CHAPTER 2

Encroaching on Ape Habitat: Deforestation and Industrial Agriculture in Cameroon, Liberia and on Borneo

Introduction

The expansion of industrial agriculture is a primary driver of tropical forest loss (Kartodihardjo and Supriono, 2000; Abdullah and Nakagoshi, 2008; Sodhi *et al.*, 2010). Tropical forests harbor high levels of terrestrial biodiversity and are the principal habitat for apes in Africa and Asia (Junker *et al.*, 2012). Numerous agro-industrial crops are found in ape ranges, including oil palm, peanut, rubber and sugarcane, as well as banana, cacao, coffee, corn, sorghum and tea. This chapter places a particular focus on oil palm cultivation as its impact on tropical forests and various endangered species has been under the loupe far more than that of other crops, particularly in Southeast Asia.

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

Oil palm (*Elaeis guineensis*) is the most rapidly expanding industrial crop in the world (Miettinen *et al.*, 2012; FAO, 2014a), driven by a growing global market for palm oil for food, cosmetics, fuel and other industrial uses (Nantha and Tisdell, 2009). The global land area of mature oil palm rose from 35,000 km² (3.5 million ha) in 1975 to 131,000 km² (13.1 million ha) in 2005 (Wicke *et al.*, 2011). Although oil palm originated in Africa, it has not been as extensively planted or intensively produced there as it is in Asia; however, a recent increase in investments in Africa suggests that the continent is likely to witness future expansion (Greenpeace International, 2012). Large areas of industrial land purchases for oil palm have recently been negotiated or are under negotiation across Africa (Carrere, 2010; Rainforest Foundation, 2013; see Chapter 3). The Congo Basin and West Africa have been identified as the continent's most suitable areas for oil palm expansion (see Chapter 1). Yet these areas overlap significantly with ape ranges (Wich *et al.*, 2014), raising concerns that their development will lead to biodiversity losses similar to those seen in Southeast Asia.

Indeed, it is highly likely that the future development of industrial agriculture will have a significant deleterious impact on ape habitats globally. Effectively addressing that threat calls for a solid understanding of the context within which industrial agriculture has evolved; to that end, this chapter presents spatially explicit information on the current overlap of ape habitats and industrial agriculture, based on research conducted by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC). The WCMC utilizes a number of data sets, including:

- the Land Matrix, a global, independent land monitoring initiative (Land Matrix, n.d.); and
- Global Forest Watch (GFW), whose online platform provides spatial data on land use and agro-industrial concessions. The source data of GFW are based on a combination of government documents, satellite imagery and GPS data.

The bulk of the chapter then focuses on the evolution of deforestation due to industrial agriculture across two countries—Cameroon and Liberia—as well as on the island of Borneo, which is divided among the countries of Brunei, Indonesia and Malaysia.

Key findings from this chapter include:

- Agro-industrial development is a major threat to ape populations across their ranges.
- While the drivers of deforestation are complex, the cause is largely attributable to a combination of poor planning and ineffective governance in relation to land use and tenure.
- Industrial agricultural estates are expected to expand, increasing pressures on ape habitats and existing populations—be it through loss and fragmentation of habitat, increased hunting or intensified conflict between ape and human populations.
- Oil palm and rubber are the crops that have caused the most significant levels of deforestation in Southeast Asia and are leading to the same in Africa.
- Liberia has the highest potential for oil palm expansion in Africa, yet 94.3% of the area suitable for oil palm lies in ape ranges that are unprotected.
- Findings indicate that crops as diverse as rubber, cotton, cacao and sugarcane affect the integrity of ape habitats across their entire range. This diversity implies that efforts to reconcile ape conservation with industrial agricultural development

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should consider broader responses in addition to addressing specific impacts of individual commodities.

Industrial Agricultural Concessions across Ape Ranges

There is a dearth of data on industrial agriculture—particularly spatially explicit data. The Land Matrix partnership provides data on transnational land deals (see Table 3.1 in Chapter 3, page 75). Precise geospatial information on land deals from the Land Matrix was available for 20 out of 30 countries that have ape ranges within their borders. In an analysis involving all 30 countries, land deals were attributed to the province or state level. Land deals were then classified by size and mapped accordingly. The precise geospatial information that was available for 20 countries was used in a separate, more detailed analysis (see Figures 2.1 and 2.2). However, due to paucity of comprehensive data on land deals, this analysis provides a conservative indication of the overlap between ape habitat and industrial agricultural concessions.

As of August 2014, the Land Matrix Global Observatory had information on approximately 1,800 land deals globally. The Matrix records 877 land deals among the countries that are home to habitat; meanwhile, 352—or 20% of all known land deals—are within or very near ape ranges in Africa and Asia (see Figures 2.1 and 2.2). The contract area of land deals is generally larger in Africa than in Asia; however, the number of deals is larger for some Asian countries, most notably Indonesia, which has 114 recorded deals, and Cambodia, which has 87. Deals in both countries show significant overlap with ape ranges and protected areas that host apes (see Box 2.1). In Africa, most land deals are found in Liberia (17) and Sierra Leone (20).

FIGURE 2.1

Contracted or Intended Land Deals in Ape Ranges in Africa

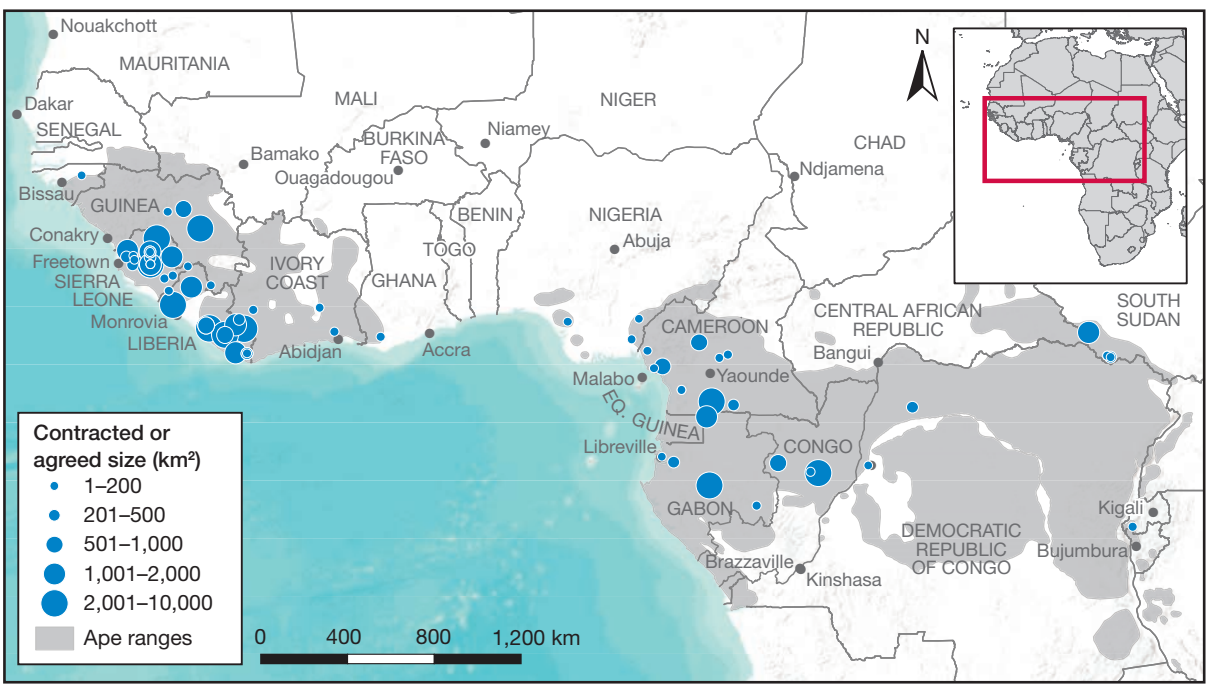

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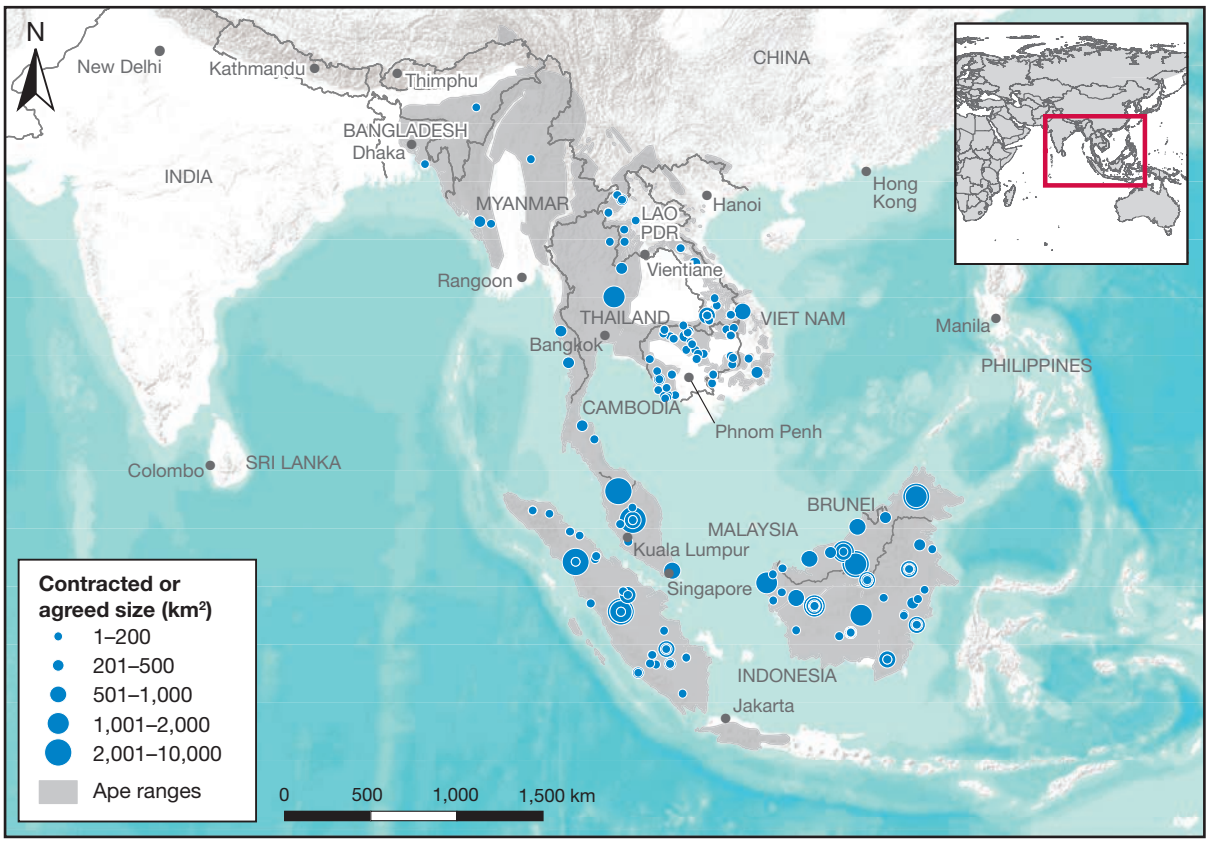
FIGURE 2.2

Contracted or Intended Land Deals in Ape Ranges in Asia



Notes for Figures 2.1 and 2.2: The size of land deals was defined as the reported contract size or, if this information was not available, the production size. If neither the contract nor the production size was available, the intended contract size was used.

Data sources for Figures 2.1 and 2.2: Land Matrix (n.d.); IUCN (n.d.)

Courtesy of UNEP-WCMC

BOX 2.1

Conflicting Interests in Cambodia: Protected Areas and Land Deals

Even though Cambodia has one of the highest deforestation rates in the world (Hansen *et al*., 2013)—with total forest cover that shrank from 72% to 48% from 1973 to 2014 (Open Development Cambodia, 2015b)—there is little information on the impacts of agricultural expansion on the country's apes. Cambodia's traditional industrial crop is rubber, which occupied about 2,800 km² (280,000 ha) in 2012; an additional 8,000 km² (800,000 ha) were earmarked for exploitation between 2012 and 2017. The Cambodian government has prioritized the development of economic land concessions, issuing a formal order to a number of government institutions to strengthen engagement in management systems, land allocation and land use (Cambodia, 2014). Increases in investments in both oil palm and rubber had already been observed before the order was issued (Colchester *et al.*, 2011).

Oil palm plantations have expanded into forested regions through the allocation of economic land concessions on state land to private companies, covering 1,180 km² (118,000 ha) in 2009 (Colchester *et al*., 2011). When it comes to the current total area of concession land, figures diverge: the Ministry of Agriculture, Forestry and Fisheries indicates that just over 12,000 km² (1.2 million ha) of land had been given out as of June 2012, yet some non-governmental organizations put that figure closer to 20,000 km² (2 million ha) (Open Development Cambodia, 2015a). Growers have planted additional crops, such as corn, soybean, cassava and mung bean (Cambodia, 2014).

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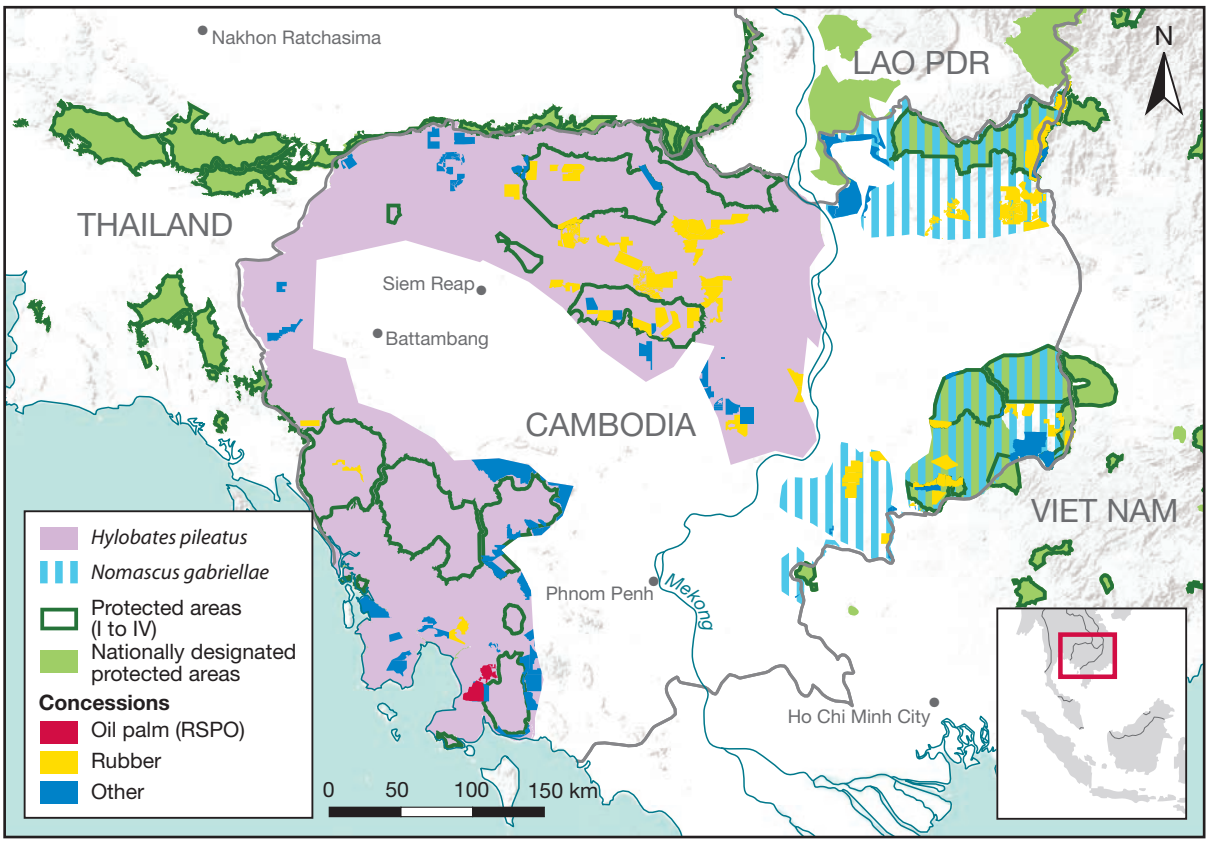
FIGURE 2.3

Overlap of Ape Ranges in Cambodia with Protected Areas, Agro-industry and Certified RSPO Sites



Note: This analysis includes only protected areas (as defined in the July 2014 version of the World Database on Protected Areas) with national protection designation; proposed protected areas are not included.

Data sources: WRI (2013); IUCN (n.d.); IUCN and UNEP (2014); Open Development Cambodia (2014)

Courtesy of UNEP-WCMC

It is estimated that the area of rubber in non-rubber growing areas in Southeast Asian countries, including Cambodia, could quadruple by 2050, replacing mainly evergreen broadleaf forests and vegetation that is currently under shifting cultivation (Fox *et al.*, 2012).

Cambodia has two gibbon species on the Red List of the International Union for Conservation of Nature (IUCN), the pileated gibbon (*Hylobates pileatus*) and the southern yellow-cheeked crested gibbon (*Nomascus gabriellae*). A third species, the northern yellow-cheeked gibbon (*Nomascus annamensis*), has been identified but has not yet been assessed by the IUCN. It is found in the northernmost block of the area currently identified as inhabited by the southern yellow-cheeked crested gibbon (B. Rawson, personal communication, 2015).

More than 100 of the 190 spatially explicit concessions for agro-industry in Cambodia are specific concessions for rubber plantations or mixed concessions of rubber and other crops (mainly acacia and sugarcane, with some oil palm). Rubber plantations occupy a total area of 5,566 km² (556,620 ha), which account for nearly 6% of ape ranges; other plantations take up an additional 4,875 km² (487,550 ha), or 5% of the range, bringing the total area of agro-industrial concessions in ape ranges close to 11%. Of the 239 km² (23,890 ha) dedicated to oil palm concessions in Cambodia, only one was RSPO-certified in 2013 (see Figure 2.3).

Several land deals appear to be located in Category I–IV protected areas and nationally protected areas (see Box 2.2); nearly all of these are rubber plantations. Agricultural concessions are not legally permitted in these categories but are now found in most of Cambodia's protected areas (Cambodia, 2014); as a result, the threat to the habitat they provide for apes and other species is significant.

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BOX 2.2

Protected Area Categories

The World Database on Protected Areas—the most comprehensive global spatial database on protected areas—is jointly produced by the IUCN World Commission on Protected Areas and the World Conservation Monitoring Centre of the United Nations Environment Programme (IUCN and UNEP, 2014). The protected areas are classified by IUCN management category, as follows:

- Category Ia: strict nature reserve
- Category Ib: wilderness area
- Category II: national park
- Category III: national monument or feature
- Category IV: habitat or species management area
- Category V: protected landscape
- Category VI: sustainable use of natural resources

These categories are distinguished by differences in the management approaches undertaken within protected areas (Dudley, 2008). Industrial agriculture is restricted in protected areas classified as IUCN Categories I through IV.

Industrial Crops in Ape Ranges

The degree to which agro-industry affects apes depends on the types of crops being cultivated in, and adjacent to, ape ranges. Apes may utilize crops for food, in competition with humans—which may result in human–wildlife conflict; humans may also destroy the forest habitat to make space for cultivation. Crops as diverse as oil palm, coffee, rubber and cotton impact the integrity of ape habitats across their entire range (see Table 2.1). In Uganda, the land used for sugarcane plantations underwent an 18-fold increase between 1988 and 2002, exerting a direct impact on chimpanzee behavior and survival (see Case Study 1.2 in Chapter 1, page 29). In Guinea-Bissau, monoculture cashew nut plantations are highlighted as a threat to the habitats of western chimpanzees (Carvalho, Marques and Vicente, 2013). Given the diversity of crops and their impacts, efforts to reconcile ape conservation with industrial agricultural development need to consider factors relating to particular crops as well as broader issues that are shaped by commodities in general.

Deforestation and Industrial Agriculture: The Cases of Cameroon, Liberia and Borneo

The context within which industrial agriculture manifests itself in ape range states can provide important insights into drivers that go beyond economic demands. This section presents a detailed analysis of the evolution and current situation of industrial agriculture and its overlap with ape habitats in Cameroon, Liberia and on the island of Borneo.

The countries of Cameroon and Liberia were selected because both are home to important ape ranges on a continent that has been experiencing recent expansion of industrial agriculture and that is likely to witness ensuing impacts on ape habitats and populations. Both these countries are important for apes, and civil society actors have scrutinized their performance and exposed related social and environmental impacts of the ongoing expansion of the palm oil industry. In contrast, Borneo has long experienced rapid and extensive deforestation due to industrial agriculture, which has been a key feature of economic development across the island since colonization. As Borneo is governed by three countries, it offers lessons based on differing trajectories, some of which can serve to inform how the industry might evolve in Africa in the absence of adequate mitigation measures.

Cameroon

Forest and Ape Status

The Republic of Cameroon lies in western Africa's Gulf of Guinea and is bordered by the Central African Republic, Chad, Equatorial

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TABLE 2.1

Summary of Impacts of Agribusiness Development on Ape Habitats in Ape Range Countries

Country	Industrial and cash crops*	Developments and coverage details	Impacts
Africa			
Burundi	Forest plantations for wood	Plantations replaced natural forests	41% of forest cover was lost from 1990 to 2010 (Nduwamungu, 2011)
Central African Republic	Coffee, cotton, tobacco, tree crops (IMF, 2008; FAO, 2014a)	Industrial crop production decreased in 2001–06 (IMF, 2008)	0.8% of forest cover was lost from 1990 to 2005 (Hansen *et al.*, 2013)
Democratic Republic of Congo	Cacao, coffee, oil palm, rubber, tea (FAO, 2014a)	Commercial agriculture is limited, but a high demand for oil palm is reportedly causing conversion of forests (Rainforest Foundation, 2013)	Currently the main threat is the hunting of apes for meat, which is exacerbated by habitat fragmentation (Hickey, Carroll and Nibbelink, 2012)
Gabon	Cacao, coffee, oil palm, rubber, sugarcane (FAO, 2014a)	Large-scale industrial agriculture is under development (Rainforest Foundation, 2013)	No direct impacts on ape populations reported, although they declined by more than half between 1983 and 2000, due to commercial hunting facilitated by logging (Walsh *et al.*, 2003)
Ghana	Cacao, coffee, oil palm, rubber (FAO, 2014a)	57% of the country is agricultural land (Oppong-anane, 2006)	Impacts of industrial agricultural development on apes not reported
Guinea	Coffee, fruits, oil palm, peanuts, rice (FAO, 2014a)	Guinea does not have any large oil palm plantations; most production comes from natural oil palm groves (Carrere, 2010)	None reported
Guinea-Bissau	Cashew nuts (Economy Watch, 2010)	Monoculture cashew nut plantations are possibly increasing (Economy Watch, 2010)	Intensive agriculture and commercial tree plantations have affected habitats suitable for western chimpanzees (Carvalho *et al.*, 2013)
Ivory Coast	Cacao, coffee, cotton, oil palm, rubber, sugarcane (Aregheore, 2009)	Cultivated land covers 21.8% of the country; the forest area produces the most export crops (Aregheore, 2009)	Severe deforestation in the past due to intensive logging and agriculture expansion (GRID-Arendal, 2005); decline in western chimpanzees due to hunting and habitat loss (Campbell *et al.*, 2008b)
Nigeria	Cacao, oil palm, rubber (Chapin Metz, 1991)	Oil palm and rubber predominate in the southeast and south-central areas (Chapin Metz, 1991)	Ape ranges are in the same areas as most oil palm and rubber plantations; apes are threatened by logging, hunting and agriculture, including plantations (USAID, 2008)
Republic of Congo	Cacao, coffee, oil palm, sugarcane, tobacco (FAO, 2014a)	Oil palm is increasing in importance (Carrere, 2010; FAO, 2014a); a single concession of 4,700 km² (470,000 ha) has been granted for oil palm plantations (Rainforest Foundation, 2013)	The area is the habitat of chimpanzees and western gorillas (Rainforest Foundation, 2013), both of which are already affected by disease epidemics and commercial wild meat hunting (Walsh *et al.*, 2003)
Rwanda	Coffee, tea	Industrial agriculture is limited, except tea and coffee (Rwanda, 2004); 50% increase in tree cover due to plantations developed in 1990–2005 (Butler, 2006; FAO, 2010)	50% of natural forest cover and woodland habitat was lost in 1990–2005 (Butler, 2006)

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Country	Industrial and cash crops*	Developments and coverage details	Impacts
Senegal	Cotton, peanuts	Agriculture is expanding inland	450 km² (45,000 ha) of forest is lost annually (New Agriculturalist, 2008)
Sierra Leone	Cacao, coffee, oil palm (IMF, 2011)	Exports of cacao, coffee and oil palm increased in 2008–12 (IMF, 2011); the number of oil palm concessions is growing (Carrere, 2010)	Much of the original forest cover was probably lost and the deforestation rate remains high (FAO, 2010) and is likely to have impacted ape populations
South Sudan	Peanuts	Large-scale land acquisitions have been made for timber and oil palm plantations (Future Challenges, 2011)	Developments are leading to deforestation (Future Challenges, 2011)
Tanzania	Cashew nuts, coffee, cotton, sisal hemp, tobacco	A government task force was set up in 2006 to promote oil palm production (Carrere, 2010)	Hunting and habitat loss have been the main factors affecting chimpanzee populations in their range in the Ntakata region (Ogawa, Moore and Kamenya, 2006)
Uganda	Coffee, sugarcane	The area of sugarcane plantations adjacent to Budongo Forest Reserve grew more than 18-fold, from 7 km² to 127 km² (690 ha to 12,729 ha) in 1988–2002 (Mwavu and Witkowski, 2008)	Forest loss is due to agricultural expansion (Mwavu and Witkowski, 2008); there are indications that ape populations persist in forest agriculture mosaics (Tweheyo, Lye and Weladji, 2004)
Asia			
Bangladesh	Jute, sugarcane (FAO, 2014a)	Land conversion and illegal logging are the main causes of deforestation (Kibria *et al.*, 2011; Islam and Sato, 2012)	Hoolock gibbon populations are affected by agricultural expansion and declines in natural forest areas (Muzaffar *et al.*, 2011)
China: Hainan province	Betel palm, cacao, cashew nuts, coconut, coffee, lemongrass, oil palm, pepper, rubber, sisal hemp, sugarcane	More than 90% of the land is under cultivation, including rubber plantations (Zhou *et al.*, 2005)	The Hainan gibbon is threatened by forest clearance: 7% of the habitat of the (estimated) remaining 20 individuals of the species was cleared in 1991–2008 (Zhang *et al.*, 2010)
China: southern Yunnan province	Rubber, sugarcane, tea, tobacco	The size of agricultural patches increased in 1965–92; cash crops replaced traditional agriculture (Fox and Vogler, 2005)	Loss of primary forest poses risk to gibbon survival (Fan Peng-Fei *et al.*, 2009)
India: the northeast	Coffee, rubber, tea	Assam state produces 53% of India's tea (Choudhury, 2009)	Agricultural encroachment, extractive industries and timber are the major threats facing the hoolock gibbons' survival (Das *et al.*, 2003; Choudhury, 2009)
Indonesia	Oil palm, rubber, tree plantations	Rubber, oil palm and pulp and paper plantations are primary agricultural crops; small-scale agriculture accounts for a significant proportion of forest loss (see the section on Borneo)	Between 2,383 and 3,882 orangutans have been killed annually; the killings seem more prevalent in areas of deforestation and plantation development (Meijaard *et al.*, 2012)
Lao People's Democratic Republic	Coffee, rubber	The government encourages foreign investment in rubber plantations (Hicks *et al.*, 2009); permanent intensive agriculture is spreading (Thongmanivong and Fujita, 2006)	None reported
Malaysia	Oil palm, rubber	Oil palm and rubber plantations cover around 60% of all agricultural land in Malaysia (Chee and Peng, 2006; Koh *et al.*, 2011)	Development of agricultural crops is a major cause of forest loss (Abdullah and Nakagoshi, 2008); conversion to oil palm threatens the survival of the Borneo orangutan (Nantha and Tisdell, 2009)

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Country	Industrial and cash crops*	Developments and coverage details	Impacts
Myanmar	Beans, jatropha, oil palm, pulses, rubber, sugarcane (ADB, 2013; FAO, 2014a)	Concessions for rubber plantations and oil palm are in development stages; more than 7,000 km² (700,000 ha) of concessions for industrial agriculture were granted by 2010—4,050 km² (405,000 ha) of which was for oil palm, including in the Tenasserim Division (Burma Environmental Working Group, 2011), home to the world's last remaining intact lowland dipterocarp rainforests (Geissmann *et al.*, 2013); agricultural concessions are sometimes granted inside protected forests (KDNG, 2010)	Forest conversion and plantation concessions are threatening the Hoolock and white-handed gibbons' habitat and associated biodiversity (Geissmann *et al.*, 2013)
Thailand	Cassava, coconut, corn, oil palm, rubber, sugarcane	Traditional subsistence farming systems are giving way to cash crops (Entwisle *et al.*, 2005)	Crop expansion is leading to forest fragmentation and large-scale deforestation (Entwisle *et al.*, 2005)
Viet Nam	Coffee, cotton, peanuts, rice, rubber, sugarcane, tea	Government aims to boost foreign investment in agriculture (Vietnam Briefing, 2014)	Past large-scale land use change has probably impacted gibbon populations; most, if not all, gibbon populations are highly fragmented and in decline (Rawson *et al.*, 2011)

Notes: * For all crops except palm oil, this table lists single-crop data from FAOSTAT rather than aggregates. Different crop categories can refer to oil palm, including fruit, kernels and "oil crops primary." A review of online country-specific resources was used to determine whether a crop is an industrial or cash crop, although that distinction is not always straightforward.

Guinea, Gabon, Nigeria and the Republic of Congo. It is home to more than 23 million people, with the highest human population densities found in southwestern Cameroon, near the border with Nigeria. The extent of forest cover in Cameroon has steadily declined, from about 243,000 km² (24.3 million ha) in 1990 to just under 200,000 km² (19.9 million ha) in 2010, a loss of roughly 18% with an average annual forest loss of 2,200 km² (220,000 ha) (FAO, 2010). An estimated 1.4% of Cameroon's dense forests—those with more than 50% tree canopy cover—were destroyed between 2000 and 2012; much of this forest loss was concentrated near the coast in southwestern Cameroon (Hansen *et al.*, 2013). For a detailed layout of land allocated to agro-industries in Cameroon, visit the World Resources Institute's Forest Atlas of Cameroon (WRI, n.d.-a).

Cameroon's forests are home to at least four ape subspecies: the Nigeria–Cameroon chimpanzee (*Pan troglodytes ellioti*), the central chimpanzee (*Pan troglodytes troglodytes*), the Cross River gorilla (*Gorilla gorilla diehli*) and the western lowland gorilla (*Gorilla gorilla gorilla*). These populations are distributed throughout the lowland and montane forest zone of southern Cameroon, including the administrative regions of Northwest, Southwest, Littoral, Center, South, and East (see Figure 2.4). Apes have been observed in 47 forest sites across Cameroon, including in 11 national parks, which provide apes with the highest legal protection (Arcus Foundation, 2014). Cameroon is an especially important site for the conservation of Nigeria–Cameroon chimpanzees and Cross River gorillas, as these subspecies are endemic to Nigeria and western Cameroon and are among the most threatened ape taxa.

The Development of Industrial Agriculture in Cameroon

Industrial agriculture has a long history in Cameroon, having been conceived and promoted by its colonial rulers, who developed

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an extractive and export economy (Gerber, Veuthey and Martínez-Alier, 2009). Starting as early as 1885 and continuing throughout German rule (1884–1916), German companies were awarded land primarily in today's Southwest region, along Cameroon's coastal area and around the fertile, volcanic soils of Mount Cameroon (Nguiffo and Schwartz, 2012b). Plantations were developed for growing bananas, oil palm, rubber and tea, all of which were primarily destined for the export market. The conversion of large tracts of land for agro-industrial development involved the expulsion and relocation of the indigenous people from the concession areas to "native reserves" (Konings, 1993; Njoh, 2002). People—both indigenous and from afar—were then brought in to serve as laborers in the plantations. Commercial plantation agriculture in coastal areas led to a large influx of migrant workers, who lived in company towns (Njoh, 2002).

Following Germany's defeat in World War I, the League of Nations divided German Kamerun into a British-mandated territory (Northern and Southern Cameroon, along the border with Nigeria, 1918–60) and a larger French-administered territory. Both colonial rulers continued the German tradition of developing large-scale, agro-industrial plantations and continued to enact laws that dispossessed indigenous people of their land by converting it into colonial property and instituting forced labor practices (Njoh and Akiwumi, 2012). Many of the former German plantations in the French territory were purchased by European private companies and later transferred to the agro-industrial company Société Africaine Forestière et Agricole du Cameroun (SAFACAM), established in 1897 as a rubber company and taken over by the Bolloré Group, a French private investment company, in 1997 (Oyono, 2013). The British inherited and retained most of the German plantation lands and, after World War II, they subsumed most of the plantations into a parastatal enterprise called Cameroon Development Corporation.

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After independence in 1960, Cameroon invested in state-owned plantations and reaffirmed state control over land and forest (Oyono, 2013). By the 1980s, however, a deep economic crisis led to structural adjustment policies imposed on the Cameroonian government by the World Bank, the International Monetary Fund and bilateral donors that aimed to privatize dozens of state-owned companies, including major agro-industries (World Bank, 1996). The goal of privatization was to increase the efficiency of agro-industrial production, increase domestic production and exports, and attract foreign investors (World Bank, 2004).

Together with these interventions, the development of Cameroon's land tenure and forest policies spurred agro-industrial expansion into the country's forests. Although the government is officially the "trustee" of most lands, the state apparatus acts as owner of all lands and regularly uses eminent domain (compulsory purchase) to displace local communities in order to grant national or private lands to foreign investors. Rural communities in Cameroon's forested zones exercise customary land tenure, but they lack legally recognized land rights on their individual lands and commons (Alden Wily, 2011). This legal framework facilitates state and investor control over forested lands and has laid the foundation for the expansion of agro-industrial development throughout Cameroon's forest zone.

While several government development strategies call for the expansion of large agro-industrial plantations (MINEPAT, 2009; MINADER, 2014), various complex external economic factors and domestic reforms are behind the most recent wave of land acquisition for plantation development in the country. Among these are:

- changing land use policies in Indonesia and Malaysia, which have led companies to diversify into Africa (Feintrenie, 2013);
- growing demand for biofuels (Danielsen, Beukema and Burgess, 2009);
- China's strategic partnership with the Government of Cameroon (Khan and Baye, 2008; Jansson, 2009);
- the perception that there is political stability in Cameroon (Feintrenie, 2014); and
- new foreign direct investment incentives and protections (MINEPAT, 2009; Hawkins and Chen, 2011).

All of these factors have contributed to the high demand from agro-industries for Cameroonian land.

As a result, Cameroon has witnessed a substantial increase in the scale of industrial agriculture in the 1990s and even more so in the following decade. Numerous agro-industries now operate throughout Cameroon's forest zone, primarily producing palm oil and rubber and, to a lesser extent, tea, rice, bananas and sugar, which, together, cover more than 3,000 km² (300,000 ha) of land (Feintrenie, 2014).

Agro-industry Development by Commodity

This section details the rise and expansion of Cameroonian agro-industries by commodity, with a particular focus on palm oil, rubber and sugar. It also considers how agro-industrial growth is likely to impact ape populations.

Palm oil

Cameroon has made agro-industrial oil palm development an economic priority. The government aims to increase palm oil production to 300,000 metric tons in 2015 and 450,000 metric tons by 2020 (Hoyle and Levang, 2012). Although artisanal processing will account for some of this increased production, the government is focused on expanding the total area under industrial oil palm development. It aims to accomplish this goal, in part, by leasing

Photo: In Cameroon, beginning as early as 1885, plantations were developed for growing bananas, oil palm, rubber and tea.

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large tracts of fertile land to foreign agro-industrial investors. Cameroon has thus positioned itself at the heart of a "new wave" of large-scale, industrial oil palm development in the African forest zone (Linder, 2013). This situation is especially unfavorable for ape conservation, as most agro-industries tend to clear primary and secondary forest for the development of oil palm plantations (Richards, 2013; Nkongho, Feintrenie and Levang, 2014).

Cameroon hosts three privately held agro-industrial oil palm producers—Société Camerounaise de Palmeraies (Socapalm), SAFACAM, and Société des Palmeraies de la Ferme Suisse—and two publicly owned ones—Cameroon Development Corporation and Pamol. In addition, at least eight other foreign agro-industries either currently lease or are attempting to acquire land for oil palm development in the country (Greenpeace International, 2012; Hoyle and Levang, 2012). These companies are targeting the same "fertile crescent" lands that colonial-era companies coveted, not only because of the rich soil, but also in view of the proximity to major urban and industrial centers as well as the Atlantic coast for export.

Sithe Global Sustainable Oils Cameroon (SGSOC), owned by the US agribusiness Herakles Farms, was the first of these agro-industries to be awarded a contract. This land acquisition, originally for 731 km² (73,086 ha) but finally reduced to 200 km² (20,000 ha), has proved to be the most controversial oil palm development in the recent resurgence of industrially produced palm oil in Africa. Cameroonian and international non-governmental organizations declared the deal a "land grab" based on details that came to light on the history of the SGSOC development (Linder, 2013). Of particular importance to this case study is the plantation's location in high-conservation-value forest. The SGSOC plantation is in the Southwest region, close to a Pamol oil palm plantation; it is flanked by four protected areas known to harbor key populations of the endangered Nigeria–Cameroon chimpanzee (Morgan *et al.*, 2011).

Sugar

Cameroon's sugar industry is controlled by the Société d'Organisation de Management et de Développement des Industries Alimentaires et Agricoles (SOMDIAA), a French conglomerate, via two affiliates: Société Sucrière du Cameroun (SOSUCAM) and the Cameroon Sugar Company (CAMSUCO), which operate in the Center region, approximately 100 km north of the capital, Yaoundé. Founded in 1965, SOSUCAM possesses a land lease for 101 km² (10,085 ha) in the Mbandjock area (Nguiffo and Schwartz, 2012b). CAMSUCO was launched in 1977 as a state-owned company in Nkoteng. It was acquired by SOMDIAA in 1998, following production stoppage and financial difficulties (Tchawa, 2012).

SOMDIAA currently exploits 187 km² (18,700 ha) of sugar plantations and has announced its intention to add another 70 km² (7,000 ha) by 2017 (SOMDIAA, n.d.). The forested zones of Mbandjock and Nkoteng have largely been converted to agricultural land for sugar production; the remaining forested zones are likely to be purchased by Chinese and Korean companies that are already developing about 100 km² (10,000 ha) of new rice plantations in the area (Nguiffo and Schwartz, 2012b). The Indo-British-Cameroonian consortium, Justin Sugar Mills SA, has also announced plans to develop a sugar plantation near Batouri, in Cameroon's forested East region. The project's future is in doubt, however, as it has yet to receive all necessary permits and lacks capital (Mbodiam, 2014).

Rubber

New investment in the rubber sector presents a major threat to the forested areas of

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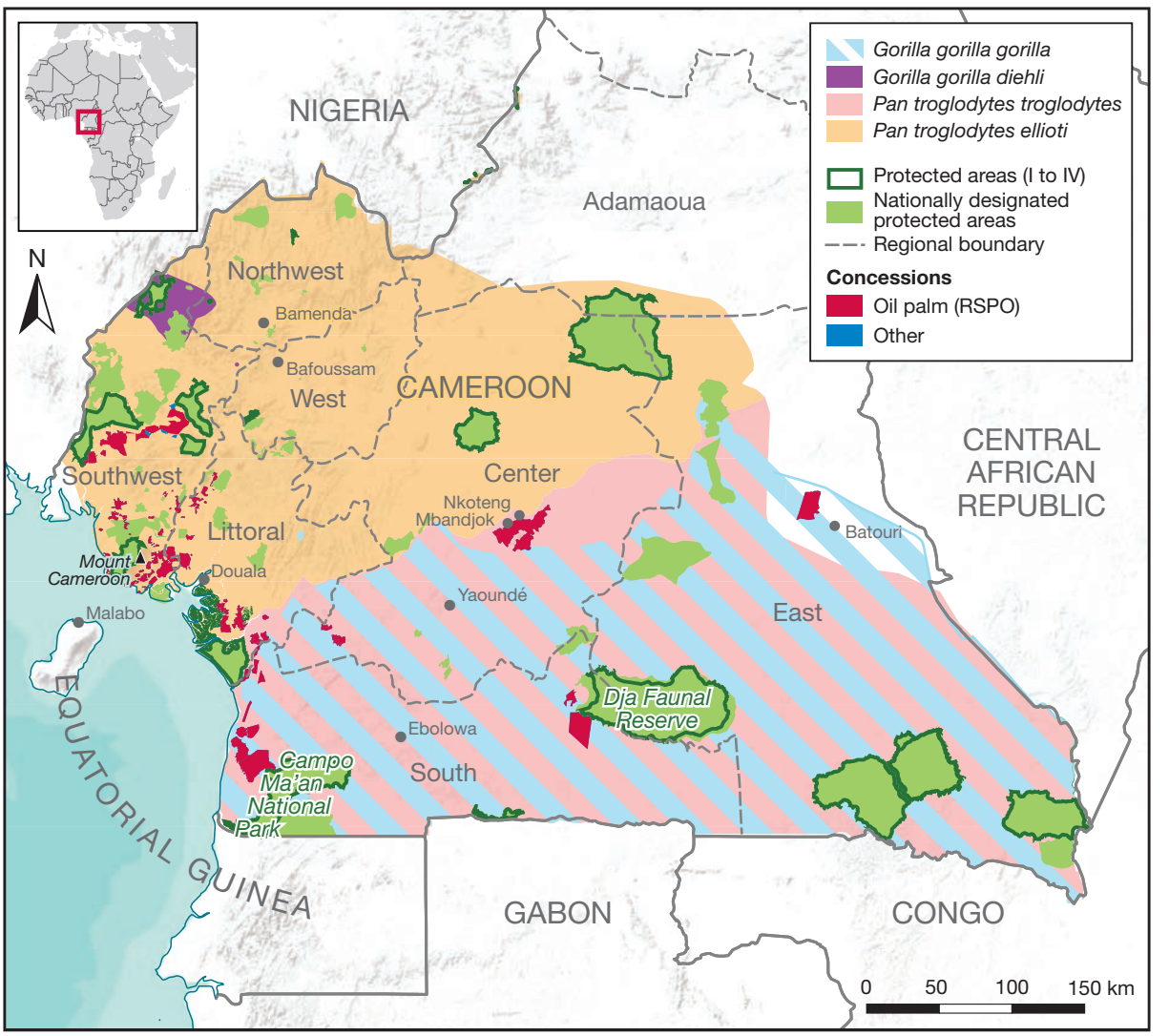
Cameroon's South region. The Chinese company Sinochem controls two major rubber companies, HEVECAM and Sud Cameroun Hevea. HEVECAM already cultivates 180 km² (18,000 ha) adjacent to Campo Ma'an National Park and has announced plans to augment the production area by 200 km² (20,000 ha) (Gerber, 2008; Biy, 2013). In 2010, Sud Cameroun Hevea obtained a land concession of more than 410 km² (41,000 ha) adjacent to the UNESCO World Heritage site Dja Faunal Reserve (Bela, 2014); the company has already cleared 30 km² (3,000 ha) of forest to establish rubber nurseries

FIGURE 2.4

Overlap of Agricultural, Oil Palm and Logging Concessions with Protected Areas and Chimpanzee and Gorilla Ranges in Cameroon



Notes: The range area for chimpanzees overlaps with the gorilla range. The size of land deals was defined as the reported contract size or, if this information was not available, the production size. If neither the contract nor the production size was available, the intended contract size was used.

Data sources: IUCN and UNEP (2014); WRI (2014a, 2014b); IUCN (n.d.)

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https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

and related infrastructure. Both Campo Ma'an National Park and the Dja Faunal Reserve are home to considerable populations of chimpanzee and gorilla and have been designated as high priority areas for their conservation (Tutin *et al.*, 2005).

The Current Situation

> "The proximity of agro-industrial plantations to protected areas is of particular concern as these parks and reserves serve as strongholds for apes and other endangered wildlife populations."

In Cameroon, agricultural plantations are allocated by the Ministry of Economy, Planning and Regional Development to private entities under long-term, renewable contracts that are then monitored by the Ministry of Agriculture and Rural Development.

All agricultural concessions in the country lie within ape ranges. Fourteen oil palm concessions fall within gorilla ranges, totaling 1,697 km² (169,740 ha), which is 1.0% of the total gorilla range in Cameroon. Another 65 oil palm concessions are found within chimpanzee ranges, totaling 3,928 km² (392,770 ha), or 1.4% of the total range. Logging concessions are also all located in gorilla and chimpanzee ranges, accounting for a total area of 98,612 km² (9.9 million ha) (see Figure 2.4).

While the current extent of industrial agriculture concessions within ape ranges is relatively low, the apportionment of concessions in ape habitats contravenes national environmental legislation that provides for the protection of endangered species such as Cameroon's great apes. Moreover, industrial agriculture is prohibited within the national forest estate (CED and RELUFA, 2013; WRI, 2014a).

In the light of past transgressions, it is unclear whether future allocations of agricultural concessions will comply with environmental legislation. Of particular concern are areas that are suitable for oil palm plantations that lie within Cameroon's ape ranges, as 48% of that land is outside protected areas (Wich *et al.*, 2014).

Conclusion for Cameroon

Agro-industrial expansion is developing into a significant driver of deforestation in areas of chimpanzee and gorilla habitats. In particular, agro-industrial companies continue to target forested lands in Cameroon's "fertile crescent"—from the Southwest region through the Littoral and Center regions and into the South region, as well as the lands farther from the Atlantic coast that are near large urban centers and new transport infrastructure. This region contains some of the largest populations of the Nigeria–Cameroon chimpanzee, the most endangered chimpanzee subspecies, distributed across several protected areas that have been designated exceptional priority sites for the conservation of this taxon (Morgan *et al.*, 2011). This analysis indicates that the expansion of oil palm and rubber plantations will be the primary cause of agro-industrial deforestation in Cameroon, given that these industries require vast areas of forested land to be economically viable.

The proximity of large-scale, agro-industrial plantations to protected areas is of particular concern as these parks and reserves serve as strongholds for apes and other endangered wildlife populations. The creation and maintenance of such protected areas is a core conservation strategy. The extent of deforestation surrounding protected areas is recognized as a significant predictor of protected area ecological health (Laurance *et al.*, 2012). As a result of the clearance of surrounding forest, hunting intensifies in protected areas, fueled by growing demand for wild meat from migrant workers and an increasingly wealthy local population (Poulsen *et al.*, 2009). The synergistic effects of habitat fragmentation and intense hunting of wildlife ultimately lead to the depletion of large-bodied mammals in protected areas (Brashares, Arcese and Sam, 2001; Gonedelé Bi *et al.*, 2012; Benchimol and Peres, 2013).

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Cameroon's government seems willing both to allow agribusinesses to circumvent national laws and to convert high conservation value forest into monoculture plantations (Nguiffo and Schwartz, 2012a; Linder, 2013). This conduct reflects a neopatrimonial approach to the governance of natural resources, whereby legal, technical and environmental factors such as environmental and social impact assessments are given little or no consideration in the decision-making process (Médard, 1977; Nguiffo, 2001). This situation is compounded by a lack of recognition of community land and forest rights, which enables the state to continue to use expropriation to accelerate deforestation and forest degradation for agro-industrial and related infrastructure developments (Stevens *et al.*, 2014).

Liberia

The Republic of Liberia is a West African country bordered by Guinea to the north, Ivory Coast to the east and Sierra Leone to the west. It is home to 4 million people and emerged in 2003 from two civil wars that destroyed its economy. In 2014–15, the Ebola crisis stretched its public services to the breaking point. Liberia currently harbors around 42% of the remaining Upper Guinea Forest, in two large forest blocks that consist of evergreen lowland forests in the southeast and semi-deciduous mountain forests in the northwest (Christie *et al.*, 2007). The tropical forests of the Guinea region are among the world's priority conservation areas and are believed to incorporate several major Pleistocene refugia. Boasting extraordinary levels of biodiversity, including the highest diversity of mammals in the world, the Upper Guinea Forest is host to high numbers of endangered and endemic species. The forest extent for the countries within the Upper Guinean Forest system has declined to just 15% of its original area (CEPF, 2000).

Evidence suggests that agricultural expansion has been the primary cause of long-term forest loss and degradation in West Africa, and a significant proportion of formerly forested land (80%) is now an agriculture–forest mosaic (Norris *et al.*, 2010). In addition to commercial and subsistence agriculture (including tree crop plantations), the significant drivers of deforestation and forest degradation are timber extraction, mining (commercial, artisanal and small-scale) and post-conflict population migrations (CEPF, 2000).

Great Apes in Liberia

The western chimpanzee (*Pan troglodytes*) is one of the most threatened subspecies of chimpanzee and is the only great ape present in Liberia. A recent nationwide survey estimates that Liberia, with its relatively large and un-fragmented forest cover, hosts more than 7,000 chimpanzees, making it home to the second-highest number of chimpanzees in West Africa (Tweh *et al.*, 2014). Liberia's National Forestry Reform Law (2006) commits the country to setting aside at least 30% of its forests (about 15,000 km² or 1.5 million ha) as a network of protected areas. Yet, to date, the government has officially declared only 3,000 km² (300,000 ha) protected land; it has been divided into three areas, each of which has very limited management activities taking place on the ground. Complicating matters, an estimated 70% of Liberian chimpanzees live outside protected areas (Tweh *et al.*, 2014).

Significant and growing threats to the chimpanzees include habitat loss through deforestation, wild meat hunting and the pet trade (Anstey, 1991a, 1991b; Greengrass, 2011; Bene *et al.*, 2013). Illegal hunting, whose rates are closely correlated with those

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of deforestation, represents the most significant threat to chimpanzee populations in Liberia (Christie *et al.*, 2007; Greengrass, 2011; Tweh *et al.*, 2014). Although taboos surround the consumption of chimpanzee meat in some regions of Liberia (Anstey, 1991a, 1991b; Greengrass, 2011), reports suggest alarmingly intense chimpanzee hunting practices. One study finds that in just one month, hunters at a camp adjacent to Sapo National Park killed 75 chimpanzees and captured seven live infants (Greengrass, 2011).

Industrial Agriculture in Liberia

Given Liberia's favorable soils and climate, the agriculture sector has long been central to the country's economy, with arable land accounting for 28.1% of the total area (World Bank, 2015b). Contributing 10% of the gross domestic product (GDP) in the late 1970s, agriculture (including fisheries) became a mainstay of the economy during the civil wars and currently contributes more than one-quarter of Liberia's GDP (IMF, 2014). The agriculture sector is also a dominant contributor to export trade and earnings as well as a major source of employment, with nearly 70% of the economically active population engaged in the sector (MOA Liberia, 2008).

Liberia's agriculture sector is dominated by traditional subsistence farming systems that are characterized by labor intensity, shifting cultivation, and low-level technologies and productivity (MOA Liberia, 2008). Cassava is the most widely grown subsistence crop in Liberia, with approximately 500,000 tons grown in 2012, followed by paddy rice and sugarcane, both of which yield about half the yearly production of cassava (FAO, 2014b). Agricultural activities in Liberia—whether commercial or concession-based—have been almost exclusively plantation estates of rubber, coffee, cacao and oil palm. Rubber was a chief export in 2013, delivering 22.0% of total export earnings. Cocoa beans and coffee made up 9.9% and 0.1%, respectively. Since the majority of active oil palm plantations are five years old or younger, significant export of palm oil has yet to commence (CBL, 2014).

Rubber

The first rubber concession agreement in Liberia was held by a British firm in 1890 for the extraction of latex from wild rubber

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trees. It was followed in 1910 by an agreement with another British-owned company, the Liberia Rubber Corporation, for commercial cultivation of rubber at Mount Barclay. In 1926, these were dwarfed by the Firestone concession agreements, which allowed Firestone to cultivate a 4,050 km² (405,000 ha) concession for a 99-year period (Chalk, 1967). Covering 4% of Liberia's land mass and 10% of its arable land, this vast concession became the world's largest industrial rubber plantation and left the country's economy highly dependent on one crop. In April 2005, the company's lease was extended until 2041 to secure the opportunity to harvest rubber from newly planted trees (SAMFU, 2008). Today, Firestone has 8 million rubber trees planted on 520 km² (52,000 ha) of its total concession (FNRC, 2014).

Foreign investors, including Firestone, own and operate four large rubber plantations totaling 1,080 km² (108,000 ha) under production (LISGIS, 2004). In addition, several smallholder-owned medium and small

Photo: Rubber remains Liberia's largest agricultural export. Source: USAID on www.public-domain-image.com. Title: liberia-aerial-view-of-rubber-plantation-45463

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private farms (<0.4 km²/40 ha) account for an estimated 2,000 km² (200,000 ha) currently under rubber production, the majority as monoculture (International Development Association, 2012). In general, however, the sector has seen a reduction in production and rubber factories are operating below capacity (The Inquirer Newspaper, 2012). The majority of the rubber trees currently under cultivation are between 30 and 60 years old and coming to the end of their productive life, so that large-scale replanting is needed to make the plantations economically viable in the future (MOA Liberia, 2008). This aging is reflected by the national decrease in rubber production, which fell from 63,074 to 55,020 tons between 2012 and 2013; the drop is also attributed to an ongoing decline in international natural rubber prices (CBL, 2014).

Nevertheless, rubber remains Liberia's largest agricultural export, delivering about US$120 million of export earnings in 2013 (CBL, 2014). It continues to be a major source of formal employment, with approximately 18,500 workers employed on commercial rubber farms (MOA Liberia, 2007).

Cocoa and coffee

Together with sugarcane, coffee was the first export-oriented crop introduced in Liberia, in the mid-19th century (IITA, 2008). However, since the 1980s, international prices have discouraged farmers from planting new coffee tree stocks, such that coffee makes up only 0.09% of Liberia's foreign export earnings. An estimated 202 tons was produced in 2013 (CBL, 2014); the more profitable rubber and cacao trees reportedly drew resources away from the rehabilitation of coffee farms.

An estimated 40,000 households grow cacao in Liberia (MOA Liberia, 2007), with 8,337 metric tons produced in 2013 (FAO, 2015). While other tree crops (especially rubber) are mostly planted in pure stands, cacao is planted along with secondary food crops, allowing for diversification of enterprise (MOA Liberia, 2008). The vast majority of cacao trees in Liberia are more than 20 years old, an age after which economic productivity decreases.

Between 1989 and 2005, the value of the Liberian coffee and cocoa sectors fell by 90.8% and 79.5%, respectively (IFAD, 2011). The major constraints for cocoa and coffee production lie in the maturity of the trees, limited availability of new plant stock, infrastructural restrictions and lack of capital (English, 2008). Since 25 years of war came to a close, little replanting has taken place and plantations have largely degenerated into secondary forest; there is yet to be any significant increase in any export commodity (FAO, 2015).

The Liberian government, in its efforts to address food insecurity, recently secured a US$24.9 million loan from the International Fund for Agricultural Development to revitalize 150 km² (15,000 ha) of existing cacao and coffee plantations in Lofa county, targeting smallholders with farms of less than 0.02 km² (2 ha). Given the low cost of rehabilitating plantations, as opposed to generating new sites, the focus is on increasing yields and the quality of existing plantations rather than clearing forest for new planting (IFAD, 2011).

Oil palm

Oil palm is native to West Africa. Its production has traditionally been managed as part of a mixed farming practice throughout West and Central Africa. Following the British abolition of the slave trade in 1807, palm oil became the most exported commodity from West Africa to the United Kingdom, feeding the industrial revolution prior to the wide uptake of mineral oils. Imports grew from 114 tons per year at the start of the 19th century to a peak of 64,159 tons in 1895 (Lynn, 1997).[1]

In the 1970s, the government of Liberia embarked on a major oil palm development program by establishing several state-owned

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industrial plantations and a number of small- and medium-scale private farmer plantations. An estimated 270 km² (27,000 ha) were planted, although up to 600 km² (60,000 ha) were reportedly allocated to various additional operators (IFC, 2008). The full extent of this proposed development was never realized, however, due to the onset of civil war in the late 1980s. During the height of the conflict era, many industrial post-harvest facilities suffered significant damage or destruction; on the whole, the civil unrest left oil palm plantations in a state of deterioration. Liberia has since moved from being a crude palm oil exporter to a net importer (Winrock International, 2010).

Today, most production in Liberia is expanding by way of industrial-scale monoculture. Between 2008 and 2010 the government signed concession agreements that potentially span an area of 6,200 km² (620,000 ha)—6.3% of Liberia's land area and more than twice the area that is currently protected (Liberia, 2008, 2009b, 2010a, 2011). Modern oil palm cultivation is generally characterized by large monocultures of uniform age structure, low canopy, sparse undergrowth, a low-stability microclimate and intensive use of fertilizers and pesticides (Fitzherbert *et al.*, 2008).

The operators of the three largest concessions—Equatorial Palm Oil, Golden Veroleum and Sime Darby—are all members of the Round Table on Sustainable Palm Oil (RSPO), a global, multi-stakeholder initiative that aims to promote the growth and use of sustainable palm oil through cooperation within the supply chain. Problems have arisen with respect to the interpretation of criteria for high conservation value and the credibility of certification assessments of the RSPO (see Chapter 5). Furthermore, the management responsibilities for high conservation value within gross concession areas are currently unclear between the state, concessionaires and local communities (R. Brett, personal communication, April 2015). Yet, the conditions outlined in a recent Norway–Liberia deal move beyond RSPO standards (see Box 2.3); the agreement stipulates that decisions regarding land clearance are to be assessed along with criteria established under the high-carbon stock approach.

RSPO members are obliged to acquire adequate free, prior and informed consent (FPIC) from the communities in which they intend to operate. Stakeholders have filed complaints with the RSPO against Equatorial Palm Oil, Golden Veroleum and Sime Darby concerning inadequate implementation of the FPIC procedure (SDI, 2010, 2012a, 2012b; FFI and Forest Trends, 2012; FPP, 2012b; Green Advocates and FPP, 2012; Rights and Resources Initiative, 2012). They exposed the lack of an integrated development strategy, little to no land use planning, inadequate participation and representation of communities and civil society, poor transparency, weak monitoring and enforcement and a lack of clarity of land tenure and local user rights (Green Advocates and FPP, 2012).

The abovementioned Norway–Liberia deal also considers the social impacts of industrial agricultural development, with the Liberian government committed to upholding adequate safeguards for communities that risk being affected by industrial development (see Box 2.3).

"Liberia has the highest potential for oil palm expansion in Africa and 94.3% of the area suitable for oil palm within ape ranges is not protected."

Implications for Liberia's Chimpanzees

Liberia has the highest potential for oil palm expansion in Africa and 94.3% of the area suitable for oil palm within ape ranges is not protected (Wich *et al.*, 2014).

The chimpanzee range covers a large part of the country (80%). Within that range, 17 oil palm plantations occupy a total area of 5,129 km² (512,940 ha), or 7% of the range

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and four rubber plantations have a combined area of 144 km² (14,420 ha), including two rubber plantations that do not overlap with oil palm plantations. The agro-forestry dataset registers another three plantations that have a combined total area of 85 km² (8,530 ha) (see Figure 2.5).

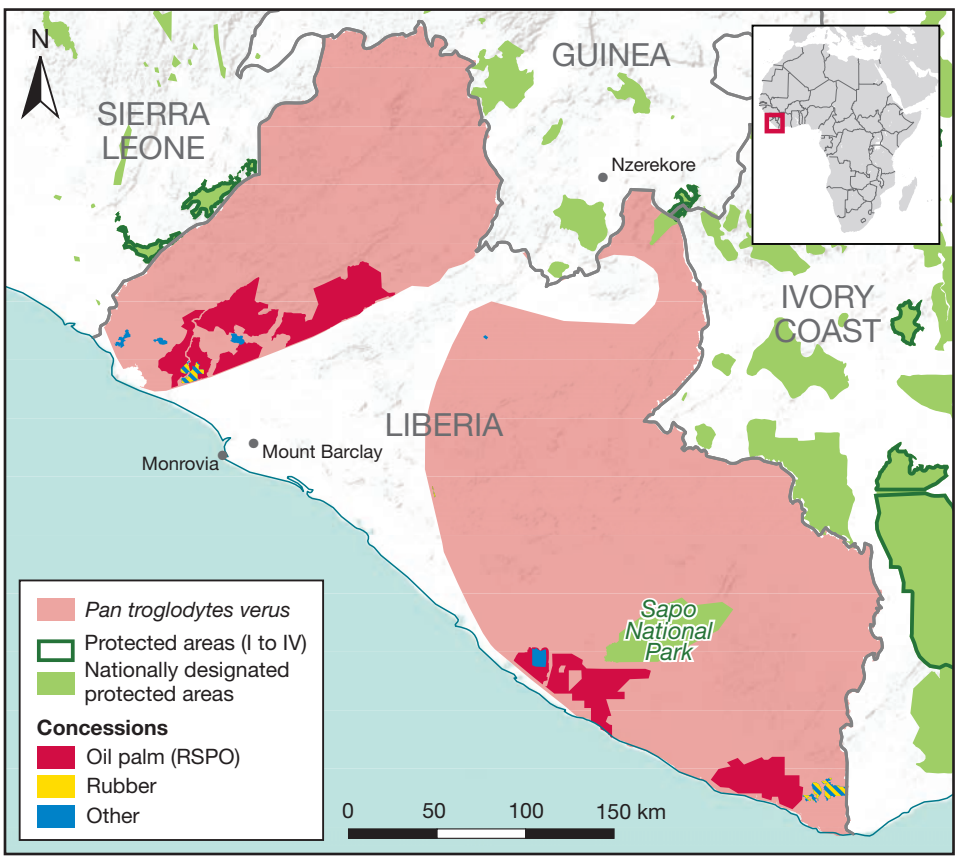
It should be noted that chimpanzees inhabiting forested areas in close proximity to palm oil plantations are at exceptionally high risk of extirpation (Linder, 2013). The elevated risk is due to increased chimpanzee vulnerability to hunting while nesting in and feeding on oil palms that become contiguous with forest edges (see Chapter 6).

Conclusion for Liberia

In focusing on natural resource extraction as the linchpin of economic recovery and poverty reduction, Liberia relies on rapid infrastructure development (Liberia, 2010c). The enormous potential for growth and job creation in the country's agro-based industries has long been recognized, with ambitious policies in land intensification and the development of related agro-industries currently being implemented to drive further economic growth. The most recent International Monetary Fund country report on Liberia outlines a number of policy approaches aimed

FIGURE 2.5

Overlap of Agro-industry and Protected Areas with Ape Ranges in Liberia



Notes: The size of land deals was defined as the reported contract size or, if this information was not available, the production size. If neither the contract nor the production size was available, the intended contract size was used.

Data sources: IUCN and UNEP (2014); WRI (2014c); IUCN (n.d.)

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at boosting agricultural productivity to support inclusive economic growth in the country (IMF, 2014). While rubber, cocoa and coffee remain important export products, the current investment focus for these crops is on the rehabilitation of aging plantations located on brownfields.

Meanwhile, the aggressive and rapid expansion of oil palm concessions is of considerable concern. As a result of a "new wave" of large-scale industrial oil palm plantations, developed through land-lease or multinational agribusiness concession agreements, Liberia now faces a shift in deforestation drivers. This is expected to significantly impact Liberia's apes, the majority of whom are outside of protected areas. Industrial agriculture constitutes a major threat to their survival, through the direct loss of habitat as well as increased hunting as a result of fragmentation and the influx of migrant workers.

The recent Norway–Liberia deal holds some promise in terms of ensuring that decision-makers consider areas of significant biodiversity, including ape habitats, and secure appropriate consent from and inclusion of human communities in the process of expanding industrial agricultural activity (see Box 2.3). This approach could also be applied to guide industrial expansion in other African states, but it is too soon to tell how effective it will be at fostering well-considered development in Liberia.

The Island of Borneo

The island of Borneo is divided among three countries: Brunei and Malaysia in the north and west, and Indonesia to the south and east. It is the third-largest island in the world, located in the center of Island Southeast Asia. It is at the heart of Southeast Asian biodiversity, with the majority of species and evolutionary lineages from the broader region originating on Borneo (de Bruyn *et al.*, 2014).

BOX 2.3

The Norway–Liberia Deal

Liberia is home to much of West Africa's remaining rainforest and some of the last viable populations of western chimpanzee. In the wake of Liberia's civil war and in the midst of significant governance challenges, large international palm oil, rubber and timber companies obtained thousands of square kilometers (hundreds of thousands of hectares) of concessions throughout the country. Many of these concessions overlap with chimpanzee habitat and other forest, raising concerns that this latter-day wave of commodity expansion could threaten Liberia's forests and communities. More recently, the Ebola epidemic introduced a new set of challenges for Liberia.

Despite government constraints, the country may be poised to lead the way in Africa in dramatically reducing deforestation with the help of results-based development aid. In September 2014, Norway and Liberia announced a landmark agreement to improve forest governance and reduce emissions from deforestation and forest degradation in the West African country. The deal, which will run through 2020, commits Norway to paying Liberia up to US$150 million to preserve its forests. Of this amount, US$70 million will be disbursed in the initial years of the commitment period to assist Liberia in developing the necessary policy measures and institutional capacity to govern its forests. The remaining US$80 million will be paid upon independent verification of reduced emissions from deforestation (Norway, 2014).

Although there is flexibility in the specific actions Liberia can take to eliminate the destruction of its forests, the Norway deal commits the country to several specific actions. These include:

- declaring a moratorium on all new logging contracts until an independent body reviews existing concessions to ensure their legality;
- placing at least 30% of Liberia's forests under protected status, as stipulated in Liberia's National Forestry Reform Law of 2006;
- piloting a project of direct payments to communities that sustainably manage their forests;
- developing a reporting system for carbon emissions from forests; and
- identifying measures to address all key drivers of deforestation in the country.

Importantly, the agreement also provides safeguards for the respect of land rights, including customary rights, and adherence to the principles of FPIC (Norway and Liberia, 2014).

The development of a deforestation-free agricultural sector forms a key pillar of the agreement. In an example of how private sector policy can contribute to government reform, multinational companies that aim to do business in Liberia will be required to issue ambitious zero-deforestation policies—as defined by a letter of intent that is at least as strong as palm oil trader Wilmar's "no deforestation, no peat, no exploitation" policy. Meanwhile, a newly commissioned study is exploring alternative models of agricultural investment, including small- and medium-scale enterprises, and an overarching strategy to be developed by Liberia's government will guide the allocation of land for agricultural use.

While the signing of the agreement is a major step forward for a country long plagued by legal and illegal forest destruction, the results—in terms of forests left standing and climate-changing carbon emissions avoided—will be the true measure of success in the years to come.

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Some of the Bornean plant lineages can be dated back as far as 130 million years, to a time well before the last dinosaurs became extinct.

Borneo is estimated to have lost more than 30% of its forest between 1973 and 2010. Fire and conversion to plantations—mainly oil palm (*Elaeis guineensis*) but also other tree crops (such as *Acacia* species (spp). and rubber)—were the greatest drivers of forest loss. In 2010, the island accommodated nearly 65,000 km^2 (6.5 million ha) of oil palm plantations and 10,537 km^2 (1.1 million ha) of other tree plantations, which together occupied 10% of its total land area (Gaveau *et al.*, 2014; see Figures 2.6 and 2.7).

A History of Deforestation

Borneo has been occupied by humans for at least 40,000 years (Brothwell, 1960) and deforestation of the island's forests started during the early iron age. The impact of these activities remained relatively small until the 17th century, when deforestation, primarily for timber extraction, gained in both intensity and spread, with log and processed timber exports departing from most Bornean ports (Knapen, 2001). What limited the impact of such harvest on forest stands was a shortage of the labor required to transport and process the trees (Knapen, 2001).

More and more, however, timber extraction and the opening up of land for agriculture started to push back the forest boundary. Valuable species such as ramin (*Gonostylus bancanus*), ironwood (*Eusideroxylon zwageri*) and sandalwood (*Santalum album*) had disappeared from large parts of south-east Borneo by the mid-19th century. Similarly, in west Borneo, along the Kapuas River, large areas had been cleared by the 19th century through unsustainable land clearing practices, the use of fire and artisanal mining (Teysmann, 1875; Gerlach, 1881; Enthoven, 1903). By the middle of the 19th century, an estimated 5% of Borneo had been deforested, mostly along the major rivers and wetlands (Brookfield, Potter and Byron, 1995).

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By the early 20th century, the major economic interests of the colonial powers—Great Britain and the Netherlands—in north Borneo shifted away from spices and other primary products, to tin and rubber as the two major commercial commodities to be traded with the British Empire, Europe and the United States (Pryer, 1883). In 1910, the Dunlop Research Station was established in Malaysia, and the British rulers encouraged private companies to develop vast tracts of land to produce rubber. Easily accessible forests close to the coast and major rivers were preferentially converted to rubber plantations. To bring rubber and other agricultural products to the market, developers built extensive roads and railways in Sabah and Sarawak, thus facilitating access to the forests in the interior of the island.

Industrialization and the invention of the one-man chainsaw, the outboard motor and more powerful vehicles designed following the end of World War II led to a rapid increase in timber exploitation and deforestation (Brookfield *et al.*, 1995). After forests are depleted of their high-value timber resources, they are often converted to agricultural land (Gibbs *et al.*, 2010). For orangutans, such crops are of very limited utility (Meijaard *et al.*, 2010; Ancrenaz *et al.*, 2015); for fully arboreal gibbons, they are of no use.

Land conversion processes started in Malaysian Borneo and subsequently began on the Indonesian side of the island. After independence in 1957, Malaysia established the Federal Land Development Authority (FELDA) scheme to settle poor, rural smallholders into newly developed areas to grow cash crops. In 1966, the Federal Land Rehabilitation and Consolidation Authority (FELCRA) was created to boost agricultural production in the country by allocating and developing land, especially idle land and degraded forests, for agricultural purposes. At this time, smallholders were also encouraged to switch from subsistence crops to cash crops, such as rubber and oil palm. In early 1970, there were 1,230 km² (123,000 ha) of oil palm compared to 13,150 km² (1.3 million ha) of rubber in Malaysia. Most of these plantations replaced natural forests.

In the 1970s, FELDA and FELCRA intensified and expanded their programs with an emphasis on oil palm expansion to eradicate poverty (Parid *et al.*, 2013). Agricultural development was concomitant with timber extraction and forest conversion. In the eastern states of Malaysian Borneo, it focused primarily on lowland forest areas; during the period from 1970 to 2010, deforestation rates reached 39.5% in Sabah and 23.1% in Sarawak (Gaveau *et al.*, 2014). Most of these forests were replaced with oil palm plantations and other crops. From 1990 to 2010, more than half of all oil palm development throughout all of Malaysia replaced forests through direct deforestation (Koh and Wilcove, 2008a).

Quantified Forest Loss and the Role of Agro-industry

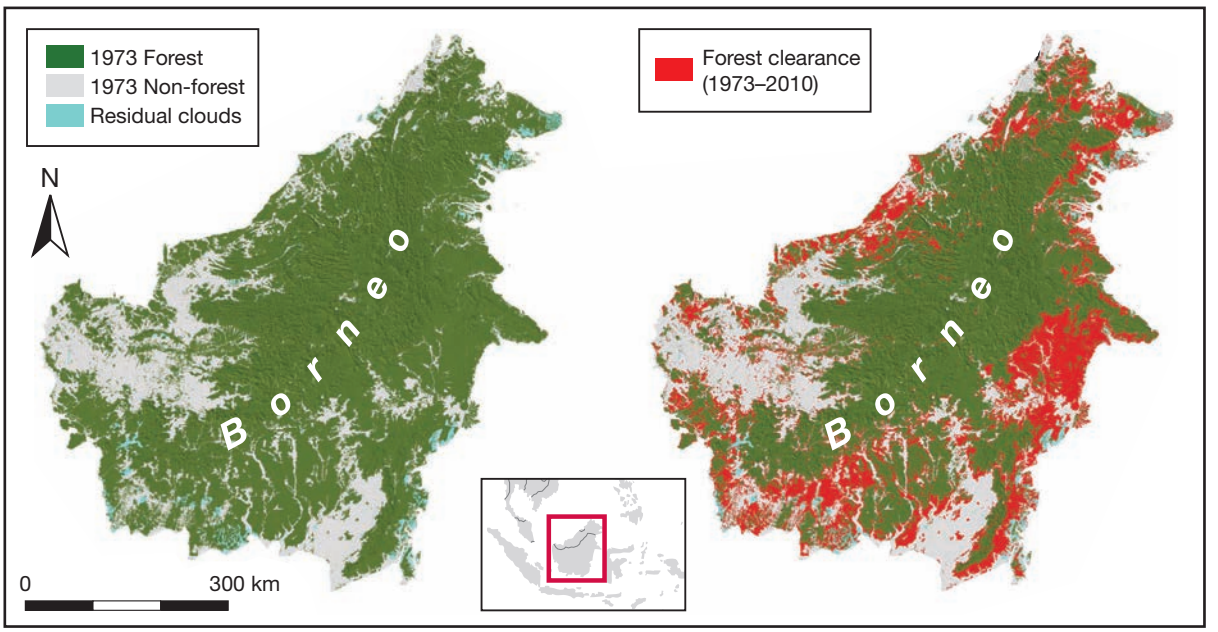
A recent analysis mapped forest extent and deforestation for the period 1973–2010 for the whole island of Borneo at medium spatial resolution (Gaveau *et al.*, 2014). In 1973, about 76% of Borneo was still under natural forest cover (558,060 km²/55.8 million ha); only 53% was still forested in 2010 (389,567 km²/39.0 million ha), mostly in the mountainous center of the island (see Figure 2.6). Intact forests represent only 54% (209,649 km²/21.0 million ha) of the total remaining forest area—or 28% of the whole of Borneo. Among the different geopolitical units on the island, Brunei has the highest proportion of intact forest area (57%), in stark contrast to the significantly lower rates in Kalimantan (33%), Sabah (19%) and Sarawak (15%). Over the past 40 years, Borneo has witnessed a loss of tropical forests amounting to 168,493 km² (16.8 million ha)—an area about four times the size of Switzerland.

Photo: Fire and conversion to plantations—mainly oil palm—have been the greatest drivers of forest loss on Borneo. © HUTAN -Kinabatangan Orang-utan Conservation Project

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

FIGURE 2.6

Borneo's Forest in 1973 and Forest Loss between 1973 and 2010



Reproduced from PLoS One (Gaveau *et al.*, 2014, p. 6).

Although timber harvest levels are currently dropping, the expansion of logging has not stopped. Especially in Sarawak, the development of logging roads in interior highlands indicates a further shift of the logging boundary (Gaveau *et al.*, 2014). In all regions of Borneo, conversion to industrial and small-scale agriculture—rather than timber exploitation—currently drives deforestation (Miettinen, Shi and Liew, 2011; Abood *et al.*, 2015). The expansion of the oil palm sector has drawn considerable attention from environmentalists and human rights activists for its major social and environmental impacts, especially in lowland areas. Even so, roughly one-third of Sabah's workforce (up to 376,000 people) is involved in agriculture—mostly in oil palm, which is the second-largest employer in the Malaysian state, after services (ETP, 2010).

By 2010, about 65,000 km² (6.5 million ha)—or about twice the size of Belgium—was planted with oil palm throughout Borneo, and an additional 10,537 km² (1.1 million ha)

TABLE 2.2

Target Proportions of Land Earmarked for Oil Palm, Industrial Tree Plantations and Forest Cover in Borneo, by Political Division

Divisions		Target oil palm	Target ITP	Target forest cover
Brunei		0%	0%	75%
Indonesia	Kalimantan	15%	4%	45%
Malaysia	Sabah	29%	5%	50%
	Sarawak	16%	2%	50%

Data source: Runting *et al.* (2015)

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

was converted to industrial tree plantations (ITPs) (Gaveau *et al.*, 2014). Although approximately 10% of Borneo is currently planted with oil palm or ITP (such as acacia, eucalyptus and rubber), the drive for further expansion of industrial agriculture is strong. Sabah has 14,000 km² (1.4 million ha)—or 20% of its land area—planted with oil palm and plans to increase the proportion to 29% (about 20,000 km²/2 million ha), with ITP taking up 5%; that expansion would leave a forest cover comprising intact and selectively logged forest of just over 50% of the state (Runting *et al.*, 2015). Table 2.2 shows targets for Sabah and the other political divisions of Borneo.

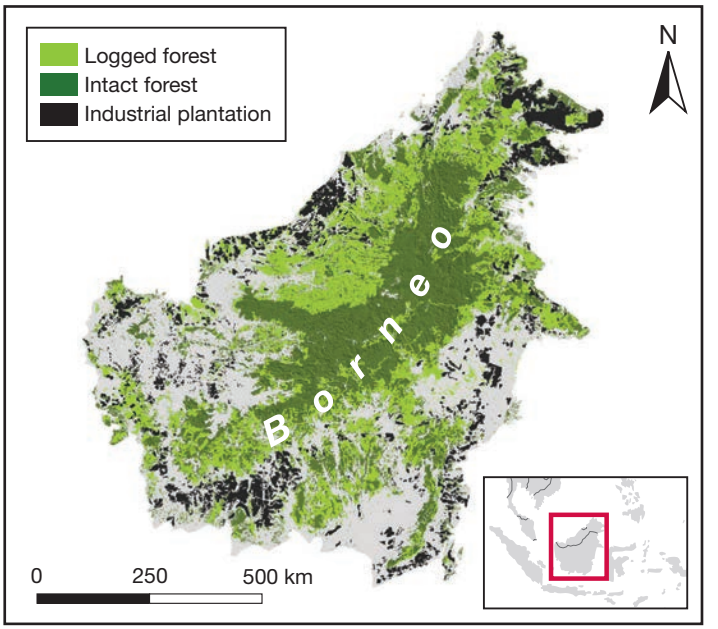
Most of the forests that have been converted for agricultural purposes used to serve as prime habitat for Borneo's apes, mainly in the coastal lowland areas (see Figure 2.7).

An unpublished study on oil palm development in different parts of Borneo indicates that the two Malaysian states have a more deliberate approach to deforestation, especially with regard to developing oil palm.[2] Between 1973 and 2010, 56% to 81% of Sabah and Sarawak's oil palm was primarily established in areas of logged and intact forest. In contrast, the rate in Kalimantan varied between 27% and 45%, with the majority of oil palm established in non-forest areas before 1973 or areas destroyed by wildfires in 1982–83 and 1997–98. These data suggest that, unlike Malaysia, Indonesia largely restricted oil palm development in Borneo to land that was already degraded or that became available after fire removed standing forests.

Nevertheless, from 2000 to 2010, ITPs, logging from natural forest, oil palm and mining—in that order—accounted for 45% (66,000 km²/6.6 million ha) of forest loss in the Indonesian states of Kalimantan, the Moluccas, Papua, Sulawesi and Sumatra. This finding indicates that most of the deforestation in these states—the remaining 55%—cannot be directly attributed to the activities of the four main industries (Gaveau *et al.*, 2013, 2014). Additional factors, such as illegal logging outside concessions, fire and small-scale agriculture also play a large role in deforestation. The major industries, and especially those associated with large-scale land conversion—such as the pulp and paper business and oil palm cultivation—may be the most visible components of deforestation, yet they are not necessarily its main drivers in Indonesian Borneo (Kalimantan).

FIGURE 2.7

Borneo's Remaining Forest in 2010 (Intact and Selectively Logged) and Areas of Industrial Plantations



Reproduced from PLoS One (Gaveau *et al.*, 2014, p. 6).

Drivers of Ape Decline: Forest Loss and Hunting

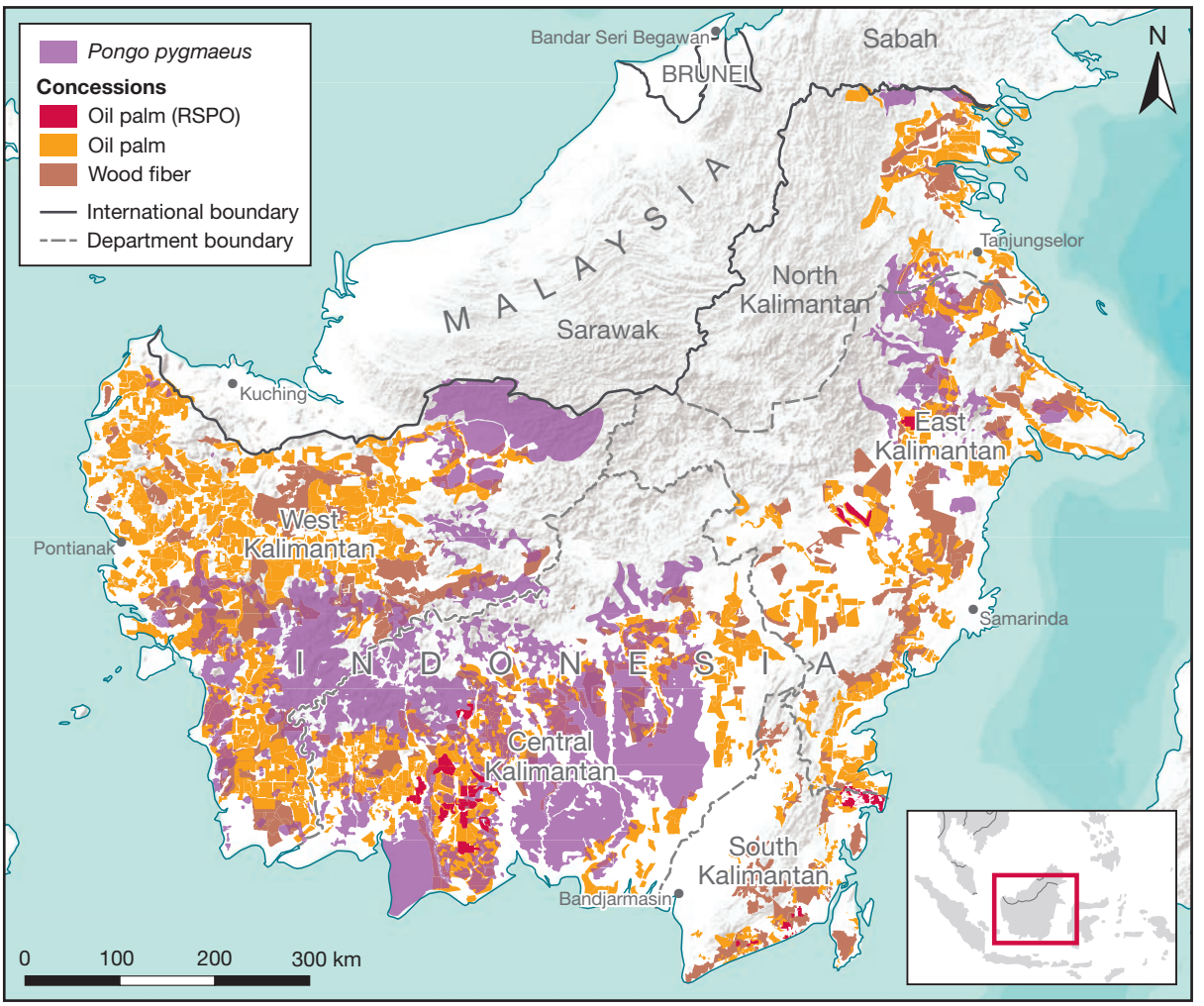
The population of Mueller's gray gibbon (*Hylobates muelleri*) has been conservatively estimated at 250,000–375,000 individuals,[3] but no total population estimates exist for the island's other species, the Bornean white-bearded gibbon (*Hylobates albibarbis*). Gibbons are deeply affected by forest degradation, loss and hunting, although actual impacts on population trends are poorly understood (see Chapter 6).

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

The Bornean orangutan (*Pongo pygmaeus* spp.) is found mainly in West and Central Kalimantan and the Malaysian state of Sabah. The most recent orangutan population estimates date back to 2008 and put the total population at more than 54,000 individuals, with a total distributional range of 155,000 km² (15.5 million ha) (Wich *et al.*, 2008, 2012b). As a result of recent technological advances, such as satellite imagery and statistical programs, future population estimates for Bornean orangutans may be revised upwards. Regardless, it is undeniable that Bornean orangutan populations are in rapid decline. The annual loss of orangutan habitat in Borneo between 1990 and 2005 was around 3,000 km² (300,000 ha) (Meijaard and Wich, 2007); based on estimates that these forests were occupied by orangutans at average densities before conversion, that decline in habitat corresponds to an average annual loss of 2,000 to 4,850 individuals (Meijaard

FIGURE 2.8

Overlap of Current and Planned Agro-industry, Certified RSPO Sites and *Pongo pygmaeus* in Indonesian Borneo



Data sources: WRI (2013, 2014c, 2014e); IUCN (n.d.)
Courtesy of UNEP-WCMC

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

et al., 2012). While an estimated 750–1,800 orangutans were directly killed in Kalimantan alone in 2007 (Meijaard *et al.*, 2011), many of these deaths are associated with deforestation and agricultural development. If people see orangutans destroying young palms, for instance, they may perceive them as a threat to agricultural production and kill them (see Chapter 1). In some cases, oil palm companies have paid a bounty for orangutans to be killed (Kusuma, 2011).

A recent study shows that 19% of the modeled potential Bornean orangutan distribution range in West Kalimantan lies in undeveloped oil palm concessions and 6% in undeveloped tree plantation concessions. Moreover, 24% of the Bornean orangutan distribution occurs outside of protected areas and concessions. If all agricultural concessions—oil palm and tree plantations—were to be fully developed, an estimated 49% of the remaining orangutan range would be lost (Wich *et al.*, 2012b). These estimates are based on modeled species ranges, which may explain why this study finds a greater overlap than does the analysis using IUCN taxa range maps in Figure 2.8.

Despite the rapid losses of Bornean apes, there is hope for their survival. Orangutans have shown remarkable ecological resilience and can survive, at least over short time frames, in degraded areas (Ancrenaz *et al.*, 2010; Meijaard *et al.*, 2010; Campbell-Smith *et al.*, 2011b). Gibbons are ecologically more vulnerable, but they do survive in degraded forests if hunting can be controlled. If a minimum area of forest were retained and if reduced-impact logging techniques were applied, both gibbons and orangutans could survive. Connectivity between these populations is vital for facilitating gene flow (Goossens *et al.*, 2005a); it also allows apes to adapt to altering ecological conditions brought about by regional and global climate change (Gregory *et al.*, 2014; Wich *et al.*, 2014; see Chapter 6).

Conclusion for Borneo

The differences in the rates of deforestation across the three states that occupy the island of Borneo reflect varying governance contexts. Malaysia's policies emphasize agricultural development and facilitate deforestation for that purpose, whereas Indonesia has been promoting the use of degraded lands, such as areas that have been burned or logged, for agricultural activities. Further analysis of Borneo's different governance structures and policies could provide additional insight into the impact of government policy on rates of deforestation in valuable ape habitats.

Given the fact that industrial agriculture is among the causes of forest loss across Borneo, engaging with industry on agricultural development is one way of helping to curb deforestation. Oil palm plantations alone occupied 10% of the entire island in 2010 and were encroaching on important ape habitats. Findings in relation to ape ecology point to the value of retaining ecological connectivity, underscoring the importance of adequate land use planning. This type of planning calls for strong collaboration at the international level—at a minimum, among the three countries that govern the island—if the ecological function across the island is to be conserved. Ultimately, the correlation between the rate and extent of forest loss and the decline of ape populations on the island of Borneo since 1975 is a stark example of a fundamental connection between economic development and ape conservation.

Conclusion

The increased demand for commodities to supply growing global human populations requires intensified and expanded agricultural practices, which are generally accompanied by a plethora of detrimental impacts

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Photo: In Malaysian Borneo, policies that prioritized agricultural development resulted in the highest rate of forest loss across the island. Kulamba, Malaysia. © HUTAN-Kinabatangan Orang-utan Conservation Project.

on terrestrial biodiversity and wider socio-ecological and environmental systems.

Given the scale of agricultural expansion in Liberia, projected changes will have dramatic impacts on the diversity, composition and functioning of the remaining natural ecosystems—unless mitigation strategies are put in place at the beginning of operational planning. Otherwise, these changes will pose insurmountable challenges in biodiversity conservation and result in the extirpation of Liberia's vulnerable, forest-dependent large mammal species, such as the elephant and chimpanzee. As part of its recent agreement with Norway, Liberia has committed to taking specific actions that surpass even the RSPO's Principles and Criteria. While it is too early to assess the impact of this model, its potential success may have implications for Cameroon and other African countries that are also pursuing agricultural development.

The case of the Herakles plantation in Cameroon has demonstrated that apes and their habitats are being impacted by the recent wave of industrial agricultural development in Africa. In this context, the allocation of concessions in proximity to protected areas is of particular concern. Unless the Cameroonian state incorporates adequate

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land use planning and establishes robust regulations to ensure that future allocations take significant sites of biodiversity into consideration, unchecked deforestation will likely become the norm.

In contrast, Borneo has already suffered rapid and extensive forest loss and degradation as a result of industrial agriculture. In Malaysian Borneo, policies that prioritized agricultural development resulted in the highest rate of forest loss across the island, highlighting the influence of aggressive government policies that do not adequately consider the environmental and social implications of such action.

In Borneo and elsewhere, two strategies could be adopted to ensure adequate protections for the environment and the local populations it serves:

- First, land use planning should be used to establish sufficient buffer zones between agro-industrial sites and protected areas so as to maintain the integrity of ape habitats (Laurance *et al.*, 2012).
- Second, governments should implement moratoria on the granting of new agro-industrial concessions until they have instituted or reformed land use planning processes to be transparent and to entail strict criteria for allocation (Hoyle and Levang, 2012; Nguiffo and Schwartz, 2012a).

Adequate land use planning is at the core of mitigating the negative impacts of industrial activities in environmentally critical landscapes. The case of Cambodia is instructive with respect to problems that can arise due to conflicting land use designations and the disregard for the value of conservation in relation to economic development.

Future research could usefully analyze the consequences of industrial agricultural expansion in terms of the social, economic and environmental costs and benefits of different land use options.

Acknowledgments

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Contributors: Marc Ancrenaz, Katherine Despot Belmonte, Max Fancourt, Fauna and Flora International, Chloe Hodgkinson, Joshua M. Linder, Erik Meijaard, Rebecca Newham, Marieke Sassen, Brendan Schwartz, Kathryn Shutt, Arnout van Soesbergen, and the United Nations Environment Programme World Conservation Monitoring Centre

Figures 2.1–2.5 and 2.8: UNEP-WCMC—Marieke Sassen and Arnout van Soesbergen—with assistance from Max Fancourt, Rebecca Newham and Katherine Despot Belmonte

Reviewers: John F. Oates, Charles Palmer and Nancy Lee Peluso

Endnotes

1 In the 19th century, the Windward Coast that runs from Freetown to Monrovia was an important site for the production of hard palm oil, which was used for industrial purposes (Lynn, 1997). It is not possible to convert export tonnage of those days into modern equivalents.

2 Based on unpublished data by D. Gaveau, seen by the authors.

3 Based on unpublished data compiled by the contributor and V. Nijman.

https://doi.org/10.1017/CBO9781316488959.006 Published online by Cambridge University Press

Photo: Thousands of square kilometers of land have been allocated for industrial-scale agricultural cultivation in Africa. Oil palm, Cameroon. © Jan-Joseph Stok/Greenpeace

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