GREAT APES

LOGGING

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Summary

All species of great apes are (critically) endangered; their continued existence depends on the conservation of the tropical rainforests. In the Congo Basin, the area inhabited by the chimpanzee, bonobo and gorilla, only 10–15% of the forests are legally protected, either as national park or nature reserve. The figure for South East Asia, where the orang-utan dwells, is about 20%. Many times that area of forest (in some countries up to 90%) is leased as logging concession. Effectively protected national parks and nature reserves are preferable habitats for great apes. However, since many great apes dwell in logging concessions, their continued existence depend, therefore, to a great extend on how well they can survive in these logging concessions.

This report deals with great apes and the threat posed to them by logging. Other major threats to great apes, such as disease (ebola), the conversion of forests to palm oil plantations and a lack of effective management in protected areas, lie outside the scope of this report and are not discussed in detail.

This report, which is based on several scientific studies, information from nature conservationists and large logging companies, aims to offer insights into FSC's (Forest Stewardship Council) effectiveness as an instrument for the protection of chimpanzees, gorillas, bonobos and orang-utans. FSC is the leading, most broadly supported global forest certification system for responsible logging.

The report's main conclusions are:

- In contrast to other forms of logging, FSC certified logging offers increased assurance that the appropriate habitat for great apes will be maintained.

  In FSC certified concessions, selective logging is combined with the prevention of undesirable side effects. Hunting and illegal logging are reduced by closing off roads and guarding them and selected fruit trees are preserved. This forms a significant contrast to other forms of logging. Furthermore, FSC logging is independently audited.

  The western gorillas and Bornean orang-utans in particular can be found in high densities in well managed FSC certified concessions. Chimpanzees and Sumatran orang-utans seem to be more sensitive to human activities, even though they appear to be able to survive well in selectively logged concessions with low hunting pressure.

- Long term survival of great apes is only ensured when the species reside in networks of effectively protected areas, certified logging concessions and other suitable habitats.

  Viable great ape populations depend on large habitats. Logging areas, provided they are FSC certified, form the best supplement to protected areas. Networks of protected areas and FSC certified logging concessions must be well-designed and management must be aligned.

- Currently, only a small area of the great apes' habitat is managed according to FSC standards.

  Most logging concessions that occur in great apes habitats are not FSC certified. The FSC certified area in South East Asia is virtually negligible, but growing. In the Congo Basin there are various large FSC logging concessions (together 4.5 million hectares) housing healthy populations of gorillas as well as chimpanzees. They represent only a small part of all concessions, but their share is growing rapidly thanks to the increasing demand for FSC products in Europe and elsewhere.

Well managed FSC concessions help to ensure the preservation of great ape habitats, but it is utilised far too infrequently. For that reason the following recommendations are made:

1. Governments of producer countries should promote FSC certification by creating an enabling environment and by active law enforcement (specifically anti-poaching).

2. Governments of producer countries should provide better guarantees that FSC certified forests will continue to be responsibly (FSC) managed in the long term.

3. Governments, nature conservation organisations and logging companies must collaborate more to better integrate the management of protected areas and FSC concessions so as to benefit the great apes' chances of survival.

4. Governments, private sector and consumers in consumer countries must give preference to FSC products.

Introduction

All great apes are (critically) endangered; their continued existence depends on the tropical rainforest. In the entire world, however, only 11% of these forests are under legal protection, as national park or nature reserve. The percentages are slightly higher in the areas inhabited by the great apes: approximately 20% in South East Asia and 10–15% in the Congo Basin (Central Africa).

Large areas of forest outside protected areas (in some countries up to 90%) are leased as logging concession. The continued existence of chimpanzees, gorillas and orang-utans thus depends in part on how well these species can survive in logging concessions (Morgan and Sanz, 2007; Meijaard and Sheil, 2007). While protected areas play a key role in plans for the preservation of great apes, the importance of logging concessions is attracting increasing attention (Tutin *et al.*, 2005; Nelleman *et al.*, 2007).

In this context, logging means cutting of large trees in natural forests and removal for sale as wood. Concession means a licence for a certain period granted by the government to a company, to cut trees for wood production in a specific area.

This report, which is based on a number of scientific studies, information from nature conservationists and large logging companies, investigates the effectiveness of FSC (Forest Stewardship Council) as an instrument for protecting the great apes. FSC is the leading, most broadly supported global forest certification system for responsible logging.

For great ape conservation to succeed it is important to also deal with other threats such as disease (ebola), the conversion of forests to other land-use (e.g. palm oil plantations), as well as poaching and illegal logging in protected areas, but these issues lie outside the scope of this report.

Logging in the tropics has a bad reputation. Justifiably so, since large areas of forest are being destroyed, both legally and illegally. According to Sayer *et al.* (2008), logging should no longer be viewed merely as an activity that contributes to the destruction of forests. When the logging is done responsibly, it can even contribute to forest conservation and biodiversity. In those areas where legal protection is not very effective, the potential importance of logging concessions is further increased. In Kalimantan, for example, forests in protected areas are being destroyed at the same rate as in the logging concessions (Curran *et al.*, 2004). And 37 of the 41 national parks in Indonesia are affected by illegal logging and encroachment in recent years (Nelleman *et al.*, 2007).

At the present time, logging leads in most cases to further harm to the forest, or its loss, partly because hunters and illegal loggers are able to penetrate further into the forest interior along the roads laid down by the loggers. Especially in South East Asia many of the concessions are dormant or abandoned after having been logged over, making these areas extremely vulnerable to degradation. Logging is however an economic reality. Clark *et al.* (2009) have studied biodiversity loss in Central Africa and state that in view of the rate at which logging concessions are being granted, the conservation of the rainforest may depend far more on the rapid introduction of sustainable logging than on creating new protected areas.

FSC sustainably logged concessions are independently certified. The Forest Stewardship Council (FSC), founded in 1993, imposes specific requirements on forest management and has them verified by independent certification bodies. These certification bodies also audit the entire chain of custody, from tree to end product. Buying FSC-branded products thus allows the consumer to contribute directly to sustainable logging.

FSC certified forests have existed in the tropics for more than a decade now, which is long enough to investigate the impacts of responsible logging. This report is an analysis of (scientific) studies of the influence of FSC and less responsible types of logging on biodiversity in general, and specifically on great apes. The report is intended to offer insights into FSC's effectiveness as an instrument for the protection of chimpanzees, gorillas and orang-utans.

Chapter 2 briefly describes the current status, distribution and threats to the great apes. Chapter 3 contains, first of all, an explanation of the added value supplied by FSC over (non-certified) selective logging. After that a description is given of the effects of selective logging and FSC on biodiversity in the tropical rainforest, based on a number of studies. Chapter 4 focuses specifically on great apes. In Chapter 5 conclusions are drawn about FSC's effectiveness and relevance to the protection of great apes.

2

Status, distribution and threats to the great apes

This chapter briefly describes the great apes, on which this report focuses, the degree to which they are threatened, and where they are found.

2.1 Chimpanzees, bonobos and gorillas

All four species of African great apes (chimpanzee, bonobo, western and eastern gorilla) are on the IUCN Red List, which describes them as endangered or critically endangered (see Table 2.1). In the short term the threats consist mainly of poaching and disease (Ebola virus). Most experts agree, however, that the advancing destruction and accompanying fragmentation of their habitat will come to represent a greater threat in future (Tutin *et al.*, 2005).

The centre of gravity of the African great apes' distribution lies in the extensive forests of the Congo Basin, running from Gabon to Western Uganda (see Figure 2.1). The area of forest in this region is expected to decline by 30% in the next 50 years. More than half of the gorillas and chimpanzees in the Western Congo Basin reside in logging concessions, while only 17% dwell in protected areas (Morgan and Sanz, 2007).

2.2 Orang-utans

There are two species of orang-utan. Both are genuine forest dwelling species, inhabiting Malaysia and Indonesia (see figure 2.2). It is estimated that in the last century the Bornean orang-utan lost 80% of its habitat and its continued existence is endangered. The most important factor behind this habitat loss is the transformation of frequently logged-over forests that have lost their value into alternative land uses that can generate profits, most notably oil palm plantations. The Sumatran orang-utan lost less habitat because the species mainly inhabits forests on steep slopes, where logging and agriculture advance more slowly. However, since this species is generally less common and small sub-populations often live isolated from each other, the Red List classifies the Sumatran orang-utan as critically endangered (see table 2.2).

Only roughly 10% of the forest on Borneo (an island comprising Indonesia-Kalimantan, Malaysia-Sabah and Sarawak, and Brunei) is strictly protected. It is crucial to conserve the remaining 90%; half of which consists of logging concessions. Meijaard and Sheil (April 2007) estimate that 75% of the Bornean orang-utans reside in these logging concessions.

***Figure 2.1** Distribution of African great apes*

Source: http://www.unep.org/grasp/Resources/fact.asp

***Table 2.1** Chimpanzee and gorilla populations and IUCN Red List classification (December 2008).*

SPECIES	ESTIMATED POPULATION	TERRITORY	IUCN RED LIST CATEGORY
Chimpanzee (Pan troglodytes)	172,700 – 299,700		Endangered
- subspecies: Western chimpanzee *(P. t. verus)*	21,000 – 56,000	Ivory Coast, Ghana [uncertain], Guinea, Guinea-Bissau, Liberia, Mali, Senegal, Sierra Leone, Western Nigeria	Endangered
- subspecies: Nigeria-Cameroon chimpanzee *(P.t. vellerosus)*	4,000 – 7,000	Eastern Nigeria, Western Cameroon	Endangered
- subspecies: Central chimpanzee *(P. t. troglodytes)*	47,000 – 78,000	Cameroon, Central African Republic, Gabon, Equatorial Guinea, Congo-Brazzaville, Angola, Western Democratic Republic Congo	Endangered
- subspecies: Eastern chimpanzee *(P.t. schweinfurthii)*	76,400 – 119,600	Burundi, Central African Republic, Democratic Republic Congo, Rwanda, Sudan, Tanzania, Uganda	Endangered
Bonobo *(Pan paniscus)*	10,000 – 50,000	Democratic Republic Congo	Endangered
Western gorilla *(Gorilla gorilla)*	94.500 - 110.000 / <175,000		Critically endangered
- subspecies: Cross River gorilla *(G.g. diehli)*	< 280	Nigeria/Cameroon border region	Critically endangered
- subspecies: Western lowland gorilla *(G.g. gorilla)*	94,500 – 110,000 / <175,000	Cameroon, Central African Republic, Gabon, Equatorial Guinea, Congo-Brazzaville, Angola (Cabinda), Western Democratic Republic Congo (probable)	Critically endangered
Eastern gorilla (Gorilla beringei)	3,650 – 5,700		Endangered
- subspecies: Mountain gorilla *(G.b. beringei)*	720	Democratic Republic Congo, Rwanda, Uganda	Critically endangered
- subspecies: Eastern lowland gorilla *(G.b. graueri)*	3,000 – 5,000	Eastern Democratic Republic Congo	Endangered

Source: Ellis, Christina (2008). Investment Strategy for the Conservation of African and Asian Great Apes: WWF Netherlands, 2008-2012. WWF Netherlands.

***Figure 2.2** Orang-utan distribution*

Source: http://www.unep.org/grasp/Resources/fact.asp

***Table 2.2** Orang-utan populations and IUCN Red List classification (December 2008).*

SPECIES	ESTIMATED POPULATION	TERRITORY	IUCN RED LIST CATEGORY
Bornean orang-utan (Pongo pygmaeus)	**57,000**		**Endangered**
- subspecies: North Eastern Bornean orang-utan (P.p. morio)	**14,842**	**Malaysia (Sabah), Indonesia (East Kalimantan)**	**Endangered**
- subspecies: North Western Bornean orang-utan (P. p. pygmaeus)	**3,000 – 4,500**	**Malaysia (South Sarawak), Indonesia (West Kalimantan)**	**Endangered**
- subspecies: Central Bornean orang-utan (P.p. wurmbii)	**>34,975**	**Indonesia (Central and West Kalimantan)**	**Endangered**
Sumatran orang-utan (Pongo abelii)	**6,624**	**Indonesia (Sumatra)**	**Critically endangered**

Source: Ellis, Christina (2008). Investment Strategy for the Conservation of African and Asian Great Apes: WWF Netherlands, 2008 - 2012. WWF Netherlands.

Effects of selective logging and FSC on biodiversity in tropical rainforests

This chapter discusses and compares a number of studies about the effects of standard selective logging and responsible selective logging on biodiversity in the tropical rainforest. First of all, Section 3.1 explains the difference between standard selective logging and responsible selective logging (as practised under FSC). This difference is important when observing the effects.

3.1 Difference between selective logging and FSC

Logging is considered as one of the most serious threats to biodiversity. In recent years, however, this view has become more nuanced. Justifiably so, since there are various types of logging, and these types differ considerably from each other in terms of their effect on biodiversity. Broadly speaking, four types of logging are distinguished in this report.

- **Clear cutting:** All the trees in a lot are felled, leaving a bare area. This type of logging is disastrous for its effect on biodiversity, especially when the lot is large. It is often associated with conversion of forests to plantations or other land-uses, and/or the harvesting of fibre for pulp mills.

- **Conventional (non-selective) logging:** industrial scale logging to remove all valuable species with little consideration of ecological effects. This often causes widespread disruption, damaging the forest soil and vegetation. This in turn leads to erosion and has adverse effects on biodiversity and the forest's capacity to regenerate, which could lead to encroachment or conversion.

- **Selective logging:** Also named Reduced Impact Logging (RIL). A limited number of trees are logged per hectare. Damage is prevented as much as possible, for example by not damming watercourses but building bridges, using smaller-sized equipment and constructing narrower roads. In this way the forest can be sustained through natural rejuvenation from young trees that were growing prior to logging, or from the seeds of trees left standing.

- **Responsible logging (in particular FSC):** In responsible logging, logging is also selective, but much more is regulated. Additional, specific ecological and social requirements are imposed, which are independently audited by means of certification. One additional requirement that is relevant to the great apes, for example, is the strict regulation of hunting. This offers the best guarantee that the forest and its biodiversity will be maintained.

FSC is currently the leading global forest certification system for responsible logging. Other systems are less consistent and transparent, are subjugated to economic interests, and are inadequately provided with objective, measurable minimum requirements (WWF, 9 February 2009; Gulbrandsen, 2008; Conroy, 2007; Visseren-Hamakers and Glasbergen, 2007).

Selective logging and responsible logging are comparable in terms of their direct effects. They differ in terms of their indirect effects.

The direct effects of logging are:

- changes in the forest's structure and composition due to the removal of commercially attractive trees;
- (habitat) fragmentation due to road construction;
- noise and disturbance.

The indirect effects of logging are:

- increased illegal activities, such as hunting and illegal logging, as people penetrate deeper into the forest along the roads;
- increased subsequent destruction of the forest due to new settlements and agriculture;
- increased disease risks due to augmented contacts between human and apes.

It is precisely the indirect effects of logging that are disastrous to many species, including the great apes. This makes the difference between selective logging and responsible logging highly relevant for this report.

3.2 Regional effects of selective logging and FSC on biodiversity

Research reports are produced in increasing numbers on the direct effects of selective and responsible logging on biodiversity in the rainforests of South East Asia, Latin America and Africa. Selective logging and especially responsible logging appear to be clearly distinguishable from conventional (non-selective) logging and clear cutting, which are disastrous to biodiversity.

South East Asia

In 2005, the book 'Life after Logging' was published by CIFOR (Centre for International Forestry Research). A large number of scientists from Indonesia, The Netherlands, the US and the UK investigated the direct effects of selective logging on birds, mammals, reptiles, amphibians and fish on Kalimantan.

Their most important conclusion is that selective logging has fewer adverse effects than is often believed. It did turn out that ground-dwelling, insect eating birds and mammals declined in numbers. According to the authors, this was because of the Indonesian law, which requires that logging companies clear away lianas and low vegetation. This is, therefore, not an irreversible effect of selective logging. Further adverse effects result from increased hunting and fragmentation (roads pose a barrier to some species).

Mannan *et al.* (2008) concluded that ground-dwelling fauna profits from responsible management in FSC certified concessions in Dermakot (Sabah, Malaysia). Mammals and flying insects were also found in Dermakot in similar numbers as in a protected area, although additional research on these groups was recommended. The authors link the positive results to FSC management. They mention the FSC requirement that fruit bearing trees, dead trunks, large trees and ground cover must be maintained, which leaves the biodiversity relatively intact.

Some large mammals were found in greater numbers in the Dermakot FSC concession than in surrounding protected areas. As a possible explanation, it was mentioned that the FSC concession, with its guarded access roads, offered better protection from hunting than the protected areas (Mannan *et al.*, 2008).

Latin America

Comparable results are emerging from the Amazon. Azevedo-Ramos *et al.* (2006) investigated the species richness, composition and population densities six months after a number of FSC concessions had been logged. The most significant effect was an increase in the number of species of birds, insects and arachnids (spider-like arthropods). Such increases also occur naturally after minor disturbances, such as tree fall. No effect of selective logging was found on mammals. The scientists did remark, however, that the areas investigated were surrounded by rainforest and so could easily be re-colonised, if species had disappeared or migrated because of the (selective) logging.

In 2007, the Bolivia es Forestal (BOLFOR) Project and the Instituto Boliviano de Investigación Forestal (IBIF) presented two studies (Alarcón *et al.*, 2007; Licona Vasquez *et al.*, 2007), concerning the effects of logging on reptiles and amphibians, and the effects on birds in the last remnants of rainforest, respectively. FSC certified logging appeared to have no significant effects on the numbers of species studied, while non-selective logging was found to have adverse effects.

Africa

A number of relevant studies appeared from the Congo Basin in 2008 and 2009. Van Vliet and Nasi (2008) concluded that the mammal distribution in a concession in Gabon was influenced more by roads and hunting than by the direct effects of logging. Duikers and small diurnal monkeys are more common at greater distances (3–10 km) from roads than in the vicinity of roads and villages. Elephants, water buffalo, gorillas and chimpanzees however, did not seem to be much affected by the roads.

Arnhem (2008) investigated the concessions in South East Cameroon. After selective logging, duikers, and gorillas appear to temporary decline in numbers. However, they reappear rapidly, in even greater numbers. The explanation brought forward is that they might profit from new vegetation in the logged clearings. A number of species increased their foraging area (including the red river hog). Elephants and chimpanzees, however, were sensitive to logging. Arnhem studied the situation relatively soon after the logging, so long-term effects cannot be indicated.

The populations of five primate species have been tracked in Uganda for 28 years (Chapman *et al.*, 2000). Censuses were undertaken in unlogged, selectively logged and non-selectively logged areas. Non-selective logging appeared to have had severe adverse effects on two of the species observed (blue monkey – Cercopithecus mitis , and redtail monkey – Cercopithecus ascanius). The populations of these species had not recovered even decades after logging. By contrast, selective logging appeared to have no effect whatsoever on any of the five species of primate: population numbers were the same in unlogged forests and those that had been logged selectively.

3.3 Explanations of the effects found

In recent years especially, studies have appeared that investigate not only the direct and indirect effects of logging, but also consider possible explanations.

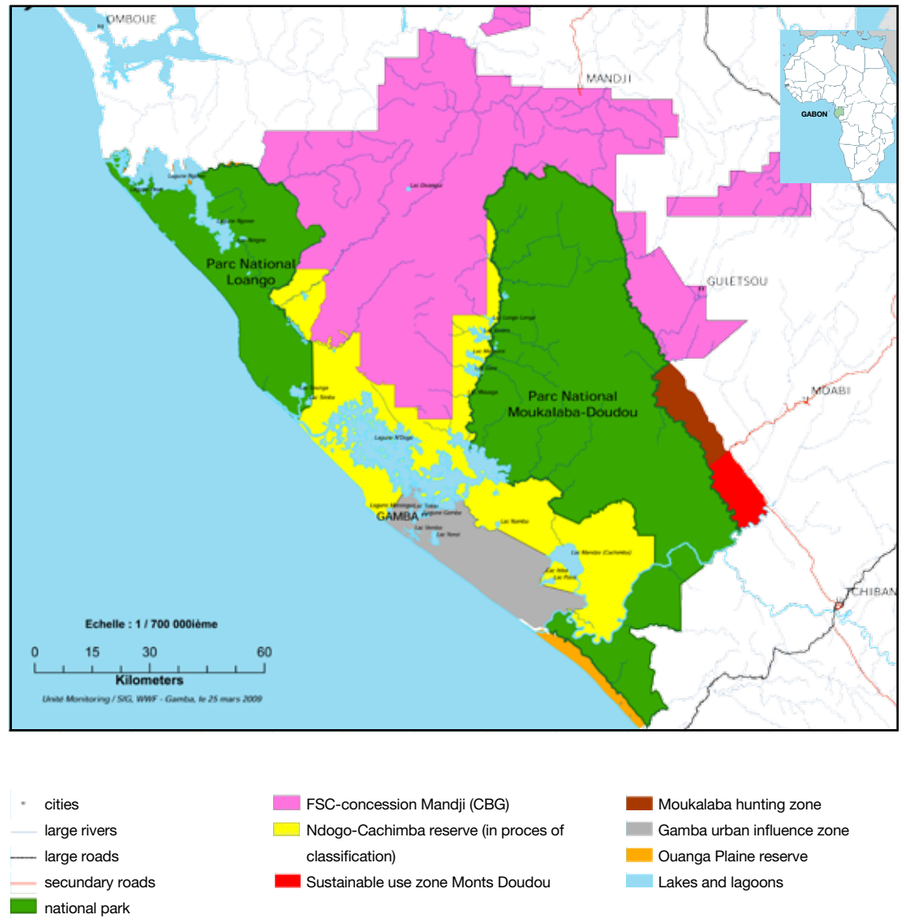
Clark *et al.* (2009) conducted extensive research in the Republic of Congo (Brazzaville). The area studied contained logging concessions (some FSC, some en route to FSC) and protected areas with little hunting. This, in other words, was a good initial situation, but not one that could compare with many tropical rainforests. The study looked at the effects of a number of factors, including distance from protected areas, distance from roads and villages, time since logging, etc.

Some species were encountered in greater densities in concessions that had been logged than in un-logged forests (water buffalo and elephant in particular). Duikers also occurred in greater numbers in disturbed forests, except those near larger towns, where one might suspect greater pressure from hunting. The most striking conclusion, though, is that the total species diversity is greater in concessions located in the vicinity of protected areas than those located further away. This would seem to indicate that protected areas serve as a refuge and/or recovery area for a number of sensitive species.

If future studies in other areas were also to indicate that biodiversity in logging concessions depends on the proximity of protected areas, it would be extremely relevant to the future planning of protected areas and logging concessions.

Furthermore, Clark *et al.* found that species diversity increased with distance from roads and villages, and with time since the area was logged. This research clearly shows that different species respond differently to logging. It also shows that it is very difficult in the field to distinguish between logging's direct and indirect effects. While logging was found to affect some species adversely, Clark *et al.* conclude that responsibly managed concessions can extend, but not replace, the protected area networks for many of Central Africa's most threatened species.

***Figuur 3.1** FSC logging concession bordering national parks (example Gabon)*



Similar to Clark *et al.*, Meijaard and Shell (2008) looked at a number of published reports on the effects of logging on mammals on Kalimantan, in an attempt to explain the results. What do the sensitive species have in common? And can this explanation lead to a prediction of other species that may be sensitive to logging, even though they have not yet been studied?

The species that respond badly to logging turn out to occupy a narrow ecological niche. They are specialist feeders or else they are very specific in their choice of habitat, being found only in the canopy, for instance, or on the forest floor. The less sensitive species are less specialised and are younger in evolutionary terms (Meijaard *et al.*, 2008). As in Africa, hunting appears to have far more impact on species' survival or density than the direct effects of logging.

4

Effects of selective logging and FSC on great apes

This chapter looks at a number of studies about the effects of selective logging and FSC on the great apes. Section 4.1 deals with the western gorillas and chimpanzees together since they inhabit the same areas. Insufficient relevant information could be found on the bonobo and eastern gorilla. Section 4.2 deals with the orang-utan. Section 4.3 shows the contemporary relevance of FSC for the great apes.

Great ape population densities published in the studies are not repeated in this report: densities obtained in different studies cannot simply be compared, partly because different survey methods are used.

4.1 Chimpanzees, bonobos and gorillas

Morgan and Sanz (2007) attempted to gain some insight into the effects of logging on African great apes by looking at a large number of scientific studies published in the last 20 years. The results are not unanimous. What is clear in any case is that non-selective logging has adverse effects. This is caused, amongst other, by the logging of important food sources (fruit trees in particular) and disruption. The effects of selective logging are more difficult to state. Gorillas seem to respond positively most of the time, but sometimes negatively as well. Chimpanzees appear to be more sensitive, even though some studies also report positive effects for this species (Putz *et al.*, 2001).

These conflicting results appear to stem in part from poorly designed studies. Morgan and Sanz conclude that the way population censuses are taken in an area is sometimes incorrect, leading to erroneous figures. They also encountered studies that compared areas that not only differed in terms of logging intensity, but were otherwise incomparable as well. In such cases the differences found in numbers of great apes cannot automatically be linked solely to the difference in logging intensity.

In many studies, Morgan and Sanz found that selective logging could have a positive effect on the numbers of western gorillas. An explanation is that selective logging leads to small clearings where grass and wild herbs can grow. Such plants are a significant source of food for the western gorilla.

Chimpanzees appear to be more sensitive to logging and the disruption it brings (including the noise of chainsaws and trucks, etc.). A possible explanation may be found in their extremely territorial behavior. Groups of gorillas live in overlapping areas. If a group flees before the loggers, it does not lead to problems with the other groups. Chimpanzees, by contrast, do not tolerate interlopers. If a group of chimpanzees flees before the loggers and ends up in another group's territory, it can lead to serious, sometimes lethal disputes (Morgan and Sanz, 2007).

Nevertheless, there are also examples of chimpanzees that, just like the gorillas, profit from the greater food supply after selective logging, as shown, for example, by studies from Uganda. Chimpanzees are also found in the unprotected, logged forests north of the Dja Reserve in Cameroon in comparable population densities to those in the reserve (Dupain *et al.* 2004).

Morgan and Sanz also looked at logging's indirect effects. The most important of these is an increase in hunting. A large number of studies report that the large mammals (elephant, gorilla, chimpanzee, the other primates and duikers) decline in numbers after the logging companies have laid down roads. If hunting pressure is high and government control poor, edible species can be completely wiped out in a zone

several kilometres wide around the roads. The ‘bushmeat’ trade – meaning meat from wild animals hunted in the rainforest – has increased tremendously in recent years and has become commercialised. Moreover, bushmeat is offered to the logging company’s employees. So, in effect, logging companies provide a new, local market, which only serves to make the bushmeat trade even more lucrative.

Since the Morgan and Sanz report was published, several new studies have appeared on great apes in FSC concessions. In a survey of FSC concessions run by CEB / Precious Woods Gabon, the population densities of gorillas found in areas which had been logged a decade previously were comparable to those found in reserves (Barroso Pujol, 2008). Intensive control ensures that there is barely any hunting in the concession. The gorillas do not seem to be frightened, building their nests to within a few hundred yards of the roads.

Campo Ma’an National Park houses healthy chimpanzee populations. This forest was used by logging concessions for 25 years before it gained national park protection in 2004. Logging thus did not lead to the chimpanzees’ disappearance (Martin Tchamba, WWF-Cameroon, personal communication, 7 July 2009).

There are high population densities of gorillas in IFO / Danzer’s FSC concession, which has an area of 1.16 million hectares (Van Loon, personal communication, 25 June 2009, based on data from the IFO Forest Management and Fauna Inventory (2001–2004); the WCS Fauna Inventory, 2007; IFO, 2007; SGS, 2009; Von Gagern, 2009). Especially in the managed forest ‘UFA Ngombé’, which is situated alongside the Odzala-Kokua National Park. Chimpanzees are found, too, but in lower densities than in the neighbouring concessions of the CIB / DLH Group. A possible explanation is that the Ngombé managed forest is an open forest with herbs of the Marantaceae (arrowroot) family in the undergrowth, which makes it less suitable for the chimpanzee. In this concession the distance to protected areas seems to have no effect on chimpanzee and gorilla population densities. Although IFO is cooperating with WCS and the government to prevent poaching and unsustainable hunting by means of so-called ‘eco-guards’, a main concern for Van Loon is the long term and intensive control of hunting in both concessions and national parks in northern Congo. Here more government and donor support is needed.

In a presentation to the Gorilla Symposium (9–10 June 2009, Frankfurt), Danzer’s von Gagern entered a plea for a network to be set up linking protected areas and logging concessions. Logging companies provide employment, income and local development, and ensure long-term finance for the protective activities of eco-guards. Furthermore, they also pay taxes, part of which should flow back into the region. Von Gagern states that responsible management of the logging concessions must form part of the protection of vulnerable species. Furthermore, governments and donors must ensure the long-term funding of protected areas, to avoid severe hunting pressure etc.

Further relevant work in a concession in South East Cameroon is reported in Arnhem *et al.* (2007) and Arnhem (2008). The concession is not FSC certified, but selective logging is practised. The first study’s conclusion is similar to those of earlier studies of African great apes and logging. The western gorillas only avoid recently logged areas in the concessions, while chimpanzees adapt less readily. In the 2008 study, Arnhem found that the number of gorillas in a logged area in the concession initially decreases, but the gorillas quickly reappear. The disappearance is thus clearly a response to the logging activities. The species, then, thrives in selectively logged areas of the forest, possibly thanks to an increase in the amount of food. This study, too, found that chimpanzees are more sensitive. The species avoids contact with humans and does not quickly return to a logged area.

In some areas, chimpanzees and gorillas do not seem to be affected by villages and roads. In a Gabon concession where selective logging was practised, Van Vliet and Nasi (2008) found considerably lower population densities of species that were hunted locally (small primates and duikers) within 3–10 km of the roads. Gorillas, chimpanzees, buffalo and elephants do not seem to respond adversely to roads and villages, even though it is known that buffalo (at least) are hunted locally. Van Vliet suggested as a possible explanation (personal communication, 24 June 2009) that roads are laid down mainly in the relatively open areas of the concession, which is the favourite landscape for, at least, the elephant, buffalo and gorilla. Incidentally, this study also showed, that most mammals do not respond adversely to the direct effects of logging in the concession.

The gorillas in South East Cameroon do not appear to experience much discomfort from selective logging, either. The population densities in national parks and concessions are comparable, the highest density being found in a logging concession (Nzooh *et al.*, 2008). This study claims that the quality of the forest’s management largely determines how well the large mammals fare. According to Nzooh *et al.*, concessions where logging companies practise responsible forest management and which are in the process of becoming certified process and, therefore, adort specific measures to avoid logging damage are home to higher population densities and more species than concessions where the loggers are not aiming for certification.

WWF CARPO collected figures on the population densities of chimpanzees and gorillas in Jengi (South East Cameroon). Gorillas are found in high densities in both national parks and logging concessions. Chimpanzees occur virtually only in national parks. There is a fair-sized population in a logging concession in the North West, but this is virgin rainforest that has not yet been logged. It is interesting to see that high densities of chimpanzees are found in Lobeke National Park, as this national park was a logging concession until 2004. It is likely that de chimpanzees returned after the national park’s foundation. (Zachari Nzooh, personal communication, 16 July 2009).

A large-scale study was conducted in the Republic of Congo (Brazzaville) into the effect of selective logging on large mammals (Clark *et al.*, 2009): 749 transects (straight lines travelled on foot through the forest) were traversed, covering a total of 3450 km, in a 1.2 million km2 logging concession leased by CIB, part of the DLH Group. This concession is partly FSC certified and partly en route to FSC certification. Clark *et al.* looked at the differences between unlogged and logged areas as well as the effects of roads, hunting pressure, the human presence, and the time elapsed since logging. The large mammal diversity in responsibly logged areas does not differ from protected areas. The population densities correspond fairly well, too. Certain species do decline in numbers in responsibly logged areas that are far removed from protected areas. Clark *et al.* thus draw the conclusion that responsibly logged forests are a good supplement to protected areas, but are no substitute for them.

Poulsen et al (2009) add a word of caution. They found that the development of industrial logging (including FSC-certified concessions) in the Republic of Congo led to a 69 percent increase in the population in logging towns in six years, and a 64 percent increase in bushmeat supply. Logging trucks were used to transport hunters and bushmeat. Poulsen et al conclude that controlling the bushmeat supply chain depends on engaging the private sector so that its actions complement conservation measures. They see room for optimism, because industry has been a willing and effective partner in conservation. The article ends with a set of recommendations for companies on how best to promote wildlife conservation and human livelihoods. These are: 1) supply protein to workers and their families at competitive prices, 2) contribute to wildlife law enforcement, 3) ensure workers only hunt legally, 4) formalize traditional systems of resource management in land-use planning, 5) close or guard roads, and 6) avoid urbanization in logging concessions.

According to David Greer (WWF CARPO, personal communication, 7 August 2009) FSC can go a long way towards making logging concessions more ape friendly if companies strictly adhere to the commitments they make under FSC standards. However, it is nearly impossible for logging companies to prevent the poaching of great apes without the help of local government. Serious and committed law enforcement efforts by host governments are indispensable. This includes dedicated anti-poaching patrols in the field and the effective prosecution of poachers.

No research data are available dealing specifically with selective logging and the bonobo, very probably due to the current political situation in the Democratic Republic of Congo, which is where the bonobo lives (south of the Congo River). A similar situation holds for the eastern gorilla. This species, too, lives mainly in the Democratic Republic of Congo. Miles and Caldecott (2005) state that bonobos are flourishing fairly well in logged forests. Nevertheless, logging, with the accompanying increase in hunting pressure, forms the most significant threat since there is a large overlap between the logging concessions and the bonobo distribution area.

4.2 Orang-utans

In the 1970s and ’80s it was assumed that orang-utans were extremely sensitive to any form of disruption (Payne and Prudente 2008). Rijksen (1978) wrote: “The orang-utan is a component of an intact ecosystem ... Every form of commercial exploitation within this ecosystem is incompatible with the proposed goal of preserving the system. The removal of components (e.g. ‘selective logging’ or ‘selective hunting’) does real damage to the balance of the system.”

Payne (1988) however found that the majority of the estimated 20,000 orang-utans in Sabah in the mid 1980s were in logged forest, and reported contrary to earlier reports, forests support similar average population densities of orang-utans before and after commercial extraction of timber.

Later studies (including that of Rao and Van Schaik, 1997), however, concurred with Rijksen’s earlier conclusion, stating that orang-utan population densities are adversely affected by selective logging, with the density in a forest that had been logged five years previously about 40% lower than in an unlogged forest, but the ecological mechanisms behind this remain unknown. Orang-utans in previously logged forests eat more leaves and less fruit; they are more nomadic and rest less. Fruit is a more suitable food for orang-utans than leaves. Fruit supplies more energy, the animals, therefore, have to spend less time eating. Felling fruit trees is an example of a direct effect of logging on orang-utan numbers.

On 27 February 2001, in an interview reported in Science Daily, Van Schaik referred mainly to the indirect effects. “Unfortunately, selective logging is rarely followed by the 30-to-40 year rest period prescribed by law. Instead, timber removal continues, illegally now, until just about all of the timber-sized trees of commercially valuable species are gone.”

Felton *et al.* (2003) and Morrogh-Bernard report comparable results to Rao and Van Schaik. In an area of the forest that had been logged two years earlier, Felton *et al.* found, for example, 21% fewer orang-utans than in an unlogged area. A possible explanation they suggested was the lower incidence of fruit trees in the logged area.

A number of recent studies sketch a different picture, though. According to these, orang-utans can recover well after an area has been logged. Knop *et al.* (2004), for example, compared a forest that had been selectively logged 22 years previously with an ecologically very similar forest that had not been logged. The orang-utan population densities were similar.

Acrenaz *et al.* (2004, 2005) offered a possible explanation for these new results. Just like the African great ape work of Morgan and Sanz (2007), Acrenaz *et al.* found in South East Asia that a number of previous surveys had been inadequately designed. The densities of great ape populations were most often determined by counting along transects. If the transects are not representative, or if the counters are of varying quality, then the results cannot be used without qualification. Another source of error arises when the results are extrapolated from a relatively small sample, which magnifies any errors in the experimental design.

Acrenaz *et al.* also work with data obtained from transects, but supplement them with counts made from helicopters. These turn out to supply far more accurate results. Orang-utans in the study area (Kinabatangan, Sabah) seemed to adapt better to disruptions than previous research had shown. This is important information, since 60% of orang-utans on Sabah live outside the protected areas in production forests that have already been logged several times and where logging continues. High population densities are mainly encountered in the Dermakot FSC concession. Densities are clearly lower in conventionally logged concessions. The authors enter a plea for an ecological network of protected areas, semi-natural landscape elements, and logging concessions for the long-term protection of the great apes.

Meijaard *et al.* (2005) supplied a breakthrough in our knowledge of the effects of logging on biodiversity. In their book 'Life after Logging', the authors look at a large number of studies of the effect of selective logging on different groups of animals on Kalimantan. In general, it seems that primates, especially the generalists, can adapt reasonably well. They are successful in absorbing changes in the structure and composition of the forests by changing their behaviour and diet.

Meijaard *et al.* state there is a lot of overlap between their recommendations and the FSC Principles and Criteria. They do, however, plead for more attention to landscape planning. An FSC concession can only maintain a high degree of biodiversity if it is permanently connected to protected areas and other responsibly managed forests. Their study shows that fragmentation is one of the most important causes of a decline in biodiversity. They also state that FSC would be even more effective in conserving biodiversity if the requirements imposed on hunting were better defined.

Specifically with respect to plantations and orang-utan Meijaard notes (personal communication, 11 August 2009) that fulfilling FSC standards alone is not enough to maintain viable populations. Through USAID's Orangutan Conservation Services Program new guidelines are being developed for management of orang-utan populations in different industrial settings (pulp and paper, natural timber, oil palm, and mining). These guidelines will be based on existing certification criteria, but they will add considerably to that, especially in concession design/land use planning, corridor planning and design, and specific management of hunting and human-animal conflict issues, and a range of habitat management and protection issues.

An extensive study carried out in Eastern Kalimantan (Marshall *et al.*, 2006) correlated the population densities of orang-utans with logging intensity, distance to villages, distance to villages where hunting is pursued, the number of fig trees, height above sea level etc. The area is logged selectively; there is no really destructive logging. The only factor found to be related to orang-utan population density was the distance to the nearest huntsmen's village. In other words, only hunting was shown to have an adverse effect on orang-utans. Marshall *et al.*'s conclusion is therefore that selectively logged forests are very important for the preservation orang-utans, but only if hunting pressure is low or absent.

Husson *et al.* (2008) took a critical look at all previous studies. As Acrenaz (2004) had already suggested, many did indeed appear to have been poorly designed. Transects were not always representative and some results were far too readily extrapolated. Some studies of the effects of logging on orang-utan density compare areas that differ in significant respects. Therefore, the reported differences in orang-utan density cannot automatically be ascribed to the effects of logging.

After a thorough analysis of previous studies, Husson *et al.* found little difference in orang-utan numbers in areas that were un-logged or selectively logged. There were clearly fewer orang-utans in non-selectively logged areas. If adverse effects were found of selective logging, these were indirect. Opening up a forest for logging nearly always leads to increased hunting and other forms of disruption. In areas subject to great hunting pressure, the harm done by hunting is always greater than that from logging.

Payne and Prudente (2008) state that orang-utans can survive well in responsibly logged areas. This is demonstrated by the high orang-utan density in the FSC certified Dermakot (Sabah) concession (55,000 ha). Payne and Prudente conclude that responsible logging should be undertaken in all forests on Borneo and Sumatra where orang-utans are found and which cannot be transformed into protected areas.

Wich et al (2008) also recognise good possibilities for the preservation of orang-utans within concessions. They state the following conditions: logging should be done selectively, fruit trees must be kept intact and hunting should be sharply monitored.

The Husson et al (2008) study showed that the Bornean orang-utan can better withstand the direct effects of logging than its Sumatran counterpart. This is probably because the Bornean orang-utan is less specialised in its feeding habits. This species (especially the subspecies P. p. morio) occurs in forests where there are natural periods of fruit scarcity, so they more easily switch to leaves. Moreover, the leaves of pioneer plants that colonise the areas cleared by logging are suitable forage for the Bornean orang-utan (Payen and Prudente, 2008). Within the natural habitat of the Sumatran orang-utan there is always fruit in ample supply and this species therefore persists on a fruit diet, even after logging has removed the supply.

***Table 4.1** Area of FSC certified forest in countries where great apes are found*

COUNTRY[1]	TOTAL FOREST AREA, INCL. PLANTATIONS (HA)[2]	AREA OF FSC CERTIFIED FOREST, INCL. PLANTATIONS (HA)[3]	FSC CERTIFIED AREA AS PERCENTAGE OF TOTAL FOREST AREA, INCL. PLANTATIONS
Angola	59,104,000	0	0
Burundi	152,000	0	0
Central African	22,755,000	0	0
Congo, Democratic Republic	133,610,000	0	0
Congo-Brazzaville	22,471,000	1,907,843 (Congolaise Industrielle des Bois: 452,200 ha Congolaise Industrielle des Bois: 296,000 ha Industrie Forestière de Ouesso: 1,159,643 ha)	8.5
Equatorial Guinea	1,632,000	0	0
Gabon	21,775,000	1,873,505 (CBG: 568,543 ha CEB - Precious Woods: 616,700 ha ROUGIER GABON / CIFHO: 688,262 ha)	8.6
Ghana	5,517,000	0	0
Guinea	6,724,000	0	0
Guinea-Bissau	2,072,000	0	0
Indonesia	88,495,000	1,090,060 (Koperasi Hutan Jaya Leastari (KHJL): 613 ha Koperasi Taman Wijaya Rasa (KOSTAJASA): 119 ha KSU ALAS MANDIRI KTI (KAM KTI): 152 ha PT Diamond Raya Timber: 91,660 ha PT Erna Djuliawati: 184,206 ha PT Intracawood Manufacturing: 195,110 ha PT Sari Bumi Kusuma: 147,600 ha PT Sumalindo Lestari Jaya Tbk: 267,600 ha PT Xylo Indah Pratama: 203,000 ha)	1.2
Ivory Coast	10,405,000	0	0

1 Source: http://www.unep.org/grasp/images/grasp-physical_map-A4.jpg and http://www.unep.org/grasp/images/grasp-Asia-physical_map-A4-rev2.jpg

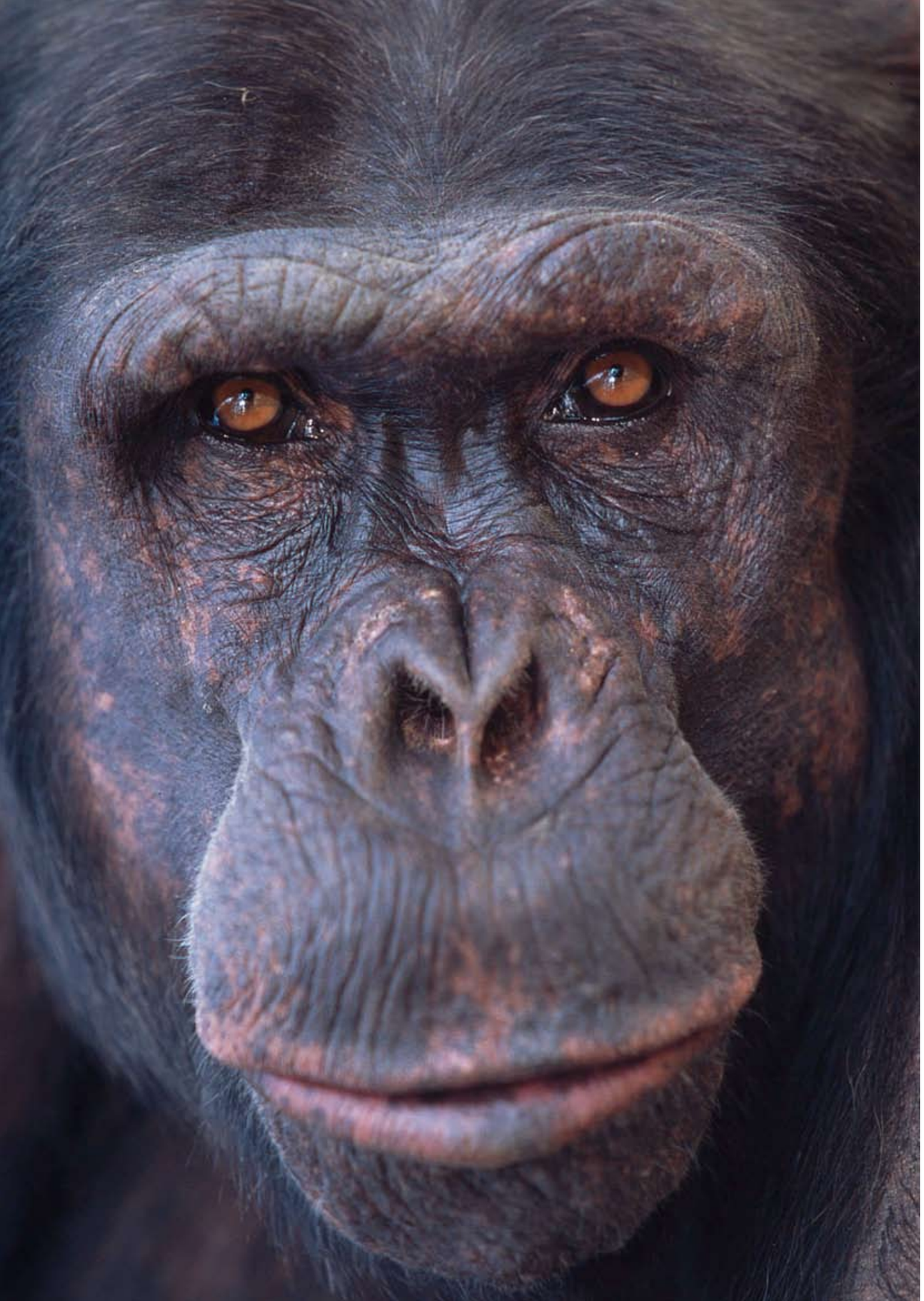
2 Source: FAO, Global Forest Resources Assessment 2005 (http://www.fao.org/forestry/32185/en). Note: If the trend indicated by FAO in 2005 has continued (FAO, 2005), the area of tropical forest will have declined by several percent in the period 2005–2009.

table 4.1 (continued)

COUNTRY[1]	TOTAL FOREST AREA, INCL. PLANTATIONS (HA)[2]	AREA OF FSC CERTIFIED FOREST, INCL. PLANTATIONS (HA)[3]	FSC CERTIFIED AREA AS PERCENTAGE OF TOTAL FOREST AREA, INCL. PLANTATIONS
Cameroon	21,245,000	878,896 (PALLISCO et Partenaires : 341,708 ha SEFAC SA: 314,655 ha Transformation Reef Cameroun: 125,490 ha WIJMA DOUALA: 97,043 ha)	4.1
Liberia	3,154,000	0	0
Malaysia	20,890,000	203,842 (Asiaprima RCF Sdn Bhd: 4,884 ha Kumpulan Pengurusan Kayu Kayan Terengganu Sdn. Bhd.: 108,900 ha Perak State Development Corporation: 9,000 ha Sabah Forestry Department: 55,139 ha Sabah Softwoods Berhad: 25,919 ha)	1
Mali	12,572,000	0	0
Nigeria	11,089,000	0	0
Uganda	3,627,000	204,207 (The New Forests Company (Uganda) Ltd: 12,607 ha UWA-FACE Mt Elgon National Park: 112,100 ha UWA-FACE Kibale National Park: 79,500 ha)	5.6
Rwanda	480,000	0	0
Senegal	8,673,000	0	0
Sierra Leone	2,754,000	0	0
Sudan	67,546,000	0	0
Tanzania	35,257,000	36,359 (Green Resources Ltd: 18,379 ha Mpingo Conservation Project: 2,420 ha TANWAT: 15,560 ha)	0,1

3 Source: FSC registered valid certificates, audit date: 24 July 2009 (http://www.fsc-info.org/VController.aspx?Path=5e8cddf3-9b09-46c6-8b11-2fbdad9e2d71&NoLayout=true).

Note: Great apes are not found in all FSC concessions.



4.3 Relevance of FSC to great apes

The studies cited above show that FSC concessions can potentially be suitable habitats for great apes, especially if strict adherence to FSC standards is achieved. It has been shown for western gorillas and Bornean orang-utans in particular that they can recover in selectively logged forests, subject to low hunting pressure (FSC standards require that hunting is controlled in their concessions, in contrast to ordinary selective logging). This means that FSC certification of tropical rainforests is an appropriate contribution to great ape conservation.

If viable great ape populations are to be preserved for the long term, FSC concessions must be inserted into large, interconnected networks of effectively protected areas. The networks must be situated in the major habitats.

As table 4.1 shows, however, only a small part of the great ape habitat is FSC certified. Since the table does not distinguish between natural forests and plantations, the actual picture is even less optimistic. This holds in particular for the orang-utans, since a significant fraction of the FSC concessions in Malaysia is composed of plantations.

The situation is better in the Congo Basin, where FSC certification is even now contributing to the responsible management of the great apes' habitat. All certified forests in Congo-Brazzaville, Gabon and Cameroon are natural rainforests, most of them housing great apes. The first FSC certificate was granted here in 2005. A milestone was reached in 2007, when 1 million ha of forest was FSC certified. Currently more than 4.5 million ha in the Congo Basin is FSC certified. A number of companies in the region are seeking to bring their activities into line with the FSC regime, so it is expected that the total area of FSC concessions in the Congo Basin will increase in the future.

While FSC is a suitable instrument, contributing to great ape conservation, it is still far too infrequently employed. A number of research reports on the effects of logging on biodiversity, therefore, insist that the governments both of producer and consumer countries must make certified timber more commercially attractive (Borner and Atok, 2008; Dennis et al., 2008; Mannan et al., 2008; Peña-Claros, 2009; Sayer et al., 2008).

Bas Huijbregts (WWF CARPO, personal communication, 18 July 2009) expressed some concerns about FSC. A company is free to decide to terminate its certification at any time. Moreover, after a concession contract expires, the government may decide to hand over the concession to a company that does not operate responsibly. It is also possible for a government to issue mining or oil extraction licences, right in the middle of an FSC concession (which would probably result in a loss of the logging company's FSC certification). It would be better if the government were to demand responsible management, specifying (FSC) certification as the means by which that is to be attained.

5

Conclusions

The information presented in the foregoing chapters permits the following conclusions to be drawn.

Non-responsible logging is harmful to the great apes.

Non-selective and selective logging often lead to poaching, illegal logging and the transformation of habitat for other uses. These indirect effects of logging in particular exert a powerful, adverse effect on great apes. Some direct effects, such as the felling of fruit trees, can also have an adverse effect on the apes.

Logging concessions play a crucial role in the continued existence of the great apes.

Great apes dwell in larger numbers in logging concessions than in protected areas. Approximately 75% of the Bornean orang-utans live in logging concessions. It is known, too, that in the Western Congo Basin larger fractions of the populations of gorillas and chimpanzees are found in logging concessions than in protected areas. Effectively protected national parks and nature reserves are preferable habitats. However, since so many great apes dwell in logging concessions these areas are crucial to their continued existence.

High population densities of great apes can be found in selectively logged concessions where hunting pressure is low.

Selectively logged concessions where there is little or no hunting can house high densities of western gorillas. They do migrate when logging is in progress, but they then return quite quickly to profit from the herbs growing in the logged clearings. Chimpanzees appear more sensitive to human activities. They are very territorial, in contrast to the gorillas, which means they cannot temporarily migrate without risking violent conflicts with neighbouring groups. Nevertheless, examples are known of chimpanzees residing in areas where trees have been felled. The Bornean orang-utan can also achieve high population densities in concessions with selective logging and low hunting pressure. The Sumatran orang-utan, which is less flexible in its dietary habits, seems to be more sensitive to the direct effects of logging than its Bornean counterpart. Too little research is available on the eastern gorilla and the bonobo to be able to draw any conclusions about their chances of survival in logging concessions. However, their territorial behaviour is not as strong as the chimpanzees' and therefore seems to favour their survival.

FSC certification offers, in comparison to other forms of logging, a good assurance of suitable living conditions for great apes in logging concessions.

A number of surveys have found high great ape densities in FSC concessions or concessions en route to FSC certification. The most significant advantage of FSC over all other forms of logging is that FSC standards combine selective logging with the avoidance of negative indirect effects. In FSC concessions, for example, hunting is countered by closing off and guarding the roads. Fruit trees, which are important to the great apes, are not felled.

The great apes will only survive over the long term in networks of protected forests, certified logging concessions and other suitable habitats.

What is needed in most regions is a mosaic of protected areas and other forests to preserve sufficiently large, contiguous areas of forest for the conservation of viable great ape populations. Logging concessions, provided they are FSC certified, form the best supplement to protected areas. Governments, nature conservation organisations and logging companies must collaborate more to better integrate management of protected areas and FSC concessions so as to benefit the great apes' chances of survival. Some studies have found high densities of great apes mainly in logging concessions bordering on national parks or otherwise fully protected areas. This needs further study as it could be relevant when planning protected areas and logging concessions.

As yet, only a small area of the great apes' habitat is managed according to FSC standards.

Most of the logging concessions where the great apes dwell are not FSC certified. The area in South East Asia is virtually negligible, but growing. In the Congo Basin there are various large FSC concessions housing healthy populations of gorillas and chimpanzees. The area involved (4.5 million hectares) is still a small fraction of all logging concessions, but it is increasing thanks to the growing demand for FSC products in Europe and elsewhere.

If FSC's relevance to great ape conservation is to increase, FSC certification must be given more political and financial support

Even though FSC certification is a suitable instrument contributing to great ape conservation, it is, however, still far too infrequently utilised. Several parties can help to stimulate further development.

Governments, private sector and consumers in consumer countries should give preference to FSC certified timber.

Governments of producer countries should promote FSC certification by creating an enabling environment (fiscally, legally, etc) and by active law enforcement (specifically anti-poaching). Furthermore, they should provide better guarantees that FSC certified forests will continue to be managed responsibly in the long term.

Glossary of abbreviations

BOLFOR	Bolivia es Forestal
CEB	Compagnie Equatoriale des Bois
CIB	Congolaise Industrielle des Bois (Congolese company that produces, processes and exports a wide variety of African timber species)
CIFOR	Centre for International Forestry Research
DLH	Dalhoff Larsen & Horneman (Danish company trading throughout the world in timber and timber products)
FCAG	Forest Certification Assessment Guide
FSC	Forest Stewardship Council
GRASP	Great Apes Survival Partnership (collaboration between UNEP and UNESCO)
IBIF	Instituto Boliviano de Investigación Forestal
IFO	Industrie Forestière d'Ouesso
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
RIL	Reduced Impact Logging
TFT	Tropical Forest Trust
TNC	The Nature Conservancy
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific en Cultural Organization
USAID	The U.S. Agency for International Development
WCS	Wildlife Conservation Society
WWF	World Wide Fund for Nature
WWF CARPO	World Wide Fund for Nature, Central African Regional Programme Office

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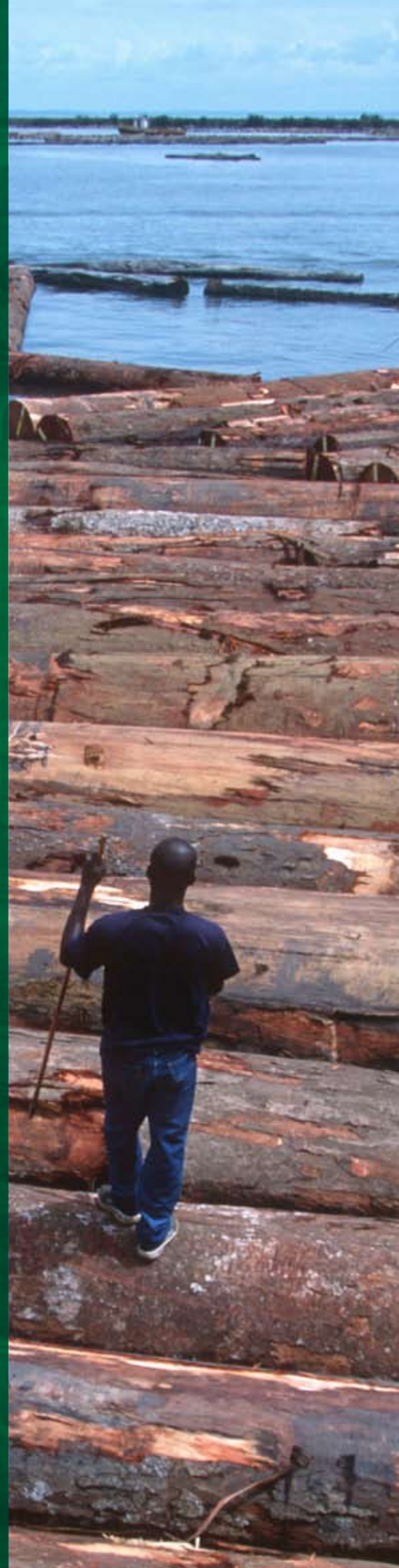

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