Environmental Impacts of Oil Palm –Practical Considerations in Defining Sustainability for Impacts on the Air, Land and Water

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ABSTRACT

Since mankind first cultivated plants, agriculture has had an impact on the environment. While the intensity of cultivation can exacerbate those impacts, all agriculture, including subsistence farming, has environmental and social impacts both on the farm and in the surrounding areas. The planting of oil palm is no exception. The first step towards reducing the most significant negative impacts is to identify them. This paper examines the most significant impacts of oil palm cultivation on land, air and water and examines them in the light of the Principles and Criteria for Sustainable Oil Palm published by the Roundtable on Sustainable Palm Oil (RSPO). Within the overall framework of this document, practical advice is given to assist plantation managers to develop operational procedures towards identifying impacts and also to measure and monitor appropriate indicators that demonstrate a reduction of impacts over time. Examples of the methodology required to manage them within the context of more sustainable agriculture are given.

Key Words: Air, Soil, Water, Land, Environmental Impacts, ISO 14001, RSPO.

INTRODUCTION

After three years of consultation and discussion, the Roundtable on Sustainable Palm Oil (RSPO) has recently adopted and published a set of principles and criteria to help oil palm producers to be more sustainable (Appendix 1). A first step is to identify the most significant negative impacts on the environment. This cannot be done by oil palm growers and refiners alone. It must include other stakeholders, e.g., labour, local communities, researchers, non-governmental organizations, and even government officials. It is not always an easy task to identify and agree on the key negative impacts. It is more difficult still to define what acceptable impacts would be. A systematic approach is necessary if this listing is to be comprehensive with direct and indirect impacts being highlighted and key indicators identified. Deciding what constitutes a “significant” impact and defining what levels of impacts are unacceptable are key.

In most systems designed to manage the impact of an organization on the environment, the first step is to establish a register of impacts and then to determine which are most significant on the environment. Risk-based evaluation methods attach a level of significance to each impact based on criteria such as magnitude of effect, frequency of occurrence, and duration. The incorporation of such risk-based assessments is at the heart of a disciplined Environmental Management System (EMS) and a strong EMS contributes significantly to any sustainable agricultural initiative. Under ISO 14001 this is called the Aspect and Impact register and it is one

of the core documents at the centre of its EMS. The RSPO acknowledges this and requests producers to prepare:

- Documentation of the impacts and assessment of their relative importance;
- Development of strategic management plans which includes the results of such assessments;
- Development of operational procedures which identify impacts and the required changes in current practices to mitigate their negative effects; and
- Production of improvement plans, including a timetable for change.

Although such documents and plans will apply to many aspects of palm oil production, the impacts will be focussed on just five receptors. In ISO 14001 these are grouped under the headings of air, water, land/soil, natural resources/flora and fauna, and community. Although community and social well-being are affected by environmental impacts, the distinction is not easily held in the general awareness of “environment issues.” The proportion or environmental aspects affecting the receptor of air land and water is given in figure 1, together these 3 account for 80% of all impacts. This paper therefore deals solely on direct adverse environmental impacts on air, land (including habitat and biodiversity), and water. A list of those RSPO criteria directly affecting these three receptors is given in Table 1.

Table 1 Some RSPO Criteria directly concerning Water land and Air

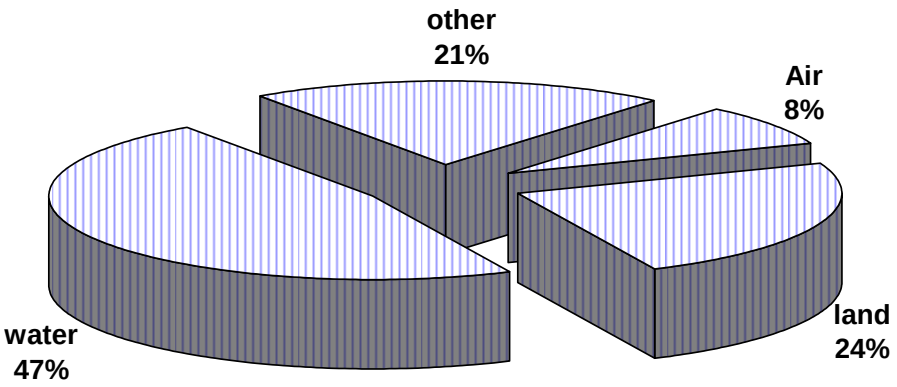
Criterion	Receptor
Principle 4: Use of appropriate best practices by growers and millers	
4.1 Operating procedures are appropriately documented and consistently implemented and monitored.	WATER, LAND, AIR
4.2 Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield.	LAND
4.3 Practices minimise and control erosion and degradation of soils.	LAND, WATER
4.4 Practices maintain the quality and availability of surface and ground water.	WATER
4.6 Agrochemicals are used in a way that does not endanger health or the environment.	WATER, LAND
Principle 5: Environmental responsibility and conservation of natural resources and biodiversity	
5.1 Aspects of plantation and mill management that have environmental impacts are identified, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement	WATER, LAND, AIR
5.2 The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and their conservation taken into account in management plans and operations.	LAND (HABITAT)
5.3 Waste is reduced, recycled, re-used and disposed of in an environmentally and socially responsible manner.	WATER, LAND, AIR
5.4 Efficiency of energy use and use of renewable energy is maximised.	WATER, LAND, AIR
5.5 Use of fire for waste disposal and for preparing land for replanting is avoided except in specific situations, as identified in the ASEAN guidelines or other regional best practice.	AIR
5.6 Plans to reduce pollution and emissions, including greenhouse gases, are developed, implemented and monitored.	WATER, LAND, AIR
Principle 7: Responsible development of new plantings	
7.1 A comprehensive and participatory independent social and environmental impact assessment is undertaken prior to establishing new plantings or operations, or expanding existing ones, and the results incorporated into planning, management and operations.	WATER, LAND
7.2 Soil surveys and topographic information are used for site planning in the establishment of new plantings, and the results are incorporated into plans and operations.	WATER ,LAND
7.3 New plantings since November 2005 (which is the expected date of adoption of these criteria by the RSPO membership), have not replaced primary forest or any area containing one or more High Conservation	LAND (HABITAT)

Values.	
7.4 Extensive planting on steep terrain, and/or on marginal and fragile soils, is avoided.	LAND
7.7 Use of fire in the preparation of new plantings is avoided other than in specific situations, as identified in the ASEAN guidelines or other regional best practice.	LAND ,AIR
Principle 8: Commitment to continuous improvement in key areas of activity	
8.1 Growers and millers regularly monitor and review their activities and develop and implement action plans that allow demonstrable continuous improvement in key operations	WATER, LAND, AIR

ENVIRONMENTAL IMPACTS ON AIR QUALITY

The establishment of oil palm plantations (along with rubber and pulp plantations) in Sumatra, Kalimantan and East Malaysia has been cited as the major cause of the air pollution that affected many areas of Southeast Asia in 1997 (Clay, 2004; Rosenburg, 1999; Sargeant, 2001). Additional carbon and sulphur emissions from smokestacks of coal-fired power stations, aluminium smelters, and cement and steel factories in southern China and particulate and air pollution from motor vehicles along the coastline of the South China Sea have also been recognized as major contributors (Rosenburg, 1999).

Figure 1 Proportion of aspects from an oil palm operation affecting the various environmental receptors



Consequences of haze In addition to medical effects, air pollution is also surmised to cause: loss of biodiversity, reduced forest carbon sinks, ground cover and organic matter, increased greenhouse gas emissions, and in the longer term, increased global warming and rising sea levels. Haze and air pollution also directly affect oil palm productivity with the total cost of lost crude palm oil in Sumatra in 1997 due to smoke haze and air pollution being estimated at US$16.25 million (Sargeant, 2001).

Sumatra is expected to absorb about a quarter of Indonesia's oil palm expansion plans over the next 20 years. Of this, 50% will be developed by smallholders with most hectarage being on wetlands (Sargeant, 2001). Although zero burning planting is the law, not all plantations practice it and the development of peat land for new

planting of oil palm often involves slash and burn land clearing methods (Ismail *et al*., 2005). In short, the risk of trans-boundary air pollution is not likely to diminish.

New development impacts on air quality

In oil palm, fire is used to clear residual wood debris. In Sumatra, oil palm occupies 2.1 million hectares. Many of the newer estates lie on peat soils. Peat can continue to smoulder and emit dense smoke haze long after the surface fire has died.

In 1997, fire in peat forests burnt uncontrollably, emitting between 0.81 to 2.57 gigatonnes of carbon into the atmosphere (the worst air pollution on record since 1957) and accounting for somewhere between 13-40% of mean annual carbon emissions world-wide (Clay, 2004). A plume of smoke larger than the continental United States spread across Southeast Asia affecting an estimated 20 million people (Rosenburg, 1999) and creating an economic loss (for agriculture, health, tourism, *etc*.) estimated at US$9.3 billion (Kamal, 2001)

The Association of Southeast Asian Nations (ASEAN) responded by creating the Regional Haze Action Plan to help set standards and to formulate prevention and remedial policies but the Agreement has still not been fully ratified and haze continues to be an on-going problem. In 2005 the haze from such fires again reached a crisis point with several deaths and closure of schools and offices in

Malaysia (Khor, 2005). The smoke and air pollution continues to drifts from Sumatra to Peninsular Malaysia and Singapore on three or four occasions each year (Sargeant, 2001). Haze, however, is not new. It has been reported since 1991 (Khor, 2005).

Existing plantation and processing impacts on air quality

Air quality is also influenced by existing plantings and milling operations. While less common, fire has also been used for land clearing and for phyto-sanitary control during replanting although this is not common and the areas involved are much smaller. Air quality is also impacted by mill emissions during oil palm processing, methane production from effluent lagoons (and to a lesser degree from integrated cattle/plantation operations), on-farm vehicle emissions and the burning of refuse. The proportion or environmental aspects affect air quality is given in figure 1.

Practical solutions and sustainable development

Change is likely to be driven by the private sector in general and specifically by individual companies' pioneering more sustainable practices. The RSPO Criteria 5.5 and 7.7 specifically deal with the use of fire in existing and in new oil palm developments respectively. What is needed is the will and the ability to enforce "no burn" bans together with the identification of ways to do it. This could be through business case analyses on the costs of adopting the no burn practices and the establishment of avenues for dissemination of information to others in the industry.

Better clearing practices do not involve burning except under certain phyto-sanitary conditions (e.g. when trees are diseased or there is fear of creating or extending a disease vector). There is no compelling reason to use fire to clear land for new plantations. The cost of establishing an estate is identical whether the land is cleared by purely mechanical means and zero burn or is first cleared mechanically and the debris then burnt (Sargeant, 2001). Ismail *et al.* (2005) provided cost/ha of US$ 515 and US$527 respectively for the two systems but stated that the cost will more than double if the residual wood has to be chipped; a possible requirement for control of *Oryctes*. Many companies have adopted zero burn policies. In PNG, New Britain Palm Oil, Ltd. (NBPOL) has had a policy in force since 1967 with the lack of widespread *Oryctes* incidence assisting its implementation. To make zero burn a practical reality, it has been important to identify and disseminate information about the best ways to clear without burning and to ensure that this information is passed on to smallholders, particularly smallholder management and extension schemes.

The RSPO recognised burning as a key environmental impact of new plantation development and a significant impact within existing plantations during replanting. Whilst not prescribing best management practices (BMPs), the RSPO offers key performance indicators expected to be found in those plantation companies and smallholder schemes committed to the elimination of burning. It addresses the issue of burning in a number of ways suggesting indicators that a third party auditor could

use to confirm that a company was utilizing better practices and working within the law. For the most part this advice follows that within the ASEAN guidelines.

Guidance for the reduction of impacts on air quality in new developments

The RSPO Principles and Criteria are clear - the use of fire in the preparation of new plantings is to be avoided other than in very specific circumstances for example as identified in the ASEAN guidelines. This of course would be superseded if national laws already banned burning. An auditor would seek evidence of non-compliance with such legislation. Satellite images for example show evidence of burn scars for up to 3 years (Sargeant 2001). Annual site visits would confirm such images and it would be expected that the auditor visit a number of sites (typically the area visited = $\sqrt{N}$, where N is the area of new developments in ha.) on each visit. Confirmation that the system was implemented would be derived through assessments of where and why fire has been used with supporting documentation and records to show assessments have been carried out to demonstrate that it is the most effective and least environmentally damaging option. Details on how fires are managed once lit would provide evidence that fire-use is carefully controlled. All such documents would be expected to be endorsed by senior management. Fire on peat soils is mentioned specifically and clear evidence that the use of fire on peat soils had been purposely avoided would be sought. This would most likely require

mapping of the extent of peat soil but need not necessarily require a comprehensive soil survey.

The issue of smallholders and fire use is difficult to address and hampered by jurisdictional and communication issues. Enforcement is often impractical and complicated, even to the point of deciding who holds the mandate. Education and training is identified to be important in bringing about change. Where extension schemes exist, they should form the nucleus of any education initiative. Operating companies who ultimately process the fruit should assist and support these, and it is likely that most schemes will have to be generated and managed by them. Many of these issues are still being considered by the RSPO.

Guidance for the reduction of impacts on air quality in established plantations

If burning has occurred in the past, a company's register of Aspect and Impacts should include burning as a significant risk and as part of the assessment of all polluting activities, including gaseous emissions, particulate/soot emissions and effluent. Overall impacts on air quality account for about 8% of plantation / mill aspects (Figure 1). Incidence of fire should be monitored and an auditor would expect to observe objectives and targets for planned reduction together with a genuine reduction in the occurrence over time. Appropriate management planning and operational procedures for change should be evident for all replanted areas or expansion of planting areas (e.g. infilling).

Fire should not be used for waste disposal so where it has been, the reason should be clearly documented. An auditor should also not expect to find evidence of mill residues being burnt but instead would like to see maps of where such residues had been applied to the plantation as well as quantities as part of a reuse and recycling plan. These numbers could then be compared to estimates of total residues based on total FFB production on a plantation.

Plans to reduce pollution and emissions, including greenhouse gases, should be developed and evidence that these are implemented and monitored should be produced and available for auditors. While not all company documents should or could be made public, by making these target reductions accessible to auditors, the process is made more transparent. Where sophisticated equipment for monitoring is not available, simple devices like Ringlemann charts which colour code emission have provided NBPOL with the ability to measure and monitor key air quality impacts.

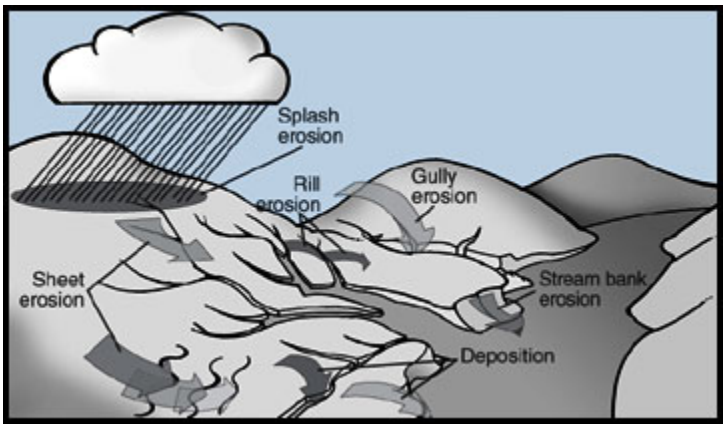
Schemes to reduce emissions fit well into the RSPO thinking about more sustainable palm oil production and refining. Carbon credits would offer attractive bonuses to companies switching from burning fossil fuels to utilising methane as an energy source and introducing bio fuels in transport fleets. Most schemes that either promote renewable energy use or reduce dependence on non renewable energy would positively affect air quality. These could be seen as “top up” credits on

schemes which already show a positive cost benefit ratio as the Kyoto Protocol deadline of 2012 approaches.

ENVIRONMENTAL IMPACT OF OIL PALM ON LAND

The impacts of oil palm production on soil health involve both soil quality and quantity**.** Soil erosion is a major soil degradation process adversely affecting the soil quality not only by directly reducing nutrients and organic matter levels but also by affecting soil properties such as infiltration rates and indirectly by depleting soil bio-diversity and impacting subsequent plant colonisation and composition.

Figure 2. Types of erosion



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Consequences of soil erosion Water erosion occurs when land use does not offer sufficient protection to the soil against the impact of rain and superficial runoff. Figure 2 shows the types of erosion encountered, the most obvious is on steep slopes. Erosion occurs mainly during forest clearing and plantation

establishment when the soil is left uncovered. The top layer of soil is the most vulnerable. Unfortunately, this also tends to be the most fertile soil horizon. As a consequence, loss of the top layer not only affects productivity but can also lead to off-site deposition of sediments. Soil suspended as solids in the water column can physically enter waterways and clog them. Later in the oil palm cycle, soil erosion can have the additional burden of transporting fertilisers and pesticides which adhere to the suspended solids. This can further contaminate waterways.

New development and existing plantation impacts on soil

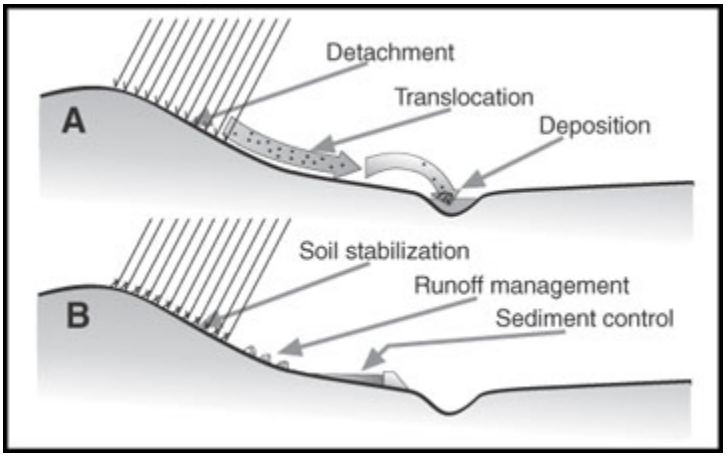
The most risk-prone period for soil erosion is during new developments when plantings are first established and subsequently during periods of replanting. Once the ground cover is established, erosion is much reduced and limited within plantations to harvest paths, roads and localised areas of steep elevation.

Clearing the land of secondary bush and windrowing of wood does disturb soil but this can be minimised. Soil loss during the preparation of drains, roads, culverts and bridges is not so easy to manage and some of the older practices used to establish oil palm plantations did lead to considerable soil erosion. Erosion is encouraged when clearing is not undertaken properly.

Cultural practises play a major role in controlling localised soil loss. Soil

stabilisation, runoff control and sediment trapping (Figure 3) can mitigate the detachment, translocation and deposition stages in the process of soil erosion. In oil palm plantations, road building results in bare soil and the incorrect sitting or construction of roads (and other infrastructure such as bridges, culverts and drains) increases soil erosion. Slope was found to be the most significant factor in soil erosion from roads (Ziegler *et al*., 1996) with roads contributing 24 times more sedimentation than agricultural land (Zieglar *et al*., 2000), and erosion increasing with traffic flow (Ziegler *et al*., 2001). Thus, in Papua New Guinea (PNG) every 100 metres of road has the potential to produces as much sediment as each hectare of oil palm. However, these issues are not unrelated as there are 50 linear metres of road for every hectare of oil palm planted. Surfacing of roads can reduce erosion by 95% (Burroughs & King,1989). Ongoing road maintenance determines sedimentation rates from roads in subsequent years.

Figure 3 Stages of erosion (A) and possible points for intervention (B)



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Practical solutions and sustainable development

Some soils are not appropriate for oil palm plantations, and these should be identified. Clay (2004) suggested that soil type, slope and aspect should be evaluated before planting due to their long-term implications for productivity and profitability. Ongoing soil management is also important. Research in Brazil has suggested that better agricultural practices can reduce soil erosion by half and effluents by up to 90 percent. The introduction of grid-based or topography-based agronomic data bases (for example the Potash and Potassium Industry's OMP system) linked to digital maps (GPS /GIS) enables producers to target and in some cases determine marginal areas before planting and replanting. Site-specific planning is common in many plantations.

The soil should be protected during all activities associated with production. Flotation tires on tractors - used for hauling fertiliser, bunch and compost spreading, pesticide spraying, and for in-field crop collection - will minimize soil compaction. Soil type should be one of the selection criteria when deciding on the method of crop collection and recovery.

Removal of top soil for nurseries is a net resource loss. A 200,000 seedling nursery requires 51,000 cubic metres of soil annually, resulting in stripping the topsoil from an area equivalent to 2 hectares. It can be avoided if the empty fruit bunches (EFB) from the mill and either mill effluent or palm kernel cake are used to make compost

dedicated for filling nursery bags. Lord *et al*. (2003) found an overall saving in the operation of a PNG nursery to be around 42% by using BMPs.

Better spray management is necessary at all stages. Evaluation before spraying should be the rule. All spraying should be selective, spot, circle or path, being carried out by fully trained operators, and reduction with programs in place. In NBPOL plantations, pesticide reduction programs have shown pesticide use on a per hectare basis to have decline 51% since 1998 (Page & Lord, 2006).

Where local sheet and rill water erosion occur, “herring bone” frond placement with the frond tips across the path would reduce soil loss. Where shade effects of the canopy brings about reduction in ground cover, box placement of fronds can assist re-establishment of natural vegetation.

Guidance for the reduction of impacts on land

Soil quality and quantity are recognised as significant receptors of environmental impacts during the life cycle of oil palm. Impacts affecting land account for nearly a quarter of all aspects in a mature oil palm operation (figure 1). The RSPO requires that practices should maintain, or if possible improve, soil fertility to a level that ensures optimal and sustained yield (Criteria 4.2 Table 1). Producers must show this link, expressing positive cultural practices with hectares planted or yield. Advances in linking agronomic databases to digital maps make this a simple

process, and such maps could also provide evidence that planned expansion on unsuitable terrain is avoided.

Soil loss can be measured simply by a fixed peg system or by theoretical calculation, e.g., The Universal Soil Loss Equation (USLE). Soil fertility and soil loss have both been included in Unilever's 11 sustainability indicators for general agriculture (Appendix 2). Suggested indicators include earthworms and predatory mites as well as soil organic carbon and soil loss. In NBPOL plantations, soil organic carbon and organic matter and earthworm populations have been measured as part of a benchmark program to characterise and map 33, 000 ha of soil.

An auditor would look for evidence that practices in established plantations minimise and control erosion. A pragmatic approach would be to establish "best management block" schemes and maintain trial records as documentary evidence as to their success. Implementation of the successful practices would then be measured on a percentage hectare basis throughout the plantation.

Producers should reduce the occurrence of bare earth and protect against the impact of rain and over-spraying. In oil palm 75% of each hectare needs to be covered with either cover crop of native species. Methods which quickly establish cover crop are very important. Timed sequence photography in PNG shows that in new plantings, a cover crop can be fully established within six months and re-

established by three months in replants.

The presence of a documented road maintenance programme would be required to show that this important aspect has been considered, and road construction should appear on the Aspect and Impact registers as a significant risk. Maintaining, and where necessary, restoring riparian areas in order to minimise erosion of stream banks should also be considered.

Assessing soil suitability is also important for small-scale producers at the beginning of a smallholder project. Attempts need to be made to translate BMPs into practical approaches suitable for national smallholders. An auditor should be able to see objective evidence demonstrating that smallholders have an understanding of the techniques required to maintain soil fertility and that those techniques are being implemented. National interpretation should identify the range of appropriate techniques. One commonality between plantations and smallholders is that training in the techniques of pesticide application can be harmonised, differing perhaps only in the depth of information provided.

ENVIRONMENTAL IMPACT OF OIL PALM ON HABITAT CONVERSION

In 2002, the total area of mature oil palm plantation in Indonesia was estimated at between 2 and 3.5 million hectares (Friends of the Earth, 2005a; Corley, 2005).

Estimates for expansion rates vary, but Corley (2005) cites O.4 Mha/year as the recent norm.

Oil palm poses a significant threat to the widest range of endangered animals. Oil palm has on average 15-25 % less mammals per hectare than tropical forests (Henson, 2003; Clay, 2004). The Sumatran tiger, Borneo and Sumatran orang-utans, Asian elephant and Sumatran rhinoceros are all threatened by oil palm expansion (Table 3). Oil palm plantations are cited as being the most significant cause of habitat fragmentation in Borneo and Sumatra (Friends of the Earth, 2005b) although the same report noted that between 1996 and 1998, 1 million hectares of swamp forest were destroyed in Central Kalimantan in an attempt to increase Indonesia's rice-production capacity. With all these species, the primary issues are the incompatible conversion and use of the habitat and the elimination of wildlife corridors between areas of genetic diversity. The conversion of natural forests to oil palm plantations reduces biodiversity (the number of species present per unit area of land) with species reductions occurring for insects, birds, reptiles, and soil micro-organisms.

Table 3. Mega species at risk from extinction

Sumatran tiger: The Sumatran tiger is one of only five remaining tiger subspecies, reduced from eight by recent extinctions. Only 250 of these animals may exist in the wild.

Bornean and Sumatran orangutans: These are the only great apes that exist outside of Africa. Both species are in crisis and may well become extinct within ten years. One study found that the orangutan population decreased by 45 percent in the 1990s, and much of their remaining habitat is slated for conversion to oil palm agriculture.

Asian elephant: Only about 2,900 elephants are estimated to remain in all of Sumatra, 800 in peninsular Malaysia, and 1,000 in Borneo. The home range of one family of elephants is about 25 to 65 square miles, so a breeding subpopulation of 20 elephant families would need to roam over about 500 to 1,300 square miles. Other Asian elephants survive in other countries.

Sumatran rhinoceros: The two biggest threats to the Sumatran rhino are illegal hunting and habitat loss. Road building shrinks the animals' travel corridors and makes them more accessible to poachers. Their total population is estimated at fewer than 400.

Source Friend of the Earth – Ape for Oil Scandal (2005)

Other impacts affecting biodiversity such as decrease in ground vegetation occur as a result of increase in shade resulting directly from overlapping fronds. This not only causes a reduction in the number of species of plants but numbers of individuals of each species as well. Blanket spraying, poor in-field upkeep, and planting density exacerbate these problems.

Practical solutions and sustainable development

To minimize destruction of the natural environment, it is necessary to optimize production. One way to do this is through more intensive cultivation (Corley, 2005).

In addition, Indonesia alone has 20 Mha of degraded land (Clay, 2004). Perennial plantations such as oil palm are appropriate for rehabilitation programs on degraded forest zones (Lamade & Setyo, 2002). Oil palm plantations are 1.4 times more efficient than tropical rainforests in net CO2 assimilation (Henson, 2003) and can sequester as much as 15 metric tonnes of carbon per hectare per year (Clay, 2004). Payments for environmental services may promote rehabilitation of degraded lands.

Recent management suggestions which would serve to increase biodiversity include the planting of leguminous cover crops, retention of palm wastes, promotion of natural predators for pest and disease control, integrated pest management (IPM), minimal use of pesticides, establishment of nature conservatories, conservation of riparian strips, permanent green belts around specific sites, effective zoning, land use planning and enforcement, and soil conservation and management strategies (Henson, 2003; Clay, 2004; Hashim *et al*., 2005).

Guidance for the reduction of impacts on habitat and biodiversity

The RSPO Principles and Criteria are specific (Criteria 7.2 Table 1) —new plantings since November 2005 should not replace primary forests or any areas containing one or more High Conservation Values (HCV; definitions are given in Table 4). Identification of HCV is not easy and must be done in consultation with local communities. Specialised training may be required. An auditor would expect to be able to check the results of the Social and Environmental Impact Assessment

(SEIA) to confirm record of groups consulted, who was involved in the assessment and identification of HCV and, where necessary, dates of any training (in-house and external) conducted together with list of participants.

Table 4 Definitions of High Conservation Value Forests

• HCV1. Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g. endemism, endangered species).
• HCV2. Forest areas containing globally, regionally or nationally significant 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.
• HCV3. Forest areas that are in or contain rare, threatened or endangered ecosystems.
• HCV4. Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control).
• HCV5. Forest areas fundamental to meeting basic needs of local communities (e.g. subsistence, health).
• HCV6. Forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

Source RSPO Principles and Criteria Guidelines (March 2006)

The status of rare, threatened or endangered species should be known and a management plan should be put in place. In some cases, there may be cause for a policing role by the plantation to prevent further damage or deterioration of applicable habitats. The presence of endangered species may be one of the mitigating circumstances that prevent a company from disclosing such information

to the general public. This would be seen as an acceptable exemption from the Transparency Principle and viewed as a genuine reason for non disclosure by an auditor

IPM practices should be recorded, mapped and monitored. The extent of IPM implementation expressed on a per hectare basis would show expansion of practices over time. Such maps should include smallholders were relevant. Evidence that use of selective pesticides that are specific to the target pest, weed or disease and which have minimal effect on non-target species should be available. Monitoring of pesticide toxicity possibly would also serve to show overall reduction in toxicity of the specific chemicals used. Some suggested parameters from Unilever (Appendix 2) include, the Percentage of crop under Integrated Pest Management and the amount of pesticides (active ingredient) applied (per ha or per tonne of product).

ENVIRONMENTAL IMPACTS ON WATER

In general, water take and water pollution are of equal interest from the perspective of agricultural impacts. Aspects that impact on water quality are by far the largest component of an environmental risk register accounting for nearly 50% of all entries (Figure 1). For oil palm, water take is a significant issue only with regard to watering during the nursery phase of seedling production, in the mill and for human

consumption. Irrigation of palms is not common. Water take is generally not considered a significant issue. Water pollution and water quality are another issue, however. Leaching of pesticides and other agrochemicals, runoff, sedimentation, pollution by effluent discharge and hydrocarbon contamination all affect water and can be significant impacts of oil palm cultivation. Normally in an Aspect and Impact register, anything which enters either ground or surface water has attached to it a significant risk factor as the magnitude is spread over a very wide area and the impact is easily seen.

Guidance for the reduction of impacts on water

Practices must maintain the quality and availability of surface and ground water. The status of surface and ground water should also be monitored. Growers should develop a water management plan. Growers and millers should address the effects of their water use and the effects of their activities on local water resources.

Other key indicators of performance would be a waste management and disposal plan, as well as pollution prevention plans on plantations and in mills. It is suggested that the latter becomes a public access document under criteria 1.2 (Appendix 1) and 8.1 (Table 1)

Mill operations have the largest potential to impact on water quality as most discharge effluent into natural water ways. Most countries have at least minimal

legislation pertaining to extraction and discharge of water. If all operations are documented as required by criteria 4.1 of the RSPO guidelines (Table 1), an auditor would want to see evidence of the standard operating procedures for measuring and monitoring mill effluent. Auditors should require that there is evidence that there was compliance with legislation as per Criteria 2.1 (Appendix 1) and that staff responsible for key environmental control were identified and trained (Criteria 4.8, Table 1). Applicable records would be job descriptions, records of training dates, trend monitoring of discharge, up to date permits and overall estimate of water use (e.g. monitoring of mill water use per tonne of FFB). In most cases, national legislation will determine discharge parameters. Auditors will need to determine if relevant national legislation exists in all countries or if it is too weak to be credible.

All sources of waste and pollution would need to be identified in some form of register (Criteria 5.1, Table 1) identifying and monitoring objectives and targets for improvement. Continuous improvement should be required and demonstrated (Criteria 8.1 Table 1). National interpretation could reflect national guidelines or best practices and where appropriate, national interpretation could include performance thresholds for requirements such as the size of riparian strips or the upper limits of acceptable maximum runoff levels.

Other aspects to consider include:

- Water use in nurseries and the effect of runoff;

- Protection of water courses and wetlands—including maintaining and restoring appropriate riparian buffer zones along all bodies of water;
- Avoiding contamination of surface and ground water through run-off of soil, nutrients or chemicals, or as a result of inadequate disposal of waste including safe disposal of used pesticide containers;
- Safeguarding potable water;
- The operation of gravel extraction processes (when used to provide aggregate for road maintenance programs) which have the potential to cause high levels of disturbed earth entering waterways; and
- Ensuring that the use of water does not result in adverse impacts on availability for downstream users including wildlife as well as humans.

CONCLUSION

The RSPO‘s vision is to insure that palm oil production contributes to a better world. However, producers do not achieve the same result with the same practices, and similarly different practices can achieve the same results for different producers. Allowing producers to find their own way to achieve targeted performance levels encourages innovation rather than mere compliance. As the goal of the RSPO is to achieve improved performance against a baseline for the most significant impacts, producers should be allowed to use, adapt, or invent the better management practices that work best for them. The challenge now is to identify appropriate indicators that can be measured to document acceptable performance levels as well

as improvement over time. Placing these within the context of smallholder producers is still being addressed by the RSPO.

ACKNOWLEDGEMENT

Acknowledgment is given to other initiatives and standards, e.g. Organic standards, The Migros Criteria and Unilever Sustainability Initiatives. However since they are different, no attempt has been made to harmonise them in this paper.

APPENDICES

Appendix 1 The RSPO Principles and Criteria

Principle 1: Commitment to transparency
Criterion 1.1 Oil palm growers and millers provide adequate information to other stakeholders on environmental, social and legal issues relevant to RSPO Criteria, in appropriate languages & forms to allow for effective participation in decision making.
Criterion 1.2 Management documents are publicly available, except where this is prevented by commercial confidentiality or where disclosure of information would result in negative environmental or social outcomes
Principle 2: Compliance with applicable laws and regulations
Criterion 2.1 There is compliance with all applicable local, national and ratified international laws and regulations
Criterion 2.2 The right to use the land can be demonstrated, and is not legitimately contested by local communities with demonstrable rights.
Criterion 2.3 Use of the land for oil palm does not diminish the legal rights, or customary rights, of other users, without their free, prior and informed consent
Principle 3: Commitment to long-term economic and financial viability
Criterion 3.1 There is an implemented management plan that aims to achieve long-term economic and financial viability.
Principle 4: Use of appropriate best practices by growers and millers
Criterion 4.1 Operating procedures are appropriately documented and consistently implemented and monitored.
Criterion 4.2 Practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield.
Criterion 4.3 Practices minimise and control erosion and degradation of soils.
Criterion 4.4 Practices maintain the quality and availability of surface and ground water.
Criterion 4.5 Pests, diseases, weeds and invasive introduced species are effectively managed using appropriate Integrated Pest Management (IPM) techniques.
Criterion 4.6 Agrochemicals are used in a way that does not endanger health or the environment. There is no prophylactic use, and where agrochemicals are used that are categorised as World

Health Organisation Type 1A or 1B, or are listed by the Stockholm or Rotterdam Conventions, growers are actively seeking to identify alternatives, and this is documented.
Criterion 4.7 An occupational health and safety plan is documented, effectively communicated and implemented.
Criterion 4.8 All staff, workers, smallholders and contractors are appropriately trained.
Principle 5: Environmental responsibility and conservation of natural resources and biodiversity
Criterion 5.1 Aspects of plantation and mill management that have environmental impacts are identified, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement.
Criterion 5.2 The status of rare, threatened or endangered species and high conservation
value habitats, if any, that exist in the plantation or that could be affected by plantation or mill management, shall be identified and their conservation taken into account in management plans and operations.
Criterion 5.3 Waste is reduced, recycled, re-used and disposed of in an environmentally and socially responsible manner.
Criterion 5.4 Efficiency of energy use and use of renewable energy is maximised.
Criterion 5.5 Use of fire for waste disposal and for preparing land for replanting is avoided except in specific situations, as identified in the ASEAN guidelines or other regional best practice.
Criterion 5.6 Plans to reduce pollution and emissions, including greenhouse gases, are developed, implemented and monitored.
Principle 6: Responsible consideration of employees and of individuals and communities affected by growers and mills
Criterion 6.1 Aspects of plantation and mill management that have social impacts are identified in a participatory way, and plans to mitigate the negative impacts and promote the positive ones are made, implemented and monitored, to demonstrate continuous improvement.
Criterion 6.2 There are open and transparent methods for communication and consultation between growers and/or millers, local communities and other affected or interested parties.
Criterion 6.3 There is a mutually agreed and documented system for dealing with complaints and grievances, which is implemented and accepted by all parties.
Criterion 6.4 Any negotiations concerning compensation for loss of legal or customary rights are dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions.
Criterion 6.5 Pay and conditions for employees and for employees of contractors always meet at

least legal or industry minimum standards and are sufficient to meet basic needs of personnel and to provide some discretionary income.
Criterion 6.6 The employer respects the right of all personnel to form and join trade unions of their choice and to bargain collectively. Where the right to freedom of association and collective bargaining are restricted under law, the employer facilitates parallel means of independent and free association and bargaining for all such personnel.
Criterion 6.7 Child labour is not used. Children are not exposed to hazardous working conditions. Work by children is acceptable on family farms, under adult supervision, and when not interfering with education programmes.
Criterion 6.8 The employer shall not engage in or support discrimination based on race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, or age.
Criterion 6.9 A policy to prevent sexual harassment and all other forms of violence against women and to protect their reproductive rights is developed and applied.
Criterion 6.10 Growers and millers deal fairly and transparently with smallholders and other local businesses.
Criterion 6.11 Growers and millers contribute to local sustainable development wherever appropriate.
Principle 7: Responsible development of new plantings
Criterion 7.1 A comprehensive and participatory independent social and environmental impact assessment is undertaken prior to establishing new plantings or operations, or expanding existing ones, and the results incorporated into planning, management and operations.
Criterion 7.2 Soil surveys and topographic information are used for site planning in the establishment of new plantings, and the results are incorporated into plans and operations.
Criterion 7.3 New plantings since November 2005 (which is the expected date of adoption of these criteria by the RSPO membership), have not replaced primary forest or any area containing one or more High Conservation Values.
Criterion 7.4 Extensive planting on steep terrain, and/or on marginal and fragile soils, is avoided.
Criterion 7.5 No new plantings are established on local peoples' land without their free, prior and informed consent, dealt with through a documented system that enables indigenous peoples, local communities and other stakeholders to express their views through their own representative institutions.
Criterion 7.6 Local people are compensated for any agreed land acquisitions and relinquishment of rights, subject to their free, prior and informed consent and negotiated agreements.
Criterion 7.7 Use of fire in the preparation of new plantings is avoided other than in specific situations, as identified in the ASEAN guidelines or other regional best practice.
Principle 8: Commitment to continuous improvement in key areas of activity

Criterion 8.1 Growers and millers regularly monitor and review their activities and develop and implement action plans that allow demonstrable continuous improvement in key operations

Source - RSPO Principles and Criteria for Sustainable Palm Oil Production. Guidance Document. March 2006

Appendix 2 **Unilever Sustainable Agriculture indicators and their measurable environmental parameters on land water and air receptors**

Sustainability Aspects	Measurable Parameters (edited)
Soil fertility/health	Number of beneficial organisms Number of predatory mites Number of beneficial micro-organisms Soil organic carbon
Soil loss	Soil cover index (proportion of time soil is covered with crop; protects against leaching and erosion, promotes water binding) Soil erosion (loss of top soil in percentage per annum or in t/ha/annum
Nutrients	Amount of inorganic Nitrogen (N)/ Phosphates (P)/ Potassium (K) applied (per ha or per tonne of product) Proportion of N fixed on site/imported Balance of N/P/K over crop rotations Emissions of N-compounds to air
Pest management	Amount of pesticides (active ingredient) applied (per ha or per tonne of product) Type applied (profiling, positive list, weighting factor) Percentage of crop under Integrated Pest Management (IPM
Biodiversity	Level of biodiversity on site: number of species Farm landscape; habitat for natural predator systems Level of biodiversity off-site: cross-boundary effects
Value chain	Total value of produce per ha Yield of target product in tonnes per ha Ratio of solid waste re-used/recycled over solid waste disposed to landfill
Energy	Balance: total energy input/total energy output, Ratio renewable over non-renewable energy inputs Emissions to air (greenhouse and pollutant gases)
Water	Amount of water used per ha or tonne of product for irrigation Leaching and runoff of pesticides to surface and ground water Leaching and runoff of N/P/K (nutrients) to surface and ground water
Social/human capital	
Local economy	
Animal welfare	

Source –Modified Unilever Sustainable Agriculture Initiatives - Growing for the future (2003), Indicators (undated) and the Colworth Farm Project (undated) - www.unilever.com

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