulnerabilities shown in worksheets 2.4 and 2.5, the linkage is specified as either 'present' ('1') or absent ('0'). If it is present, this would mean that if a 'vulnerability' is

present the particular environmental value would be particularly sensitive to the specific stress factor. In the case of a 'mitigating measure', this would mean that if the mitigating measure is in place, this would tend to reduce the sensitivity of the environmental value to the particular stress factor.

Figure 14, purely for illustrative purposes, shows tapir and jaguar as being considered particularly vulnerable to the stress factor 'RS1 Construction and maintenance of permanent roads and tracks', but not being considered particularly vulnerable to 'RS4 Felling of target tree species'.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
2		Potential Environmental Vulnerabilities	RS1 - Construction and maintenance of permanent roads and tracks	RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	RS3 - Cutting fire breaks	RS4 - Felling of target tree species (timber, pole, fuelwood)	RS5 - Skidding	RS6 - NTFP harvesting (plants only)	RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)	RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)	RS9 - Hunting, fishing and/or collecting of fauna (authorised and unauthorised)	RS10 - Fires	RS11 - Agricultural encroachment/ conversion	RS12 - Unauthorised harvesting of timber or
70														
71		1.4 Large landscape level forest-dependent species (HCV2)												
72		Tapir	1								1		1	
73		Jaguar	1											
74		Macaw												
75														
76														
77		Group 2: Key habitat features												
		2.1 Small scale sites or features of high												

Figure 14. Extract from Worksheet 2.4 showing linkages between identified 'vulnerabilities' and a selection of stress factors

Figure 15, again purely for illustrative purposes, shows a variety of linkages between mitigating measures and specific environmental values.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2			1.1 Target species						1.3 Threatened and endangered species						
3		Mitigating Measures and links with Environmental Values	Target species group 1 (trees)	Target species group 2 (fauna)	Target species group 3 (NTFPs)	0	0	1.2 Non-target species	Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)	1.4 Large landscape level forest-dependent species	2.1 Small scale sites/ features of high ecological value
4		RS1 - Construction and maintenance of permanent roads and tracks													
5		Roads are constructed using materials local to the site													
6		Roadside ditches are well designed and free of blockages.													
7		Drainage is unimpeded by roads, either by location or through the use of well maintained culverts.													
8		Roads are located to minimise impacts on landscape.												1	
9		Road verges are maintained to minimise impact on landscape.												1	
10		Habitat areas of importance to rare, threatened and endangered species; ecosystems in their natural state; and rare, threatened or endangered ecosystems have been explicitly identified and are systematically avoided during road construction.							1	1	1	1	1		1
11															

Figure 15. Extract from Worksheet 2.5 showing linkages between identified mitigating measures and a selection of stress factors

In these three tasks, the examples illustrate linkage values specified by one person, or by a group that has reached consensus as to whether a value should be '0', '1' or '2'. An alternative approach is to ask each member of the expert group to specify their linkage

values independently. The results for each expert can then be summed and averaged, and average values can be entered into the regionally adapted workbook.

4.1.3 Calibrating the regionally modified ERA

Before applying the ERA at the level of a forest management unit, it needs to be calibrated. During regional development, stress factors may be modified, and linkage values may be changed. Both these aspects would modify the values at which 'warning lights' would come on in relation to specific environmental values.

The 'safe risk value' is defined as the risk value at which the combined scale and intensity for all stress factors is 3 or less. This would always be achieved whenever either the scale or the intensity of every stress factor is low or small (i.e the scale x intensity for each stress factor is 3 or less). Since the maximum scale and intensity for each risk factor is 9 (3 x 3), the 'safe risk value' for each environmental value is 33.3% of the maximum possible value (in the absence of vulnerabilities).

To calibrate the system, the scale and intensity of all stress factors (Worksheet 1.2) should be set to 'high' (so total scale x intensity is 3 x 3 = 9). All possible mitigating measures (Worksheet 1.3) and vulnerabilities (Worksheet 1.1) should be marked as being 'absent'. This gives the maximum possible level of risk, in the absence of specific FMU level vulnerabilities, in column AF and row 23 on Worksheet 1.4.

These 'maximum possible' risk values should now be copied and pasted from column AF to column AG, and from row 23 to row 24 respectively. Only the <u>values</u> are pasted - not the associated formulae. When this has been done correctly the percentage values in column AH and row 25 should all show 100% (except for those columns or rows that are empty, which should show a value of 0%). This is illustrated in Figure 16, below. Once this has been done, the worksheet 1.4 should be 'protected' again, and the Excel file should be saved.

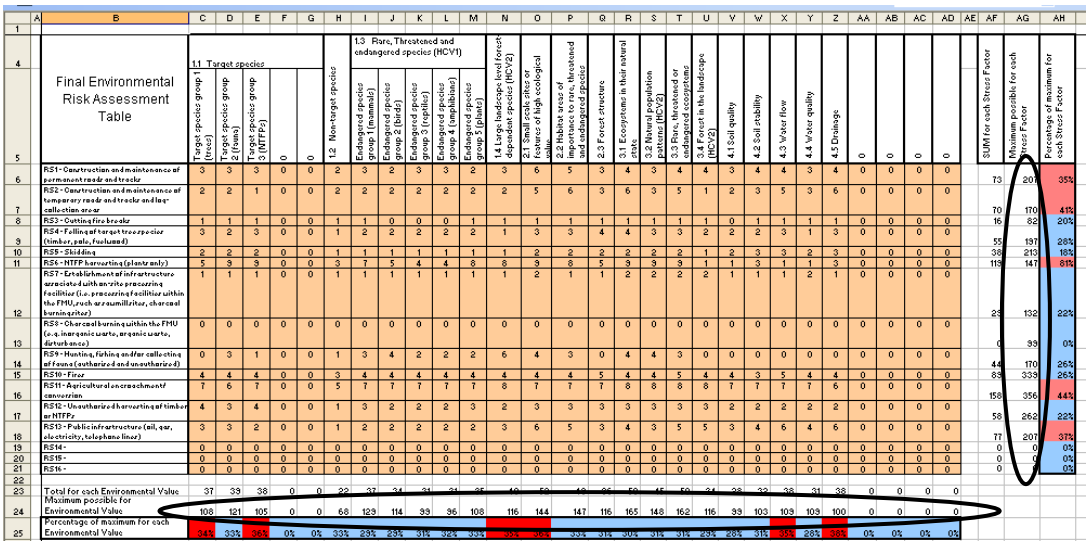


Figure 16. Extract from Worksheet 1.4 showing calibration of the 'maximum possible' level of risk for stress factors and environmental values.

The calibration can be tested by going back to worksheet 1.2 and re-setting all the scale values to 1 (so scale x intensity is now 1 x 3 = 3). The percentage values on worksheet 1.4 should now all become 33.3%, and all the 'warning lights' should be turned off.

When the ERA is now used, if the combined scale x intensity of *any* stress factor is greater than 3, then the 'safe risk value' will always be exceeded for at least one environmental value,

unless the risk is reduced by the presence of mitigating measures. Similarly, if there are any specific vulnerabilities at the FMU level, the safe risk value will be exceeded unless there are mitigating measures in place.

The greater the number, scale and intensity of stress factors, the higher the 'risk value', and the greater the number of mitigating measures that would be required to reduce the risk for any given environmental value to a safe level. The exact specifications will depend on the number and strength of linkages and associated mitigating measures and vulnerabilities, but if all stress factors are scored as 4 or more it becomes impossible to reduce the risk values of all stress factors to a safe level, however many mitigating measures are implemented.

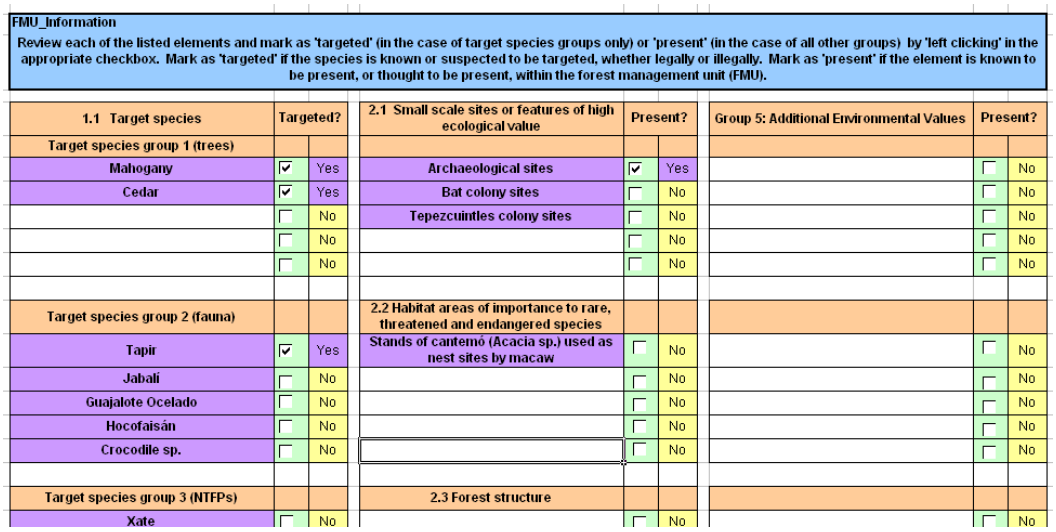
4.2 Use of the Regionally Adapted ERA by Forest Managers

This section describes how any ERA that has already been set up for use in a particular region (in this case, the Selva Maya) may be applied in a single FMU which is interested in certification.

This section is presented in the form of explicit instructions that may be followed by community forest technicians. It should be possible for community forest managers to apply the ERA with little or no external assistance. The section is also available as a free-standing booklet.

4.2.1 Identify any vulnerabilities that are present in the FMU.

In the Worksheet 1.1 “FMU level information", click on the tick box next to each identified vulnerability that is present in this FMU.



FMU_Information

Review each of the listed elements and mark as 'targeted' (in the case of target species groups only) or 'present' (in the case of all other groups) by 'left clicking' in the appropriate checkbox. Mark as 'targeted' if the species is known or suspected to be targeted, whether legally or illegally. Mark as 'present' if the element is known to be present, or thought to be present, within the forest management unit (FMU).

1.1 Target species	Targeted?		2.1 Small scale sites or features of high ecological value	Present?		Group 5: Additional Environmental Values	Present?	
Target species group 1 (trees)								
Mahogany	☑	Yes	Archaeological sites	☑	Yes		☐	No
Cedar	☑	Yes	Bat colony sites	☐	No		☐	No
	☐	No	Tepezcuintles colony sites	☐	No		☐	No
	☐	No		☐	No		☐	No
	☐	No		☐	No		☐	No
Target species group 2 (fauna)			2.2 Habitat areas of importance to rare, threatened and endangered species					
Tapir	☑	Yes	Stands of cantemó (Acacia sp.) used as nest sites by macaw	☐	No		☐	No
Jabalí	☐	No		☐	No		☐	No
Guajalote Ocelado	☐	No		☐	No		☐	No
Hocofaisán	☐	No		☐	No		☐	No
Crocodile sp.	☐	No		☐	No		☐	No
Target species group 3 (NTFPs)			2.3 Forest structure					
Xate	☐	No		☐	No		☐	No

Figure 17. Extract from Worksheet 1.1 showing the selection of vulnerabilities that are relevant to a particular Forest Management Unit**.**

4.2.2 Evaluate the scale and intensity for stress factors

In Worksheet 1.2, score every stress factor according to the Scale and Intensity at which they apply in this FMU. The descriptions of 'high', 'medium' and 'low' scale and intensity are specified in Annex 4. Enter a '3', '2' or '1' as appropriate in Column H (for Scale) and Column I (for Intensity) (Figure 18).

The scale and intensity should be scored for the *greatest* impact in relation to any specific examples. For example, in relation to Hunting and Fishing, if the intensity of hunting pig is 'high', but the intensity of fishing is 'low', the overall intensity should be specified as high - '3'.

The worksheet 1.2 automatically shows any vulnerabilities identified in this FMU, according to the boxes that were ticked in Worksheet 1.1.

Stress factors	FMU-specific vulnerabilites if relevant		Scale (a)	Intensity (b)	Scale x Intensity (a x b)
RS1 - Construction and maintenance of permanent roads and tracks			2	2	4
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas			2	2	4
RS3 - Cutting fire breaks			1	2	2
RS4 - Felling of target tree species (timber, pole, fuelwood)	Mahogany	Cedar	2	2	4
RS5 - Skidding			1	2	2
RS6 - NTFP harvesting (plants only)			3	3	9
RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)			1	2	2
RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)	Tapir		0	0	0
RS9 - Hunting, fishing and/or collecting of			3	1	3

Figure 18. Extract from Worksheet 1.2, showing the scoring of 'Scale' and 'Intensity' for regionally significant stress factors, and the relevant FMU-specific vulnerabilities.

4.2.3 Identify any mitigating measures that are applied in this FMU.

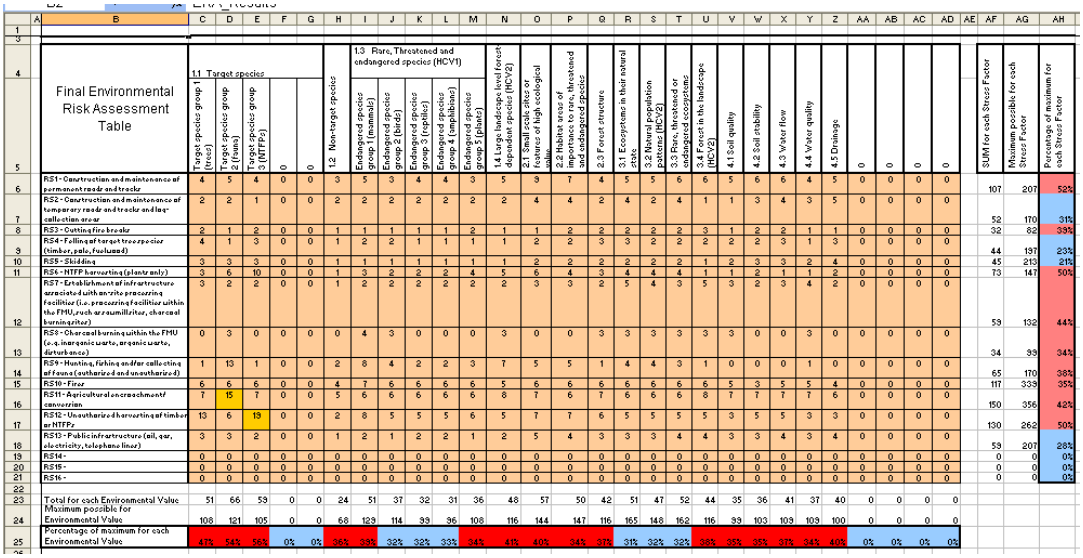
In Worksheet 1.3, identify any 'mitigation measures' that occur in this FMU. This is done by reviewing the list of potential Mitigation Measures in Worksheet 1.3, and clicking on the relevant tickbox if the measure occurs in this FMU (Figure 19).

Mitigating Measures present at the FMU level	Present?	
RS1 - Construction and maintenance of permanent roads and tracks		
Roads are constructed using materials local to the site	☑	Yes
Roadside ditches are well designed and free of blockages.	☐	No
Drainage is unimpeded by roads, either by location or through the use of well maintained culverts.	☑	Yes
Roads are located to minimise impacts on landscape.	☐	No
Road verges are maintained to minimise impact on landscape.	☐	No
Habitat areas of importance to rare, threatened and endangered species; ecosystems in their natural state; and rare, threatened or endangered ecosystems have been explicitly identified and are systematically avoided during road construction.	☑	Yes
0	☐	No
0	☐	No
0	☐	No
0	☐	No
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas		
Temporary roads are rehabilitated prior to abandonment, or are constructed on sites of previous roads	☐	No
Log collection areas are rehabilitated prior to abandonment	☑	Yes
0	☐	No

Figure 19. Extract from Worksheet 1.3 showing a selection of mitigating measures that are applied within the FMU 'checked' as present.

4.2.4 Evaluate the ERA results

As soon as the previous three steps have been completed, the results will automatically appear in Worksheet 1.4.



Final Environmental Risk Assessment Table	1.1 Target species: Target species group 1 (trees)	Target species group 2 (Palms)	Target species group 3 (NTFPs)	0	0	1.2 Non-target species	1.3 Rare, Threatened and endangered species (HCV1): Endangered species group 1 (mammals)	Endangered species group 2 (birds)	Endangered species group 3 (reptiles)	Endangered species group 4 (amphibians)	Endangered species group 5 (plants)	1.4 Large landscape-level forest dependent species (HCV2)	2.1 Small scale sites or features of high ecological value	2.2 Habitat areas of importance to rare, threatened and endangered species	2.3 Forest structure	3.1 Ecosystems in their natural state	3.2 Natural population patterns (HCV2)	3.3 Rare, threatened or endangered ecosystems	3.4 Forest in the landscape (HCV2)	4.1 Soil quality	4.2 Soil stability	4.3 Water flow	4.4 Water quality	4.5 Drainage	0	0	0	0	SUM for each Stress Factor	Maximum possible for each Stress Factor	Percentage of maximum for each Stress Factor
RS1 - Construction and maintenance of permanent roads and tracks	4	5	4	0	0	3	5	3	4	4	3	5	3	7	4	5	5	6	6	5	6	6	4	5	0	0	0	0	107	207	52%
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas	2	2	1	0	0	2	2	2	2	2	2	2	4	4	2	4	2	4	1	1	3	4	3	5	0	0	0	0	52	170	31%
RS3 - Cutting fire breaks	2	1	2	0	0	1	1	1	1	1	2	1	1	2	2	2	2	2	3	1	2	2	1	1	0	0	0	0	32	82	39%
RS4 - Felling of target tree species (timber, pole, fuelwood)	4	1	3	0	0	1	2	2	1	1	1	1	2	2	3	3	2	2	2	2	2	3	1	3	0	0	0	0	44	197	23%
RS5 - Skidding	3	3	3	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	1	2	3	3	2	4	0	0	0	0	45	213	21%
RS6 - NTFP harvesting (plants only)	3	6	10	0	0	1	3	2	2	2	4	5	6	4	3	4	4	4	1	1	2	1	1	2	0	0	0	0	73	147	50%
RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as mills/kilns, charcoal burning sites)	3	2	2	0	0	1	2	2	2	2	2	2	3	3	2	5	4	3	5	3	2	3	4	2	0	0	0	0	59	132	44%
RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)	0	3	0	0	0	0	4	3	0	0	0	3	0	0	3	3	3	3	3	3	0	0	3	0	0	0	0	0	34	99	34%
RS9 - Hunting, fishing and/or collecting of fauna (authorized and unauthorized)	1	13	1	0	0	2	8	4	2	2	3	7	5	5	1	4	4	3	1	0	0	0	1	0	0	0	0	0	65	170	38%
RS10 - Fires	6	6	6	0	0	4	7	6	6	6	6	5	6	6	6	6	6	6	6	5	3	5	5	4	0	0	0	0	117	333	35%
RS11 - Agricultural encroachment/ conversion	7	15	7	0	0	5	6	6	6	6	6	8	7	6	7	6	6	6	8	7	7	7	7	6	0	0	0	0	150	356	42%
RS12 - Unauthorized harvesting of timber or NTFPs	13	6	19	0	0	2	8	5	5	5	6	5	7	7	6	5	5	5	5	3	5	5	3	3	0	0	0	0	130	262	50%
RS13 - Public infrastructure (oil, gas, electricity, telephone lines)	3	3	2	0	0	1	2	1	2	2	1	2	5	4	3	3	3	4	4	3	3	4	3	4	0	0	0	0	59	207	28%
RS14 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
RS15 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
RS16 -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Total for each Environmental Value	51	66	59	0	0	24	51	37	32	31	36	48	57	50	42	51	47	52	44	35	36	41	37	40	0	0	0	0			
Maximum possible for Environmental Value	108	121	105	0	0	68	123	114	93	96	108	116	144	147	116	165	148	162	116	99	103	109	109	100	0	0	0	0			
Percentage of maximum for each Environmental Value	47%	54%	56%	0%	0%	35%	39%	32%	32%	33%	34%	41%	40%	34%	37%	31%	32%	32%	38%	35%	35%	37%	34%	40%	0%	0%	0%	0%			

Figure 20. Extract from Worksheet 1.4 showing the final results of an ERA, illustrating a number of environmental values considered 'safe' (in blue) and others that might require mitigation, reduction of scale or intensity of stress factors, or monitoring (in red).

The cells highlighted in yellow show where an individual stress factor has a particularly high impact on a specific environmental value.

The bottom row (Row 25) shows which of the environmental values are considered to be safe, and which of them may be at some risk. The value specifies the level of risk as a percentage of the maximum possible. Values below 33.3% are considered to be safe.

The final column (Column AH) shows which stress factors are having the most impact overall. As for environmental values, the figures are presented as a percentage of the maximum possible. Any figures over 33.3% are highlighted in pink.

4.2.5 Considering options: Finally, the implications of the ERA results can be considered. Any environmental values that score above 33.3% *may* be at risk. They are not necessary being affected in a way that would be incompatible with the FSC P&C, but they are the ones where the risk is highest. In this case the manager has a range of options. The options are not exclusive - a combination of options is likely to be necessary.

a) The manager may choose to monitor the environmental value to determine whether it is being affected in practice. Monitoring results will then tell the manager whether any further action is required.

b) The manager may choose to reduce the scale and/or intensity of the stress factors that have an impact on that environmental value. The implications can be tested by entering new, hypothetical values in Worksheet 1.2 and then seeing whether these reduce the risk value for a particular environmental value to below the 33% level.

c) The manager may choose to implement one or more mitigating measures. Again, the implications can be tested by entering the proposed measures on Worksheet 1.3.

IMPORTANT NOTE: the actions and decisions taken by the manager should be clearly documented. *If* the manager chooses to take action to reduce the scale and intensity of stress factors, or to implement additional mitigating measures, these decisions must be documented and the new activities must be provided to the certification body and others on request. A

copy of the ERA *before* such actions were taken, AND *after* such actions are taken must be saved. This will be essential documentation to show the certification body how the managers have complied with a number of elements of the FSC Principles and Criteria.

The results may then be presented to the certification body, as evidence of compliance with FSC requirements, and as evidence that there are no unacceptable environmental impacts occurring in this FMU. Once verified by the certification body, the ERA report will justify the level of environmental monitoring that has been implemented in this FMU.

4.3 Use of the Regionally Adapted ERA by Certification Bodies

4.3.1 Introduction

As noted in Part 3, use of an ERA and acceptance of the results may in the longer term be formally referenced in FSC international policy, FSC national standards, or in the operating systems of certification bodies.

In the short term, whether a certification body accepts the results of an ERA depends on the details of the FSC national standard(s) applicable in a region, and on the certification body's interpretation of what it considers an appropriate level of monitoring, taking account of the scale and intensity of management. This will be at the discretion of individual certification bodies, as well as depending on the particular wording of their current sets of 'generic' indicators.

It is proposed that use of an appropriate regionally adapted ERA is an objective and reasonable justification for greatly reduced levels of environmental monitoring in some cases.

This section provides very brief guidance to certification bodies as to how they can verify the use of the ERA, if its results are accepted as valid in principle.

4.3.2 Verifying use of the ERA

The certification body should:

1. verify that the use of the ERA is appropriately referenced in the community's management planning documentation, and that there is someone working with or in the community who is responsible for its implementation, and has received appropriate training in its use.

2. request a copy (either printed or electronic) of the community's completed ERA to be included in the certification report.

3. confirm the version of the ERA that the community has used, and confirm that this version is applicable to the region in which it is being used, and was up to date at the time it was used.

4. in case of doubt, the certification body may download an applicable and up to date version from the internet, and re-enter the information required to complete worksheets 1.1, 1.2 and 1.3 (this should take only a few minutes), and confirm that the ERA results are the same as on the community's version.

5. discuss with responsible technician how the community has interpreted the results, and what environmental monitoring is taking place. In some cases there may be environmental monitoring of specific aspects even though the ERA does not suggest that monitoring is essential. In other cases, the ERA may show environmental risks which merit monitoring or other actions, and the certification body will want to understand what monitoring is taking place.

6. verify that the data provided by the community are correct. This will require verification in the field, and should take place at the same time as the certification body's other field work. The certification body will need to confirm that it agrees with the community's self-assessment of the scale and intensity of the stress factors acting on the FMU, that the applicable vulnerabilities have been correctly identified, and that any mitigating measures that the community has identified are in fact being implemented effectively in practice.

7. verify that if environmental monitoring is required, it is specified in management planning documentation and is taking place as described.

8. finally, verify other aspects of the ERA, for example that the results have been used to modify the community's management documentation (in relation to compliance with Criterion 8.4), or that the ERA results are publicly available (in relation to compliance with Criterion 8.5).

Once these elements have been verified, the ERA results and recommendations may be used as evidence for compliance with relevant aspects of the FSC Principles and Criteria, which may include in whole or in part: Criteria: 6.1, 6.2, 6.3, 6.4, 7.1, 8.1, 8.2, 8.4, 8.5, 9.3 and 9.4, as described in Section 3.3, above.

Part 5: Further Development

The *Selva Maya* ERA was developed as Phase One of a project supported by the Netherlands-based Interchurch Organization for Development Cooperation (ICCO). The scope of the project was deliberately narrow so that work could focus as much as possible on developing the core ERA tools, whilst limiting the amount of project management and complexity that might have resulted from developing and testing a tool in several regions of the world simultaneously. The Phase One project was also limited in duration - so whilst the tools have been field-tested in terms of their practicability, they have not been tested in a wide enough range of management situations to confirm the robustness of the results. It is hoped that these limitations will be addressed through further work. A number of specific topics that are proposed for inclusion in a Phase Two project are described briefly below.

For further information in relation to such work, or if you are interested in making use of the generic ERA system in another area or for another purpose, please contact Dr Timothy Synnott at timsynnott@prodigy.net.mx.

Additional materials will be published on the OneWorldStandards website, as they become available: www.oneworldstandards.com/ERA.html

5.1 Testing in a Broader Range of Management Situations

The ERA was developed and tested in the context of a small number of community forest situations in the *Selva Maya*. The limited testing of the ERA to date suggests that it does identify risk appropriately in these situations.

The identified environmental values and risk factors should be generic to all types and scales of operation, and an effort was made to specify a range of scales and intensities of stress factors, and a range of vulnerabilities and mitigating measures that would be applicable to all types of management in this region.

However, further testing is required in a greater number and range of forest management situations to build confidence that the ERA's identification of environmental risk are reliable. The authors are particularly interested to see the model tested in a range of commercial and relatively high intensity management situations, to determine whether it reliably identifies management which would be generally considered 'high intensity' as requiring appropriate monitoring.

5.2 Testing in Combination with Assessment of FSC Principle 9

The *Selva Maya* ERA was not developed in association with an in depth evaluation of the implementation of FSC Principle 9 at the FMU level. Now that a working version of the ERA is available, it would be useful to test this directly in combination with an assessment of the implementation of FSC Principle 9 in the region.

It is expected that the ERA will already address most, if not all, of the environmental aspects of FSC Principle 9. However, it would be valuable to confirm this (and, if necessary, add additional HCVs to the list of potential regional vulnerabilities). Once this exercise has taken place, implementation of an appropriate regional version of the ERA should demonstrate compliance with most aspects of Principle 9 for a 'SLIMF' forest in the region.

5.3 Use in New Geographic Regions

The scope of the Phase One project was to develop and test the system in the *Selva Maya* region. However, the system was explicitly designed to be easily modifiable for application in other regions of the world.

There have been expressions of interest to develop regionally adapted versions for Amazonia (both Brazilian and non-Brazilian regions), Ghana, Papua New Guinea and Sweden.

It is hoped that further work will lead to the development of regionally adapted ERAs for many more regions of the world, as well as more detailed procedures for the development of regionally adapted versions of the ERA.

5.4 Formal Recognition Within the FSC System

The Phase One project was necessarily experimental. Representatives of FSC International Center, FSC National Initiatives and FSC-accredited certification bodies were all involved in the project as members of the Project Reference Group, but it must be emphasised that the results of this Phase are in no way formally endorsed by FSC, nor have they been formally incorporated into its policies or standards.

It is hoped that in a second phase of the project it will be possible to work with FSC's formal procedures for development of international policy, with the result that the ERA can be officially referenced in relation to FSC certification, increasing the confidence that forest managers and certification bodies can have in its use in an FSC context.

5.5 Adaptation for Other Purposes

Interest has also been expressed about the possibility of using the basic approach as a mechanism for evaluating risk in relation to the management of High Conservation Values (HCVs) for small forest owners in Australia, and in relation to small scale plantation management in South Africa.

The ERA approach should be adaptable to these contexts. However, the system may need more extensive modification than was envisaged in developing the recommendations in Part 4. A specific project task of Phase Two should be to test the extent to which the system can be readily adapted to such different contexts.

Annex 1: FSC Principles and Criteria Relating to Environmental Monitoring

Principle 6: Environmental impact
Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

> **Criterion 6.1** Assessment of environmental impacts shall be completed – appropriate to the scale and intensity of forest management and the uniqueness of the affected resources – and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.

Principle 8: Monitoring and assessment
Monitoring shall be conducted – appropriate to the scale and intensity of forest management – to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

> **Criterion 8.1** The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment.

> **Criterion 8.2** Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators:
> - Yield of all forest products harvested.
> - Growth rates, regeneration and condition of the forest.
> - Composition and observed changes in the flora and fauna.
> - Environmental and social impacts of harvesting and other operations.
> - Costs, productivity and efficiency of forest management.

Principle 9: Maintenance of high conservation value forests
Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

> **Criterion 9.4** Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.

Annex 2: Environmental Values and Objectives / Goals

Environmental values and environmental objectives
Environmental Value Group 1: Fauna and Flora *Objective: Viable and self-sustaining populations of all species within the FMU are maintained within the FMU in the long term.*
Value 1.1 Target species (the species selectively removed by harvesting or by silvicultural treatments. Target species may be subdivided into timber trees, pole trees, fuelwood, NTFPs and animals. They may be subdivided further by species, groups or orders. In this ERA, we have identified 3 groups: Trees, Hunted animals and Palms & Other NTFPs.) Objectives*: All target species maintain long-term viable populations within the FMU. The population of each tree species within the FMU includes seedlings, immature trees and mature trees in sufficient quantities to ensure regeneration in the long term. Conditions for their successful regeneration occur within the FMU over time.* **Value 1.2 Non-target species** (all species of flora and fauna that are not harvested. May be subdivided into trees, shrubs, climbers, herbs, and animal orders, and further subdivided into species.) Objective: *All species maintain viable and self-sustaining populations within the FMU in the long term.* **Value 1.3 Rare, threatened and endangered species (HCV1)** (*See footnote. In this ERA, we have identified five groups: mammals, birds, reptiles, amphibians, plants)*) Objective*: Population levels of species classified as threatened or endangered at national or regional levels in national legislation (e.g. in NOM 059) are maintained over time. Significant concentrations of endemic, rare, threatened or endangered species are maintained or enhanced.* **Value 1.4 Large landscape level forest-dependent species (HCV2)** Objective*: Forest management stress factors have no significant negative impact on the viability of populations of species which depend on the forest landscape at a scale greater than the FMU itself (i.e. large landscape level forests).*
Environmental Value Group 2: Key habitat features Objective*: Forest management ensures that key habitat features are maintained within the FMU so as to ensure that all species in the FMU can maintain viable and self-sustaining populations*.
Value 2.1 Small scale sites or features of high ecological value Objective: *Small scale sites or features of high ecological value (e.g. nesting sites, small wetlands, ponds, small open areas, old, non-commercial trees; trees with special ecological value; standing dead trees; and dead fallen wood) are maintained within the FMU at levels that are sufficient to be sure of achieving the stated Objectives for Environmental Values 1.1 to 1.4.* **Value 2.2 Habitat areas of importance to rare, threatened and endangered species** Objective: *Sufficient areas of the FMU that are of importance to rare, threatened or endangered species (including areas for breeding, feeding, or of seasonal importance, seasonal refugia, HCV1) are maintained to be sure of achieving the objectives for Environmental Values 1.1 to 1.4.* **Value 2.3 Forest structure** Objective: *All elements of forest structure (e.g. the age and size structure of canopy trees, under-storey, ground flora, shrub layer) continue to exist within the FMU, sufficient to achieve the objectives for Environmental Values 1.1 to 1.4, and to provide reference sites for long-term ecological monitoring.*

Environmental values and environmental objectives

Environmental Value Group 3: Ecosystems

Objective: Forest management ensures that examples of all natural ecosystems are maintained within the FMU.

Value 3.1 Ecosystems in their natural state

Objective: Examples within the FMU of ecosystems in their natural state are maintained, sufficient to ensure that the objectives 1.1 and 1.2 are met, and to provide reference sites for long term ecological monitoring.

Value 3.2 Natural population patterns (HCV2)

Objective: *The ability of the FMU to support naturally occurring species in natural patterns of distribution and abundance is maintained or enhanced.*

Value 3.3 Rare, threatened or endangered ecosystems (HCV3)

Objective: *Rare, threatened or endangered ecosystems in the FMU are maintained or enhanced*.

Value 3.4 Forest in the landscape (HCV2).

Objectives: *The management of forests of any size has no significant negative impacts on the landscape, and no impact on the most important landscape features (ref FSC Criteria 6.1, 6.4) nor on the viability of species that are associated with large landscape-level forests (HCV2)*

Environmental Value Group 4: Environmental elements

Objective: *Forest management has minor or insignificant negative impacts on key indicators of the physical environment and on the landscape*.

Value 4.1 Soil quality

Objective: *Soil compaction and significant soil disturbance takes place on less than 0.01% of the FMU area per year.*

Value 4.2 Soil stability

Objective: *The total annual sediment load in streams leaving the FMU does not change by more than 10% compared to natural or undisturbed loads*.

Value 4.3 Water flow

Objective: *Annual, peak and minimum water flows do not change by more than 10% compared to natural or undisturbed flows in any stream or river leaving the FMU.*

Value 4.4 Water quality

Objective: *The indicators of environmental quality, including temperature, pH and pollutant loads, in streams and rivers leaving the FMU, and in other water resources of the FMU, are not detectably different from natural levels (for sediment, see 4.2).*

Value 4.5 Drainage

Objective: *Less than 0.1% of streams within the FMU are blocked or diverted in a way which creates an impediment to the natural movement of fish or other aquatic species*.

Environmental Values and Objectives: A generic list of the environmental values that may be affected by stress factors in the forest, and the objectives or goals of management that are considered acceptable or desirable results of management, in the context of certification.

Note: Value 1.3: Rare, threatened and endangered species: These include all species covered by the FSC Glossary, and also all species officially classified as Threatened or Endangered in national regulations. Principle 6 refers to the need to protect 'rare, threatened and endangered' species. Principle 9 includes requirements relating to the assessment and monitoring of significant concentrations of Endangered species only (it does not refer to rare or threatened species). Rare and threatened species are include as a precaution in this Value, but it is recommended that national legislation is used as the basis for more specific definitions at the regional level, as in this case.

Annex 3: Stress Factors with Negative Environmental Impacts: the potentially significant stress factors.

References: 6, 7, 8, 9, 10, 11, 17, 19, 20, 21, 22, 26, 28, 29, 30, 31, 33, 34, 35, 38, 39, 41, 42, 43, 44, 47, 48, 49, 50, 52, 53, 54, 55, 59, 60, 63, 64, 65, 70, 71, 72, 73, 74, 76, 77, 80, 83, 85, 86, 88, 89, 91, 92, 93, 94, 95, 96, 97, 98, 99.

		1. Roads, transport and access
1	1	*Construction and maintenance of permanent roads and tracks*
1	2	*Construction and maintenance of temporary roads, tracks and log-loading areas*
		2. Silviculture and site management
2	1	Felling of non-target species as a silvicultural treatment
2	2	Poisoning of non-target species as a silvicultural treatment
2	3	Thinning and weeding
2	4	Pruning
2	5	Planting
2	6	Climber cutting
2	7	Pesticide use (including insecticides, herbicides, etc)
2	8	Use of fertilisers
2	9	Use of biological control agents
2	10	Use of GMOs
2	11	Use of exotic species
2	12	Conversion from natural or semi-natural forest to plantation or non-forest use
2	13	*Cutting and maintaining fire breaks*
		3. Harvesting
3	1	Construction of logging camps (site clearing, construction materials, etc)
3	2	Climber cutting & clearing in preparation for harvest
3	3	*Felling of target tree species (timber, pole, fuelwood)*
3	4	*Skidding and log-loading (extraction)*
3	5	*Harvesting of NTFP plants*

3	6	Disposal of inorganic waste associated with harvesting (e.g. oil, containers, abandoned machinery and parts)
3	7	Removal of biomass from the FMU
		4. Processing
4	1	Transportation to processing site (may be inside or outside FMU, e.g. pollution associated with transport, noise, disturbance, oil)
4	2	*Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)*
4	3	*Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)*
4	4	Sawmill operation within the FMU, including portable sawmill operations (e.g. inorganic waste, organic waste, disturbance)
		5. Other stress factors in the forest
5	1	Workers' impacts at logging camps (e.g. inorganic waste, organic waste, disturbance)
5	2	*Hunting and fishing (authorised and unauthorised)*
5	3	*Fires*
5	4	*Agricultural encroachment/ conversion*
5	5	Fly-tipping / rubbish dumping
5	6	Recreation and Tourism
5	7	*Unauthorised harvesting of timber or NTFPs (flora only)*
5	8	*Public infrastructure (oil, gas, electricity, telephone lines)*
5	9	Public road construction
5	10	Grazing of livestock (authorised and unauthorised).

Potentially Significant Stress Factors: This is a generic list of the activities that sometimes occur in managed forests, anywhere in the world, and which often cause significant negative environmental impacts.

Regionally Significant Stress Factors: These are the activities that have been identified as occurring in at least some of the FMUs in the Selva Maya, and that have a significant negative environmental impact when they occur. *They are identified in italics*.

Annex 4: Scales and Intensities for Selected Stress Factors

SCALE (area and/ or frequency)	INTENSITY
Stress factor 1.1 Construction and maintenance of permanent roads and tracks	
Scale score 1: low Less than 50% of the management divisions (compartments) of the FMU contain a permanent road **Scale score 2: medium** 50 - 80% of the management divisions (compartments) of the FMU contain a permanent road **Scale score 3: high** More than 80% of the management divisions (compartments) of the FMU contain a permanent road	**Intensity score 1: low** Less than 2% of the surface area of the FMU is taken up by permanent roads and associated constructions **Intensity score 2: medium** 2 - 5% of the surface area of the FMU is taken up by permanent roads and associated constructions **Intensity score 3: high** More than 5% of the surface area of the FMU is taken up by permanent roads and associated constructions
Stress factor 1.2 Construction and maintenance of temporary roads, tracks and log-loading areas	
Scale score 1: low Less than 50% of the management divisions (compartments) of the FMU contain or have contained a temporary road, track or log-loading areas. **Scale score 2: medium** 50 - 80% of the management divisions of the FMU contain or have contained a temporary road, track or log-loading area. **Scale score 3: high** More than 80% of the management divisions of the FMU contain or have contained a temporary road, track or log-loading area.	**Intensity score 1: low** Less than 2% of the surface area of the FMU is taken up by temporary roads, tracks or log-loading areas OR all are closed after use and revert to forest vegetation within two years **Intensity score 2: medium** 2 - 5% of the surface area of the FMU is taken up by temporary roads, tracks or log-loading areas. **Intensity score 3: high** More than 5% of the surface area of the FMU is taken up by temporary roads, tracks or log-loading areas, OR they are not all are closed after use or do not revert to forest vegetation within two years.
Stress Factor 2.13 Cutting and Maintaining Firebreaks	
Scale score 1: low: Less than 50% of the management divisions or compartments of the FMU contain a firebreak. **Scale score 2: medium** 50 - 80% of the management divisions of the FMU contain or have contained a fire break. **Scale score 3: high** More than 80% of the management divisions of the FMU contain or have contained a fire break.	**Intensity score 1: low** Firebreaks are cleared of all native trees and shrubs, but always have vegetation ground cover, and/or are less than 4 m wide. **Intensity score 2: medium** Firebreaks retain a fire-barrier of natural or planted trees, but all ground vegetation is cleared at least annually. **Intensity score 3: high** Firebreaks are frequently cleared of all vegetation down to the bare soil, and/or are more than 8 m wide.
Stress Factor 3.3 Felling of target timber species (timber, poles, fuelwood)	
1: low Harvesting takes place in less than 2% of the production forest area per year (i.e. a maximum 50 year cycle). **2: medium** Harvesting takes place in between 2% and 5% of the production forest area per year (i.e. a cycle of between 20 and 50 years). **3: high** Harvesting takes place in more than 5% of the production forest area per year (i.e. less than a 20 year cycle).	**1: low** Harvesting is estimated to remove less than 2 cubic metres per hectare per year in the harvested areas. **2: medium** Harvesting is estimated to remove between 2 and 5 cubic metres per hectare per year in the harvested areas. **3: high** Harvesting is estimated to remove between more than 5 cubic metres per hectare per year in the harvested areas.

SCALE (area and/ or frequency)	INTENSITY
Stress Factor 3.4 Skidding and extraction	
1: low Temporary extraction tracks have been planned so that maximum skidding distance is less than 50m. **2: medium** Temporary extraction tracks have been planned so that maximum skidding distance is less than 100m. **3: high** Skidding distance regularly exceeds 100m	**1: low** Skidding is by cable or by hand **2: medium** Skidding is by small, low-impact machinery or adapted agricultural tractor **3: high** Skidding is by heavy logging equipment (ref: DFID recommendations)
Stress factor 3.5 Harvesting of NTFP (plants only)	
1: low Harvesting is not permitted in at least 20% of the target species range within the FMU, *and* there are effective restrictions designed to ensure that viable populations are maintained in the harvested areas. **2: medium** Less than 20% of the target species range within the FMU is protected from harvesting, *or* restrictions on harvesting are not considered sufficient to ensure that viable populations are maintained in the harvested areas. **3: high** Less than 20% of the target species range within the FMU is protected from harvesting, *and* restrictions on harvesting are not considered sufficient to ensure that viable populations are maintained in the harvested areas.	**1: low** Harvesting is not considered to have a significant impact on the reproductive potential of the species (e.g. is non-destructive, and does not make use of reproductive elements such as flowers or fruit) **2: medium** Harvesting is non-destructive, but is likely to affect the reproductive potential of the species, for example through the harvesting of a significant proportion of fruit or flowers. **3: high** Harvesting is destructive, including the removal or killing of individual whole plants, or the destruction of their reproductive potential.
Stress Factor 4.2 Establishment and operation of processing facilities within the FMU (e.g. sawmill sites, charcoal burning sites)	
1: low Less than 0.01% of the production forest area is directly or indirectly affected (not including harvesting) by the presence of processing facilities within the FMU. 2: medium Between 0.01% and 0.05% of the production forest area is directly or indirectly affected (not including harvesting) by the presence of processing facilities within the FMU. 3: high More than 0.05% of the production forest area is directly or indirectly affected (not including harvesting) by the presence of processing facilities within the FMU.	1: low Processing facilities are not associated with any of the following characteristics: - evidence of damaged foliage as a result of heat, smoke, or emissions - more than 100m2 of bare or compressed soil - latrines which allow sewage to come into contact with water or topsoil - large piles of sawdust or offcuts other than temporary storage prior to use or removal - evidence of oil, chemical or other spillage. 2: medium Processing facilities are associated with one of the following characteristics: - evidence of damaged foliage as a result of heat, smoke, or emissions - more than 100m2 of bare or compressed soil

SCALE (area and/ or frequency)	INTENSITY
	- latrines which allow sewage to come into contact with water or topsoil - large piles of sawdust or offcuts other than temporary storage prior to use or removal - evidence of oil, chemical or other spillage. 3: high Processing facilities are associated with two or more of the following characteristics: - evidence of damaged foliage as a result of heat, smoke, or emissions - more than 100m2 of bare or compressed soil - latrines which allow sewage to come into contact with water or topsoil - large piles of sawdust or offcuts other than temporary storage prior to use or removal - evidence of oil, chemical or other spillage.
Stress Factor 4.3 Charcoal burning within the FMU	
1: low Less than 0.01% of the production forest area is directly affected (not including harvesting) by charcoal burning activity in any year **2: medium** Between 0.01% and 0.05% of the production forest area is directly affected (not including harvesting) by charcoal burning activity in any year **3: high** More than 0.05% of the production forest area is directly affected (not including harvesting) by charcoal burning activity in any year	**1: low** Charcoal burning sites are not associated with any of the following characteristics: - fire damaged foliage - more than 100m2 of bare or compressed soil on each site **2: medium** Charcoal burning sites are associated with one of the following characteristics: - fire damaged foliage - more than 100m2 of bare or compressed soil on each site **3: high** Charcoal burning sites are associated with both of the following characteristics: - fire damaged foliage - more than 100m2 of bare or compressed soil on each site
Stress Factor 5.2 Hunting, fishing, trapping (both authorised and unauthorised)	
1: low Hunting occurs rarely or in few restricted locations only. **2: medium** Hunting is relatively widespread, but at least 20% of the FMU is considered an effectively protected area in which hunting does not take place. **3: high** Hunting is thought to occur over most or all of the FMU.	**1: low** There is no evidence that numbers of other species taken is declining in relation to the hunting effort expended. **2: medium** There is anecdotal evidence that numbers of other species taken is declining in relation to the hunting effort expended. **3: high** There is reliable evidence that numbers of other species taken is declining in relation to the hunting effort expended.
Stress Factor 5.3 Fires	
1: low Fire has affected less than 1% of the FMU area over the previous 25 years. **2: medium** Fire has affected between 1% and 5% of the FMU area over the previous 25 years.	**1: low** In the areas affected by fire, most trees of 10 – 20 cm diameter survived and continued to grow afterwards. **2: medium** In the areas affected by fire, most trees of 10 - 20 cm in diameter died, but most trees above 20 cm survived and continued to grow afterwards.

SCALE (area and/ or frequency)	INTENSITY
3: high Fire has affected more than 5% of the FMU area over the previous 25 years. **NB: scale of impact should be normalised in comparison to levels estimated to have been normal over the previous 500 years or so.**	**3: high** In the areas affected by fire most trees above 20 cm were killed by the fire. **NB: intensity of impact should be normalised in comparison to intensity estimated to have been normal over the previous 500 years or so.**
Stress Factor 5.4 Agricultural encroachment	
1: low Agricultural encroachment affects less than 0.01% of the FMU per year. **2: medium** Agricultural encroachment affects between 0.01% and 0.05% of the FMU per year. **3: high** Agricultural encroachment affects more than 0.05% of the FMU per year.	**1: low** Encroachment is temporary, and previously encroached areas returning to forest in less than three years. **2: medium** Encroachment is temporary, and previously encroached areas return to forest in between and 3 and 10 years. **3: high** Encroachment appears to be permanent, with previously forested areas remaining deforested for 10 or more years.
Stress Factor 5.7 Unauthorised harvesting of timber or NTFPs (plants only)	
1: low Illegal or unauthorised harvesting of timber occurs rarely or in few restricted locations only. **2: medium** Illegal or unauthorised harvesting of timber is relatively widespread, but is thought to occur on less than 5% of the FMU area per year. **3: high** Illegal or unauthorised harvesting of timber is thought to occur in more than 5% of the FMU area per year.	**1: low** Illegal or unauthorised harvesting of timber is considered to be less than 1% of the legal annual harvest. **2: medium** Illegal or unauthorised harvesting of timber is considered to be between 1% and 5% of the legal annual harvest. **3: high** Illegal or unauthorised harvesting of timber is considered to be more than 5% of the legal annual harvest.
Stress Factor 5.8 Public infrastructure: oil, gas, electricity, telephone lines	
1: low Forest clearance for public infrastructure affects less than 5% of the total FMU area. **2: medium** Forest clearance for public infrastructure affects between 5% and 10% of the total FMU area. **3: high** Forest clearance for public infrastructure affects more than 10% of the total FMU area.	**1: low** Two years after infrastructure is installed more than 90% of the cleared area is covered with native vegetation. **2: medium** Two years after infrastructure is installed between 50% and 90% of the cleared area is covered with native vegetation. **3: high** Two years after infrastructure is installed soil remains exposed over more than 50% of the affected area

Generic Table of Scales and Intensities. This table displays the options for the temporal and/or spatial scale and the intensity of all stress factors that have already been identified as regionally significant (RS) (Annex 3) in this region.

Annex 5: Mitigating Measures in the *Selva Maya*

Mitigating measures are the actions taken by the forest managers, or other factors, practices or customs applied in this region that help to reduce the negative environmental impacts caused by any interventions, activities or stress factors in the forest.

The ERA system takes account of the mitigating measures to adjust the Risk Values that exist in the FMU, as shown in Excel Spreadsheet 1.3, 2.5 and others.

This list shows that mitigating measures that may be relevant in the Selva Maya region, and their linkages with the Regionally Significant (RS) Stress Factors. Each ERA evaluation in each FMU should select those that are actually practiced or operational in that FMU.

References: 2, 4, 12, 13, 39, 45, 51, 58, 61, 62, 66, 78, 79, 81, 84, 101, 102.

RS1 - Construction and maintenance of permanent roads and tracks
Roads are constructed using materials local to the site
Roadside ditches are well designed and free of blockages.
Drainage is unimpeded by roads, either by location or through the use of well maintained culverts.
Roads are located to minimise impacts on landscape.
Road verges are maintained to minimise impact on landscape.
Habitat areas of importance to rare, threatened and endangered species; examples of ecosystems in their natural state; and rare, threatened or endangered ecosystems have been explicitly identified and are systematically avoided during road construction.
RS2 - Construction and maintenance of temporary roads and tracks and log-collection areas
Temporary roads are rehabilitated prior to abandonment, or are constructed on sites of previous roads
Log collection areas are rehabilitated prior to abandonment
RS3 – Cutting and maintaining fire breaks
Habitat areas of importance to rare, threatened and endangered species, examples of ecosystems in their natural state, and rare, threatened or endangered ecosystems are identified and systematically avoided during the cutting of firebreaks.

RS4 - Felling of target tree species (timber, pole, fuelwood)
At least 10% of the FMU is permanently protected from harvesting.
At least 20% of the FMU is permanently protected from harvesting.
Habitat areas of importance to rare, threatened and endangered species, examples of ecosystems in their natural state, and rare, threatened or endangered ecosystems are identified and protected from harvesting.
Low impact logging techniques are implemented as a matter of course (directional felling, vine cutting...)
There is enrichment or compensatory planting of some of the target tree species in harvested areas.
RS5 – Skidding
At least 10% of the FMU is protected from harvesting.
At least 20% of the FMU is protected from harvesting.
Habitat areas of importance to rare, threatened and endangered species, examples of ecosystems in their natural state, and rare, threatened or endangered ecosystems are identified and protected from harvesting.
Brash is used to protect soils from impacts of extraction.
Skidding is not permitted in wetlands or within 10 metres of water courses, wetlands or water bodies.
RS6 - NTFP harvesting (plants only)
Harvesting technique is regulated to minimise reduction in reproductive potential of affected species
At least 10% of the FMU is protected from harvesting.
At least 20% of the FMU is protected from harvesting.
Rare, threatened or endangered ecosystems and examples of ecosystems in their natural state are identified and protected from harvesting.
There is enrichment or compensatory planting of some of the harvested NTFP species in harvested areas
RS7 - Establishment of infrastructure associated with on-site processing facilities (i.e. processing facilities within the FMU, such as sawmill sites, charcoal burning sites)
Processing facilities are not established within 100m of watercourses, wetlands or water bodies.
Sites are not visible from public roads
There is an effective program in place to clear up rubbish associated with processing facilities
RS8 - Charcoal burning within the FMU (e.g. inorganic waste, organic waste, disturbance)

Habitat areas of importance to rare, threatened and endangered species, ecosystems in their natural state, and rare, threatened or endangered ecosystems are identified and protected from charcoal burning.
Charcoal burning is not permitted in wetlands, or within 10 metres of water courses, wetlands or water bodies.
Charcoal sites are planted or sown to restore vegetation cover soon after use.
RS9 - Hunting, fishing and/or collecting of fauna (authorised and unauthorised)
No rare, endangered or threatened mammals are considered to be adversely affected by hunting or collecting
No rare, endangered or threatened birds are considered to be adversely affected by hunting or collecting
No rare, endangered or threatened animals are considered to be adversely affected by hunting or collecting
There is an effectively enforced closed season corresponding to the breeding season for the hunted/collected species
Areas known to be important for breeding are effectively closed to hunting/collecting
At least 10% of the FMU is protected from all hunting, fishing and trapping.
At least 20% of the FMU is protected from all hunting, fishing and trapping.
Rare, threatened or endangered ecosystems, and examples of ecosystems in their natural state are identified and protected from all hunting, fishing and collecting
Populations of hunted animal species are supported through a programme of systematic re-introduction.
RS10 – Fires
There is an effective system of fire breaks across the whole FMU, at least in the more vulnerable areas.
There is an early warning system to identify and react to fires when they occur
Firefighting teams have been nominated and trained
Effective firefighting equipment is readily available
RS11 - Agricultural encroachment/ conversion
Agricultural encroachment has not taken place within 100m of protected areas, habitat areas of importance to rare, threatened and endangered species, ecosystems in their natural state, or rare, threatened or endangered ecosystems.
RS12 - Unauthorised harvesting of timber or NTFPs

Unauthorised harvesting has not taken place within 100m of protected areas, habitat areas of importance to rare, threatened and endangered species, ecosystems in their natural state, or rare, threatened or endangered ecosystems.
RS13 - Public infrastructure (oil, gas, electricity, telephone lines)
Infrastructure has been planned to avoid key ecosystems, habitat areas of importance to rare, threatened and endangered species, examples of ecosystems in their natural state, and rare, threatened or endangered ecosystems
Infrastructure has been planned to avoid disruption to natural population patterns
Temporary roads are rehabilitated prior to abandonment, or are constructed on sites of previous roads
There are proper erosion controls, ditches, etc
Drainage is maintained through use of culverts
Infrastructure is located to minimise impacts on landscape
Verges, etc are maintained to minimise impact on landscape
RS14 -
RS15 -
RS16 -

Annex 6: Rare, Threatened and Endangered Species in the *Selva Maya*

The species in this Annex have been classified as "Species at risk" by the Government of Mexico in NOM 059. The list includes species in the following categories:

P Species in danger of extinction
A Threatened species
Pr Species subject to special protection, being species with a limited natural distribution that may be naturally scarce or rare.

This list has been prepared from a data base of the species of the Mexican portion of the Yucatán peninsula, provided by CONABIO. We are still seeking information about other species in the Selva Maya that are classified in Guatemala.

The **species in bold** are those classified by Radachowsky (69) as endemic to the Yucatan. Not all the endemic species are classified as RTE. Some others species are endemic to a larger region, called by Radachowsky the Lowland Maya Forest that extends to Veracruz. [Cf. also: Ref. 34 and CONAP lists]

Species	Local name	NOM 059 Category
INVERTEBRATES		
Creaser morleyi	langostino	A
Danaus plexippus	mariposa monarca	Pr
Typhlatya campecheae	chacales	P
Typhlatya pearsei	chacales	A
AMPHIBIANS		
Bolitoglossa yucatana	**salamandra lengua hongueada**	**Pr**
Eleutherodactylus yucatensis	**rana ladrona yucateca**	**Pr**
Gastrophryne elegans	sapo boca angosta elegante	Pr
Rana berlandieri	rana del Rio Grande	Pr
Rana brownorum	rana de Brown	Pr
Rhinophrynus dorsalis	sapo excavador	Pr
Triprion petasatus	**sana de árbol yucateca**	**Pr**
REPTILES		
Anolis biporcatus	anolis verde	Pr
Anolis pentaprion	anolis liquen	Pr
Aristelliger georgeensis	geco pestañado	Pr
Coleonyx elegans	cuija yucateca	A
Corytophanes cristatus	turipache cabeza lisa	Pr
Corytophanes hernandezi	turipache de Hernández	Pr
Ctenosaura defensor	**iguana**	**A**
Ctenosaura similis	iguana espinosa rayada	A
Iguana iguana	iguana verde	Pr
Laemanctus longipes	lemacto coludo	Pr
Laemanctus serratus	lemacto coronado, lagartija	Pr
Lepidophyma flavimaculatum	lagartija puntos amarillos	Pr

Sceloporus cozumelae	**lagartija escamosa**	**Pr**
Sphaerodactylus glaucus	geco enano collarejo	Pr
Thecadactylus rapicaudus	geco	Pr
Boa constrictor	boa	A
Crotalus durissus	culebra	Pr
Dipsas brevifacies	**culebra caracolera chata**	**Pr**
Elaphe phaescens	culebra ratonera	Pr
Imantodes cenchoa	culebra cordelilla chata	Pr
Imantodes gemmistratus	culebra cordelilla	Pr
Imantodes tenuissimus	**culebra cordelilla yucateca**	**Pr**
Lampropeltis triangulum	culebra real coralillo	A
Leptophis ahaetulla	culebra perico verde	A
Leptophis mexicanus	culebra perico mexicana	A
Micrurus brownii	serpiente coralillo de Brown	Pr
Micrurus diastema affinis	serpiente coralillo variable	Pr
Pliocercus andrewsi	culebra imita coral de Andrew	A
Porthidium yucatanicum	**nauyaca nariz de cerdo**	**Pr**
Symphimus mayae	**culebra labios blancos maya**	**Pr**
Mantillita lintoni	culebra cola corta de Linton	Pr
Thamnophis macianus	culebra listonada manchada	A
Thamnophis proximus	culebra listonada occidental	A
Claudius angustatus	tortuga amizclera chopontil	P
Dermatemys mawii	tortuga riverina blanca	P
Kinosternon leucostemum	tortuga pecho quebrado	Pr
Kinosternon scorpioides	tortuga pecho quebrado	Pr
Rhinoclemmys areolata	tortuga de monte mojina	A
Staurotypus triporcatus	tortuga guau	Pr
Terrapene carolina	tortuga de Carolina	Pr
Trachemys scripta	tortuga gravada	Pr
Crocodylus acutus	cocodrilo de río	Pr
Crocodylus moreletii	cocodrilo de pantano Moreleti	Pr

BIRDS

Tinamus major	tinamú mayor	Pr
Crypurellus boucardi	tinamú jamuey	Pr
Tachybaptus dominicus	zambullidor menor	Pr
Tigrisoma mexicanus	garza-tigre mexicana	Pr
Egretta rufescens	garceta rojiza	Pr
Agamia agami	garza agami	Pr
Mycteria americana	cigüeña americana	Pr
Cairina moschata	pato real	P
Leptodon cayanensis	gavilán cabeza gris	Pr
Ictinia plumbea	milano plomizo	A
Geranospiza caerulescens	gavilán zancón	A
Buteogallus anthracinus	aguililla negra menor	Pr
Buteogallus urubitinga	aguililla negra mayor	Pr
Buteo albicaudatis	aguililla cola blanca	Pr
Buteo albonotatus	aguililla aura	Pr
Micrastur semitorquatus	halcón selvática de collar	Pr
Ortalis leucogastra	chachalaca	Pr

Crax rubra	hocofaisán	A
Meleagris ocellata	**guajalote ocelado**	**A**
Rallus limicola	rascón limícola	Pr
Sterna antillarum	charrán mínimo	Pr
Columba speciosa	paloma escamosa	Pr
Columba leucocephala	paloma corona blanca	A
Aratinga nana	perico pecho sucio	Pr
Amazona farinosa	loro verde o corona azul	A
Amazona xantholora	**loro yucateca**	**Pr**
Crotophaga ani	garrapatero pico liso	A
Otus asio	tecolote oriental	Pr
Trogon collaris	trogón de collar	Pr
Trogon massena	trogón cola oscura	A
Hylomanes momotula	momoto enano	A
Galbula ruficauda	jacamar cola rufa	A
Pteroglossus torquatus	arasari de collar	Pr
Ramphastos sulfuratus	tucán pico canoa	A
Campephilus guatemalensis	carpintero pico plata	Pr
Xenops minutus	picolezna liso	Pr
Dendrocincla anabatina	trepatroncos sepia	Pr
Platyrinchus cancrominus	mosquero pico chato	Pr
Onychorhyncus coronatus	mosquero real	P
Attila spadiceus	atila de Cozumel	Pr
Manacus candei	manaquín cuello blanco	Pr
Vireo pallens	vireo manglero	Pr
Vireo bairdi	vireo de Cozumel	Pr
Hylophilus ochraceiceps	verdillo ocre	Pr
Polioptila plumbea	perlita tropical	Pr
Toxostoma guttatum	cuitlacoche de Cozumel	P
Dendroica chrysoparia	chipe mejilla dorada	A
Limnothlypis swainsonii	chipe corina café	Pr
Eucometis penicillata	tángara cabeza gris	Pr
Psaracolius montezuma	oropéndola de Moctezuma	Pr

MAMMALS

Alouetta pigra	mono aullador, saraguato	P
Ateles geoffroyi	mono araña	P
Caluromys derbianus	tlacuache arboícola	Pr
Rhynchonycteris naso	murciélago	Pr
Coendou mexicanus	puerco espín tropical	A
Herpailurus yagouarondi	jaguarundi	A
Leopardus pardales	tigrillo, ocelote	P
Leopardus wiedii	ocelote, margay	P
Pantera onca	jaguar	P
Oryzomys couesi cozumelae	rata arrocera	A
Otonyctomis hatii		**A**
Peromyscus leucopus cozumelae		A
Reithrodontomys spectabilis	**ratón cosechero de Cozumel**	**A**
Eira barbara	tayra	P
Galictis vittata	grisón	A

Contra longicaudis	nutria de río	A
Tamandua mexicana	oso hormiguero	P
Chrotopterus auritas	vampiro falso lanudo	A
Lonchorhina aurita	murciélago espada de tomas	A
Micronycteris brachyotis	murciélago orejón	A
Micronycteris schmidtorum	murciélago orejón	A
Mimon bennetti	murciélago	A
Mimon crenulatum	murciélago lanza rayado	A
Tonatia brasiliense	murciélago oreja redonda	A
Tonatia evotis	murciélago oreja redondo	A
Trachops cirrhosus	murciélago labio verrugoso	A
Vampyrum spectrum	vampiro falso	P
Bassariscus sumichrasti	cacomixtle tropical	Pr
Potos flavus	mico de noche, kinkajou	Pr
Procyon pygmaeus	**mapache de Cozumel**	**Pr**
Cryptotis mayensis	**musaraña orejillas parda**	**Pr**
Tapirus bairdii	tapir	P

PLANTS

Beaucarnea pliabilis	soyate, ts-ii-pil	A
Echinodorus cordifolius fluitans		A
Echinodorus nymphaeifolius		A
Sagittaria intermedia		P
Astronium graveolens		A
Spondias radlkoferi		A
Guatteria anomala		A
Monstera tuberculata		A
Tabebuia chysantha	primavera, ahanché	A
Tillandsia festucoides		Pr
Conocarpus erectus	mangle negro	Pr
Laguncularia racemosa	mangle blanco	Pr
Zinnia violacea		A
Acosmium panamense		A
Vatairea lundellii	tinco	P
Hibiscus spiralis		A
Nelumbo lutea		A
Vanilla planifolia	vainilla	Pr
Bactris balanoidea	caña chiquiyul	Pr
Coccothrinax readii	palma nakás	A
Cryosophila argentea	guano kum	A
Chamaedorea graminifolia	palma fina	A
Gaussia maya	gausia cimarrona	A
Pseudophoenix sargentii	palma kuká	A
Roystonea dunlapiana	palma real	Pr
Roystonia regia	palma real	Pr
Sabal gretheriae	palma de guano	Pr
Thrinax radiata	palma chit	A
Pinus caribaea	pino de Honduras	A
Asplenium serratum	helecho	A
Polypodium triseriale		A

Rhizophora mangle	mangle rojo	Pr
Avicennia germinans	mangle prieto	Pr
Dioon spinulosum		P
Zamia loddigesii		A
Guaiacum sanctum	guayacán, ken	Pr

Annex 7: Glossary

Words in this document are used as defined in most standard English language dictionaries. The precise meaning and local interpretation of certain phrases (such as local communities) should be decided in the local context by forest managers and certifiers. In this document, the words below are understood as follows:

This glossary is adapted from the FSC Principles and Criteria, with other terms used especially in ERA.

Biological diversity: The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems (see Convention on Biological Diversity, 1992).

Biological diversity values: The intrinsic, ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components. (see Convention on Biological Diversity, 1992)

Biological control agents: Living organisms used to eliminate or regulate the population of other living organisms.

Ecosystem: A community of all plants and animals and their physical environment, functioning together as an interdependent unit.

Endangered species: Any species which is in danger of extinction throughout all or a significant portion of its range.

Environmental values: In the ERA system, these include all biological, ecological and environmental components and services of the forest ecosystem, especially those covered by FSC requirements. Cf. Sections 2.2, 3.2 and Annex 2.

Exotic species: An introduced species not native or indigenous to the area in question.

Forest integrity: The composition, dynamics, functions and structural attributes of a natural forest.

Forest Management Unit: For the purposes of this ERA, the FMU is considered to be the area subject to operational forest management, including protection and conservation. In Mexican ejidos, the FMU is considered to be the Área Forestal Permanente (Permanent Forest Area) designated in the Management Plan. In the Petén, the FMU is that part of the concession area which has not been cleared for agriculture or grazing.

Genetically modified organisms: An organism in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination or both.

High Conservation Value Forests: High Conservation Value Forests are those that possess one or more of the following attributes:

a) forest areas containing globally, regionally or nationally significant: concentrations of biodiversity values (e.g. endemism, endangered species, refugia); and/or large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;

b) forest areas that are in or contain rare, threatened or endangered ecosystems;

c) forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control);

d) forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

High Conservation Value: Any of the following values:

HCV 1 Concentrations of biodiversity values that are significant at global, regional or national levels (e.g., endemism, endangered species, refuges).

HCV 2 Large landscape-level forests or other ecosystems, significant at global, regional or national level, within or including the management unit, where viable populations of the majority or all the naturally occurring species exist in natural patterns of distribution and abundance.

HCV 3. Rare, threatened, or endangered ecosystems.

HCV 4. Basic environmental services in critical situations (e.g. protection of critical water catchments, control of erosion).

HCV 5. Areas fundamental for satisfying basic necessities of local communities (e.g. for subsistence, health).

HCV 6. Areas critical for the traditional cultural identity of local communities (areas of cultural, ecological, economic or religious importance identified in cooperation with these local communities).

Intensity: In ERA systems, intensity is a measure of the severity of the impact of an activity, on a scale from 1 to 3. An activity with a low intensity is expected to have a minor impact on a particular environmental value, or on environmental values in general. Cf. Section 2.5 and Annex 4.

Landscape: A geographical mosaic composed of interacting ecosystems resulting from the influence of geological, topographical, soil, climatic, biotic and human interactions in a given area.

Linkage: Linkages, in ERA systems, describe the relationship between environmental values and stress factors. A strong linkage indicates that if the stress factor exists in any situation where the environmental value occurs or is relevant, then there is a significant risk of damage to that value. Cf. Section 2.4.

Long term: The time-scale of the forest owner or manager as manifested by the objectives of the management plan, the rate of harvesting, and the commitment to maintain permanent forest cover. The length of time involved will vary according to the context and ecological conditions, and will be a function of how long it takes a given ecosystem to recover its natural structure and composition following harvesting or disturbance, or to produce mature or primary conditions.

Mitigating Measures: In the ERA system, mitigating measures are any measures taken by the forest operators, or by others, which help to reduce the negative impacts caused by stress factors on the environmental values of the forest. Cf. Sections 2.6, and Annex 5.

Native species: A species that occurs naturally in the region; endemic to the area.

Natural cycles: Nutrient and mineral cycling as a result of interactions between soils, water, plants, and animals in forest environments that affect the ecological productivity of a given site.

Natural Forest: Forest areas where many of the principal characteristics and key elements of native ecosystems such as complexity, structure and diversity are present, as defined by FSC approved national and regional standards of forest management.

Non-timber forest products: All forest products except timber, including other materials obtained from trees such as resins and leaves, as well as any other plant and animal products.

Precautionary approach: Tool for the implementation of the precautionary principle.

Scale: In ERA systems, scale is a measure of the extent to which an activity affects a forest, in time or space, on a scale from 1 to 3. An activity with a small or low spatial scale affects only a small proportion of the forest each year, an activity with a small or low temporal scale occurs only at long intervals. See Section 2.5.

Silviculture: The art of producing and tending a forest by manipulating its establishment, composition and growth to best fulfil the objectives of the owner. This may, or may not, include timber production.

Stress factor: Stress factors, in ERA systems, are any activities or actions in the FMU caused by human intervention that may have a significant negative impact on the environmental values or objectives. Cf. Section 2.3 and Annex 3.

Succession: Progressive changes in species composition and forest community structure caused by natural processes (nonhuman) over time.

Threatened species: Any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Vulnerability: In ERA systems, vulnerability values may be applied to certain environmental values, when there is evidence that they are especially sensitive to disturbance or to forest management activities. Cf. Section 2.7.

Annex 8: Bibliography Relevant to ERA in the *Selva Maya*

(Individual references are cited in the text or tables as appropriate)

1 Akçakaya H.R. (1996) Linking GIS with models of Ecological Risk Assessment for Endangered Species. Paper, Third International Conference on Integrating GIS and Environmental Modelling, New Mexico.

2 Álvarez Alatriste, A. (1987) Perspectivas de la regeneración natural y de plantaciones de enriquecimiento en las áreas de aprovechamiento de los ejidos del Plan Piloto Forestal de Quintana Roo, México. Taller Internacional sobre Silvicultura y Manejo de Selvas. SARH-COFAN-FAO, Chetumal, 11-20 Mayo 1987. 14 p.

3 Andersen M.C. (2007) Ecological Risk Assessment (extract from Encyclopaedia of Earth, http://eoearth.org/article/Ecological_risk_assessment)

4 Azevedo-Ramos, C., O. de Carvalho Jr. & B.D. do Amaral (2006) Short-term effects of reduced-impact logging on eastern Amazon fauna. Forest Ecology and Managmt. 232, 26-35.

5 Balas, R. et al. (2004) The practical utility of biological monitoring in the Maya Biosphere reserve. WCS, CONAP, USAID, FIPA Biological Monitoring project, Guatemala. 11 pp.

6 Barker-Plotkin, A., E.Boose, D.Foster & B.Hall (in press…) Ecological impacts of Hurricanes across the Yucatan Peninsula (1851--) In Lowland Maya Area: Three Millennia at the Human-Wildland Interface. A. Gómez-Pompa, M. F. Allen, S. Fedick and J. J. Jiménez-Osornio, eds. Haworth Press, New York, NY.

7 Barrera de Jorgensen, A. (1993) Chicle extraction and forest conservation in Quintana Roo, Mexico. M.S. Thesis, Univ. of Florida, Gainesville.

8 Barrera de Jorgenson, A. (1994) La extracción del chicle y la conservación del chicozapote (*Manilkara zapota*) en las selvas de quintana Roo. P. 47-64 en: Snook, L.K. & A. Barrera de Jorgenson (1994) Madera, Chicle, Caza y Milpa. Contribuciones al Manejo Integral de las selvas de Quintana Roo, México. Memorias del Taller, Chetumal, Julio 1992. 135 p.

9 Bauer, G.P. et al. (1989) Hurricane Gilbert impact on the forests of Quintana Roo, Mexico. Report, Technical Assistance Project for North American Forestry Commission. 24 p.

10 Brokaw, N.V.L. & L.R.Walker (1991) Summary of the effects of Caribbean hurricanes on vegetation. Biotropica 23: 442-447.

11 Carrillo, P.R. (2007) Comparative study of broadleaf forest in the Rio Bravo Conservation and Management Area, Belize: with an emphasis on the impacts of forest management. MSc thesis, CATIE. 85 pp.

12 Centro Maya (1999) Medidas de Mitigación. Anexo 1, Plan de Manejo Forestal, Cooperativa La Técnica Agropecuaria La Libertad, Petén. Informe. 7 p.

13 Centro Maya (1999) Medidas de Mitigación, Plan de Manejo Forestal, Parcelamiento Yanahi, La Libertad, Petén. Informe. 6 p.

14 Centro Maya (2000) Estudio de Evaluación de Impacto Ambiental, Cooperativas y Comunidades con Planes Integrados de Uso y Manejo de la Tierra en la región de las

Cooperativas del Usumacinta, La Libertad, Petén, bajo la asistencia Técnica del Centro Maya. Informe. 84 p.

15 CONAP (1999) Sistema de Monitoreo y Evaluación en Unidades de Manejo, Zona de Uso Múltiple, Reserva de la Biosfera Maya. 28 p.

16 CONAP (2002) Xate (*Chamaedora* spp.): Situación del Sistema de Recolección y Exportación y Recomendaciones para un Plan de Trabajo. 54p.

17 CONAP (2003) Normativa para el Manejo, Protección, Transporte y Comercialización de Especies Comerciales del genero *Chamaedora* en Guatemala. CONAP, Petén. 19 p.

18 CONAP (sin fecha) Estrategia para el Monitoreo del Manejo de Áreas protegidas del SIGAP. Informe, CONAP, TNC, SIGAP [Sistema Guatemalteco de Áreas Protegidas]. 70 p.

19 Cornelius, J.P., C.M.Navarro, K.E.Wightman & .E.Ward (2005) Is mahogany dysgenetically selected? Environmental conservation 32(2): 129-139.

20 Del Ángel Santos, B. (2000) Ensayo de tratamientos silvícolas para incorporar a las operaciones forestales del Ejido Noh-Bec. Informe, TRL. 9 p.

21 Dickinson, M.B., D.F. Whigham & S.M. Hermann (2001) Low rates of background canopy-gap disturbance in a seasonally dry forest in the Yucatan peninsula with a history of fires and hurricanes. Journal of Tropical Ecology 17: 895-902.

22 Dirzo, R. & A. Miranda (1991) Altered patterns of herbivory and diversity in the forest understorey: a case study of the possible consequences of contemporary defaunation. Pp. 273 – 287 in P.W.Price, T.M.Lewinsohn, G.W.Fernández & W.W.Benson (Eds.) (1991) Plan animal interaction: evolutionary ecology in tropical and temperate regions. Wiley, New York.

23 Ellis, E.A. & C.T.Beck (2004) Dinámica de la vegetación y uso de suelo en los bosques tropicales de la zona maya de Quintana Roo. 203-230 en: N. Armijo Canto & C. Llorens C. (Eds.)(2004) Uso, Conservación y Cambio en los Bosques de Quintana Roo. UQRoo. 285 p.

24 Ellis, E.A. & D.B.Bray (2005) Landscape analysis and determinants of sustainability in two forest communities of the Zona Maya, Quintana Roo, México. Resumen, p. 102-103, Primer Congreso Internacional de Casos Exitosos de Desarrollo Sostenible del Trópico, Veracruz, México. CITRO, Universidad Veracruzana.

25 Finegan, B., J.Hayes, D.Delgado & S.Gretzinger (2004) Monitoreo ecológico en Bosques de Alto Valor para la Conservación manejados certificados por el FSC: Una guía para certificadores y manejadores de bosques en el trópico húmedo. CATIE. 140 p.

26 Fredericksen, T.S. & W.Pariona (2002) Effect of skidder disturbance on commercial tree regeneration in logging gaps in a Bolivian tropical forest. Forest Ecology and Management 171: 223-330.

27 FSC (2007) Strengthening Forest Conservation, Communities and Markets: The Global Strategy of the Forest Stewardship Council.

28 García Cuevas, X. (1990) Aplicación de diferentes intensidades de corta para favorecer la regeneración natural de caoba (Swietenia macrophylla King). Pp. 188-211 en: Rodríguez Franco, C. & A.M.Fierros González (Eds.)(1990). Taller Internacional sobre Investigación en Silvicultura y Manejo de Selvas. Informe del Taller Oct.29 – Nov.9, 1990, Escárcega, Campeche. SARH-INIFAP & USDAFS-COFAN. Publ. COFAN No. 006. 244 p.

29 García Cuevas, X., P. Negreros Castillo & B. Rodríguez Santiago (1993) Regeneración natural de caoba (*Swietenia macrophylla* King) bajo diferentes densidades de dosel. Ciencia Forestal en México 18(74) 25-44

30 García Cuevas, X., B. Rodríguez Santiago & J. Chavelas Polito (1992) Regeneración natural en sitios afectados por el huracán Gilberto e incendios forestales en Quintana Roo. Ciencia Forestal en México 17(72) 75-100.

31 García Cuevas, X., B. Rodríguez Santiago & J. Chavelas Polito (1996) Evaluación de áreas afectadas por el huracán Gilberto e incendios forestales en Quintana Roo. Publicación Especial. INIFAP, Centro de Investigación Regional del Sureste, Mérida, Yucatán, México.

32 Gómez Caal, C. (2003) Capacitación en la aplicación de la Guía de Monitoreo Ecológico para Bosques Certificados y Bosques de Alto Valor para la Conservación. Informe del Curso, Fundación NPV, Santa Elena, Petén, Guatemala. 7 p.

33 Gullison, R.E. & J.J. Hardner (1993) The effects of road design and harvest intensity on forest damage caused by selective logging: empirical results and a simulation model from the Bosque Chimanes, Bolivia. Forest Ecology and Management 59: 1-14.

34 Hawthorne, W.D. & C.E. Hughes (1997) Bioquality of the forests of Quintana Roo. Biology Component, Final Report, Quintana Roo Forest Management Project, UK-DFID

35 Hernández, J. (1992) Estudio de regeneración de Caoba en función de la superfície de perturbaciones provocados por medio del aprovechamiento forestal. Tesis, UANL, Linares.

36 Hobday A.J (2006) Including a Risk-Based Component in the MSC Certification Process: a Solution to Data-Deficient and Small-scale Fishery Assessments. Marine Stewardship Council.

37 Hobday A.J et al. (2007) Ecological Risk Assessment for the Effects of Fishing, Methodology, Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

38 Hogan Baur, E. (1998) Estudio de la cacería de subsistencia en la Concesión Forestal de Carmelita, San Andrés, Petén. Informe Final para Propetén & Conservation International. 65p

39 Hughell, D. & R. Butterfield (2008) Impact of FSC certification on deforestation and the incidence of wildfires in the Maya Biosphere Reserve. Report, RainForest Alliance, 16 p.

40 ITTO (2005) Status of Tropical Forest Management. Tropical Forest Update 2006/1. ITTO, Yokahoma, Japan.

41 Johns, J.S., P.Barreto & C.Uhl (1999) Logging damage during planned and unplanned logging operations in the eastern Amazon. Forest Ecology and Management 89: 59-77

42 Jolon Morales, M.R. (2000) Monitoreo de Cacería en la Concesiones Comunitarias de San Miguel La Palotada y La Pasadita, Petén, Guatemala. Informe, CATIE, CONAP. 58 p.

43 Jorgenson, J.P. (1993) Gardens, wildlife densities and subsistence hunting by Maya Indians in Quintana Roo, Mexico. PhD thesis, Univ of Florida, Gainesville.

44 Jorgenson J.P. (1994) La cacería de subsistencia practicada por la gente Maya en Quintana Roo. Pp. 19-46 in L. Snook & A. Barrera de Jorgenson, "Madera, chicle, caza y

milpa: Fundamentos para el manejo integral de las selvas de Quintana Roo. Chetumal, July 1992.

45 Kunen, J. & J. Roney (2004) Evaluation and Recommendation for protection of archaeological sites within community forest concessions in the Multiple Use Zone of the Maya Biosphere Reserve, Petén, Guatemala. Draft document, 11 p.

46 Lee D.C. et al. (2005) Illuminating Choice in Sustainable Forest Management: CRAFT – A Comparative Risk Assessment Framework and Tools, Final Report to the National Commission on Science for Sustainable Forestry (NCSSF).

47 López Portillo, J., M.R. Keyes, A. González, E. Cabrera C. & O. Sánchez (1990) Los incendios de Quintana Roo: ¿catástrofe ecológica o evento periódico? Ciencia y Desarrollo 16: 43-57.

48 Lynch, J.F. (1991) Effects of Hurricane Gilbert on birds in a dry tropical forest in the Yucatan Peninsula. Biotropica 23: 488-496.

49 Macario Mendoza, P.A. (1991) La repoblación natural en una selva subperennifolia de Quintana Roo bajo aprovechamiento forestal. Tesis de Maestría, Colegio de Posgraduados, Chapingo. 145 p.

50 Macario, M.P. (1992) Natural regeneration of mahogany, *Swietenia macrophylla* King, in a tropical rainforest under selective timber extraction. Bulletin, Ecol. Soc. Amer. 73 (Suppl. 2):258.

51 Macario Mendoza, P.A., L.C.Sánchez Pérez & A.Segundo Cabello (2004) Enriquecimiento de acahuales como método alternativo de reforestación en X-Hazil y Anexos. Pp. 115-130 en: N. Armijo Canto & C. Llorens C. (Eds.)(2004) Uso, Conservación y Cambio en los Bosques de Quintana Roo. UQRoo. 285 p.

52 Manzanero Cano, M.A. (2003) Estudio de la regeneración natural de las especies de interés económico, en árboles semilleros y áreas afectadas por incendios forestales, en las concesiones comunitarias de Carmelita y San Andrés, petén, Guatemala. Tesis de Maestria, Universidad Rural de Guatemala.

53 Manzanero Cano, M.A. (2003) Aprovechamiento Forestal. Documento preparado para Técnico Forestales Comunitarios, ACOFOP, Petén.

54 Manzanero Cano, M.A. (2003) Metodología para la Evaluación del Aprovechamiento Forestal. ACOFOP, Petén. 18 p. (Evaluation methods)

55 Manzanero Cano, M.A. (2005) Establecimiento de la regeneración natural después del aprovechamiento y labores silviculturales. Informe, CONAP, Petén. 17 p.

56 Manzanero Cano, M.A. & G.I. Pinelo (2002) Plan de Monitoreo Continuo en Unidades de Manejo Comunitarias de la Reserva de la Biosfera Maya, Petén, Guatemala. Informe, WWF, NPV, CONAP. 44 p.

57 Manzanero Cano, M.A. & M. Rivas Mejía (2003) Monitoreo continuo en las actividades de aprovechamiento Forestal. Informe, CONAP, ACOFOP, Chemonics. 40 p.

58 Márquez Morales, G. & Cruz Bolanos, J. (2000) Tratamientos silviculturales de enriquecimiento con la especie caoba en áreas de aprovechamiento anual de las unidades de

manejo Río Chanchich, Chosquitán y Uaxactún, Reserva de la Biosfera Maya. Fundación Naturaleza para la Vida.

59 Meerman, J. (2004) Rapid ecological assessment Columbia River Forest Reserve past hurricane Iris. Report for Ya'axche Conservation Trust and Toledo Institute for Development and Environment.

60 Morales Cancino, J.C. (2003) Efecto del aprovechamiento forestal maderable en la estructura, composición y dinámica del bosque natural en San Miguel, San Andrés, Petén, Guatemala. Tesis, Universidad de San Carlos de Guatemala. 72 p.

61 NPV (2000) Tala Dirigida, Unidades de manejo Río Chanchich, Chosquitan y Uaxactún, Reserva de la Biósfera Maya, Petén, Guatemala. Documento del Curso. Fundación Naturaleza para la Vida. 20 p.

62 NPV (2003) Lineamientos para la Protección de Sitios Arqueológicos en la Zona de Uso Múltiple de la Reserva de la Biosfera Maya, Petén, Guatemala. Fundación Naturaleza para la Vida. 28 p.

63 Ogata, N. (1993) Explicación alternativa de la abundancia de *Brosimum alicastrum* (Moraceae) en el centro de la península de Yucatán, México. Biótica nueva epoca 1: 103-107.

64 Pereira, C.A. & H.Vester (2001) Hurricane effects on the Quintana Roo landscape; a vulnerability analysis. USA, New York, World Bank, GEF.

65 Pinelo Morales, G.I. (2001) Efecto de un incendio forestal rastrero sobre la vegetación de un bosque natural latifoliado en San Francisco, Petén, Guatemala. Tesis, Universidad de San Carlos de Guatemala. 122 p.

66 Plumptre, A.J. (1995) The importance of "seed trees" for the natural regeneration of selectively logged tropical forest. Commonwealth Forestry Review 74(3) , 253-258

67 Primack, R.B., D.Bray, H.A. Galletti & I. Ponciano (Eds.) (1998) Timber, tourists and temples. Conservation and development in the Maya forest of Belize, Guatemala and Mexico. Island Press, Washington D.C.

68 Primack, R.B., D.Bray, H.A. Galletti & I. Ponciano (Eds.) (1999) La Selva Maya. Conservación y desarrollo. Siglo Veintiuno Editores, México. 475 p.

69 Radachowsky, J. (2002) Endemism in the Maya Forest. Report for WCS, FIPA, USAID. 25 p.

70 Radachowsky, J. (2003) Effects of managed extraction on populations of the understorey palm Xate (*Chamaedora* spp.) in northern Guatemala. Progress report. 16 p.

71 Radachowsky, J. (2004) Efectos ecológicos del aprovechamiento de madera certificada en las concesiones forestales en el norte del Petén. WCS, CONAP, USAID, FIPA Biological Monitoring Project, Guatemala. 79 pp.

72 Ramos, V.H., I. Burgués, L.C.Fleco, B.Castellanos, C.Albacete, G.Paiz, P.Espinosa & J.Reid (2007) Análisis económico y ambiental de carreteras propuestas dentro de la Reserva de la biosfera Maya. Wildlife Conservation Society. 126 p.

73 Redford, K.H. (1992) The empty forest. BioScience 42: 412-422.

74 Robinson, C. (1998) Selective logging and sustainable silviculture at the Rio Bravo Conservation and Management Area in Northwestern Belize. Master's project, Nicholas School of the Environment, Duke University, Durham, North Carolina.

75 Robles, T. & R. Luna (1999) Elaboración de Indicadores para Proyectos Ambientales. PROARCA / CAPAS. 45 p.

76 Rodríguez F., C., A.G. Vera C., J. Chavelas P., J.C. Escoto P. & C. Parraguirre L. (1989) Evaluación de daños en el área afectada por el huracán Gilberto y el incendio ocurrido en 1989. INIFAP. Documento interno.

77 Roldan, A.I. & J.A.Simonetti (2001) Plant-mammal interactions in tropical Bolivian forests with different hunting pressures. Conservation Biology 15(3) 617-623.

78 Sánchez Pérez, L.C. & P.A. Macario Mendoza (2002) Reforestación alternativa: enriquecimiento de acahuales en Quintana Roo, México. Memoria, II Simposium Internacional sobre Manejo Sostenible de los Recursos Forestales. Abril 002, Universidad de pinar del Río, Cuba.

79 Sánchez Rejón, L.A. (1994) Evaluación de las reforestaciones con caoba (*Swietenia macrophylla* King) en bacadillas de los ejidos Noh-Bec y Petcacab, Quintana Roo. Tesis, UACh, Chapingo.

80 Sánchez Sánchez, O. & G.A. Islebe (1999) Hurricane Gilbert and structural changes in a tropical forest of south-eastern Mexico. Global Ecology and Biogeography 8: 29-38.

81 Sist, P. & F.N.Ferreira (2007) Sustainability of reduced-impact logging in the Eastern Amazon. For. Ecol & Mgt 243, 199-209.

82 Smith A.D.M et al. (2007) Ecological Risk Assessment for the Effects of Fishing, Methodology, Final Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

83 Stöger, K. & H. Galletti (1987) El Efecto silvicultural del sistema de aprovechamiento actual en el Plan Piloto Forestal de Quintana Roo, México. Taller Internacional sobre Silvicultura y Manejo de Selvas. SARH-COFAN-FAO, Chetumal, 11-20 Mayo 1987. 16 pp.

84 Synnott, T.J. (2005) Evaluación de las plantaciones forestales en el área de Sian Ka'an – Calakmul en los Estados de Quintana Roo y Campeche. Informe para el Corredor Biológico Mesoamericano – México, CONABIO. 72 p.

85 Tanner, E.V.J., V.Kapos & J.R.Healey (1991) Hurricane effects on forest ecosystems in the Caribbean. Biotropica 23: 513-521.

86 Urquiza-Haas, T., P.M.Dolman & C.A.Peres (2007) Regional scale variation in forest structure and biomass in the Yucatan Peninsula, Mexico: effects of forest disturbance. For. Ecol. & Mgt. 247, 80-90.

87 WCS, CONAP, USAID, FIPA (2003) Monitoreo de la integridad ecológica de las concesiones forestales de la Reserva de la Biosfera Maya, Petén, Guatemala. Componente de Madera. Reporte de Avances. 50 p.

88 WCS, CONAP (2003) Monitoreo de Incendios Forestales y Estimación de Superficies Quemadas, Reserva de la Biosfera Maya, 2003. 32 p.

89 WCS, CONAP (2004) Monitoreo de Incendios Forestales, Reserva de la Biosfera Maya, 2004. 20 p.

90 Wenban-Smith M.G., Fernholz K., Bowyer J., (Dovetail, 2007) Forest certification in the tropics: is the glass half full or half empty? http://dovetailinc.org/reports/pdf/DovetailTropCert0307jm.pdf

91 Whigham, D.F., I.Olmsted, E. Cabrera Cano & M.E. Harmon (1991) The impact of hurricane Gilbert on trees, litterfall and woody debris in a dry tropical forest in the north-eastern Yucatan Peninsula. Biotropica 23: 434-441.

92 Whigham, D.F. & J.F. Lynch **(….)** Responses of plants and birds to hurricane disturbance in a dry tropical forest in Quintana Roo, Mexico. In: F. Dallmeier (Ed.) Measuring and monitoring forest diversity: Proceedings of the International Network of Biodiversity Plots. USA, Washington D.C., Smithsonian Institute.

93 Whigham, D.F., M.B. Dickinson & N.V.L. Brokaw (1999) Background canopy gap and catastrophic wind disturbance in tropical forests. In: L.R. Walker (Ed.) Ecosystems of disturbed ground. Amsterdam, Elsevier.

94 Whitman, A.A., N.V.L. Brokaw & J.M.Hagan (1994) The response of mahogany and other tree species to selective logging in northern Belize. Manomet Observatory for Conservation Sciences and Programme for Belize. Mimeo report. 18 p.

95 Whitman, A.A., N.V.L. Brokaw & J.M.Hagan (1997) Forest damage caused by selection logging of mahogany (*Swietenia macrophylla*) in northern Belize. Forest Ecology and Management 92:87-96

96 Whitman, A.A., J.M.Hagan & N.V.L. Brokaw (1998) Effects of selection logging on birds in northern Belize. Biotropica 30:449-457.

97 Wolffsohn, A.A. (1967) Post hurricane forest fires in British Honduras. Commonwealth Forest Review 46: 233-238

98 Wolffsohn, A.A. (1989) Informe al Gobierno de México sobre la selva del norte de Quintana Roo. 48 p.

99 Wright, S.J., H.Zeballos, I.Domínguez, M.M.Gallardo, M.C.Moreno & R.Ibáñez (2000) Poachers alter mammal abundance, seed dispersal and seed predation in a Neotropical forest. Conservation Biology 14(1): 227-239

100 WWF (2004) Monitoreo ecológico del manejo forestal en el trópico húmedo: una guía para operadores forestales y certificadores con énfasis en Bosques de Alto Valor para la Conservación WWF Centroamérica. 116 p.

100a WWF (2007) Ecological Monitoring of Foresty Management in the Humid Tropics: A Guide for Forestry Operators and Certifiers with Emphasis on High Conservation Forests. WWF Malaysia. A partial translation of WWF 2004. 95 p.

101 Zafar-ul-Hasan & S.Gutiérrez M. (1998) Manual para prácticas de aprovechamiento forestal en los bosques tropicales de Quintana Roo. DFID, Chetumal. 29 p.

102 Zafar-ul-Hasan & S.Gutiérrez (1998) Manual for Forest Harvesting Practices. Proyecto de Manejo forestal en Quintana Roo. DFID, Chetumal. 19 p.

Annex 9 ERA and the FSC Principles and Criteria

Extracts from FSC P&C for Forest Stewardship	The use of the Selva Maya Environmental Risk Assessment for the purpose of FSC certification
INTRODUCTION	
FSC and FSC-accredited certification organizations will not insist on perfection in satisfying the P&C. However, major failures in any individual Principles will normally disqualify a candidate from certification, or will lead to decertification. These decisions will be taken by individual certifiers, and guided by the extent to which each Criterion is satisfied, and by the importance and consequences of failures. Some flexibility will be allowed to cope with local circumstances.	This paragraph in the introduction to the FSC P&C provides the context for the notes below. The Selva Maya ERA was developed in consultation with representatives of the FSC International Center, FSC Board of Directors, the FSC accreditation body ASI, FSC certification bodies operating in Mexico and Guatemala, and the FSC National Initiatives (NIs) in Brazil and Mexico. This ERA may be used by certification bodies to justify their decisions in relation to satisfaction of FSC's requirements for environmental monitoring specified in the FSC P&C, for FSC certification in the Selva Maya. However, this ERA is not a formal FSC document. To formalise the use of this ERA and guarantee that its results will meet the requirements for FSC certification would require that the ERA is included in an FSC accredited certification body's accredited certification methodology, is referenced in an FSC accredited national or regional forest stewardship standard, and/or is referenced in a formal FSC International Policy or Guidance document.
The scale and intensity of forest management operations, the uniqueness of the affected resources, and the relative ecological fragility of the forest will be considered in all certification assessments. Differences and difficulties of interpretation of the P&C will be addressed in national and local forest stewardship standards.	**Scale and intensity of forest management operations** The ERA methodology explicitly takes account of the scale and intensity of forest management operations by classifying both scale and intensity of stress factors as low, medium or high. In doing so, use of the ERA allows certification bodies to show that they are adapting their certification methodologies to the needs of small and low intensity managed forests (SLIMFs in FSC terminology), as required by FSC. For forest managers, the ERA methodology provides a basis for claiming that their FMU is managed at a low intensity, using an approach which takes account of a wider range of factors and conditions than that suggested by the default FSC definition of 'low intensity' defined in *FSC-STD-01-003 (version 1-0) SLIMF Eligibility Criteria*. It would be for certification bodies and/or FSC NIs to decide whether or not to accept such an argument and, if so, to make the case to the FSC IC. Certification bodies and FSC NIs could also consider

	using the ERA approach as a formal basis for defining 'low intensity' managed forests within a particular region. In this case the certification body or NI would need to inform the FSC IC how the ERA is to be used in their region to identify 'low intensity' managed forests. Subsequently, any forest which qualified as a 'low intensity managed forest' on this basis would be eligible for application of a streamlined certification methodology and certification standards. **Uniqueness of the affected resources, and the relative ecological fragility of the forest** The ERA allows the identification of specific 'vulnerabilities' to be taken into account at the level of an individual FMU. The identification of vulnerabilities is explicitly designed to take account of the uniqueness and relative fragility of the forest at both the regional level, and the FMU level (see Section 2.7 of the text). **National and local forest stewardship standards** To formalise the use of this ERA in the interpretation of the FSC P&C it would need to be incorporated into a certification body's formal assessment methodology, or into an FSC accredited national or regional forest stewardship standard. One of the following approaches would be used to achieve this: - an FSC accredited certification body may incorporate the ERA methodology into its own formal certification methodology, for the purposes of FSC certification. Once the certification methodology has been approved by FSC's accreditation body (currently Accreditation Services International, ASI) the certification body should be able to apply the methodology in all its subsequent certification assessments and decisions. - an FSC NI may reference the use of the ERA methodology in its own FSC National Standard. Once the National Standard has been approved by FSC, certification bodies may apply the methodology in all their subsequent certification assessments and decisions within the scope of the national standard.
The FSC P&C should be used in conjunction with national and international laws and regulations. FSC intends to complement, not supplant, other initiatives that support responsible forest management worldwide.	The ERA is not designed to ensure that all national or international laws in relation to environmental monitoring, impact appraisal or risk assessment are met at the level of the FMU. However, when an ERA is adapted for application in a region it takes account of these requirements. For example, this ERA, adapted for use in the Selva Maya, incorporates definitions and lists of Threatened and Endangered species from national regulations. It should be possible to incorporate other national

	requirements into the ERA as appropriate. In future, if the ERA approach becomes widely accepted, local or national authorities would be able to reference use of the ERA themselves as a simple evaluation tool to ensure that local forest managers are carrying out management at an acceptable intensity, such that (nationally defined) rare, threatened or endangered species, ecosystems and other values are not put at risk.
5 Principle #5: Benefits from the forest Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits. 5.3 Forest management should minimize waste associated with harvesting and on-site processing operations and avoid damage to other forest resources. 5.5 Forest management operations shall recognize, maintain, and, where appropriate, enhance the value of forest services and resources such as watersheds and fisheries. 5.6 The rate of harvest of forest products shall not exceed levels which can be permanently sustained.	The ERA is *not* designed or intended to support evaluation of FSC Principle 5. In particular it is *not* intended to address issues of waste, consideration of the value of a forest's environmental services, or issues of sustained yield of forest products.
6 Principle #6: Environmental impact Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.	FSC Principle 6 identifies a number of explicit values that could be considered "Environmental Values" in relation to the ERA. In terms of conforming to the FSC P&C, FSC is clear that compliance at the level of an FSC Principle is to be determined by evaluation of compliance at the level of each FSC Criterion. The ERA therefore focuses on the identification of environmental values as referenced in the Criteria, rather than the wording of the Principle *per se*.
6.1 Assessment of environmental impacts shall be	The authors propose that verified implementation of the ERA should be considered to satisfy the elements of

completed -- appropriate to the scale, intensity of forest management and the uniqueness of the affected resources -- and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.	FSC Criterion 6.1 in the case of small or low intensity managed forests, for the following reasons: 1. The ERA system explicitly assesses the likely impacts of a forest management operation on the specific environmental values identified in the FSC P&C, and on High Conservation attributes. 2. The assessment explicitly takes account of the scale and intensity of the forest management (through the FMU specific evaluation of the scale and intensity of stress factors) and the uniqueness of the affected resources through the identification of FMU specific vulnerabilities. 3. The ERA is integrated into the forest management system, through consideration of mitigating measures. 4. The ERA includes both landscape level considerations (Environmental Values 1.4 and 3.4) and the impacts of on-site processing facilities (Potentially significant stress factors 4.1 to 4.4). 5. The ERA is a generic system which would be implemented prior to certification, and therefore prior to site disturbing operations. However, the ERA is designed to operate at the level of the FMU as a whole, and would not provide useful information about the impacts of a specific operation at a specific site level. The ERA does not substitute for appropriate site-specific procedures to identify and protect site-specific environmental values during normal operations.
6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.	Rare, threatened and endangered species are identified as Environmental Value 1.3. Hunting, fishing, trapping and collecting are all identified as potential stress factors (see stress factors 3.5 and 5.2).
6.3 Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession.	Forest regeneration and succession are incorporated into the definition of Environmental Values 1.1 and 1.2. Species diversity is addressed by Environmental Values 1.1 to 1.4. Ecosystem diversity is addressed by Environmental Values 3.1 to 3.3.

b) Genetic, species, and ecosystem diversity. c) Natural cycles that affect the productivity of the forest ecosystem.	Natural cycles (which incorporate aspects of species diversity as well as ecological and physical aspects of the environment) are addressed through the combination of Environmental Values in Groups 1 through to 4. Genetic diversity is not explicitly addressed as an environmental value as it is very hard to determine how this would be assessed or monitored in any meaningful way beyond consideration of species or ecosystem diversity.
6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.	Ecosystems in the landscape and in their natural state are addressed by Environmental Value 3.1.
6.5 Written guidelines shall be prepared and implemented to: control erosion; minimize forest damage during harvesting, road construction, and all other mechanical disturbances; and protect water resources.	Erosion is addressed in Environmental Value 4.2. Water resources are addressed in Environmental Values 4.3 to 4.5. Forest damage during harvesting is identified in potential Stress Factors 3.1 to 3.7. Permanent and temporary road construction is identified as potential Stress Factors 1.1 and 1.2. Other mechanical disturbances are considered in Stress Factors 3.4, 3.5, 4.1 and 4.2.
6.6 Management systems shall promote the development and adoption of environmentally friendly non-chemical methods of pest management and strive to avoid the use of chemical pesticides. World Health Organization Type 1A and 1B and chlorinated hydrocarbon pesticides; pesticides that are persistent, toxic or whose derivatives remain biologically active and accumulate in the food chain beyond their intended use; as well as any pesticides banned by international agreement, shall	Potential environmental impacts of pesticides are considered through the identification of pesticide use as potential Stress Factors 2.2 and 2.7

be prohibited. If chemicals are used, proper equipment and training shall be provided to minimize health and environmental risks.	
6.7 Chemicals, containers, liquid and solid non-organic wastes including fuel and oil shall be disposed of in an environmentally appropriate manner at off-site locations.	Management of inorganic waste is addressed through consideration of Stress Factors 3.6, 4.3, 4.4 and 5.1.
6.8 Use of biological control agents shall be documented, minimized, monitored and strictly controlled in accordance with national laws and internationally accepted scientific protocols. Use of genetically modified organisms shall be prohibited.	Use of biological agents is considered as potential Stress Factor 2.9. Use of GMOs is prohibited by the FSC P&C, but is included as potential Stress Factor 2.10 for the sake of completeness. Monitoring would be considered necessary only if the use of biological control agents was identified as a particular issue at the FMU level.
6.9 The use of exotic species shall be carefully controlled and actively monitored to avoid adverse ecological impacts.	Use of exotic species is considered as potential Stress Factor 2.11. Monitoring would be considered necessary only if the use of exotic species was identified as a particular issue at the FMU level.
6.10[3] Forest conversion to plantations or non-forest land uses shall not occur, except in circumstances where conversion: a) entails a very limited portion of the FMU; and b) does not occur on HCV forest areas; and c) will enable clear, substantial, additional, secure, long term conservation benefits across the FMU.	Forest conversion is considered as potential Stress Factor 2.12. Unauthorised conversion to agricultural use is considered as potential Stress Factor 5.4.
7 Principle #7: Management plan	
7.1 The management plan and supporting documents shall provide: e) Provisions for monitoring of forest growth and dynamics.	The monitoring of forest growth and dynamics relates primarily to issues of future forest product yield, and is not the focus of this ERA. The need for 'Environmental safeguards based on environmental assessments' is explicitly addressed through the use of this ERA. It is proposed that by

[3] Criterion 6.10 was ratified by the FSC Members and Board of Directors in January 1999.

f) Environmental safeguards based on environmental assessments. g) Plans for the identification and protection of rare, threatened and endangered species.	carrying out and documenting an ERA self-assessment, and if necessary introducing mitigating actions to reduce the potential environmental impacts of their operations, community forest managers should be deemed to comply with this aspect of the FSC P&C. Similarly, application of the ERA should show whether there is a need for the specification of specific plans for the protection of rare, threatened and endangered species. Generally, if the ERA does not suggest that these are at risk explicit plans for their identification and protection should not be considered necessary. Nonetheless, if there it is known that a particular rare, threatened or endangered species is at risk within a particular FMU then this local knowledge of risk should take precedence.
8 Principle #8: Monitoring and assessment Monitoring shall be conducted -- appropriate to the scale and intensity of forest management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.	FSC Principle 8 identifies a number of explicit requirements in relation to monitoring. In terms of conforming with the FSC P&C, FSC is clear that compliance at the level of an FSC Principle is to be determined by evaluation of compliance at the level of each FSC Criterion. The ERA therefore focuses on the requirements for monitoring as referenced in the Criteria, rather than the wording of the Principle *per se*.
8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change.	The ERA provides an explicit and consistent approach to take account of the scale and intensity of forest management and the relative complexity and fragility of the affected environment when determining the type and nature of monitoring that is appropriate. It considers the scale and intensity of forest management through the FMU specific evaluation of scale and intensity of stress factors. It considers the relative complexity and fragility of the affected environment at two levels: firstly through the regional identification of linkages between stress factors and environmental values; and secondly by the FMU specific identification of 'vulnerabilities' in relation to each environmental value. It is proposed that where the results of the ERA show that the risk of unacceptable environmental impacts is very low, monitoring of those environmental values is not necessary at the FMU level. It is recognised that this proposal would *not* allow FMU level monitoring to be "consistent and replicable over time to allow comparison of results and assessment of change." However, it is noted that this Criterion is

	written using the word 'should' rather than the word 'shall'. In the drafting of international standards it is widely accepted that this indicates that the element is a recommendation rather than an absolute requirement. (e.g: FSC-STD-20-002 Para 3.13; *ISO Guide 2: Standardization and related activities - General vocabulary (1996)* [4]; *ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards, Annex H (normative requirrement) Verbal forms for the expression of provisions, Table H.1. (Fifth Edition 2004).* If the FSC Principles and Criteria are changed to introduce an absolute requirement for monitoring to be replicable over time, it will be a serious burden for many forest management operations, and may lead to the loss of certificates. ERA is based on the assumption that monitoring programmes will continue to be determined by the degree of risk, as well as the scale and intensity of operations, and the uniqueness and vulnerability of the environmental values.
8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators: a) Yield of all forest products harvested. b) Growth rates, regeneration and condition of the forest. c) Composition and observed changes in the flora and fauna. d) Environmental and social impacts of harvesting and other operations. e) Costs, productivity, and efficiency of forest management.	As above, it is noted that this Criterion uses the word 'should' rather than the word 'shall'. It is proposed that when the ERA is used, and can demonstrate that the risk of unacceptable environmental impacts is very low, it should not be necessary to monitor the environmental factors listed in b), c) and d) of this Criterion at the FMU level.
9 Principle #9: Maintenance of high conservation value forests Management activities in HCV forests shall maintain or enhance the attributes which	FSC Principle 9 identifies a number of explicit requirements in relation to environmental values and monitoring. In terms of conforming with the FSC P&C, FSC is clear that compliance at the level of an FSC Principle is to be determined by evaluation of compliance at the level of each FSC Criterion. The ERA therefore

[4] "7.1 provision: expression in the content of a normative document, that takes the form of a statement, an instruction, a recommendation or a requirement. NOTE - These types of provision are distinguished by the form of wording they employ; e.g. instructions are expressed in the imperative mood, recommendations by the use of the auxiliary “should” and requirements by the use of the auxiliary “shall”."

define such forests. Decisions regarding HCV forests shall always be considered in the context of a precautionary approach.	focuses on the requirements as referenced in the Criteria, rather than the wording of the Principle *per se*.
High Conservation Values: HCV 1: Concentrations of biodiversity values, significant at the global, regional or national level (for example, endemism, endangered species, refuges). HCV 2 : Large landscape-level forests contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. HCV 3: Rare, threatened and endangered ecosystems. HCV 4: Basic environmental services in critical situations (e.g. protection of water catchments, control of erosion). NB: HCV 5 and HCV 6 relating to social values are not addressed by the ERA approach, which considers explicitly environmental values.	HCV1: These are covered by Environmental Values 1.3, 2.1 and 2.2. The application of these Values will also take account of any guidance issued by FSC or by accredited National Initiatives about the identification of "significant concentrations", and may be specifically identified as vulnerabilities in the region (Worksheet 1.1). HCV2 includes forests that form a dominant component of the landscape or panorama, and those that are large enough for the majority of native species to maintain viable populations and complete their lifecycles. These elements are covered by Environmental Values 1.4 and 3.4 and may be specifically identified as vulnerabilities in the region (Worksheet 1.1). HCV3 is specifically covered by Environmental Value 3.3, and is also included in 2.1, 2.2 and 3.1, and may be specifically identified as vulnerabilities in the region (Worksheet 1.1). HCV4 is covered by Environmental Values 4.2 and 4.3, and may be specifically identified as vulnerabilities in the region (Worksheet 1.1).
9.1 Assessment to determine the presence of the attributes consistent with HCV Forests will be completed, appropriate to scale and intensity of forest management.	The ERA incorporates the key elements of all the HCV attributes within its list of environmental values. Whenever the ERA is used it is assumed that these environmental values are likely to be present, and considers what kind of impact management operations might have on them. The ERA does not consider what level of assessment would be necessary to determine the presence of specific HCV attributes at the FMU level. However, it is noted that the assessment should be 'appropriate to the scale and intensity of forest management', and it is proposed that where scale and

	intensity of forest management is low, as indicated by the evaluation of stress factor scale and intensity, intensive or specialist assessment of the presence of HCV attributes should not be required. This ERA assumes that the assessment of HCV attributes should be based on knowledge which is already readily available to community forest managers. In other words it should not be necessary to undertake additional, specialist evaluations if the scale and intensity of forest operations is sufficiently low. Where the ERA is used and indicates that operations have a very low risk of causing unacceptable damage to the specified environmental values it is proposed that no further assessment of the presence of HCV attributes at the FMU level should be required.
9.3 The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.	The ERA explicitly considers the need to introduce mitigating measures in order to reduce the risk of unacceptable damage to environmental values. Where forest management operations are of very low scale and/or intensity no mitigating measures may be necessary. However, the greater the scale and intensity of operations, and/or the more vulnerable the forest resource, the greater is the need for such measures. The ERA approach provides an explicit basis, consistent with the precautionary approach, for determining whether additional mitigating measures may be required. Conversely, the ERA approach shows when the measures in place are already sufficient to ensure that HCV attributes are sufficiently protected.
9.4 Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.	The ERA does not provide a basis for assessing the effectiveness of the measures taken to maintain or enhance HCV attributes at the FMU level on an annual basis.

Annex 10: Proposed Means of Verification for FSC "Generic Indicators"

The "possible SLIMF Indicators" listed below are based closely on the examples of indicators found during the authors' previous analysis of all certification body 'generic' indicators and all FSC-accredited national standards as of December 2007. These indicators have been developed as examples of 'best practice', ensuring that all the necessary elements of the FSC Criteria, and all applicable FSC international policies and standards are met. Additional 'Means of Verification' have been proposed where the use of an ERA could demonstrate that the Indicator has been properly implemented.

In most cases it is only necessary to reference the use of an approved ERA as 'Means of Verification' in relation to generic indicators which are recommended whether or not there is an approved ERA for the region. For a small number of Indicators, it is proposed that the use of an ERA should be referenced in the Indicator itself. In all cases, references to an ERA are highlighted in yellow.

These Indicators and Means of Verification have no official status within the FSC system, but may be used by any FSC National Initiative or FSC-accredited certification body as they see fit, to facilitate development of national or generic FSC standards. The proposed 'Means of Verification' are designed to integrate the use of regionally adapted ERA approaches into the FSC system, where such indicators are used. Where different Indicators are used, the suggested Means of Verification would need to be adapted accordingly.

Although these indicators and Means of Verification are designed to meet FSC's international requirements, they may not meet national requirements in a given country. FSC national standards, and local adaptations of certification bodies' generic standards would need to be adapted to ensure conformity with national requirements.

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
6.1 Assessment of environmental impacts shall be completed -- appropriate to the scale, intensity of forest management and the uniqueness of the affected resources -- and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.	**Indicator 6.1.1** A documented assessment of the environmental impacts of the forest management activities within the FMU under assessment has been completed (or has been reviewed and if necessary revised) within the previous five year period. **Indicator 6.1.2** A documented assessment of the environmental impacts of any processing facilities within the FMU under assessment has been completed (or has been reviewed and if necessary revised) within the previous five year period. **Indicator 6.1.3** The assessments of impacts referred to in Indicators 6.1.1 and 6.1.2 identify the main environmental impacts of management, taking account of the size and intensity of the operations being undertaken, and the sensitivity of the site to such operations.	**Means of Verification:** Implementation of a documented Environmental Risk Assessment (ERA) approved by the National Initiative is deemed to meet this requirement. **Means of Verification:** Implementation of a documented Environmental Risk Assessment (ERA) approved by the National Initiative is deemed to meet this requirement. **Means of Verification:** Implementation of a documented Environmental Risk Assessment (ERA) approved by the National Initiative is deemed to meet this requirement.

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	Indicator 6.1.4 The assessments of impacts referred to in Indicators 6.1.1S and 6.1.2S explicitly consider potential impacts on any High Conservation Values identified within the FMU. **Indicator 6.1.5** The management plans and/or other relevant policies and procedures of the enterprise identify the actions to be taken to mitigate or reduce the environmental impacts identified as a result of the assessments.	**Means of Verification:** Implementation of a documented Environmental Risk Assessment (ERA) approved by the National Initiative is deemed to meet this requirement. **Means of Verification:** Implementation of a documented Environmental Risk Assessment (ERA) approved by the National Initiative is deemed to meet this requirement.
6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.	**Indicator 6.2.1** There is an up to date list of the rare, threatened or endangered species that are present or are likely to be present within the FMU. **Indicator 6.2.2** The management plans and other relevant policies and procedures of the enterprise clearly identify actions that are taken to maintain or enhance the presence of rare, threatened or endangered species within the FMU as a whole. **Indicator 6.2.3** The presence of features or areas of high conservation value (see Principle 9) has been assessed and, where present, such features or areas are marked on maps. **Indicator 6.2.4** There is no evidence that the forest enterprise allows or condones illegal or unauthorised hunting, fishing, trapping or collecting within the FMU. **Indicator 6.2.5** Features and/or areas within the FMU which are important to the conservation of local biodiversity have been identified and are marked on maps. **Indicator 6.2.6** Where such features and/or areas are present, specific management activities	**Means of Verification:** Annex 8 of the *Selva Maya* Environmental Risk Assessment (ERA) is deemed to meet this requirement in the *Selva Maya*. Equivalent lists developed for the implementation of the ERA in other regions would be deemed to meet this requirement. **Means of verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 1 (Fauna and Flora) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.2.2. **Means of verification:** Where implementation of an approved ERA shows a safe

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	(and/or restrictions) designed to protect or enhance the associated biodiversity have been defined and are implemented.	level of risk in relation to the environmental values of Group 1 (Fauna and Flora) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.2.2.
6.3 Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession. b) Genetic, species, and ecosystem diversity. c) Natural cycles that affect the productivity of the forest ecosystem.	**Forest regeneration and succession** **Indicator 6.3.1** In natural (see Glossary) and other non-plantation forest areas managed for production, the silvicultural system is designed to encourage and take advantage of natural regeneration, evidenced, for example, by the identification and retention of seed trees, the timing of harvesting, design and size of harvest areas, and short and long term post-harvest treatment of the site. See also 6.3.6 and 6.3.6 below. **Genetic, species and ecosystem diversity** **Indicator 6.3.2** A sample of old, non-commercial trees; trees with special ecological value; standing dead trees; and dead fallen wood are all systematically retained within the production area of the FMU, and in sufficient quantity to support populations of species of birds and insects dependent on old trees and dead wood across the FMU. See also 6.3.1, 6.3.2, and Criterion 6.2. **Indicator 6.3.3** Small scale sites of high ecological value (e.g. nesting sites, small wetlands, ponds, small open areas, etc) are systematically retained and protected (e.g. through appropriate buffer zones) throughout the production area of the FMU. **Natural cycles** (see Glossary) **Indicator 6.3.4** Site preparation and harvesting methods have been designed to	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.1. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features) and 3 (Ecosystems), no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.2. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 2 (Key habitat features) and 3 (Ecosystems) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.3. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	minimise soil compaction and maximise the retention of nutrients on site.	environmental values of Group 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.4.
	Indicator 6.3.5 Protective areas are established between the management areas and the areas which have high risk of fire or erosion (e.g. bordering on pastures or small farming areas).	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.5.
	Indicator 6.3.6 There is no evidence that the harvesting of material from the site is reducing the potential productivity of the soil in the long term.	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.6.
	Indicator 6.3.7 There is no use of fertiliser within the forest or plantation area, other than as a short term measure to restore sites that have been degraded by previous management practices. See Criterion 6.5 for other measures to avoid soil erosion and loss, and to protect hydrological cycles.	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.7.
	Indicator 6.3.8 In plantation (see Glossary) areas of the FMU a proportion of non-target tree and understorey species is retained within the plantation matrix throughout the management cycle.	**NB** the ERA system could be applied to plantations, but the current system has not been explicitly designed for this context so no MoV are proposed for plantations.
6.4 Representative samples of existing ecosystems within the	**Indicator 6.4.1** The FMU has been surveyed to identify	

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.	any areas representative of ecosystems in their natural state, and all such areas are identified on maps. **Indicator 6.4.2** The conservation zones designated by the forest enterprise (see Criterion 6.2) include representative areas of any examples of ecosystems in their natural state as identified in 6.4.1. **Indicator 6.4.3** Management prescriptions are specified in the enterprise's forest management plan and other documents in order to protect the representative examples of ecosystems within conservation zones in their natural state and in the long term **Indicator 6.4.4** Reference sites of the representative ecosystems within conservation zones, have been identified and clearly marked on maps, and are monitored at least once a decade to identify and evaluate long term changes. The enterprise analyses and utilizes the results of the monitoring to evaluate management of the conservation zones.	**Means of Verification:** Monitoring should focus on indicators of 'naturalness' - the intent of monitoring is to confirm that the sites are being protected, not as the basis for ecological research. In SLIMFs, inspect to confirm that there is no visible change.
7.1 The management plan and supporting documents shall provide: e) Provisions for monitoring of forest growth and dynamics. f) Environmental safeguards based on environmental assessments. g) Plans for the identification and protection of rare, threatened and endangered species.	**Indicator 7.1.5** The management plan and/or supporting documents describe the provisions for monitoring of forest growth and dynamics (see also Criterion 8.2). **Indicator 7.1.6** The management plan and/or supporting documents specify environmental safeguards based on environmental assessments (see also Criterion 6.1, 9.3).	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 7.1.5. The FMU is expected to make use of the latest available regional information in relation to forest growth and dynamics. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
		required at the FMU level to satisfy the requirements of Indicator 7.1.6.
	Indicator 7.1.7 The management plan and/or supporting documents include plans for the identification and protection of rare, threatened and endangered species (see also Criteria 6.2, 6.3, 6.4, 9.3).	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 7.1.7 in relation to the protection of rare, threatened and endangered species.
8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change.	**Proposed Indicator 8.1.1** The frequency, intensity, and selection of elements for monitoring are justified, taking account of the scale and intensity of forest management operations, the vulnerability of the species and ecosystems to such operations, and the specification of measures (such as protection areas, low impact logging techniques, etc) that are recognised to limit negative impacts.	**Means of Verification** Implementation and documentation of the results of an approved ERA is deemed to satisfy the requirement to justify the frequency, intensity and selection of elements for monitoring.
	Indicator 8.1.2 Monitoring procedures are consistent with the justification provided in 8.1.1 and are clearly documented.	**NB:** Where implementation of an approved ERA shows a safe level of risk in relation to one of the monitoring elements listed in Criterion 8.2, no specific monitoring of that element is required at the FMU level.
	Indicator 8.1.3 The monitoring procedures describe the approach for monitoring each Indicator of Criterion 8.2, and specify the frequency with which data is collected.	**NB:** Where implementation of an approved ERA shows a safe level of risk in relation to one of the monitoring elements listed in Criterion 8.2, no specific monitoring of that element is required at the FMU level.
	Indicator 8.1.4 The described techniques will provide reliable data, adequate to monitor change in the specified social, environmental and economic indicators over time and on a timescale that is useful to continuing improvement of management.	**NB:** Where implementation of an approved ERA shows a safe level of risk in relation to one of the monitoring elements listed in Criterion 8.2, no specific monitoring of that element is required at the FMU level.
	Indicator 8.1.5 Adequate numbers of personnel have been trained and are available to implement the procedures specified in	

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	8.1.2. See Criterion 8.4 for the use of monitoring information.	
8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators: a) Yield of all forest products harvested. b) Growth rates, regeneration and condition of the forest. c) Composition and observed changes in the flora and fauna. d) Environmental and social impacts of harvesting and other operations. e) Costs, productivity, and efficiency of forest management.	**Yield of all forest products harvested:** **Indicator 8.2.1** The forest enterprise collects and maintains data on the quantity of each forest product harvested within the FMU updated on at least an annual basis. **Growth rates, regeneration and condition of the forest:** **Indicator 8.2.2** Pre- and post- harvest inventory is carried out for all harvested areas, *unless* an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements). **Indicator 8.2.3** The data collected during pre- and post-harvest inventory are sufficient to provide a reasonable estimate of species composition, stocking, growth rates, regeneration and presence of commercially significant pests or diseases over the FMU as a whole. **Composition and observed changes in the flora and fauna:** **Indicator 8.2.4** The forest manager keeps notes of the presence of any notable species of flora or fauna, sufficient to identify significant trends over time. **Environmental and social impacts of harvesting and other operations:** **Indicator 8.2.5** The data collected during pre- and post-harvest inventory is sufficient to identify any significant environmental impacts of harvesting. See Criterion 4.4 for monitoring of social impacts **Indicator 8.2.6** The forest enterprise has a specific programme for collecting data sufficient	**Means of Verification:** Documented results of an approved ERA. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) this element of pre- and post- harvest inventory is not required. **Means of Verification:** A checklist recording sightings of notable species listed in Annex 8 of the *Selva Maya* Environmental Risk Assessment (ERA) is deemed to meet this requirement in the *Selva Maya*. Equivalent lists developed for the implementation of the ERA in other regions would be deemed to meet this requirement. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements)) this element of pre- and post-harvest inventory is not required. **Means of Verification:** Documented results of an approved ERA.

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	to demonstrate the maintenance (or otherwise) of any High Conservation Values (see Criterion 9.1.1, 9.1.2) within the FMU, *unless* implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements). **Costs, productivity, and efficiency of forest management:** See Criteria 5.1, 5.2, 5.4 and 5.5 for economic indicators	
8.4 The results of monitoring shall be incorporated into the implementation and revision of the management plan.	**Indicator 8.4.1** The data collected as a result of the monitoring procedures specified under Criteria 8.1 and 8.2 are readily accessible to managers, and in a format which permits the analysis of trends over time. **Indicator 8.4.2** Managers are able to demonstrate how the results of monitoring have influenced subsequent changes to the management plan and associated documents.	**Means of Verification:** Where the implementation of an approved ERA indicates that monitoring is not required, the documented annual results of such an ERA would meet the requirements of Indicator 8.4.1. **Means of Verification:** Documented results showing that an approved ERA was implemented, and showing how the results led to changes in management (e.g. the implementation of additional mitigating measures, or actions taken to reduce the scale or intensity of stress factors) would meet the requirements of Indicator 8.4.2.
8.5 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 8.2.	**Indicator 8.5.1** There is a single, publicly available document, summarising the results of monitoring to date. **Indicator 8.5.2** The document summarises the results of monitoring for (at least) all of the data listed in Criterion 8.2. **Indicator 8.5.3** It is clear to the public how they can request a copy of the document, and the document is made readily available to any interested party on request.	**Means of Verification:** Where an approved ERA has been used to justify reduced monitoring, publication of the completed ERA (or its availability on request) is deemed to meet the requirement to publish monitoring results for these elements of Criterion 8.5.
9.1 Assessment to determine the presence of the attributes consistent with HCV Forests will be completed, appropriate to scale and intensity of forest management.	**Indicator 9.1.1** The forest enterprise has carried out an assessment of the FMU sufficient to identify all parts of the FMU that have each of the following attributes: HCV 1: Concentrations of biodiversity values, significant at the global, regional or national level (for example, endemism, endangered species,	**NB:** **ONLY THE ENVIRONMENTAL VALUES OF PRINCIPLE 9 ARE ADDRESSED BY THE ERA APPROACH. HCV 5 AND HCV 6 ARE SOCIAL VALUES AND ARE NOT COVERED.** Where the process for

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
	refuges). HCV 2 : Large landscape-level forests contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. HCV 3: Rare, threatened and endangered ecosystems. HCV 4: Basic environmental services in critical situations (e.g. protection of water catchments, control of erosion). **Indicator 9.1.2** The forest enterprise has maps clearly showing all areas within the FMU which have each of the six attributes listed under Indicator 9.1.1.	development of the regionally adapted ERA has included the explicit identification of regional HCVs, then the list of HCVs from this process may be used as a 'checklist' for the identification of these HCVs at the FMU level. Similarly, once the forest managers at the FMU level have carried out an assessment to determine whether these HCVs are present within their FMU, the results should be used directly to justify identification of the 'vulnerabilities' on worksheet 2.4.
9.2 The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof.	**Indicator 9.2.1** Local stakeholders with relevant expertise or knowledge have been consulted on the management options to maintain or enhance the identified High Conservation Values within the FMU.	**Means of Verification:** Where the process for development of the regionally adapted ERA has included the explicit identification of regional HCVs for inclusion as potential 'vulnerabilities', and a group of regional experts has considered appropriate management techniques and included these in the ERA as 'mitigating measures', the documented results of such a process shall be deemed to meet the requirements of Indicator 9.2.1
9.3 The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.	See Indicators 6.1.6, 7.1.10 and 7.4.2	**Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 9.3. Incorporation of the results in the management plan summary is addressed under Criterion 7.4. Implementation of the ERA, and its inclusion in the publicly available management plan

FSC Criterion	Possible SLIMF Indicators	Proposed means of verification, where there is a regionally adapted ERA recognised by an FSC national initiative
		summary is deemed to meet the requirements of FSC Criterion 9.3.
9.4 Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.	See Indicator 8.2.6	**Means of Verification:** Where the process for development of an approved regionally adapted ERA has included the explicit identification of regional HCVs for inclusion as potential 'vulnerabilities', and where implementation of the ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) additional monitoring is not required to demonstrate compliance with Criterion 9.4.

Annex 11: Proposed Means of Verification for FSC Mexican National Standard

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
6.1 Assessment of environmental impacts shall be completed -- appropriate to the scale, intensity of forest management and the uniqueness of the affected resources -- and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.	6.1.1. La OMF deberá demostrar que se han identificado y se conocen los posibles impactos negativos de sus actividades y debe procurar minimizarlos. **Verificadores:** • **Documento de identificación de impactos ambientales y propuesta para minimizarlos.** • **Observación de esfuerzos de la OMF por minimizar los impactos ambientales identificados.**	**Means of Verification:** Documentation showing the implementation of the *Selva Maya* ERA, and appropriate responses (monitoring, mitigation, or actions to reduce the scale or intensity of stress factors) is deemed to meet this requirement.
6.2 Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g., nesting and feeding areas). Conservation zones and protection areas shall be established, appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.	6.2.1. **Solo aplicable a SLIMF:** Cuando existe información sobre especies en algún estatus de riesgo (en peligro, amenazadas o bajo protección especial, según la NOM-059-SEMARNAT-2001 o el apéndice I de CITES) y sus hábitats, la OMF debe usar la información para protegerlas y cartografiarlas. En el caso de realizarse aprovechamiento de alguna de estas especies, las condiciones especiales de aprovechamiento se señalan en el plan de manejo y éstas se llevan lleva a cabo conforme a la normativa vigente. **Verificadores:** • **Se cuenta con una lista de especies presentes en la UMF y su categoría de estatus de conservación y sus hábitats.** • **Mapas de ubicación de hábitats o especies en algún estatus de conservación.** • **Las medidas de la OMF, verifican que protege estos hábitats y/o especies.** • **En caso de aprovechamiento de alguna de estas especies, se tienen copias de las leyes, normas y reglamentos que regulan su aprovechamiento, y el Plan de Manejo cuenta con medidas para su cumplimiento.** 6.2.2. La cacería, pesca, pastoreo, captura de animales y colecta de PFNM debe ser controlada y realizarse dentro de los límites de la sostenibilidad y no perjudicar la viabilidad y reproducción	**Means of Verification:** Annex 8 of the *Selva Maya* Environmental Risk Assessment (ERA) is recognised as an acceptable basis for the identification of species "en peligro, amenazadas o bajo protección especial, según la NOM-059-SEMARNAT-2001 o el apéndice I de CITES". **Means of verification:** Where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Group 1 (Fauna and Flora) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.2.1. **Means of verification:** Where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Group 1 (Fauna and Flora) no further measures (i.e. additional to

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	de las especies y en cumplimiento de la normatividad aplicable. El uso comercial deberá contar con un estudio de población de la especie de interés para conocer los niveles sostenibles de extracción, y contar con la autorización pertinente de SEMARNAT. **(Aplica a todas las OMFs, incluidos SLIMFs).** **Verificadores:** • **En el caso de ejidos y comunidades, el Reglamento Interno o Estatuto Comunal, respectivamente, considera estas actividades dentro del mismo y ha establecido lineamientos para su regulación y control.** • **Para OMF privadas existe una regulación interna para controlar estas actividades y se especifica si el aprovechamiento lo hace la OMF o terceros.** • **Estudios de población de las especies aprovechadas de manera comercial.** • **Autorizaciones de SEMARNAT** • **Podría tenerse una Unidad de Conservación y Aprovechamiento Sustentable de la Vida Silvestre (UMA).** • **En cualquier caso, se cumple con la legislación aplicable.** • **La colecta de PFNM como hongos y plantas medicinales que se realiza para consumo interno se regula a través de acuerdos comunitarios.** • **Evidencia de sanciones (cuando sea el caso) a quienes incumplen los acuerdos para controlar estas actividades.**	those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.2.2.
6.3 Ecological functions and values shall be maintained intact, enhanced, or restored, including: a) Forest regeneration and succession. b) Genetic, species, and ecosystem diversity. c) Natural cycles that affect the productivity of the forest ecosystem.	6.3.1. Se deberá documentar la justificación ecológica y silvicultural de las prescripciones de manejo, y deberá estar basada en regulaciones gubernamentales, datos de campo específicos del bosque y/o información publicada. Ante una eventual falta de datos de campo específicos del bosque, se puede utilizar información de sitios similares. **Verificadores:** • **El PMF u otros documentos, provee información sobre las características del bosque y su propuesta silvícola se basa en**	**Means of Verification:** Where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.1.

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	regulaciones gubernamentales, datos de campo específicos del bosque y/o información publicada.	
	6.3.2. En bosques naturales, se deberán mantener poblaciones viables de todas las especies existentes en la UMF, así como mantener su diversidad genética con muestras de todos los ecosistemas existentes. **Verificadores:** • **Observación de condiciones de los bosques residuales.** • **Observación de muestras de ecosistemas.** • **El PMF u otros documentos, plantean una propuesta de manejo que mantendrá poblaciones viables de todas las especies existentes en la UMF, así como su diversidad genética con muestras de todos los ecosistemas existentes.**	**Means of Verification:** Where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features) and 3 (Ecosystems) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.2.
	6.3.3. Se deberá dejar un porcentaje de árboles secos en pie y/o caídos que garantice se mantengan o aumenten las funciones y valores ecológicos del bosque. **Verificadores:** • **El PMF o sus anexos incluye una sección en la que se reconozcan salvaguardas para árboles viejos o muertos en pie y se proponen medidas para su mantenimiento y se justifica su remoción bajo un análisis de que no están cumpliendo algunas de estas funciones.** • **Observación en campo de que los árboles viejos o muertos en pie están constituyendo hábitat de epifitas o refugio a fauna silvestre.** • **Los supervisores técnicos de las operaciones forestales (jefe de monte o montero para el caso de ejidos y comunidades) identifican estos árboles.**	**Means of Verification:** Where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Groups 2 (Key habitat features) and 3 (Ecosystems) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.3.
	6.3.4. Existe regeneración natural que asegura el repoblado de una superficie intervenida. De no ser así, se considera en el programa de manejo forestal un plan de	**Means of Verification:** Where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) no further measures (i.e. additional to

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	reforestación y/o enriquecimiento para el restablecimiento de la masa forestal, utilizando especies nativas y así mantener la composición del ecosistema. **Verificadores:** • **Observación de establecimiento de regeneración natural en las áreas intervenidas.** • **Se incluye en el PMF o sus anexos una sección en la que se considera la reforestación como medida para restablecer la masa forestal.** • **Se utilizan especies nativas para restablecer o complementar la masa forestal y mantener la composición.** • **Informes periódicos a SEMARNAT** 6.3.5. Cuando se reforestan áreas siniestradas por fenómenos naturales, se utiliza una mezcla de especies nativas, con el fin de restaurar la estructura y composición original del bosque. **Verificadores:** • **Observación de establecimiento de reforestación en las áreas siniestradas.** • **Se incluye en el PMF o sus anexos una sección en la que se considera la reforestación como medida para restablecer la masa forestal en áreas siniestradas.** • **Se utilizan especies nativas para restablecer la masa forestal y mantener la composición.** • **Se cuenta con el PMF simplificado para esas áreas.** 6.3.6. En plantaciones comerciales, el tamaño del área continua de corta en mata rasa, selección en grupos, debe ser justificada claramente, de acuerdo a la dinámica del bosque y la particularidad de los recursos afectados. **Verificadores:** • **Revisión de la propuesta silvicultural y plan de cortas. Esta debe estar justificada técnicamente en función de la**	those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 6.3.4. **NB** the ERA system could be applied to plantations, but the current system has not been explicitly designed for this context so no MoV are proposed for Indicator 6.3.6.

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	dinámica del bosque y recursos afectados. • **Revisión de las superficies en campo** • **Revisión de informes periódicos a la SEMARNAT.**	
6.4 Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources.	6.4.1. Muestras de ecosistemas únicos y/o representativos existentes deberán estar siendo protegidos en su estado natural ya sea en el bosque bajo evaluación o en bosques cercanos, y están ubicados en mapas. **Verificadores:** • **Observación en campo de estas áreas.** • **La OMF está protegiendo estas áreas.** • **Mapas donde se estén ubicadas estas áreas**	
7.1 The management plan and supporting documents shall provide: e) Provisions for monitoring of forest growth and dynamics. f) Environmental safeguards based on environmental assessments. g) Plans for the identification and protection of rare, threatened and endangered species.	7.1.1. Deberá existir un programa de manejo que incluye, al menos, lo siguiente: a) Todos los elementos solicitados por la normatividad forestal vigente. b) Objetivos de manejo; c) Descripción del bosque; d) Cómo se cumplirán los objetivos, los métodos de aprovechamiento y los sistemas silviculturales (tala rasa, corta selectiva, aclareos) para garantizar la sostenibilidad; e) Límites sostenibles de aprovechamiento (que deberán ser coherentes con el Criterio 5.6 del FSC); f) Impactos ambientales/sociales del programa; g) Conservación de especies raras y de valores altos de conservación; h) Mapas del bosque, en los que se indiquen áreas protegidas, manejo planificado y propiedad de la tierra, y i) Duración del programa. **Verificadores:** • **Se cuenta con un PMF, anexos u otros documentos que incluyen al menos la información solicitada en el criterio.**	**Means of Verification:** Where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to the environmental values of Group 1 (Flora and Fauna) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 7.1.1e. The FMU is expected to make use of the latest available regional information in relation to forest growth and dynamics. **Means of Verification:** Where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 7.1.1f. **Means of Verification:** Where implementation of an approved ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicator 7.1.1.g in relation to the protection of rare, threatened and endangered species.

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
8.1 The frequency and intensity of monitoring should be determined by the scale and intensity of forest management operations as well as the relative complexity and fragility of the affected environment. Monitoring procedures should be consistent and replicable over time to allow comparison of results and assessment of change.	8.1.1. El monitoreo se deberá llevar a cabo de forma rutinaria y replicable, permitiendo la comparación de resultados de las operaciones de aprovechamiento y regeneración. **Verificadores:** • **Existe un informe de monitoreo que incluye información de resultados de las operaciones de aprovechamiento y regeneración.**	**Note:** Where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to one of the monitoring elements listed in Criterion 8.2, no specific monitoring of that element is required at the FMU level.
8.2 Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators: a) Yield of all forest products harvested. b) Growth rates, regeneration and condition of the forest. c) Composition and observed changes in the flora and fauna. d) Environmental and social impacts of harvesting and other operations. e) Costs, productivity, and efficiency of forest management.	8.2.1 La OMF deberá, como mínimo, monitorear y registrar información sobre los siguientes aspectos: • **Cantidad de productos aprovechados;** • **Cantidad de productos vendidos;** • **Precios de los productos vendidos;** • **Cantidad de utilidades de la venta de productos forestales y cantidades de utilidades distribuidas a los socios de la OMF** • **Crecimiento y regeneración de especies bajo manejo;** • **Identificación de los impactos y efectos de las operaciones sobre el bosque residual y suelo;** • **Especies exóticas invasoras;** **Verificadores:** • **Documento que incluya los elementos solicitados. Este deberá contener la metodología, lista de indicadores o variables a medir y periodicidad de la toma de datos.**	**Note:** Where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to one of the monitoring elements listed within Indicator 8.2.1, no specific monitoring of that element is required at the FMU level. **Means of Verification:** Documented results of an approved ERA.
8.4 The results of monitoring shall be incorporated into the implementation and revision of the management plan.	8.4.1. La revisión del programa de manejo, sus anexos u otros documentos, deberá demostrar que los resultados del monitoreo son incorporados en la planeación. **Verificadores:** • **El PMF, sus anexos y otros documentos, cuentan con información productos de los monitoreos y es utilizada para la planeación en la actualización de los mismos.**	**Means of Verification:** Where the implementation of the *Selva Maya* ERA indicates that monitoring is not required, the documented annual results of such an ERA would meet the requirements of Indicator 8.4.1. **Means of Verification:** Documented results showing that the *Selva Maya* ERA was implemented, and showing how the results led to changes in management (e.g. the implementation of additional mitigating measures, or actions taken

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
		to reduce the scale or intensity of stress factors) would meet the requirements of Indicator 8.4.1.
8.5 While respecting the confidentiality of information, forest managers shall make publicly available a summary of the results of monitoring indicators, including those listed in Criterion 8.2.	8.5.1. La OMF deberá tener a disposición del público interesado un resumen de los resultados de los principales elementos de su sistema de monitoreo. **Verificadores:** • **Existe un resumen de los resultados del monitoreo** • **El resumen está disponible para consulta del público interesado en la oficina central de la OMF.** • **Se tiene un mecanismo para hacer públicos los resultados del monitoreo como página web, murales, trípticos, etc.**	**Means of Verification:** Where use of the *Selva Maya* ERA has been used to justify reduced monitoring, publication of the completed ERA is deemed to meet the requirement of Indicator 8.5.1.
9.1 Assessment to determine the presence of the attributes consistent with HCV Forests will be completed, appropriate to scale and intensity of forest management.	9.1.1 Se habrán realizado consultas con interesados ambientales, pobladores, instituciones gubernamentales, trabajadores y socios de la OMF y/o investigadores para determinar AVC o BAVC. Se deberá realizar un informe con la información proporcionada por los grupos y personas consultadas que contenga una identificación de AVC o BAVC en la UMF. **Verificadores:** • **La OMF realizó consultas con interesados ambientales, instituciones gubernamentales o investigadores para determinar AVC o BAVC.** • **Informe que sintetiza la información proporcionada por los Grupos interesados.** • **Se cuenta con una lista que incluye cargo, especialidad, dirección, teléfono y/o correo electrónico de los interesados consultados.** • **Las entrevistas realizadas por el equipo evaluador de la certificación a Grupos interesados, manifiestan la presencia de AVC o BAVC dentro de la UMF.**	**NB:** Once the *Selva Maya* ERA has been reviewed and if necessary updated to ensure that it considers all HCVs that are potentially present within FMUs in the region, it may subsquently be used by forest managers as a 'checklist' for the identification of these HCVs at the FMU level. Similarly, once forest managers at the FMU level have carried out an assessment to determine whether these HCVs are present within their FMU, the results may be used directly as the basis for checking whether the 'vulnerabilities' on *Selva Maya* ERA worksheet 2.4 are present or absent.
9.2 La parte consultiva del proceso de certificación debe prestar especial atención a los atributos de conservación que se hayan identificado, así como a las opciones para su mantenimiento.	9.2.1. Las consultas de la OMF con Grupos interesados deberán especificar claramente los atributos de conservación que se hayan identificado, así como las estrategias propuestas para su mantenimiento o	**Means of Verification:** Once the *Selva Maya* ERA has been reviewed and if necessary updated to ensure that all HCVs that are potentially present within FMUs in the region are identified as potential 'vulnerabilities', and a group of

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	para la reducción de amenazas. **Verificadores:** • **La OMF realizó consultas con Grupos interesados y éstas especifican la presencia de AVC o BAVC y medidas para su mantenimiento.** • **Informe que sintetiza la información proporcionada por los Grupos interesados.** • **Se cuenta con una lista que incluye cargo, especialidad, dirección, teléfono y/o correo electrónico de los interesados consultados.** • **Las entrevistas realizadas por el equipo evaluador de la certificación a Grupos interesados, especifican la presencia de AVC o BAVC dentro de la UMF.** 9.2.2. La consulta realizada a los Grupos interesados durante la evaluación para la certificación, deberá indicar que la OMF considera y protege consistentemente los valores de los BAVC identificados. **Verificadores:** • **Durante las entrevistas realizadas por el equipo evaluador de la certificación a Grupos interesados, especifican la presencia de AVC o BAVC dentro de la UMF y que la OMF protege los valores de estos AVC y/o BAVC.** • **Documentos mostrados por los Grupos interesados durante la evaluación**	regional experts has considered appropriate management techniques and included these in the ERA as 'mitigating measures', the documented results of such a process shall be deemed to meet the requirements of Indicator 9.2.1
9.3 The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.	9.3.1. Si hubiesen BAVC o AVC, el programa de manejo forestal u otros documentos deberán tener consideraciones especiales para los sitios donde existen estos y deberán presentar una descripción detallada de las medidas tomadas para restaurarlos o protegerlos. Estas medidas deberán aparecer en el resumen del plan de manejo accesible al público. **Verificadores:** • **El PMF u otros documentos, incluyen una sección donde se indican las consideraciones para restaurar o proteger los sitios donde existan AVC o**	**Means of Verification:** Subsequent a formal process to ensure full inclusion of all HCVs at the regional level (see 9.1, 9.2, above): where implementation of the *Selva Maya* ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) no further measures (i.e. additional to those identified in the ERA as mitigating measures) are required at the FMU level to satisfy the requirements of Indicators 9.3.1 - 9.3.4.

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	BAVC. • **El resumen accesible al público del PMF contiene las medidas para restaurar o proteger los BAVC o AVC.** 9.3.2. Se deberá evidenciar en campo la aplicación de las medidas de protección a AVC o BAVC. **Verificadores:** • **Las observaciones de campo verifican que la OMF aplica las medidas para la protección de AVC o BAVC.** • **Durante las entrevistas realizadas por el equipo evaluador de la certificación a Grupos interesados, especifican la presencia de AVC o BAVC dentro de la UMF y que la OMF protege los valores de estos AVC y/o BAVC.** 9.3.3. Ante una eventual falta de información, el programa de manejo considera un enfoque precautorio. Si se sospecha que un área forestal se clasificaría como BAVC, se deben realizar los aprovechamientos forestales y otras actividades de manejo tomando medidas que permitan conservar los probables AVC, y utilizando métodos de extracción de bajo impacto. **Verificadores:** • **EL PMF incluye una sección en la que se considera un enfoque precautorio para aquellas áreas en las que se sospeche de que puedan tener AVC o BAVC.** • **Las observaciones de campo verifican que las áreas con probables AVC o BAVC están utilizando métodos de extracción de bajo impacto.** 9.3.4. El sistema de manejo en el resto de los bosques de la OMF contribuye a reducir la presión sobre los BAVC. **Verificadores:** • **Se observa que el aprovechamiento en otro tipo de áreas forestales, evita y/o reduce la presión sobre los BAVC identificados.**	

FSC Criterion	Possible SLIMFS indicators	Proposed means of verification, referencing the *Selva Maya* ERA
	• **Las observaciones de campo verifican que los AVCs no están en riesgo por las actividades en la UMF, y que todos los AVCs identificados están siendo protegidos.**	
9.4 Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.	9.4.1. Si se han identificado BAVC o AVC y, aunque estas áreas estuvieran segregadas de los aprovechamientos, se establece un sistema de monitoreo para evaluar la efectividad de las medidas empleadas para mantener o incrementar los AVC. **Para el caso de SLIMF en que las áreas con BAVC están segregadas de los aprovechamientos, no aplica este indicador.** **Verificadores** • **Los SLIMF con BAVC que no están segregados de los aprovechamientos, y todas las OMF que han identificado BAVC o AVC, tienen un sistema de monitoreo sobre las medidas empleadas para mantener o incrementar los AVC.** 9.4.2. Si las medidas empleadas para mantener los AVC no están siendo efectivas, se han propuesto e implementado cambios en la propuesta de manejo en las áreas con estos AVC. **Verificadores** • **Cambios en la propuesta de manejo.** • **Verificación de las nuevas medidas de manejo en estas áreas.**	**Means of Verification:** Subsequent a formal process to ensure full inclusion of all HCVs at the regional level (see 9.1, 9.2, above): where implementation of the *Zona Maya* ERA shows a safe level of risk in relation to the environmental values of Groups 1 (Flora and Fauna) 2 (Key habitat features), 3 (Ecosystems) and 4 (Environmental elements) additional monitoring is not required to demonstrate compliance with Indicator 9.4.1.