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Status Survey and Conservation Action Plan

West African Chimpanzees

Compiled and edited by Rebecca Kormos, Christophe Boesch, Mohamed I. Bakarr and Thomas M. Butynski

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Contents

Foreword

Jane Goodall

At the turn of the century there were between one and two million chimpanzees living in 25 African countries. Even in 1960 when I began my chimpanzee research in Tanzania, East Africa, there must have been at least a million, though they had vanished from two to three nations. Today, 40 years later, only some 150,000 are thought to remain. This shocking reduction in numbers is due to habitat destruction as human populations grow and move into new areas, to trapping, to disease (chimpanzees are so like us genetically, differing in structure of DNA by only about 1%, that they are susceptible to many known human infectious diseases) and, most recently, to the bushmeat trade, the commercial hunting of wild animals of all kinds for food, much of it for sale to the urban elite within Africa. Bushmeat, including parts of chimpanzees, may even be illegally shipped to other countries.

Chimpanzees, like the other great apes, are slow breeders. Females do not give birth until they are 12 years of age or older, and only have one infant every five or six years. Their behavior resembles ours in many ways – the long term bonds between family members that may persist throughout a life of 60 years or so; the long period of dependency on the mother (seven to eight years); the gestures of the non-verbal communication system, (such as embracing, kissing, patting one another on the back, swaggering, shaking their fists and so on); their intellectual abilities, which include making and using primitive tools; and the expression of emotions (such as happiness, sadness, anger, fear, despair and so on). Biologically and behaviorally, then, chimpanzees are our closest living relatives in the animal world. It will indeed be tragic if we do not prevent their extinction.

It is particularly important to make concerted efforts to protect chimpanzees in West Africa, since DNA studies show that they are genetically rather different from those of Central and East Africa. Such efforts will require unprecedented collaboration between government officials, scientists, field researchers and local and international conservation non-governmental organizations. In addition, and most important, it will require the cooperation of the local people.

On September 12–13, 2002, the first regional meeting on the conservation of the West African chimpanzee was held in Abidjan, Côte d'Ivoire. A total of 72 participants representing 51 institutions from 19 countries gathered to share information about chimpanzee distribution, to discuss threats to their survival and to draw up comprehensive plans for their protection. The report from that landmark meeting represents the collaborative efforts of many organizations and individuals and sets a fine standard for conservation efforts in the new millennium.

It is essential both for chimpanzee conservation and for other conservation efforts in West Africa that cooperation between interested parties continue into the future. There are many problems to be overcome, such as the different languages spoken and the need for collaboration between police and customs officials at border crossings between countries, without which conservation efforts will be seriously undermined. The results of the September meeting shows that in most countries, approximately 45–81% of the surviving chimpanzee populations exist outside designated protected areas. It will be necessary to find the funding to increase the number and size of protected areas and to provide adequate infrastructures to ensure that these areas can, in fact, be adequately protected. This is compounded by the frequent political instability in the range countries and the humanitarian crises that result and may overshadow conservation efforts.

It will be extremely important to involve local governments and local people, in all areas, in proposed conservation plans. In some areas this will be easy, since chimpanzees have played an important role in the cultures of some tribes who consider chimpanzees sacred and will not harm them. The fate of the chimpanzees ultimately will rest in the hands of the people in whose country they live, but financial help must come from western countries. This will help to mitigate, to a small extent, the vast debt owed by the West to the people of Africa.

Acknowledgements

On May 10, 1999, United States Senator Jim Jeffords introduced the Great Ape Conservation Act. The bill acknowledges the decline in Great Ape populations and the threats that put their long-term survival in jeopardy. The legislation authorized five million dollars to be put into a Great Ape Conservation fund each year from 2001 to 2005. Assistance from this fund made the production of this document possible.

We would like to thank the United States Fish and Wildlife Service Great Ape Conservation Fund for providing the main funding for this project. In particular, Richard Ruggiero has been of tremendous help in making this action plan a reality. We would also like to thank the Critical Ecosystems Partnership Fund who supported the translation of the action plan into French and financed the printing and distribution of the document. We are also most grateful to the Center for Applied Biodiversity Science at Conservation and the West Africa Program at Conservation International, who both provided core funding and logistical support for this project. In addition, we thank the Primate Action Fund, the Great Ape Survival Project and the Foundation Step by Step for the additional funding they provided.

The authors (listed under ''Contributors'') who wrote the chapters of this action plan, did so either on their own time or while they were sponsored by the institutions with which they are affiliated. We are most grateful for the time they put into these chapters and for sharing their information and expertise with us.

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Finally, we would like to thank all those who participated in the national workshop in Conakry, Guinea (September 9 and 10, 2002) and the regional workshop in Abidjan, Côte d'Ivoire (September 12 and 13, 2002) who worked extremely hard to reach consensus on determining priority actions and priority sites for the conservation of chimpanzees in West Africa.

Executive Summary

Wild chimpanzees are only found in tropical Africa, where their populations have declined by more than 66% in the last 30 years, from 600,000 to fewer than 200,000 individuals (Butynski 2001). While this decline by itself is alarming, it merits additional concern because, more than any other species, chimpanzees closely resemble humans genetically, behaviorally, and physically, and thus provide an important link to our evolutionary history.

This action plan deals primarily with the subspecies of chimpanzee called the western chimpanzee *Pan troglodytes verus*, which ranges from Senegal eastward to either the Dahomey Gap or the Niger River (Butynski 2001). As the boundary between the western subspecies and the Nigerian-Cameroon subspecies *Pan troglodytes vellerosus*, which ranges through to the Sanaga river in Cameroon, is still unclear (Gonder *et al.* 1997; Gagneux *et al.* 1999), this action plan will also examine the distribution and threats to chimpanzees in Nigeria. In addition, this action plan deals with the region of West Africa, which traditionally extends to Nigeria. In Cameroon there is also another subspecies of chimpanzee, the central chimpanzee *Pan troglodytes troglodytes.* We have therefore drawn the artificial limit of Nigeria for the scope of this action plan.

The two West African subspecies are the most threatened of all chimpanzees. Indeed, *P.t.verus* has already disappeared in two to three West African countries[1]: Benin and Togo, and possibly Burkina Faso[2]. Throughout their range, chimpanzees are threatened by deforestation, poaching, disease, and capture for the pet trade and research purposes. These threats are exacerbated by the recent human population explosion in West Africa.

This action plan, based on the work of leading scientists and conservationists working with chimpanzees in West Africa, provides a detailed framework for addressing conservation needs of chimpanzee at the regional and national levels. The most up-to-date information on the status and threats to chimpanzees is presented here. In addition, priorities are identified for the conservation of both subspecies throughout their range.

This action plan benefited greatly from a regional workshop in Abidjan, Côte d'Ivoire, where an international group of 72 biologists, protected areas managers, government officials and other experts met to discuss priority actions for protecting chimpanzees in West Africa.

Much remains unknown about West Africa's chimpanzee populations, and many estimates of population sizes and distributions in West Africa are based on outdated information. Our current knowledge, albeit limited, on the status of chimpanzees in all countries within western chimpanzee's current and former ranges is summarized in this plan. Recent national censuses in countries like Côte d'Ivoire (Marchesi *et al.* 1995), and Guinea (Ham 1998) have added to this body of knowledge, as have censuses in smaller, more specific regions like the Bafing in Mali (Pavy 1993; Duvall and Niagaté 1997). However, further surveys of West African chimpanzee populations are urgently needed.

In the first section of this document, background information on the biology of chimpanzees is presented, including their behavior, ecology and genetics. The second section contains action plans for each country within the range of this species in West Africa, prepared by authors who have the most recent information about chimpanzees in each country. Country action plans provide information on the country, threats, former studies on chimpanzees, as well as suggested national priority locations and actions. In the final section, regional assessments of threats and action recommendations are presented, including an analysis of logging, agriculture, the bushmeat trade, the pet trade, disease, and policy issues. The final chapter provides an overview and recommendations of methodologies that can be used to survey chimpanzee populations in attempts to harmonize the data that will be gathered in the future.

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[1] Former publications on the West African Chimpanzee (e.g., Lee *et al.* 1988; Teleki 1989) suggest that chimpanzees once existed in The Gambia, but are now extirpated from this country. Most recent evidence suggests that chimpanzees may never have in fact lived in The Gambia (see Butynski 2003, Chapter 1). In this action plan, we no longer cite The Gambia as a former range state, but it is important to acknowledge that this is still under discussion. We still include a full chapter on this country and include it in our analyses.

[2] Although the western chimpanzee is reported to be extirpated from Burkina Faso, there is some evidence that they may still be present in this country (see Butynski 2003, Chapter 1).

(Photo credit: Janis Carter)

Captured from the forests of Liberia and then confiscated in December 1999 by the United States Fish and Wildlife Service at New York's John F. Kennedy airport, Esme was sent for rehabilitation to The Gambia but was never able to resume her life in the wild. In May 2002, she died despite the efforts of many people to save her life.

(Photo credit: Christophe Boesch)

Miriam and Makeba were twins born on November 17, 2000, to Margot in the South Group in the Taï National Park, Côte d'Ivoire. On November 15, 2002, a poacher shot and killed the mother Margot. Unfortunately, the present civil conflict in Côte d'Ivoire has made interventions impossible, and the fate of Miriam and Makeba remains unknown.

Dedication

This conservation action plan is dedicated to Esme, Margot, Miriam and Makeba, four chimpanzees who died or have been captured for the pet trade during the year 2002–2003 in which this action plan was compiled. These are only four examples of chimpanzees who have been victims of the commercial trade, which is only one of the threats they face. Their deaths and capture highlight the urgent need for a concerted action plan to address the threats to chimpanzees in West Africa.

Introduction

Rebecca Kormos

Background

Included among the many species of large mammals throughout Africa in danger of becoming extinct is the robust chimpanzee *Pan troglodytes*, which is presently listed as Endangered in the *2002 IUCN Red List of Threatened Species* (Hilton-Taylor 2002). In addition to habitat destruction and unsustainable hunting, chimpanzees are threatened by capture from the wild for use in the entertainment industry, as pets and for biomedical purposes. Their vulnerability is exacerbated by their slow reproduction rate in comparison to most species, which makes it more difficult for chimpanzee populations to bounce back quickly. A female chimpanzee does not start reproducing until she is 14 years old (Boesch and Boesch-Achermann 2000b) and typically only gives birth every five or six years (Boesch and Boesch-Achermann 2000b; Sugiyama 1999).

This action plan is focused on one of the four chimpanzee subspecies, the western chimpanzee *P. t. verus.* Along with the Nigeria chimpanzee *P. t. vellerosus*, the western chimpanzee is one of the two chimpanzee subspecies most threatened with extinction (Butynski 2001). The majority of the western chimpanzee population is found in the lowland forests along the Gulf of Guinea coast from Guinea to Nigeria. These forests are among the most biologically rich in the world, and among the most threatened. They have been designated as one of 25 global biodiversity hotspots (Myers *et al.* 2000) and one of the two highest priorities for primate conservation in the world (Mittermeier *et al.* 1999).

The Guinean forest hotspot may be best known for its high diversity of primates, but this could rapidly change if serious conservation action is not taken. The forests have already been reduced to 10% of their original size, and much of the remaining forest is severely fragmented (Myers *et al.* 2000). Another primate species, Miss Waldron's red colobus *Procolobus badius waldroni* – formerly found in forests around the Côte d'Ivoire-Ghana border area – has been reduced to such small numbers that it may in fact be Extinct in the Wild (Oates *et al.* 2000). Its disappearance would signify the first extinction in the twentieth century of a widely recognized primate taxon and warns that further extinctions of large mammals will probably follow (Oates *et al.* 2000). The western chimpanzee has already disappeared from two to three countries[3], including Benin and Togo, and possibly Burkina Faso,[4] and is on the verge of extirpation in others. Urgent action is therefore needed throughout its range and at all levels (from regional to national and local) to reverse this trend. Conservationists, non-governmental organizations, governments, development and relief organizations must work together to find a solution so that chimpanzees do not disappear from West Africa altogether.

How this action plan came about

This action plan began as an assemblage of background information pulled together to provide the most up-to-date information on the status of chimpanzees throughout West Africa and the threats to their survival. This information was then provided to participants of a workshop held September 12–13, 2002, in Abidjan, Côte d'Ivoire, with 72 participants from over 19 countries, including Senegal, Mali, The Gambia, Guinea, Guinea-Bissau, Liberia, Sierra Leone, Côte d'Ivoire, Ghana and Nigeria. The workshop aimed to discuss the status of chimpanzees in West Africa, and what can be done to ensure their survival. Participants also identified priority actions needed at the local, regional, and national levels to ensure the survival of chimpanzees. These priorities have been incorporated into this plan.

Conservation priority-setting exercises are becoming increasingly common. There are specific challenges of conducting such an exercise for one species whose range spans many different countries, with different languages and cultures. Once consensus is reached however, on what needs to be done, the end product becomes something that is fully endorsed and supported by all.

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[3] Former publications on the West African Chimpanzee (e.g., Lee *et al.* 1988; Teleki 1989) suggest that chimpanzees once existed in The Gambia, but are now extirpated from this country. Most recent evidence suggests that chimpanzees may never have in fact lived in The Gambia (see Butynski 2003, Chapter 1). In this action plan, we no longer cite The Gambia as a former range state, but it is important to acknowledge that this is still under discussion. We still include a full chapter on this country and include it in our analyses.

[4] Although the western chimpanzee is reported to be extirpated from Burkina Faso, there is some evidence that they may still be present in this country (see Butynski 2003, Chapter 1).

The aims of this action plan

The overall aim of this action plan is to halt or reverse the decline in chimpanzee numbers in West Africa by increasing awareness of their plight and by presenting a plan for action that represents a consensus among the governments of countries where chimpanzees are living, chimpanzee researchers, protected area managers, natural resources managers outside protected areas, and non-governmental organizations working in West Africa. This action plan aims to guide donors to where further investment is needed, researchers and conservationists as to where and how they should be concentrating their efforts, and development organizations to where they should be exceptionally careful so that their actions do not adversely affect chimpanzee populations.

More specifically, the plan aims to:

- provide a synthesis of available information on chimpanzees in West Africa,
- present an analysis of factors leading to, or likely to lead to, a decline in chimpanzee populations in West Africa,
- provide a review of the size and distribution of the chimpanzee populations in West Africa and
- present a prioritized list of sites and actions for chimpanzee conservation in West Africa.

Action plan structure

The action plan is divided into the following three sections:

Section I contains background information on all four subspecies of chimpanzees in Africa, including the behavior and ecology of the West African subspecies. Information is also presented on the genetic similarities between chimpanzees and humans and between subspecies of chimpanzees.

Section II focuses on national level assessments and includes chimpanzees in each of the range countries in West Africa. Each chapter provides a brief profile of the country, chimpanzee studies in the country, and legislation and conservation policies that are in place to protect chimpanzees. At the end of each chapter, a list of prioritized sites and actions are presented.

Section III provides regional level assessments and reviews the main threats to the survival of chimpanzees across West Africa, including logging, agriculture and hunting for pest control, bushmeat or the pet trade. It also presents information on chimpanzee sanctuaries throughout West Africa, and how these can be integrated into the overall regional action plan for chimpanzee conservation, as well as information on how disease may be a growing threat to chimpanzee populations and regional policy recommendations. This section also presents information on methodologies used to survey chimpanzee populations in hopes of harmonizing the way data is collected throughout the region.

How this action plan should be used

This document was born out of a tremendous collaborative effort of people across the world from different disciplines and from different sectors, including governments, universities and national and international non-governmental organizations. We hope that it will be useful as a tool for fundraising, for education and awareness raising, and for conservation planning by all those interested in protecting the chimpanzee in West Africa. We also hope that development organizations and government representatives beyond the conservation sector will use it as a planning tool.

Finally, we emphasize that this is a living document. As we gain more knowledge about chimpanzee distribution in West Africa, and as the political and economic landscapes change, the priorities for chimpanzee conservation will also change. We hope that this action plan will be revisited and updated in the years to come.

SECTION I

BIOLOGY OF WEST AFRICAN CHIMPANZEES

(Photo credit: Christophe Boesch)

An orphan chimpanzee called Utan fighting to open the hard pods of *Xylia* to eat the seeds. Taï Forest, Côte d'Ivoire.

SECTION I: BIOLOGY OF WEST AFRICAN CHIMPANZEES

This section contains background information on chimpanzees in West Africa. In Chapter 1, Butynski summarizes information on the taxonomy, distribution, numbers and status of chimpanzees, not only in West Africa, but also throughout Africa. In Chapter 2, Humle gives an overview of what is presently known of the behavior and ecology of chimpanzees in West Africa. In Chapter 3, Vigilant provides a summary of the current knowledge of the genetics of western chimpanzees. This information sets the stage for the country-specific reports that follow in Section II.

Chapter 1

The Robust Chimpanzee *Pan troglodytes*: Taxonomy, Distribution, Abundance, and Conservation Status

Thomas M. Butynski

1.1 Introduction

Although the robust (or common) chimpanzee *Pan troglodytes* is the most widespread and abundant of the world's six species of great ape, it is nonetheless an ''Endangered species'' (Hilton-Taylor 2002). All four subspecies of *P. troglodytes* are also Endangered.

This introductory chapter provides an overview of what we know about the taxonomy, distribution, abundance and conservation status of the robust chimpanzee as of 2003. Most of this information is taken directly from Butynski (2001) but updated as a result of data obtained during the Regional Workshop on Chimpanzee Conservation in West Africa held in Abidjan, Côte d'Ivoire, September 12–13, 2002, and from recent publications by Usongo (2001) and Plumptre *et al.* (2003).

1.2 Problems with the database

The accuracy of the estimates presented in this chapter for numbers of each subspecies of robust chimpanzee, and for the size of each subspecies' geographic range varies greatly. Some estimates are thought to be close to the actual numbers, while others are mere best guesses. There are two reasons for this lack of accuracy: first, the numbers and distributions of only a small portion of robust chimpanzee populations have been adequately assessed; second, many of the surveys on which the estimates are based were conducted more than a decade ago. With the widespread loss of habitat and the rapid decline in numbers of the robust chimpanzee, data more than a few years old often may be of limited value. For example, the estimate of robust chimpanzee numbers for the Democratic Republic of Congo (DRC, formerly Zaire), the country thought to hold the largest number of robust chimpanzees (Teleki 1991), is especially important but particularly speculative. The distribution of the robust chimpanzee in the DRC is poorly known, little of the potential habitat has ever been surveyed, and those surveys that have been conducted are now dated.

Given the limitations of the estimates, the values presented in this chapter should be used with the utmost care, and always with a cautionary note concerning accuracy. In addition, to provide as great a margin of safety as possible, we should always apply the ''precautionary principle'' – in other words, we should always use the lowest estimates for the sizes of robust chimpanzee populations and geographic ranges when making conservation decisions.

In this chapter, the term *geographic range* is equivalent to the term *extent of occurrence* as defined by The World Conservation Union (IUCN 2001). *Area of occupancy* (or *area occupied*) is used in this chapter as defined by IUCN (2001).

For the robust chimpanzee, the area of occupancy is certainly much smaller than the geographic range. I suspect that once we have more accurate information, the area of occupancy for all taxa will be found to be only 5–25% of the geographic range.

1.3 Taxonomy of the robust chimpanzee

In order to set priorities for the conservation of the robust chimpanzee, it is important to determine the number of subspecies. Three subspecies of robust chimpanzee have usually been recognized in recent decades: western chimpanzee *P. t. verus*, central chimpanzee *P. t. troglodytes*, and eastern chimpanzee *P. t. schweinfurthii* (Napier and Napier 1967; Groves 2001). Mitochondrial DNA studies, however, lend support to the recognition of the Nigeria chimpanzee as a distinct subspecies, *P. t. vellerosus* (Gonder *et al.* 1997; Hilton-Taylor 2000; Grubb *et al.* 2003; Vigilant 2003, Chapter 3).

A mitochondrial DNA study by Morin *et al.* (1994) found that *P. t. verus* might be sufficiently different from *P. t. troglodytes* and *P. t. schweinfurthii* to warrant elevation to a full species (*Pan verus*). Recognition of *Pan verus* is pending, primarily because intervening populations have not been adequately sampled and because morphological, ecological or behavioral differences sufficient to merit species designation have not been demonstrated (Jolly *et al.* 1995; Groves 2001; Grubb *et al.* 2003). This is obviously an area for research and consideration.

Hill (1967, 1969) recognized a fifth subspecies of robust chimpanzee for the montane forests of Cameroon and Gabon, the koolokamba or gorilla-like chimpanzee *P. t. koolokamba.* This classification lacks current support among primate taxonomists; the specimens ascribed to *P. t. koolokamba* all fall within the range of variation of *P. t. troglodytes* (Cousins 1980; Shea 1984; Groves 2001; Grubb *et al.* 2003).

1.4 Distribution of the robust chimpanzee

The robust chimpanzee lives in savanna woodlands, mosaic grassland forests, and tropical moist forests from sea level to about 2,800m (9,200ft) elevation (Groves 1971; Kortlandt 1983; Teleki 1989). This species probably once spanned most of Equatorial Africa, from south Senegal to south-west Tanzania, ranging over all or part of at least 25 countries (Hill 1969; Teleki 1989). Today the robust chimpanzee is the most widely distributed of Africa's apes, occurring in 22 countries from 13°N to 7°S latitude (Hill 1969; Kortlandt 1983; Lee *et al.* 1988; Teleki 1989; Table 1.1, Figure 1.1). With few exceptions, however, the past and present distributions of the robust chimpanzee within these countries are poorly known. The present geographic range of the robust chimpanzee, as shown in Figure 1.1, is approximately 2,342,000km^2 (904,000 miles^2, as measured by Map Info computer mapping software).

Western chimpanzee. The western chimpanzee *P. t. verus* is known to have once occurred in 12 countries, but is currently patchily distributed in nine or ten countries from south-east Senegal east probably to either the Dahomey Gap or the Niger River (Lee *et al.* 1988; Teleki 1989; E. Sarmiento and J. Oates, pers. comm.). Contrary to statements in various articles (e.g., Lee *et al.* 1988; Teleki 1989), there is no hard evidence (e.g., museum specimens) that the chimpanzee is indigenous to The Gambia (Grubb *et al.* 1998). Nonetheless, old hunters orally report that they used to encountered chimpanzees in the Pakao area of Senegal during the 1920s and 1930s, and that some chimpanzees were still present in the 1960s. The Pakao area is located about 10km south of The Gambia. The forest in which these sightings occurred is contiguous with forest in south-east Gambia (A. Sarr, pers. comm. to J. Carter, pers. comm.).

Although now highly fragmented, the range of the western chimpanzee may have been almost continuous from Senegal to Togo until the mid-1900s (Jolly *et al.* 1995). Teleki (1989) suggested that the original population of the western chimpanzee had a geographic range of nearly 2,000,000km^2 (800,000 miles^2), but it seems unlikely that it was ever this large. The geographic range presented in Figure 1.1 is 631,000km^2 (244,000 miles^2, as measured by Map Info).

Nigeria chimpanzee. The northern limit of the Nigeria chimpanzee *P. t. vellerosus* is suspected to be either the Niger River or the Dahomey Gap, and the southern limit is probably the Sanaga River (M. K. Gonder and J. Oates, pers. comm.). Thus, the geographic range of this subspecies lies in what was considered the southern range of the western chimpanzee (i.e., Benin or west Nigeria) and the northern range of the central chimpanzee (i.e., east Nigeria and west Cameroon). The geographic range shown in Figure 1.1 is 142,000km^2 (55,000 miles^2, as measured by Map Info).

Central chimpanzee. The geographic range of the central chimpanzee *P. t. troglodytes* extends across seven countries, presumably from the west bank of the Ubangi River south-west to near the mouth of the Congo River and north probably to the Sanaga River (Gonder *et al.* 1997), not to the Niger River as reported previously (Hill 1969; Tuttle 1986; Lee *et al.* 1988; Teleki 1989). In 1987, the central chimpanzee was known to occupy an area of about 17,000km^2 (6,800 miles^2), with an additional 254,000km^2 (101,600 miles^2) of potentially suitable habitat in need of survey (Lee *et al.* 1988; Teleki 1989). The geographic range shown in Figure 1.1 is 695,000km^2 (268,000 miles^2, as measured by Map Info).

Eastern chimpanzee. The eastern chimpanzee *P. t. schweinfurthii* occurs in seven countries. The geographic range presumably extends from the east bank of the Ubangi River across much of the DRC north of the Congo River and east of the Lualaba River, to south-east Central African Republic (CAR) and extreme south-west Sudan, to west Uganda, Rwanda, and Burundi, to south-west Tanzania (Kortlandt 1983; Lee *et al.* 1988). There were 29,000km^2 (11,600 miles^2) of habitat known to be occupied by the eastern chimpanzee in 1987 to 1989, with an additional 473,000km^2 (189,200 miles^2) of potential habitat (Lee *et al.* 1988; Teleki 1989, 1991). The geographic range shown in Figure 1.1 is 874,000km^2 (337,000 miles^2, as measured by Map Info).

1.5 Abundance of the robust chimpanzee

The question of how many robust chimpanzees there are, and of individuals in each of the four subspecies, is a thorny one, as indicated by the considerable ranges in the estimates provided for some taxa over the past decade. Nonetheless, even rough estimates provide some indication of the level of endangerment for each taxon and, therefore, some basis on which to set priorities for conservation action.

Western chimpanzee. The western chimpanzee *P. t. verus* is Extinct in the Wild in two countries (Benin and Togo), and, at fewer than 500 animals, almost Extinct in three other countries (Burkina Faso, Senegal, Ghana; Lee *et al.* 1988; IUCN 1996, Table 1.1). Although the western chimpanzee is reported to be Extinct in Burkina Faso, J. Moore (pers. comm.) has good second-hand information that a few chimpanzees are still present in that country in riverine forest along the Volta River near ''the bend'' at the village of Douroula.

Teleki (1989) suggested that the original population of western chimpanzee numbered more than 600,000 individuals. In 1987 there were an estimated 2,000 in known habitats (9,000km^2; 3,600 miles^2) and another 12,000–19,000 in potential habitats (39,000km^2; 15,600 miles^2; Lee *et al.* 1988; Teleki 1989). Teleki (1989) argued that in Sierra Leone alone the population dropped from 20,000 in the late 19th century to 2,000 in 1987.

The number of western chimpanzees in Liberia was estimated by Teleki (1991) to be 3,000–4,000. The number at present is estimated to be between 1,000 and 5,000 (Nisbett *et al.* 2003, Chapter 11).

Teleki (1991) suggested that there were 600–800 western chimpanzees in Mali. However, field work by Pavy (1993) indicated that there were 1,800–3,500 chimpanzees in Mali in the early 1990s. This higher figure has been corroborated by Duvall *et al.* (2003, Chapter 6) who estimate that there are now 1,600–5,200 chimpanzees in Mali.

Teleki (1991) estimated that Côte d'Ivoire held 500–1,000 western chimpanzees in 1989. This estimate was contradicted by field surveys in 1989 and 1990 by Marchesi *et al.* (1995) who indicated there were 10,500–12,800 chimpanzees in Côte d'Ivoire. These researchers found the highest densities of chimpanzees in the Marahoué National Park. Work in the Marahoué National Park in 1997 to 1998 strongly suggests, however, that the density of chimpanzees there has declined dramatically since 1990 (Barnes 1997; Struhsaker 1998). The most recent assessment suggests that there are 8,000–12,000 chimpanzees in Côte d'Ivoire and that there has been a nationwide decline in chimpanzee numbers since the 1989 to 1990 survey (Herbinger *et al.* 2003, Chapter 12).

Sugiyama and Soumah (1988) and Teleki (1991) placed the number of chimpanzees in Guinea at 1,400–6,600, and 2,000–4,000, respectively. More recently, however, the results of a 15-month nationwide survey indicate that the number of chimpanzees in Guinea is roughly 17,600 (range 8,100–29,000; Ham 1998). Guinea and Côte d'Ivoire support the largest numbers of western chimpanzees.

The total number of western chimpanzees in 1989 was estimated at 8,000–13,000 (Teleki 1991). In 1997, the World Wide Fund for Nature estimated that there were 12,000 western chimpanzees (Kemf and Wilson 1997). More recent surveys (Table 1.1) indicate that this was a considerable underestimate and that today there are probably between 21,000 and 56,000 western chimpanzees.

Nigeria chimpanzee. Estimates of past and current numbers of the Nigeria chimpanzee *P. t. vellerosus* are particularly difficult because this subspecies was subsumed within *P. t. troglodytes* until recently, and because the limits of its geographic range remain uncertain. Teleki (1991) estimated that there were 100–300 chimpanzees in Nigeria in 1989, but Hogarth (1997) found roughly 1,500 chimpanzees in the Gashaka Gumti National Park alone. Oates *et al.* (2003, Chapter 17), who have conducted the most extensive surveys of the forests of Nigeria, estimated that there are today 2,000–3,000 chimpanzees in Nigeria. It is probable that at least a few thousand of the 35,000 chimpanzees estimated to be present in Cameroon (Usongo 2001) are Nigeria chimpanzees. E. Gadsby, P. Jenkins, J. Oates and J. Groves (pers. comm.) estimate that there are 3,000–5,000 Nigeria chimpanzees in Cameroon. Therefore, a reasonable guess is that the total number of Nigeria chimpanzees is between 5,000 and 8,000.

Central chimpanzee. The largest populations of the central chimpanzee *P. t. troglodytes* are found in Gabon and Cameroon. There is also a substantial population in the People's Republic of Congo (PRC). Smaller populations are present in Equatorial Guinea, the CAR, north Angola (Cabinda enclave), and extreme west DRC, north of the Congo River.

Table 1.1. Estimated number of robust (common) chimpanzee *Pan troglodytes* in 2003 by subspecies and country. The taxonomy used here is that of Grubb *et al.* (2003). This is the taxonomy adopted by the IUCN/SSC Primate Specialist Group and the *2002 IUCN Red List of Threatened Species* (Hilton-Taylor 2002). This table is adopted from Butynski (2001) and updated.

Subspecies and country	Number of chimpanzees	
	Low	**High**
Western Chimpanzee (*P. t. verus*)	**21,300**	**55,600**
Benin	0	0
Togo	0	0
Nigeria	0	?a
Burkina Faso	0	Few?
Senegal	200	400
Ghana	300	500
Guinea-Bissau	600	1,000
Sierra Leone	1,500	2,500
Liberia	1,000	5,000
Mali	1,600	5,200
Côte d'Ivoire	8,000	12,000
Guinea	8,100	29,000
Nigeria Chimpanzee (*P. t. vellerosus*)	**5,000**	**8,000**
Nigeria	2,000	3,000[a]
Cameroon	3,000	5,000[b]
Central Chimpanzee (*P. t . troglodytes*)	**70,000**	**116,500**
Democratic Republic of Congo (DRC)	?	?
Angola (Cabinda)	200	500
Central African Republic (CAR)	800	1,000
Equatorial Guinea (Rio Muni/Mbini)	1,000	2,000
People's Republic of Congo (PRC)	10,000	10,000
Cameroon	31,000	39,000[b]
Gabon	27,000	64,000
Eastern Chimpanzee (*P. t. schweinfurthii*)	**76,400**	**119,600**
Central African Republic (CAR)	?	?
Sudan	200	400
Burundi	200	500
Rwanda	500	500
Tanzania	1,500	2,500
Uganda	4,000	5,700
Democratic Republic of Congo (DRC)	70,000	110,000
TOTAL	**172,700**	**299,700**

Note: All data from Teleki (1991), except as follows: Burundi (Teleki 1991; Nishida 1994); Cameroon (Usongo 2001); Côte d'Ivoire (Marchesi *et al.* 1995; Herbinger *et al.* 2003, Chapter 12); Equatorial Guinea (Teleki 1991; J. Sabater-Pi, pers. comm. quoted in Nishida 1994); Gabon (Tutin and Fernandez 1984; Blom *et al.* 1992; L. White, pers. comm. quoted in Stevens 1997); Guinea (Ham 1998; Kormos, Humle *et al.* 2003, Chapter 9); Guinea-Bissau (Gippoliti *et al.* 2003, Chapter 8); Liberia (Teleki 1991; Nisbett *et al.* 2003, Chapter 11); Mali (Duvall *et al.* 2003, Chapter 6); Nigeria (Oates *et al.* 2003, Chapter 17); PRC (S. Kuroda, pers. comm. quoted in Nishida 1994); Rwanda (Nishida 1994); Senegal (Galat-Luong *et al.* 2000); Uganda (Plumptre *et al.* 2003). Teleki (1991) does not provide references for the sources of his estimates, but most of these can be found in Lee *et al.* (1988).

a The chimpanzee in Nigeria west of the Niger River may belong to the subspecies *P. t. verus.*

b An unknown number of the approximately 35,000 chimpanzees in Cameroon in 1988 (Usongo 2001) belonged to the subspecies *P. t. vellerosus* (Gonder *et al.* 1997). This table assumes that 3,000–5,000 are *P. t. vellerosus* (E. Gadsby, P. Jenkins, J. Oates and J. Groves, pers. comm.).

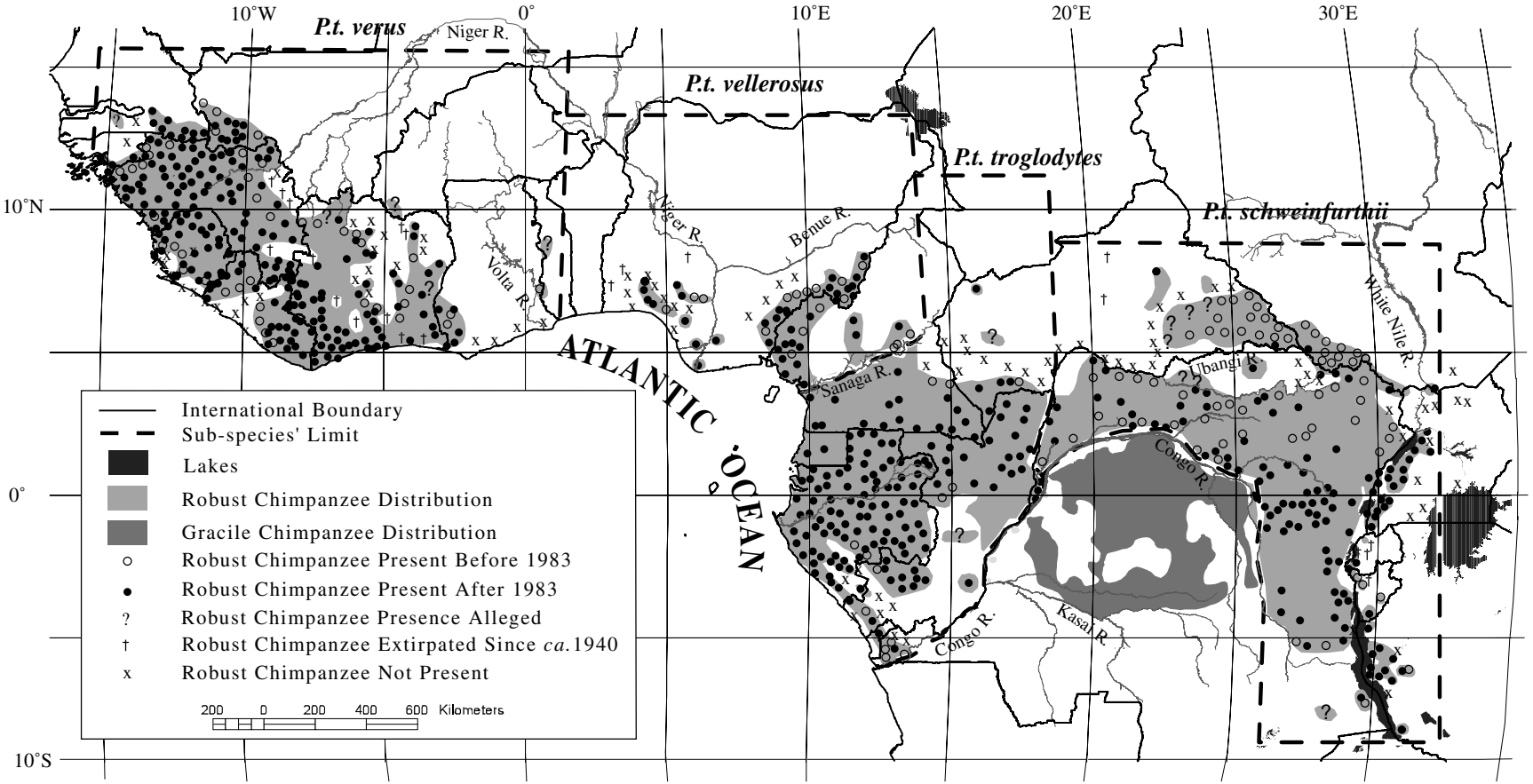

Figure 1.1. Distribution of the robust (common) chimpanzee *Pan troglodytes*, and gracile chimpanzee (bonobo) *Pan paniscus*. The pre-1983 localities for the robust chimpanzee are taken from Vandebroek (1958), Hillman (1982), Kortlandt (1983), Thys Van den Audenaerde (1984), and Tutin and Fernandez (1984). Much of the data on sites where the robust chimpanzee was confirmed to be present post-1983 were compiled by E. van Adrichem (unpublished data) in 1998 but come also from Fay *et al.* (1989), Mwanza and Yamagiwa (1989), Blom *et al.* (1992), Massawe (1992, 1995), Hart and Sikubwabo (1994), Nicholas (1995), Anderson (1997), Gonder *et al.* (1997), Ogawa *et al.* (1997), Abedi-Lartey (1998), Hall *et al.* (1998), Ham (1998), Omari *et al.* (1999), Allan (2000), Galat-Luong *et al.* (2000), Usongo (2001), Carter *et al.* (2003, Chapter 5), Duvall *et al.* (2003, Chapter 6), Gippoliti *et al.* (2003, Chapter 8), Halford *et al.* (2003), Hanson-Alp *et al.* (2003, Chapter 10), Herbinger *et al.* (2003, Chapter 12), Kormos, Humle *et al.* (2003, Chapter 9), Magnuson *et al.* (2003, Chapter 13), Nisbett *et al.* (2003, Chapter 11), Oates *et al.* (2003, Chapter 17), and Plumptre *et al.* (2003). In addition, unpublished data were provided by A. Blom, M. Languy, R. Fotso and S. Gartlan (Cameroon); A. Blom and M. Colyn (CAR); D. Messinger, J. Hart, K. Smith, F. Smith, T. Butynski and D. Wilkie (DRC); S. Lahm (Gabon); M. K. Gonder, J. Oates and S. Gartlan (Nigeria); J. Carter (Senegal); S. Blake, J. Moore, M. Colyn, and A. Blom (PRC); J. Kingdon (Sudan); and J. Moore (Tanzania).

Given the high levels of habitat loss and hunting since 1930, the robust chimpanzee is not now found over the entire range shown. On the other hand, there are undoubtedly sites where the robust chimpanzee occurs but that have yet to be documented. Note that there are large parts of the geographic range of the robust chimpanzee that have never been surveyed (e.g., south-east CAR and north DRC), or that have not been surveyed since 1985 (e.g., the vast forests of Gabon). Although the robust chimpanzee almost certainly still occurs over much of Gabon, there are no current data to confirm this. This map is adopted from Butynski (2001) and updated to 2003.

Tutin and Fernandez (1984) estimated the number of chimpanzees in Gabon in 1980 to 1983 to be 51,000–77,000. Blom *et al.* (1992) estimated the number to be 64,000 chimpanzees in 1985 to 1988. These estimates may now be outdated, given the substantial increases in logging and hunting in the country since these two surveys were conducted. Indeed, L. White (quoted in Stevens 1997) suspected that the number of chimpanzees in Gabon declined by more than 50% (from 64,000–30,000 individuals) between 1988 and 1997.

In 1991 Teleki estimated that there were 3,000–5,000 chimpanzees in the PRC. Since then, two to three times as many chimpanzees were found to be present (S. Kuroda, pers. comm. in Nishida 1994). Usongo (2001) reports that in 2000 there were many more chimpanzees in Cameroon (*c.* 35,000 animals) than estimated by Teleki (1991; 6,000–10,000 animals). The majority of these are central chimpanzees, whereas those in the north are probably Nigeria chimpanzees.

In 1987, there were about 5,000 central chimpanzees in known localities (17,000km^2; 6,800 miles^2) and an estimated 57,000–91,000 in unsurveyed areas with potentially suitable habitat (254,000km^2; 101,600 miles^2; Lee *et al.* 1988; Teleki 1989). Teleki (1991) estimated that there were 62,000–91,000 central chimpanzees in 1989. The data in Table 1.1 indicate that the present number of central chimpanzees is likely between 70,000 and 117,000.

Eastern chimpanzee. The number of eastern chimpanzees *P. t. schweinfurthii* from known habitats (29,000km^2; 11,600 miles^2) was put at 10,000 in 1987 to 1989, with an additional 65,000–108,000 animals in potential habitats (473,000km^2; 189,200 miles^2; Lee *et al.* 1988; Teleki 1989, 1991). This gives a total of 75,000–118,000 individuals for this subspecies in 1987 to 1989. The majority (an estimated 70,000–110,000) of them were in the DRC (Teleki 1991), and small populations totaling 5,100–8,600 animals were in Uganda, Tanzania, Rwanda, Burundi, and Sudan. There are no data on the number of eastern chimpanzees in south-east CAR.

The major problem with estimating the number of eastern chimpanzees is the paucity of information on densities and distribution of this species in the DRC. Based on extensive surveys, Hart and Hall (1996) estimated that there are 12,800–21,900 chimpanzees within the 30,530km^2 (12,210 miles^2) area in east DRC covered by the Maiko National Park, Kahuzi Biega National Park, and Okapi Wildlife Reserve. On this basis it seems reasonable to retain Teleki's (1991) estimate of 70,000–110,000 eastern chimpanzees for the DRC. Information from Burundi (Nishida 1994), Rwanda (Nishida 1994), and Uganda (Plumptre *et al.* 2003) suggests that the present number of eastern chimpanzees remains between 76,000 and 120,000 (Table 1.1).

The data presented in Tables 1.1 and 1.2 indicate that roughly 3% of the robust chimpanzees are Nigeria chimpanzees, 16% are western chimpanzees, 39% are central chimpanzees, and 42% are eastern chimpanzees.

Teleki (1991) claimed that there were once millions of robust chimpanzees in Africa. Goodall (2000) has argued that there were about 2,000,000 robust chimpanzees in Africa at the beginning of the 20th century, more than a million in 1960, and no more than about 150,000 in 1989.

The total number of robust chimpanzees in known localities (55,000km^2; 22,000 miles^2) in 1987 was about 17,000, and estimates based on area of potentially suitable habitat (766,000km^2; 306,400 miles^2) suggested an additional 134,000–218,000 animals (Teleki 1989). This yields a total of 151,000–235,000 robust chimpanzees in 1987. Teleki (1991) provided a population range total of 145,000–228,000 for this species in 1989. The country-by-country estimates presented in Table 1.1 indicate that, despite a considerable decline in robust chimpanzee numbers since 1989 because of habitat loss and hunting, the number of robust chimpanzees in 2003 is probably between 173,000 and 300,000. The estimate of 200,000 robust chimpanzees given by WWF in 1997 (Kemf and Wilson 1997) lies near the center of this range. That there are between 173,000 and 300,000 robust chimpanzees today indicates that the estimates provided for 1987 and 1989 were somewhat low.

1.6 Conservation status of the robust chimpanzee

The robust chimpanzee is listed as an ''Endangered species'' under Section 4 of the United States Endangered Species Act of 1973. This species is also listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). That is, the robust chimpanzee is considered to be among those ''species threatened with extinction which are or may be affected by trade'' (CITES 1973). All 150 member countries of CITES are required to ''take appropriate measures to enforce the provisions of the present Convention and to prohibit trade in specimens in violation thereof.''

The most recent action plan for African primates, produced by the IUCN/SSC Primate Specialist Group (Oates 1996a), summarizes the primate conservation needs for Africa and sets priorities for conservation action. The robust chimpanzee is listed among the seven African primates with the highest ''conservation priority ratings.''

The *Threatened Primates of Africa: The IUCN Red Data Book* (Lee *et al.* 1988) ranked the western chimpanzee as an ''Endangered taxa''. The other two subspecies of robust chimpanzee recognized in 1988 were ranked as ''Vulnerable'' (Table 1.2). These two degrees of threat are defined by IUCN (2001) as follows:

Endangered: ''A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild''.

Vulnerable: ''A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild''.

During the period 1988 to 1996, the ''causal factors'' (i.e., habitat loss and hunting) not only continued to operate, but their rates of damage to robust chimpanzee populations and habitats accelerated (Kemf and Wilson 1997; World Society for the Protection of Animals 2000).

The *1996 IUCN Red List of Threatened Animals* used a new set of criteria for assessing degree of threat (IUCN 1994, 1996). The majority of the IUCN/SSC Primate Specialist Group members working with the robust chimpanzee in the wild believed that it should be classified as ''Endangered'' under criterion A2. That is, based on observed or suspected changes in area of occupancy, extent of occurrence, quality of habitat, and levels of exploitation, they projected that the wild populations would decline by at least 50% over the next three generations. For the robust chimpanzee, three generations is taken to be 60 years (as defined in IUCN 1994).

The robust chimpanzee was one of six species of African primate considered by the *1996 IUCN Red List of Threatened Animals* to be ''Endangered'' (IUCN 1996; Butynski 1997). The western, central and eastern chimpanzee were rated as ''Endangered'' subspecies (Table 1.2). The Nigeria chimpanzee was not recognized at this time.

In February 2000, an IUCN/SSC Primate Specialist Group workshop reassessed the taxonomy and degree of threat status of the world's primates in preparation for the *2000 IUCN Red List of Threatened Species* (Hilton-Taylor 2000). About 25 of the world's most experienced field primatologists, primate taxonomists, and primate molecular biologists participated in this workshop. They concluded that the robust chimpanzee, and all four of its subspecies, were ''Endangered'' (Table 1.2).

Much has been said and published over the past 15 years on the threats to the robust chimpanzee and other African apes – and numerous recommendations have been made to reduce these threats and to reverse the downward trend in numbers (Teleki 1989; Ammann and Pearce 1995; Oates 1996a; Butynski 1997, 2001; Kemf and Wilson 1997; Ape Alliance 1998; Bowen-Jones 1998; Bowen-Jones and Pendry 1999; Wilkie and Carpenter 1999; Ammann 2000; World Society for the Protection of Animals 2000).

1.7 Conclusions

Four subspecies of the robust chimpanzee are recognized, all of which are in rapid decline (both in terms of numbers and geographic range), and all are in danger of extinction. Numbering roughly 5,000–8,000 individuals, the Nigeria chimpanzee is the rarest of these subspecies. The western chimpanzee is the next most threatened subspecies of robust chimpanzee with approximately 38,000 individuals. Of the four subspecies, the biggest concern from a conservation perspective must, therefore, be for the survival of the Nigeria chimpanzee and the western chimpanzee.

The western chimpanzee has already been extirpated from at least two countries (Benin, Togo), and could soon be extirpated from five additional countries where national populations are thought to be smaller than 1,000 individuals (Nigeria, Burkina Faso, Senegal, Ghana, Guinea-Bissau).

Table 1.2. Category of threat allocated to each subspecies of robust (common) chimpanzee *Pan troglodytes* in *Threatened Primates of Africa*: *IUCN Red Data Book* (Lee *et al.* 1988), the *1996 IUCN Red List of Threatened Animals* (IUCN 1996), the *2000 Red List of Threatened Species* (Hilton-Taylor 2000), the *2002 Red List of Threatened Species* (Hilton-Taylor 2002), and the estimated total number of individuals for each subspecies in 2003. The taxonomy used here is that of Grubb *et al.* (2003).

Species and subspecies	1988	1996	2000 and 2002	Total number[a]
Robust chimpanzee *P. troglodytes*	Vulnerable	Endangered	Endangered	235,000
Western chimpanzee *P. t. verus*	Endangered	Endangered	Endangered	38,000
Nigeria chimpanzee *P. t. vellerosus*	[b]	[b]	Endangered	6,000
Central chimpanzee *P. t. troglodytes*	Vulnerable	Endangered	Endangered	93,000
Eastern chimpanzee *P. t. schweinfurthii*	Vulnerable	Endangered	Endangered	98,000

a See Table 1.1. for country-by-country estimates for 2003, and for references for the data on which these estimates are based.

b The Nigeria chimpanzee was not recognized in 1988 and 1996. Thus, no degree of threat assessment was made.

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Chapter 2

Behavior and Ecology of Chimpanzees in West Africa

Tatyana Humle

2.1 Introduction

This chapter provides information on the behavior and ecology of chimpanzees in West Africa. It aims to provide data of feeding, ranging and nesting behavior, as well as social structure, in order to give a background of information that can be used in the conservation and management of chimpanzees. It is hoped that this information can help in such activities as creating conservation policies, or in designing reserves, or corridors between reserves. It thus provides such information on what chimpanzees prefer to eat, how much space they need and how many individuals are typically in a group.

This chapter generally draws upon long-term studies that have been conducted on chimpanzees in West Africa. Of the six recognized long-term study sites of chimpanzees in Africa, two have focused on the West African subspecies *P. t. verus.* These include Bossou, Guinea (Sugiyama and Koman 1979a; 1979b) and Taï, Côte d'Ivoire (Boesch 1978), which were both established in 1976. Information on the chimpanzee population in and outside the Niokolo Koba National Park at Mt. Assirik, Senegal, was also used. This population was studied by Bermejo (1993) for 19 months in 1986, and on-going research has resumed there since 2000. This field site was originally set up as part of the Stirling African Primate Project, which lasted four years during the late 1970s (Baldwin 1979). Several other areas, especially within Guinea and Côte d'Ivoire, have also been surveyed or are currently being established as research sites and have also yielded useful information about chimpanzee distribution, behavior and ecology that will be referred to in this chapter.

2.2 Feeding behavior

Feeding behavior in chimpanzees varies seasonally and is greatly influenced by food availability and habitat type. As the feeding repertoire of chimpanzees at different sites is being compiled and expanded, it is becoming apparent that there are differences in species eaten across sites that cannot be explained by differences in their biotic environments and that reflect traditional and potentially cultural variants between communities (e.g., Nishida *et al.* 1983; McGrew 1992). These differences also relate to food processing techniques (Nishida *et al.* 1983) and to the use of plants for self-medication purposes (c.f. Huffman and Wrangham 1994).

At Bossou more than 200 plant species, representing approximately 30% of available species in the habitat, are consumed by chimpanzees, comprising more than 246 plant parts (Sugiyama and Koman 1992). So far little information is available on the dietary repertoire of the Mt. Assirik chimpanzees; however, indirect data collected suggests that they may have a narrower dietary breadth than other chimpanzee populations (McGrew *et al.* 1988). The chimpanzees of Mt. Assirik live in an open, hot and arid savanna environment, where species diversity is lower than in the forests of Bossou and Taï (McGrew *et al.* 1988). Although forest covers only 3% of the study area within the Niokolo Koba National Park, it provides the Mt. Assirik chimpanzees with more than 30% of the food species comprising their diet (McGrew *et al.* 1988).

Chimpanzees are omnivorous and have a diverse diet although fruit pulp usually comprises the largest portion of their diet. Leaves and woody pith are the next two most important food types for the chimpanzees at Bossou as well as seeds and the pith of herbaceous plants (Yamakoshi 1998). Different communities may diverge in the diversity of their dietary repertoire and the proportion of low-quality foodstuffs they consume. At Mt. Assirik, chimpanzees appear to spend more time on low quality foods, including underground storage organs that are time consuming to collect or tedious to obtain and process. However, this may simply reflect the poor quality of their habitat, which is dominated by savanna (McGrew *et al.* 1988).

Other items consumed by Bossou chimpanzees include flowers, bark, roots and tubers, tree gum and insects such as adult termites *Isoptera* sp., ants *Dorylus* sp. and *Oecophylla longinoda*, and the larvae and eggs of ants, bees and several species of beetles such as the raphia coleoptera *Rhynchophorus quadrangulus*. Different chimpanzee communities incorporate different insect prey into their diet, with some being ignored at some sites while consumed at others (McGrew 1992). For example, although *Macrotermes* termites are consumed at Mt. Assirik (McGrew *et al.* 1988), and are available at Bossou, chimpanzees at the Bossou site

do not feed upon them (although one exceptional observation of a female and her offspring briefly doing so was reported in 1997, Humle 1999). Other food items also consumed by Bossou chimpanzees, although more infrequently, include algae, mushrooms, honey, bird eggs and mammals such as the tree pangolin *Manis tricuspis*. Hunting for animal prey at this site is relatively rare compared to other sites where chimpanzees have been studied, mainly due to the paucity of other mammalian species in the habitat.

(Photo credit: Tetsuro Matsuzawa)

During times of hardship, the chimpanzees of Bossou effectively increase their tool use activities (e.g., nut cracking and ant dipping) in order to gain access to otherwise inaccessible food resources and to boost their energy intake.

At Taï, chimpanzees hunt regularly for animal prey. Their focal prey include different species of primates, especially the Western red colobus *Procolobus badius* (Boesch and Boesch-Achermann 2000b). Taï chimpanzees have developed a sophisticated collaborative hunting strategy, unique among non-human primates, mainly involving males of the community who gain rewards for their contribution to the hunt by acquiring a share of the meat (Boesch and Boesch-Achermann 2000b). But meat sharing also involves other members of the community including females and youngsters who can acquire scraps through begging. At Mt. Assirik, traces of prosimian primates, including a species of bushbaby *Galago senegalensis* and the potto *Perodicticus potto*, have been found in the feces of chimpanzees, indicating that Assirik chimpanzees also prey on mammalian species (McGrew *et al*. 1978). Meat eating in chimpanzees often entails cooperation during hunting episodes and food sharing between members of the same community, behaviors also frequently observed in other contexts in chimpanzees. However, the frequency of hunting for mammalian prey may vary significantly between sites depending on the chimpanzee community and the availability of potential prey within its habitat.

The proportion of food items in the chimpanzee diet may also vary significantly across seasons. Plant species that show little inter-annual variation, either in the amount of resources produced or in the seasonal timing of availability, are termed ''keystone resources'' or ''fallback foods'' (Terborgh 1986). Fig trees (*Ficus* sp.), for example, constitute one of the main keystone food resources for chimpanzees across many field sites, due to their aseasonal fruiting patterns and general year-round availability. In the Nimba Mountains region, *Nauclea* trees, which produce a succulent fleshy fruit, also play an important role for the chimpanzees, due to their availability in times when the abundance of other fruits is low (Humle, pers. obs.). Terrestrial herbaceous vegetation, such as plant species belonging to the Marantaceae and Zingerberaceae families, can also constitute an important fallback food in forest habitats in times of fruit scarcity. Chimpanzees may eat the pith and the fruit of these species. Yamakoshi (1998) also showed that at Bossou the chimpanzees heavily rely upon the parasol tree *Musanga cecropioides* and the oil palm tree *Elaeis guineensis* during such times. The oil palm tree provides them with year-round food resources, including the rich mesocarp of the fruit, the oily nut kernel, the petiole of young palm fronds, the base of immature flowers, the pith of mature leaves and the sugary and nutritious palm heart. In addition, it appears that during times of hardship, the chimpanzees of Bossou effectively increase their tool use activities (e.g., nut cracking and ant dipping) in order to gain access to otherwise inaccessible food resources and to boost their energy intake (Yamakoshi 1998). During periods of fruit scarcity, chimpanzees will rely and concentrate on different ''keystone resources'' or ''fallback foods,'' which will depend on their habitat and the feeding traditions of their community.

2.3 Nesting behavior

Chimpanzees build arboreal nests every night. Chimpanzees build their nest by preparing a foundation of solid side branches or forks, bending, breaking and inter-weaving side branches crosswise (Fruth and Hohmann 1996). They complete this arboreal construction by bending most of the smaller twigs in a circular fashion around the rim. Detached twigs are sometimes added for lining (Goodall 1968). Chimpanzees may also build nests during the day for resting. These nests are usually in trees, although there have also been reports of use of ground nests in several communities (see below). Goodall (1968) noted that infants as young as eight months old begin to build rudimentary nests in play. Nests may range from very rough and superficial structures, usually day nests, to carefully built night nests. Chimpanzees do not hesitate to combine trees when these interface, but usually they use only one tree. The maximal number of trees integrated in a single nest is seven at Seringbara, Guinea (Humle 2003a), and the largest number of nests found in a single tree is ten, as observed by Goodall (1962) in the Gombe Stream Reserve, Tanzania.

Chimpanzees are selective in the choice of their nesting site. Indeed, most studies of nesting in chimpanzees reveal that nests accumulate in specific areas depending on forest type and proximity to water and food resources (Baldwin *et al.* 1982; Groves and Sabater Pi 1985; Kortlandt 1992; Sept 1992). Moreover, there are indications that chimpanzees have preferences for nesting material and for the height at which nests are constructed (Wrogemann 1992; Fleury-Brugiere 2001).

During Ham's nationwide survey of chimpanzees in Guinea from 1995 to 1997, the species of tree were identified for 573 nests. The most frequently used species of trees for nesting are listed in Table 2.1. Preferred species varied between regions. For example, in the Fouta Djallon, *Erythrophleum suaveolens* was the preferred species and made up 26% of the total nests. In Guinée Maritime, 44% of all nests recorded were made in the oil palm tree *Elaeis guineensis* (i.e., 75 nests). There is a high density of oil palm trees in this region, especially towards the coastal areas. However, even when other species of trees are present in certain areas, chimpanzees still seem to prefer to nest in oil palm trees. Gippoliti and Dell'Omo (1995) also reported that almost all chimpanzee nests they observed in Guinea-Bissau, close to the border with Guinea, were constructed in oil palms. Interestingly, De Bournonville (1967) traveled throughout Guinée Maritime and, during his study, only reported finding one nest in a palm tree. This may suggest that in this area of Guinea, nesting in oil palm trees is a fairly recent development. It may also be linked however, with increased deforestation rates. Palm trees tend to be better preserved as they provide a significant income to local villagers through the production of oil palm. At Bossou however, ever since 1976, chimpanzees have commonly and preferentially made nests in the crown of oil palm trees, a species that is also heavily used at this site by chimpanzees as a food resource, i.e., nuts, fruit, palm fronds and palm heart (Yamakoshi and Sugiyama 1995; Yamakoshi 1998). In Seringbara, only 6km away, although oil palm trees are available on the edge of the home range of the chimpanzees, these were never used for either nesting or feeding (Humle 2003a). At Mt. Assirik, oil palm trees are absent from the core study area of 50km^2 within the park that was explored in the 1970s (McGrew 1992). Although elsewhere in the park oil palms are available in gallery forests that are accessible to the chimpanzees by riverine routes, there is as yet no indication that chimpanzees use these for nesting (McGrew 1992). Goodall (1968) also reported a temporary fashion for building nests in palm trees for chimpanzees in Gombe, Tanzania.

(Photo credit: Rebecca Kormos)

In several sites in Guinea, chimpanzees nest in oil palm trees *Elaeis guineensis.*

Table 2.1. Species of trees used most frequently for nesting throughout Guinea (from Ham 1998).

Tree species	No. nests	% of sample
Erythrophleum suaveolens	198	34.6
Elaeis guineensis	75	13.1
Parkia biglobosa	67	11.7
Pterocarpus erinaceus	55	9.6
Parinari excelsa	49	8.6
Khaya senegalensis	35	6.1
Cola cordifolia	26	4.5
Sterculia tragacantha	26	4.5
Carapa procera	23	4.0
Anthonotha crassifolia	19	3.3
TOTAL	**573**	**100**

The availability of different habitat types appears to strongly influence the choice of nesting sites in chimpanzees, but they do seem to prefer certain habitat types over others. In the Haut Niger National Park in Guinea, Fleury-Brugière (2001) found that gallery forests contained 40% of the nests found, whereas they made up only 6% of the area under survey. Dry forest, which covered 27% of the study area, was also preferentially used, harboring 40% of the nests. However, savanna ecosystems were rarely used for nesting.

Unlike chimpanzees living in more forested areas such as at Taï or Bossou, savanna chimpanzees often use non-forested areas for nesting (Pruetz *et al.* 2002). In Mt. Assirik, as in the Niokolo Koba National Park, Pruetz *et al.* 2002 found that riverine forest is the preferred habitat for nesting inside the park; however, chimpanzees living on the outskirts do not show this preference. The chimpanzees living outside the park may be deterred from nesting in those areas as human habitation is usually situated near watercourses. As a result, human presence may influence nesting behavior in chimpanzees and could potentially put them at risk of predators, e.g., leopard *Panthera pardus*, since other habitats where they are forced to nest may not provide them with sufficient protection, especially at night.

During her survey of chimpanzees in Guinea, Ham (1998) found that the height at which nests were built varied across regions and was the lowest in the Fouta Djallon and highest in Guinée Maritime. The average height for the nests used was 17.65m+0.23 (n = 923, Range = 0–37m). These differences in nest height may be influenced by the habitat (McGrew *et al.* 1981), predation and also possibly by climatic variables, e.g., wind factor, rainfall and sunlight accessibility. Ham (1998) also found several ground nests, especially in the Fouta Djallon. Day nests on the ground have also been reported for chimpanzees at Taï (Boesch 1995) and in the Nimba mountains region both in Guinea and Côte d'Ivoire (Humle, pers. obs.; Matsuzawa and Yamakoshi 1996) and at Bossou (Humle pers. obs.; Sugiyama and Koman 1979b; Sugiyama 1981). Matsuzawa and Yamakoshi (1996) have suggested that some of the ground nests found in the Nimba region may actually serve as night nests. However, these observations are based on indirect evidence and remain to be confirmed through direct observation of the chimpanzees in this region.

Finally, choice of nesting site is variable across populations and communities of chimpanzees and is dependent on habitat structure, resource distribution, predation levels and human disturbance. Chimpanzees can exhibit strong preferences for certain tree species for nesting, independent of their availability in the habitat. Therefore, some aspects of nesting, such as tree species choice and possibly terrestrial nest building, could potentially represent cultural variants. However, only further studies of nesting in chimpanzees will elucidate the variation observed in nesting behavior in chimpanzees and will help verify its cultural propensity.

2.4 Demography

Chimpanzees are so long-lived, and demographic data so slowly gathered, that demographic differences between populations are still not fully described. In the wild, chimpanzees are known to live for more than 40 years. Mean inter-birth interval is 5.9 years at Taï (Boesch and Boesch-Achermann 2000b) and 4.4 years at Bossou, which is remarkably short compared to other sites (Sugiyama 1999). Such a large inter-birth interval reflects the long maternal investment that is characteristic of chimpanzees.

The probability of infant survival to the age of four is 0.81 at Bossou (Sugiyama 1989b) and 0.6 at Taï (Boesch and Boesch-Achermann, 2000b). At Taï, the average age at first parturition is 13.8 (Boesch and Boesch-Achermann 2000b), while at Bossou females as young as 9.6 years of age may produce their first offspring. It has been suggested that such demographic differences could have long-term ramifications on social behavior as a result of effects on group structure.

Typically in chimpanzees, females emigrate by the age of puberty (9–13 years old), and males are philopatric, remaining within their natal community (Goodall 1983; Hiraiwa-Hasegawa *et al.* 1984; Boesch and Boesch-Achermann 2000b). At Taï, females usually transfer at about 11 years, followed by a period of adolescent sterility for 2.6 years (Boesch and Boesch-Achermann 2000b).

One of the threats to the long-term survival of chimpanzees in West Africa is the fragmentation of their habitat. Studies from the chimpanzees at Bossou reveal how such habitat disturbance can modify both demographics and behavior. No immigration of females has ever been recorded, although there is suggestive evidence that one female of the

community was potentially an immigrant to the community (Humle 1999; Matsuzawa 1999), and three transient male immigrations into the community were noted (Sugiyama 1981, 1984, 1999). Therefore, despite its isolation from other neighboring chimpanzee communities, several immigrations of non-resident chimpanzees into the Bossou group have been recorded, the last one dating back to 1982. More studies are needed on the effects of forest fragmentation on chimpanzee populations to fully understand how chimpanzees adapt or are not able to adapt to these situations.

Since 1976, as many males as females (i.e., 13 of both sexes) native to Bossou have disappeared as juveniles or during their adolescence or early adulthood. The greatest numbers of these disappearances have occurred among adolescent individuals of both sexes, which corresponds to the age at which chimpanzees (usually females) from other field sites have been reported to leave their natal group and emigrate to another community (Goodall 1983; Hiraiwa-Hasegawa *et al.* 1984). In contrast to other study sites, this suggests that male emigration may be common within this particular community. Bossou chimpanzees have indeed been sighted as far as the village of Seringbara at the foothills of the Nimba Mountains (6km from Bossou) (T. Matsuzawa, pers. comm.), where chimpanzee presence has been confirmed (Shimada 2000; Humle and Matsuzawa 2001).

Most likely as a result of the unusual population dynamics of this community, Bossou females form bonds with each other, defined through differential association and grooming, more than do East African chimpanzees at Gombe and Mahale, Tanzania (Sugiyama 1988) and West African chimpanzees at Taï (Boesch and Boesch-Achermann, 2000b). Bossou is therefore an unusual population characterized by a short inter-birth interval, high infant survival rates and limited immigration and possible emigration of both sexes.

2.5 Social organization

Chimpanzees live in a fission-fussion social structure (Kummer 1971). This implies that at any time temporary and unstable parties are formed representing only a subset of the whole community. Such a fluid and dynamic social structure allows chimpanzees more flexibility in exploiting the available resources in their habitat that may be annually or seasonally highly variable or patchily distributed. Such a flexible social structure may help some communities minimize intra-specific competition, especially in times of fruit scarcity or in habitats where food resources are patchily distributed. In addition, party composition and size may also be influenced by the threat of predators (e.g., Mt. Assirik: Tutin *et al.* 1983), by hunting for mammalian prey (e.g., Taï: Boesch and Boesch-Achermann 2000b), the availability and distribution of water, nesting sites and home range size (e.g., Mt. Assirik: Baldwin *et al.* 1982; Tutin *et al.* 1983). However, as well as being environmentally determined, social organization in chimpanzees is also very much influenced by the sociological and demographic conditions prevailing in the population, e.g., female relationships, group structure and size and availability of reproducing females (Boesch and Boesch-Achermann 2000b). All these variables may consequently induce rather different social systems within the basic fission-fusion structure across separate chimpanzee populations.

Social interactions in chimpanzees may also be rather complex, demonstrating capacities for cooperation, reconciliation and coalition or alliance formation. In chimpanzees, the male hierarchy is generally heavily formalized, that is, males frequently communicate their status to one another, while the female hierarchy is rather vague, since status communication is rare among females. Chimpanzees are able to employ social strategies to obtain certain goals, e.g., food or access to females. Chimpanzees groom each other, which on the one hand has a hygienic function through removal of ectoparasites, and on the other hand serves a social function. Used as a social tool, mutual grooming can reinforce bonds between individuals, reduce social tension and create alliances between non-related individuals. Finally, chimpanzees have a highly developed social system and structure which is strongly reminiscent of that observed in humans and reflects their remarkable ability for social intelligence (Byrne and Whiten 1988).

2.6 Ranging behavior

Ranging behavior in chimpanzees may vary depending on the quality of the habitat and community size. Inter-specific and intra-specific competition for food and predation risk may also be important determinants of ranging behavior in chimpanzees. Table 2.2 shows the difference in sizes of home ranges for different sites.

At Taï, range size varies between 19 and 22km^2. Inter-community competition is an important determinant of ranging patterns (Boesch and Boesch-Achermann 2000b; Herbinger *et al.* 2001). At this site, this variable appears to have a stronger influence than food abundance and distribution in influencing ranging behavior.

The Bossou chimpanzees have a much smaller range size, and mostly confine their daily activities within a core area of about 6km^2, although they sometimes travel to adjacent forests using the few remaining gallery forest corridors that extend their home range to around 15km^2. This is similar to the home range size found by Albrecht and Dunnett (1971) for chimpanzees at Kanka Sili, Guinea. Unlike the Taï chimpanzees, the main influence on ranging in the Bossou community is related to food availability and distribution, since

this community is free of natural predators, and there are no other competing neighboring chimpanzee communities. The opportunity to raid crops and the high density of available fallback foods may have also enabled this community to maintain a relatively small home range size. Thus, in comparison with habitats of poorer quality such as at Mt. Assirik, the Bossou community has not been forced to extend its home range during periods of fruit scarcity, when food resources may be patchily distributed and more rare. Indeed, chimpanzees at Bossou spend less time feeding and moving and decrease their dietary diversity during times of fruit scarcity (Takemoto 2002).

The home range size of 278–333km^2 of the Mt. Assirik chimpanzees is unusually large when compared to other field sites in West Africa. It has been proposed that chimpanzees at this site may have to range further to fulfill their dietary requirements (see Table 2.2) (Baldwin *et al.* 1982).

2.7 Tool use and tool-making

Chimpanzees make and use a diverse and rich kit of tools and, with the exception of humans, they are the only living primates to consistently and habitually use and make tools. Tool use behavior in chimpanzees has been observed at all field sites where chimpanzees have been studied (Whiten *et al.* 1999). Each community of chimpanzees has a unique repertoire of tool use behaviors that may differ from that of other communities (McGrew 1992; Whiten *et al.* 1999). Tool use in chimpanzees may serve several purposes including extracting, probing, body cleaning, displaying and pounding. A total of 51% of tools employed by wild chimpanzees are used in a feeding context, while 17% are used in aggressive contexts against conspecifics or other species (mainly leopards, snakes or even humans), 12% are used for communication purposes, 11% are used to inspect the environment and 9% are used to clean their own bodies (Boesch and Boesch-Achermann 2000b).

Taï chimpanzees display the most tool use behaviors of any site thus far studied with altogether 26 tool use behaviors, of which seven are unique to this community (Boesch and Boesch-Achermann 2000b).

Among all the tool use behaviors observed in the wild, nut cracking is probably the most sophisticated one performed by chimpanzees and has only ever been observed among some populations of the West African subspecies of chimpanzee, although nut-bearing tree species are available at many sites where chimpanzees have been studied elsewhere in Central and East Africa (Boesch *et al.* 1994; McGrew *et al.* 1997). Diffusion of nut cracking via social transmission processes from far-western Africa to the east has probably been prevented by the major geographical barrier represented by the N'Zo-Sassandra River (Boesch *et al.* 1994).

Chimpanzees at Bossou use a stone hammer and anvil to crack open the nuts of the oil palm tree *Elaeis guineensis.* At Taï, chimpanzees do not crack oil palm nuts, although these nuts are available in their environment. They do, however, crack five other species of nuts: *Coula edulis, Panda oleosa, Parinari excelsa, Detarium senegalensis*, and more rarely *Sacoglottis gabonensis* (Boesch and Boesch 1983). These species of nut-bearing trees, with the exception of *Parinari excelsa*, are not available in the habitat of the Bossou chimpanzees (Sugiyama and Koman 1992). Boesch and Boesch (1983) also show that Taï chimpanzees select the type and weight of tools for cracking nuts in accordance with the physical features of the species of nuts being opened. Taï chimpanzees may use wooden clubs or stones as hammers and stone or tree roots as anvils.

Tool use in chimpanzees has been shown to play an important role in survival by enabling them to exploit food resources that would be otherwise difficult to access. For example, Bossou chimpanzees depend strongly on tools for their subsistence. The availability of keystone resources, such as oil palm *Elaeis guineensis* nuts and apical meristem (i.e., palm heart), have been shown to be essential for these chimpanzees during periods of fruit scarcity. However, these two food items are only accessible by using tools, respectively nut cracking and pestle pounding (Yamakoshi 1998).

For Mt. Assirik, the only tool use behaviors reported so far include the use of wands to dip for driver ants *Dorylus* sp. probes to fish for termites from their mounds *Macrotermes* sp. (McGrew 1992), and the smashing of the hard-shelled fruit of the baobab tree *Andansonia digitata* against stone or

Table 2.2. Community and home range size of chimpanzees across different field sites in West Africa.

Country	Site	Source	Community size	Range size (km^2)
Guinea	Bossou	Sugiyama (1994a)	16–20	6
Guinea	Kanka Sili	Albrecht and Dunnett (1971)	50	5
Côte d'Ivoire	Taï	Boesch and Boesch-Achermann (2000b)	33–82	19.1–21.6
Senegal	Mt. Assirik	Baldwin *et al.* (1982)	28	278–333

root anvils and tree trunks (Baldwin 1979; McGrew *et al.* 1988). The latter tool use behavior is so far unique to the Mt. Assirik population, mainly since the baobab tree is absent from the habitat of chimpanzees at other field sites where research has been ongoing.

In the Nimba Mountains at Seringbara, Guinea and Yealé, Côte d'Ivoire, as at Bossou, chimpanzees dip for driver ants *Dorylus* sp. using sticks and stalks as wands. Seringbara chimpanzees may also use a digging stick to dig up the underground nests of these ants (T. Humle, pers. obs.). Such use of a digging stick in ant feeding has only been observed once at Bossou (Sugiyama *et al.* 1988). There has, however, been no indication yet of nut cracking in Seringbara, although nut-bearing species reported as being cracked at other sites, such as the oil palm *Elaeis guineensis*, *Detarium senegalensis* and *Parinari excelsa*, are available within the home range of these chimpanzees (Humle and Matsuzawa 2001). In Yealé, evidence for cracking of oil palm nuts and *Coula edulis* nuts using stones has been found (Matsuzawa and Yamakoshi 1996; Humle and Matsuzawa 2001). *Panda oleosa, Detarium senegalensis* and *Parinari excelsa* are also available within the habitat of the Yealé chimpanzees, but there is no indication that the chimpanzees are cracking these species.

In the Diécké forest, *Panda oleosa* and *Coula edulis* nuts are cracked by chimpanzees using stones, rocks or tree roots as anvils and stone hammers. No other evidence of tool use has yet been reported or observed in this region (Humle and Matsuzawa 2001).

There have been further records of nut cracking in other areas of Guinea and Côte d'Ivoire (c.f. Boesch *et al.* 1994; Joulian 1994; Ham 1998). Records from other West African countries include those from Liberia – *Panda oleosa, Coula edulis, Parinari excelsa* and *Saccoglottis gabonensis* in Sapo (Anderson *et al.* 1983); *Elaeis guineensis* in south-eastern Liberia (Beatty 1951); and *Coula edulis* in Cape Palmas (Savage and Wyman 1843/44) and Mt. Kanton (Kortlandt and Holzhaus 1987) – and, in Tiwaï, Sierra Leone, *Detarium senegalensis* (Whitesides 1985).

Studies of chimpanzees in different regions of Africa have revealed that chimpanzee communities exhibit different tool use behaviors and may use different tools for the same purpose at different sites. Nut cracking behavior is pervasive only in a very small area within the evergreen forest perimeter of West Africa, more precisely west of the N'Zo-Sassandra river, which seems to demarcate the eastern limit of its distribution (Boesch *et al.* 1994). Chimpanzees clearly demonstrate the ability to fashion tools adapted for the specific purpose of their task and demonstrate variability across sites in their use of raw materials for tool manufacture (e.g., McGrew *et al.* 1979; Boesch and Boesch 1990). Not all of this regional and local variation can be explained by the demands of the physical and biotic environments in which they live. These variations in tool use behavior have been suggested recently to represent cultural behaviors (Whiten *et al.* 1999).

2.8 Conclusions

Chimpanzees are highly social and intelligent animals that exhibit great behavioral flexibility and diversity. Their remarkable cognitive ability for social learning, enabling sets of behaviors to be passed on and maintained from one generation to the next, clearly underlies their propensity for demonstrating a wide range of cultural behavioral patterns.

It remains essential that management strategies and conservation initiatives in different regions are sensitive to, and incorporate, an understanding of the specific behaviors and ecology of the chimpanzee communities inhabiting these areas.

Finally, the observed variation in community-wide behavioral patterns, which incorporate behaviors in the social, communication, nesting and feeding domains, can only urge rapid conservation actions for this species. Indeed, not only would the extinction of chimpanzees represent the disappearance of our closest relatives, but also the vanishing of whole cultural communities.

Chapter 3

Genetic Perspectives on *Pan troglodytes verus*

Linda Vigilant

3.1 Introduction

The purpose of this article is to briefly summarize for non-specialists some insights from genetic investigations of chimpanzees, with an emphasis on western chimpanzees. The information presented begins with a broad focus on chimpanzees and their relationship to the other hominoids, followed by comparative analyses of individuals from multiple populations and then by analyses at the level of individual communities. Finally, the value to conservation of genetic information from western chimpanzees is described.

3.2 The relationship between chimpanzees and humans

The differences in appearance between humans and chimpanzees mask a striking underlying genetic similarity (King and Wilson 1975; Gagneux and Varki 2001). In fact, the close genetic similarity between humans, chimpanzees, and gorillas means that only recently has enough information been accumulated to convincingly state whether chimpanzees or gorillas represent the closest evolutionary relatives of humans. The majority of the genetic evidence collected to date supports a human-chimpanzee clade with an earlier branching off of the lineage leading to gorillas (Ruvolo 1997; Chen and Li 2001). The timing of the divergence between humans and chimpanzees is estimated at 4.6–6.2 million years ago, with the divergence to gorillas occurring earlier at some 6.2–8.4 million years ago (Chen and Li 2001).

The close relationship between humans and chimpanzees means that studies of the evolution and genetic variation of chimpanzees can also be useful for increasing our understanding of these variations in humans. The human and chimpanzee genomes are almost 99% similar, and an active field of research focuses on finding and understanding the apparently small number of genetic differences between these species (Enard *et al.* 2002; Wildman *et al.* 2003). This information is not only interesting for providing an evolutionary perspective on the genetic variation in humans, but can be of practical interest. For example, chimpanzees are not as severely affected by some diseases common to humans, such as epithelial cancers, human immunodeficiency virus (HIV-1) and hepatitis B (Muchmore 2001). An understanding of the molecular basis of human susceptibility to these diseases could potentially be of therapeutic value to humans. Humans enjoy a long lifespan compared to chimpanzees (Hill *et al.* 2001), and the genetic differences between humans and chimpanzees can also shed light on this. Historically, biomedical studies used chimpanzees as experimental models for human disease and were responsible for a huge drain on the wild populations of chimpanzees in West Africa. Luckily it is possible to study these subjects today relying only on the use of genetic samples for comparative analysis from blood samples, tissues from subjects that have died of natural causes, and in some cases even non-invasively obtained samples such as feces or shed hair (Woodruff 1993; Morin *et al.* 2001).

3.3 Evolutionary genetics of chimpanzees

As discussed by Butynski (2003, Chapter 1), chimpanzees are currently taxonomically described as four subspecies with non-overlapping distributions in Equatorial Africa (Groves 2001; Grubb *et al.* 2003). Individuals from each of these subspecies have been analyzed for variation at a DNA locus that evolves rapidly, the mitochondrial DNA (mtDNA) control region (Morin *et al.* 1994; Goldberg and Ruvolo 1997; Gonder *et al.* 1997; Gagneux *et al.* 1999). Phylogenetic analysis to reconstruct the evolutionary relationships of sequences found has resulted in a tree not wholly consistent with taxonomy (Figure 3.1) (Gagneux *et al.* 1999). While individuals from both western subspecies, *P. t. verus* and *P. t. vellerosus*, cluster together into subspecies-specific clades, similar sub-specific grouping is not observed for the eastern and central subspecies. This can be interpreted as evidence of recent or even ongoing gene flow between populations taxonomically designated as central and eastern chimpanzees. In the case of western chimpanzees, the mtDNA sequences obtained from western chimpanzees from the Taï National Park, Côte d'Ivoire, and Solo, Mali, are intermingled, and thus the variation at this genetic locus does not show a geographic pattern within western chimpanzees (Gagneux *et al.* 1999). In practical terms, these results indicate that analysis of mtDNA from a chimpanzee of unknown origin could be used to determine

only whether this individual was likely a representative of the *P.t.verus, P.t.vellerosus*, or *P.t.troglodytes/schweinfurthii* subspecies. Furthermore, since the mtDNA is inherited solely from the mother, such an analysis reveals only maternal origin and so may not be useful in a situation where captive breeding may have brought together individuals from various subspecies. Variation on the Y-chromosome could potentially be analyzed to provide data on male-mediated gene flow to contrast with information from mtDNA. Although some work on characterization of variation in the Y-chromosome of chimpanzees of captive origin has been done, the current lack of representative sampling across a wide geographic range and low level of variation detected limit application of this approach at this time (Stone *et al.* 2002).

3.4 Genetic variation at the community level

A powerful approach to understanding the patterns of genetic variation within a population or subspecies employs micro-satellite genotyping to examine variation at multiple loci in the nuclear genome. This results in the collection of individually distinctive genotypes, which can be used for answering very specific questions, such as paternity of offspring within a chimpanzee community (Vigilant *et al.* 2001). Genetic analysis of non-invasive samples can also be applied as a mark-recapture technique for the monitoring of populations of limited size (Taberlet *et al.* 1997; Taberlet *et al.* 1999). Such a project could, for example, aid in assessing the success of a program to release confiscated chimpanzees into the wild (e.g., Tutin *et al.* 2001) by determining whether the released individuals have survived and reproduced (Goossens *et al.* 2003). In addition, the characterization of representatives of multiple populations allows other questions to be addressed regarding the levels of gene flow between populations and the assignment by probability methods of individuals to source populations (Cornuet *et al.* 1999; Pritchard *et al.* 2000). This information could be of practical use in conservation management by revealing patterns of gene flow among local populations, identifying the origins of confiscated individuals and in planning reintroduction or release projects. However, such analyses require a comprehensive database of genotypes from representatives of populations across the range of chimpanzees, and such data are at the moment very limited. In fact, such data currently exist for only two populations of chimpanzees: three communities of the western chimpanzees of the Taï National Park, Côte d'Ivoire (Vigilant *et al.* 2001) and the Kasakela community of eastern chimpanzees of the Gombe National Park, Tanzania (Constable *et al.* 2001). The limitations of current technology render the acquisition of accurate genotypes from non-invasive samples a costly, time-consuming process, and thus studies focusing on genetic relationships within particular chimpanzee communities are likely to be the only source of additional data in the near future. Nonetheless, even field researchers not planning a longer-term collaboration on genetic analysis of a particular community or population could contribute greatly to the establishment of an improved database of chimpanzee genotypes by incorporating opportunistic collection of fecal samples into their work. Fresh fecal samples weighing about 5g are typically stored in 50ml plastic tubes containing about 30ml of dessicant gel beads (Bradley *et al.* 2000). Such samples can be stored at ambient temperature, and as feces is not restricted by Convention on International Trade in Endangered Species of Wild Fauna and Flora regulations, can be readily transported in accordance with guidelines of the source and recipient countries concerning such samples.

3.5 Genetics and conservation

It must be emphasized that the interpretation of information from genetic analyses for conservation planning is far from straightforward. Although evolutionary significant units (ESUs) were originally defined as populations exhibiting significant adaptive variation (Ryder 1986), the difficulty of measuring this quantity has led instead to an (over) emphasis on the identification of populations in reproductive isolation (Crandall *et al.* 2000). The criteria for identifying such populations is typically a gene tree showing sorting of sequences by origin, such that all sequences from one population are clustered together separately from those of another population. The amount of time it takes for two isolated populations to depict this pattern is highly dependent upon the ancestral level of variation and size of the ancestral and subsequent isolated populations (Edwards and Beerli 2000). The use of a single, maternally inherited genetic locus, or even multiple nuclear markers, produces only an estimation of the genetic characteristics of populations. This may not present much of a difficulty when genetic divergences coincide with morphological or geographic variation, but can be problematic when populations appear undifferentiated, as is currently the case within subspecies of chimpanzees. A conservative approach to preserving genetic variation within chimpanzee subspecies would be to support conservation of all extant populations, as existing information is too limited to allow selection of key populations according to genetic evidence. Thus, although genetic investigation provides necessary information concerning the evolution of populations, it is best used in the context of ecological data for the purposes of conservation planning (Crandall *et al.* 2000).

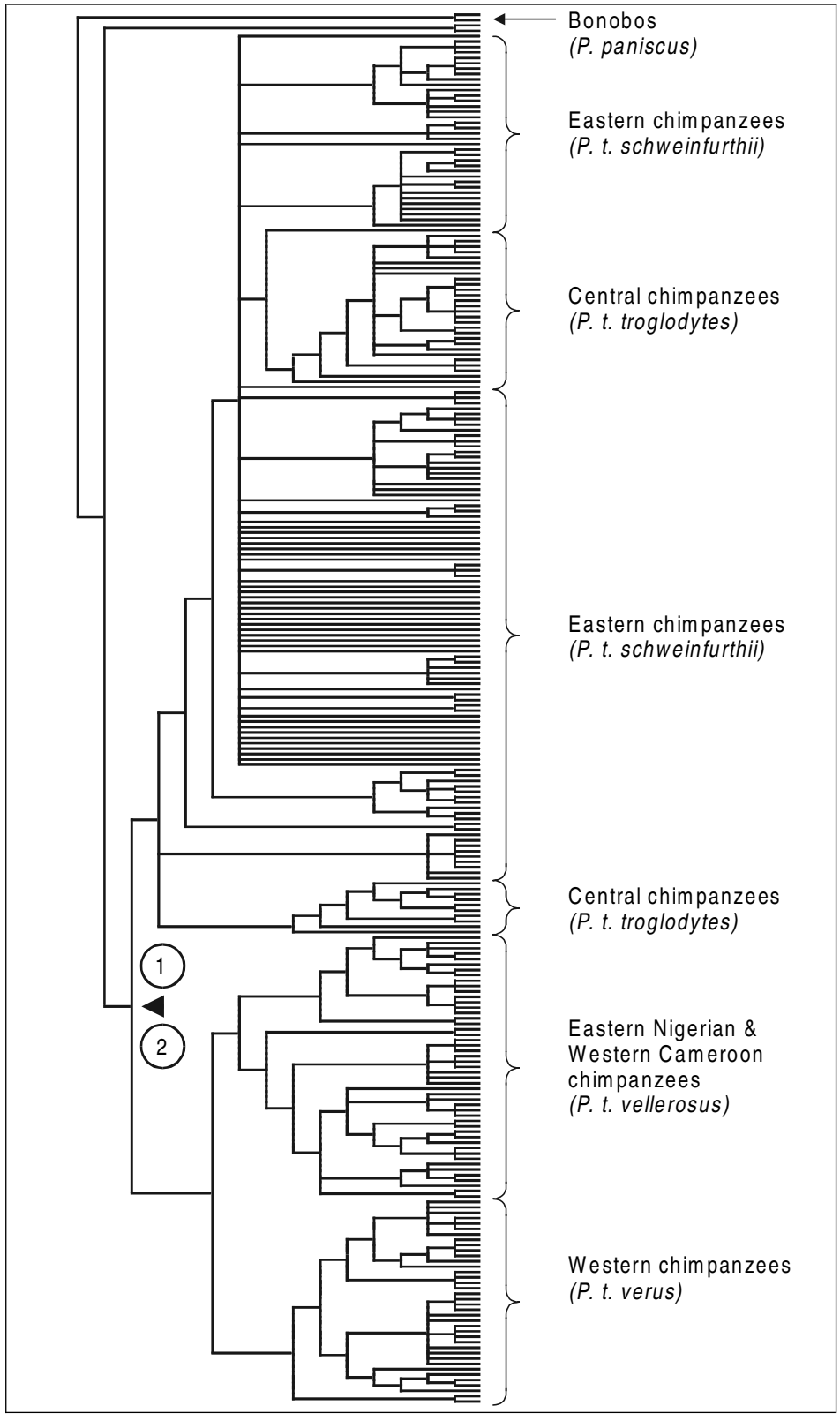

Figure 3.1. Parsimony consensus tree relating 256 sequences of the chimpanzee mtDNA control region and two bonobo sequences as an outgroup. Modified from Bradley and Vigilant (in press). The triangle and the numbers 1 and 2 indicate the deepest split within the chimpanzee lineages, which results in a clade (1) composed of sequences from eastern and central chimpanzees and a clade (2) composed of sequences from western chimpanzees (*P. t. verus*) and the Nigerian/Cameroonian chimpanzees *(P. t. vellerosus*).

SECTION II: STATUS SURVEYS AND RECOMMENDATIONS

COUNTRY REPORTS

(Photo credit: Christophe Boesch)

Mandela playing with his older sister Mognié, while the rest of the group is resting on a tree fall, Taï Forest, Côte d'Ivoire.

SECTION II: STATUS SURVEYS AND RECOMMENDATIONS: COUNTRY REPORTS

The chapters in this section contain status descriptions of chimpanzees in West Africa in each of the countries within their natural range. Each status description begins with a brief profile of the country so that chimpanzee numbers and distribution can be related to parameters such as human population, climate and vegetation. The general country profile is followed by a review of relevant legislations to protect chimpanzees, a review of conservation research work on the subspecies, and a list of recommendations for priority areas and actions needed to ensure the survival of chimpanzees in the country. In Chapter 4, we introduce the status descriptions by synthesizing the information and highlighting important differences and patterns in the status and conservation of chimpanzees. Chapters five through 17 contain the status descriptions for separate countries, moving through West Africa from west to east. These descriptions are based on the most recent information available for each country.

Chapter 4

Regional Summary

Rebecca Kormos and Mohamed I. Bakarr

4.1 Introduction

In the following section, chapters are presented on each of the countries within the chimpanzee's former home range in West Africa. This chapter summarizes some of the results from this section.

4.2 Country profiles

The natural range of chimpanzees in West Africa spans across 12 or 13 countries[1], although today, they are only found in nine countries (Table 4.1). The largest of these is Mali (1,240,192km^2), and the smallest is The Gambia (11,300km^2). Only the countries of Liberia, Sierra Leone and Guinea fall entirely within the natural range of chimpanzees, and these countries also have the greatest area of chimpanzee distribution, possibly due to the diversity of suitable terrestrial habitat types.

The extent and ecological characteristics of West Africa's terrestrial ecosystems are primarily determined by rainfall gradients – wetter in the south-west and becoming progressively drier to the north and east (Figure 4.1).

West Africa's tropical high forest zone extends along the coast of the region, stretching inland for three to 400km. The region becomes progressively drier inland, transitioning into savanna woodlands composed of widely varying degrees of tree canopy cover (Food and Agricultural Organization 2002). The moist forests of West Africa constitute the Guinean Forest hotspot (Myers 2000) and include two major blocks: (1) the Upper Guinea forest ecosystem, which extends from Guinea into Sierra Leone and eastward through Liberia, Côte d'Ivoire, Ghana and western Togo; and (2) the Lower Guinea forest ecosystem that extends from western Nigeria to the Sanaga river in south-western Cameroon, and beyond into the Congo Basin. The Dahomey Gap, a mixture of savanna and dry forest in Togo and Benin, separates the two major forest blocks. Of the original moist forest zone of 0.3 million km^2 stretching from Guinea to Ghana at the turn of the 19th century, only 0.08 million km^2 remain (Parren and de Graaf 1995).

West African countries have some of the highest population densities on the continent. Among the chimpanzee range countries, human population is highest in Nigeria (129,934,911) and Ghana (20,244,154), and the density is greatest in Nigeria (141 people per km^2) and The Gambia (129 people per km^2). Population density is lowest in Mali (nine people per km^2). The population growth rate is highest in Sierra Leone (3.21%), and lowest in Ghana (1.7%). Life expectancy at birth is highest in Ghana (57 years) and lowest

[1] As mentioned in Butynski (2003, Chapter 1), although chimpanzees have only been recently introduced in The Gambia, the actual status of the country as a natural range state has been questioned.

Table 4.1. Demographic, social and economic indices of chimpanzee range countries in West Africa (CIA World Factbook 2002).

	Population July 2002 est.[a]	Population density 2000[a]	Surface area (km^2)[a]	Average annual population change 2002 est.[a]	Life expectancy at birth (years)[a]	Literacy (age 15 and over can read and write)[a]	Per capita GDP 2001[b]	Urban population[c]	Rural population[c]
Benin	6,787,625	60	112,620	2.91%	50	38%	361 US$	43%	57%
Burkina Faso	12,603,185	46	274,200	2.64%	46	36%	203 US$	17%	83%
Côte d'Ivoire	16,804,784	52	322,460	2.45%	45	49%	637 US$	44%	56%
The Gambia	1,455,842	129	11,300	3.09%	54	48%	300 US$	31%	69%
Ghana	20,244,154	85	239,460	1.7%	57	76%	265 US$	36%	64%
Guinea	7,775,065	32	245,857	2.23%	46	36%	375 US$	28%	72%
Guinea-Bissau	1,345,479	37	36,120	2.23%	50	34%	174 US$	32%	68%
Liberia	3,288,198	30	111,370	1.91%	52	38%	256 US$	46%	54%
Mali	11,340,480	9	1,240,000	2.97%	47	38%	200 US$	31%	69%
Nigeria	129,934,911	141	923,768	2.54%	51	57%	435 US$	45%	54%
Senegal	10,589,571	54	196,190	2.91%	63	39%	479 US$	48%	52%
Sierra Leone	5,614,743	78	71,740	3.21%	46	31%	164 US$	37%	63%
Togo	5,285,501	93	56,785	2.48%	54	52%	273 US$	34%	66%

[a] CIA World Factbook 2002

[b] Per capita gross domestic product in US dollars from the National Accounts section of the United Nations Statistics Division database as of April 2003 http://unstats.un.org/unsd/demographic/social/inc-eco.htm#srce

[c] Population Division of the United Nations Secretariat. Population Division of the United Nations Secretariat, *World Urbanization Prospects: The 2001 Revision, Data Tables and Highlights* (ESA/P/WP.173, 20 March 2002). http://unstats.un.org/unsd/demographic/social/hum-set.htm

Figure 4.1. Distribution of forest zones along a rainfall gradient in West Africa (Parren and de Graaf 1995).

in Côte d'Ivoire (45 years). All of the range countries except Ghana are listed in the lowest 25% of the United Nations Human Development Index, and seven of the 13 countries are listed in the lowest 10% worldwide. Literacy is over 50% in Ghana, Nigeria and Togo. It is lowest in Sierra Leone (31%). GDP is highest in Côte d'Ivoire (637 US$) and Senegal (479 US$) and lowest in Sierra Leone (164 US$) and Guinea-Bissau (174 US$).

For more than a decade now, the West Africa region has been fraught with civil conflicts, involving at least three of the range state countries. The main conflicts in the last two decades have been in Guinea-Bissau, Liberia, Sierra Leone, and now Côte d'Ivoire. These conflicts have displaced hundreds of thousands of people throughout the region and left hundreds of thousands dead. Relative stability has returned once again to Sierra Leone, where reestablishment of government authority throughout the country has been completed with the help of the United Nations, after peaceful elections in May 2002. Unfortunately civil unrest continues in Liberia and Côte d'Ivoire. An attempted coup in mid-September 2002 plunged the nation of Côte d'Ivoire into civil war, from which it is still recovering.

4.3 Chimpanzee distribution and numbers

Based on national estimates, Guinea is home to the largest population of the western chimpanzee, followed by Côte d'Ivoire, Mali and Liberia. Sierra Leone still has significant populations, but no recent realistic estimates are available. Guinea-Bissau, Ghana and Senegal are all believed to have under 1,000 chimpanzees (see Table 1.1 in Butynski 2003, Chapter 1), while Burkina Faso, The Gambia, Togo and Benin have no known wild populations.

In total there are 26 protected areas within the western chimpanzee's range and three in the Nigerian chimpanzee range (Table 4.2). These protected areas cover a total surface area of 41,655km^2, which is 6.6% of the natural range. It is estimated that between 10,440 and 11,562 chimpanzees exist within these protected areas, which could represent between 19–55% of the total number of individuals. Although some country estimates are based on results of surveys, many are educated guesses at how many chimpanzees remain, especially in areas where surveys have never been conducted or have been prevented from occurring for many years due to civil unrest. This fact highlights the extreme importance of considering protected areas in any strategy for protecting this species. It is also important to consider methods for protecting chimpanzees outside protected areas.

Nigeria has 10,502km^2 of protected area, which is about 6.9% of the Nigerian chimpanzee home range. Approximately 1,640 chimpanzees are estimated to be living in these protected areas, which represents 21–33% of the population.

4.4 Conclusions

In a region with such diverse geography, climate, vegetation and population, it is challenging to determine priorities for conservation action. The following chapters provide detailed information at the national level about chimpanzees in West Africa, and Section III presents the results of the regional action plan for chimpanzees.

Table 4.2. Estimated status of the western chimpanzee (*P.t.verus*) and the Nigerian chimpanzee (*P.t.vellerosus*) within protected areas in each country.

Country	Population estimate		Source	# protected areas in chimpanzee range	Size of protected areas in chimpanzee range (km^2)	Estimated # chimpanzees in protected areas	
Pan troglodytes verus							
	min.	**max.**				**min.**	**max.**
Côte d'Ivoire	8,000	12,000	Herbinger *et al.* 2003, Chapter 12	10	20,506	7,647	7,657
Ghana	300	500	Butynski 2001	1	238	?	?
Guinea	8,100	29,000	Kormos, Humle *et al.* 2003, Chapter 9	4	2,863	1,400	1,450
Guinea-Bissau	600	1,000	Gippoliti *et al.* 2003, Chapter 8	1	700	?	?
Liberia	1,000	5,000	Nisbett *et al.* 2003, Chapter11	1	1,304	300	300
Mali	1,600	5,200	Duvall *et al.* 2003, Chapter 6	1	5,200	400	1400
Nigeria	200	400	Oates *et al.* 2003, Chapter 17	1	180	?	?
Senegal	200	400	Teleki 1991	1	9,130	23	25
Sierra Leone	1,500	2,500	Butynski 2001	6	1,534	670	730
TOTAL	**21,500**	**56,000**		**26**	**41,655**	**10,440**	**11,562**
Pan troglodytes vellerosus							
	min.	**max.**				**min.**	**max.**
Nigeria	1,800	2,500	Oates *et al.* 2003, Chapter 17	3	10,502	1,640	1,640

Chapter 5

Senegal

Janis Carter, Souleye Ndiaye, Jill Pruetz and William C. McGrew

5.1 Introduction

The distribution of chimpanzees in Senegal is limited to the administrative region of Tambacounda, which is located in the south-eastern portion of the country. There are currently believed to be 200–400 chimpanzees in Senegal, 23–25 of which are living in the Niokolo Koba National Park of 9,130km^2, the only protected area in Senegal in which chimpanzees can be found.

A systematic survey of the total area of Senegal inhabited by chimpanzees has never been conducted. Population estimates given in this paper are derived from extrapolations using density figures at specific field sites within Senegal, from estimates derived in other countries with similar habitat and from responses to questionnaires and interviews (Teleki 1991; Ndiaye 1999; Butynski 2001; Pruetz *et al.* 2002).

Through its legislation and conservation policies, Senegal provides chimpanzees both national and international protection. Local protection also exists through traditional and religious beliefs that elevate chimpanzees to a unique position both apart from other primates and close to humans. In spite of these protective measures, the future of chimpanzees in Senegal is seriously threatened by rampant habitat destruction, fragmentation of forest pockets and competition with humans over critical water and food sources. Information on the current status of these populations is urgently needed in order to recommend specific protective measures that will prevent them from becoming extinct in the next decade.

5.2 Country profile

5.2.1 Geography

Senegal is situated at the extreme west of the continent of Africa, between latitudes 12° and 17°N and longitudes 11° and 18°W. It covers an area of 196,190km^2 and is bordered to the north by Mauritania, to the east by Mali, to the south-east by Guinea, and to the south-west by Guinea-Bissau. The Gambia bisects the country, creating an enclave 300km long and varying from roughly 20–40km wide. Senegal has a rather flat relief, with a maximum altitude of 50m above sea level for more than 75% of the territory. The highest point, estimated at 358m, is located in the extreme south-eastern corner of the country at the foothills of the Fouta Djallon mountains.

5.2.2 Climate

The climate of Senegal is marked by two principal seasons: a dry season from November to April/May and a rainy season from May to June to October. Mean annual rainfall in areas where there are chimpanzees include 872mm (N = 4 years) at Mt.Assirik, and 885mm (N = 35 years) in Tambacounda (McGrew 1992). Mean daily maximum and minimum temperatures are 35° C and 23° C respectively at Mt. Assirik (McGrew *et al.* 1981).

5.2.3 Habitat

The distribution of different habitats in Senegal is related to rainfall. Three main phytogeographic zones from north to south are recognized. First is the Sahelian zone, which is characterized by vegetation dominated by acacia species and annual grasses. Second is the Soudanien zone, characterized by a range of vegetation types from wooded savannas to dry forests with species such as *Bombax costatum, Cassia siberiana, Combretum* sp.*, Cordyla pinnata, Daniellia oliveri, Pterocarpus erinaceus, Sterculia setigera* and grasses. Third is the Guinean zone, characterized by semi-dry forests composed of *Afzelia africana, Detarium microcarpum, Elaeis guineensis, Khaya senegalensis, Erythrophleum guineense* and an understory of lianas and herbaceous vegetation (Centre Suivi Ecologique 2001). Gallery forests are also found along river courses.

5.2.4 People

The estimated total population figure for Senegal is 10,589,571 inhabitants with a growth rate of 2.91% (CIA World Factbook 2002). People from the Wolof ethnic group make up about 43.3% of the population, followed by Pular (23.8%), Serer (14.7%), Jola (3.7%), Mandinka (3%), Soninke (1.1%), European and Lebanese (1%), and other ethnicities (9.4%).

5.2.5 Political context

In 1982, Senegal joined with The Gambia to form the nominal confederation of Senegambia. Integration of the two countries was never carried out and the union was dissolved in 1989. Since 1982 government forces and a separatist group in the Casamance region have occasionally clashed. Senegal also has a long history of participating in international peacekeeping (CIA World Factbook 2002).

5.2.6 Economy

The economy of the country relies principally on agriculture (dominated by groundnuts), fishing and tourism. GDP is $479 US per capita.

5.3 Legislation and conservation policies

The management of natural resources in Senegal is shared between the Direction des Eaux et Forêts, de la Chasse et de la Conservation des Sols and the Direction des Parcs Nationaux. These two offices are placed under the Ministère de la Jeunesse, de l'Environnement et de l'Hygiène Publique. The Direction des Eaux et Forêts, de la Chasse et de la Conservation des Sols has the responsibility of managing natural resources throughout the territory of the country, excluding national parks and wildlife reserves which fall under the authority of the Direction des Parcs Nationaux. As chimpanzees inhabit areas within and outside of the national park, their protection is the concern and responsibility of both departments.

Senegal provides chimpanzees with complete protection under Article 67-28 of May 23, 1967, and Decree 67–610 of May 30, 1967, of the Code for Hunting and the Protection of Fauna. This law states that the hunting and capture of totally protected species, including young individuals or eggs, is strictly forbidden throughout the entire range of the territory of Senegal. This ban does not prevent their capture for approved scientific purposes. The penalty for infractions includes both a fine ranging from $300–3,000 US and imprisonment for a period of one to five years. The most recent version of the Code for Hunting and the Protection of Fauna reinforced these measures under Article 86–04 of January 24, 1986, and the accompanying Decree 86–844 of July 14, 1986.

Legislation protecting forest resources, which includes chimpanzee habitat, is covered under Article 093–06 of February 4, 1993, and Decree 95–357 of April 11, 1995, of the Forest Code. At the national level, Senegal has a number of laws and action plans to implement its national environmental policy. The most important action plans and strategies of environmental and natural resource management include Le Plan National d'Aménagement du Territoire, Le Plan National d'Action pour l'Environnement, La Stratégie Nationale et le Plan d'Action pour la Conservation de la biodiversité and Le Plan d'Action National de Lutte contre la Désertification. Locally, chimpanzees also benefit from the protection of traditional and religious beliefs that forbid the killing or eating of apes (Ndiaye 1990).

Senegal has signed or ratified many international conventions dedicated to the protection of the environment and natural resources. As a signatory to the Convention on International Trade in Endangered Species, Senegal has provided the chimpanzee with international protection since 1977.

5.4 Past research and conservation efforts

De Bournonville (1967) conducted a four month study of northern Guinea and southern Senegal, focusing on the Fouta Djallon mountains and surrounding foothills. The objective of this survey was to determine the geographic distribution of chimpanzees in this area, the relative and absolute density and the habitat and dietary preferences of the species, and to gather information on the species' conservation status.

Beginning in 1972 Stella Brewer released a total of 15 young chimpanzees over a period of five years in the Mt. Assirik region of Niokolo Koba National Park (Brewer 1978) (see Carter 2003b, Chapter 22 for more detail). The identification of the subspecies of these chimpanzees is not definitive. Though most of them were caught in the wild and then confiscated by the Gambian government, these chimpanzees spent varying degrees of time in captivity under quite different conditions. In time, aggressive encounters between the resident wild chimps and the group of rehabilitants increased, both in frequency and intensity. Reluctantly, Brewer abandoned the reintroduction attempt and transferred eight of the chimpanzees to the safety of the River Gambia National Park in The Gambia in early 1979. The remaining chimpanzees either disappeared or died and there is no evidence that they joined the wild ones.

In 1976, the Stirling African Primate Project, coordinated by William McGrew and Caroline Tutin, established a research center in the south-eastern corner of the Niokolo Koba National Park near Mt. Assirik. From 1976 through 1979 researchers studied various aspects of the ecology and ethology of what was considered at the time to be a single isolated community of chimpanzees. Though habituation of this group was difficult due to extreme climatic conditions and the chimpanzees' extensive ranging habits, researchers

pursued their work without provisioning the chimpanzees with food supplements.

Papers published on the research at Mt. Assirik focused on social organization (Tutin *et al.* 1983), ranging (Baldwin *et al.* 1982), ecology (Baldwin 1979; McGrew *et al.* 1981), diet (McGrew *et al.* 1978, 1979a, McGrew *et al.* 1979b; McGrew 1983) anti-predator behavior (Tutin *et al.* 1981) and nesting (Baldwin *et al.* 1981).

In 1986 the chimpanzees of Mt. Assirik became the focus of more research when Bermejo *et al.* (1989) conducted a 16-month field study focusing on tool use.

In collaboration with L'Insitut francais de recherche scientifique pour le developpement en cooperation (ORSTOM, currently the Institut de Recherche pour le Développement), the Direction des Parcs Nationaux conducted an annual census of the mammals of the Niokolo Koba National Park from 1990 to 1995 and again in 1998. Although no observations of chimpanzees were collected in the earlier time frame, the census from 1998 provided nine observations of chimpanzees (Galat *et al.* 1998).

Between March 1998 and March 1999, P. Ndiaye spent 80 days surveying chimpanzees in three areas in south-eastern Senegal: (1) the Niokolo Koba National Park, (2) Pays Bassari and (3) the area south of the Faleme river near Saraya and Fongolembi. This was the first study since De Bournonville in 1967 that surveyed chimpanzees outside of the park. Ndiaye conducted interviews in 54 villages and investigated 49 sites for the presence of chimpanzees (Ndiaye 1999). He collected information on 1,783 nests and 39 direct observations of chimpanzees.

At Mt. Assirik in 2000, more than 20 years after the closing of the Stirling African Primate Project Pruetz conducted a nine-week survey aimed at determining the distribution and density of chimps in the Niokolo Koba National Park and its surroundings (Pruetz *et al.* 2002). A brief large-scale survey outside of the park encompassed an area of roughly 2,400km^2 south and east of the park boundaries. A comparison was drawn between the density of chimpanzees within the park and the density determined for areas of high concentration outside the park. The similarities and differences between nesting preferences of chimpanzees inside and outside of the park were also examined.

Finally, in May 2001, Pruetz established a research site in the Tomboronkoto region of south-eastern Senegal, outside of the Niokolo Koba National Park, with the aim of studying the ecology and behavior of ''savanna'' chimpanzees. This site is a mosaic of woodland-savanna, interspersed with small areas of riverine gallery forest and larger areas of laterite plateau. Pruetz and her team are in the process of habituating this group, which she refers to as the Fongoli chimpanzees. Behavioral data is being collected opportunistically, and estimates of chimpanzee densities are being calculated based on nest counts. Studies also include the identification of conflicts between chimpanzees and humans, particularly the competition over the mutual harvesting of *Saba senegalensis*, a major food source for chimpanzees in this area.

5.5 Chimpanzee distribution and numbers

5.5.1 Chimpanzee distribution

De Bournonville's (1967) broad yet brief survey made in the dry season of 1965–1966 found chimpanzees both inside Niokolo Koba National Park and south of the park, along the borders of Guinea. Based on interviews and field visits, De Bournonville ascertained the presence of chimpanzees in six locations within the Niokolo Koba National Park and the immediate surroundings: (1) Mt. Ndebou near Kedougou, (2) on the road between Tiankoye and the border of Guinea, (3) on the road between Tiankoye and Vorouli, (4) near the abandoned village of Safaya between Mt. Assirik and Banbare, (5) at km 27 on the road between Niokolo and Vourouli and (6) at Simenti.

Ndiaye's survey indicated the following six specific areas of importance for chimpanzees, based on the presence of nests, observations, and reports from villages: Diarha pont, Souti, Ethiolo, Diakhaba, Linguekoto and Diaguiri (Ndiaye 1999).

Of the ten areas surveyed by Preutz outside the park, four were considered to have high concentrations of chimpanzee nests: Bandafassi, Fongolembi, Segou and Tomboronkoto (Pruetz *et al.* 2002).

Table 5.1 gives the location of confirmed presence of chimpanzees and these points are illustrated in Figure 5.1.

5.5.2 Chimpanzee numbers

Teleki (1989) estimated the number of chimpanzees in Senegal to be between 100 and 300 from evidence of Baldwin *et al.* (1982) McGrew *et al.* (1981) and Brewer (1978).

De Bournonville (1967) did not give an overall estimate for the number of chimpanzees in Senegal, but he did provide an estimated average density of 0.075 individuals per km^2.

McGrew *et al.'s* study from 1976 to 1979 determined the number of chimpanzees living in the Niokolo Koba National Park to be 25. The total range of this single community was projected to be roughly 250km^2. Over a period of nearly four years chimpanzees were observed 367 times. A density figure of 0.09 chimpanzees per km^2 was derived from nest

Table 5.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Senegal.

#	Name	Latitude Longitude
1	Thianguinagaye	12°23′N 12°30′W
2	Gargassaki	12°22′N 12°33′W
3	Thiomboukoure	12°25′N 11°53′W
4	Linguekoto	12°42′N 12°46′W
5	Kevoye	12°27′N 12°40′W
6	Diaguiri	12°31′N 11°58′W
7	Diaguiri	12°31′N 11°57′W
8	Bilel	12°32′N 12°46′W
9	Missira Bakhaoka	12°33′N 12°47′W
10	Kosiray	12°26′N 12°02′W
11	Ethiolo	12°35′N 12°51′W
12	Dindefellou	12°22′N 12°19′W
13	Segou	12°24′N 12°16′W
14	Angafou (Bandafassi)	12°38′N 12°28′W
15	Kereconko (Mako)	12°46′N 12°24′W
16	Arnoud (Mbong)	12°34′N 12°56′W
17	Dadeya	12°30′N 12°06′W
18	Ngari	12°40′N 12°13′W
19	Kounsi	12°26′N 12°08′W
20	Diaguiri	12°33′N 11°56′W
22	Oubadji	12°40′N 13°03′W
23	Sukuto	12°53′N 12°21′W
25	Garaboureya	12°42′N 11°26′W
26	Sanio	12°33′N 12°10′W
27	Fongoli	12°39′N 12°13′W
28	Nangar	12°35′N 12°49′W
29	Parayamba	12°34′N 12°43′W
30	Fello Madhou	12°41′N 12°46′W
31	Pouguemou Lande	12°34′N 12°24′W
32	Fongolimbi	12°25′N 11°59′W
33	Banyomba	12°46′N 12°24′W
34	Djindji	12°39′N 12°11′W
35	Fongoli	12°37′N 12°14′W
36	Fongoli	12°41′N 12°13′W
37	Mt. Assirik	12°58′N 12°46′W

counts made in the most heavily used areas of their range, which were estimated to total 42km^2 in size.

Based on nest counts in a roughly 50km^2 core range area, Pruetz *et al.'s* 2000 study estimates the current chimpanzee density at Mt. Assirik (Niokolo Koba National Park) to be 0.13 chimpanzees per km^2; similar to the 0.09 individuals per km^2 for the same range area estimated 20 years earlier (McGrew *et al.* 1981). Based on the largest number of fresh nests observed together, the minimum community size using the valley near Mt. Assirik is estimated to be 14 individuals. As the largest party size is thought to represent roughly 60% of the total community, the current total population for the Niokolo Koba National Park is determined to be roughly 23 chimpanzees.

Pruetz's 2001 data estimates the Fongoli social group of Tomboronkoto (rather than outside Niokolo) to consist of a minimum of 15 individuals. The minimum range of this community is estimated at 35km^2. Calculations based on nest counts for this group provide a density figure of 0.09 individuals per km^2.

5.6 Threats to chimpanzees

5.6.1 Habitat destruction

Habitat destruction and alteration are thought to be major threats to the continued survival of chimpanzees in Senegal. Most populations inhabit small pockets of forest under increasing pressure of alteration and fragmentation. Destruction of forest corridors connecting these forest blocks isolates groups and reduces opportunities for genetic exchange, thus limiting prospects for long-term survival.

5.6.2 Hunting

Illegal commercial or subsistence hunting of chimpanzees does not appear to be a current threat in Senegal, though it was considered a contributing factor in the past. However, populations located to the south of the park are thought to migrate across the border into Guinea, where illegal hunting activities are more prevalent, and where government efforts to control hunting are more problematic.

5.6.3 Competition with humans over access to critical resources

In Senegal, chimpanzees and humans share and compete for various natural resources, including water, honey and numerous wild food species. As the dry season progresses, natural water sources dry up, and in some areas chimpanzees and humans compete for access to the few remaining sources of water. Although not directly aggressive towards humans, the mere presence of an adult chimpanzee at a water source can be an intimidating and frightening experience for women and children whose chore it is to collect water.

Chimpanzees and humans consume some of the same wild foods, including the fruits of *Saba senegalensis*, *Parkia biglobosa*, *Tamarindus indica*, *Adansonia digitata* and *Vitex doniana.* One of the main food sources for chimpanzees in Senegal is the astringent tasting fruit of the *Saba senegalensis liana* (Baldwin 1979; Pruetz *et al.* 2002). This species is also popular with humans as a fruit and in the preparation of a drink. As it has become more popular with the growing urban community of Dakar, this fruit has evolved into a cash crop, collected and sold by women to buyers for the market in Dakar and other large cities. Thus, protective measures must be taken now to counteract

Figure 5.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Senegal.

unsustainable harvesting methods of the species. Absence or serious reduction of this fruit in certain already marginal areas could impact negatively on the ability of chimpanzees to survive in their present territory. Groups might come into territorial conflict with other chimpanzees by migrating out of their own range in search of a new core habitat. The lack of sufficient wild foods during this particular period could increase the low incidence of crop raiding by chimpanzees, thus reducing the tolerance of humans for the presence of chimpanzees in their area.

5.6.4 Trade in young chimpanzees

Since 1997, the Chimpanzee Rehabilitation Project in The Gambia has received five separate reports of baby chimpanzees held in captive conditions in Senegal. In the 25 years since it was established, the Chimpanzee Rehabilitation Project has received only one other report of a captive held chimpanzee in Senegal. This report was received in 1990 and concerned a ten-year-old female chimpanzee who resided in a private zoo in southern Senegal. Although the origin of the recent five orphaned chimpanzees cannot be verified, the current increase in orphaned chimpanzees in Senegal is alarming, and the cause needs to be investigated.

5.7 Priority sites for chimpanzee conservation

With only 200–400 chimpanzees remaining in Senegal, it is clear that all locations need to be considered priority sites in need of special attention. Some of these sites are described below.

5.7.1 Niokolo Koba National Park

The Niokolo Koba National Park is the only protected area in Senegal known to have wild chimpanzees. It is also the site of the first and only long-term study of the ecology of chimpanzees in Senegal. Data collected by McGrew *et al.* in the late 1970s and 20 years later provide valuable baseline and comparative information on chimpanzee distribution, density and population size over time. Comparison of this data can provide valuable insights into the natural population trends in areas where human activities have been controlled.

5.7.2 Diarha river

The Diarha river is critical to the survival of several groups of chimpanzees in the district of Salemata. As early as two months after the last rain, rivers and water sources dry up, forcing chimpanzees from neighboring areas to migrate to the Diarha river. By the middle of the dry season, several groups of chimpanzees have settled into the area, where they remain until the first rains, at which time they migrate back to their point of origin. The Diarha has been selected as a site for long-term monitoring to determine the number of chimpanzees using the area and to identify migration routes to and from their point of origin. Recommendations will be made to ensure the protection of these vital migration corridors (Carter unpublished report 2002).

5.7.3 Dindefellou

The village of Dindefellou, located south-west of Kedougou, straddles the border of Guinea and Senegal. Residents of this village developed a tourist campground more than ten years ago using the natural attraction of a nearby waterfall. Further study and protection of this area could contribute to the survival of the chimpanzee community residing on the neighboring mountain range. Though it has been proposed to habituate resident chimpanzees to enhance the tourism potential of Dindefellou, habituation of chimpanzees in Senegal for the purposes of eco-tourism is considered risky and not in the best interests of the long-term survival of the species. Though habituation may not be a lengthy process, the impact on the safety of the individuals endures for a lifetime. Documentation of the negative impacts of ape habituation emphasize the effect of stress on already fragmented populations (Butynski 2001). It is strongly recommended that efforts to introduce the habituation of chimpanzees for ecotourism in Senegal should be well researched and approved only by a multidisciplinary board of scientists and conservationists knowledgeable in the threats posed by ape habituation.

5.7.4 Pays Bassari

Pays Bassari refers to the area of Bassari villages located south of the Niokolo Koba National Park in the Salemata district. Although traditionally hunter-gatherers, the modern day Bassari carve out their existence as agriculturalists on marginal farming land. Chimpanzees are a part of this landscape, living as migrant neighbors to the Bassari. Lack of water toward the end of the dry season is a serious problem for both chimpanzees and humans in Salemata. Reports of competition between humans and chimpanzees over water have increased in the past ten years in certain villages (J. Carter, pers. obs.).

5.7.5 Tomboronkoto

The Fongoli population currently being studied near Tomboronkoto merits further attention because the scientific

study now in progress is intended to last for ten years. The continuation of studies relating to the competition between humans and chimpanzees over natural resources could enhance the long-term survival of this group.

5.7.6 Fongolembi

The mountain range extending from Dindefellou through Segou to Fongolembi is thought to be an area where chimpanzees are highly concentrated. Having a low human density, this area of mountainous terrain most probably serves as a natural barrier of protection for chimpanzees. Information on the distribution and density of these groups would provide an important basis of comparison with other areas.

5.7.7 Linguekoto

Chimpanzees inhabiting this area are known to migrate across the Gambia river at the end of the dry season, when the water level is low (B. Boubane, pers. comm.). Future plans to construct a dam at Sambangalou, roughly 10km from Kedougou, will most certainly alter this environment by raising the water level to some 10–15m higher than the current level. Baseline data on the range and migration patterns of this population need to be collected prior to dam construction to determine the impact of the proposed dam.

5.8 Priority actions for chimpanzee conservation

5.8.1 Complete survey of region known to support chimpanzees

A national survey of the distribution and numbers of chimpanzees in Senegal is being conducted by the Programme d'Education et de Recensement des Chimpanzés au Sénégal, which is working in collaboration with the Direction des Eaux et Forêts, de la Chasse et de la Conservation des Sols and the Direction des Parcs Nationaux, and is funded by Friends of Animals. Survey methods include line transects located randomly throughout the area known to support chimpanzees, reconnaissance surveys and questionnaires/ interviews with resource persons. Focus is given to interactions and competition between human and chimpanzees over natural resources; particularly water. Areas of special interest, such as Pays Bassari and the Diarha river are being monitored for at least 12 months to determine the migration patterns of these groups and identify forest corridors critical for genetic exchange between groups. Solutions to issues of water competition will be sought as well as recommendations to ensure the protection of essential migration corridors. This program has a strong educational component that is considered essential to the conservation of chimpanzees in Senegal. The education program focuses on the fact that chimpanzees, as humans and other species, need space and resources to survive.

5.8.2 Promote educational activities to raise the awareness of the plight of chimpanzees in Senegal

Although chimpanzees are generally not hunted or eaten in Senegal, they are threatened by destruction of their habitat. Nevertheless, people living in south-eastern Senegal do not feel that chimpanzees are endangered in their vicinity or in need of increased protection. The Programme d'Education et de Recensement des Chimpanzes au Senegal is conducting an education program focusing on the need of chimpanzees for space and resources to ensure their survival. More education work needs to be done throughout the area supporting chimpanzees in Senegal emphasizing the role of habitat destruction as a threat to chimpanzee survival in Senegal.

5.8.3 Revise current legislation concerning chimpanzees

Though the capture and trade of totally protected wildlife species in Senegal is prohibited, a special dispensation is accorded to holders of scientific permits. Given the highly endangered status of chimpanzees in Senegal, special treatment should be applied whereby capture and trade is forbidden for any purpose. The Senegal government's recognition of this contradiction and amendment to this law would confirm their commitment to the conservation of this endangered species.

5.8.4 Explore solutions to the competition between humans and chimpanzees over access to water

As the dry season progresses, many natural sources dry up, and access to water becomes problematic for both humans and wildlife in southern Senegal and northern Guinea. Competition between chimpanzees and humans over water has already been observed and reported in several sites, e.g., Pays Bassari (J. Carter, pers. obs.; Ndiaye 1999), Fongolembi, Saraya (Ndiaye 1999) and Tomboronkoto (Pruetz 2002). It is often the case that as sources dry up villagers move into the territory of chimpanzees in search of water, thus forcing chimpanzees to delay drinking, retreat

into areas supporting other chimpanzee communities or defend their own territory. The last two actions could put the lives of chimpanzees in jeopardy. In order to ensure the survival of these populations, the absolute need of both species for access to water must be recognized. Efforts must be made to investigate the precise circumstances under which the competition occurs and explore possibilities for either mutual sharing of this resource or alternative measures. Funding from the United States Agency for International Development Guinea's Expanded Natural Resource Management Activity has helped to develop a very practical and appropriate solution to ensuring that both species have access to water (Carter unpublished report 2001). Villages experiencing direct competition with chimpanzees over natural water sources have been provided wells in the village proximity in exchange for a contractual agreement whereby the natural source becomes the permanent domain of chimpanzees and other wildlife.

The Programme d'Education et de Recensement des Chimpanzés au Sénégal has selected the village of Parayamba and Ethiolo to conduct a case study on the problems associated with the competition over water. This study aims to determine the nature of the competition and to develop viable alternatives or appropriate solutions that allow both species to survive and prosper (Carter unpublished report 2002).

5.8.5 Explore solutions to competition between humans and chimpanzees over access to the fruits of *Saba senegalensis*

Reports on competition between humans and chimpanzees over natural resources include the mutual harvesting of *Saba senegalensis*, an essential food for chimpanzees and a popular fruit for humans. The current manner of commercial exploitation of this fruit is not considered sustainable. Measures for sustainable harvest must be put in place before the resource base of this species is destroyed and regeneration is no longer possible.

To address this problem it is recommended that a survey be conducted on the distribution and density of *Saba senegalensis* in various areas of high chimpanzee concentration, including forest reserves and the Niokolo Koba National Park, to determine normal levels of production. It is also recommended that a temporary moratorium on all harvesting of *Saba senegalensis* be imposed until the above assessment is completed and decisions on sustainable levels of harvest have been recommended. More stringent controls on harvesting are needed. One solution to this problem would be to require the purchase of a permit for collection, to restrict the use of each permit to the holder, and to limit the number of fruits harvested under each permit. It is important to identify areas of high chimpanzee concentration for testing various sustainable harvest methods. These methods could include; (1) identifying specific forests for human harvesting and those for chimpanzee harvesting, (2) alternating annually the harvesting of specific forests, or (3) partitioning forest blocks and permitting rotation of harvest of individual blocks. Finally, it is recommended that the possibilities of supporting commercial plantations also be explored.

5.8.6 Collaborate with the Guinea government on the protection of chimpanzee populations migrating across the Senegal-Guinea border

The safety of chimpanzees migrating back and forth across the border between Senegal and Guinea is the responsibility of both governments. Increased information sharing and collaboration on protection should be developed between the relevant government departments in order to ensure the survival of these communities of chimpanzees.

5.9 Conclusions

Chimpanzees receive a high degree of international and national protection in Senegal. In addition, traditional and religious beliefs provide a more effective form of protection in that they forbid the eating of chimpanzees. Though there are a few recent reports of orphan chimpanzees in captivity, commercial trading of chimpanzees does not exist in Senegal. In spite of all these measures of protection, chimpanzees in Senegal are on the brink of extinction.

Loss of habitat poses the most serious threat to the survival of chimpanzees in Senegal. The needs of the country's increasing human population are encroaching on the needs of wildlife, often to their detriment and in some cases even to the point of extinction. Increased habitat conversion for agriculture, the increased needs of the local population for wood and other forest resources and expanding markets in urban areas for charcoal, wood products and even wild foods are all factors which contribute to deforestation, environmental degradation and a rapidly diminishing population of chimpanzees.

If chimpanzees are to survive in the harsh environmental conditions of southern Senegal, it will only be with the immediate and concerted effort of conservationists, the Senegal government and most importantly the local population with whom chimpanzees share their habitat. Although some communities already have quite positive attitudes towards chimpanzees, this foundation must be enhanced with the provision of current and relevant information on the plight of chimpanzees in Senegal and those in neighboring countries. All recommendations concerning the protection of chimpanzees must be supported by rural populations and

integrated with their needs. To ensure that the traditional attitudes towards chimpanzees remain in force, issues over resource rights must be recognized and dealt with on a case-by-case basis. And finally, ways must be found to help local communities perceive the benefits of conservation efforts and, in this fashion, foster positive attitudes critical to the long-term survival of chimpanzee habitat and wild populations.

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Chapter 6

Mali

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6.1 Introduction

Chimpanzees are known only from the southern portion of Mali's westernmost region, in the Manding mountains area. Mali has an estimated total national population of 1,555–5,249 chimpanzees, with an estimated 417–1,408 occurring in the Bafing Biosphere Reserve, the only protected area in which the presence of chimpanzees has been confirmed. An estimated total of 19,440km^2 of probable chimpanzee habitat exists in Mali, of which 5,215km^2 are protected. Most areas of probable habitat have not been surveyed for chimpanzees, however, and our knowledge of their distribution and population density is poor.

Although Malian government agencies and non-governmental organizations have taken commendable steps to protect wildlife, including chimpanzees, future conservation work remains hampered by a lack of funds, a lack of information, a lack of international attention, and the profound need for economic development.

6.2 Country profile

6.2.1 Geography

Mali is the second-largest nation in West Africa, covering 1,240,000km^2. It is a landlocked country, bounded by Algeria, Mauritania, Niger, Senegal, Côte d'Ivoire, Guinea and Burkina Faso. The terrain ranges from flat to rolling plains in the north and center, to rugged hills in the south-west and north-east, where the highest elevation is 1,555m.

6.2.2 Climate

Average annual precipitation ranges from virtually zero in the extreme north to greater than 1,500mm in the south (Barth 1986; Leroux 2001). Yearly variation in the amount and timing of precipitation is high throughout Mali (FAO 1984). Precipitation in the Manding mountains, where chimpanzees occur, averages 900–1,500mm annually and falls mainly between June and October (FAO 1984; Barth 1986; Leroux 2001). In the Manding mountains (as recorded at Kéniéba from 1950 to 1980), average annual temperature is 28.2°C, with average daily high temperatures peaking in April (40.0°C), and the lowest average daily low temperatures occurring in December (16.8°C) (FAO 1984).

6.2.3 Habitat

About one-third of Mali is covered by the hyperarid Sahara, with the southern portion of the nation covered by arid to subhumid grassland, wooded grassland, woodland, forest, and edaphic plant communities (Barth 1986; Warshall 1989; Adams *et al.* 1996). In chimpanzee range in the Manding mountains, complex topography creates a wide range of microhabitats characterized by a high level of plant biodiversity (Jaeger 1959; Lawesson 1995). Vegetation varies from barren, exposed sandstone outcrops with sparse herbaceous cover to dense gallery forests in well-protected topographic sites; most areas are covered by woodlands and wooded grasslands (Jaeger 1956; Projet Inventaire 1990; Duvall 2001). The gallery forests are rich in rare plant species characteristic of more southerly phytochoria, including the endemic tree *Gilletiodendron glandulosum*, and appear to be important chimpanzee habitat (Moore 1985, 1986; Pavy 1993; Duvall 2000, 2001).

6.2.4 People

Mali has a human population estimated at 11,340,480, growing at a rate of 2.97% annually (CIA World Factbook 2002). The total national population density figure of nine persons per km^2 is misleading because the vast majority of people live in the southern third of the country.

Although Mali's population is culturally very diverse, two ethnic groups, the Maninka and the Fulani, predominate in the area where chimpanzees occur (Kéïta 1972; Pavy 1993; PREMA 1996; Caspary *et al.* 1998). The Maninka (or Malinké) are mainly sedentary agriculturalists, living in most of the Manding mountains. The Fulani (or Fula or Peulh or Fulfulde) – who are found mainly in the southern part of this area – are also sedentary farmers. Those Fulani to the north of the Manding mountains mostly practice pastoral livestock husbandry and visit chimpanzee range only during the dry season. Neither group eats chimpanzee meat, but traditional Maninka medicinal use of chimpanzee meat has been reported by Duvall and Niagaté (1997) and Caspary *et al.* (1998).

6.2.5 Political context

Mali is an emerging democracy; it has embarked on a course of profound political change toward administrative decentralization and participatory democracy since a popular uprising ousted the former military government in 1991. In May 2002, the nation completed its third consecutive free and fair presidential election, and the prospects for continued political stability, democratization and economic development seem good under President Amadou Toumani Touré. Mali has friendly relations with its neighbors, and there have not been major internal conflicts since the early 1990s, when Tuareg rebels were active in the north-eastern portion of the country. South-western Mali has not experienced significant political instability or warfare since the late 19th century (Kéïta 1972; Koenig and Diarra 1998).

6.2.6 Economy

Despite a history of political stability, south-western Mali lags behind most of the country in terms of economic development because it has been marginal in terms of national economy and human geography (Kéïta 1972; Koenig and Diarra 1998). Only in the past 20 years have large-scale development projects begun in most of the Manding mountains, including a major dam and hydroelectric plant at Manantali; road construction between Bamako, Kita, Manantali, Koundian, and Bafoulabé; and the expansion of commercial agricultural, especially near Kita (Dames and Moore 1992; PREMA 1996; Caspary *et al.* 1998). While these projects represent important efforts to improve the income of local residents and Mali as a whole, economic development has also caused disruption of indigenous social systems and brought an influx of job-seeking migrants, two factors that have contributed directly to increased natural resource use (Pavy 1993; Caspary *et al.* 1998; Duvall 2001; cf. S. Wood *et al.* 2000). National economic policies, particularly structural adjustment, have also contributed to deforestation and soil fertility loss and erosion due to the expansion of agriculture in response to market demand and the loss of subsidies for chemical fertilizers (Koenig and Diarra 1998; cf. S. Wood *et al.* 2000). In international economic terms, Mali is a very poor country, with $200 US per capita GDP and 64% of Malians living below the poverty line (CIA World Factbook 2002).

6.3 Legislation and conservation policies

The Direction Nationale de la Conservation de la Nature is responsible for managing wildlife in Mali. It was established in 1998 to replace many aspects of the former Direction Nationale des Eaux et Forêts, which had been renamed in 1996. The Direction Nationale de la Conservation de la Nature is based in Bamako and has administrators in the main regional cities. Forestry agents, who are directly responsible for law enforcement, are stationed in many smaller towns throughout the country.

Until the early 1990s, all hunting and most wood cutting were illegal, and the Direction Nationale des Eaux et Forêts enforcement policies were notoriously unfair, factors that made the agency highly unpopular (Warshall 1989; Sanogo 1990). Following the 1991 return to civilian rule, legislators modified natural resource laws to suit the decentralized, democratic politics of former President Alpha Oumar Konaré. As a result, current Malian wildlife and forest management laws and policies, which allow some degree of community-based resource management, represent a departure from the centralized approach taken by the Direction Nationale des Eaux et Forêts (Berthé 1996). Additionally, the Direction Nationale des Eaux et Forêts did not and the Direction Nationale de la Conservation de la Nature does not have a significant presence in most of the area where chimpanzees occur.

Chimpanzees are protected within Mali by national law 95-031, which governs wildlife management. Chimpanzees are listed in Appendix 1 of this law, which includes all animals given the highest level of legal protection against hunting, capture and habitat disruption. Exceptions to this level of protection may be granted only by ministerial approval for scientific collection or the removal of dangerous animals. Additionally, components of other Malian laws, particularly law 95–004, which governs forest resource management, provide general protection for floral resources that comprise important habitat for chimpanzees, particularly gallery and riparian forests. Mali is a signatory of the Convention on International Trade in Endangered Species as of 1994, which means that Malian law strictly limits exchange across its borders of chimpanzees or products derived from chimpanzees.

Protected areas cover 3.7% of the nation (IUCN 1998), including the proposed Bafing Biosphere Reserve, which is located within chimpanzee range and further described below (Figure 6.1).

6.4 Past research and conservation efforts

Since Sayer's (1977) first report of the presence of chimpanzees in Mali, there has been only limited research on this population. Substantial information on chimpanzees in Mali has been reported in five published and unpublished reports (Moore 1985, 1986; Pavy 1993; Duvall and Niagaté 1997;

Duvall 2000). Three other authors have reported either direct or anecdotal observations of chimpanzees in Mali (Kortlandt 1983; AMCFE 1995; Caspary *et al.* 1998). All field studies have been short-term and relied predominantly on indirect evidence, such as nest counts to estimate population size and fecal analysis to identify dietary items. In general, observational knowledge of chimpanzee ecology in Mali is too incomplete to make comparisons with other West African subpopulations, although Moore (1985) and Pavy (1993) have identified possible differences in nesting behavior between Mali's chimpanzees and those studied at Mt. Assirik, Senegal.

In 1995, P. Gagneux collected chimpanzee hairs from nests in this area, which were analyzed in two subsequent studies. Schoeninger *et al.* (1998) found that the stable carbon isotope values in two samples of these hairs were similar to those of chimpanzees at Ugalla, Tanzania, indicating that the animals feed in both relatively mesic (i.e., gallery or riparian forest) and xeric (i.e., woodland or grassland) habitats (Schoeninger *et al.* 1999). In their study of hominoid phylogeny, Gagneux *et al.* (1999) found that the Malian chimpanzee subpopulation is genetically characteristic of the western subspecies, and thus has not been isolated from other West African subpopulations, at least historically.

Past conservation and research projects have centered on the Bafing Faunal Reserve, which was established by presidential decree in 1990 to mitigate environmental damage caused by construction of the Manantali Dam (completed in 1988). Chimpanzee conservation was a goal of the Bafing Faunal Reserve when it was proposed (as a national park) in the mid-1980s (Maldaque 1985), and has remained a primary focus of subsequent conservation efforts in the area (Pavy 1993; PREMA 1996; Caspary *et al.* 1998). In the period 1995 to 1999, there were several tangible achievements in the institutionalization of this Reserve, including establishment of an administrative structure, with both governmental and non-governmental representatives; installation of signs marking reserve boundaries; reestablishment of two forestry posts in the general area, including one at Kouroukoto, in the reserve; organization of a local hunters group; and completion of several public awareness campaigns in villages in the reserve area. Additionally, several conservation projects have produced valuable information on local fauna and flora, including chimpanzees (Pavy 1993; Duvall and Niagaté 1997; Caspary *et al.* 1998).

During the 1990s, several researchers found that areas outside the Bafing Faunal Reserve retained relatively high levels of faunal abundance and diversity, and that Bafing Faunal Reserve boundaries did not adequately encompass the most biologically valuable sites in the area (Pavy 1993; Duvall and Niagaté 1997; Caspary *et al.* 1998). As a result, the Malian government began a redesign of the Bafing Faunal Reserve in 2002 with the establishment of Korofin and Wongo National Parks and Bafing Chimpanzee Sanctuary. The government also plans to establish the Flawa Multi-use Area and a buffer zone to encompass these four areas, and seek United Nations Educational, Scientific and Cultural Organization (UNESCO) recognition of the entire set of protected areas as the Bafing Biosphere Reserve (Figure 6.1).

Despite its new status, the Bafing protected area remains almost non-existent in practice. Since 1999, on-the-ground conservation work has stagnated following the scheduled termination of two regional conservation and development projects, one funded by Office Allemand de la Coopération Technique (GTZ) and one by the United States Agency for International Development (USAID). There are currently no active research projects on chimpanzees in Mali, but one of the authors (Duvall) is preparing an 18-month study of chimpanzee and human habitat use to begin in May 2003.

6.5 Chimpanzee distribution and numbers

6.5.1 Chimpanzee distribution

Most of south-western Mali has not been surveyed for chimpanzees, especially the area east of the Bafing river. Moore (1985), Pavy (1993), AMCFE (1995), Duvall and Niagaté (1997), Duvall (2000) and Caspary *et al.* (1998) confirmed specific sites or areas of chimpanzee distribution based on observations of animals or nests (Table 6.1, Figure 6.2). The only confirmation of chimpanzees east of the Bafing river resulted from a brief survey by American volunteers east of the Bafing Biosphere Reserve (A. Kanouté, pers. comm. to Pavy 1992). The distribution of confirmed chimpanzee habitat corresponds generally with the search effort: in those parts of south-western Mali where researchers have purposefully sought evidence of chimpanzees because the probability of their presence seemed high, such evidence has usually been found.

Moore (1985), Pavy (1993) and Duvall and Niagaté (1997) estimated the area of probable chimpanzee range both east and west of the Bafing river based on interviews of Bafing Biosphere Reserve-area residents, forestry agents, expatriate travelers and others, as well as qualitative assessments of habitat. Pavy's representation of chimpanzee range east of the Bafing river (based solely on interview data) is the representation used here, while the area shown west of the river is a composite of the three sources, combined with more recent observations of habitat quality (C. Duvall, pers. obs.). Based on these sources of data, probable current chimpanzee range in Mali covers approximately 19,440km^2, of which about 5,215km^2 are protected (Table 6.2).

Figure 6.1. Chimpanzee distribution in Mali. The following protected areas comprise the Bafing Biosphere Reserve (BBR): BWA = Bloc Ouest Wilderness Area; BZ = buffer zone; FCS = Bafing Chimpanzee Sanctuary; KNP = Korofin National Park; WNP = Wongo National Park. BBR boundaries based on Caspary *et al.* (1998) are not official. 'Confirmed chimpanzee range' shown as squares five minutes of latitude and longitude (*c.* 9km) per side, with irregular edges along the Bafing River. One or many individual sightings of chimpanzees or nests have been reported in each square. 'Probable chimpanzee range' shows areas where chimpanzees likely occur, based on interview data and observation of habitat quality. Most of this range has not been surveyed for chimpanzees. 'Possible chimpanzee range' indicates the northern limits of area where topography and vegetation as represented by Projet Inventaire (1990) are similar to known chimpanzee habitat, but there is no recent evidence that chimpanzees occur in these areas. See text for data sources. Only towns mentioned in the text are shown.

Table 6.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Mali.

#	Name	Latitude Longitude	Date	Source
1	Hills north-west of Madina-Talibé	12°25′N 10°44′W	1984	Moore (1985)
2	Moralia area	12°57′N 11°11′W	1984	Moore (1985)
3	Faraba-Kossaya road	12°29′N 10°56′W	1984	Moore (1985)
4	Faraba area	12°25′N 10°52′W	1984	Moore (1985)
5	Hills north-west of Madina-Talibé	12°27′N 10°46′W	1984	Moore (1985)
6	Solo area	12°55′N 10°24′W	1984	Moore (1985)
7	Kofoulabé area	12°53′N 10°26′W	1984	Moore (1985)
8	Binda area	12°31′N 10°33′W	1984	Moore (1985)
9	Oulara area	12°36′N 10°35′W	1984	Moore (1985)
10	Bafing-Makana area	12°33′N 10°12′W	1990?	Kanouté (pers. obs.)
11	Saraya area	12°43′N 10°22′W	1995	AMCFE (1995)
12	Makadugu area	13°00′N 10°36′W	1999	Duvall (pers. obs.)
13	Makadugu area	13°00′N 10°37′W	1999	Duvall (pers. obs.)
14	Makadugu area	12°57′N 10°36′W	1999	Duvall (pers. obs.)
15	Makadugu area	12°58′N 10°37′W	1999	Duvall (pers. obs.)
16	Solo area	12°58′N 10°27′W	1999	Duvall (pers. obs.)
17	Djibashin water source	13°03′N 10°36′W	1996	Duvall (pers. obs.)
18	Wongo Hill	12°55′N 10°43′W	1996	Duvall (pers. obs.)
19	Kofoulabé area	12°54′N 10°25′W	1996	Duvall (pers. obs.)
20	Tuduwa area	12°48′N 10°23′W	1996	Duvall (pers. obs.)
21	Farina area	12°43′N 10°27′W	1996	Duvall (pers. obs.)
22	Kaméa area	12°26′N 10°24′W	1995	Duvall (pers. obs.)
23	Dalibitoukourou Hill	12°51′N 10°26′W	1996	Shambaugh (pers. obs.)
24	Sitaféto area	12°44′N 10°17′W	1997	Caspary *et al.* (1998)
25	Sitaninnkoto area	12°45′N 10°14′W	1997	Caspary *et al.* (1998)

Table 6.2. Area of chimpanzee range in Mali. Only areas of probable chimpanzee habitat, as depicted in Fig. 6.1, are included in the range portions considered below. Area estimate for Bafing Biosphere Reserve calculated from figures in Caspary *et al.* (1998).

Portion of chimpanzee range	Approximate surface area (km^2)
Protected areas (Bafing Biosphere Reserve)	5,215
Area west of Bafing river	13,649
Total chimpanzee range	19,440

Additionally, Kortlandt (1983), Moore (1985) and Duvall (2000) recount anecdotes of chimpanzee presence east, north and west of the area where chimpanzees have recently been confirmed to occur, which may indicate past range extensions that are no longer accurate (Figure 6.1). The margins of Sayer's (1977) range are also probably historic at this point in time, and are depicted as possible habitat (Figure 6.1). It is likely that chimpanzee range has contracted in the past 50 years in Mali, reflecting the increased human pressures on faunal resources described by Sayer (1977), Warshall (1989), Heringa (1990), Pavy (1993) and Caspary *et al.* (1998).

6.5.2 Chimpanzee numbers

There is little information on chimpanzee population size in Mali. Only two previous estimates have been made. First, Moore (1985) multiplied Baldwin *et al.*'s (1982) density estimate of 0.08 chimpanzees per km^2 from Mt. Assirik, Senegal, by the area that he considered probable chimpanzee range. Second, Pavy (1993) calculated chimpanzee density to be 0.27 chimpanzees per km^2 based on a nest survey and multiplied this figure by the total area he considered probable chimpanzee habitat. Subsequent qualitative observations in the Bafing Biosphere Reserve area by Duvall in 1995 to 1997 and 1999 suggest that the density value used by Moore is too low for most of the area, while Pavy's density estimate is more accurate. Average density over the entire chimpanzee range, however, is likely to be somewhat lower than Pavy's estimate, especially east of the Bafing river. Therefore, using the population density figures of Moore and Pavy as limits of the range in which the true

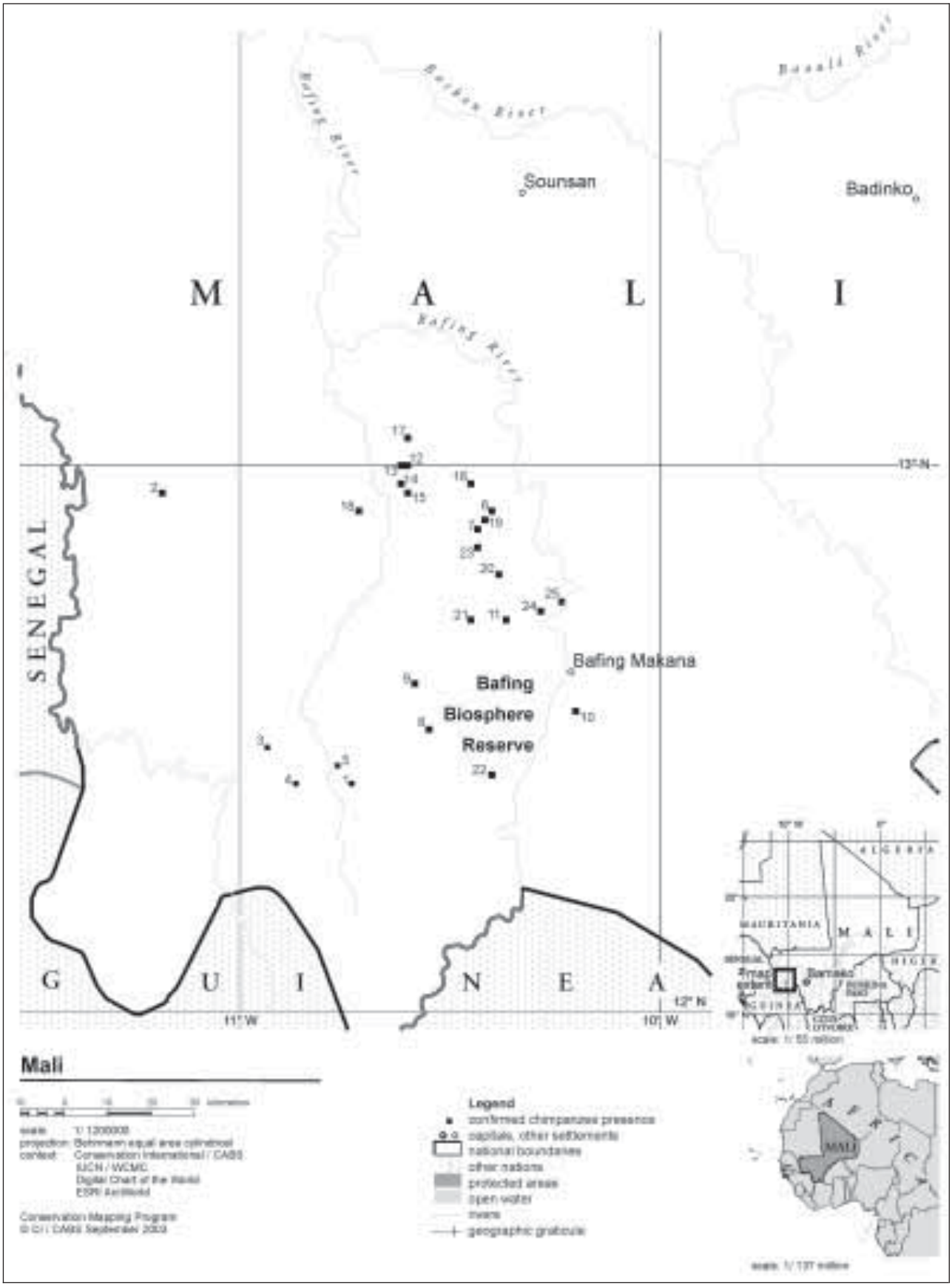

Figure 6.2. Confirmed presence of chimpanzees *Pan troglodytes verus* in Mali.

density figure falls, total chimpanzee population size in Mali, based on the range depicted in Figure 6.1 is likely to lie between 1,555 and 5,249 animals, with 417–1,408 occurring in the Bafing Biosphere Reserve (Table 6.3).

Table 6.3. Chimpanzee population size in Mali. The density estimates shown below are those used by Moore (1985) (0.08 individuals/km^2) and calculated by Pavy (1993) (0.27 individuals/km^2).

Portion of chimpanzee range	Density estimate	Population estimate
Protected areas (Bafing Biosphere Reserve)	0.08	417
	0.27	1,408
Area west of Bafing river	0.08	1,092
	0.27	3,685
Total chimpanzee range	0.08	1,555
	0.27	5,249

6.6 Threats to chimpanzees

Populations of several other species of large wild animals in Mali have declined drastically, especially in the past 50 years (Warshall 1989; Heringa 1990; Pavy 1993; Duvall and Niagaté 1997), and it therefore seems probable that Mali's chimpanzee population has also declined, although there is no information on demographic trends to prove this. The main causes of this population decline are hunting and agricultural expansion, as outlined below.

6.6.1 Habitat destruction

For the most part, swidden agriculture as practiced in southwestern Mali requires a relatively large area of land, but is not highly disruptive of natural resources over the long term. However, population growth can increase the total area under cultivation (van Keulen and Breman 1990; Weber *et al.* 1996) or change vegetation-clearing practices and thus alter fallow succession (cf. Nyerges 1989; Bassett and Koli Bi 2000), both of which clearly may affect the quality and quantity of wildlife habitat. Currently, agricultural change – whether due to population growth or the expansion of commercial agriculture – is probably the greatest medium- to long-term threat to chimpanzee survival in Mali.

This is especially true if agricultural change is stimulated by poorly planned economic development projects. Possibilities for further development include a proposed road connecting Bamako and Dakar passing through Kouroukoto and increasing industrial mineralogical exploration in the Bafing Biosphere Reserve area due to recent gold-mining successes near Kéniéba and Sadiola (Caspary *et al.* 1998).

While the Bafing Biosphere Reserve remains relatively sheltered as it lies at the center of probable chimpanzee range in Mali, human activities may be causing range contraction through habitat destruction in this area primarily on two axes. First, population growth around Manantali (caused primarily by population resettlement due to dam construction) has led to increased demand for farmland and wild floral and faunal resources (PREMA 1996; Caspary *et al.* 1998; Koenig and Diarra 1998; Duvall 2001). Population movement and settlement along the recently completed Manantali-Koundian road may lead to pressure on the northern edge of chimpanzee distribution and thus a southward contraction of its range. Second, commercial cotton cultivation (promoted by the Malian parastatal cotton production company, CMDT) is expanding around Kokofata and Sagabari, and toward the eastern edge of the Bafing Biosphere Reserve. It is possible that this may result in increased population movement and settlement within the reserve.

6.6.2 Hunting

While all available sources have reported that chimpanzees in Mali are subject to low absolute levels of hunting (Moore 1985; Pavy 1993; AMCFE 1995; Duvall and Niagaté 1997; Caspary *et al.* 1998; Duvall 2000), there has been no examination of the actual hunting practices of residents or of visitors to the Bafing Biosphere Reserve in particular, or southwestern Mali in general. Even though laws do exist to protect chimpanzees and their habitat, enforcement of these laws is weak in most of Mali and particularly in the Bafing Biosphere Reserve area due to the government's lack of resources. There have been no reports of trade in chimpanzee meat within Mali, although there is limited anecdotal evidence of possible trade in live chimpanzees, mainly for potential use as pets (Pavy 1993). Some chimpanzee hunting must occur in Mali, because skin and hands may be purchased easily for traditional medicinal use in Bamako (Moore 1985; Pavy 1993; Caspary *et al.* 1998).

As noted by Moore (1985), even light absolute levels of hunting may be a relatively high threat to Mali's chimpanzees, especially if their population size is small. It is probable that largely non-commercial, opportunistic or accidental hunting is the main short-term threat to the survival of chimpanzees in Mali, but a greater understanding of hunting practices would greatly aid in developing conservation policies to mitigate this threat.

Better knowledge of human-chimpanzee interactions is necessary to assess accurately current threats to chimpanzee survival in Mali. For instance, both Pavy (1993) and Duvall (2000) suggest that chimpanzee range in Mali may correlate to topography: chimpanzees seem to be most abundant along

cliffs and steep hills, where surface water is available in seasonal drainage channels and springs. The Maninka find such locations unsuitable for agriculture, do not consider chimpanzees agricultural pests, and rarely hunt them (Pavy 1993; Duvall and Niagaté 1997; Caspary *et al.* 1998; Duvall 2000). This suggests that it is possible that humans and chimpanzees may be able to coexist even if human population density is relatively high (cf. Happold 1995). Support for this hypothesis comes from Pruetz *et al.'s* (2002) recent survey in south-eastern Senegal, where they found chimpanzee density in agricultural areas outside Niokolo-Koba National Park equal to or greater than that within the park. However, the implications of this possibility must be considered along with the fact that there may be significant competition between humans and chimpanzees for some wild food plants (Duvall 2000; Pruetz 2002), the harvesting of which is essentially unregulated in the Bafing Biosphere area (Duvall 2001).

6.7 Priority sites for chimpanzee conservation

6.7.1 The Bafing Biosphere Reserve

The Bafing Biosphere Reserve should be the focus of any program for the conservation of chimpanzees in Mali as it is the only protected area within the range of chimpanzees in Mali.

6.7.2 Area east of the Bafing river

The area east of the Bafing river may hold significant numbers of chimpanzees (Moore 1985; Pavy 1993). Any chimpanzees in this area would face higher threats to survival than those west of the river since the area east of the Bafing is closer and more accessible to the centers of Kita, Bamako and the Dakar-Bamako railroad. In 1997 most wild animal skins and parts for sale in Bamako came from this area (Duvall, unpublished data from interviews of sellers). Loss of habitat to agriculture is also probably higher east of the Bafing river, especially since the Malian parastatal cotton production company (CMDT) began expansion in the Kita region in the late 1990s.

6.7.3 Tambaoura cliffs

The Tambaoura cliffs, north of Kéniéba, appear to provide suitable, and rather northern, habitat for chimpanzees based on topography and vegetation (Projet Inventaire 1990), but only anecdotal evidence exists to suggests that chimpanzees may occur there (Kortlandt 1983).

6.7.4 The Falémé river valley

The Falémé river valley, along the Mali-Senegal border, has not been surveyed for wildlife (East 1997). This area is sparsely populated and has been marginal both economically and geographically throughout the 20th century (Kéïta 1972). Wildlife may be threatened by the growing populations of Kéniéba and Sadiola, which have expanded due to the development of multinational industrial gold mining operations in the area during the 1990s.

6.8 Priority actions for chimpanzee conservation

6.8.1 Conduct a survey of south-western Mali

A leading priority for chimpanzee conservation in Mali is a survey of south-western Mali in order to more precisely determine chimpanzee distribution and population size. In particular, three areas must be studied because chimpanzees in these areas, if present, would face higher levels of threat than chimpanzees immediately in and around the Bafing Biosphere Reserve: east of the Bafing river, the Tambaoura cliffs, and the Falémé river valley (see above).

6.8.2 Focus on conservation of the Bafing Biosphere Reserve

Increase financial support. Although the Bafing Biosphere Reserve protects over 5,200km^2 of chimpanzee habitat and a population of probably several hundred chimpanzees, it remains weakly enforced and lacks sufficient resources to ensure adequate surveillance. Financial and technical support is needed to make the Bafing Biosphere Reserve a reality on the ground. Although the Malian government has committed important resources to developing the Bafing Biosphere Reserve, the financial and technical resources available nationally are not sufficient to ensure successful long-term conservation. International donors, organizations and conservationists should be approached to support the efforts of Malian government agencies and non-governmental organizations in the Bafing Biosphere Reserve by contributing their expertise and financial resources.

Improved management. Improved management of the Bafing Biosphere Reserve is needed to attract donors to support the Direction Nationale de la Conservation de la Nature's management plan for the area. ''Improved management'' means that Malian managers account for the use and management of resources devoted to biodiversity conservation and economic development, and that the success of their management activities are monitored ecologically. Such accountability and monitoring are crucial to attracting donors to support the Bafing Biosphere Reserve. The opportunity provided by decentralization reform should be exploited for the benefit of biodiversity conservation by strengthening local government conservation services and reorganizing the institutional management of the Bafing Biosphere Reserve by tapping existing sources of expertise and motivation (particularly Malian NGOs such as the Association Malienne pour la Conservation de la Faune et de l'Environnement). The opportunity to advance biodiversity conservation in south-western Mali is ripe, based on the interests expressed by both the newly elected commune councils and international donors who support the reform process.

Tolerate sustainable use but enforce regulations. Biodiversity conservation in the Bafing Biosphere Reserve should not mean a prohibition of all natural resource use by local residents, who rely on wild plants and animals for many essential dietary and material items. However, population growth due to immigration, expansion of commercial cotton cultivation and decline in traditional land management practices altogether have great potential to encourage unsustainable use of natural resources in the Bafing Biosphere Reserve. In the past, law enforcement activities have focused on preventing destructive resource exploitation by non-residents – in particular poaching, which resulted in the extirpation or near-extirpation of many large animal species (Pavy 1993; Duvall and Niagaté 1997; Caspary *et al.* 1998). In the future, this emphasis must be maintained, but resource managers must also prevent unsustainable resource use by Bafing Biosphere Reserve residents by publicizing and enforcing pertinent natural resource management regulations. While rigorously enforcing conservation laws, the Bafing Biosphere Reserve administration should cooperatively assist and organize new municipalities and local residents to manage sustainable use of natural resources in a participatory, transparent manner.

Stimulate local development. Conservation cannot succeed in a development vacuum. In order to help guarantee the support of local residents and the long-term success of the Bafing Biosphere Reserve, management of the protected area complex should address the economic development needs of the local population (Pavy 1993; Caspary *et al.* 1998). The official wildlife management plan for the Bafing Biosphere Reserve (Caspary *et al.* 1998) recognizes the importance of economic development in contributing to successful biodiversity conservation in the Bafing Biosphere Reserve. Mali has numerous development partners and projects whose efforts could be extended to the Bafing area and jointly implemented as part of overall regional development. Those projects focusing on decentralization with capacity-building for the new commune councils are particularly important. In any case, development projects should not be perceived or conceived as a strategy to ''buy'' a commitment to conservation by local residents; such projects should aim to strengthen activities and values that directly lead to positive conservation outcomes.

Improve the quality of information. Better information is needed on the distribution of chimpanzees and other wildlife in the western portion of the Bafing Biosphere Reserve in particular, and a more precise population estimate is needed for the entire protected area in order to more accurately assess its international significance and funding priority. Information is also needed on the status and planning of potential economic development projects in the Bafing Biosphere Reserve area, on the hunting practices of visitors to and residents of the area in which chimpanzees occur and on the effects of farming practices on the composition and structure of wildlife habitat. Finally, information is needed on many aspects of natural resource availability and use in the Bafing Biosphere Reserve, ranging from the abundance and distribution of farming hamlets to the nature of mineralogical resources (Caspary *et al.* 1998).

Training and employing local residents to collect data used to analyze chimpanzee habitat and population parameters would contribute to both conservation commitment and economic development in local communities. Most past research and conservation efforts have relied heavily on the assistance of resident hunters and farmers, and some data-collection techniques used to study chimpanzees (e.g., nest surveys and fecal analysis) could be carried out by local residents with minimal supervision and at a relatively low cost.

6.9 Conclusions

Although many foreigners are surprised to learn that chimpanzees naturally occur in desert-dominated Mali, this country may hold an internationally significant number of the western subspecies, *P. t. verus*. Mali's chimpanzees have benefited from the efforts of Malian conservationists as well as the geographical isolation of the area in which they occur. Several factors may account for the lack of attention that has been paid to Mali's chimpanzee population. First, the Manding mountains area has been and continues to be marginal to Mali's economy. The lack of infrastructure in the Bafing Biosphere Reserve area raises the costs and logistical difficulties of initiating conservation or research projects, especially when compared to other ''savanna'' chimpanzee sites or other important areas for biodiversity conservation

in Mali. Second, this area is poorly known by both Malian and international conservationists (Warshall 1989; Duvall 2001), and many biodiversity assessments have either emphasized ecological regions that are better known and more abundantly represented nationally (e.g., Heringa 1990), or focused on portions of the ecological regions present in south-western Mali located in other countries, where they are better known and more abundantly represented (e.g., Oates 1996a) Thus, the potential importance of the Bafing Biosphere Reserve for national and international biodiversity conservation has been underestimated (although see Warshall 1989). Third, wildlife conservationists and managers in Mali have historically focused on other species, particularly large ungulates and elephants, because of the economic importance of these animals as producers of meat and ivory and as competitors with livestock (Sayer 1977; Warshall 1989; de Bie 1991). Finally, although the Bafing Biosphere Reserve has a richer surviving fauna than Mali's Boucle de Baoulé National Park, it is less rich than other West African protected areas with similar ecologies, particularly Niokolo-Koba National Park, Senegal. As a result, the Bafing Biosphere Reserve has gained less attention from international conservation organizations even though its chimpanzee population appears to be larger than those of other ecologically comparable protected areas in West Africa.

Though the potential for successful chimpanzee conservation in Mali seems high, a lack of knowledge, funding and international support hinders current and future conservation and research efforts. While Mali's chimpanzee population appears to be relatively secure in the short term due to the probably low absolute level of hunting pressure it faces, human population growth and economic and agricultural change will likely increase the intensity of the threats chimpanzees face in the medium to long term through hunting and habitat loss. The potential for protecting Mali's chimpanzee population is great, but depends on the ability of Malian conservationists and resource managers, with the support of international collaborators, to muster the resources necessary to improve biodiversity conservation and economic development in south-western Mali.

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Chapter 7

The Gambia

Janis Carter

7.1 Introduction

The Gambia lies at the northern boundary of the historical range of the western chimpanzee. Oral reports state that chimpanzees disappeared from this country around the turn of the century. The illegal trafficking of baby chimpanzees, smuggled into the country from Guinea and Senegal, continued long after the disappearance of the species. Progressive wildlife legislation, application and enforcement of these laws, and the long-term presence of the Chimpanzee Rehabilitation Project successfully eliminated this barbaric trade. In 1979, the chimpanzee was reintroduced to the River Gambia National Park through the efforts of the Chimpanzee Rehabilitation Project and the Department of Parks and Wildlife Management. Over more than two decades 47 chimpanzees have been released onto islands and an additional 55 chimpanzees have been born to the original released population. As of June 2003, the total chimpanzee population of The Gambia was comprised of 62 chimpanzees living on three islands in four social groups and two more awaiting release. As with wild populations located elsewhere, continued monitoring of the chimpanzees, patrolling of the protected area, education and other development activities are conducted to ensure their future safety.

7.2 Country profile

7.2.1 Geography

Situated in the drought-prone Sudano-Sahelian region of West Africa, 13°28′N, 16°34′W, The Gambia is roughly 500km long, 24–50km wide and covers a total area of 11,300km^2. The terrain is relatively flat as it consists mostly of the flood plain of the Gambia river bordered by some low hills with the highest point of 53m.

7.2.2 Climate

The climate is divided into two periods: a dry season from November to May and a shorter rainy season from June to October. Average rainfall ranges from 800mm in the eastern portion of the country to 1,200mm along the coast. Analysis of climatic data collected over a period of 45 years (1951 to 1995) provides an overall average annual rainfall figure of 900mm with a mean temperature of 25°C. As with other countries in the region, the overall trend is in the direction of increasing temperatures, decreasing rainfall and drier atmospheres.

7.2.3 Habitat

There are two major habitat types in The Gambia; Guinea savanna woodland is predominant from the west coast inland changing into open Sudan savanna as one moves east.

7.2.4 Biodiversity

The Gambia serves as a haven for more than 550 bird species (Barlow *et al.* 1997) and at least 99 recorded mammal species (Murphy 1998). An estimated 974 species of higher plants can be found in this country.

7.2.5 People

The Gambia supports an estimated population of 1,455,842 people. Ranking as the fourth most densely populated country in Africa, The Gambia has an overall density of 129 persons per km^2 with a population growth rate of 3.09% per annum (CIA World Factbook 2002).

7.2.6 Political context

The Gambia became independent from the United Kingdom in 1965. Between 1982 and 1989 it formed the Senegambia confederation with Senegal. In 1991 the two nations signed a friendship and cooperation treaty. A military coup overthrew the president in 1994. In 1997, parliamentary balloting completed a nominal return to civilian rule. The country undertook another round of presidential and legislative elections in late 2001 and early 2002.

7.2.7 Economy

About 75% of the population of The Gambia depends on crops and livestock for its livelihood. GDP is $300 US per capita.

7.3 Legislation and conservation policies

Originally created as a unit under the Forestry Department in 1977, the present day Department of Parks and Wildlife Management was established in 1981 and serves as the government agency responsible for the management and protection of wildlife. Though small and densely populated, The Gambia has always taken a strong and progressive stand on the conservation of wildlife. Measures of protection initiated by the government include the Banjul Declaration (1977) and The Wildlife Conservation Act of 1977. Both actions prohibit the commercial trade of all wildlife species, including those not indigenous to The Gambia. The Department of Parks and Wildlife Management is currently responsible for the management of four national parks and three nature reserves (two are Ramsar Sites); covering a total area of 43,779 hectares and representing 4.2% of the total surface area of the country. The Gambia is a signatory on the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Convention on Biological Diversity and the Ramsar Convention on Wetlands.

7.4 Historical situation

The Gambia falls along the northern boundary of the historical range of the western chimpanzee subspecies. Although both scientists and laypeople have functioned on the premise that chimpanzees are indigenous to The Gambia (Lee *et al.* 1988; Teleki 1989), there is no hard evidence from museum collections to support this claim (Grubb *et al.* 1998). Historical literary records of mammals inhabiting The Gambia do not specifically state the presence or absence of chimpanzees (Haywood 1933; Johnson 1937; Reeve 1969; Parker 1973) Nevertheless, oral reports made by living elder hunters refer to the presence of chimpanzees in the 1920's in forest patches located in the eastern part of the country bordering southern Senegal (A. Sarr, pers.comm.). Not considered a recent event, extinction is thought to have taken place around the turn of the last century. Causal factors responsible for this disappearance are thought to include the destruction of habitat and hunting for trade.

For several decades after local extinction of the species, chimpanzees were still seen for sale in market places, presumably smuggled into the country from neighboring Senegal and Guinea. Prior to the Wildlife Conservation Act, the Animal Cruelty Act was enforced to assist in the confiscation of chimpanzees held in grim captive conditions. Working closely together, the Chimpanzee Rehabilitation Project and the Department of Parks and Wildlife Management have vigorously eliminated the illegal trafficking of chimpanzees in The Gambia through law enforcement, confiscation and education activities. The last chimpanzee confiscated by the Department of Parks and Wildlife Management was in early 1994.

7.5 Present situation

With the support and close cooperation of the Department of Parks and Wildlife Management, the Chimpanzee Rehabilitation Project began the reintroduction of chimpanzees to The Gambia in 1979 at the River Gambia National Park. Composed of five islands, the park covers a total land area of approximately 6km^2 and is characterized by a mosaic of woodland savanna, swamp savanna and some of the last remaining stands of riverine gallery forest in the country. The variety of habitat has enabled a virtually complete spectrum of The Gambia's mammal fauna to exist, including the locally endangered hippopotamus *Hippopotamus amphibious* and manatee *Trichechus senegalensis.*

Over a span of more than two decades the Chimpanzee Rehabilitation Project has released 47 chimpanzees, most of them confiscated in The Gambia and neighboring countries. Fifty-five more chimpanzees have been born to the original released population. As of June 2003, the total chimpanzee population of The Gambia is comprised of 64 individuals; 62 of which live in four social groups on three islands. Two chimpanzees are awaiting release.

Eighteen of the present population were released on the islands. Forty-four of the 55 island births have survived, 39 of them first generation offspring and five being second generation offspring. There are presently 17 reproducing females with an average birth interval of 64.4 months. Infant survival rate (infancy defined as birth through age five) is 86%. As recorded for wild chimpanzees, there are fluctuations in group membership as well as permanent transfers of females reaching reproductive age.

The long-term efforts of the Chimpanzee Rehabilitation Project have been successful in reintroducing this species to a natural habitat within the species historical range. The close collaboration between the Department of Parks and Wildlife Management and the Chimpanzee Rehabilitation Project has eliminated the illegal trade of young chimpanzees in The Gambia. Equally well known in neighboring countries and abroad, the Chimpanzee Rehabilitation Project has served as a receiving station for chimpanzees confiscated by several other governments including Senegal, Guinea, and most recently the US in January 2000, thus facilitating other countries in their attempts to abolish the trafficking in young chimpanzees.

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Chapter 8

Guinea-Bissau

Spartaco Gippoliti, Daniel S. Embalo and Claudia Sousa

8.1 Introduction

It appears that in the past some countries have been often forgotten not only by the world politicians, but even by the scientific and conservation community. However, lack of knowledge does not necessarily mean an absence of conservation opportunities. This is perhaps the case of Guinea-Bissau and other West African countries.

In 1988, chimpanzees were declared Extinct in Guinea-Bissau (Lee *et al.* 1988), but recent evidence has shown the distribution of chimpanzees still to be similar to the map provided by Kortlandt in 1983 (Kortlandt 1983). Their current range is believed to extend through the south of the country in the Boé region between the Corubal river and the Guinea border (Monard 1940; Limoges 1989) and in the south-east regions of Quinara and Tombali (Gippoliti and Dell'Omo 1996). Most recent surveys suggest that there are between 600 and 1,000 chimpanzees still living in Guinea-Bissau today (Gippoliti and Dell'Omo 1996). The Parque Natural das Lagoas de Cufada, officially declared in 2000, is the only protected area within the chimpanzees' range in this country. The Park is about 700km^2 and is believed to harbor an unknown number of chimpanzees. The Cantanhez Forest, in Tombali region, is the only primary subhumid forest in the country (J.-C.Vié, pers.comm.) but is suffering severe habitat degradation and fragmentation.

Chimpanzees are not generally used for human consumption in Guinea-Bissau because they are considered too similar to humans. Rather, the main threat to their survival is agricultural expansion. Nowadays, major emphasis is placed in the conservation of the unique coastal and island ecosystems of Guinea-Bissau. The Parque Natural das Lagoas de Cufada is recognized as an internationally important site of the Ramsar Convention on Wetlands, and great attention has been paid to migrant birds and coastal wetlands conservation there (Stuart *et al.* 1990). However, the opportunity exists to plan effective protection of inland-forested areas as well and encourage chimpanzee-watching tourism in the country. Guinea-Bissau is one of the ten poorest countries in the world, and here, even more than elsewhere in West Africa, biological conservation should be coupled with attempts to encourage economic growth.

8.2 Country profile

8.2.1 Geography

Bounded by Senegal to the north and Guinea to the south and east at 10°55′–12°40′N and 13°38′–16°43′W, Guinea-Bissau is one of the smallest countries in coastal West Africa. The country totals 36,120km^2 in area (CIA World Factbook 2002) and is made up of mainland as well as a number of offshore islands, most of them composing the Bijagós Archipelago, which are almost linked to the continent by wide intertidal mud flats. The topography of the country is low-lying, rising eastwards from sea level to low altitudes (highest point at 260m).

8.2.2 Climate

Most of the country receives 1,500–2,000mm of rain yearly, but the south-west (regions of Quinara and Tombali) averages more precipitation than the rest of Guinea-Bissau (Scott 1992). Temperatures are at their lowest in January (24.7°C) and their highest in July (28.0°C) (data for Bissau).

8.2.3 Habitat

Closed broadleaved forests occur on the lowland plain. Small areas of primary subtropical forests are still found in the south-west (Tombali and Quinara regions) and in the north-west (Cacheu region). With 60% of its land covered by forests, Guinea-Bissau is considered the most forested country of West Africa (Amsallem 2001). The study by the United Nations Food and Agriculture Organization shows a decline of 0.9% of forest cover between 1990 to 2000, which appears to be a somewhat optimistic figure (Amsallem 2001).

8.2.4 People

The estimated population size of Guinea-Bissau is 1,345,479, with an annual population growth rate of 2.23%. Population densities are higher in the north-west (*c.* 42 people per km^2), while the southern and eastern parts of the country are sparsely populated (15 people per km^2) (Portas

and Oliveira Costa 1985). Several ethnic groups live in the country, the major ones being the Balanta, the Fula (or Fulani) and the Mandyak. Guinea-Bissau is politically divided into nine Administrative Regions and a number of Sectors.

8.2.5 Political context

Guinea-Bissau became independent from Portugal in 1974. In 1994, the country's first multiparty legislative and presidential elections were held. A civil war in 1998 created hundreds of thousands of displaced persons. The president was ousted by a military junta in May 1999, and then the interim government turned over power in February 2000 to opposition leader Kumba Yala after two rounds of transparent presidential elections.

8.2.6 Economy

Guinea-Bissau is one of the ten poorest countries in the world. Farming is the main occupation of the people inhabiting the coastal plains, while the people of the inland plateau are mostly itinerant cattle herders (Chardonnet and Limoges 1989). GDP is $174 US per capita (CIA World Factbook 2002).

8.3 Legislation and conservation policies

The protection of chimpanzees and other wildlife is the responsibility of the Direçao Geral das Florestas e Caça. Chimpanzees are fully protected by current hunting regulations (Decree No. 21/1980). Hunting is completely prohibited in the Hunting Reserves. Designated areas include the Canthanez Forest (650km^2) and the whole Boé Sector (Portas and Oliveira Costa 1985; Chardonnet and Limoges 1989), and the Lagoas de Cufada area was recently upgraded to protected area level. The country has signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora, Convention on Biological Diversity, and the Ramsar conventions.

8.4 Past research and conservation efforts

The vertebrate fauna of the country has been scarcely investigated. Bocage published a first list of the terrestrial mammal species in 1890. Ten years later, during a five-month survey for the Genoa Natural History Museum, Leonardo Fea collected specimens in Bissau, Bolama, Farim, Cacheu, Cacine and Cambec (Gestro 1904), but his (relatively scarce) mammal records, including chimpanzee, were never published. In 1906 Maclaud published an account on the mammals and birds of West Africa, including the Portuguese Guinea. The first scientific expedition, however, was that of the Swiss zoologist Albert Monard, who collected in 1937–38 specimens in various localities of the country (Monard 1940). After the war, in 1945–46, a Portuguese zoological expedition ''Missão Zoológica da Guiné,'' headed by Fernando Frade, provided new information on Guinea-Bissau's fauna (Frade 1949). Then, for more than 40 years no zoological investigations were carried out in the country. Finally, in 1989, the Direction Office of Forestry and Hunting of Guinea-Bissau and Canadian Cooperation undertook a comprehensive wildlife inventory with financial help from IUCN (Limoges 1989). In February-March 1994, during a primate survey of selected areas of the country, ten days were spent in the Canthanez Forest to confirm chimpanzee presence and make a preliminary conservation assessment (Gippoliti and Dell'Omo 1996). Modern reviews on the fauna of the country include Frade and Silva (1980) and Reiner and Simões (1998) for mammals and Gippoliti and Dell'Omo (2003) for primates.

Even the recent conservation interest has focused on different habitats and species of greater economical importance, such as game species management, coastal wetlands and marine species (e.g., Altenburg *et al.*, 1992; Thibault 1993; Silva and Araujo 2001), and there still remains much to be learned about chimpanzees in this country.

8.5 Chimpanzee distribution and numbers

8.5.1 Chimpanzee distribution

Chimpanzees are still common in the Boé region between the Corubal river and the Guinea border (Monard 1940; Limoges 1989) and in the south-east regions of Quinara and Tombali (Gippoliti and Dell'Omo 1996). Three groups and 26 individuals were observed in the hilly woodlands of the Boé sector during a nation-wide faunistic census (Limoges 1989). Nests and vocalizations were commonly recorded on the southern side of the Cantanhez Forest, around the Fazenda São Francisco da Floresta (11°20′N–15°00′W) and neighboring areas (Gippoliti and Dell'Omo 1995, 1996). Féron and Correia (1997) reported that the species is easily observed in the Darsalame peninsula (between the Grande de Buba and Tombali rivers).

The northern limit of chimpanzee distribution is said to be the Corubal river (Maclaud 1906; Féron and Correia 1997). The former author reported the surprise of villagers in

the Gabú Region, which lies north of the Corubal river, upon seeing a young captive chimpanzee, suggesting that chimpanzees do not exist there. Thibault (1993) reported the presence of chimpanzees and their nests along the Corubal river inside the proposed Dulombi National Park, but did not specify if the observations were from both sides of the river. During a recent visit (December 2002), chimpanzees were reported by locals to inhabit both sides of the Corubal river. The species is still reported present in the region of Xitole, especially in the proposed Dulombi National Park, north of Corubal river (Reiner and Simões 1998).

Chimpanzees are also present in the Parque Natural das Lagoas de Cufada (Catarino and Costa 2000) and on the North Bank of Rio Grande de Buba (J.-C. Vié, pers. comm.), in the Quinara district, but details are lacking about density and size of the chimpanzee population here. The proposed Dulombi National Park, situated south of Bafata on both sides of the Corubal river, has never been established, but a community-based management scheme exists. However, chimpanzees appear scarce there (B. Limoges, pers. comm.) (Table 8.1 and Figure 8.1).

8.5.2 Chimpanzee numbers

The status of *Pan troglodytes* in Guinea-Bissau has been recently reviewed by Gippoliti and Dell'Omo (1995). Regrettably, few additional data have become available since. The scarcity of ''modern'' observations led to the incorrect conclusion that the species was Extinct in Guinea-Bissau (Lee *et al.* 1988), despite the correct map compiled by Kortlandt (1983). Chimpanzee population size has never been estimated in any area within the country, but it is believed that 600–1,000 chimpanzees still live in Guinea-Bissau.

8.6 Threats to chimpanzees

8.6.1 Habitat destruction

Forest degradation and destruction appears to be the primary threat to chimpanzee survival in the Tombali and Quinara regions. The situation in the Cantanhez Forest continues to deteriorate, and the forest cover is becoming seriously fragmented to make space for banana, cashew and other fruit plantations (L. Mendes, pers. comm.). Crop raiding had been reported in the Cantanhez region and is seen as an increasing problem among the villagers (J.-C. Vié, pers. comm.).

8.6.2 Hunting

All authors agree that chimpanzees are not hunted for meat in Guinea-Bissau. As has been reported for other regions of West Africa (i.e., Duvall *et al.* 2003, Chapter 6), in Guinea-Bissau chimpanzees – locally known as ''dari'' – are not generally used for human consumption because ''they are too similar to humans.'' In the Boé Region, people say they shelter the spirit of elders (B. Limoges, pers. comm.). This creates a positive social milieu for chimpanzee conservation in the country.

However, the hunting of wildlife by snares – reported for example in the Cantanhez Forest, which is officially a hunting reserve (V. Bilego, pers. comm.) – represents an indirect threat to chimpanzees. Chimpanzee meat is not consumed but other body parts are sometimes used in traditional medicine.

8.6.3 Trade in young chimpanzees

Occasionally, young chimpanzees are kept as pets, but this does not represent a great threat at the moment.

8.7 Priority sites for chimpanzee conservation

8.7.1 Lagoas de Cufada Natural Park

Created in 2000, the 700km^2 Parque Natural das Lagoas de Cufada in the Quinara district between 11°34′–11°51′N and 14°49′–15°16′W was the first protected area in Guinea-Bissau. Chimpanzees are reported to occur in the National Park, where they frequently make nests in oil palms (Catarino and Costa 2000), but details are lacking about density and size of the chimpanzee population inside the protected area. Several institutions have collaborated to manage the protected area for the last four years (Direcção Geral do Ambiente (Guiné-Bissau); Direcção Geral de Florestas e Caça (Guiné-Bissau); Instituto da Cooperação Portuguesa (Portugal); Instituto da Conservação da Natureza (Portugal); Instituto de Investigação Científica Tropical (Portugal); União Internacional para a Conservação da Natureza; Instituto Nacional de Estudos e Pesquisa (Guiné-Bissau); Comissão Europeia (Centro de Áreas Protegidas de Buba)) with financial aid from the European Union. Prospects for this National Park are poor at the moment. For the last four years it has been managed by the Portuguese Instituto da Conservação da Natureza, together with Direcção Geral de Florestas e Caça and other organizations, but in 2002 the contract expired, and its future remains uncertain (L. Mendes, pers. comm.).

Table 8.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea-Bissau.

#	Name	Latitude Longitude	Date	Source
1	Fazenda de São Francisco	11°20′N 15°00′W	1994	Gippoliti and Dell'Omo 1996
2	Jemberam	11°14′N 15°02.307′W	2002	Gippoliti and Sousa (pers. obs.)
3	Parque Natural das Lagoas de Cufada	11°34′N 11°51′N and 14°49′W 15°16′W	2000	Catarino and Costa 2000
4	Boé	11°49.822′N 14°03.526′W	2002	Gippoliti and Sousa (pers. obs.)

8.7.2 Basin of the Tombali, Cumbija and Cacine rivers, including the Cantanhez forest

The basin of the Tombali, Cumbija and Cacine rivers is the biologically richest area of Guinea-Bissau, with extensive mangroves, mudflats and subhumid forest. Other than chimpanzees, notable primate species found here include Temminck's red colobus *Procolobus badius temminckii*, western black and white colobus *Colobus polykomos* and the sooty mangabey *Cercocebus atys.* The Cantanhez forest has been seriously fragmented by cultivate fields and immediate action is necessary. Conservation is hindered by a growing human population in the area.

8.7.3 Boé Sector

The Boé sector is an inland zone in the south-east that rises to a height of 300m (western fringe of the Fouta Djallon massif). The vegetation is mainly savanna with forest along the rivers and on the hills. The area is scarcely populated, and the occasional capture of young chimpanzees by outside hunters is the only reported threat to the species. Threatened species believed to occur in the Boé region include the African wild dog *Lycaon pictus* and the giant eland *Tragelaphus derbianus.*

8.8 Priority actions for chimpanzee conservation

Given the high population growth and the poor economical situation of Guinea-Bissau, conservation objectives will likely not be considered as a priority by the government in the near future. However, international cooperation could help the country achieve some of the following conservation goals, which may also positively affect the livelihoods of people.

8.8.1 Conduct further surveys of chimpanzee populations

Wider and more detailed surveys of chimpanzee populations should be conducted in order to determine the exact distribution of chimpanzees throughout the country. A nationwide survey was once planned (Féron and Correia 1997) but its results are unknown; it was probably aborted due to civil unrest. Priority areas that should be targeted for surveys include the Boé sector, the Lagoas de Cufada area and what is left of the Cantanhez forest and surrounding areas at the border with the Republic of Guinea.

8.8.2 Develop a national strategy for chimpanzee conservation

Future research should be aimed at developing, with the support of a foreign non-governmental, a national strategy for the conservation of chimpanzees through the identification of protected areas at least for two viable populations, one in the south-east and one centered in the Boé sector.

8.8.3 Investigate the feasibility of a transnational protected area along the Guinea-Bissau/Guinea border

As suggested in the African Primate Action Plan (Oates 1996a), the possibility to create one or two transnational protected areas along the Guinea-Bissau/Guinea border should be investigated, as chimpanzees are reported as common or abundant in several localities of the Koundara, Tougue and Boké Provinces of the Republic of Guinea (Kormos, Humle *et al.* 2003, Chapter 9).

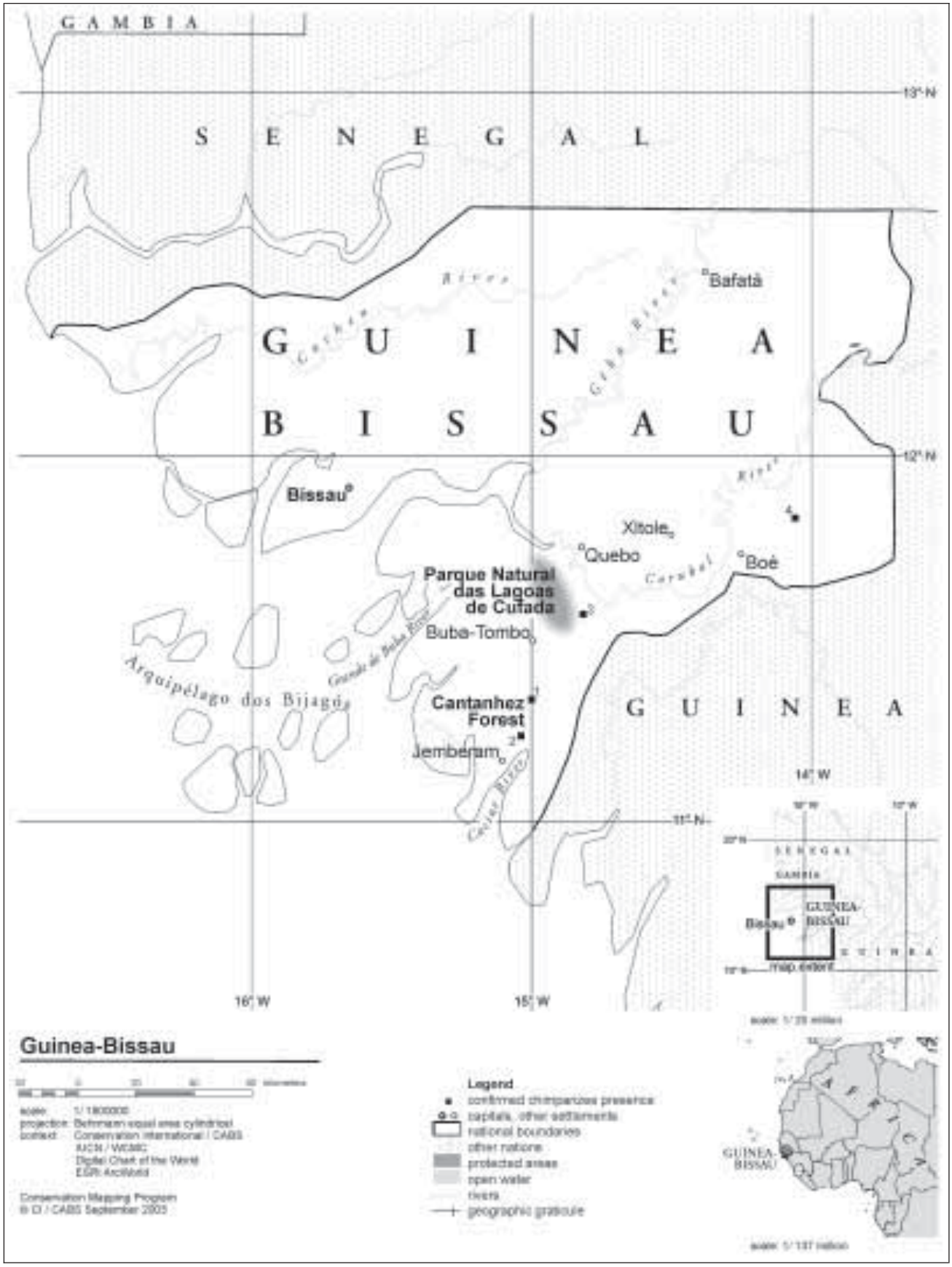

Figure 8.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea-Bissau.

8.8.4 Ensure protection of the Cantanhez forest and the basin of the Tombali, Cumbija and Cacine rivers

Protection of the Cantanhez forest and the basin of the Tombali, Cumbija and Cacine rivers should be another important goal of the conservation community. These areas are already considered of priority importance by several documents concerning Guinea-Bissau biodiversity (Portas and Oliveira Costa 1985; Chardonnet and Limoges 1989; Stuart *et al.* 1990), and chimpanzees could indirectly benefit from this interest.

8.8.5 Encourage ecotourism in one or more of the protected areas

West Africa is often not considered an ideal region for community-based conservation (Adams and Hulme 2001). However, given the numerous important sites for conservation, the scarcity of available resources and the pressure of a growing human population, it is unlikely that much could be achieved by adopting a ''protectionist'' approach to conservation that relies exclusively on government declared protected areas. The great diversity of landscapes and biological importance of this small country could, however, support a number of conservation projects dependent on wildlife tourism.

The possibility of establishing a research and habituation program to encourage tourism in one or more of the protected areas should be investigated. It is expected that this would be locally welcomed given the positive attitude of people toward chimpanzees. Such a program could also generate income for local communities without the risk of seriously increasing poaching problems. Informal ecotourism programs seem to already be established by local people, i.e., at Jemberem (C. Duvall, pers. comm.). Any such program would be extremely challenging in a country with so little infrastructure, but worth investigating. Finally, as highlighted in Chapter 23 (Formenty *et al.* 2003), chimpanzees and humans share many similar diseases and therefore precautions must be taken to avoid such transmission from tourists to habituated apes. In addition, stress is also believed to make chimpanzees more vulnerable to disease. Any ecotourism project would therefore have to be well researched and planned and have very strict regulations.

8.8.6 Send orphaned chimpanzees to sanctuaries in other countries in the region

At the moment, the holding in captivity and trading of young chimpanzees is very limited in Guinea-Bissau. It is suggested that confiscated chimpanzee pets be sent to appropriate centers in other countries in West Africa with such facilities, instead of creating a new orphanage in Guinea-Bissau (the country does not have any zoological facility at the moment). Release of orphaned chimpanzees back to the wild is a technically complicated task (Tutin *et al.* 2001), and every effort should be made to address the main causes of the chimpanzee conservation problem, mainly deforestation.

8.8.7 Conduct further studies of chimpanzee conservation in open woodlands

Further studies are needed to understand what kind of conservation tools are better suited to assure the long-term conservation of the chimpanzee and other wildlife species in the Boé sector. For example, it appears that at moderate human density, the coexistence of chimpanzees with cattle herders can be highly successful in West African savanna habitats (Duvall 2000; Pruetz *et al.* 2001; Kormos, Humle *et al.* 2003, Chapter 9), a fact anecdotally confirmed in south-east Guinea-Bissau (Limoges 1989; B. Limoges, pers. comm.). Even in light of recent studies on the effects of human density on persistence of wildlife in African reserves (Brashares *et al.* 2001; Harcourt *et al.* 2001), the importance of widespread chimpanzee populations in the low-human-density, open woodlands of the Fouta Djallon region for the highly threatened *Pan troglodytes verus* (Teleki 1989) should be reconsidered and highlighted. Therefore, the feasibility of a community-based approach to chimpanzee habitat conservation in the whole Boé sector as opposed to the establishment of a strictly protected area should be carefully investigated.

8.8.8 Promote further studies on chimpanzee culture in Guinea-Bissau

The conservation and study of chimpanzee populations in Africa is of great interest for students of chimpanzee traditions and regional culture, since this population represents the westernmost extreme of chimpanzees from this subspecies (Wrangham *et al.* 1994; Whiten *et al.* 1999). Cultural differences have already been documented by preliminary observations of nest site selection in the Cantanhez forest, where many observed nests were located on oil palms *Elaeis guineensis* (Gippoliti and Dell'Omo 1995). This behavioral pattern has only occasionally been observed elsewhere (De

Bournonville 1967; Barnett and Prangley 1996), but it has also been confirmed as a common feature in the adjacent Guinée Maritime Province of Guinea (Kormos, Humle *et al.* 2003, Chapter 9). The chimpanzee population inside the Parque Natural das Lagoas de Cufada should also be of interest as it offers the chance to study chimpanzee adaptation to the unique flooded savanna-woodland habitat that characterizes south-west coastal Guinea-Bissau.

8.9 Conclusions

After an 11-month period of civil unrest that began in June 1998, Guinea-Bissau is slowly returning to civilian rule. It is hoped that the return of peace may once again result in increased interest in conservation in the country. In turn, this could provide a highly needed source of financial income through ecotourism for a small country with a great variety of different and attractive landscapes. Primates, particularly chimpanzees, are among the most visible members of the biodiversity of Guinea-Bissau and have an important role to play as ''flagship'' species for the conservation of some of the most remarkable terrestrial natural habitats of the country.

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Chapter 9

The Republic of Guinea

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9.1 Introduction

Chimpanzees are found almost throughout Guinea, except in the far east of the country, although reports from people local to that region indicate that chimpanzees once lived there too, and have only recently disappeared. In all of West Africa, Guinea is probably the country with the greatest number of chimpanzees, with approximately 17,582 (8,113–29,011) individuals nationwide. There are three protected areas in Guinea recognized by IUCN (1998) and the new ''World Database on Protected Areas – 2003'' Copyright IUCN and UNEP–WCMC: Badiar National Park (382km^2), the Mount Nimba Strict Nature Reserve (130km^2 with an estimated 500 chimpanzees) and the Massif du Ziama Strict Nature Reserve (1,123km^2 with an estimated 300 chimpanzees) (IUCN 1998). Although not officially recognized by the IUCN (1998), the Haut Niger National Park has been an official national park in Guinea since January 1997 (1,228 km^2 with an estimated 600–650 chimpanzees). Together, these four areas are home to a total of about 1,500 chimpanzees. However, the remaining 80–95% of the chimpanzee population lives outside protected areas. About one half of the overall chimpanzee population is believed to be living in the Fouta Djallon region of Guinea, where people do not generally hunt chimpanzees. Hunting however, is still a significant threat to chimpanzee populations elsewhere in Guinea, as is agricultural expansion.

Guinea is home to one of the longest-term studies of chimpanzees in Africa, at Bossou in the south-east of the country. Because of the results from this study, combined with results from the nationwide survey and more recent initiatives in the Fouta Djallon and in Haute Guinea, our knowledge about chimpanzees in this country is probably greater than for many other countries in West Africa. This knowledge base provides an excellent opportunity for determining priority sites and actions that will ensure the survival of this species for future generations.

9.2 Country profile

9.2.1 Geography

The Republic of Guinea, lies between 7°05′–12°51′N and 7°30′–15°10′W and spans an area of 245,857km^2. Guinea is bordered by six countries: Guinea Bissau, Senegal, Mali, Côte d'Ivoire, Liberia and Sierra Leone, with the Atlantic Ocean to the west. Guinea is politically divided into 34 provinces, which are in turn divided into 345 sub-provinces. The country is also divided into four natural regions: Guinée Maritime (36,208km^2), the Fouta Djallon (or Moyenne Guinée; 63,608km^2), Haute Guinée (96,667km^2) and Guinée Forestière (49,375km^2), which are very different in terms of their geology, topography, climate and vegetation.

From Guinée Maritime, the terrain rises up to the highlands of the Fouta Djallon. The Fouta Djallon is located in the center of the country and is extremely mountainous. The mountain range traverses the region from north to south, rising steeply from the west and gently from the east. The highest point is in the province of Mali. To the east of the Fouta Djallon are the relatively flat plains in Haute Guinée, where the average elevation is only about 300m. To the south of Haute Guinée lies the region of Guinée Forestière, with highest points at Mont Nimba (1,752m), Pic de Fon (1,656m), Pic de Tibe (1,504m) and Mont Ziama (1,387m). Not surprisingly, due to its high elevation, the sources of many of the major rivers of West Africa are found in Guinea (e.g., the Gambia, the Senegal and the Niger rivers).

9.2.2 Climate

The climate in Guinea gets progressively hotter and drier from south to north and from west to east and is extremely variable depending on elevation and proximity to the coast. The climate has two seasons: a dry season and a rainy season that lasts from three months in the north to more than nine months in the south-east. The annual precipitation varies between 4,000mm at the coast to 1,300mm in Haute Guinée. It rains throughout the country in July and August. Temperatures can be as low as 14°C and as high as 37°C in the mountainous Fouta Djallon region. Mean monthly

maximum temperatures are highest around March, and mean monthly minimum temperatures are lowest around December. The climate is hottest in the north-east.

9.2.3 Habitat

Guinea straddles three main climatic and vegetation zones. The rain forests in the south of Guinea form part of the Upper Guinea Forest block (Sayer *et al.* 1992). The transitional woodland-grassland mosaic extends across the middle of the country, and the dry Sudanian savanna vegetation zones lie in the northeast (White 1983). Mangroves hug the northern coastline. A large part of the surface area of Guinea is also covered in agricultural and fallow lands, villages and roads.

9.2.4 People

With a population of 7,775,065, Guinea has about 32 people/km^2 (CIA World Factbook 2002). Approximately 73% of the population is rural. The country's population is predicted to double by 2020 (Wilson 1992). Of all the regions in Guinea, Guinée Maritime is the most densely populated, followed by the Fouta Djallon, Guinée Forestière and Haute Guinée. In the low coastal area of Guinée Maritime, people belong mainly to the Sousou ethnic group, and the main livelihoods are fishing and agriculture. Conakry, the capital of Guinea, is located in this region. The majority of the people in the Fouta Djallon belong to the Fulani ethnic group and are mostly pastoralists or pastoralists and agriculturalists combined. Haute Guinée is dominated primarily by the Malinké ethnic group, though many different ethnic groups live in this area.

Guinée Forestière has seen a massive influx of refugees since the war in Sierra Leone and Liberia. Guinea has more refugees than in any other African country. At the end of 1996 it was predicted that there were about 650,000 refugees in Guinea from Liberia (400,000) and Sierra Leone (250,000) (United Nations High Commissioner for Refugees 1997). An estimated 400,000 Liberians are evenly distributed between the eastern and western zones of Guinée Forestière. Nearly 220,000 refugees from Sierra Leone are in the western zone of Guinée Forestière where the borders of Guinea, Sierra Leone and Liberia meet. More than 30,000 refugees from Sierra Leone live in the Forécariah province.

9.2.5 Political context

Guinea was the first country to become independent from France since 1958. However, it did not hold democratic elections until 1993, when General Lansana Conte was elected president. Conte was reelected in 1998. Although surrounded by countries that have been engaged in civil conflicts, such as Liberia, Sierra Leone and Côte d'Ivoire, until recently, Guinea has remained relatively stable. Insecurity in the country, however, has recently augmented.

9.2.6 Economy

Guinea possesses over 30% of the world's bauxite reserves and is the second largest bauxite producer. The mining sector accounted for about 75% of exports in 1999. However, escalating fighting along the Sierra Leonean and Liberian borders has caused major economic disruptions. In addition to direct defense costs, this violence has led to a sharp decline in investor confidence. GDP is $375 US per capita.

9.3 Legislation and conservation policies

The governmental body responsible for wildlife is the Ministry of Agriculture and the Direction Nationale des Eaux et Forêt. In each Province, the Direction Nationale des Eaux et Forêt representative is the ''Chef de Section.'' In each sub-Province the Direction Nationale des Eaux et Forêt representative is the ''Chef de Cantonnement.''

The law governing the use of wildlife is the ''Code de la Protection de la Faune Sauvage et Réglementation de la Chasse'' (République de Guinée 1988). This law was drafted in 1988, adopted in 1990 and amended in 1997. In this code, species are listed as either (1) integrally protected, (2) partially protected or (3) other species. Species that are integrally protected cannot be hunted, captured, detained or exported except if a scientific permit is obtained from the government. Chimpanzees are included in this list. For species that are not specially protected, hunters must obey the ''Réglementation de la chasse.'' For these species, hunters must have a permit to hunt, can only hunt between 13 December and 30 April and only between sunrise and sunset. The penalty for hunting, capturing or detaining an integrally protected species is between six months to one year in prison and a fine of 40,000 to 80,000 FG, or one of these two penalties.

Protection of wildlife also involves protection of their habitat. A forest classification system was started in 1936 (during colonial times) and has continued after Independence. There are presently a total of 162 classified forests, covering 11,821km^2 or 4.8% of the total surface area of the country. Protected areas can be one of six types: (1) Parcs Nationaux, (2) Réserves Naturelles Intégrales, (3) Réserves Naturelles Gérées, (4) Réserves Spéciales ou Sanctuaires de

Faune, (5) Zones d'Intérét Cynégétique, or (6) Zones de Chasse.

There is presently only one national park in Guinea recognized by IUCN (1998): Badiar National Park, covering an area of 382km^2. There are four Biosphere Reserves, totaling an area of 10,646km^2 including: Mount Nimba (171km^2), Ziama (1,162km^2), Badiar (2,843km^2) and Haut Niger (6,470km^2). The core area of the biosphere reserve of Monts Nimba includes a portion of the Nimba massif (125km^2), the classified forest of Bossou (3km^2) and the classified forest of Déré (89km^2).

Guinea is one of the 150 member countries of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Guinea has also ratified the Convention Concerning the Protection of World Culture and Natural Heritage (WHC, Paris, 1972) and the Convention for the Cooperation in the Protection and Development of the Marine and Coastal Environment of the Western and Central African Region (Abidjan, 1981). Guinea has signed but not ratified The African Convention for the Conservation of Nature and Natural Resources (Barnett and Prangley 1997).

9.4 Past research and conservation efforts

One of the first ever field studies of primates took place in Guinea, undertaken by Nissen (1931), who studied a population of chimpanzees east of Kindia. Kortlandt then visited the south-east of Guinea in 1960, 1964 and 1965. The next study of chimpanzees in Guinea was in 1965 and 1966, when De Bournonville conducted a study on the density and distribution of chimpanzees in the west of Guinea (De Bournonville 1967). In 1976 Sugiyama and his team from the Kyoto University Primate Research Institute, Japan, established Bossou as a long-term field site for the study of chimpanzees. This community of wild chimpanzees was habituated to observers without provisioning. Bossou is situated in the south-eastern region of Guinea, about 6km from the foot of the Nimba mountains on the border with Côte d'Ivoire and Liberia. According to Kortlandt (1986), the site of Bossou was discovered as an important chimpanzee field site by the French zoologist M. Lamotte in 1942. Kortlandt was the first primatologist to conduct research at this site during his first visit to Bossou in 1960 (Kortlandt 1962), but it was not until 1976 that continuous research on chimpanzees began here and has continued ever since.

In recent years, the Kyoto University Primate Research Institute research team has been collaborating with foreign institutions and has opened its field site to international students from France, Britain and Portugal. Published papers include information on conservation (Hirata *et al.* 1998a), the flora of Bossou (Sugiyama and Koman 1992), folklore about chimpanzees (Holas 1952, 1954, 1975), population dynamics (Sugiyama and Koman 1979a; Sugiyama 1981, 1984, 1989a, 1994c, 1999; Matsuzawa *et al.* 1990; Sakura 1991, 1994; Matsuzawa 1997a), social structure (Sugiyama and Koman 1979a; Sugiyama 1981, 1984, 1989a, 1991; Sakura *et al.* 1991), feeding behavior (Sugiyama and Koman 1987; Yamakoshi 1998), grooming behavior (Sugiyama 1988; Muroyama and Sugiyama 1994), genetics (Sugiyama *et al.* 1993b), and tool use focusing on ontogeny of behavior, social transmission and material culture (Sugiyama and Koman 1979b; Kortlandt *et al.* 1981; Kortlandt 1986, 1989; Kortlandt and Holzhaus 1987; Sugiyama *et al.* 1988; Sugiyama 1989b, 1993, 1994b, 1995a, 1995b, 1997; Fushimi *et al.* 1991; Matsuzawa 1991, 1994, 1996, 1997b, 1998a, 1998b 1998c, 1999; Sakura and Matsuzawa 1991; Sugiyama *et al.* 1993a; Derrick 1994; Yamakoshi and Sugiyama 1995; Matsuzawa *et al.* 1996, 2001; Matsuzawa and Yamakoshi 1996; Innoue-Nakamura and Matsuzawa 1997; Hirata *et al.* 1998b; Humle 1999; Vogel 1999; Whiten *et al.* 1999; Humle and Matsuzawa 2001; Tonooka 2001).

Sugiyama and Soumah (1988) conducted a nationwide survey of chimpanzees in Guinea. This was followed by Ham's (1998) nationwide survey of chimpanzees, almost ten years later, as part of the European Union-funded Projet de Conservation des Chimpanzés en Guinée. The Projet de Conservation des Chimpanzés en Guinée was directed by J. Carter and was composed of five major components; (1) a nationwide survey to collect information on chimpanzee numbers and their distribution, (2) the review and strengthening of legislation concerning the protection of chimpanzees, (3) the establishment of a rehabilitation center to accommodate placement and care of confiscated chimpanzees, (4) design of educational materials to raise awareness of the plight of chimpanzees, and (5) the development of a low-cost reliable method of monitoring select populations of chimpanzees over time. The final component has been conducted in Nialama classified forest, then expanded to the Bakoun Forest. It is currently in the first stages of implementation in the classified forests of Balayan Souroumba and Sincery Oursa in Dabola.

In recent years, several new sites have been surveyed for chimpanzees or established as sites for the long-term monitoring of chimpanzee populations. In 1999 Matsuzawa and his colleagues established a temporary encampment in Seringbara, in the Nimba mountains approximately 10km from Bossou, for the purpose of ongoing research on chimpanzees (Shimada 2000; Humle and Matsuzawa 2001).

In 2001 Marie-Claire Fleury-Brugière and David Brugière began a population survey of chimpanzees in the Haut-Niger National Park, using nest counts along line transects in the Mafou forest, one of the two core areas of the Park. Marie-Claire Fleury-Brugière and David Brugière have also conducted surveys in Kouya forest (the park's second core area) and in the Tamba and the Amana classified forests (located in the park's buffer zone). They have also

been carrying out a feasibility study on chimpanzee habituation in this area.

Laura Martinez and Nicolas Granier have carried out surveys with the European Union project Projet d'Aire Transfrontalière Bafing-Faléme in the north of Guinea, close to the border with Mali. They completed 31 reconnaissance surveys, confirmed the presence of chimpanzees in 16 of these, and recorded a total of 267 nests (Granier and Martinez 2002). Brief surveys for chimpanzees have been made to the classified forest of Bakoun, Souti Yanfou, Balayan Souroumba and Sincery Oursa for the Programmatic Environmental Assessment of the United States Agency for International Development funded project, the ''Expanded Natural Resources Management Activity'' (Catterson *et al.* 2001). Both Sugiyama and Shimada have conducted brief surveys in Gouéla at the foot of the Nimba mountains on the eastern side of the range, close to the border with Côte d'Ivoire (Shimada 2000). A research team from Kyoto University Primate Research Institute, Japan, led by Matsuzawa, including Hiroyuki Takemoto, Satoshi Hirata and Gaku Ohashi, conducted a reconnaissance trip to the classified forest of Diécké in January–February 1999. The areas of Yossono (west of the reserve: 7°38′N and 8°30′W) and Nonah (east of the reserve: 7°33′N and 9°05′W) have since been the target of brief but regular visits to gather basic behavioral information about the chimpanzee populations inhabiting these regions.

9.5 Chimpanzee distribution and numbers

9.5.1 Chimpanzee distribution

Sugiyama and Soumah (1988) conducted the first nationwide survey of chimpanzees in Guinea. Information was gathered from 20 of the 34 provinces using a questionnaire distributed to the provincial officers of the Direction Nationale de la Recherche Scientifique et Technique and the Direction Nationale des Eaux et Forêts. Site surveys were conducted in 14 of these provinces. Of the provinces that did not return the questionnaire, seven were confirmed as harboring chimpanzees either by Sugiyama and Soumah or Bhoye Sow and Koman in the late 1970s or early 1980s. Provinces where neither questionnaires nor site visits confirmed the presence of chimpanzees were Macenta, Coyah, Forecariah, Kankan, Kissidougou and Guéckédou, although in the last two provinces, Sugiyama and Soumah (1988) proposed that chimpanzees might be present on the basis of the habitat type.

Almost ten years later, Ham (1998) also used questionnaires sent to forestry officials to obtain preliminary information about chimpanzee number and distribution. These questionnaires indicated that chimpanzees are present in all but two provinces: Beyla and Mandiana, although questionnaires were not returned for the provinces of Coyah, Kissidougou and Macenta (Table 9.1). Ham (1998) then directly confirmed the presence of chimpanzees during field visits in 71 sites throughout Guinea. Ham (1998) was not able to confirm the presence of chimpanzees in Beyla or Mandiana (as reported in the questionnaires) or Coyah or Kankan (questionnaires were not returned for these provinces), but chimpanzee presence was confirmed in all other provinces.

Several observations of chimpanzees in Guinea since Ham's survey (1988) bring the number of confirmed locations for chimpanzee presence up to 96. Table 9.2 provides a list of these locations and Figure 9.1 illustrates their location.

9.5.2 Chimpanzee numbers

Nissen's (1931) pioneering study did not produce a population estimate, though the population of chimpanzees in Guinea was thought to be large. When Adrian Kortlandt visited the south-east of Guinea in 1960, 1964 and 1965, he believed there to be about 15,000 chimpanzees in the area south of the Fouta Djallon (Kortlandt 1965). De Bournonville's survey in 1965 and 1966 in the West of Guinea estimated the number of chimpanzees in the area he covered to be about 12,500 (De Bournonville 1967).

Although Lee *et al.* (1988) suggested that Guinea once was home to the largest remaining population of the western chimpanzee, Sugiyama and Soumah's (1988) nationwide survey suggested that the population had declined greatly to only 1,420–6,625.

In order to obtain information about chimpanzee numbers, Ham (1998) used questionnaires and also walked 5km transects that were placed randomly in 42 locations across Guinea in order to survey chimpanzee nests. Using this method, there were estimated to be 17,582 (8,113–29,011) chimpanzees nationwide. Data from questionnaires gave similar results, suggesting there to be between 11,949 and 23,123 chimpanzees nationwide (Table 9.1).

More detailed information on chimpanzee densities exists from several of the longer-term studies, and these will be described below.

9.5.2.1 Bossou

In January 2002, the chimpanzee population in Bossou is currently comprised of 19 individuals and group size has remained fairly constant (range: 16–23) since 1976 (Sugiyama 1981, 1984, 1999).

Table 9.1. Estimated number of chimpanzees in each prefecture based on Ham (1998).

Region	Province	Minimum estimate of chimpanzees	Maximum estimate of chimpanzees
Fouta Djallon	Dalaba	779	1,161
Fouta Djallon	Gaoual	963	1,536
Fouta Djallon	Koubia	367	506
Fouta Djallon	Koundara	98	214
Fouta Djallon	Labé	363	639
Fouta Djallon	Lélouma	427	777
Fouta Djallon	Mali	625	1,032
Fouta Djallon	Mamou	1,418	2,996
Fouta Djallon	Pita	542	774
Fouta Djallon	Tougué	680	1,233
Guinée Forestière	Beyla	0	0
Guinée Forestière	Guéckédou	97	128
Guinée Forestière	Kissidougou	NA	NA
Guinée Forestière	Lola	91	162
Guinée Forestière	Macenta	NA	NA
Guinée Forestière	N'Zérékoré	80	141
Guinée Forestière	Yomou	209	307
Guinée Maritime	Boffa	121	545
Guinée Maritime	Boké	297	606
Guinée Maritime	Coyah	NA	NA
Guinée Maritime	Dubréka	185	201
Guinée Maritime	Forécariah	171	242
Guinée Maritime	Fria	132	269
Guinée Maritime	Kindia	302	478
Guinée Maritime	Télimélé	2,478	2,929
Haute Guinée	Dabola	304	560
Haute Guinée	Dinguiraye	449	4,237
Haute Guinée	Faranah	348	664
Haute Guinée	Kankan	98	177
Haute Guinée	Kérouané	82	163
Haute Guinée	Kouroussa	178	304
Haute Guinée	Mandiana	0	0
Haute Guinée	Siguiri	65	142
	TOTAL	**11,949**	**23,123**

Table 9.2. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea.

#	Name	Latitude Longitude	Date	Source
1	Kegna Oula	11°24′N 11°33′W	1996	Ham (1998)
2	Fogo	11°20′N 11°50′W	1996	Ham (1998)
3	Noussi	11°15′N 12°08′W	1996	Ham (1998)
4	Tiankoye	11°46′N 12°39′W	1996	Ham (1998); Carter (2000)
5	Gueme	11°45′N 12°43′W	1996	Ham (1998); Carter (2000)
6	Fello Sita	11°38′N 12°36′W	1996	Ham (1998)
7	Fello Digue	11°44′N 13°07′W	1996	Ham (1998)
8	Bannekota	10°05′N 11°50′W	1996	Ham (1998)
9	Fodea	10°09′N 11°52′W	1996	Ham (1998)
10	Bagata	10°40′N 11°40′W	1996	Ham (1998)
11	Simbakonian	10°36′N 11°36′W	1996	Ham (1998)
12	Fetoual	10°31′N 12°08′W	1996	Ham (1998)
13	Windeyetti	10°34′N 12°05′W	1996	Ham (1998)
14	Sérékoro	10°22′N 10°21′W	1996	Ham (1998)

Table 9.2. ... continued. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea.

#	Name	Latitude Longitude	Date	Source
15	Sérékoro	10°17′N 10°28′W	1996	Ham (1998)
16	Kobikoro	9°13′N 10°32′W	1996	Ham (1998)
17	Chute de Sala	11°17′N 12°31′W	1996	Ham (1998)
18	Roumirgo	11°12′N 12°18′W	1996	Ham (1998)
19	Donghi	11°32′N 12°13′W	1996	Ham (1998)
20	Fello Horeséré	11°23′N 12°12′W	1996	Ham (1998)
21	Kourou	10°50′N 12°00′W	1996	Ham (1998)
22	Fougoumba	10°52′N 12°06′W	1996	Ham (1998)
23	Koba	10°33′N 12°23′W	1996	Ham (1998)
24	Soindé	10°54′N 12°50′W	1996	Ham (1998)
25	Mt. Demoukolina	10°36′N 12°47′W	1996	Ham (1998)
26	Dikourou	10°36′N 12°26′W	1996	Ham (1998)
27	Massi	10°55′N 12°26′W	1996	Ham (1998)
28	Horé Fello	11°07′N 12°55′W	1996	Ham (1998)
29	Nyongongie	12°02′N 12°28′W	1996	Ham (1998)
30	Bagata	12°17′N 11°47′W	1996	Ham (1998)
31	Kondiéya	11°12′N 11°42′W	1996	Ham (1998)
32	Sinnthiourou	11°42′N 12°42′W	1996	Ham (1998)
33	Fello Kolon	12°07′N 13°05′W	1996	Ham (1998)
34	NDama Hindé	12°05′N 13°07′W	1996	Ham (1998)
35	Ndama	12°15′N 13°10′W	1996	Ham (1998)
36	Sébétéré	11°42′N 12°51′W	1996	Ham (1998)
37	Kankirabou	10°56′N 10°58′W	1996	Ham (1998)
38	Fadia	11°07′N 10°56W	1996	Ham (1998)
39	Santanfara	11°18′N 11°11′W	1996	Ham (1998)
40	Kambo	10°10′N 13°25′W	1996	Ham (1998)
41	Wamifily	9°04′N 12°59′W	1996	Ham (1998)
42	Tabekouré	9°33′N 12°49′W	1996	Ham (1998)
43	Hamadia	10°15′N 12°55′W	1996	Ham (1998)
44	Mamou	9°52′N 12°38′W	1996	Ham (1998)
45	Gbélima	9°54′N 12°39′W	1996	Ham (1998)
46	Nongoya	9°55′N 10°09′W	1996	Ham (1998)
47	Dounkirè	11°09′N 13°29′W	1997	Ham (1998)
48	Daramangaki	10°55′N 13°35′W	1997	Ham (1998)
49	Konsotami	10°49′N 13°49′W	1997	Ham (1998)
50	Sanankoro	9°27′N 10°18′W	1997	Ham (1998)
51	Kessedou	8°30′N 10°30′W	1997	Ham (1998)
52	Soundedou	8°15′N 9°24′W	1997	Ham (1998)
53	Farafina	9°04′N 8°59′W	1997	Ham (1998)
54	Yossono	7°31′N 8°52′W	1997	Ham (1998); Matsuzawa *et al.* (1999); Humle and Matsuzawa (2001)
55	Forêt Classe Diéké	7°30′N 8°50′W	1997	Ham (1998)
56	Alaminata	8°12′N 8°40′W	1997	Ham (1998)
57	Bossou	7°39′N 8°31′W	1976–present	http://www.pri.kyoto-u.ac.jp/chimp/index.html
58	Gambadougou	8°05′N 8°21′W	1997	Ham (1998)
59	Ouré Kaba	10°10′N 11°50′W	1997	Ham (1998)
60	Barakhaya	10°13′N 13°45′W	1997	Ham (1998)
61	Tagbé	10°30′N 14°08′W	1997	Ham (1998)
62	Siria	10°50′N 14°05′W	1997	Ham (1998)
63	Wassadou	11°05′N 14°45′W	1997	Ham (1998)
64	Koumbia	11°30′N 13°30′W	1997	Ham (1998)
65	Moyerai	11°50′N 13°40′W	1997	Ham (1998)
66	Kounsitel	11°45′N 13°05′W	1997	Ham (1998)
67	Koulako	10°45′N 11°33′W	1997	Ham (1998)
68	Fidako	12°05′N 9°10′W	1997	Ham (1998)
69	Koulako	10°40′N 11°35′W	1997	Ham (1998)
70	Kouramoké	10°30′N 12°05′W	1997	Ham (1998)
71	Ley Fello Madina	11°52′N 11°38′W	1997	Ham (1998)

Table 9.2. ... continued. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea.

#	Name	Latitude Longitude	Date	Source
72	Classified forest of Bakoun	11°47′N 11°09′W	2001, 2002	Catterson *et al.* (2001); Martinez and Granier (2002)
73	Classified forest of Souti Yanfou	Approx. 10°10′N 12°30′W	2001	Catterson *et al.* (2001)
74	Seringbara	7°39′N 8°25′W	1999	Shimada (2000); Humle and Matsuzawa (2001)
75	Centre Koya	11°55′N 11°53′W	2001	Martinez and Granier (2002)
76	Classified forest of Mafou and Amana	Approx. 10°30′N 10°10′W	2001	Fleury-Brugiere and Brugiere (2002)
77	Kouya	Approx. 10°00′N 10°00′W	2001	Fleury-Brugiere and Brugiere (2002)
78	Foulaya	11°21′N 11°57′W	2002	Granier and Martinez (2002)
79	Fafaya centre	11°49′N 11°39′W	2002	Granier and Martinez (2002)
80	Fello Koundoua	11°49′N 11°22′W	2002	Granier and Martinez (2002)
81	Kouratongo	11°37′N 11°17′W	2002	Granier and Martinez (2002)
82	Kollé	11°47′N 10°13′W	2002	Granier and Martinez (2002)
83	Ganiakaly	11°32′N 10°59′W	2002	Granier and Martinez (2002)
84	Siguirini	11°45′N 10°05′W	2002	Granier and Martinez (2002)
85	Gouéla	7°37′N 8°23′W	1999	Sugiyama (1995a); Shimada (2000)
86	Nonah	7°34′N 9°01′W	2000	Matsuzawa *et al.* (1999); Humle and Matsuzawa (2001).
87	Marwata	11°45′N 11°41′W	2002	Granier and Martinez (2002)
88	Ley Fello	11°49′N 11°34′W	2002	Granier and Martinez (2002)
89	Kouroufegné	11°53′N 11°37′W	2002	Granier and Martinez (2002)
90	Nibourassi	11°54′N 11°22′W	2002	Granier and Martinez (2002)
91	Dabatou	11°47′N 10°40′W	2002	Granier and Martinez (2002)
92	Boussoura	11°42′N 11°55′W	2002	Granier and Martinez (2002)
93	Classified forest of Boula and Dokoro	11°29′N 11°14′W	2002	Granier and Martinez (2002)
94	Classified forest of Gombo	11°42′N 11°05′W	2002	Granier and Martinez (2002)
95	Sandinkourou	11°48′N 09°31′W	2002	Granier and Martinez (2002)
96	Bhoundou Demou	10°51′N 12°39′W	2000	Carter (2000)

9.5.2.2 Seringbara

Several hundred nests have been recorded in Seringbara, and nesting group size ranges from one to 21 (Humle 2003a). The size of the main group studied so far is estimated to be at least 30 individuals.

9.5.2.3 Diécké forest

In Diécké Forest, Ham observed 14 nests on a 5km transect from which rough density estimates can be extrapolated but more detailed studies are needed.

9.5.2.4 Haute Niger National Park[1]

In Haute Guinée, Marie-Claire Fleury-Brugière and David Brugière have estimated the number of chimpanzees in the Parc National du Haut Niger using 11 census blocks, set randomly, in the Mafou forest (park's first core area), and in the buffer zone of the park near a small village. Each block consisted of two to four transects. Distances censused per block varied from 4.95–11.7km (mean = 9.5 ± 2.0km), and the total distance censused was 113.825km. In the Mafou forest a total of 823 nests were observed along the 113.825km of transects. The mean density of nests was estimated at 188.4 nest/km^2, ranging from 0–575.8 nests per km^2 according to census blocks. Using a nest decay rate of 300 days and assuming that 20% of the nests were day nests, this translates into a mean density of 0.50 adult chimpanzees per km^2 (95% confidence interval: 0.29–0.87) and a total population of about 260 adult individuals.

If we assume that the density is similar in the Kouya forest (674km^2), these two core areas of the Haut-Niger National Park could protect a population of 600–650 adult chimpanzees. Indeed, informal observations made in the Kouya forest suggest that chimpanzee density could be higher in this forest than in the Mafou forest. This is prob-

[1] The Haut Niger National Park is not officially recognized by IUCN (1998) and the new ''World Database on Protected Areas – 2003'' Copyright IUCN and UNEP–WCMC.

Figure 9.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Guinea.

ably explained by the fact that dry forest is a more common vegetation type at Kouya than at Mafou.

9.5.2.5 Nialama classified forest

Results of a survey in 1998 as part of the follow-up to the Projet de Conservation des Chimpanzés en Guinée indicate four social groups of chimpanzees residing in the park, three of which take permanent residence in their respective blocks. The total population of these four social groups is considered to be 83 individuals. At least four more populations of chimpanzees are reported to inhabit areas peripheral to the Nialama classified forest study area (Carter 2000).

9.5.2.6 Bakun classified forest

A chimpanzee monitoring study began in the Bakun classified forest in April 2001. Transects were placed along watercourses fringed by gallery forest which serves as critical habitat for chimpanzees. Preliminary information indicates at least nine social groups of chimpanzees residing in this classified forest. Although not considered a definitive figure, the largest number of chimpanzees seen on any one day since monitoring began was 167.

9.6 Threats to chimpanzees

9.6.1 Habitat destruction

Probably one of the most important factors affecting the survival of chimpanzees in Guinea is the loss of habitat, which is leading to the fragmentation of forest blocks and therefore the isolation of chimpanzee populations. Not only could isolation threaten the long-term gene pool of chimpanzees, but it also may affect the immediate social structure and interactions within the group. It is suggested therefore that wherever possible corridors of forest be created between chimpanzee habitats. These could follow the course of rivers, which would have the additional benefit of protecting water sources from erosion.

The chimpanzees of Bossou offer an interesting example of chimpanzees living in a small isolated forest patch. Despite the fact that cultivated fields are scattered around the home range of the Bossou group, and the nearest community of chimpanzees is located about 6km away, individuals have in fact been suspected to emigrate from Bossou (Sugiyama *et al.* 1993b), suggesting that chimpanzees do find means of transfer even when extremely isolated. However, immigration into the Bossou community has not been recorded since 1982 (Sugiyama 1999). Nevertheless, the population at Bossou appears to have remained healthy since studies began. The isolation of communities therefore may not be the most immediate concern for chimpanzee conservation, but should be considered to ensure the long-term viability of populations.

9.6.2 Hunting

Hunting is also one of the factors most affecting chimpanzee distribution and abundance in Guinea. Studies from questionnaires (Ham 1998) revealed that chimpanzees were hunted in only 52% of the sub-provinces in Guinea. When this is examined by region, chimpanzees are most hunted in Guinée Forestière (only 24% of sub-provinces reported never hunting chimpanzees) and least hunted in the Fouta Djallon (64% of the sub-provinces reported never hunting chimpanzees).

One of the reasons that chimpanzees are hunted is that they destroy crops such as oranges, bananas and maize, although this does not appear to be the major factor in the hunting of chimpanzees. Hunters report increased frequency of crop raiding by chimpanzees during periods of fruit scarcity. This may be evidence that habitats are becoming too small, so that chimpanzees are forced to supplement their diet with cultivated food. It may also merely be a result of the forced interactions between chimpanzees and humans due to the encroachment into chimpanzee habitats.

Chimpanzees are hunted mainly for their meat. Questionnaires from Ham (1998) indicated chimpanzee meat is eaten in only about 24% of sub-provinces. When this is examined regionally, in the Fouta Djallon only 6% of the sub-provinces reported eating chimpanzee meat, whereas chimpanzee meat was found to be eaten in 47% of the sub-provinces in Guinée Forestière, 46% in Guinée Maritime and 29% in Haute Guinée. Most people in the Fouta Djallon are Muslim, and Islam forbids the eating of primate and pig meat, explaining the infrequency of chimpanzee meat-eating in this region. In Guinée Forestière, Christianity is more widespread and does not forbid eating of chimpanzees.

In addition to religious taboos, many of the people living in the Fouta Djallon also have traditional and cultural taboos against eating chimpanzee meat. There are many legends about chimpanzees relating them to humans, and it is said that anyone who is capable of killing and eating a chimpanzee is said to be capable of doing so to a human as well. Such totemization of the chimpanzee is also characteristic of certain ethnic groups in other parts of Guinea as well, such as the Manon people living in Guinée Forestière. Indeed, Bossou provides a rare example of a site where wild chimpanzees and local people have been living side by side, sharing the resources of the same forest.

Although religion and local taboos forbid the eating of chimpanzee meat, traditions are rapidly changing. Unfortunately many of the rules and regulations concerning hunting are rarely transmitted to the younger generation and therefore traditional values are not being passed on. Even if there

is little hunting in the Fouta Djallon, people from the surrounding areas where there is demand for chimpanzee meat are encroaching gradually. There are reports of hunters selling chimpanzee meat to trucks from Guinée Forestière in Dinguiraye and Mamou. Because chimpanzees are slow reproducers – interbirth interval ranges from 4.4 years at Bossou (Sugiyama 1989a) to 6.0 years at Mahale (Nishida *et al.* 1990 – even a small amount of hunting can have a catastrophic effect on chimpanzee numbers.

9.6.3 Trade in young chimpanzees

The pet trade in Guinea is an enormous problem and a significant threat to chimpanzees in the wild. The government of Guinea desperately seeks a solution for the chimpanzees presently held in an orphanage-sanctuary in the Haut Niger National Park (see Carter 2003b, Chapter 22 for more details).

In the past chimpanzees were captured for medical research. Because chimpanzees reproduce slowly, however, this historical event could still be a significant factor affecting chimpanzee distribution and abundance today. The Institute Pasteur in Guinea was established in 1923 and is to this day a facility for medical research. There are presently no chimpanzees at the Institute (although the last ones left only a few years ago), but the extensive cages are evidence of the many animals that were once kept there. In addition to capture for medical research in Guinea, many chimpanzees are known to have been captured and sold through the institute and shipped to other countries through the port in Conakry. It is believed that approximately 3,000–4,000 mothers were killed in order to capture their babies (Kortlandt 1965). Chimpanzees are much sought after for medical research, especially for Hepatitis, HIV and Ebola virus research.

9.7 Priority sites for chimpanzee conservation

9.7.1 Bossou, Mount Nimba Biosphere Reserve

The village of Bossou is located at 550m above sea level. It is surrounded by small hills 70–150m high that are covered in primary and secondary forests (Sugiyama and Koman 1979a). The forest surrounding the village of Bossou constitutes the core area of the Bossou chimpanzee community. The home range of the Bossou chimpanzees is dominated by secondary and scrub forest, with primary forest only covering about 1km^2. It is also surrounded by savanna vegetation interspersed with occasional gallery forests, which connect to small adjacent forests, beyond which lie, on the south-eastern side, the Nimba mountains. The chimpanzee community inhabiting the forest surrounding the village of Bossou has been habituated to observers without provisioning since 1976. Observation distance currently varies between five and 20m, and all members of this community can be identified individually.

Bossou should be considered as a priority area for conservation on several grounds. First, from a scientific and conservation point of view, this site is unique. Ongoing research on understanding chimpanzees' cognitive abilities, whether social or technical, and chimpanzee culture can only promote the conservation value of this species. In view of the recent deforestation of the chimpanzees' habitat, mainly caused by an influx of Liberian refugees in the area since 1990, continued research at this site has provided insights into how chimpanzees cope in the face of habitat destruction and reduction, and how the environment is able to recover from such interferences. This site also represents a unique opportunity to monitor management difficulties that may arise in other areas where chimpanzees and humans live in close proximity or are sharing some of the same resources. Bossou is a microcosm where the influence of deforestation on chimpanzee ranging behavior, social behavior and feeding behavior, including reliance on crop raiding, could be assessed accurately. Such studies could provide useful recommendations for conservation of chimpanzee communities at other sites. In October 2001, the Institut de Recherche Environnementale de Bossou was created as a result of 25 years of collaboration between the Guinean government and Japanese researchers. This institute could become a useful training ground for Guinean students and Park managers.

Second, considering that chimpanzees are a totem for the local Manon people, their conservation is of intrinsic cultural importance in this region of Guinea. Third, the value of Bossou as a flagship for conservation education and public awareness is great. Finally, Bossou has great potential as a center for limited ecotourism, thus providing economical benefits to the local communities.

In spite of its isolation, the Bossou community of chimpanzees has remained stable in number since 1976. Nevertheless, in order to ensure their long-term survival, a project has been underway since 1997 to create a natural corridor, or ''green passage'' extending between Bossou and the Nimba mountains (Hirata *et al.* 1998a). The aim is to plant trees 5m apart along a 300m-wide and 4km-long stretch of savanna extending from the edge of Bossou to the foothills of the Nimba mountains near Seringbara. The ultimate purpose of this project is to facilitate potential individual interchange between the Bossou chimpanzee community and those of the Nimba mountains. This project was, unfortunately, halted during the heavy border conflicts between Sierra Leone, Liberia and Guinea between October 2000 and May 2001. It has now resumed and is currently still underway. A

Harungana and *Uapaca* forest is already emerging as a result of the efforts that have been made since 1997, and some trees are already reaching 4m in height. Further initiatives such as these should be launched in areas where chimpanzee populations are currently isolated and where the creation of a forest corridor could increase the long-term viability of these populations.

9.7.2 Seringbara, Biosphère du Mont Nimba and World Heritage Site

The Nimba mountains are located directly to the south-east of Bossou, forming a natural boundary between Guinea, Côte d'Ivoire and Liberia. They have attracted the interest of scientists, including geographers, geologists, soil experts, botanists, zoologists and other specialists, ever since the late 1930s (Kortlandt 1986). In Guinea and Côte d'Ivoire, the Nimba mountains are classified as a national reserve, the ''Réserve Naturelle Intégrale du Mont-Nimba,'' and as a ''Réserve de Biosphère et Site du Patrimoine Mondial'' (UNESCO 1998). The reserve extends over 220km^2, and the highest peak is at 1,752m. The biosphere reserve of the Nimba mountains (145,200ha) corresponds to the Guinean portion of the Cavally basin. It consists of a transition area (88,280ha), a buffer zone (35,140ha) and a cluster of three core areas: the ecosystem of Bossou (320ha), the ecosystem of Déré (8,920ha) and a section of the Nimba range which constitutes the World Heritage Site (12,540ha) and where the territories of three countries, Côte d'Ivoire, Liberia and Guinea, meet. The Nimba mountains are characterized by wet evergreen forest of medium altitude (Guillaumet and Adjanohoun 1971). The region below 800m is entirely covered by primary tropical forest, and above 800m, where the mountain becomes steeper, the vegetation is interspersed with montane forest and patches of terrestrial herbaceous vegetation and high altitude grasslands.

The village of Seringbara, near the site where Matsuzawa and his colleagues have been conducting research on chimpanzees since 1999, is located at the foot of the Nimba mountains only 6km to the south-east of Bossou. Seringbara is a sub-province of Bossou, and Institut de Recherche Environnementale de Bossou's potential activities extend to the Seringbara area.

Hunting and poaching in this area is relatively rare, although hunting pressure in the region of Gbakoré and Gouéla in the Nimba mountains appears to be greater. Fortunately, chimpanzees are not a target prey. There are recent reports of the use for cattle grazing on savanna areas on the mountain slope within the reserve (Fujita, pers. comm.). Cattle breeding is a fairly recent activity in the region. However, it appears to be causing conflicts in some areas between farmers and breeders due to free-ranging cattle stamping cultivated fields.

Moreover, the Nimba mountains are under pressure from potential mining of iron ore in its northern area, near the border with Côte d'Ivoire. Mining would have dramatic consequences for the environment and chimpanzees in the region. The resulting influx of people would increase the pressure for cultivation, causing a reduction in fallow time and therefore further deforestation and habitat encroachment up the slopes of the mountain. This is already taking place, although so far still on a small scale. In addition, mining would likely cause erosion, water pollution and consequent deterioration of swamp-agriculture rice yields. The region comprising Bossou and the Nimba mountains, i.e., the biosphere reserve of the Nimba mountains, harbors many endemic species of flora and fauna and is therefore extremely important in the context of the biological diversity of Guinea as a whole. Development plans for the region should carefully consider the delicate balance between environment and economic growth.

9.7.3 The biosphere reserve of Ziama

The biosphere reserve of Ziama of 112,300km^2 is the largest classified forest in Guinea. It is probably the area with the greatest cover of continuous tropical rain forest in the country. Despite the huge refugee problem in Guinée Forestière, the vegetation in these forests has survived relatively undisturbed. Biodiversity is extremely high and many rare and threatened species are reported to exist here, including Diana monkeys *Cercopithecus diana*, red colobus *Procolobus badius*, olive colobus *Procolobus verus* and elephants *Loxodonta africana.* Other species rarely found elsewhere in Guinea live here, including bongo *Tragelaphus euryceros* and zebra duiker *Cephalophus zebra.*

During a visit to Ziama forest in February 1997, Ham (1998) observed 12 chimpanzee nests in one of the most remote areas of the forest. Monitoring the chimpanzees here would be difficult because the terrain is so mountainous, and hunting pressures will make them difficult to approach. The greatest threat in this forest is probably hunting, and therefore education and awareness activities with the surrounding communities, as well as better law enforcement, are probably the most needed activities here.

9.7.4 The classified forest of Diécké

The forêt classée of Diécké extends over 700km^2, stretching about 35km from north to south and 35km from east to west, and is one of the last forest blocks left of tropical rain forest in Guinea. Like Ziama, Diécké is one of the most important areas for mammal diversity in Guinea. Although elephants are not known to occur here, there are pygmy hippos *Hexaprotodon liberiensis*, which are endemic and one of the most endangered large mammal species in West Africa.

Hunting pressure is relatively high in the Diécké forest. The Centre Forestier de N'Zérékoré, which is responsible for the reserve, reported the killing of three adult chimpanzees in 2001, the last one dating back to July 2001, in the Yossono area, in the eastern part of the reserve. Hunting pressure in Nonah, in the west, is also very high. Due to the large size of the forest and limited number of forestry agents, it is difficult to monitor hunting activities in the whole region. Local people indicated that many hunters not native to the area come into the reserve and set up camps deep within the forest, where they spend several days at a time hunting indiscriminately before returning home and supplying the bushmeat market in large cities such as N'Zérékoré. A constant presence of a hunter monitor inside the classified forest would be an excellent deterrent to poachers.

Evidence of nut cracking behavior was found in the classified forest of Diécké, making it an important area for future studies of chimpanzee culture (Ham 1998; Matsuzawa *et al.* 1999).

9.7.5 Haut Niger National Park

The Haut Niger National Park should be considered of national significance for the conservation of chimpanzees in Guinea and possibly in West Africa for several reasons. Haut Niger has national park status and the two core areas (the Mafou and Kouya forest) of the park are currently well protected and free of major human disturbances. The park area is large (core areas = 1,228km^2; buffer zone = *c.* 8,500km^2), and there is a high density of chimpanzees in the park (Fleury-Brugière and Brugière 2002).

Suggestions for priority research and conservation actions in the park include conducting a chimpanzee census of the population in the Kouya forest, as well as an investigation of the status of the chimpanzee population in the two buffer zones (the main points to be addressed being: Is the current distribution of chimpanzees in these areas continuous or fragmented? What are the main determinants of the current distribution? Has the distribution changed over the past ten years?). It is also a priority to build local capacity to monitor the chimpanzee population.

9.7.6 The classified forest of Fello Digué

The classified forest of Fello Digué is 29km^2 and lies in the heart of the Fouta Djallon. It is significant for conservation in that chimpanzees are already somewhat naturally protected because they are not generally hunted for food or for pets in this region. It is also significant for conservation efforts in that it is one of the few places left in Guinea with a truly viable population of chimpanzees. Ham (1998) visited this area in February 1996 and recorded over 50 nests.

The greatest priority action in this area would be to increase understanding of the numbers and distribution of this chimpanzee population and the threats to their survival in order to design appropriate actions to ensure their protection.

9.7.7 The classified forests of Balayan and Souroumba

The classified forests of Balayan and Souroumba of 245km^2 are an extremely important area for conservation due to the high density of chimpanzees and the importance of this forest for large mammal migrations. It is also an extremely important area for water conservation as it supplies the growing population of Dabola in the valley with its fresh water supply.

Chimpanzees are somewhat naturally protected in this area because of the mountainous terrain and because people do not generally hunt chimpanzees. However, people have begun to have problems with chimpanzees in the area that have been stealing calves, goats and sheep and have been raiding crops. Nevertheless, there is ample territory for the chimpanzees, unlike other areas where chimpanzees have been observed to steal livestock (e.g., Koba).

Although the local populations in Dinguiraye do not generally believe in killing chimpanzees, people are starting to come from Guinée Forestière to offer money for chimpanzees since they have exterminated them in their own provinces. This area lies at the frontier of differences in attitudes towards chimpanzees and would be an important area for chimpanzee conservation to prevent the spread of hunting into the Fouta Djallon. This area is very accessible by the main national highway between Mamou and Dinguiraye.

9.7.8 The classified forest of Sala

The classified forest of Sala is a small 5.7km^2 forest located in one of the most densely populated areas of Guinea. This forest contains a spectacular waterfall that is already a popular tourist location. The chutes are found only an hour's drive from Labé, one of the main cities in Guinea. Chimpanzee density is high in this region, and there are many other species of interest, including black and white colobus *Colobus polykomos*, mona monkeys *Cercopithecus mona*, baboons *Papio papio*, patas *Erythrocebus patas*, green monkeys *Cercopithecus sabaeus aethiops* and mangabeys *Cercocebus atys atys.* The expansion of this area should be investigated, as it is an important site for protection of fauna, flora and water resources.

The human population surrounding this area does not generally hunt chimpanzees. As evidence of this, a nest was even observed at the edge of the fence around the village, only 30m from a house. As tourism expands in Guinea, this site will most certainly be developed, and it is important to put a system into place now that will ensure the long-term survival of chimpanzees in this area.

9.7.9 The Nialama classified forest

The Nialama classified forest of 99km^2 is located in the subprovince of Linsan-Saran. In 1998, the Projet de Conservation de Chimpanzés implemented an activity in which local hunters were trained to collect, on a long-term basis, information on the numbers and movement of chimpanzees inhabiting the forest.

The Nialama classified forest serves an important role in the conservation of chimpanzees in that it supports at least three resident groups of chimpanzees and possibly serves as part time habitat for at least four other groups of chimpanzees inhabiting forest blocks nearby. Located in the Fouta, the chimpanzees of the Nialama classified forest receive a natural form of protection in that peoples' beliefs and traditions forbid the hunting or eating of chimpanzees. Nevertheless, habitat destruction and alteration are factors threatening the survival of chimpanzees here.

Due to serious land pressure for increased agricultural needs, the Nialama classified forest became the first classified forest in Guinea to undergo co-management. It was also the first site for implementation of the hunter-monitoring component of the Projet de Conservation des Chimpanzés en Guinée (Carter 2000), which is now an integral part of the forest co-management activity of United States Agency for International Development Expanded Natural Resource Management Activity. Since 1998, resident hunters have been collecting data on chimpanzee numbers and their movements and use of the forest, including identification of critical habitat and corridors of migration.

Although integrating the needs of chimpanzees into the co-management of the Nialama classified forest is a major achievement, there is still more work to be done. More emphasis needs to be placed on convincing neighboring communities that chimpanzees actually need their help. The forest co-management activity provides an excellent framework in which to work and a rural audience already somewhat sensitized to the idea that natural resources must be managed in a sustainable fashion if they are to provide for the needs of everyone.

Introduced first in the Nialama classified forest, the monitoring study was expanded to the Bakoun classified forest in 2001. It is currently in the first stages of implementation in the classified forests of Balayan Souroumba and Sincery Oursa in Dabola.

9.7.10 The classified forests of Pinselli and Soyah

The classified forest of Pinselli was a wildlife reserve in the 1930s open to big game hunting. Much of the wildlife has thus been exterminated, and pressure is still high on the remaining wildlife population. However, chimpanzee density is still high. In February 1996, chimpanzee density was found to be high in both the classified forests of Pinselli (13,000ha) and Soyah (8,400ha): 37 nests were found in one 5km transect and 25 nests in another 5km transect placed randomly within this zone (Ham 1998). Chimpanzees are also found in the classified forest of Soyah, which is very close to Pinselli. It should be investigated whether these areas could be joined into a much larger protected area. The area of Soyah has one of the lowest human population densities in Guinea (eight inhabitants per km^2). Although Ouré Kaba village is large, many of the villages around it are isolated, and therefore the effects of habitat destruction are comparatively less than those in some areas in Guinea. Efforts for public awareness of villages near the border could be beneficial for controlling poachers.

9.8 Priority actions for chimpanzee conservation

9.8.1 Further surveys and monitoring of chimpanzee populations

Questionnaires have revealed a possible 606 locations for chimpanzees in Guinea (Ham 1998). In order to develop a more detailed and comprehensive action plan for chimpanzees in Guinea, it is important that more of these areas are visited. Further confirmation of the presence of chimpanzees in the 606 locations cited by the Chef de Cantonnement would provide a more in-depth understanding of chimpanzee distribution in Guinea. Visits to these sites could either be made with the purpose of confirming chimpanzee presence, or information could be collected indirectly when trips are being made to these sites for other purposes.

In many areas of Guinea there are what are called ''Groupements des Chasseurs.'' The structure and hierarchy within these groups is often complex. Creating or reinforcing such ''groupements des chasseurs'' to monitor the local chimpanzee population and ensure that no hunting takes place may help to share the responsibility for chimpanzee conservation, especially when few resources exist within the Direction National des Eaux et Forets for travel and surveillance.

9.8.2 More information on the bushmeat trade

Evidence suggests that the meat of chimpanzees and other endangered species is being taken out of the Fouta Djallon and transported to Guinée Forestière to be sold. Most evidence of this is circumstantial (but see Ziegler 1996), and therefore a systematic and comprehensive study identifying where the target areas are for hunting for the trade, how the

meat is transported and who the buyers are is urgently needed. Such a study would provide essential information so that concrete actions to address this problem could be implemented.

9.8.3 Increase protected area status

The network of protected areas devoted to the conservation of biodiversity (IUCN Categories I–IV) is currently poorly developed. The situation may improve soon with the launch of the second phase of an European Union funded regional project Programme Régional d'Appui à la Gestion Intégrée des Ressources Naturelles des Bassins du Niger et de la Gambie. The structure of the project includes one component whose aim is to create and manage a network of national and trans-boundary protected areas. Four sites have been selected: the Niokolo-Koba/Badiar national parks (Senegal/Guinea), the Parc National du Haut Niger (Guinea), the Bafing/Faleme proposed protected area (Mali/Guinea) and the Québo/Débis proposed protected area (Guinea-Bissau/Guinea). This network is of great importance for conservation of chimpanzees (and other large mammal species as well) since all these areas, including the proposed ones, are large ($> 1{,}000 km^2$) and contain populations of wild chimpanzees. Chimpanzees should be made an integral part of the planning and implementation of the Programme Régional d'Appui à la Gestion Intégrée des Ressources Naturelles des Bassins du Niger et de la Gambie project.

9.8.4 Awareness raising and education

Some of the threats to chimpanzees in Guinea result from a lack of information or awareness about chimpanzees. Several targeted awareness and education programs using posters, pamphlets, billboards and radio and television programs would go a long way to preventing the needless killing of chimpanzees. Music and dance play a large part in Guinean culture, and songs created about chimpanzees by artists in different languages could aid in disseminating information.

One of the greatest threats to chimpanzees is the capture of baby chimpanzees for sale (and often consequential slaughter of the mothers). These babies are often sold to expatriates within the country who are not aware that chimpanzees are a protected species and that paying money for these babies encourages the trade. Information about where individuals bring orphaned chimpanzees that are in their possession would also be useful. Surveys have also shown that one of the groups that most frequently buys chimpanzees for pets is the military. Therefore, the same posters, pamphlets and stickers should be distributed to the military. A workshop held specifically to provide the military with information about chimpanzees and other endangered wildlife would also be useful. It is important to reach children at a young age to educate them about endangered species within their country. Books for children with culturally significant illustrations, would be ideal to tell a story about chimpanzees and why it is important to protect them.

Visits should be made in person to embassies and project headquarters to raise awareness about these issues. Non-governmental organizations often have their own information networks or even newsletters within the country that could be used. Lectures could be given at the Direction National des Eaux et Forêts, universities and cultural centers. There have already been several initiatives to create awareness about chimpanzees in Guinea. It would be good to harmonize these efforts and to collaborate in order to give a stronger and more united voice about what the priority actions for conservation are.

9.8.5 Engage with development sector/extractive industry

As Guinea increases its development activities, more and more foreign companies will take interest in exploiting Guinea's natural resources. Many such projects, whether they are mining activities or forest exploitation, will be encroaching on remaining habitat for chimpanzees. It should be a requisite of the government of Guinea to demand that an impact assessment be conducted on the effects of any new activity in chimpanzee habitat, and that guidelines be provided as to how they will mitigate the impact on chimpanzee populations.

9.9 Conclusions

Guinea appears to be the West African country with the greatest number of chimpanzees, a species which plays an important part in Guinea's cultural heritage. The population of Guinea should therefore unite in developing a concerted action plan for the conservation of this species in order to ensure its continued survival. This will involve integrating chimpanzee conservation activities into development activities and protected areas management throughout the country, raising awareness and supporting further research and adjustment of legal status of this species. Awareness also needs to be raised within the international community of the great importance of Guinea for the future of chimpanzees in West Africa.

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Chapter 10

Sierra Leone

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10.1 Introduction

Chimpanzees have a wide distribution in Sierra Leone, ranging from lowland rainforests in the east and south, through montane vegetation on the Loma and Tingi, to woodland-savanna ecosystem in the north. The number of chimpanzees in Sierra Leone was estimated by Teleki (1991) to be 2,000, but actual numbers are believed to have decreased drastically, especially outside the few existing natural habitat blocks and officially designated protected areas where they have become increasingly isolated. There are several important areas in Sierra Leone where chimpanzees are known to occur, although no recent surveys have been conducted to confirm their presence. The areas include Outamba-Kilimi, Tiwai Island Wildlife Sanctuary, Kangari Hills, Gola Forest Reserves, Loma Mountains, Tingi Hills and Western Area Forest Reserve, totaling an area of 2,835km^2. It is not known how many chimpanzees are within the boundaries of these parks, but even chimpanzees in these protected areas are also believed to have declined greatly due to inadequate protection from tree cutting, hunting and the pet trade.

Sierra Leone gained itself an international reputation for being a key exporter of chimpanzees in the 1970s, supplying young apes mainly for the biomedical and entertainment field worldwide. Well focused campaigns against the inhumane capture and sale of baby chimpanzees resulted in the Sierra Leone government imposing a ban on hunting and trapping of chimpanzees for export in 1978, which contributed immensely to safeguarding the species from total extirpation. However, chimpanzees continue to face dire threats from the pet trade and bushmeat hunting. The threats are further exacerbated by continued loss of habitat across the country.

Nearly a decade of war has made it almost impossible for any conservation or field research activities to continue, but as peace returns to Sierra Leone there is renewed hope. There is need to gather comprehensive data on Sierra Leone's fauna and flora, and efforts should concentrate on priority sites such as the Gola Forest Reserves, Outamba-Kilimi National Park, Tiwai Island, Loma Mountains and Western Area Forest Reserve. The Outamba-Kilimi National Park is believed to be the stronghold for chimpanzee conservation in Sierra Leone and should be a major target of any future conservation activities for this species. Other urgent conservation measures include strengthening the capacity of local non-governmental organizations, effective implementation of wildlife laws and education programs that target communities living in and around wild chimpanzee ranges, utilizing traditional knowledge in combination with contemporary conservation to encourage and enforce forest species protection.

10.2 Country profile

10.2.1 Geography

Sierra Leone lies between latitudes 6°55′–10°00′N and longitudes 10°14′–13°17′W. With a land area of approximately 71,740km^2, Sierra Leone is one of the smallest countries in West Africa and shares borders with two neighboring countries, Guinea to the north and east and Liberia to the south and south-east. Major rivers like the Mano and Great Scarcies mark the boundaries between Sierra Leone and Liberia and between Sierra Leone and Guinea. The west and south-west is bounded by the Atlantic Ocean, with a coastline of 402km. Physically, the country is divided into five regions, including the coastal plain, the interior lowlands, the interior plateau, the Freetown peninsula and the Fouta Djallon. The drainage system includes seven major rivers that run parallel with each other flowing from north-east to south-west into the Atlantic Ocean.

10.2.2 Climate

Sierra Leone is a tropical country with two distinct seasons; a dry season lasting approximately six months (November to April) and a wet season (May to October). Rainfall is variable, with No. 2 River on the coast receiving a total of 5,230mm per annum, while Gberia Timbako in the northern savanna region has an annual rainfall of 1,830mm per annum (Gwynne-Jones *et al.* 1978). Temperatures are highest in the early dry season, with a maximum of about 36°C and a minimum of about 21°C. During the harmattan period of December and January, night temperatures are low and in the northern region can reduce to 10°C. The hottest months in Sierra Leone are March and April, with the coolest month being August. The relative humidity varies greatly with temperature, with 50% humidity being common

on the days when temperatures are 32°C, while a humidity of 95% can be experienced at night when the temperature reads 21°C.

10.2.3 Habitat

Sierra Leone lies almost entirely within the Upper Guinea forest ecosystem in West Africa. The vegetation of Sierra Leone has undergone tremendous changes throughout the country's history, and what remains today purports to a country that was once largely forested. The different vegetation types could be grouped under lowland rainforest, montane, savanna and wetland ecosystem. The only comprehensive vegetation assessment, which dates back to three decades ago, produced an estimate of 5% of the country under closed canopy forest (Gordon *et al.* 1979). Lowland rain forest is made up of both moist and semi-deciduous forest and is largely confined to the east and south of Sierra Leone, with one westerly fragment on the Freetown peninsula. The dominant plant species include *Lophira alata*, *Heritiera utilis*, *Cryptosepalum tetraphyllum* and *Erythrophleum ivorense.* The montane vegetation is confined to the Loma Mountains and Tingi Hills in the Koinadugu district and Kono district, respectively. The Loma Mountains include the Bintumani Peak, which, at 1,945m, is the highest peak west of Mount Cameroon. Savanna is restricted to the north of Sierra Leone, and includes several fire resistant tree species such as *Lophira lanceolata*, *Pterocarpus erinaeceus* and *Borassus aethiopum*. The wetland ecosystem is comprised of freshwater swamps, riparian forests and mangrove swamp forests. Common plant species of freshwater swamp forests include *Raphia vinifera*, *Raphia hookeri*, *Mitragyna stipulosa*, *Anthocleistsa nobilis*, *Thaumatococcus daniellii* and *Calamus deeratus.* Species typical of the mangrove forests include *Rhizophora racemosa*, *Rhizophora harrisonii*, *Rhizophora mangle*, *Avicennia nitida* and *Laguncularia racemosa.* Riparian or gallery forests bear resemblance to lowland moist forests in terms of species composition and structure, with a typical species list including *Piptadeniastrum africanum*, *Uapaca togoensis*, *Pterocarpus santalinoides*, *Cynometra vogelii* and *Heritiera utilis.* Ten major rivers form the drainage systems, flowing south-west and roughly parallel from the northern uplands to the extensive mangrove swamps along the coast.

10.2.4 People

The population of Sierra Leone is estimated to be 5,614,743, with a growth rate of 3.21% (CIA World Factbook 2002). For thousands of years, Sierra Leone has been inhabited by waves of different peoples, but historical language patterns suggest that the coastal Bulom (Sherbro), Temne and Limba peoples have lived in near continuous settlements, while there was sporadic immigration from inland Mande-speaking peoples, including Vai, Loko and Mende. Presently, there are 26 different languages spoken in Sierra Leone, including the *lingua franca* Krio, brought to Sierra Leone by settlers who had liberated themselves from American slavery in the late 1700s.

10.2.5 Political context

For nearly a decade, starting in 1991, Sierra Leone was engulfed in a bloody and horrific civil war. Although peace has slowly returned following elections in 2001, there are still tens of thousands of internally displaced persons living in camps across the country, waiting to return to their homes. The environmental impacts and human health risks of such large concentrations of people in refugee camps poses a major conservation challenge. A National Environmental Action Plan was drafted in the early 1990s but never implemented. The National Biodiversity Strategy and Action Plan is now being drafted, although the current focus is on developing the nation's economic standing and improving fundamental human needs for food security, health, and education.

10.2.6 Economy

Agriculture plays a major role in Sierra Leone's economy, with 80% of the country's labor force involved in agricultural activities. The majority of the social organization of agriculture is based on traditional communally owned land tenure, the exception being within the Western District, where the European system of land tenure is used.

Sierra Leone is also known for its wealth of mineral resources, including diamonds, titanium ore, bauxite, iron ore and gold. Despite its abundant natural resources Sierra Leone ranks near the bottom of global Gross National Product and Human Development Index, as determined by the United Nations Environment Program. In 1997, Sierra Leone's external debt was $1.68 billion, with an interest payment of approximately $5.2 million US. The official national income for that year was $75.2 million US. Over 65% of the population is living under the poverty line, and less than 40% have access to health services, safe water and sanitation (Sierra Leone Central Statistics Office 1998).

10.3 Legislation and conservation policies

The government agency mandated to manage wildlife in Sierra Leone is the Wildlife Conservation Branch, a unit within the Forestry Division of the Ministry of Agriculture, Forestry and Food Security.

The first legislation pertaining to wildlife in Sierra Leone appeared at the beginning of the 20th century, with the passing of the ''Ordinance for the Preservation of Wild Animals, Birds and Fish'' in 1901 (Teleki and Baldwin 1981; Allan 1990). The near obscurity of the ordinance did little to change the face of wildlife conservation in Sierra Leone. Further changes in this Ordinance by the post-independent government of Sierra Leone resulted in the 1972 ''Wildlife Conservation Act'' (Government of Sierra Leone 1973), and subsequently the formal establishment of the Wildlife Conservation Branch two years later. The Wildlife Conservation Branch is administered by a wildlife superintendent and assisted by a deputy superintendent. The main responsibility of the superintendent is to manage the wildlife, national parks, non-hunting forest reserves and wildlife sanctuaries of Sierra Leone. Because of its existence as a branch under the Forestry Division and the lack of trained and qualified technical staff, the Director of Forests serves as *de facto* head of the Wildlife Conservation Branch. The forestry sector gets all the attention in terms of financial resources, technical expertise and staff training, and if no major structuring occurs in the administration, financial resources and technical orientation of the Wildlife Conservation Branch, there is little hope that the declining wildlife populations will recover.

Wildlife conservation in Sierra Leone had an indirect beginning with recommendations for the establishment of forest reserves to ensure timber supply and protect watersheds. The forests selected to constitute the first forest reserves included Kasewe Hills, Kangari Range, Nimini Range, Loma Mountains and Peninsula Forests. At the end of the first decade, the total number of forest reserves and restricted areas numbered six, with a total land area of 540km^2. The Colonial Reserve (Peninsula Forest, in the Freetown peninsula) was the largest reserve at that time, with an area of 190km^2. The move toward wildlife conservation actually started in the 1960s with a country-wide wildlife survey by a FAO/IUCN consultant (Hill 1963). Subsequent surveys between 1968 and 1987 resulted in species-specific surveys as well as general wildlife surveys (Bakarr 1992). With the formation of the Wildlife Conservation Branch in 1974, the years following marked the beginning for the establishment of wildlife reserves. Five categories of wildlife reserves were proposed; national park, strict nature reserve, nature reserve, game reserve and game sanctuary. To date only two of the 18 proposed wildlife conservation areas have been legally constituted and include the Outamba-Kilimi National Park and the Tiwai Island Wildlife Sanctuary. Currently, approximately 4% of Sierra Leone's biodiversity is under protection, although many of the protected areas receive inadequate protection or proper management.

In Sierra Leone, the law governing the protection and utilization of chimpanzees is the Third Schedule of the Wildlife Conservation Act of 1972, wherein chimpanzees are listed as ''Protected Animals'' and the young of the genus *Pan* is noted as ''Specifically Protected.'' However, under the Fourth Schedule of the same act, an individual is allowed two kills of chimpanzees. Any person being in possession of protected animals except otherwise granted by the issuance of a license is guilty of an offence and is liable to pay a fine of Le40.00 ($0.02 US) or face a four-month prison term on first conviction. A second conviction results in a fine of Le80.00 ($0.04 US) or a prison term of eight months or both. Under the new amendments being proposed, chimpanzees are regarded as being part of ''all globally threatened Primates and Apes'' and therefore should receive maximum protection from hunting, trapping and pet trade. The amendment further proposes that the phrase ''genera of which young are specifically protected'' should be replaced by ''young and immature animals of the following groups and species,'' of which chimpanzees are listed as the premier species. Under the proposed new amendment, chimpanzees are exempt from hunting. The proposed Fifth Schedule lists chimpanzees as ''animals destruction of which must be reported.'' Proposed modifications have also been suggested for penalties and prison terms, with monetary fines of Le100,000.00 ($50.00) and Le400,000.00 ($200.00) for first and second convictions, respectively. Prison terms of between six and 12 months for first and second convictions, respectively, have also been proposed. Both monetary fines and prison sentences can be carried out concurrently.

Wildlife conservation in Sierra Leone has also seen a move, albeit a rather slow one, toward closer ties with international conventions. Sierra Leone is a signatory to important international treaties, although ratification of most treaties has been slow. In 1966, Sierra Leone signed the Convention on Fishing and Conservation of Living Resources on the High Seas, and two years later signed the African Convention on Conservation of Nature and Natural Resources. The Sierra Leone government also signed in 1981 the Plant Protection Convention (Bakarr 1992). The military government of the National Provisional Ruling Council signed the Convention on International Trade in Endangered Species in 1995, while the democratic government signed the Ramsar convention in 1999. Sierra Leone is also a signatory to the Convention on Biological Diversity, but like every other convention signed, ratification is still pending.

10.4 Past research and conservation efforts

The earliest written behavioral and tool-using observations of chimpanzees in Sierra Leone were made by two Luso-African traders in the 16th century and a Jesuit priest in the 17th century. Translations of their anecdotes give reference to palm nut cracking with stone tools and nest building as well as reference to the capture of young chimpanzees (Sept

and Brooks 1994). Migeod (1926) reported being told by hunters in Shebro country that they had observed chimpanzees catching fish and laying down sticks in shallow water and embanking them with mud.

Contemporary studies of wild chimpanzee behaviors and distribution surveys have, for the most part, been sparse and short term. In 1965, following recommendations by Hill (1967), the Sierra Leone government approached the idea of designating part of the Tambakha Chiefdom as a game reserve, and in 1974, two separate key areas, Outamba and Kilimi, were gazetted as the first national game reserves. Prompted further by a report submitted by Phillipson (1978), who proposed a national conservation strategy and the establishment of a national park system, with Outamba-Kilimi as one of the key areas for upgrading, the government endorsed the strategy but failed to finance or activate it. During this time, Sierra Leone had become infamous for its continued international exports of live chimpanzees to fuel the biomedical and entertainment trade in Europe, the United States and Asia. Realizing the obvious urgency to implement stricter regulations on chimpanzee exports and gain a better understanding of the size of national chimpanzee populations, the government of Sierra Leone commissioned a nationwide survey (Teleki 1981).

As a result of this initial survey followed by campaigns, led by Teleki, against a well organised chimpanzee trade ring in Sierra Leone, a complete ban on the export of chimpanzees was instituted by President Siaka Stevens in 1978, followed in 1981 by a presidential announcement in Parliament to ban the export of all wildlife products and specimens for an initial five-year period (Teleki 1985). Since Outamba-Kilimi had been identified as a key area for wild chimpanzee populations, funding for the initial development of this area as a national park was forwarded by the IUCN and World Wildlife Fund. Unfortunately, however, a multitude of influences, including the refusal of people living within the proposed park boundaries to take part in a controversial resettlement program, hampered any further conservation or research activities, and eventually financial support ceased in 1984. While it was not possible to conduct much research within the Outamba section of the Outamba-Kilimi National Park, Harding (1984) surveyed the Kilimi section and produced results of primate distributions, including chimpanzees.

Elsewhere in Sierra Leone, Davies (1987a, b) conducted and published survey results from the Gola Forest Reserves. At the same time, the Tiwai Island Wildlife Sanctuary was gaining international attention for its biodiversity and density of primates, including chimpanzees. One of the first reports of tool use by chimpanzees came from Tiwai Island, where Whitesides (1985) observed them using stone hammers to open nuts of the tree *Detarium* sp.

Until 1989, most other surveys or reports of wild chimpanzees were part of other research projects rather than specific to chimpanzees, although they have ultimately helped to form a basis for understanding chimpanzee distributions and behaviors in Sierra Leone. The nationwide survey by Teleki and Baldwin (1981) represented the first and only study that focused specifically on assessing the distribution and conservation status of chimpanzees in Sierra Leone.

A seven-month field survey of wild chimpanzees around the Tambara Hills in central Outamba (a farmed area in close proximity to Dubaia village) was conducted in 1989 by Rosalind Hanson-Alp, which confirmed there to be a significant population within Outamba, warranting a longer-term follow-up study. Follow-up studies were initiated in Tenkere, which was more suitable to observe chimpanzees than Tambara Hills. Tenkere was a more forested and undisturbed location within Outamba, and situated 1–2km from the nearest farms and 3km from the small farming village of Kande Kole. From 1991 to 1994, Alp attempted to habituate the Tenkere chimpanzees, but after three years progress was slow. Data were gathered on ranging, feeding, nest building and tool using. Behavioral data on the Tenkere chimpanzees made it possible to conduct comparisons with other wild chimpanzee communities (Alp 1993, 1994; Fruth and Hohmann 1996). The prevalence and variability of tool use among geographically separated wild chimpanzee communities has formed the basis for amplifying our understanding of the existence of cultures within non-human species. Observations of the Tenkere chimpanzees' tool-using repertoire only helps to confirm their cultural identity, as their use of ''stepping-stick'' and ''seat-stick'' tools are unique to this community (Alp 1997). It is also interesting to note that while Whitesides (1985) recorded nut-cracking behavior in chimpanzees on Tiwai Island, a type of tool use commonly found only among chimpanzees in West Africa, the absence of this behavior in Tenkere, despite the availability of both tools and nuts (Alp unpubl. data), may suggest that somewhere between Tiwai and Outamba is the transitional phase out of this cultural phenomenon.

Tiwai Island was one of the few protected sites where quantitative research data on a wide range of species, particularly primates, had been accumulated over several years. When the war erupted in Sierra Leone, Tiwai Island was one of the first areas to be affected and as a result, all research and conservation efforts halted abruptly. The near decade of war made it almost impossible for any conservation or research activities to continue, and various other influences, described throughout this chapter, indicate that while it is of vital importance to gather comprehensive data on Sierra Leone's remaining fauna and flora, this information must be used constructively to preserve those species' and habitats.

At present, the only chimpanzee-oriented conservation program, and the most crucial for Sierra Leone, is the Tacugama Chimpanzee Sanctuary. Like most primate sanctuaries around the world, it evolved on an *ad-hoc* basis as a response to an overwhelming crisis in the high number of chimpanzees kept as pets within the urban and country environment. Tacugama presently provides sanctuary for 62

chimpanzees (June 2003) with funding from various non-governmental organizations and private sources. Tacugama is in dire need of major financial support. Additional enclosures are needed and, more importantly, extend their education programs, having had success in the capital city, Freetown, must be extended into the provinces and gain support from increased law enforcement capabilities so that Tacugama becomes a means to an end and not a captive future for Sierra Leone's wild chimpanzee population.

10.5 Chimpanzee distribution and numbers

10.5.1 Chimpanzee distribution

Chimpanzees have a wide distribution in Sierra Leone, ranging from the lowland rain forests in the east and south, through the montane vegetation of the Loma and Tingi, to the woodland-savanna ecosystem of Outamba in the north of the country. However, few sites offer suitable habitats or have viable populations. Chimpanzee populations are declining even in protected areas, with the remaining populations outside these areas becoming increasingly isolated. All the protected areas lack adequate protection, with the current distribution and abundance of chimpanzee populations unclear. Based on available data and anecdotal evidence, chimpanzees have been located in the following areas; the whole of the Gola forests, Tiwai Island Wildlife Sanctuary, Outamba-Kilimi National Park, Loma Mountains, Kambui and Tingi Hills as well as the Western Area Forest Reserve on the Freetown peninsula (Table 10.1 Figure 10.1).

10.5.2 Chimpanzee numbers

As an initial survey, rather than a systematic population census, Teleki (1991) provided a population estimate of 2,000 chimpanzees. There is little recent information available to accurately estimate the population size of chimpanzees in Sierra Leone today, but the authors suggest this could be an underestimate. However, if current practices continue, this figure will become a hopeful exaggeration.

Field studies on the density (and number of groups) of wild chimpanzees for sites such as Outamba-Kilimi National Park, Gola forests, and Tiwai Island Wildlife Sanctuary have been conducted, and provide the only quantitative data on the distribution and abundance of chimpanzees in Sierra Leone. The following reports on what is known of these areas.

Table 10.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Sierra Leone.

#	Name
1	Kilimi (Part of Outamba-Kilimi National Park)
2	Outamba (Part of Outamba-Kilimi National Park)
3	Lake Sonfon
4	Loma Mountains Non-Hunting Forest Reserve
5	Sankan Biriwa (Tingi Hills Non-Hunting Forest Reserve) (PROBABLE)
6	Kangari Hills Non-Hunting Forest Reserve (PROBABLE)
7	Western Area Forest Reserve
8	Tiwai Island Wildlife Sanctuary
9	Gola Forest Reserves

10.5.2.1 Outamba-Kilimi National Park

In a study done almost two decades ago in the Outamba-Kilimi National Park in northern Sierra Leone, Harding (1984) identified approximately four groups of chimpanzees in the Kilimi section of the park. He concluded that a minimum number of 49 chimpanzees include Kilimi in their range, with the possibility of 60 individuals being a better estimate if nest counts were taken into account. In a site covering 240km^2, approximately 0.3 chimpanzee per km^2 was recorded (Harding 1983).

Alp's 1989 field survey of wild chimpanzees in central Outamba confirmed there to be high populations occurring throughout this section of the park. During Alp's 1991 to 1994 work in Tenkere, Outamba, 18 individuals were recognizable, a total of 27 individuals were observed in a group at one particular time, and the largest number of nests encountered at once was 24 (Alp, unpubl. data). A minimum of 27 individuals made up the Tenkere community, living within a range of at least 30km^2, but considering chimpanzees' social system of fission-fusion, it is likely that the Tenkere community population size is much larger. Without adequately identifying all individuals of the Tenkere community, it is difficult to estimate their number.

Unpublished surveys (Bangura 1980 to 2003; Huffman 1986 to 1987; Alp 1989 to 1994; Seiser 1991 to 1993), confirm that wild chimpanzees are presently living and thriving throughout Outamba today, and that it is home to possibly the largest population of wild chimpanzees and the most significant to any future national conservation of this species. Chimpanzee population size in Outamba is estimated to be between 200–300 individuals. Given that Outamba offers a richer habitat for chimpanzees than the less forested Kilimi, which is predominantly savanna and heavily populated by

Figure 10.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Sierra Leone.

humans, Outamba could potentially harbor a population of approximately 600–700 chimpanzees.

10.5.2.2 Gola Forest Reserves

The Gola Forest Reserves were previously the most extensively surveyed protected area in Sierra Leone. Davies (1987a, b) published survey results from the Gola Forest Reserves, and although evidence of chimpanzees was found from all parts of the reserves, few direct observations were made, and it would seem that the chimpanzee populations there are minimal. Davies (1987a, b) recorded the presence of chimpanzees in both primary and logged forests but concluded that they were rare regardless of the habitat type.

10.5.2.3 Tiwai Island Wildlife Sanctuary

In the Tiwai Island Wildlife Sanctuary, Davies (1987a) recorded more than three groups of chimpanzees with less than 40% of their home range in a 0.6 km^2 study area. Within the same study location, sightings were made of only solitary chimpanzees, with 22 such sightings being in young forest and 38 sightings in old forest. Post war, evidence of chimpanzees' presence and nut-cracking behavior have been confirmed by a number of people (T. Garnett, A. Lebbie, A. Barrie, R. Alp, pers. comm.).

10.5.2.4 Loma Mountains

Sporadic surveys were conducted around the Loma Mountains before 1993, and in the late 1980s Loma was proposed as the prime area to capture wild chimpanzees and establish a biomedical research facility. This proposal was thwarted by intense international protest, but gives some idea of how important Loma was for wild chimpanzees. However, later surveys all confirmed that hunting and agriculture were extensive, and few signs of wild chimpanzees were found.

10.5.2.5 Lake Sonfon

Little is known of this area, except that with reference to habitat types it is potentially an important area for wild chimpanzees and biodiversity conservation. Since there is no conservation presence, it is assumed that hunting and agriculture may have significantly impacted this area.

10.5.2.6 Western Area Penninsular Forest Reserve

While there have been some extensive surveys in the distant past, to date it is unclear how much wildlife remains in the Western Area Penninsular Forest Reserve or how much is being exploited on a daily basis. Ausden and Wood (1990) reported hearing several groups of chimpanzees, but concluded that the species might have been ''over-recorded.'' Recently, preliminary surveys have only confirmed the presence of two solitary females in the Regent section of the reserve, which appears to be better protected than the remaining forest because of the presence of the Tacugama Chimpanzee Sanctuary. However, Tacugama volunteer, Asami Kabasawa, recently heard a group of approximately ten wild chimpanzees vocalizing around the hills south of the sanctuary and reported finding a group of seven nests (A. Kabasawa, pers. comm.).

Recently, A. Lebbie and A. Barrie (pers. comm.) have begun surveying parts of the Area Penninsular Forest Reserve, but have found little evidence of wild chimpanzees, although group vocalizations have been heard on a number of occasions. The Tacugama Chimpanzee Sanctuary has been regularly visited for some years, initially by a solitary wild female chimpanzee and later a second adult female. Since the Tacugama Chimpanzee Sanctuary is the only conservation presence and is sited in one small portion of the reserve, the remaining area is devoid of any protection. Wild chimpanzees seem to have returned to the north-western area of the reserve, but this may only be because of the sanctuary location.

10.6 Threats to chimpanzees

10.6.1 Habitat destruction

Although the actual extent of forest cover at the turn of last century was never really documented, it has been suggested that nearly 70% of the country must have been forested (Unwin 1920; Martin 1938; Teleki and Baldwin 1981). Today, a mosaic of natural forest and farm bush in various stages of succession characterizes the vegetation of Sierra Leone. Farm bush or forest regrowth is increasingly becoming the dominant vegetation as a result of slash-and-burn agriculture. In addition, plantations for cash crops are replacing the remaining areas of forest and suitable habitats. In the eastern province of Sierra Leone, diamond-mining activities have resulted in the clearance of forests and large-scale modification of the terrestrial habitat. While a few primate species can adapt to modified habitats, hunting pressure is a much greater threat to primates, especially gorillas and chimpanzees (Tutin and Fernandez 1984; Oates 1996b). But Davies (1987a, b) has noted the occurrence of chimpanzees in logged forests despite being subjected to higher hunting pressure. Chimpanzees are also known to frequent farm bush and active tree crop farms across the entire country, which further supports their adaptive capabilities.

10.6.2 Hunting

In parts of West Africa, there are well developed markets for wild animal meat (bushmeat), and primates are among the most preferred in some areas (Mittermeier 1987; Eves and Bakarr 2001). In Sierra Leone such a market is only found in Kesema in the south-eastern province. The level to which chimpanzee meat features in the bushmeat trade in Sierra Leone remains unknown, but the large size of the animal makes it an easy and preferred target for hunters. In areas where guns are not readily available or the cost of a cartridge is prohibitive, chimpanzees are trapped for their meat or for the pet trade using nets made of palm fibres. The nets are hung in trees in areas frequented by chimpanzees, such as food crops and plantations. A food trigger mechanism built into the net is activated upon contact, causing the net to fall on the unsuspecting chimpanzee, which becomes entangled in it. A forked tree branch is frequently used to subdue the trapped animal by positioning it behind its neck (and below the skull) and forcing the forehead to the ground. The larger adults that cannot be readily subdued by this method are killed on the spot while the less violent ones are taken for the pet trade. In some of the rural areas of Sierra Leone, the strong belief system that paints chimpanzee bones as possessing vitality encourages their use in traditional medicine. The bones are sun dried, crushed and used in traditional remedies as potions for strength and vitality. Sometimes, a piece of the dried bone is tied around the waist or wrist of infants in the belief that it makes them stronger as they grow into adulthood.

10.6.3 Trade in young chimpanzees

The hunting and trapping of chimpanzees in Sierra Leone has spanned a period of almost three centuries, and still poses a great conservation challenge. To fully comprehend the current crisis facing chimpanzees in Sierra Leone, one has to trace the historical precedence that led in the first place to the exploitation of wild chimpanzees for the pet trade. This historical antecedent is adequately captured in the following statement, made over a century ago: ''*Freetown is the chief West African market for wild animals, and here the agents of the European menageries come to purchase snakes, carnivora, gorillas, and* ***chimpanzees***.'' (Reclus 1890). The first reported case of chimpanzee export from Sierra Leone predates this period by over 150 years, as confirmed by the *London Magazine* (1738 Issue) (Teleki and Baldwin 1981).

A century on, the live capture and trade in both infant and adult chimpanzees continue in Sierra Leone, despite their endangered status in West Africa. In the 1960s, chimpanzees were reported to be so few in number that the only animals often observed were those in captivity (Jones 1960). While there were conflicting statements about the status of the wild population, there was general agreement that the numbers were declining as they were ruthlessly hunted down (Lowes 1970; Robinson 1971).

The demand for live chimpanzees for medical research overseas led to a boom in the export of chimpanzees from Sierra Leone. Within an 11-year period (1957 to 1968), an estimated 2,574 chimpanzees were exported from Sierra Leone (Robinson 1971). Between 1973 and 1978, two wild animal exporters from Sierra Leone are reported to have shipped 1,582 live chimpanzees to countries overseas (Teleki and Baldwin 1981), in particular The Netherlands (Biomedical Primate Research Centre, in Rijswijk), Japan and the United States. It has been reported that for every infant chimpanzee captured in Sierra Leone, five adults are killed (Teleki 1989). The loss of wild chimpanzees may be four to five times higher when one considers that fewer of the infants survive the arduous journey to the importing country (Cowlishaw and Dunbar 2000).

While there is a current export ban on wild chimpanzees from Sierra Leone because of the country's ratification of the Convention on International Trade in Endangered Species, the capture of wild chimpanzees for the pet trade still continues at an alarming rate. Prior to the development of the Tacugama Chimpanzee Sanctuary, a brief survey of chimpanzee pet numbers in the western area of Freetown found over 60 captive apes in varying condition. All the chimpanzees at the Tacugama Chimpanzee Sanctuary were recovered from individuals who had bought them with the hope of keeping them as pets or trading them to others for cash income. Despite Tacugama′s relentless national and international awareness campaign efforts, chimpanzees can still sometimes be found in captivity around Freetown, and the situation is appalling in the provinces where people continue to capture baby chimpanzees either in the hope of bringing them for sale to Freetown or to expatriates presently working with the United Nations special peace envoy in the provinces.

Despite the species being listed as Endangered, local exploiters capture wild chimpanzees in the hope of selling them to foreign tourists. Most exploiters are ignorant of the wildlife laws of Sierra Leone, and are quick to assert that there is an abundance of chimpanzee populations in the country, and that their actions pose no immediate danger of depleting the wild populations. Wild chimpanzees captured in the provinces are brought to Freetown (the capital city), where they are often found improperly cared for. As peace returned to Sierra Leone and provincial roads opened up, the inflow of pet chimpanzees into Freetown increased dramatically, despite the existence of wildlife personnel and other law enforcement agencies in the city. The Wildlife Conservation Branch lacks the requisite manpower and financial resources to effectively enforce the illegal exploitation of chimpanzees for the pet or bushmeat trade.

10.6.4 Civil conflict

Protecting wild chimpanzees in Sierra Leone following the return of peace and stability requires urgent actions to prevent further declines in the remaining wild populations. During the recent civil conflict that spanned a period of approximately ten years, law enforcement was virtually eliminated, and all the protected areas in the country lacked any form of management. The proliferation of arms, coupled with the lack of law enforcement, provided the ideal conditions for exploitation of wildlife resources in protected areas (Lebbie 1998). Garnett and Utas (2000) noted that the impact of the civil conflict on biodiversity and human lives in Sierra Leone was high. During the reign of the Armed Forces Revolutionary Council in Sierra Leone, military officers were in the habit of giving ammunition to local hunters to supply them with bushmeat (Lebbie 1998). With the presence of the United Nations peace keeping troops in Sierra Leone, there are anecdotal reports of United Nations troops providing support as well as market opportunities for local hunters to supply them with monkeys and chimpanzees, either as bushmeat or as pets. The large numbers of unemployed and displaced refugees see the troops as a potential market opportunity with dispensable foreign cash, a powerful incentive that lures the locals to engage in the exploitation of wildlife resources. In other African countries where civil conflicts have raged on for decades, the poaching of wildlife by warring factions is a common occurrence and is reported to have severe consequences on wildlife resources (Burnham 1995; Plumptre *et al.* 1997).

10.7 Priority sites for chimpanzee conservation

10.7.1 Outamba-Kilimi National Park

Outamba-Kilimi is possibly home to Sierra Leone's largest population of wild chimpanzees and the most significant to any future national conservation of this species. The Wildlife Conservation Branch and local non-governmental organization partners are currently hoping to redevelop conservation research and tourism programs in the near future.

Prior to the civil war, resettlement and compensation of local communities located in the Park was a controversial issue for many years. The European Union issued compensation and resettlement funds to some people, as well as construction costs for the headquarters, but since Outamba was a rebel stronghold during the civil war, these funds have been depleted. The reconstruction and rehabilitation of the Outamba-Kilimi National Park through anti-poaching activities and promotion of tourism and conservation research in and around the Park are essential activities in conserving chimpanzees in Sierra Leone. In addition, a more sensitive and perhaps more practical approach to protecting Outamba-Kilimi National Park would be to develop participatory community programs. Utilising specialist community members, such as hunters for instance, to collect field data and spread awareness, has proved successful in other West African countries like Guinea (Carter 2000).

10.7.2 Gola Forest Reserves

The Gola Forests represent the largest remaining lowland rain forest habitats in Sierra Leone and as such have been exploited for the timber industry since the 1960s. There are no settlements within the reserves, although extensive hunting and agriculture all along the periphery continue to pose major threats. Negotiations are currently underway to upgrade parts of the Gola Forest to National Park status as well as create a trust fund for effective long-term management.

10.7.3 Tiwai Island Wildlife Sanctuary

Tiwai is especially famed for its incredibly high biomass and diversity of primates, which in addition to chimpanzees, include several other threatened species such as the Diana monkey *Cercopithecus diana diana.* Prior to the war, Tiwai was given a high protective status, with a permanent research facility and a small-scale visitor center to promote eco-tourism. The research facility was established and maintained through a joint partnership between Hunter College of the City University of New York, University of Miami and Njala University College. Unfortunately, all facilities and the camp base were destroyed during the war. The flora and fauna, however, appear to have been only moderately impacted by encroachment over the last few years. The Environmental Foundation for Africa maintained the only conservation presence around Tiwai, during the early days of peace, working with local communities to set up tree planting activities and ban hunting and farming on the island. The Environmental Foundation for Africa in collaboration with Njala University's Biological Sciences Department, recently secured a three-year grant from the Critical Ecosystem Partnership Fund to reconstruct biodiversity conservation, research and ecotourism on Tiwai, while enabling the community owners of the island, among other stakeholders, to take a leading role in its development and future management. By the end of 2003, both ecological research and ecotourism will have fully resumed on the Island.

10.7.4 Loma Mountains

Although poorly surveyed for primates, the relative importance of the Loma mountains for conservation of other mammals, birds and unique forest habitats makes it an significant target for chimpanzee conservation. A priority action will be to conduct an assessment of the status of chimpanzees in the forest.

10.7.5 Western Area Forest Reserve

While the Western Area Forest Reserve is essential to protecting Freetown's valuable water supply, as well as being in close proximity to the capital, it has received little conservation attention, and the rate of deforestation is alarming. While there have been some extensive surveys in the distant past, to date it is unclear how much wildlife remains in this area or how much is being devastated on a daily basis. At least one community of wild chimpanzees inhabit parts of this reserve. A two year community conservation awareness program, specifically aimed along the Western Area Peninsular Forest Reserve, was started in 2003 as a collaboration between the Environmental Foundation for Africa, RARE and Conservation International. It is hoped that this programme will give the much needed conservation attention to this area, while making a practical effort to preserve the remaining forests.

10.8 Priority actions for chimpanzee conservation

The crisis facing chimpanzees in Sierra Leone stems from a diversity of problems, and solutions should not just hinge on a critical examination of the intrinsic and extrinsic forces causing declines, but the employment of strategies that also take into account sociopolitical problems. Addressing hunting and habitat disturbance, managing small and declining populations and securing funds for surveys and long-term conservation work should be pursued as an integrated approach to safeguarding chimpanzees. Additional strategies are necessary and should be explored for both short-term and long-term conservation goals. In this regard, we propose the following recommendations as a beginning point for chimpanzee conservation in Sierra Leone.

10.8.1 Nationwide population census of wild chimpanzees

A nationwide population census of wild chimpanzees in representative ecosystems utilizing a multiplicity of approaches should serve as a beginning point for understanding the current distribution and abundance of chimpanzees. There is a critical lack of information regarding the distribution and abundance of chimpanzees, and any new information will help us identify additional priority sites with viable populations for conservation. The status of chimpanzees in the current protected areas should also be ascertained. More emphasis should be paid to priority sites such as Gola Forests, Tiwai Island Wildlife Sanctuary, Outamba-Kilimi National Park, Loma Mountains and the Western Area Forest Reserve, as these may hold some of the last remaining viable populations of wild chimpanzees in Sierra Leone.

10.8.2 Review of the Wildlife Conservation Act of 1972

A review of the Wildlife Conservation Act of 1972 should be undertaken as a matter of urgency, as the current act does not adequately provide protection for chimpanzees. The status of chimpanzees should be upgraded to ''Endangered'' in the legislations and severe penalties imposed for all relevant violations.

10.8.3 Strengthen management of all target protected areas

Conservation activities in all protected areas should be strengthened as part of the Wildlife Conservation Branch field operations by recruiting and training a cadre of motivated and dedicated game guards and rangers through the provision of financial rewards for successfully executing their duties. Foot patrols in conjunction with vehicular patrols should be undertaken periodically in protected areas with viable populations of chimpanzees. International support for local conservation non-governmental organizations should be provided, with particular emphasis on skills training and the provision of logistical support for the conservation of chimpanzees.

10.8.4 Involvement of other law enforcement agencies

Other law enforcement agencies such as the police force and the judiciary should be engaged in prosecuting and enforcing the wildlife laws pertaining to chimpanzees. Currently there is a general lack of understanding of these laws with no judicial interest in prosecuting offenders. The revised wildlife conservation act should be integrated with the police curriculum, and all new recruits should be taught to implement the laws relating to chimpanzees and other wildlife. Other law enforcement agencies should also adopt these laws as part of their training program. The government should also consider streamlining the prosecution process to

eliminate bottlenecks and constraints that encourage perpetual offenders to risk breaking the law.

10.8.5 Initiate conservation education and public awareness-raising programs about chimpanzee conservation

Well designed and focused conservation education and public awareness-raising programs about chimpanzees should be initiated, with one such program targeting people in the rural areas (more specifically chimpanzee range areas) who are crucial to any potential protection of Sierra Leone's fauna and flora. Campaigns should be targeted towards chimpanzee suppliers in the provinces and those in urban areas who buy and keep chimpanzees as pets. The Tacugama Chimpanzee Rehabilitation Sanctuary should continue to lead the effort by refusing to pay financial compensation to pet owners, and the Wildlife Conservation Branch and other law enforcement agencies should collaborate with the Tacugama Chimpanzee Sanctuary to prosecute offenders.

10.8.6 Establish and maintain corridors between fragmented habitats

Creating corridors between fragmented habitats that hold isolated populations of chimpanzees will be crucial to long-term survival of Sierra Leone's chimpanzees. Because of the ability to adapt and effectively utilize derived vegetation such as farm bush, chimpanzees can quickly expand their range and populations under conditions of little or no hunting pressure. As a result, patches of natural vegetation, riparian forests and mature bush fallows should all be considered as critical habitats when designing landscapes to accommodate conservation needs of chimpanzees. However, such an effort must be coordinated with local communities and other government agencies to ensure that potential conflicts with humans are thoroughly discussed and addressed as part of the conservation strategy.

10.8.7 Provide international support to the Tacugama Chimpanzee Sanctuary

Significant international support should be given to the Tacugama Chimpanzee Sanctuary, since it acts as an essential contribution to law enforcement efforts, particularly as a place to house confiscated apes, protect wild chimpanzee habitat and provide environmental education.

10.9 Conclusions

Sierra Leone has an immediate need for the conservation of chimpanzees and their habitats because of the long history of animal poaching and habitat destruction and a ten-year civil conflict that inflicted a great toll on human life and biodiversity. Wildlife legislation pertaining to chimpanzees is weak, and the enforcement of the laws is almost non-existent. In particular, the government agency mandated to manage and protect chimpanzees and other wildlife is inadequately staffed, lacks basic logistical support and is financially weak. All of this translates into the lack of proper management for chimpanzees and other animals.

Despite being one of the most important countries for conservation of the western chimpanzee, Sierra Leone has received inadequate attention at the international level for their conservation. There is an urgent need for international support to strengthen the capacity of local non-governmental organizations with vested interest in the conservation of wildlife and their habitats. The local non-governmental organizations could be more effective in achieving long-term conservation goals by building partnerships with local law enforcement agencies for the effective implementation of wildlife laws in the country. This is particularly crucial if the illegal taking of wild chimpanzees for the pet trade and the rising demand for bushmeat is to be curtailed. Tacugama should be given full recognition as a valuable asset to chimpanzee conservation in Sierra Leone, rather than a chimpanzee drop-off point struggling to ensure financial security. Education programs that target producers and end users of chimpanzees should be carefully designed and implemented as a strategy in achieving the long-term goal of protecting chimpanzees and their habitat.

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We thank all the researchers, conservationists and donors in the past who have contributed immensely to our limited knowledge of Sierra Leone's ecological status and the staff of the Wildlife Conservation Branch who have, at least, maintained a presence in some of the protected areas, despite the almost total lack of financial resources and moral support. We appreciate the constructive comments from Professor John F. Oates, Abdulai Barrie and Peter Hanson on an earlier draft of this chapter. We are grateful to the Tacugama Chimpanzee Sanctuary staff, in particular, Bala Amarasekaran, for dedicating themselves, when no one else would, to the practical and educational advocacy of chimpanzee welfare and conservation at a time when sanctuaries are still unfairly ignored by many conservationists. We hope that this chapter will not gather dust on tables, but spur the start of well supported research and conservation programmes that should breathe life back in to the forests and woodlands of Sierra Leone.

Chapter 11

Liberia

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11.1 Introduction

Chimpanzees have likely been present previously in all of the closed-forest areas throughout Liberia. Sapo National Park is the only protected area in the country and chimpanzee surveys have been conducted there. A 1970s study by the Interagency Primate Steering Committee, cited in Wolfheim (1983), estimated the size of the chimpanzee population in Liberia to be around 1,000–5,000 individuals. However, a quarter century later the lack of scientific data still renders it virtually impossible to estimate with confidence either the original distribution or present figures regarding population size. Habitat loss and commercial hunting are the most serious threats to chimpanzees in Liberia, and both are exacerbated by civil disturbance due to military and paramilitary operations and the resulting human displacements. Our recommendations include a public awareness campaign, a nationwide chimpanzee survey, better law enforcement and the creation of additional protected areas.

11.2 Country profile

11.2.1 Geography

Liberia lies between 6°30′N and 9°30′W on the west Coast of Africa with Sierra Leone on the west, Guinea on the north, Côte d'Ivoire on the east and the Atlantic Ocean to the south. Liberia is 111,370,000km^2 in size. The topography is characterized by three bands; flat coastal lowlands, inland rolling hills centrally and highlands in the north, with the inland plateau/highlands reaching 1,380m in the Wologizi and Nimba ranges.

11.2.2 Climate

The climate is hot and humid with a mean annual temperature of 26°C. It is hotter and wetter along the coast, with annual rainfall averaging 4,600mm in the capital of Monrovia and 2,000mm in the north-central. The rainy season occurs from May to November, with a short dry season in July or August.

11.2.3 Habitat

While it seems likely that tropical moist forest originally covered all of the country, with the possible exception of about 1,000km^2 of Guinea savanna in the far north-west, there is a debate regarding recent disturbance regimes and the classification of ''primary'' vs ''secondary'' forest in the 19th and 20th centuries. Some evidence suggests less forest cover and considerably higher human population density around 300 years ago, such that the majority of extant closed forest in the country is considered by some as late secondary forest (Sayer *et al.* 1992). Presently, Liberia has about 50% forest cover and contains perhaps 40% of the intact, remaining Upper Guinea Forest, a recognized global hotspot exhibiting high levels of endemism and biodiversity (Martin 1991; Sayer *et al.* 1992; Bakarr, Bailey *et al.* 2001). Two broad types of forest occur; the wet evergreen rain forests of the south and central (i.e., the ''*Cynometra-Lophira-Tarrietia*'' association), and the moist semideciduous forests of the drier north-west uplands (i.e., the ''*Celtis-Triplochiton*'' association). The Nimba area contains montane forest remnants.

11.2.4 Biodiversity

Liberia is situated within the Upper Guinea Forest block, a late Pleistocene refugium. The large-mammal community is comprised of many endangered species, including the pygmy hippopotamus *Hexaprotodon liberiensis*, forest elephant *Loxodonta africana cyclotis*, leopard *Panthera pardus*, Jentink's duiker *Cephalophus jentinki*, zebra duiker *Cephalophus zebra*, Liberian mongoose *Liberiictis kuhni*, and giant pangolin *Manis gigantea.* The non-human primate community contains at least 12 species (Oates 1986; Nisbett and Agoramoorthy 1990) including chimpanzees, vervets, mangabeys, guenons, colobines and prosimians. Furthermore, there is a large and important bird fauna (Gatter 1998), including the rare white-breasted guinea fowl *Agelastes meleagrides.*

11.2.5 People

Today, the population of Liberia is estimated to be 3,288,198 with a 1.91% growth rate (CIA World Factbook 2002). Historically, population density in Liberia has been low, with a

relatively high urban bias. The historic settlement pattern was characterized by concentrations on the coastal fringe and in the central zone of the country alongside a very few major roads. During the seven-year civil war (1989 to 1996), conservative estimates place the number of deaths due to atrocities, starvation and disease at between two and 5% of the pre-war population and about one-quarter to one-half of the population was either internally- or externally-displaced (Huband 1998; Ellis 1999; Reno 1999). It is estimated that Monrovia swelled from less than 500,000 pre-war inhabitants to perhaps greater than one million today.

11.2.6 Political context

The oldest republic in Africa, Liberia was ''colonized'' in the 1820s by freed American slaves and established in 1847, modeled after the United States. A coup in 1980 brought to power a military dictatorship supported by the US. An insurgency led by Charles Ghankay Taylor began on 24 December 1989. After seven years of civil conflict, open presidential and legislative elections were held in 1997, with the warlord Taylor elected President. The current domestic security situation is very unstable due to rebel activity that re-ignited in 1999. In 2001, the United Nations imposed economic sanctions on Liberia that included the diamond trade, an arms embargo, and a travel ban on government officials in response to Taylor's alleged support of the rebel insurgency in Sierra Leone and his complicity in regional instability in Guinea and Côte d'Ivoire. As of this writing (early July 2003), President Taylor has been indicted for crimes against humanity by the international war crimes tribunal in Sierra Leone, Monrovia is under siege by rebel factions (LURD and MODEL) that control at least 60% of the country and 12 of the 15 counties, and the United Nations belatedly has extended economic sanctions to include timber exports.

Due to porous colonial borders and the ongoing military and paramilitary activities in the Mano River Union Basin borderlands, the United States Agency for International Development has estimated that perhaps one million inhabitants of the three Mano River Union Basin countries (Guinea, Liberia and Sierra Leone) are living as either internally or externally displaced persons within the Mano River Union Basin or neighboring countries. The sustained conflict is viewed as one of the most severe humanitarian crises in the world (United States Agency for International Development 2003) and United Nations Secretary General Kofi Annan has made an urgent plea for international intervention, led by the United States, to avert an humanitarian catastrophe (30 June 2003).

11.2.7 Economy

Since the end of the Cold War, infusions of foreign assistance and government revenue have fallen precipitously. External debt is about $2 billion US. Current Republic of Liberia revenue is estimated in the range of $70–100 million US per annum. Iron ore, rubber and timber were significant export industries supporting the national economy prior to the country's civil war. The staple crops of shifting agriculturalists are still rice and cassava, but production has not reached pre-war levels. Pressure on timber exports for foreign currency and funds for armaments and munitions was high during the civil conflict and has increased since the 1997 elections. Based upon quality-of-life and ''healthy adjusted life expectancy'' formulae, etc., the World Bank, the United Nations and the World Health Organization rank Liberia in the bottom 5% of the world's countries.

11.3 Legislation and conservation policies

In 1971, the Republic of Liberia banned the trade in and export of chimpanzees. However, no federal agency was charged with the comprehensive protection and management of wildlife species until 1976 when the Forestry Development Authority was established. The establishment of this agency provided an opportunity to create a Wildlife and National Parks Division that became responsible for formulating conservation programs. Upon formation, the Wildlife and National Parks Division launched public awareness and education programs to inform the people about the importance of wildlife species, their habitat and the necessity of protecting certain species as well as setting aside a portion of the unique forest environments for posterity. Under this program, chimpanzees were included on a list of species to be accorded full protection because of perceived threats from hunting and the biomedical trade. In 1981, the Republic of Liberia became a signatory of the Convention on International Trade in Endangered Species. Wildlife and National Parks promulgations ensuring the protection and sustainable use of wildlife were codified and enacted into federal law in 1988. Recently, a new Forestry and Wildlife Law has been enacted to protect all species considered threatened by extinction due to habitat loss, hunting and the bushmeat trade.

11.4 Past research and conservation efforts

By the middle of the 14th century, Portuguese explorers had reached Cape Palmas (Johnston 1906) on what came to be known as the ''Grain Coast,'' and ultimately the ''Fever

Coast.'' They were likely preceded by Arabs and certainly followed by the Dutch, French and English. By the 17th century, the coastal regions of modern-day Liberia and its indigenous populations, especially at the mouths of such rivers as the Mano, St. Paul, St. John, Sinoe, and Cavalla, were being exploited regularly by European mariners and traders (see Moran 1990). Early zoological collections and reports on native fauna by European naturalists date from the 19th century when collectors such as Samuel Morton, F.X. Stampfli and Johann Büttikofer ventured inland along the northern river systems (Büttikofer 1890; Martin 1991). Based on his explorations of the lower Lofa-Mano riversheds in north-western Liberia during the 1880s, Büttikofer asserted that the western chimpanzee *Pan troglodytes verus*, though rare, occurred throughout the forested areas of Liberia.

In addition to those areas visited by Büttikofer's expeditions in the north-west (Gola, Kpelle and Loma Forests), chimpanzees have been recorded since then in the Upper Lofa area and the national forests of north-central (Gio, Nimba East and Nimba West Forests) and south-eastern Liberia (Grebo, Sapo, Krahn-Bassa, Barrabo, and Cavalla Forests). From the late 1950s to mid-1970s, the use of chimpanzees in biomedical research resulted in several thousand individuals being exported from Sierra Leone and Liberia (see Wolfheim 1983 and sources therein, particularly Kortlandt 1966 and Robinson 1971). A colony of captive chimpanzees used for hepatitis, onchocerciasis and other infectious-disease studies has been maintained for several decades at the Liberian Institute for Biomedical Research near Robert's Field. Semi-naturalistic research on Liberian Institute for Biomedical Research chimpanzees relocated to nearly river islands has been conducted, e.g., on nut-cracking activities (Hannah and McGrew 1987).

Until the official creation of Sapo National Park in Sinoe county in 1983, there had been no systematic study of chimpanzee populations in Liberia, although records concerning presence and distribution were collected during forestry surveys. Prior to the Liberian civil war, preliminary studies on density and nut cracking were initiated at the Gbaboni Base Camp in Sapo National Park. A country-wide chimpanzee survey was in the final planning stages when the civil war erupted in December, 1989.

Previous estimates of chimpanzee distribution and density have been based, for the most part, on various anecdotal sources: discussions with old foresters who conducted the first forestry inventories in the early 1960s and 1970s; conversations with the late Harry Gilmore, a big-game hunter who was a major supplier of chimpanzees to the Liberian Institute for Biomedical Research; and reviews of forest inventory reports prepared by the German Forestry Mission to Liberia. Anderson *et al.* (1983) conducted a brief chimpanzee survey in the south-eastern portion of what is now Sapo National Park. In December 1988, Nisbett and Agoramoorthy (1990) re-surveyed that area and also opened three transects from Sapo National Park's Gbaboni Base Camp, conducting a census of forest primates from January to April 1989. Later in 1989, prior to the eruption of hostilities signaling the start of the civil war, Alison Hannah of the University of Stirling conducted a chimpanzee nut-cracking survey and did some additional, preliminary census work at Gbaboni. Also in 1989 to 1990, a countrywide, large-mammal survey was initiated, producing some germane data on chimpanzee distribution (Anstey 1991a; Dunn 1991).

From early 1990 until early 1997, few outsiders had access to the Liberian hinterlands due to the activities of numerous warring factions operating throughout the country. During the disarmament process of March 1997, a multinational team (comprised of representatives from the Society for Conservation of Nature in Liberia, the Society for the Renewal of Nature Conservation in Liberia (an international non-governmental organization based in southern California) and the Philadelphia Zoo was able to reach Sapo National Park and adjacent population centers. In every subsequent year since 1997, members of that team have conducted a variety of assessments, rural development initiatives and humanitarian projects in the vicinity of Sapo National Park. For example, in 1998, a team visited 23 villages to conduct rapid participatory rural appraisals focused on local needs, perceptions and attitudes related to Sapo National Park, its reactivation and wildlife utilization. Our team surveyed the Cestos-Senkwehn watershed in 1999 interviewing local hunters (Robinson and Suter 1999). In concert with Society for Conservation of Nature in Liberia, the Philadelphia Zoo has been working since 2000 on bushmeat utilization and marketing routes throughout Liberia, but focusing on the south-eastern region. A biomonitoring program was also conducted for four weeks in and around Sapo National Park during April and early May 2001 (Waitkuwait 2001). The data from these studies and innumerable key informant interviews over the past six years have been synthesized here as the best available information regarding the current status of chimpanzees in Liberia.

11.5 Chimpanzee distribution and numbers

11.5.1 Chimpanzee distribution

Assessments and ongoing studies initiated since 1988 are synthesized in Table 11.1 and confirmed presence of chimpanzees illustrated in Figure 11.1. In the absence of a systematic, long-term survey or country-wide scientific census of chimpanzees in Liberia, the distribution list provided below is provisional. Based upon nest counts, Nisbett and Agoramoorthy (1990) reported several small groups in western Sapo National Park, with larger groups occurring in the heart of the park. Given the size of Sapo National Park

and local taboos by some groups in the area, it seems apparent that further efforts towards chimpanzee conservation should be focused on Sapo National Park. However, the species has been present previously in all of the closed-forest areas in the country. For example, the east and west Nimba Forest Reserves bordering Guinea and Côte d'Ivoire supported populations of chimpanzees before the civil war, and local people report that populations increased in those areas during the war (M. Luo, pers. comm.). The Gio National Forest in central Nimba County also supported some populations of chimpanzees, but these have either disappeared or may occur in very small groups today. Large populations have been recorded for the north-west and mid-central part of the country but this region has been heavily impacted by factional fighting, resource extraction and civil displacements over the past 15 years.

Table 11.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Liberia since 1988.

#	Name	Latitude Longitude	Date	Source
1	Loma Forests			
2	Lofa-Mano Forests		1989–90	Anstey (1991a)
3	Kpelle Forests	7°30′N 10°25′W		
4	Gola Forests		1989–90	Anstey (1991a)
5	In Robertsport/Cape Mount area	6°45′N 11°15′W	1989 2002	R.A. Nisbett (pers. comm.) R.A. Hoyt (pers. comm.)
6	Gbarnga area	7°02′N 9°26′W	2002	R.A. Hoyt (pers. comm.)
7	Tapeta area	6°30′N 8°50′W	2002	R.A. Hoyt (pers. comm.)
8	Camp 4 along Cestos river	~5°41′N 9°13′W	1999	Robinson and Suter (1999)
9	N of Midway City (Rivercess Cty.)	5°37′N 9°19′W	1999 2000 (Confirmed by hunters)	Robinson and Suter (1999) R.A. Hoyt and R.A. Nisbett (pers. comm.)
10	Blay Town	5°29′N 9°13′W	2000 (Confirmed by hunters)	R.A. Hoyt and R.A.Nisbett (pers. comm.)
11	Butaw Oil Palm Plantation	5°15′N 9°10′W	2000 (Confirmed by hunters)	R.A. Hoyt and R.A. Nisbett (pers. comm.)
12	Juarzohn area	5°23′N 8°50′W	2000 (Confirmed by hunters) 2001	R.A. Hoyt and R.A. Nisbett (pers. comm.) R.A. Hoyt and R.A. Nisbett (pers. comm.)
13	Krahn-Bassa Forests		1989–1990	Anstey (1991)
14	Reported as crop pests near Zwedru (Grand Gedeh Cty.),	6°04′N 8°07′W		R.A. Hoyt (pers. comm.)
15	Pynestown area	5°42′N 8°25′W	2000 (Confirmed by hunters)	R.A. Hoyt and R.A. Nisbett (pers. comm.)
16	Bardua Town area	5°24′N 8°33′W	2000 (Confirmed by hunters)	R.A. Hoyt and R.A. Nisbett (pers. comm.)
17	Chebioh's Town area	5°22′N 8°38′W	2000 (Confirmed by hunters)	R.A. Hoyt and R.A. Nisbett (pers. comm.)
18	Gbason Town area (Sinoe Cty.)	5°19′N 8°55′W	1997 2000 (Confirmed by hunters)	R.A. Nisbett and R.A. Hoyt (pers. comm.) R.A. Hoyt and R.A. Nisbett (pers. comm.)

Table 11.1. ... continued. Confirmed presence of chimpanzees *Pan troglodytes verus* in Liberia since 1988.

#	Name	Latitude Longitude	Date	Source
19	Djaley's Town/WA Safari Camp area	5°21′N 8°48′W	1997 1998 2000 (Confirmed by hunters) 2001	R.A. Nisbett and R.A. Hoyt (pers. comm.) R.A. Nisbett (pers. comm.) R.A. Hoyt and R.A. Nisbett (pers. comm.) R.A. Hoyt and R.A.Nisbett (pers. comm.)
20	Jaoude area	5°37′N 8°20′W	1998 2000 (Confirmed by hunters)	R.A. Nisbett (pers. comm.) R.A. Hoyt and R.A. Nisbett (pers. comm.)
21	Jarpukehn area	5°16′N 8°22′W	1988–1989	Nisbett and Agoramoorthy (1990)
22	Nimba Forest region adjacent to the forested Nimba highlands of bordering countries			
23	Grebo Forests		1989–1990	Anstey (1991a)
24	Plebo area	4°40′N 8°00′W	2002	R.A. Hoyt (pers. comm.)
25	Sapo National Park		1988–89	Nisbett and Agoramoorthy (1990)
26	NW SNP near Gbaboni Base Camp	5°19′N 8°43′W	1988–89	Nisbett and Agoramoorthy (1990)
27	Near Naklen (all in Sinoe Cty.)	5°10′N 8°35′W	1998	R.A. Nisbett (pers. comm.)
28	Near Gbatekehn	5°19′N 8°18′W	1998	R.A. Nisbett (pers. comm.)
29	High forest (logged and unlogged), secondary forest, and farmbush	Not on map	1989–90	Dunn (1991)

Coordinates were not available for all confirmed sightings discussed in the text, indicated on the figure or in this table; some coordinates in the table are indicated as approximations; however, all specific coordinates listed in the table came from GPS readings (although these were recorded over a period of several years by multiple observers and GPS units from various manufacturers). Cty. = county.

11.5.2 Chimpanzee numbers

Wolfheim (1983) summarized a 1978 study by the Interagency Primate Steering Committee (with J.S. Gartlan, C. Jones, A. Kortlandt and T.T. Struhsaker as consultants) that concluded an estimated 1,000–5,000 chimpanzees occurred in Liberia. While we believe that the overall chimpanzee population in Liberia presently exceeds this conservative estimate, we have no reliable data to substantiate our informed opinion or refute earlier estimates. All previous in-country surveys of chimpanzee distribution and estimates of chimpanzee density in Liberia have been based either on methodologically sound but short-term rapid assessments or upon unsystematic field observations. Based upon the 1988 to 1989 broad survey and transect data collected by Nisbett and Agoramoorthy (1990), an estimate of 500–1,000 chimpanzees in Sapo National Park was in general concordance with that made by Anderson *et al.* (1983). Using habitat-type data from that 1988 to 1989 study, and the figure calculated by Marchesi *et al.* (1995) for Taï, Sapo National Park could contain as many as 1,640 chimpanzees (1.64 chimps per km^2 for intact primary forest multiplied by about $1000km^2$ of suitable habitat in Sapo National Park). The obvious conclusion is that a countrywide survey is urgently needed (see below).

Figure 11.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Liberia.

11.6 Threats to chimpanzees

11.6.1 Habitat loss

Due to increased pressure for foreign revenue, since the 1997 national elections the Republic of Liberia has pursued a policy of reducing the number of timber concessionaires from a few dozen to several large consortia. Transnational timber companies have negotiated concessions of several million acres in the Krahn-Bassa forests of the south-east and the Lofa-Mano forests in the north-west. The scale of current logging activities is staggering. Nisbett and Monath (2001) reviewed the situation and discussed the potential for negative impacts on the health of local people due to the transmission of zoonotic diseases.

11.6.2 Hunting and capture

We have assembled unassailable evidence that hunting chimpanzees for bushmeat does occur throughout the country. As deplorable and unsustainable as this offtake is, we would be remiss in not asserting that the view held by some that non-human primates are ''finished'' in Liberia is both sadly misinformed and represents a disservice to conservation activities in the country. In some areas there are local or even familial taboos against the consumption of non-human primate bushmeat, in particular among many adherents to Islam in the north. In eastern Nimba and among some ethnic groups and clans in the south-east, for instance among the Sapo in Pynestown and Kpanyan districts of Sinoe County, it is also taboo to eat chimpanzee (Society for Conservation of Nature in Liberia 1998). The Wehdjeh clan of the Sapo along the northern boundary of Sapo National Park consider themselves relatives of the chimpanzees, from whom they have acquired knowledge pertaining to forest skills, and prohibit killing a chimpanzee.

However, as non-native migrant farmers and laborers employed in the logging and mining industries and military/paramilitary troops move into rural areas, there are increased pressures for subsistence hunting, commercial hunting and for the pet trade (it is not unusual for foreigners to be approached in Monrovia by individuals attempting to sell infant chimpanzees). The bushmeat trade, generally, is heavily influenced by ''extrinsic'' economic forces since commercial hunting and marketing of bushmeat require capital investment (for trapping and hunting material) and organization. It appears that Liberian bushmeat is marketed widely in the Upper Guinea Forest subregion and possibly reaches a global market. With regard to cultural practices, it should be noted that even in remote areas along the border of Sierra Leone and Liberia where it is taboo to eat chimpanzees, the species is hunted for body parts used for medicinal purposes. For example, in the Gola Forest of eastern Sierra Leone where eating the flesh is prohibited locally, chimpanzee brain was prescribed as recently as 1991 as a cure for infertility. Similarly, central incisors were procured to be worn as an amulet around the waist of infants to protect them and give them power over others in their cohort. Concerning the ''northern'' cultural practice of using chimpanzees in biomedical research, representatives of the Liberian Institute for Biomedical Research have stated that the facility no longer accepts any wild chimps for use as study subjects.

11.6.3 Civil conflict

Although habitat loss and commercial hunting are the most serious threats to chimpanzees in Liberia, both are exacerbated by civil disturbance due to military and paramilitary operations, and the attendant human displacements. The situation is particularly serious in northern Liberia in the Mano River Union Basin borderlands. Here factional fighting continues and enormous refugee populations are aggregated as of this writing in the summer of 2003. There are also increasing refugee populations in the south and east due to the present factional fighting along the border with Côte d'Ivoire. Between 1970 and 2000, anecdotal reports have suggested that chimpanzee numbers have declined in the north-west and north-central forests of the country. The inability to enforce existing legislation in the more secure parts of the country is another threat as the procurement of chimpanzees for the bushmeat and pet trade appears to be on the rise again.

11.7 Priority sites for chimpanzee conservation

Given the lack of data concerning chimpanzee distribution and population density in Liberia, it is a difficult but necessary task to designate priority conservation areas. Obviously, given its legal status and the presence of Forestry Development Authority staff, Sapo National Park should be the focus of immediate, systematic chimpanzee studies. Likewise, suitable habitat and the presence of chimpanzees argue for the protection of forested areas and initiation of studies in Nimba, Lofa and Cape Mount Counties.

11.7.1 Sapo National Park

Consisting of 1,308km^2, Sapo National Park is situated in the wet evergreen forests of south-eastern Liberia. The largest tropical rainforest areas remaining in West Africa include Taï National Park in Côte d'Ivoire and continue through the forests around that park, such as the N'Zo fauna reserve, the Cavally-Goin and Haute Dodo classified forests

in Côte d'Ivoire, through the Grebo forest in Liberia, and reaching west to the Republic of Liberia's Sapo National Park. This entire area includes the best, remaining Upper Guinea Forest tropical rain forest and thereby protects other endemic species such as pygmy hippos, zebra duikers, Jentink's duikers and forest elephants. This important stretch of forest could also help stabilize the regional climate that has already suffered from a precipitious decline in rainfall due to deforestation (Paturel *et al.* 1995; Servat *et al.* 1997). This bi-national area could potentially harbor as many as 8,000 chimpanzees and could therefore become the stronghold of the Western chimpanzee critical in protecting the genetic diversity of the species as well as its important and unique protocultural behavior vis-à-vis other chimpanzee subspecies (Whiten *et al.* 1999; Boesch and Boesch-Ackermann 2000a).

In order to ensure the viability of chimpanzees and other wildlife in this area, it will be necessary to create and maintain a conservation corridor linking chimpanzee populations. This will require feasibility and impact studies, a stakeholders workshop, better management of the protected areas and connectivity of forest fragments. A biomonitoring program should be initiated within this corridor, including the forests of Taï National Park, Cavally Goin, N'Zo, Haute Dodo in the Côte d'Ivoire, and the Grebo, Cestos Forests, and Sapo National Park in Liberia.

11.7.2 Nimba Highlands

The Liberian portion of the Nimba mountains is located in the north-central section of the country and lies within latitudes 7°00′–8°00′N and longitudes 8°00′–9°00′W. The proposed nature reserve has an area of 84.3km^2. The forest vegetation is being degraded rapidly due to multiple activities such as logging, farming, settlement and mining. The Nimba area in Liberia has been heavily impacted by the extraction of iron ore. Nonetheless, rising to 1,700m, the massif is suspected to contain relict populations of mammals, amphibians and perhaps even non-human primate species. The area contains remnant montane forest and high forest characterized by an unusually high density of the Guinean plum tree *Parinari excelsa.* The Liberian portion of the Nimba Mountains needs to be recognized nationally and internationally as an integral part of the whole Nimba ecosystem. Chimpanzee surveys should be conducted in the Liberian regions of the Nimba massif. Finally, support is needed for a tri-national program integrating conservation activities in the Nimba Mountains in order to synchronize biomonitoring and protective measures among Guinea, Côte d'Ivoire and Liberia.

As this publication went to press in October 2003, the new Interim President of Liberia signed into law two important legislative acts that are the culmination of several years of active engagement from the conservation community: (1) an expansion of Sapo National Park to add another 494km^2, or an increase of 37%; and (2) the creation of the East Nimba Nature Reserve, comprising more than 134km^2 adjacent to the Nimba World Heritage Site in Guinea-Côte d'Ivoire. Together, these acts provide both additional protection for an impetus to implement immediate field surveys of, chimpanzee populations in the affected areas.

11.7.3 Lofa

The Upper and Lower Lofa Forests contain the other large block of relatively intact, though impacted, forest cover in Liberia. These moist-deciduous forests are characterized by a greater abundance of Meliaceae species. Several protected areas have been proposed in both the Lower Lofa region and Wologizi range in the Upper Lofa region.

11.7.4 Wonegizi

In Liberia, Wonegizi is a proposed national park that lies across the border from Ziama. It is presumed that a large population of chimpanzees is found here. Surveys for chimpanzees should be conducted in this area, since evidence for a viable chimpanzee population would rekindle support for the gazetting of this area as a new protected reserve.

11.8 Priority actions for chimpanzee conservation

Taking meaningful steps towards the goal of protecting chimpanzees in Liberia necessitates intersectoral, multilateral and international resolve. Those activities which require limited capital resources but rely on source-country resolve should commence immediately and operate concurrently with extramural efforts to create momentum and secure necessary capital funds. We have prioritized the following concurrent activities.

11.8.1 Continue ongoing monitoring of the bushmeat trade

In cooperation with local and international non-governmental organizations and the Republic of Liberia, initiate pilot projects for the development of alternative sources of protein to reduce dependence on bushmeat in Liberia. Support sustainable community development in local communities where taboos against killing and eating chimpanzees are already established.

11.8.2 Conduct an awareness campaign

Collaborating with local and international non-governmental organizations, assist the Forestry Development Authority in conducting urban campaigns (primarily in Monrovia) to inform policymakers and civil leaders of the urgent need to protect chimpanzees in Liberia. In addition, conduct a national public campaign in both urban and rural areas to promote awareness of the protected status of chimpanzees and the undesirability of chimpanzees as pets – especially to expatriates with the means to purchase and maintain such a pet. Expand programs such as the Community Liaison Officer project funded by the Philadelphia Zoo to employ and educate local people in targeted areas so that chimpanzee conservation efforts are sustainable.

11.8.3 Improve law enforcement

Republic of Liberia wildlife-protection legislation is acknowledged to be among the most well-crafted in the world. Work with the Forestry Development Authority and other governmental entities to develop more effective means of enforcing existing wildlife regulations.

11.8.4 Address the issue of crop raiding by chimpanzees

With local communities and federal partners, conduct research into and implement means of reducing and ameliorating crop raiding by chimpanzees to maintain public support for their protection.

11.8.5 Create new protected areas in Liberia

In cooperation with the Republic of Liberia, identify and establish new protected areas.

11.8.6 Reactivate conservation and rural development projects around Sapo National Park

Work with all local and external entities to reactivate immediately the pre-war enforcement, conservation-education and community-development activities in secure areas surrounding Sapo National Park presently staffed by the Forestry Development Authority. Re-initiate highly visible research programs into chimpanzee ecology, behavior and conservation at Sapo National Park. Our studies and assessments over the years have demonstrated the public perception that conservation and development initiatives must proceed hand-in-hand with an emphasis on literacy and health, as well as marketing of local agricultural and non-timber forest products, as tangible benefits to local communities struggling to balance the oftentimes intangible benefits (= luxuries?) of preservation and conservation activities.

11.8.7 Create a national Liberian Chimpanzee Specialist Group

Create a national chimpanzee specialist group with representatives from both government agencies and non-governmental organizations to oversee all in-country initiatives. Secure resources to ensure regular attendance and training of the Liberian Chimpanzee Specialist members at regional and international meetings related to chimpanzee conservation and facilitate networking and coordination with colleagues in the Upper Guinea Forest subregion.

11.8.8 Conduct a nationwide survey

Initiate immediate planning to conduct a countrywide chimpanzee survey, beginning in areas that are presently secure and known to contain viable populations of chimpanzees.

11.9 Conclusions

Chimpanzees are presumed to have exhibited previously a very broad distribution throughout the closed high forests of Liberia. In recent decades, they have been reported from primary, secondary and regenerating forests and living in close proximity to rural human populations. In the second half of the 20th century, commercial logging operations and iron-ore mining activities undoubtedly have reduced available habitat. The larger forested tracts in the north-west and south-east are now facing intense pressure from timber extraction and mining activities, as well as the subsistence cultivation that inevitably follows new roads and laborer settlements carved into the primal forest. While chimpanzee populations in the south-east appear to have increased during the civil war, the threats have intensified in recent years as transnational logging firms have acquired huge timber concessions. Certainly, the continuing civil strife in the north-west and south-east negatively impacts remaining chimpanzee populations. In addition to habitat loss, chimpanzee populations may also have been heavily impacted by, or even disappeared from some areas of their former range due to over-hunting for food, medicinal use, biomedical research and the pet trade. The need for protection is urgent.

The lack of scientific data renders it impossible to estimate with confidence either the original distribution or present figures regarding population size. While all enacted wildlife laws since the 1970s have included chimpanzees as

fully protected species, enforcement of these laws has been inconsistent to nonexistent. Efforts to obtain reliable estimates and initiate effective protection and education measures have been hampered by more than two decades of civil instability, destroyed infrastructure and institutional capacity, and a declining standard of living. Some of the greatest challenges facing chimpanzee conservation *per se* in Liberia reflect those found throughout the developing world: the negative synergies of abject poverty, malnutrition, illiteracy and usufruct rights/land reform issues. We remain optimistic that, through multilateral collaborations matching the expertise and resources of external partners with source-country resolve and experience, viable chimpanzee populations can be protected in Liberia.

Acknowledgements

The authors would like to thank Rebecca Kormos for extending the invitation to participate in this endeavor, despite the paltry but important data from Liberia. At the outset, we would like to acknowledge our enormous debt to and genuine admiration of the people in Sinoe county who have endured unfathomable tragedy with such inspiring human dignity. Over the past few decades, not merely have they invited us into their villages and homes, sheltered, fed, entertained, instructed and comforted us always with gracious hospitality and patience, but they have also enriched our lives immeasurably by allowing us to be their voice ''on the other side.'' The tireless efforts of many foreigners on behalf of Liberia, her forests and indigenous peoples kept our hopes alive during the war years; we'd like to mention in particular Henk Dop, Wulf Gatter, Phillip Robinson, and Charles and Annie Steiner. A great many individuals, foundations, Republic of Liberia agencies and NGOs have contributed resources and expertise to the findings presented here: Forestry Development Authority, SCNL, Philadelphia Zoo, WWF, FFI, CI, ICCO, SRNCL, OUHSC and the College of Arts and Sciences at Texas Tech University. We would like to express appreciation for the support and camaraderie of Nelson Bobway, Dirck Byler, James Coleman, Ben Donnie, Jill Frayne, Theo Freeman, Joseph Fully, James Murray, Thomas P. Norman, Bokartus Toto and Jamison Suter, as well as the untold personal sacrifices by Nancy, Emily, and Laura. Finally, RAN would like to conclude by invoking the memory of Morris Karmoh, the wizard of the Djaedepo deep forests, who was murdered in the civil war but still lives whenever recollections of his delightful campfire tales of chimpanzee behavior tickle the imagination.

Chapter 12

Côte d'Ivoire

Ilka Herbinger, Christophe Boesch and Adama Tondossama

12.1 Introduction

The chimpanzee population of Côte d'Ivoire has suffered enormously because of deforestation and poaching pressure in the past 40 years, dwindling from probably over 100,000 to around 8,000–12,000 chimpanzees at present. Most populations are isolated from each other, and for many there is not much hope of their long-term survival. Only about half of the total chimpanzee population, 7,225 (53%), live in protected areas, and 6,511 (47%) live in poorly or non-protected areas. There are ten protected areas in the country with chimpanzees, and a total area of 20,506km^2. Efforts to find out more about the present distribution and status of chimpanzees in classified and other forests and a better protection of these chimpanzee habitats must be of high priority to guarantee their survival.

Most information on the numbers and distribution of chimpanzees in Côte d'Ivoire comes from a census by Hoppe-Dominik in 1988 (Hoppe-Dominik 1991) and a nationwide census carried out by P. and N. Marchesi, B. Fruth, C. Boesch and D. Lia in 1989 to 1990 (Marchesi *et al.* 1995) and from censuses carried out by one of the authors (Herbinger) with the assistance of Lia and local guides (Herbinger and Lia unpublished report 2001a, b).

Economic crisis in the 1980s had far reaching consequences for the protected area management system. Government funding diminished below critical levels, leaving protected areas unattended and allowing poaching to increase to alarming levels. The chimpanzee population has suffered enormously because of deforestation and poaching pressure. Information is limited about the current status of Côte d'Ivoire's chimpanzee population, but a more active conservation policy would allow the protection of one of the most viable population of chimpanzees in West Africa.

12.2 Country profile

12.2.1 Geography

Côte d'Ivoire covers 322,460km^2 is situated between latitudes: 4°15′N–10°40′N and longitudes: 8°30′W–2°30′W, and is bordered by Mali and Burkina Faso to the north, by Ghana to the east, by Liberia and Guinea to the west and by the Gulf of Guinea to the south. The topography is mostly flat to undulating plains with mountains in the north-west. The highest point is Mont Nimba at 1,752m.

12.2.2 Climate

Average annual rainfall varies from 1,905mm in the coastal region to about 1,143mm in the savanna. In the south the average annual temperature remains roughly the same throughout the year (27°C). In the north the temperature can vary from 14–39°C (Données encyclopédiques 2001). In forested areas like Taï National Park, daily mean temperature ranges from 25–35°C. Mean annual rainfall varies from 1,700mm in the northern part of the park to 2,200mm in the southern part. The rainy season is characterized by peaks in June and September (Gartshore *et al.* 1995).

12.2.3 Habitat

The land is divided into two geographical areas consisting of equatorial rain forests to the south and a drier savanna belt to the north. In 1987 the Ministére de l'Environment et de la Forêt reported a total forest area of 51,700km^2, but this is clearly an overestimation.

12.2.4 People

The human population of Côte d'Ivoire is estimated at 16,804,784 with a growth rate of about 2.5% annually (CIA World Factbook 2002). Population density is about 52 persons per km^2. About 44% of the population is urban with 2,877,948 people living in the economical capital Abidjan (Institut National de la Statistic in Côte d'Ivoire 1998).

The area around Abidjan and the south of the country are the most populated areas (Abidjan 1,475 people per km^2, Bouaké 154 people per km^2, Haute Sassandra 73 people per km^2, Odienne 11 people per km^2) with about 78% of the total population. The western part of the country is the least populated. In 1971 the population density in the vicinity of Taï National Park, which is probably the most important protected area for chimpanzees in Côte d'Ivoire, was reported at 1.3 people per km^2, but by 1979 it had grown to 7.7 people per km^2 and continues to grow today. In the 1990s, population density west of Taï National Park had peaked at 135

people per km^2 due to refugee influx from Liberia. For 1998 the National Institute for Statistique reports of 67 people per km^2 in the vicinity of Marahoué National Park as well as in the vicinity of Comoé National Park, both considered to hold important populations of chimpanzees.

The population of Côte d'Ivoire is culturally very diverse with over 60 different ethnic groups. The main groups are the Akan (42.1%), the Voltaiques/Gur (17.6%), the Northern Mandes (16.5%), the Krous (11%), the Southern Mandes (10%) and other ethnic groups that make up about 2.8% of the population (CIA World Factbook 2000). Many different ethnic groups live in the vicinity of chimpanzee habitats, since chimpanzee populations are distributed throughout the country. Some families from different ethnic groups consider chimpanzees as their totem, and they neither kill nor eat chimpanzees.

12.2.5 Political context

Despite a long history of political stability, Côte d'Ivoire has been subject to political ''unrests'' since 1990 due to repression of a multi-party democracy. In December 1999, the first military coup in the country's history overthrew the government led by President Henri Konan Bédié. Presidential and legislative elections held in October and December 2000 provoked violence due to the exclusion of opposition leader Alassane Ouattara. In October 2000, Laurent Gbagbo replaced Robert Guei as president, ending ten months of military rule. Political instability in the last two years led to negative economic growth in the year 2000 because of difficulties meeting the conditions of international donors. Since September 2002, a civil war has divided the country in three sectors, and the progressive worsening of the situation has made the work of the Eaux et Forêt agents and researchers very difficult in all regions of the country. It is hoped that the situation will improve rapidly since both the human and some wildlife populations suffer directly from this.

12.2.6 Economy

Côte d'Ivoire is among the world's largest producers and exporters of coffee, cocoa beans and palm oil. As a result, the economy of Côte d'Ivoire is very sensitive to fluctuations in international prices for these products. The government has tried to diversify the country, but about 68% of the population still remains mostly dependent on agriculture and related activities. GDP is $637 US per capita.

12.3 Legislation and conservation policies

Authorities that enforce conservation policies in Côte d'Ivoire are currently divided into two Ministries. The Ministère de l'Environnement et Cadre de Vie, including the Direction de la Protection de la Nature, is in charge of managing protected areas. The Ministère de l'Environnement et Forêt includes the Direction de la Protection de la Faune et Peche en Eaux Continentales and Societé de Developpement des Forêts, which manages the classified forests (Forêt Classées). There are administrators of these ministries situated in the main regional cities across Côte d'Ivoire. Forest agents are often based near national parks and are directly responsible for law enforcement. However, the number of forest agents per park are usually insufficient, as are their means of transportation and equipment.

Until recently, protected area management was carried out by a centralized administration without significant involvement of the local communities. In 1995 the Government realized the need for broad reform and adopted a National Strategy for the Parks and Reserves. In 1996 a National Environmental Action Plan (Plan National d'Action Environnemental) was created which is supposed to be implemented through a National Protected Area Management Program called the Projet Cadre de Gestion des Aires Protegées. The objective of the Projet Cadre de Gestion des Aires Protegées is to set up a sustainable and efficient system for the management of all protected areas in the country. The 12-year project is to be implemented in three four-year phases, and it is currently still in its initial phase.

In 1974 hunting was made illegal throughout Côte d'Ivoire. Unfortunately, hunting activities have continued and even increased to uncontrollable levels. Currently there is an unresolved debate about whether hunting will be legalized again, and studies are now being carried out that aim to determine what restrictions and conditions should be imposed if hunting is to be made legal again.

Under the present law the chimpanzee is listed as a species that is completely protected (''integralement protegé''). Côte d'Ivoire also signed the Convention on Biological Diversity in November 1994, as well as the Convention on International Trade of Endangered Species, where chimpanzees are listed under Appendix I and therefore are protected from any international commercial usage. Côte d'Ivoire is also an active participant in the UNESCO Biosphere Reserves Program. The Taï and Comoé National Parks and the Nature Reserve Mount Nimba were declared Natural World Heritage Sites under the International Convention concerning the Protection of the World Cultural and Natural Heritage. Côte d'Ivoire also signed the Tropical Timber 83

and 94 Convention, the Ramsar Convention on Wetlands, the Desertification and the Climate Change Convention. The Convention on Biological Diversity as well as the Climate Change Convention are currently enforced under the Ministère de l'Environnement et Forêt, whereas Convention on International Trade of Endangered Species and the Ramsar Convention are enforced under the Direction de la Protection de la Nature.

In Côte d'Ivoire there are eight national parks totaling 17,321km^2, six natural reserves totaling 3,396km^2, 16 botanical reserves totaling 1,984km^2, and 147 classified forests totaling 29,000km^2. So called ''sacred'' or ''village forests'' (''forêt sacré'' or ''forêt villagoise'') – small, isolated forests next to villages – might account for approximately 40km^2 of forest in Côte d'Ivoire (Croix Verte reports of over 6,500 of these forests [1998]). Including only national parks and natural reserves, (20,717km^2), 6.4% of the country's land area is under protection. Within protected areas such as national parks and reserves any human activity is strictly forbidden, like hunting, capturing, fishing and habitat destruction. Classified forests, on the contrary, have been created with the purpose of exploiting wood in a sustainable way. Only about 5% of each classified forest is declared as a biological reserve (reserves biologiques) and therefore protected from exploitation. Classified forests are not as well controlled as national parks and therefore are often exposed to heavy poaching, agricultural use and human settlements.

12.4 Past research and conservation efforts

The main field research project on the West African chimpanzee (*Pan troglodytes verus*) in Côte d'Ivoire is carried out in Taï National Park, under the supervision of Christophe Boesch. Taï chimpanzees have been the subjects of observation and behavioral research here for over twenty years. Study of this population has led in particular to insights concerning cooperative hunting behavior and tool use by chimpanzees. More recently, comparison of behavior patterns seen at Taï with those exhibited by chimpanzees at other study sites has led to the more widespread recognition that culture, an attribute often restricted to humans, is also present in chimpanzee societies.

At Taï, three habituated communities totaling some 100 individuals are under observation, with habituation of a fourth community in progress. Observation of nine neighboring groups, including collection of samples for genetic analysis, is also being conducted. Some of the topics currently being investigated by researchers on Taï chimpanzee behavior include food, social grouping and reproduction (Anderson 2001; Anderson *et al.* 2002), vocalizations and communication (Crockford and Boesch 2003; Crockford *et al.* submitted), hormonal cycle and sexual behavior (Deschner *et al.* 2003), food distribution and abundance (Goné Bi 1999; Goné Bi *et al.* in prep.), intergroup dynamics (Herbinger *et al.* 2001; Herbinger and Boesch submitted a, b; Herbinger and Boesch in prep), long-term Taï chimpanzee behavior database (Lehmann and Boesch 2003; Lehmann and Boesch submitted a, b), diseases and disease transmission (Leendertz *et al.* 2003; Ehlers *et al.* 2003), social learning (Y. Möbius), sexual behavior of female chimpanzees (Stumpf and Boesch in prep. a, b, c), genetics (Bradley *et al.* 2000; Morin *et al.* 2001; Vigilant *et al.* 2001) and conflict management (Wittig and Boesch 2003a, b, in press, submitted). Published papers by Boesch include information on social structure (Boesch 1996a; Boesch and Boesch-Achermann 2000a), social learning and communication (Boesch 1991a, c, 1995; Boesch and Boesch-Achermann 2000b), mother-infant relation (Boesch 1997), nut cracking (Boesch 1991d, Boesch and Boesch 1981, 1983, 1984a, b, 1993b), tool use (Boesch 1993b; Boesch and Boesch 1990, 1993a), hunting behavior (Boesch 1994a, b, c, 2001b; Boesch and Boesch 1989), predation (Boesch 1991b), sicknesses and mortality (Hill *et al.* 2001, Santiago *et al.* 2002), theory of mind (Boesch 1992), evolution (Boesch-Achermann and Boesch 1994; Gagneux *et al.* 1999) and culture (Boesch 1993a, 1996b, c, d, 2001a; Boesch *et al.* 1994; Boesch and Tomasello 1998; Whiten *et al.* 1999; Whiten and Boesch 2001).

Collaborative projects between the researchers at Taï and other chimpanzee research sites (e.g., Uganda, Tanzania) have also been established. A collaborative project with the World Health Organization, under the supervision of Dr. Pierre Formenty, aiming to find the reservoir of the Ebola virus, was also undertaken in this area, although this project has recently come to an end (Formenty *et al.* 1999a, b; Le Guenno *et al.* 1995, 1998; Wyers *et al.* 1999). The Taï Monkey Project, under the supervision of Prof. Dr. Ronald Noë, Dr. Klaus Zuberbühler, and others, concentrates mostly on the behavior of all the monkey species in Taï, but also relates to chimpanzee behavior since chimpanzees are an important predator to some of the monkeys (Zuberbühler 2000, 2001).

Some other short-term chimpanzee research has been conducted in Comoé National Park, Banco National Park and in the Nimba mountains (Matsuzawa and Yamakoshi 1996).

Present chimpanzee related conservation projects include the Ecotourism Project of the Projet Autonome pour la conservation du Parc National de Taï. This project offers among other activities a guided visit to a habituated chimpanzee community. The World Wildlife Fund for Nature, a partner organization of the Projet Autonome pour la conservation du Parc National de Taï responsible for education and awareness-creation around the Taï National Park, initiated some chimpanzee-related seminars in schools. To help children and teachers understand more of the life of wild chimpanzees, Grégoire Nohon, the main field assistant of the Taï

Chimpanzee Project, visits schools to discuss with the students his own experiences and knowledge of chimpanzees.

The Wild Chimpanzee Foundation, founded by Christophe and Hedwige Boesch, was created in 2000 and is directly concerned with the protection of chimpanzees. The Wild Chimpanzee Foundation is a multi-national foundation, where individuals combine efforts to preserve as many of the remaining wild chimpanzee populations as possible, as well as their natural habitat throughout their range in Africa. The main objectives of the Wild Chimpanzee Foundation are to establish a ''Pan-African Forest network of scientists working for the conservation of chimpanzees,'' with the aim of assuring protection of 20,000–25,000 chimpanzees, and to create a ''Pan-African monitoring program'' to guarantee the preservation of the forest network by involving local people and by increasing our knowledge of the chimpanzee populations being protected. The Wild Chimpanzee Foundation aims to achieve these goals through education, conservation and research, and it aims to involve the local human populations around the protected key sites, school children from developed and sub-Saharan countries and scientists. Environmental education projects around Taï National Park have already been initiated, such as an interactive theater play, a newsletter and film presentations.

12.5 Chimpanzee distribution and numbers

12.5.1 Chimpanzee distribution

Most information on the distribution and numbers of chimpanzees in Côte d'Ivoire comes from a census by Hoppe-Dominik from November to December 1988 (Hoppe-Dominik 1991) and a nationwide census carried out by P. and N. Marchesi, B. Fruth, C. Boesch and D. Lia from September 1989 to December 1990 (Marchesi *et al.* 1995). More recent information on chimpanzee distribution comes from censuses carried out by one of the authors (Herbinger) with the assistance of D. Lia and local guides.

Chimpanzees are found throughout Côte d'Ivoire, but their range is generally limited to areas that receive some sort of protection. Table 12.1 provides a list of all the national parks and classified forests where chimpanzee presence has been confirmed in Côte d'Ivoire. Figure 12.1 provides a map of the known distribution of chimpanzees throughout Côte d'Ivoire. The authors considered the total population as highly endangered since only the chimpanzee populations in three national parks – Comoé, Marahoué and Taï – revealed large enough numbers to be viable in the long term.

12.5.2 Chimpanzee numbers

Hoppe-Dominik (1991), Marchesi *et al.* (1995) and Herbinger and Lia (unpublished report 2001a, b) all used the classical line transect method to estimate chimpanzee numbers (Anderson *et al.* 1983; Tutin and Fernandez 1983, 1984). Hoppe-Dominik (1991) walked 17 transects varying from 1.4–15km in six areas, totaling 83.6km of transects. A total of 82 nests were observed and 39 nest groups. Hoppe-Dominik also questioned local communities about the occurrence of chimpanzees. Persons in a total of 166 villages and settlements in the rain forest zone were questioned. In addition, a total of 40 individuals in government-owned enterprises and forestry and hunting departments, as well as scientists and hunters were interviewed.

Hoppe-Dominik (1991) estimated the total chimpanzee population in Côte d'Ivoire to be 11,867 individuals. He found the majority of the chimpanzees (10,692 or 90.1%) to be living in the rain forest zone, 560 (4.7%) in the Guinea zone and 615 (5.2%) in the Sudan zone. He estimated the overall chimpanzee population density to be 0.09 chimpanzees per km^2 in rain forest near villages, 0.36 chimpanzees per km^2 in forest plantations and 0.03 chimpanzees per km^2 in the Sudan area.

Marchesi *et al.* (1995) walked transects varying from 9–15km and a 10m strip on each side of the transect line was always recorded, whatever the density of the habitat. During their study 154.4km of transects were walked in 14 sites. They also surveyed, without transects, 21 other sites. In total, 611 nests were observed on transects.

Marchesi *et al.* (1995) estimated the total number of chimpanzees in Côte d'Ivoire to be 11,676 $\pm$ 1.168, very similar to Hoppe-Dominik's (1991) estimate of 11,867. The densities for different habitat types were estimated as follows; intact primary forest – 1.64 chimpanzees per km^2, degraded forest – 0.4 chimpanzees per km^2, human encroached forests and mosaic habitats – 0.09 chimpanzees per km^2. Marchesi *et al.* (1995) estimated the chimpanzee population in the national parks and reserves in Côte d'Ivoire to be about 7,225 individuals and estimated the chimpanzee population in the classified and other unprotected forests in Côte d'Ivoire to be 6,511 individuals.

Hoppe-Dominik (1991) gave a much higher estimate for the number of chimpanzees outside national parks and reserves (8,896 chimpanzees). Since Marchesi *et al.* (1995) did not undertake transects in these areas, it is possible that they underestimated the chimpanzee population in unprotected areas. On the other hand, it is possible that Hoppe-Dominik's study might be an overestimate due to the inaccuracies of information from questionnaires. He did however manage to confirm the presence of chimpanzees in the majority of sites where interviews indicated that they

Table 12.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Côte d'Ivoire.

	Name	Latitude Longitude
1	Taï National Park	5°09′-6°09′N/6°48′-7°26′W
2	Comoé National Park	8°5′N-9°06′N/3°01-4°04′W
3	Marahoué National Park	6°53′-7°14′N/5°46′-6°10′W
4	Mount Sangbé National Park	8°02′N/7°24′W
5	Mount Péko National Park	7°01′N/7°16′W
6	D'Azagny National Park	5°13′N/4°53′W
7	Banco National Park	5°21′-5°25′N/4°01′-4°05′W
8	Mount Nimba Nature Reserve	7°34′N/8°25′W
9	Haut Bandama Fauna Reserve	8°27′N/5°29′W
10	Duékoué Classified Forest	6°38′N/7°07′W
11	Mount Kopé	4°59′N/7°27′W
12	Monogaga Classified Forest	4°48′N/6°26′W
13	Nizoro Classified Forest	5°51′N/5°56′W
14	Dagbégo (Dassiékro Classified Forest)	5°05′N/5°31′W
15	Go Classified Forest	5°50′N/5°31′W
16	Bossématié Classified Forest	6°20′-6°35′N/3°20′-3°35′W
17	Gbapleu (Tiapleu Classified Forest)	7°27′N/8°14′W
18	Blépleu (Sangouiné Classified Forest)	7°23′N/7°49′W
19	Mount Tonkouri Classified Forest	7°25′N/7°38′W
20	Mount Bétro Classified Forest	6°39′N/7°54′W
21	Mount Zoa (Scio Classified Forest)	6°47′N/7°49′W
22	Guiniadou (Niegré Classified Forest)	5°30′N/6°03′W
24	Mopri Classified Forest	5°48′N/4°58′W
25	Irobo Classified Forest	5°29′N/4°44′W
26	Songan Classified Forest	5°46′-6°12′N/3°12′-3°26′W
27	Haute Dodo Classified Forest	4°54′N/7°18′W
28	Sangoue Classified Forest	6°12′N/5°28′W
29	Sanaimbo Classified Forest	6°36′N/4°30′W
30	Port Gauthier Classified Forest	5°09′N/5°25′W
31	Tioko (west bank of Boubou river)	5°13′N/5°14′W
32	Assahara-Soungassou northwards (north-east Dimbokro)	6°40′N/4°35′W
33	Fresco	5°04′N/5°34′W
34	Forest at Bandama (Tene Sodefor plantations)	6°32′N/5°28′W
35	Fetekro (District Gagnoa)	7°48′N/4°49′W
36	Vatoua (Cantonnement Danane)	7°04′N/8°06′W
37	Rapide Grah	5°04′N/6°53′W
38	Fresco Kotrohou Village II westwards	5°06′N/5°45′W
39	Bacanou II south-east (near Sikensi)	5°36′N/4°38′W
40	Sebso (Kouakoukro)	7°30′N/4°01′W

were present (Appendix II and III). Whether the Marchesi *et al.* (1995) or the Hoppe-Dominik (1991) estimate is more accurate, both studies suggest that about half of the chimpanzees in Côte d'Ivoire live in poorly or unprotected forests, and this stresses the need to identify and improve the status of these populations.

12.5.2.1 Mont Péko National Park

A recent census carried out by Herbinger and Lia (unpublished reports 2001a) found a significant population of chimpanzees in the Mont Péko National Park. The census in Mont Péko was carried out in April 2001 using four different straight transect lines between 2–4km long, and totaling 12.5km in length. The census suggested a density of 1.6 chimpanzees per km^2 and estimated a total population of around 320 weaned chimpanzees for Mont Péko. This is much higher than the density estimate given by Marchesi *et al.* (1995) for this park of 0.4 chimpanzees per km^2, and a total population of 78 chimpanzees. The classified forest of Haut Sassandra, which is connected through corridors to Mont Péko, might still hold up to 400 chimpanzees (Hoppe-Dominik 1991).

12.5.2.2 Mont Sangbé National Park

Herbinger and Lia (unpublished reports 2001b) also carried out a chimpanzee survey in Mont Sangbé National Park in

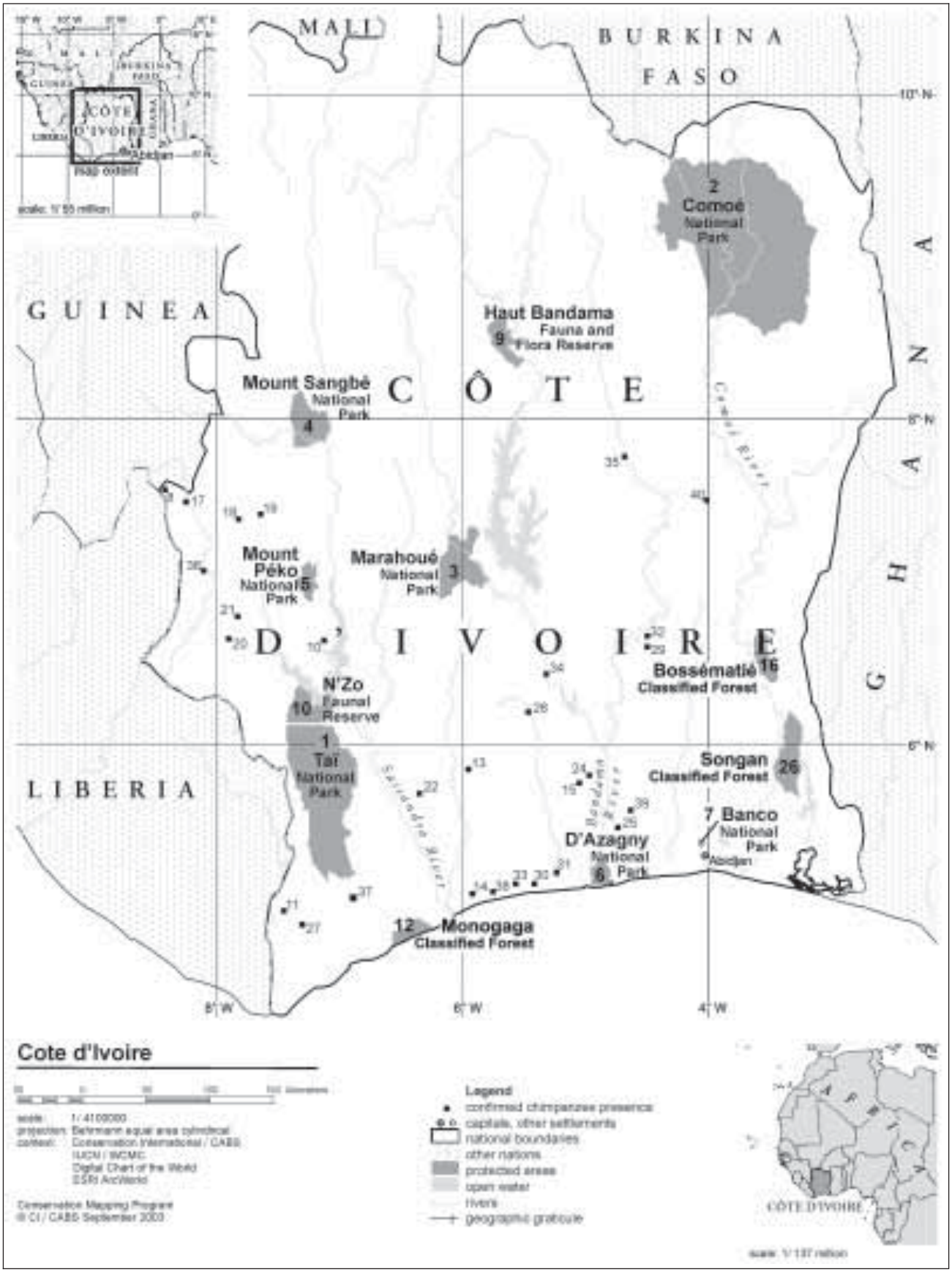

Figure 12.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Côte d'Ivoire, including only direct sightings, audition of vocalizations, observations of nests or shot animals.

May 2001. Five different transect lines between two and 5km were walked, totaling 19.75km in length. Herbinger and Lia (unpublished reports 2001b) found a much higher density estimate for Mont Sangbé of 5.7 chimpanzees per km^2 compared to the 1.64 chimpanzees per km^2 found by Marchesi *et al.* (1995) and a higher overall population of 235–260 chimpanzees in the park than the estimated 55 chimpanzees by Marchesi *et al.* (1995). The very high-density number of 5.7 chimpanzees per km^2 for Mont Sangbé National Park could be due to a concentration of the chimpanzees in the forested parts of the park, that only account for less than 5% of the total area. Also, ageing of nests has not been studied in that zone, and mean nest duration used for calculations might have been underestimated. Nevertheless, during the census Herbinger and Lia (unpublished reports 2001b) heard chimpanzees several times and recorded 31 fresh nests out of 578 from 48 groups of nests.

12.5.2.3 Taï National Park with Reserve N'Zo

Marchesi *et al.* (1995) estimated the total number of chimpanzees in Taï to be 4,507 and 292 individuals in the N'Zo reserve. For the reserve, as well as for the classified forests surrounding Taï National Park (Haute Dodo, Cavally Goin), the status of protection needs to be improved to guarantee the survival of the assumed 1,500 chimpanzees living in these forests. Together with the estimated 4,500 chimpanzees in the Park, this population holds about 6,000 chimpanzees.

12.5.3 Marahoué National Park

Marchesi *et al.* (1995) found the highest density of chimpanzees in Côte d'Ivoire to be in the Marahoué National Park (6.39 chimpanzees per km^2 and 1,407 individuals). During a rapid assessment survey in 1998, however, the evidence confirming the presence of chimpanzees included one nest, no sightings and four auditions, which suggests that the population has declined greatly (Schulenberg *et al.* 1999).

12.5.4 Comoé National Park

Marchesi *et al.* (1995) estimated the total number of chimpanzees in this park to be 470 individuals, which is the highest number of chimpanzees in the Soudanian Belt in Côte d'Ivoire. New censuses are planned in the near future. Fischer and Gross (1999) have most recently confirmed the presence of chimpanzees in Côte d'Ivoire.

12.5.5 Banco National Park

Marchesi *et al.* (1995) presumed that chimpanzees have disappeared from Banco National Park but recent observations by Joulian Fréderic and personal communications with park rangers confirmed their presence in this park.

12.5.6 D'Azagny National Park

Marchesi *et al.* (1995) estimated the total number of chimpanzees in this park to be 57. The presence of chimpanzees in D'Azagny National Park today is questionable, and a survey is needed to confirm whether this park still holds a population (Boesch sighted chimpanzees in 1988).

12.5.7 Nature Reserve Mount Nimba

Marchesi *et al.* (1995) estimated the total number of chimpanzees in this reserve on the Côte d'Ivoire side to be 59 individuals. The Mont Nimba reserve straddles three countries (Côte d'Ivoire, Liberia, Guinea), and together with the connected classified forest of Tiapleu in Côte d'Ivoire, it is estimated to contain over 300 chimpanzees.

12.5.8 Haut Bandama

Marchesi *et al.* (1995) estimated the total number of chimpanzees in this reserve to be 300 individuals.

12.5.9 The classified forest of Monogaga

The classified forest of Monogaga might still hold a chimpanzee population of over 100 individuals (Hoppe-Dominik 1991, Marchesi *et al.* 1995).

12.5.10 Classified forests of Bossématié and the nearby Songan-Tamin-Mabi-Yaya Complex

Chimpanzees in the Songan Complex have been estimated to number around 500 individuals (Hoppe-Dominik 1991), but currently they are highly threatened by hunting. The isolated but nearby classified forest of Bossématié presumably still holds around 100 individuals (Marchesi *et al.* 1995).

12.5.11 Haute Dodo classified forest

The Haute Dodo classified forest probably still holds a significant population of chimpanzees (around 500 individuals, Hoppe-Dominik 1991), but at present we lack information of its status.

12.5.12 Mount Kopé

Marchesi *et al.* (1995) found a density of 1.67 chimpanzees per km^2 in this forest.

12.5.13 Other areas

Other classified forests that presumably still hold significant populations of chimpanzees are Rapide Grah classified forest in connection with Haute Dodo and the Cavally-Goin classified forest north-west of Taï National Park, and the Niegré and the Scio classified forests.

12.6 Threats to chimpanzees

12.6.1 Habitat destruction

The southern half of Côte d'Ivoire was once covered by equatorial rain forest (160,000km^2, Lanly 1969). However, strong economic growth based mostly on agriculture, combined with a government policy of active immigration from the northern countries, led to one of the highest deforestation rates worldwide. Between the years 1956 and 1966, 28,000km^2 of dense forest, or 30% of the area covered by forest in 1956 (98,000km^2), were cleared by cultivation. Forest was disappearing at an annual rate of 10km^2 in 1956. By 1966, the annual deforestation rate was 5,000km^2 per year (Lanly 1969). Deforestation continued at this high annual rate until the 1980s. Today, 90% of the dense forest in Côte d'Ivoire has vanished (FAO/Banque Mondiale 1988).

12.6.2 Hunting

Although it is forbidden to kill, consume or trade wild animals in Côte d'Ivoire, a study by Caspary *et al.* (2001) showed that 35.5 million wild animals, weighing 120,000 tons and worth 76.8 billion FCFA, were killed in 1996 by hunters. Their study estimated that each inhabitant of Côte d'Ivoire consumes daily about 22g of meat. Over half of the hunted species were those listed under Appendix I of the Convention on International Trade of Endangered Species. They found that chimpanzees made up about 3% of the species sold in urban markets and served in village restaurants (Caspary *et al.* 2001). Chimpanzees are also hunted because they raid crops and to a lesser extent for medicine and the trade of orphans. During his study, Hoppe Dominick (1991) found that villagers reported damage to their farms in 26.6% of all interviews. Damage was reported primarily to cocoa plantations (35.5% of all cases) and banana plantations (25% of all cases).

12.6.3 Disease

Chimpanzees in Côte d'Ivoire are threatened by diseases of zoonotic or natural origin (e.g., Ebola, Monkeypox), as well as by diseases introduced to the wild population through interactions between chimpanzees and humans, e.g., while crop raiding and through hunters, researchers or tourists. In 1994 chimpanzees in Taï National Park suffered from an infection of a new subtype of Ebola virus, whereby 25% of a community under study died (Formenty *et al.* 1999a, b; Boesch and Boesch-Achermann 2000b). In 1999, an epidemic of acute respiratory disease reduced the community further by 25% (see Formenty *et al.* 2003, Chapter 23 for details). Currently, a veterinarian is carrying out a Ph.D. thesis in Taï National Park to find out more about the ways and sources of infections and how to prevent them in the future.

12.7 Priority sites for chimpanzee conservation

12.7.1 Mont Péko and the classified forest of Haut Sassandra

Mont Péko National Park and the nearby classified forest of Haute Sassandra hold together an important number of chimpanzees (around 700). Both forests are connected by two corridors (G. Rondeau, pers. comm.). Protection and enlargement of these corridors should be of high priority for conservation actions. Moreover, a survey for the population still living in Haute Sassandra classified forest is urgently needed.

12.7.2 Mont Sangbé National Park

Mont Sangbé National Park has high biodiversity as a result of being situated between the Guinean and Soudanian Belt. To protect the chimpanzee population of Mont Sangbé, improved efforts of surveillance, especially in the southern region of the park, must be undertaken. The northern part already shows a much lower density of chimpanzees, which in part can be attributed to the nature of the forest but also to the presence of some villages and camps within the national park. Habituation of a chimpanzee community for ecotourism is also a possibility in this area. Visibility in the forest can reach up to 50m (in comparison to 20m in Taï), and this could facilitate first the habituation process and later the observation of chimpanzees by tourists. A feasibility study to develop ecotourism in this park should be of high priority, as well as a survey of the chimpanzee population covering areas that have not yet been surveyed.

12.7.3 Taï National Park and Reserve N'Zo together with adjacent classified forests of Haute Dodo, Cavally Goin and Rapide Grah

Taï National Park and Reserve N'Zo hold nearly half of the total population of chimpanzees in Côte d'Ivoire. Taï chimpanzees are recognized internationally due to the published results of over 20 years of research on this population and the new insights into the behavior of the species that they have provided. Moreover, the habitat in Taï National Park and Reserve N'Zo is intact and well preserved and represents, together with the classified forests of Haute Dodo, Cavally Goin and Rapide Grah and the adjacent forest in Liberia, the largest forest bloc in the Guinean belt. The forests of Haute Dodo and Cavally Goin seem relatively intact, whereas the forest of Rapide Grah is much more disturbed.

A survey of the current population and an inventory of the habitat is of high priority to be able to monitor changes in chimpanzee populations over time. Another high conservation priority is to increase the protected area status of the N'Zo Fauna Reserve and the classified forests Cavally-Goin and Haute Dodo and create corridors linking chimpanzee populations in Côte d'Ivoire to populations in Liberia. It will also be important to better understand the threat of bushmeat, and therefore a bushmeat survey should be conducted which will give information on wildlife offtake in this area. In order to increase value of chimpanzees to local people and provide alternative income, chimpanzee-related tourism in Taï National Park should be promoted, as well as education and awareness campaigns.

12.7.4 Marahoué National Park

Marahoué National Park is currently threatened by agricultural activities as well as a high hunting pressure carried out by the adjacent local population. An improvement in law enforcement is necessary to save the habitat as well as the fauna. A survey to estimate the current population of chimpanzees should be of high priority in order to determine the decline. Park guards and national researchers should be trained in survey techniques and in the establishment of a system for long-term monitoring of primates within the park.

12.7.5 Comoé National Park and the biodiversity zone of GEPRENAF (West African Pilot Community-based Natural Resources and Wildlife Management Program)

Chimpanzees in Comoé are currently threatened by a high hunting pressure. Conservation actions should aim at increasing the status of the biodiversity zone GEPRENAF, conducting a survey of the population and developing anti-poaching mechanisms.

12.7.6 Banco National Park

Banco National Park presumably holds a very small number of chimpanzees but because of its uniqueness of being situated in the center of a city of 3,000,000 people, the presence of chimpanzees offers an enormous potential for awareness and education programs. Furthermore, a survey is urgently needed to estimate the number of chimpanzees that are currently present. New surveys are planned here in the near future.

12.7.7 D'Azagny National Park

The presence of chimpanzees in D'Azagny National Park is currently questionable. A survey to determine whether the park still holds a population should be of high priority.

12.7.8 Mont Nimba Reserve and the classified forest of Tiapleu

Mont Nimba Reserve has a high biodiversity in flora and fauna, an intact forest and is connected to the well studied chimpanzee population of Bossou in Guinea. Efforts are underway to improve the forest corridor between the chimpanzees in Bossou and the population in Mont Nimba. A survey of the total population in Mont Nimba Reserve as well as an improved protection status of the classified forest of Tiapleu should be considered as high priority actions.

12.7.9 The classified forest of Monogaga

Because of its already well established infrastructure as one of the nicest beach resorts in Côte d'Ivoire and its closeness to San Pedro, a feasibility study to develop ecotourism including a visit to habituated chimpanzees should be undertaken in the classified forest of Monogaga.

12.7.10 The classified forests of Bossématié and the nearby Songan-Tamin-Mabi-Yaya complex

The Songan complex represents the largest and best preserved forests in the east of Côte d'Ivoire. Actions of high priority should be aimed at improving the protection of wildlife in this forest, specifically chimpanzees. A survey should be conducted of the chimpanzee populations here and studies undertaken to find out if it would be feasible to create a corridor that connects Bossématié and the nearby Songan-Tamin-Mabi-Yaya complex.

12.8 Priority actions for chimpanzee conservation

12.8.1 Nationwide census

A nationwide census should be conducted again in order to update the information from Marchesi *et al.* (1995) and determine the rate of decline of chimpanzees in Côte d'Ivoire. This survey should focus on priority sites and larger classified forests and assess the status of potentially important chimpanzee habitats (e.g., the classified forest of Niegré). During the survey, an impact study should also be conducted in order to identify threats and appropriate conservation actions.

12.8.2 New legislation

The status of complete protection for chimpanzees should be assured in the National Protected Area Management Program, which will be implemented in the next twelve years.

12.8.3 Improved protected areas network in Côte d'Ivoire

The protected areas network in Côte d'Ivoire should be improved by both reinforcing the infrastructure and effectiveness of national parks and improving the protection status of reserves and classified forests (e.g., N'Zo, Haute Dodo, Cavally Goin, Haut Sassandra, Songan Complex, Monogaga). Training of park personnel (management, researchers, forest agents) on conservation issues would also help to reinforce the strength of protected areas.

12.8.4 Education and awareness-raising campaigns

Education and awareness-raising campaigns in rural and urban areas are needed to relate to the conservation of chimpanzees (interactive theater, discussion rounds, films, newsletters, seminars, campaign inclusion in school curriculae). Local taboos to kill or consume chimpanzees exist throughout the country. They mostly consider the similarity between humans and chimpanzees and could be used to promote the conservation of this species. Regular visits of school classes to protected areas could serve to raise awareness about nature early on. In Abidjan, Banco National Park should play a crucial role in education programs.

12.8.5 Corridor creation, maintenance, and improvement between fragmented habitats that hold isolated populations of chimpanzees

Corridors should be created and improved between isolated small populations in order to provide chimpanzees with the possibility of genetic exchange, which they need for long term survival. Smaller chimpanzee populations like, for example, those in the Haut Sassandra or Bossématié classified forests might only be viable when connected to a larger population living nearby.

12.8.6 Ecotourism development

Rich cultural diversity combined with high biological diversity could potentially attract a sufficient number of tourists to Côte d'Ivoire. The habituation of chimpanzees in sites like Taï National Park, (where one project is already ongoing), Mont Sangbé National Park or the classified forest of Monogaga, offers a good potential for ecotourism. Local as well as foreign tourists could experience chimpanzees in their natural habitat, thereby raising awareness of the uniqueness of this species. Moreover, ecotourism allows for employment, income and involvement of the local community through nature conservation. Therefore it may be more readily accepted than a solely ''protectionist'' approach. However, a habituation program needs to be accompanied by a health-monitoring program for the chimpanzees to prevent disease transmission between humans and chimpanzees.

12.9 Conclusions

Besides Guinea, Côte d'Ivoire appears to be the only country within West Africa that might support a chimpanzee population greater than 10,000 individuals. However, most populations exist in isolation, and half of the total population lives in unprotected areas. Improving the protected areas network, connecting fragmented habitats and raising awareness for the plight of chimpanzees will be necessary to ensure the long-term survival of this viable population. Immense habitat destruction and high hunting pressure have already reduced the chimpanzee population enormously in the recent past, and immediate conservation actions are needed to stop further decline. Since September 2002 Côte d'Ivoire has suffered from civil war, leaving hundreds of people dead and hundreds of thousands displaced. Together with the humanitarian crises, nature conservation has suffered likewise. National parks and classified forests are left uncontrolled, and illegal hunting in protected and unprotected areas is increasing to alarming levels. The chimpanzee population is very likely suffering from a strong increase in threats that contribute to their decline, and efforts to protect fauna and flora are needed in parallel with efforts to help the human population to rebuild peace.

Acknowledgements

We thank all the governmental and non-governmental organizations and institutions and individual local and foreign people involved in nature conservation in Côte d'Ivoire for their efforts to protect fauna and flora, and more particularly the chimpanzees. We also thank all individuals, researchers and institutions that have contributed to the findings presented here.

Chapter 13

Ghana

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13.1 Introduction

The distribution of chimpanzees in Ghana is limited to the high forest zone in the south-west of the country and probably to only a few forests. In 1989, Teleki estimated the number of chimpanzees in Ghana to be between 300 and 500 (Teleki 1989). This means that Ghana is second only to Senegal as the country with fewest chimpanzees left in West Africa. Due to a large bushmeat trade and extremely fragmented forests, chimpanzees risk being extirpated from this country unless urgent action is taken. There are presently only two protected areas (IUCN category I–IV) in Ghana where chimpanzees may still occur; Bia National Park of 78km^2 and Nini-Suhien National Park of 160km^2. There are also other areas where chimpanzees are believed to occur, including Ankasa Resource Reserve of 343km^2 and Krokosua Hills Forest Reserve of 295km^2. They may also be present in Dadieso Forest Reserve of 165km^2 and Yoyo Forest Reserve of 235km^2.

13.2 Country profile

13.2.1 Geography

Located at 8°00′N, 2°00′W and bordered by Burkina Faso, Côte d'Ivoire and Togo, Ghana is 239,460km^2. Ghana is made up mostly of low plains but is dissected by a plateau in the south-central area. The entire south-western portion of Ghana is covered in rain forest that becomes progressively drier in the northern part of the country. This gives way to savanna bush in the northern Brong-Ahafo region. The highest point is Mount Afadjato of 880m. The eastern Volta region is dominated by the Volta basin and the man-made Lake Volta that covers roughly one third of the country. This area is far more mountainous than any other region in Ghana.

13.2.2 Climate

Along the south-west coast, Ghana's climate is tropical and warm. It is comparatively dry along the south-east coast, hot and humid in the south-west and hot and dry in the north. In the areas where chimpanzees are found, two rainy seasons occur, from May to July and from September to October. Annual rainfall ranges from about 750mm in the dry northern forests to about 1,750mm in the wet southern forests (Hall and Swaine 1981). Temperatures in the forest zone range from 19°C in the coldest month (August) to 33°C in the hottest months (February and March, Hall and Swaine 1981).

13.2.3 Habitat

Ghana's total forest zone is estimated to be about 81,342km^2, though it has lost over 80% of its forested land in the last century (Cleaver 1992). The high forest zone in Ghana is divided into several forest types. Forest areas most likely to harbor chimpanzee populations fall under the Moist Semi-Deciduous and Wet Evergreen forest types. They may also occur in Moist Evergreen and Dry Semi-Deciduous forests, but this has not been confirmed. Moist semi-deciduous forests are characterized by *Triplochiton scleroxylon, Celtis* spp., and *Sterculia rhinopetala* and have the tallest trees of all forest types (Hall and Swaine 1981). Wet evergreen forests are characterized by *Lopheria, Heriteria* and *Cynometra* species (Hall and Swaine 1981).

Riverain woodland is found along the rivers in the northern area and contains *Anogeissus schimperi*, *Celtis integrifolia*, *Cola laurifolia*, *Cynometra vogelii*, *Lannea* spp. and *Parinari polyandra.* Throughout the Guinea savanna woodland *Anogeissus schiemperi*, *Vitellaria paradoxa*, *Detarium senegalense* and *Parkia filicoidea. Daniellia oliveri* are common. The Acacia species are more frequent in the north than in the south and *Combretum* spp. and *Terminalia* spp. are numerous. On worked land, the vegetation consists of short shrub growth of *Bauhinia rufescens*, *Combretum* spp. and *Piliostigma thonningii*, and fires and grazing tend to restrict their height growth. The Sudan savanna woodland is restricted to a small area in the extreme north-east of the country. It has the highest density of rural population, which has resulted in settled farming. This zone has very sparse tree cover.

13.2.4 People

The population of Ghana is 20,244,154 with a growth rate of roughly 1.7% (CIA World Factbook 2002). There are many different ethnic groups in Ghana speaking over 50 different

languages and dialects. The largest tribes are the Akan or ''Ashanti'' (44%), Moshi-Dagomba (16%), Ewe (13%), Ga (8%), Gurma (3%), and Yoruba (1%).

13.2.5 Political context

In 1957, Ghana became the first country in colonial Africa to gain its independence. Several coups, however, ended in the suspension of the constitution in 1981 and banning of political parties. Finally in 1992 a new constitution, restoring multiparty politics, was approved. Lt. Jerry Rawlings, head of state since 1981, won presidential elections in 1992 and 1996. Fighting between the Konkomba and Nanumba tribal ethnic groups in the northern region of Ghana resulted in the killing of at least 1,000 persons and the displacement of more than 150,000. Jerry Rawlings was succeeded by John Kufuor.

13.2.6 Economy

Ghana is well endowed with natural resources, and has roughly twice the per capita income of the poorer countries in West Africa. Ghana, however, still remains heavily dependent on international financial and technical assistance. Major sources of foreign exchange include gold, timber, and cocoa production. GDP is estimated to be 265 US$ per capita, and 31.4% of the population lives below the poverty line (CIA World Factbook 2002).

13.3 Legislation and conservation policies

The mission of the Wildlife Division of Ghana is to work efficiently with others to ensure sustainable management and development of Ghana's wildlife and habitats in order to, ''optimize their contributions to national socioeconomic development.'' This mission immediately indicates the significance of wildlife for commercial use in Ghana. The cultural significance and economic benefits of bushmeat in Ghana is staggering and has certainly taken its toll on forest wildlife, including chimpanzees. It is estimated that 90% of Ghana's population eats bushmeat when available (Ntiamoa-Baidu 1997). Hence the importance of wildlife laws for the sustainable use of wildlife in the future.

In 1961 Ghana adopted the Wild Animals Preservation Act (Act 43) that regulated export and hunting of ''wild animals, birds and fish'' in Ghana. This law listed Chimpanzees in the Schedule I list of wholly protected species. This was later strengthened by the list of Wildlife Conservation Regulations introduced in 1971. Thus it became illegal to ''hunt, possess or destroy'' chimpanzees or their young at any time, under any circumstances without proper authority from the governing Wildlife Division (then the Wildlife Department). Ghana became a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1976. It was the second country in Africa to do so, following Nigeria.

In 1999 and 2000, wildlife management in Ghana shifted slightly as the once independent Wildlife Department, was re-classified as a division of the Forestry Commission. Some resulting changes to date include employment of Forestry Division staff at Wildlife Division parks (but not the reverse) and a relaxation of the laws regarding snail collection in some forest areas. The latter in particular has already had seriously negative effects on wildlife as snail collecting is often the gateway through which many people gain access to forest areas for hunting, albeit illegally. Without increased funds for staff salary and training, these problems will only escalate.

Though wholly protected in theory, laws protecting chimpanzees are not often enforced due to inadequate staffing and poorly trained workers in many areas. Parks controlled by the Forestry Division often have so few staff that they have trouble maintaining boundary lines let alone patrolling for poaching activities. These areas are completely unprotected. Forest areas controlled by the Wildlife Division enjoy slightly more protection but often are not adequately patrolled, having only minimal effect at reducing hunting activities. Patrol efforts are also not well standardized or regulated and are often inefficient due to the use of wide patrol trails that are easily recognized (and subsequently avoided) by poachers. It has been observed in many forest areas that hunting pressure increases dramatically within a few meters of a standard patrol trail (Magnuson 2002).

13.4 Past research and conservation efforts

In recent years, very little attention has been paid to chimpanzees in Ghana. A preliminary survey and study of the ecology of chimpanzees was carried out by Martin (1991) in the Bia and Ankasa conservation areas. In 1994, Martin also initiated a rehabilitation project in Bia National Park. Animals that were held in captivity were returned to the wild. Unfortunately, it is believed that most of these animals have now been killed by poachers (see Chapter 23). Recent primate surveys conducted by Magnuson (2002), although not specifically focusing on chimpanzees, provide the most up-to-date information available on their current distribution.

13.5 Chimpanzee distribution and numbers

13.5.1 Chimpanzee distribution

Chimpanzees are confined mainly to the high forest zone of south-western Ghana, comprised of the Western, Ashanti, Central and Brong-Ahafo regions. In 1989, Teleki (1989) was not able to confirm the presence of chimpanzees throughout Ghana, except along the Côte d'Ivoire border, citing Booth (1956) Jeffrey (1970, 1974) and Asibey (1978). In 1995 chimpanzees were confirmed to still be present in the Bia/Goaso, Ankasa/Tano and Fure river forest regions of western Ghana. Magnuson (2002) conducted primate surveys in nine forest areas throughout south-western Ghana. Over 100 interviews were also conducted with hunters, bushmeat traders, Wildlife Division staff and ''chop-bar'' restaurant owners. Field surveys detected chimpanzees in the Ankasa Resource Reserve, which followed three reports of chimp observations in this park. Abedi-Lartey and Amponsah (1999) were also able to confirm chimpanzee presence in the Krokosua Hills Forest Reserve. Chimps were not detected in the remaining seven forest areas (including Nini-Suhien, Kakum, Yoyo, Dadieso, Cape 3 Points and Draw River) though hunters indicated that they might still occur in several of these parks (Table 13.1, Figure 13.1).

13.5.2 Chimpanzee numbers

No estimate of chimpanzee numbers in Ghana exists since Teleki's (1989) estimate of between 300–500 chimpanzees. Given the lack of recent evidence for their continued presence, it is possible that this species is nearing extirpation in this country. Based on interviews with villagers and Wildlife Division staff, the chimpanzee was considered the most rare primate in Ghana (apart from the possibly Extinct Miss Waldron's red colobus monkey). Except in Ankasa and Krokosua, no interviewees reported having seen chimps in the last five, or in many cases, ten years. Currently there are four chimpanzees in captivity in the two national zoos.

Table 13.1. Confirmed presence of chimpanzees *Pan troglodytes verus* in Ghana.

#	Protected Area
1	Bia National Park
2	Ankasa Resource Reserve
3	Krokusua Hills Forest Reserve
4	Nini-Suhien National Park (POSSIBLE)
5	Dadieso Forest Reserve (POSSIBLE)
6	Yoyo Forest Reserve (POSSIBLE)

13.6 Threats to chimpanzees

13.6.1 Habitat destruction

Three of the major reasons for the destruction of chimpanzee habitat in Ghana are road construction (Curry-Lindahl 1969; Jeffrey 1970), farming and agriculture (Jeffery 1970) and timber extraction practices (Johns and Skorupa 1987).

Most farms in Ghana are based on the bush fallow system in which cropping and fallow periods are alternated. The fallow periods have been drastically reduced to between two and four years This is exacerbated by human migrations to the more productive forest areas (Oates 1999) and a dramatic decline in soil fertility of agricultural lands. Therefore, pressure from demand for productive lands to cultivate cocoa, oil palm and other cash crops has resulted in major encroachments on protected areas.

13.6.2 Hunting

Hunting remains one of the most significant threats to wildlife in Ghana (Mittermeier 1987; Wildlife Department 1998). Currently in Ghana the bushmeat trade is an industry worth $350 million in Ghana and an estimated 385,000 tons of bushmeat are harvested every year (Wildlife Department 1998). Primates, however, are not the most sought after animal. In fact, the grasscutter *Thryonomys swinderianus* remains the most preferred bushmeat (65.1%) of the animals listed in terms of volume of trade and preference (Ntiamoah-Baidu 1997). However, as discussed in Chapter 22, even very small amounts of hunting can have devastating effects on chimpanzee populations. The increasing pet trade is also believed to have a significant draining effect on remaining wild populations of chimpanzees in Ghana (Mittermeier 1987).

13.7 Priority sites for chimpanzee conservation

The area of chimpanzee habitat in south-west Ghana includes a large number of forest reserves. Several are fairly intact structurally (Nini-Suhien National Park, Bia National Park, Dadieso Forest Reserve, Yoyo Forest Reserve), but provide little or no protection against hunting pressures. As-

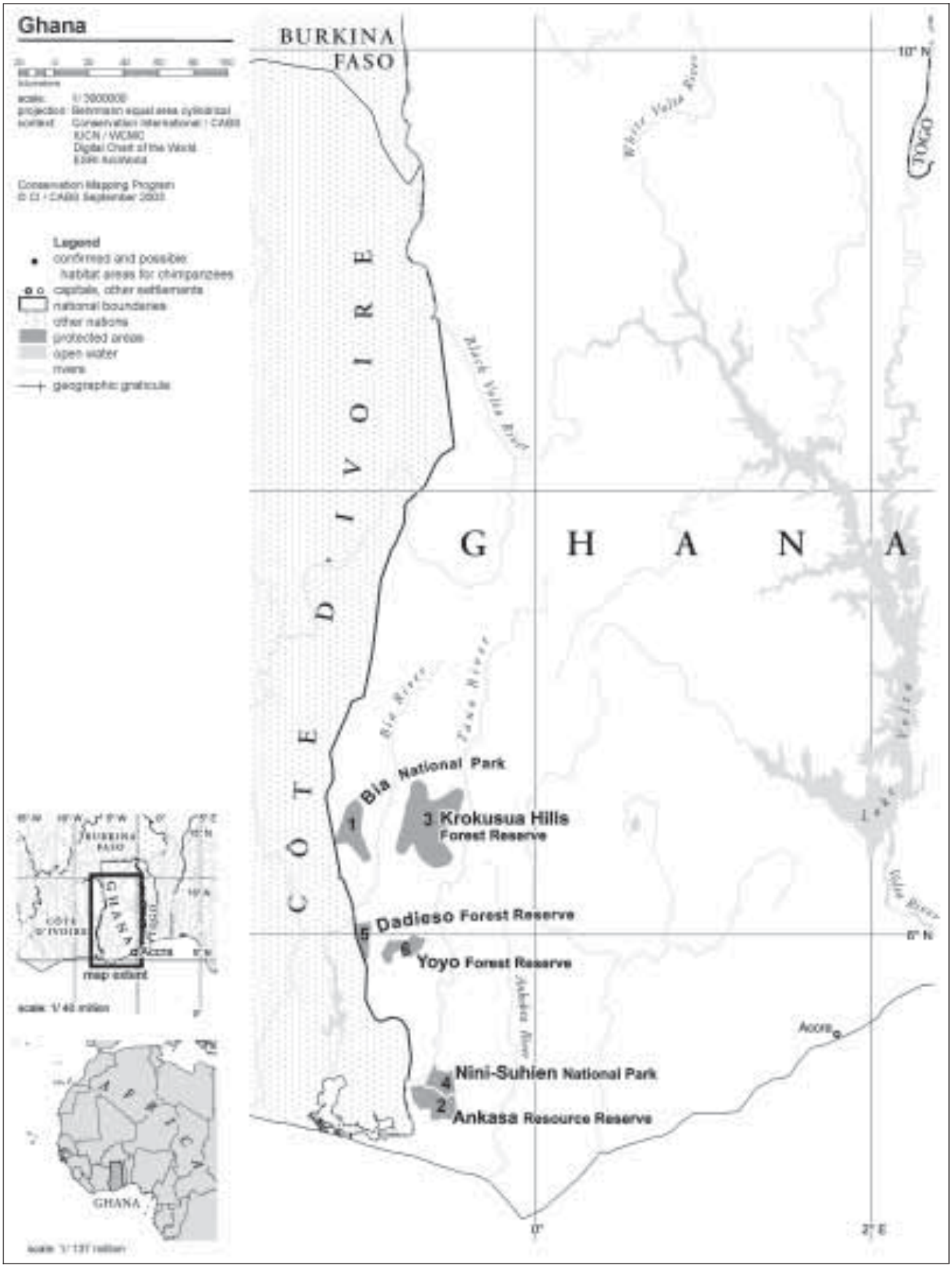


Figure 13.1. Confirmed and possible habitat areas for chimpanzees *Pan troglodytes verus* presence in Ghana.

suming infrastructure improvements can reduce the present levels of hunting in these reserves, it is possible that chimpanzee populations may rebound in some areas.

13.7.1 Ankasa-Tano

This area includes Ankasa Resource Reserve and adjoining Nini-Suhien National Park as well as the Globally Significant Biodiversity Areas of Draw River and Boin Tano. Ankasa, in particular, offers the best wildlife protection of all forest areas visited by Magnuson (2002) and likely harbors a small but relatively stable chimpanzee population, as staff report seeing this animal far more often in recent years, and sightings have never decreased (L. Magnuson, pers. obs.). L. Magnuson (pers. obs.) detected chimpanzees early 2003 at Ankasa following three observations in different areas of the park by wildlife staff in the past six months. Two persons reported observing juveniles in groups in Ankasa during 2002. Ankasa is of particular interest, as it is the most diverse of the forest areas in Ghana, and, due to its dramatic topography and stands of marshland, it is difficult to penetrate in some areas. This is rumored to discourage poaching and Wildlife Division patrols in such marshy areas report very low levels of human disturbance.

Draw River, though having some tracts of intact forest, was illegally logged in 2001, and hunting pressure observed there was second only to that observed in Dadieso (Magnuson 2002). However, like Dadieso, assuming the hunting pressure is reduced, this park may provide suitable habitat for chimpanzees. In addition, a small section of Draw River borders Ankasa Resource Reserve just below the Nini-Suhien National Park and therefore comprises a large section of this forest block.

Nini-Suhien, though a national park, is almost completely unprotected from poaching activities. Though structurally pristine, this forest area was virtually devoid of all large mammals when surveyed in 2001 (Magnuson 2002). The level of hunting in this reserve is very high and is also heavily poached for building materials and other non-timber forest products such as medicines and chewing sticks. There are plans to build a ranger camp in this park, though recent interviews indicated that most staff have rarely if ever visited this park despite its relative proximity to the main ranger camp (5km).

13.7.2 Bia-Goaso

This national priority area for chimpanzees includes the National Park of Bia, the Globally Significant Biodiversity Area of Krokosua and the forest reserves of Bia-North, Ayum, Bonsambpo, Bia-Tano, Mpameso and Bonkoni. Bia National Park has historically been viewed as a prime area for chimpanzee research and conservation. However, though this park has more field staff than the much larger Ankasa Resource Reserve, the area has been heavily hunted in recent years, making observation of large mammals difficult. This seems to have stemmed partly from miscommunication between the administration and staff, but is also likely due to a lack of motivation on both sides. Interviews in surrounding communities indicated that primates are among the most often killed animals, but that chimpanzees were one of the rarest primates in the forest (second to Miss Waldron's red colobus). Many hunters had not seen chimpanzees in over five years. The national park itself is quite small (78km^2) but is bordered in the south by the Bia Resource Reserve. This area, though recently logged, in combination with the national park, comprises a significant area of Moist Semi-Deciduous forest, and, if better protected, it is likely that any remaining population of chimpanzees would rebound in time.

Krokosua Hills Forest Reserve (north) is comprised mainly of old secondary forest, but large tracts of pristine forest remain (particularly in the north-west of the reserve). Similar to parts of Ankasa, the topography of Krokosua is extremely dramatic, and it seems poaching activities do not extend far beyond the well-worn trails already in existence. However, the hunters will undoubtedly adapt their behavior to any increase in protection and penetrate these hilly areas as well. This park is probably second to Ankasa as the best area to conduct research and promote conservation of chimpanzees in Ghana. Though this forest is extremely heavily hunted, the human population surrounding (and within) the park boundaries is relatively low in some places, and reports of chimpanzees were more frequent than any other area in Ghana (Magnuson 2002). Assuming Wildlife Division staff could be placed permanently at this park to reduce hunting pressure (ideally, local hunters could be hired as staff), this large forest reserve may provide the best chance of supporting a large chimpanzee population in Ghana.

13.7.3 Dadieso-Yoyo

Within the belt of forest near the Côte d'Ivoire border, Dadieso is notable for its entirely intact structure. Dadieso has never been logged and, as it has recently been declared a Globally Significant Biodiversity Area, will be completely protected from logging in the future. However, there is no Wildlife Division presence in this area, and it was by far the most heavily hunted reserve visited (Magnuson 2002). Most hunters interviewed indicated that they could recognize chimpanzees but had either never seen one or had not seen them in over ten years (Magnuson 2002). The Critically Endangered White-naped mangabey *Cercocebus atys lunulatus* was detected in this reserve in 2001, an encouraging sign for the primate population there. Though it would take a great deal of effort, this park would provide ideal habitat for chimpanzees.

Perhaps a more realistic candidate for sustainable chimpanzee habitat is Yoyo Forest Reserve, located just east of Dadieso. Evidence there shows far less hunting than most other forests visited despite a lack of protection there (Magnuson 2002). L. Magnuson (pers. obs.) found that hunters were often unfamiliar with the forest immediately bordering their farmland, and few trails existed over 1km inside the forest. However, in 2001 most of the reserve was slated to be logged, which will likely increase hunting activity due to road building and increased accessibility to the park. A small 50km^2 section of Yoyo has been declared a Globally Significant Biodiversity Area and will be theoretically protected from logging in the future.

13.8 Priority actions for chimpanzee conservation

13.8.1 Surveys

There is the need to estimate chimpanzee numbers and distribution in the Ankasa Conservation Area (comprised of Ankasa Resource Reserve and Nini-Suhien National Park) and the Krokosua Hills Forest Reserve. Due to the extremely small population of chimpanzees in Ghana, efforts in these two parks will provide the most information for further research. Additional surveys in Yoyo Forest Reserve, Bia National Park and Dadieso Forest Reserves will also greatly increase our understanding of chimpanzee distribution in Ghana. The results of these surveys should be used to develop a five-year conservation program for the chimpanzee populations in Ghana.

13.8.2 Mapping of habitat

All chimpanzee habitats should be mapped and added to a GIS database. This information could form the basis for an ecological monitoring program for chimpanzees and other wildlife.

13.8.3 Improved management of protected areas

Training for protected area staff is crucial for strengthening monitoring. Brief interviews with Wildlife Division staff indicated that some couldn't visually distinguish a chimpanzee from other forest primates in Ghana using pictures (L. Magnuson, pers. obs.). Though training sessions are being planned for Ankasa Resource Reserve staff, additional training should be offered to Wildlife Division staff in all parks believed to harbor chimpanzee populations. This training should teach staff to identify chimpanzees by sight and to recognize their calls and the signs of their existence (i.e., nests). Anti-poaching patrol teams could then better document any indication of chimpanzee activity in these parks.

In the case of reserves controlled by the Forestry Division, management action will be far more difficult. However, as the Wildlife Division is now part of the Forestry Commission, one of two things can be done to encourage wildlife conservation in these areas. Either Forestry Division staff could be trained to identify chimpanzees and asked to periodically patrol the forest area, or Wildlife Division staff could be sent to periodically monitor forest reserves. The latter option, though less feasible, would be most effective at documenting the presence of chimpanzees in these areas.

13.8.4 Trans-border conservation measures

The chimpanzee range in West Africa is continuous over many countries. Effectively addressing threats to the long-term viability of chimpanzee populations in the wild will require the joint commitment and effort of countries that contain portions of the chimpanzee range. A trans-border conservation approach among range states of chimpanzees would allow for conservation practices that supercede political boundaries and enable us to harmonize management and land use practices, thus providing mutually beneficial and ecologically sustainable management of shared natural resources.

13.9 Conclusions

Although existing forests in chimpanzee habitat in Ghana are heavily fragmented, this country represents a tremendous opportunity for species conservation due to the existence of a relatively high capacity for conservation and the lack of civil conflict. However, the shift from traditional hunting practices to commercial bushmeat trade throughout Ghana and the continued encroachment of human populations into forested areas significantly threaten the very small remaining population of chimpanzees.

Continuing political stability in this area has allowed the rise of established institutions staffed with environmental professionals. National Environmental Processes exist in both Ghana and Côte d'Ivoire, which have led to the establishment of Globally Significant Biodiversity Areas and classified forests, respectively. However, such protection has not been sufficient to curb the threats to identified biodiversity priorities. It is necessary for conservationists to work with the national government of Ghana to upgrade the status of some of these forests in order to better mitigate these threats.

Chapter 14

Togo

Aaron Brownell

14.1 Introduction

Although chimpanzees were recorded in Togo as recently as 1971 (Harrison 1971; Lee *et al.* 1988), they are considered extirpated in this country today (Lee *et al.* 1988). Habitat loss and hunting are considered to have been the cause of their demise (Oates 1996a).

14.2 Country profile

14.2.1 Geography

The surface area of Togo is 56,785km^2. At 8°00′N, 1°10′E, Togo is located between Ghana, Benin and Burkina Faso. The terrain consists of gently rolling savanna in the north, central hills, southern plateau and a low coastal plain with extensive lagoons and marshes. The highest point is Mont Agou at 986m (CIA World Factbook 2002).

14.2.2 Climate

Mean temperatures in January are 26.8°C and 25°C in July. Annual rainfall is approximately 889mm. Total rainfall varies relatively little throughout the zone.

14.2.3 Habitat

Togo is relatively sparcely forested with around 23% forest cover with an additional 59% of other wooded land. The majority of the forest and woodland is savanna, which extends from the Guinean into the Sudanian vegetative zone. In the plateau region, a dense savanna is characterized by species such as *Daniellia oliveri* and *Butyrospermum paradoxum.* Further to the north, Sudanian-type species are more common, such as *Khaya senegalensis* and *Prosopis africana* and the Black rhun palm *Borassus aethiopium.* Closed forests in Togo are mainly semi-deciduous montane forests in the Akwapim Togo ranges, with *Antiaris africana* and *Chlorophora excelsa* as the common species.

14.2.4 People

The country's population was estimated at 5,285,501 and is growing at an annual rate of 2.48% (CIA World Factbook 2002). There are 37 ethnic groups in Togo, and the Ewe, Mina and Kabre are the most prominent.

14.2.5 Political context

Togo gained independence from France in 1960. General Gnassingbe Eyadema became the military ruler in 1967 and is Africa's longest-serving head of state. Togo has come under criticism from international organizations for human rights abuses. This combined with continued political unrest has resulted in very little bilateral and multilateral aid to this country.

14.2.6 Economy

Togo is extremely dependent on both commercial and subsistence agriculture, which provides employment for 65% of the labor force. Cocoa, coffee and cotton generate about 40% of export earnings. GDP is $273 US per capita.

14.3 Legislation and conservation policies

On January 16, 1968, Togo established a law under the ''Ordinance on wildlife protection and hunting in Togo.'' This document specifies chimpanzees in the list of protected species. Togo also became a signatory of the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1979. Despite this legal protection, chimpanzees still disappeared from Togo.

14.4 Historical situation

There is disagreement about the extent of the historic range of chimpanzees in Togo. In 1943, Yerkes believed chimpanzees where found from the coast to about 450km inland to the north. In 1958, Vandebroek believed their range only to

be a very small area in the south-eastern most tip of the country. In 1968, Kortlandt and van Zon suggested that chimpanzees had a small range in the south on the western border of Togo with Ghana, and also further north along this border (Kortlandt and van Zon 1969).

The ultimate cause of the disappearance of chimpanzees from Togo is unknown but is likely a combination of the many reasons listed by Oates (1996a), include hunting for meat and traditional medicine, habitat loss and the bio-medical trade.

14.5 Conclusions

Togo is one of the most recent countries to have its population of chimpanzees become extirpated. Further investigation into the causes of their disappearance may help to provide clues as to how to prevent this occurring in other nations such as Senegal and Ghana, where there are a few hundred left.

Chapter 15

Benin

Aaron Brownell

15.1 Introduction

Although Benin is believed to have once hosted a significant population of western chimpanzees, today they are considered extirpated from this country (Korlandt and van Zon 1969; Green 1984; Lee *et al.* 1988; Teleki 1989). They are believed to have disappeared in recent decades due to hunting and habitat loss (Sayer and Green 1984; Lee *et al.* 1988, Oates 1996a).

15.2 Country profile

15.2.1 Geography

The land area of Benin is 112,620km^2. At 9°30′N, 2°15′E Benin is located between Burkina Faso, Niger, Nigeria and Togo. The terrain is mostly flat with undulating plain and some hills and low mountains. The highest point is Mont Sokbaro at 658m.

15.2.2 Climate

The climate is hot and humid in the south and semi-arid in the north. The annual rainfall for the country is 1,177mm and the mean temperature is between 25–28°C (CIA World Factbook 2002).

15.2.3 Habitat

Woodlands cover about 31% of the country. Many of the forests in Benin are located in the south-eastern and central parts of the country and are believed to be the areas where chimpanzees were once widespread (Lee *et al.* 1988).

15.2.4 People

The population of Benin is 6,787,625, with an annual growth rate of 2.91%. There are 42 ethnic groups, the most prominent being the Fon, Adja, Yoruba, and Bariba (CIA World Factbook 2002).

15.2.5 Political context

In 1975, 15 years after achieving its independence from France, Benin changed its name from Dahomey to Benin. From 1974 to 1989 the country was a socialist state. Free elections were re-established in 1991.

15.2.6 Economy

The economy of Benin is dependent on subsistence agriculture, cotton production, and regional trade. GDP is $361 US.

15.3 Legislation and conservation policies

Benin became a signatory of the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1984. However, no legislation was ever created within the country for specifically protecting chimpanzees (IUCN 1986; Lee *et al.* 1988). The lack of legislation for protection is an indication that chimpanzees may have already disappeared by the time the hunting laws were created (1971 and revised in 1980).

15.4 Historical situation

In 1943, Yerkes reported that chimpanzees ranged from the coast to about 400km inland to the north. In 1958 Vandebroek reported that chimpanzees in fact had a much smaller range and claimed they were only found in one area in the southern part of the country. It is possible that between 1943 and 1958 something caused a drastic reduction in range of the chimpanzee in Benin (Kortlandt and van Zon 1969).

Sayer and Green (1984) note that Raynaud and Gregory (1969) observed chimpanzees on the Nigerian border with Benin, north of Porto Novo. However, they do not report chimpanzees being present on the Benin side of the border. A map by Kortlandt and van Zon (1969) also indicates that chimpanzees had disappeared in Benin by this time.

15.5 Conclusions

Chimpanzees are believed to have undergone a drastic reduction from 1943 to 1958, and by 1969 they had disappeared from the country altogether. As with chimpanzees in Togo, a more thorough investigation into the causes of their disappearance could help greatly in preventing a similar disappearance in other countries in West Africa where they presently live.

Chapter 16

Burkina Faso

Aaron Brownell

16.1 Introduction

Chimpanzees are considered extirpated from Burkina Faso (Lee *et al.* 1988; Teleki, 1989), although unconfirmed reports suggest that chimpanzees may still be migrating into Burkina Faso during the rainy season in the south-western part of the country near the border with Cote d'Ivoire (Lee *et al.* 1988).

16.2 Country profile

16.2.1 Geography

Burkina Faso (13°00′N, 0°00′W) is located to the north of Ghana and is bordered by Benin, Côte d'Ivoire, Mali, Niger and Togo. Land area is 274,200km^2. The terrain is mostly flat with hills in the west and south-east (highest point 749m).

16.2.2 Climate

The climate is tropical with warm, dry winters and hot, wet summers. The annual rainfall for the country is 814.7mm, and the mean temperature is 24.8°C for January and 27.2°C for July.

16.2.3 Habitat

Burkina Faso has approximately 15% forest cover and an additional 34% of other wooded land. The country has very little closed forest, which is mainly gallery forests along watercourses. The open forests are comprised by approximately four types of savanna: Sahelian, in the north; Sahelian-Sudanian; Sudanian; and Sudanian-Guinean, in the south. Most land north of Ougadougou is the Sahelian zone and consists mainly of sparse desert scrub with *Acacia seyal* and *A. ataxacantha.* The habitat is progressively less dry moving south, and vegetation becomes correspondingly more dense. The central savanna zones are characterized by the presence of *Isoberlinia doka.* The Sudanian-Guinean zone extends into forest comprising Guinean-type species (including palms) such as *Antiaris africana* and *Chlorophora excelsa.*

16.2.4 People

The country's human population has been estimated at 12,603,185 and is growing at an annual rate of 2.64% (CIA World Factbook 2002). Major ethnic groups include Mossi, Gurunsi, Senufo, Lobi, Bobo, Mande and Fulani.

16.2.5 Political context

Burkina Faso (formerly known as Upper Volta) became independent from France in 1960. Instability during the 1970s and 1980s was followed by multiparty elections in the early 1990s.

16.2.6 Economy

Burkina Faso is one of the poorest countries in the world, with a high population density, few natural resources and a fragile soil. About 90% of the population is reliant on mainly subsistence agriculture. Thousands of farmers migrate south every year to Côte d'Ivoire and Ghana. GDP is $203 US.

16.3 Legislation and conservation policies

On December 31, 1968, Burkina Faso established a Wildlife Conservation and Hunting Act and then in 1985 established ''Hunting Regulations,'' in which chimpanzees are listed as a protected species (IUCN 1986). Burkina Faso became a signatory of the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1990.

16.4 Historical situation

The range of chimpanzees in Burkina Faso was probably never large. In 1943, Yerkes believed that chimpanzees were living in a relatively small area in the southern part of the

country west of Ghana. In 1958, Vandebroek did not believe the chimpanzees' range extended into Burkina at all. In 1968, Kortlandt and van Zon (1969) stated there was an alleged but unconfirmed presence of chimpanzees in the south-western part of the country near the borders of Mali and Côte d'Ivoire (Kortlandt and van Zon 1969). Lee *et al.* (1988) also states that unconfirmed sightings suggest that during the rainy season chimpanzees may be crossing into Burkina from Côte d'Ivoire.

16.5 Conclusions

Burkina Faso is the fourth country discussed in this section where chimpanzees are believed to no longer exist. One priority action is to investigate whether chimpanzees really are still crossing into Burkina Faso, and if this is the case, conservation activities should be initiated to help the repopulation of chimpanzees into this area.

Chapter 17

Nigeria

John Oates, Liza Gadsby, Peter Jenkins, Katherine Gonder,
Carolyn Bocian and Alade Adeleke

17.1 Introduction

In a regional context the chimpanzees of Nigeria and their habitats merit special attention, given their still poorly-understood evolutionary relationships and the highly threatened status of many of their surviving populations. Nigeria is particularly interesting from the point of view of chimpanzee biology because the lower Niger river was long held to be the boundary between the subspecies *Pan troglodytes verus* and *P. t. troglodytes.* However, this boundary had been proposed in the absence of any careful studies of chimpanzees on either side of the Niger. Recent genetic studies by Gonder (2000) have suggested that all Nigerian chimpanzees (along with those in south-western Cameroon) share a more recent evolutionary relationship with the chimpanzees that inhabit the forests of the Upper Guinea region (*P.t. verus*) than with those in western equatorial Africa (*P. t. troglodytes*). At the same time, these Nigeria-Cameroon chimpanzees still differ significantly (at least in parts of their mtDNA) from *P. t. verus.* It has been proposed (Gonder *et al.* 1997) that the name *P. t. vellerosus* be revived for this population; alternatively, it might be grouped with *P. t. verus.* Very little genetic sampling has yet been done on the chimpanzees in western Nigeria, and the precise affinities of that population are still not fully resolved.

Chimpanzees still appear to be present in many forests across the southern part of Nigeria, but there has been no comprehensive survey, so that their exact distribution and numbers are not known; at most sites they are now very rare animals. However, there may be at least 2,000 chimpanzees living in several forested areas across the southern part of the country. There are three protected areas known to have chimpanzees; Cross River National Park, Gashaka Gumti National Park and Afi Mountain Wildlife Sanctuary, totaling approximately 11,500km^2.

Nigeria's large and growing human population and relatively high level of economic development (promoted in significant part by oil revenues) have led to a continuing high rate of both forest conversion and other forms of natural resource exploitation. This has led to a widespread loss of chimpanzee habitat both outside and (in some instances) inside national parks and forest reserves. Although theoretically protected by state and federal laws, chimpanzees are hunted for their meat in most parts of southern Nigeria, including protected areas. While further survey work is needed, already it is clear that the survival prospects for chimpanzees would be improved by increasing the effectiveness of protected areas in the chimpanzee's range, creating new protected areas, and by the better implementation of state and federal wildlife laws, especially those related to hunting.

17.2 Country profile

17.2.1 Geography

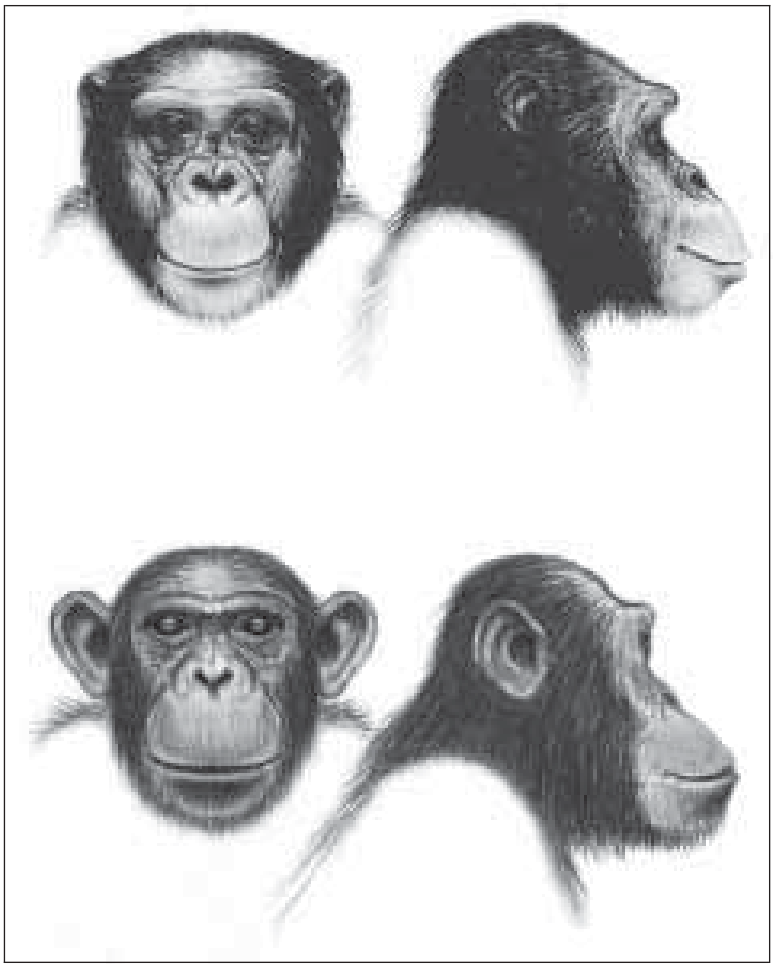
Situated at 10°N and 9°E, and bordered by Benin, Niger, Chad, and Cameroon, Nigeria is one of the largest countries in West Africa, covering 923,768km^2. There are significant uplands in the form of the Jos Plateau in the center of the country and extensions of the Cameroon Highlands along the eastern border. The Benue river joins the Niger in south-central Nigeria and flows to the sea, breaking up into the myriad channels of the vast Niger Delta, the largest river delta in tropical Africa. The highest point is Chappal Waddi at 2,419m.

17.2.2 Climate

Within the range of chimpanzees in Nigeria, annual precipitation is quite variable, but falls generally within the range of 1,500–4,000mm per annum, with a three to five month dry season between November and March.

17.2.3 Habitat

A series of vegetation zones extends from west to east across the country, the result of a rainfall gradient from the wet coastal zone fringing the Gulf of Guinea to the arid Sahel in the north. The mangrove and freshwater swamp forests of the Niger Delta are flanked to the east and west by zones once clothed in lowland rain forest; much of this forest has now been replaced by cultivation. The largest remaining areas of closed-canopy rain forest are in the south-east, in



(Illustrations by Stephen D. Nash)

The Nigerian chimpanzee (*Pan troglodytes vellerosus*) (top) and the Western chimpanzee (*Pan troglodytes verus*) (bottom) are the two most threatened subspecies of chimpanzee.

Cross River State, and are contiguous with the forests of south-west Cameroon.

17.2.4 Biodiversity

The Niger itself, and the Cross river which flows into the Gulf of Guinea further east, are both important zoogeographical barriers, influencing the distribution of several primate species. The complexity of Nigeria's vegetation and topography, and these river barriers, have resulted in high biological diversity, including at least 26 species of non-human primate.

17.2.5 People

Nigeria has by far the largest population of any African country, estimated to be about 130 million in 2002 with an annual population growth rate of about 2.5% (CIA World Factbook 2002). About half of these people occur within the historic range of chimpanzees across the southern part of the country. The human population of Nigeria contains more than 250 different ethnic groups, with a major cultural divide between the predominantly Muslim north, and the south where Christianity is more prevalent (particularly in the south-east).

17.2.6 Political context

The north-south divide has been a continuing source of tension in the country. In 1900, the area of present-day Nigeria contained the British-administered Protectorates of Northern Nigeria and Southern Nigeria, the Colony of Lagos and the north-western part of German-administered Kamerun. The Northern and Southern Protectorates were amalgamated with the Colony of Lagos as the Colony and Protectorate of Nigeria in 1914. The Federation of Nigeria came into being, with Northern, Western and Eastern Regions, in 1954. In 1960, the federation gained its independence as the Federal Republic of Nigeria. The former United Nations trust territory of Northern Cameroons (including most of the Mambilla Plateau) joined the federation in 1961. In 1967 the Eastern Region broke away from the federation as the Republic of Biafra, leading to a civil war that came to an end in 1970.

One of the precipitating factors leading to civil war was a proposal to abolish Nigeria's large administrative regions and replace them with twelve smaller states. The state system has prevailed, and there are now 36 states in the Federal Republic, plus the Federal Capital Territory of Abuja. In 1999, Nigeria adopted a new constitution and elected a civilian president after many years of military rule.

17.2.7 Economy

Beneath the Niger Delta and its offshore waters lie large reserves of oil, and the exploitation of this resource has had a major impact on modern Nigeria. The oil price increases of the 1970s led to vast revenues flowing to Nigeria, but the country has also become heavily dependent on these revenues (95% of foreign exchange earnings and 65% of total budgetary revenue), and the economy has therefore suffered when oil prices have declined. When oil revenues decline there is less money available to federal and state government departments, including those concerned with conservation. Furthermore, the continued poverty of most people in the oil-producing areas in and around the Niger Delta have led

to local political activism. The resulting insecurity of the delta has tended to interfere with conservation efforts in that area, whose fringes are the home of some remnant chimpanzee populations.

17.3 Legislation and conservation policies

Wildlife and forestry were regional administrative responsibilities before the civil war, and these responsibilities devolved to the states. The states have often lacked the resources or expertise to provide effective management of their forests or to properly enforce wildlife laws. An exception to this pattern of devolution is the national park system, administered at the federal level.

Federal and state wildlife laws theoretically protect chimpanzees wherever they occur, but these laws are only occasionally enforced. The applicability at the state level of federal endangered species legislation (which covers chimpanzees) is ambiguous.

Nigeria has ratified the African Convention on the Conservation of Nature and Natural Resources (1968), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973), the Convention on Migratory Species (1973) and the Convention on Biological Diversity (1996). Nigeria does not currently have a World Heritage Site, though some sites have been at least informally proposed. Nigeria ratified the World Heritage Convention in 1971.

17.4 Past research and conservation efforts

Nigeria's chimpanzees have been relatively neglected by scientists and conservationists. There have been limited surveys in western Nigeria (Agbelusi 1994; Persson and Warner 2000) and on the eastern edge of the Niger delta (Bocian 1999). Gonder (2000) has collected hair samples from chimpanzee nests across Nigeria for genetic analysis. Recently a concentrated study of the behavior and ecology of chimpanzees and other primates in the Gashaka-Gumti National Park was initiated by a team from University College London (directed by V. Sommer), working in conjunction with the Nigerian Conservation Foundation.

The presence of chimpanzees was taken account of in establishing the Gashaka-Gumti and Cross River National Parks, but chimpanzees were not the main reason for establishing these parks, and special conservation measures are not in place for this species.

Captive orphan chimpanzees that are by-products of the bushmeat trade have been rescued by the Pandrillus organization in Calabar (Cross River State) and are being cared for in the Pandrillus facilities in Calabar and in Buanchor (on the edge of Afi Mountain Wildlife Sanctuary [see below]).

17.5 Chimpanzee distribution and numbers

17.5.1 Chimpanzee distribution

A few of the sites where chimpanzees occur are national parks, where all wildlife is theoretically protected, but where in practice the laws are often not well-enforced. Some of the sites are forest reserves, under the administration of state governments; in these reserves the government is supposed to control logging and farming, but there is usually little control of hunting (even though chimpanzees are supposed to be protected by federal and state laws regardless of the protected status of their habitat). Yet other sites are on community land that has no formal protection by government (Table 17.1, Figure 17.1).

17.5.2 Chimpanzee numbers

The **National Parks** (managed by Nigeria National Parks, which are under the authority of the Federal Ministry of the

Table 17.1. Confirmed presence of chimpanzees *Pan troglodytes* in Nigeria.

#	Name
1	Oba Hills Forest Reserve
2	Omo Forest Reserve
3	Okomu National Park
4	Ise Forest Reserve
5	Idanre, Akure-Ofusu, Ala, Onishere, Owo, and Ohosu Forest Reserves
6	Ifon Forest Reserve
7	South-eastern Niger Delta
8	Cross River National Park Oban Division
9	Cross River National Park Okwangwo Division
11	Afi Mountain Wildlife Sanctuary
12	Mbe Mountains
13	Afi River Forest Reserve
14	Gashaka-Gumti National Park
15	Ngel Nyaki Forest Reserve
16	Mambilla Plateau and Donga Valley

Figure 17.1. Confirmed or possible locations of chimpanzee populations in Nigeria.

Environment) and **Wildlife Sanctuaries** (managed by state government forestry departments) known or believed to contain chimps are:

17.5.2.1 Okomu National Park (formerly Okomu Wildlife Sanctuary), Edo State, south-western Nigeria.

Currently, 180km^2 of the Okomu Forest Reserve are being managed by Nigeria National Parks as the Okomu National Park. No chimpanzees have been seen by scientists in the wildlife sanctuary/national park in recent years, but one was killed by a hunter several kilometers south of the park during 2000. We guess that 25–50 chimps may use the area of Okomu Forest Reserve (1,200km^2, but much of this is now farmland and plantations), and some of these may use the national park itself on an occasional basis.

17.5.2.2 Cross River National Park, Cross River State, south-eastern Nigeria

This park probably has the second largest surviving chimpanzee population in Nigeria, but no surveys specifically looking at chimps have been made. The park is approximately 5,000 km^2 and is divided into two divisions, each supporting chimpanzees; Oban (*c.* 05°30′N 8°40′E) in the south and Okwangwo (*c.* 06°15′N 9°15′E) in the north. A guess is that there might be at least 200 chimpanzees in Okwangwo (adjacent to Takamanda Forest Reserve in Cameroon), and at least 400 in Oban (adjacent to Korup National Park in Cameroon). There is much poaching of wildlife in Cross River National Park, largely for the bushmeat trade. Both the Oban and Okwangwo Divisions of the National Park have large adjacent areas of non-park forest that could support chimpanzees (see below).

17.5.2.3 Afi Mountain Wildlife Sanctuary, Cross River State, south-eastern Nigeria

This sanctuary is located at 06°22′N 8°57′E and is approximately 100km^2. It was gazetted in 2000 and comprises the north-western corner of Afi River Forest Reserve (see below). There is also a small gorilla population in the sanctuary, in which hunting is banned. The wildlife sanctuary is tenuously connected by forest to the Mbe mountains (see below), although a surfaced road runs through this corridor. Chimpanzees occur in the sanctuary in small numbers; the population has not been censused but almost certainly numbers less than 40 individuals.

17.5.2.4 Gashaka-Gumti National Park, Adamawa and Taraba States, north-eastern Nigeria

Gashaka-Gumti is located at 07°20′N 11°35′E and 6,402km^2, and it almost certainly has the largest remaining chimpanzee population in Nigeria. Although this is a large national park, much of the northern (Gumti) sector is savanna. (However, Gonder did encounter chimps in the Gumti sector in 1997.) Chimpanzees mostly use gallery forests and patches of montane forest in the park. Possibly less than half of the park could be regarded as potential chimpanzee habitat. Gashaka-Gumti is estimated to contain up to 1,500 chimpanzees.

The **State Forest Reserves** definitely or probably containing chimps are:

17.5.2.5 Oba Hills Forest Reserve, Osun State, south-western Nigeria

This little-known reserve of 52km^2 is on hilly terrain, with deep gorges. About 12% of the area is planted with teak. Chimpanzees are reported present by forest officers and local people, and a dead chimp was offered for sale in a nearby market in 1999. No population estimate is possible at this point.

17.5.2.6 Omo Forest Reserve, Ogun State, south-western Nigeria

Nearly half of this 1,300km^2 reserve is occupied by tree plantations and farmland, and the remainder is logged forest. There is a 142km^2 ''Biosphere Extension Area'' that has been the focus of non-governmental organization conservation efforts. Mammals were surveyed in Omo in November 2000 by Henriette Persson and Mark Warner. Persson and Warner (2000) had one sighting of chimpanzees and saw dried chimpanzee body parts in local markets. Omo is contiguous with five other forest reserves, including the Oluwa Reserve in Ondo State, but these other areas have not been recently surveyed. At a guess, this set of reserves might contain up to 100 chimpanzees.

17.5.2.7 Idanre, Akure-Ofusu, Ala, Onishere and Owo Forest Reserves, Ondo State, and Ohosu Forest Reserve, Edo State, south-western Nigeria

These reserves are contiguous, forming a forested area of $>$1,000km^2. Chimpanzees have been reported present by Agbelusi (1994), and Gonder found two chimp nests in Owo (6°58′N, 5°32′E) in 1997. It is likely that less than 100 individuals inhabit this area, which has been heavily logged and also damaged by fire.

17.5.2.8 Ise Forest Reserve, Ekiti State, south-western Nigeria

Chimpanzees were encountered at Ise Forest Reserve of *c.* 200km^2 at 07°23′N 05°26′E by Gonder in 1997. North of Ise, also on the Ogbesse river, is the small Ogbesse Forest Reserve, from which chimpanzees were reported by Agbelusi (1994). The remaining chimpanzee population at Ise is probably very small ($<$20). Gonder located one group of six individuals (fresh nests seen and calls heard nearby),

and heard other calls in the distance. Ise Forest Reserve supplies an active bushmeat trade, but hunters claim that they do not penetrate the depths of the forest because of the thickness of the vegetation (probably a result of long-term logging).

17.5.2.9 Ifon Forest Reserve Ondo State, south-western Nigeria

Hunters and forestry staff reported to Gonder and Oates in 1997 that chimpanzees are still present in Ifon Forest Reserve of 737km^2. No population estimate is possible.

17.5.2.10 Afi River Forest Reserve Cross River State, south-eastern Nigeria

This forest reserve of 383km^2 includes Afi Mountain Wildlife Sanctuary (gazetted 2000), in which hunting is banned (see above). Local people report an absence of chimpanzees in lowland sections of the reserve, which has been selectively logged, but their presence in the wildlife sanctuary and in the nearby Mbe mountains suggests that chimpanzees probably use the lowland areas occasionally.

17.5.2.11 The **Cross River South** and **Ukpon River Forest Reserves,** adjoining the Oban Division of Cross River National Park, may contain chimpanzees, but have not been surveyed.

17.5.2.12 Ngel Nyaki Forest Reserve Taraba State, north-eastern Nigeria

In this forest of 46km^2 at *c.* 07°05′N 11°04′E on the edge of the Mambilla Plateau, chimpanzees were encountered by Oates in 1995 and by Gonder in 1997. This is the largest remaining forest on Mambilla and is well-described in a recent publication by Chapman and Chapman (2001). We do not have an estimate of the chimpanzee population, but it may be >20.

Other **Forest Areas** containing chimpanzees include:

17.5.2.13 South-eastern Niger Delta

The community forests of Okoroba, Etiema and Emago in Bayelsa State have been proposed as the Edumanom Forest Reserve. Powell (1995) noted that hunters' reports suggested the presence of 5–10 small chimpanzee groups in this general area, with a total population probably not exceeding 50 individuals. Bocian saw chimps in the Etiema Forest in 1998 and heard chimps in the Okoroba Forest in 1999. Hunters claim that chimps are also present in the Emago Forest. Bocian's surveys suggest a minimum of three groups of chimps (of unknown size, but probably small) in Etiema plus Okoroba, and she agrees with Powell's overall estimate of population size in the area. The forest here is swamp forest, fragmented into small patches, none of which are larger than 25km^2. The patches are scattered over a total area of at least 90km^2.

17.5.2.14 Mbe mountains, Cross River State, south-eastern Nigeria

These hills support around 100km^2 of community forest, sandwiched between Afi River Forest Reserve and the Okwangwo Division of Cross River National Park. There are probably at least 25 chimpanzees in the Mbe mountains.

17.5.2.15 Other forests in south-eastern Nigeria.

There are considerable areas of forest west and south of the Oban Division of Cross River National Park, north and south of the Ikpan Block of Oban Division, south of the Okwangwo Divison of the park, and south of Afi River Forest Reserve. These are not included in protected areas or forest reserves and may contain chimpanzees. Some of the gallery forests in the deeply-dissected Kashimbila area, north-east of the Obudu Plateau and adjacent to Cameroon, might also be inhabited by chimpanzees and need to be surveyed.

17.5.2.16 Mambilla Plateau and Donga Valley, Taraba State, north-eastern Nigeria.

Chimpanzees were seen in the small Leinde Fadali forest (10km^2) between about 1,300 and 1,500m in the north-eastern corner of the Mambilla Plateau in 1977 and 1988 (Chapman and Chapman 2001). The forest was protected by its inaccessibility and local custom. On the western escarpment of the Mambilla Plateau, above the Donga river valley, at 760–1,170m elevation, chimpanzees were seen in 1978 in the Akwaizantar (or Akoh-Zanto) forest by Chapman and Chapman (2001), and in 1997 by Gonder. Gonder found several places where chimpanzees had recently nested, and their numbers appeared to be large; between seven and 35 nests of the same or similar age were found in close proximity to each other in several locations. This forest extends for about 11km along the Zonyo stream. This important site has no formal protection. It may have survived relatively untouched because of a tradition of a pestilence that killed earlier human inhabitants, or because it forms a no-man's land between Tigon and Mambilla people (Chapman and Chapman 2001).

17.6 Threats to chimpanzees

17.6.1 Habitat loss

Logging is one of the main threats to chimpanzee populations in Nigeria. Except in Cross River State and the Niger delta, little forest (and therefore chimpanzee habitat) now

remains outside state government forest reserves and federally-administered national parks. Almost all forest reserves in Nigeria have logging concessions assigned over much of their area, although not all of these concessions are being actively logged; no nationwide map of concessions is available. Much logging in forest reserves is done illegally, rather than through the concession system. Many forest reserves have been logged over several times and often this land is now being converted into farms and plantations, resulting in a total loss of chimpanzee habitat. Relatively large areas of community forest still exist in Cross River, but this forest is increasingly threatened by logging as well as by agriculture.

17.6.2 Hunting

Hunting is probably the greatest threat to chimpanzee populations in Nigeria. Given their generally very low densities, chimpanzees are probably rarely specifically targeted by hunters, but will be shot if encountered and their meat sold in the bushmeat trade. In most of southern Nigeria there appear to be no general taboos on consumption of chimpanzee meat, though there may be local taboos. Dried heads and hands of chimpanzees are also sold in fetish (''juju'') markets, especially in western Nigeria. There is much lighter hunting pressure on chimpanzees in Islamic areas in the northern parts of their Nigerian range (this applies especially to Gashaka-Gumti National Park), but it is likely that very few surviving chimpanzee populations are completely unhunted. In the vicinity of the proposed Edumanom Forest Reserve in Bayelsa State, on the edge of the Niger delta, Bocian found that older hunters preferred to hunt animals other than chimpanzees, but younger hunters showed little concern for traditional attitudes and boasted about having killed chimps. Young chimpanzees captured as a by-product of hunting enter the pet and zoo trade, and there is a significant illegal trade in wildlife and wildlife products from Kano in northern Nigeria.

17.6.3 Economic development

Finally, ''development,'' involving the expansion of agriculture, road networks and oil extraction activities, poses a major threat to the future of chimpanzee populations in Nigeria. Throughout most of southern Nigeria, chimpanzee habitat is being eroded by the expansion of farmland and plantations. For instance, the Cross River State government has plans to develop new plantations of oil palm, pineapple and cashew on community forest lands. Large commercial farms and tea estates have also been spreading on the Mambilla Plateau in Taraba State, where chimpanzees still hang on in several remnant forest patches. Nigeria has a well-developed road system compared with most of tropical Africa. Very little chimp habitat in Nigeria is more than one day's walk from a road (and most sites are at most no more than one to a few hours away). In the Niger delta there are fewer roads, but waterways and oil pipelines (and their associated service paths) provide access to the forests. In addition to the destructive activities of the oil industry, forests in the Niger Delta are threatened by the expansion of oil palm plantations and road building; for instance, a proposed new federal road from Ogbia to Nembe would pass between two of the swamp forest patches inhabited by chimps in the Edumanom area (see below).

17.7 Priority sites for chimpanzee conservation

17.7.1 Gashaka-Mambilla – Nigeria and Cameroon

The Gashaka-Mambilla region is one of two areas in Nigeria that have large populations of the Nigerian chimpanzee. The area includes Nigeria's Gashaka-Gumti National Park and immediately adjacent parts of Cameroon, the remnant forests of the Mambilla Plateau, and small forest areas on the upper Donga valley.

17.7.2 Takamanda-Okwangwo – Nigeria and Cameroon

The Takamanda-Okwangwo area is centered on the Okwangwo Division of Nigeria's Cross River National Park and the adjacent Takamanda Forest Reserve of south-west Cameroon. It also includes (in Cross River State, Nigeria) the Afi Mountain Wildlife Sanctuary and other areas of Afi River Forest Reserve, and the Mbe mountains community forest area that lies immediately between Afi and Okwangwo, and (in South-west Province, Cameroon) the Mone Forest Reserve, and the Mbulu forest, as well as other areas of community forest to the east and south of Takamanda. This is an important area for the Nigerian chimpanzee as it includes large areas of intact lowland closed-canopy moist forest that are at the northern edge of the moist forest zone, as well as areas of submontane vegetation. This area is also home to the threatened and endemic Cross River gorilla *Gorilla gorilla diehli*, the drill *Mandrillus leucophaeus* and Preuss's guenon *Cercopithecus preussi.* Hunting is currently the biggest threat to chimpanzees and other primates in this area, and there is a significant cross border trade in bushmeat from Cameroon to Nigeria from Takamanda.

17.7.3 South-west Nigeria and the Niger Delta - Nigeria

This large area includes many poorly-protected forest reserves in western Nigeria, the Okomu National Park, and the forests of the Niger Delta. Remaining chimpanzee populations in this area are small, highly fragmented and severely threatened. The affinities of these populations with *P. t. verus* to the west and *P. t. vellerosus* to the east have not been resolved.

17.8 Priority actions for chimpanzee conservation

17.8.1 General conservation needs

17.8.1.1 Increased effectiveness of protected areas and wildlife laws

Protected areas and wildlife laws need to be made more effective everywhere. Much more serious efforts must be made to protect chimpanzees from hunting.

17.8.1.2 Increased public awareness of conservation issues

The level of public awareness of conservation issues needs to be raised.

17.8.1.3 Extension of protected area coverage in chimpanzee habitat

Formal protected area or reserve status needs to be extended to chimpanzee habitats that currently lack such status: including the community forests in Bayelsa State that have been proposed as the Edumanom Forest Reserve; the remnant forests of the Mambilla Plateau in Taraba State; and the Mbe mountains in Cross River State.

17.8.2 Actions needed at priority chimpanzee conservation sites

17.8.2.1 Gashaka-Mambilla

Priority actions in this area include supporting existing conservation and research activities in Gashaka-Gumti National Park, Nigeria. Basic surveys should also be conducted to assess the distribution and numbers of chimpanzee populations across the Mambilla Plateau and the adjacent Donga river valley, as well as adjoining areas in Cameroon south and east of Mambilla and Gashaka. Surveys would also evaluate the degree and possibilities for connectivity between forests and populations.

17.8.2.2 Takamanda-Okwangwo

Priority activities here should include continuation of existing primate conservation efforts in Cross River National Park Okwangwo Division, Afi River Forest Reserve (including Afi Mt Wildlife Sanctuary), and the Mbe mountains in Nigeria, and Takamanda Forest Reserve, Mone Forest Reserve, and Mbulu Forest in Cameroon. Connections within the meta-population of Takamanda-Okwangwo should also be assessed. Finally, efforts to bring hunting for the bushmeat trade under control should be supported, including improved law enforcement and an education and awareness campaign.

17.8.2.3. South-west Nigeria and the Niger Delta

Surveys are urgently needed to assess the distribution, abundance, and genetic affinities of chimpanzees in this area. The chimpanzee populations assessed by these surveys to be most viable must then be given rigorous protection, and at least one should be selected for a long-term research effort.

SECTION III

REGIONAL ASSESSMENT OF THREATS AND ACTION RECOMMENDATIONS

(Photo credit: Rebecca Kormos)

Slash and burn agriculture in Guinea.

SECTION III: REGIONAL ASSESSMENT OF THREATS AND ACTION RECOMMENDATIONS

The following section examines threats to chimpanzees across the region and actions that may be able to reduce these threats. First, Parren and Byler examine the direct and indirect impacts of logging on chimpanzees. Duvall then examines the effects of agriculture on chimpanzees in West Africa, and Humle looks at the related problem of crop raiding by chimpanzees and their sometimes being hunted as a consequence. Kormos, Bakarr, Bonnéhin and Hanson-Alp examine the extent of the bushmeat trade as a threat to chimpanzees in West Africa. They also discuss cultural taboos in the region against eating ape meat. Carter investigates the pet trade problem and summarizes the state of chimpanzee sanctuaries in West Africa. Formenty, Karesh, Froment and Wallis discuss the threat of disease to chimpanzees in West Africa, drawing on examples from Great Apes elsewhere in Africa. C. Kormos summarizes policy recommendations for chimpanzees in West Africa aimed at decreasing the threats outlined in this section. Finally Plumptre presents recommendations for censussing chimpanzee populations in forests with the aim of harmonizing methods for surveying chimpanzees across Africa so that results will be comparable.

Chapter 18

Logging in West Africa: Impacts on Chimpanzees

Marc P.E. Parren and Dirck Byler

18.1 Introduction

The forests of West Africa have had a long history of commercial timber exploitation, dating back to the late 19th century. Commercial timber extraction has occurred at varying levels throughout West Africa, with the principal operations occurring in the moist forests of Côte d'Ivoire, Ghana, Liberia and Nigeria. Forested areas logged for select timber species have been largely replaced by slash-and-burn agriculture, plantation agriculture, and a variety of other mixed uses. National parks in West Africa provide protection for the biodiversity in only a small fraction of the remaining forests. Forest reserves established to ensure sustainable forest management harbor most of the remaining blocks of tropical moist forest in West African countries. The unreserved forests are rapidly vanishing in most of the region since commercial logging is often followed by slash-and-burn agriculture. Given that most West African forest soils can only be worked for a short time, slash-and-burn agriculture is largely unsustainable. The result is an ever-expanding encroachment into forested areas of slash-and-burn farming, leading to the loss of primary habitat for native species. This dramatic deforestation has led to forest fragmentation that often goes hand in hand with high hunting pressure. A commercial bushmeat trade is thriving in most countries, affecting conservation and timber production areas alike. As a result some animal species may have been extirpated (Oates *et al.* 2000) or reduced to unsustainable low levels and may face extinction in the coming decades (Holbech 1998; Caspary 1999; Caspary *et al.* 2001).

Given the wide range of impacts of logging on a forest ecosystem, the reaction of chimpanzee communities to logging is likely complex and varied. Chimpanzees are a highly adaptable species, occurring over a wide range of habitats, including lowland tropical moist forest, Afromontane forest and arid savannas, in which the only forest cover is in narrow galleries (White and Tutin 2001). Clearly, however, habitat alteration and destruction coupled with the indirect impacts brought about by commercial logging put chimpanzee populations living in surrounding areas at risk.

This chapter provides an overview of commercial timber extraction within the moist forest zone of West Africa, and takes a closer look at the current timber crisis in West Africa and its potential impacts on chimpanzee populations.

18.2 History of logging in West Africa

Timber practices in West Africa's moist forests have ranged from various forms of selective felling to clear-cutting large areas of forest to make room for plantation agriculture. At the end of the 19th century, high forests in Ghana and Nigeria were removed to develop cocoa plantations. From the

earliest years, exploitation for timber was by selective logging of emergents with diameters surpassing one meter harvested at very low densities often not surpassing one tree per ha. Until 1951, mahogany led the list of West African timber exports. Timber export growth from West Africa slowed during the first part of the 20th century due to the cost of transporting logs to distant locations. However, the combination of new mechanized operations and increased European demand for tropical hardwood fueled a steady increase from the 1950s to the 1970s. The net volume extracted from the forest is usually only 5–35m^3 per ha for exports to European and North American markets, and the bulk of the production is accounted for by less than ten species, with secondary importance attached to species suited to plywood and other processed wood products. The repeated removal of the best individuals of a limited number of species at very short felling cycles has led to overexploitation of the forests. This process forced the conservative timber market to accept more and more species at ever dwindling diameters, as low as just half a meter (Parren and de Graaf 1995).

The increased exploitation of Côte d'Ivoire's forests was most astonishing, leaping from 0.4 million m^3 annually in the 1950s to five million m^3 annually in the 1970s (Arnaud and Sournia 1980), which slowed down to around three million m^3 per annum since 1987. The early development of cocoa came about entirely from the initiative of peasant farmers. Young cocoa trees benefit from overhead shade, and were underplanted in semi-deciduous high forests. In Nigeria and Ghana, cocoa was established over extensive areas by peasant farmers, and the bulk of the semi-deciduous forests outside reserves became converted to cocoa (Moor 1936). In Côte d'Ivoire, cultivation of coffee and cocoa began in the 1930s, and due to efforts made in promoting cultivation of both crops from the late 1940s, Côte d'Ivoire ranked as the world's first and third producer, respectively, by the 1980s. This policy encouraged cultivators to establish cocoa and coffee plantations inside forest reserves because they received premiums which largely compensated them for the fines they had to pay for illegal entry into the reserves. In some cases (e.g., at Toumanguié, Miemni and Boubo), the reserved status was removed in order to allow entry of farmers (Ibo 1993). In Côte d'Ivoire large-scale cocoa growing benefited from new findings of research undertaken at Tafo, Ghana, avoiding any shelterwood. This plantation system led to salvage felling and the complete removal of the semi-deciduous forest before cocoa planting. Much timber comes from already exploited ''residual'' forest, and after this timber is exploited the clearing for agriculture usually takes place. Forests remaining in Côte d'Ivoire and Ghana are now heavily fragmented by plantation agriculture, primarily cocoa, coffee, oil palm and rubber, and a few significant blocks are confined to the permanent forest estate.

The late 1990s saw the arrival of Asian buyers and operators in West and Central Africa who at first extracted timber with little discrimination, taking a wide range of species including those never accepted before by the timber market, and at high intensities per ha. This move was made because the Philippines and Vietnam were already almost deforested, while at the same time Thailand, Malaysia and Indonesia became much stricter about log exports and logging. Nearby supplier nations in the South Pacific and Siberia were not able to satisfy Southeast Asian, Chinese and Japanese demand, even as the installed sawmill, pulp and plywood capacity had quadrupled in Southeast Asia (Sizer and Plouvier 1999; Matthews 2002).

Nowadays most of the Asian companies in Africa operate like the former companies, at densities of about one tree per ha and exploiting only a limited number of species. This shift was most likely caused by economic factors such as ''diameters of profitability'' and transport costs to Asia (Debroux and Karsenty 1997). Most Asian operators halted operations soon after in countries such as Cameroon and Gabon. However, in countries like Equatorial Guinea and Liberia, Asian operators still cut indiscriminately and intensively as no local control measures whatsoever are applied to their operations (Van Breugel and Parren 1997; Anon. 2001).

In spite of high transportation costs, demand for African timber and especially secondary species has increased in Asia. This demand is driving companies like Oriental Timber Corporation and Shimmer International (the West/Central African subsidiary of Rimbunan Hijau) to find cheap access to timber resources. In a place like Liberia, many of the coastal forested zones have not been targeted by European hardwood markets since the timber species traditionally in demand were found only in low densities in these forests, making logging operations more expensive. In addition, wood from these areas tends to have properties (e.g., low grain density) that makes it less prized than wood from drier and more seasonal zones. Consequetly, West African forests in bad condition are mainly confined to the drier areas (Hawthorne 1996), which stand to reason considering that semi-deciduous forests show the highest share of commercial species and have accordingly suffered excessively from both logging and the subsequent fires (see also Hawthorne 1993, 1994). Coastal areas, which tend to have the highest rainfall and plant endemicity, are normally dominated by species of only moderate commercial value, such as Caesalpinioideae species like *Tetraberlinia tubmaniana* in coastal Liberia. Deforestation of the Upper Guinean forest ecosystem has generally started in the driest zones and then moved to moist forests. Generally speaking, economic pressures have opened up areas that formerly were not desirable for commercial timber activities and agriculture. However, as agriculture and especially bushmeat trade have followed logging, chimpanzees in the drier areas were threatened first with habitat loss and fragmentation, and these pressures have encroached progressively into the wettest zones.

18.3 Current distribution of forests in West Africa

The current distribution of moist forests in West Africa (Figure 18.1) is heavily fragmented, with the largest blocks existing in north-west Liberia and extending over the border of south-east Sierra Leone and south-east Liberia and then east to Taï National Park in Côte d'Ivoire. Important but heavily fragmented forests also exist in south-west Ghana and to a lesser extent in south-east Côte d'Ivoire. Selective logging continues in most West African countries, particularly in Côte d'Ivoire, Ghana, Liberia and Nigeria. National reserves exist throughout West Africa, mainly as timber production areas, with a wide variety of different levels of protection for wildlife from nature reserves to little or no protection at all. Much of the present-day forest estate in West Africa is land reserved by colonial forestry departments. In a number of cases, the demarcated forests were areas of late secondary forest depopulated by local conflicts in the centuries prior to colonial rule. In other cases, reserves were delimited in areas that once served as boundary wildernesses between neighboring pre-colonial polities (Ahn 1959; Murphy and Bledsoe 1987; Richards 1996a). These areas of so-called no man's land status have been at the origin of recent conflict in Liberia and Sierra Leone as they are most often the least developed and hardly fall under central government control. They are somehow an outback (Kaplan 1996; Richards 1996b). However, in Nigeria only in areas of high ethnic diversity (the Niger Delta and Cross River State) in the extreme south-east does much forest survive, while in areas with strong Ibo, Hausa or Yoruba presence (and organization), most forest has been lost, even in areas that are supposedly forest reserves dating from the colonial era (J. Suter, pers. comm.).

18.4 The current logging crisis in West Africa

Due to rapid population growth and economic development, in much of West Africa a serious timber shortage has developed, and reserved forest lands have become insufficient to meet even domestic timber needs. In densely populated countries such as Ghana (86 people per km^2, 2001 figures) and Nigeria (139 people per km^2), the domestic timber markets have now become even more important than the export markets, which is triggering diversification of marketable species. However, in a less densely populated country like Côte d'Ivoire (52 people per km^2), some 75% of the timber trade is still destined for export, and the home market is insufficient to absorb lesser known species. Intermediate yields from both natural forest and timber plantations that were formerly unmarketable may be marketable today. The timber production levels of countries such as Côte d'Ivoire, Ghana and Nigeria far outstrip the biological production potential to sustain such high levels of production over the long term. Ghana currently faces many problems with illegal logging inside their reserves and overexploitation of the resource outside the reserves. The forest reserves encompass one million ha, and the country can produce *c.* one million m^3 of roundwood equivalents sustainably, equally divided from on and off reserves. Côte d'Ivoire has been overexploiting its resources since the 1970s, leading to seriously degraded reserves and even the disappearance of entire reserves, which exist only in name today. Their production potential might equal that of Ghana with production reserves encompassing a surface of some 2.7 million ha, mostly in a bad condition. This has forced their industry to look at opportunities to fuel their sawmill capacities from other sources. Since the 1990s Côte d'Ivoire has been relying more and more on timber resources originating from Liberia and the high forests of Guinea (Anon. 2001).

The high forest zone of Guinea encompasses only 20% of the total land surface of the country but has high population

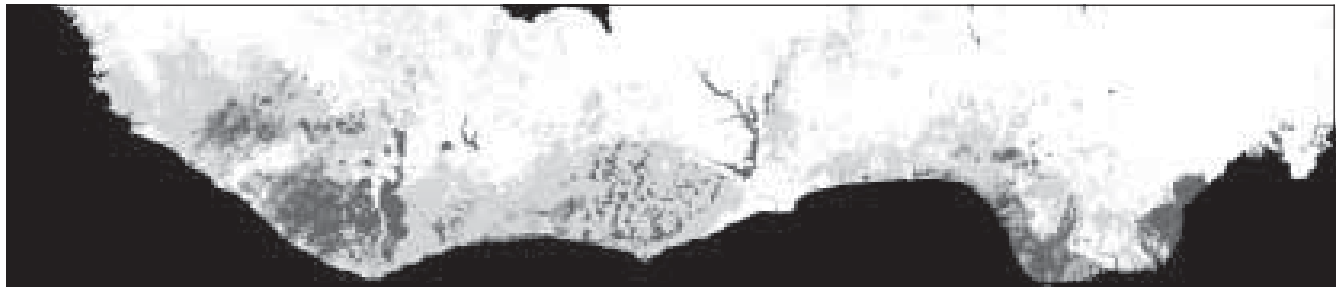


Figure 18.1. West African moist forest zone, indicating the original and present closed-canopy moist forest area. SPOT-4 satellite data from February 2001 at a 1km resolution were used to delimit the vegetation types. Dark green: dense moist forest; medium green: less dense moist forest; pale green: secondary vegetation; light brown: mosaic secondary vegetation and crops; beige: non forest; pink: mangrove; blue: water bodies. Source: Philippe Mayaux, Africa Coordinator – TREES Project, Global Vegetation Monitoring Unit – Space Applications Institute, DG Joint Research Centre – European Commission, Ispra, Italy.

densities including camps for refugees from Sierra Leone and Liberia. The high forest in this region still encompass 0.7 million ha, of which just 0.3 million have protected status. Until recently the exploitation of these resources took place in an anarchic way as Guinea never had a national forest inventory, so hardly any planning took place and the legislation was outdated. The introduction of a new forest policy in 1990 has led to the acceptance of forest management plans formulated by the GTZ-supported project for Diécké, Mt. Béro and Ziama forest reserves in 1995, totaling an area of over 0.2 million ha, or almost the entire reserved area (Diallo 2002). The most interesting development is that 30% of the total surface was selected as areas to conserve the genetic tree stock and as haven for animals. This concept was earlier developed at a GTZ-funded forest restoration project in eastern Côte d'Ivoire for timber production reserves (Parren and de Graaf 1995). However, no plan exists to manage the unreserved forests sustainably. In February 2002 this alarming deforestation led the president to declare a ban on all timber harvesting in the high forest zone of Guinea (Guinée Forestière).

The two largest contiguous blocks of lowland evergreen forest remaining in the Upper Guinea forest block, however, are confined to Liberia. These blocks represent a significant portion of chimpanzee habitat in West Africa and contain the largest number of endemic species. Large-scale timber operations in Liberia are quickly fragmenting the forest both inside and outside nationally designated forest reserves, through the construction of an extensive network of new roads aimed at extracting a wide range of commercial species. Small-scale replanting is occurring, dominated by Asian softwood species aimed for future use in plywood production. A major bushmeat trade that threatens existing wildlife populations is currently facilitated through the timber operations. As noted in Kormos, Bakarr *et al.* (2003) Chapter 21, bushmeat hunting and slash-and-burn agriculture are on the rise, threatening viable populations of many critical species, including the chimpanzee.

18.5 Impacts of logging on chimpanzees

Current understanding of the response of primate communities to vegetation change following logging is poor. Limited community-level research undertaken in Central Africa (Skorupa 1986; Howard 1991; Plumptre and Reynolds 1994; White and Tutin 2001) indicates that closely related species of primates may respond very differently (White and Tutin 2001). Some of the important habitat variables influenced by logging include harvest offtake, including incidental damage, details of plant foods remaining, and the nature of plant regeneration after logging (Struhsaker 1997).

Given the wide range of impacts of logging on a forest ecosystem, the reaction of chimpanzee communities to logging is also likely to be diverse. Given that chimpanzees have been shown to be extremely adaptable to varying circumstances, it may be expected that the impacts of logging would be comparatively less for chimpanzees than for other species. However, studies in both East and West Africa demonstrate a decline in chimpanzee numbers following logging (Tutin and Fernandez 1984; Skorupa 1986).

Impacts of logging on chimpanzees are both direct and indirect, creating a complex array of factors that influence the distribution, structure, and behavior of chimpanzee groups. Direct impacts produced by logging include (1) the alteration of the ecological composition of chimpanzee habitat and loss of traditional food sources due to selective cutting of forested areas and the replanting of exotic species; (2) the displacement of chimpanzee groups due to the noise and activities generated by on-going timber activities; (3) the fragmentation and destruction of habitat from road construction; and (4) the complete loss of habitat due to clear-cutting. Indirect impacts include (1) the encroachment and subsequent habitat destruction of slash-and-burn farmers following timber operations and (2) increased bushmeat hunting from timber employees and others moving into the area opened by logging activities. Our present knowledge of the above effects of logging on chimpanzees is only available for chimpanzees in Central and East Africa. No studies have been done to date on the effects of logging in West Africa, and it is possible that there may be differences.

18.5.1 Direct impacts of logging

18.5.1.1 Habitat degradation from selective logging and subsequent replanting of exotic tree species

West Africa's moist forests show high plant diversity, including large trees. However, the density of preferred species is rather low. This situation favors selective logging, which results in minimal changes to the forest structure, as normally not more than one harvestable tree per hectare is removed. These valuable species occur at much lower densities in Africa than in Southeast Asia or the Neotropics (Parren and de Graaf 1995). This implies that the rotation period should cover almost a century, with felling cycles of several decades each, depending on the dynamics of the forest. The problem is that, rather than waiting 20 or 30 years before reentering an area to extract timber, it is common practice to reenter five to six times in a 20–30 year rotation period. Reentering is stimulated by sales orders from distant markets for a variety of species each time. This has been common practice in Côte d'Ivoire since the early 1960s, causing rapid degradation of forests. Ghana on the other hand is facing serious problems with illegal logging

activities in and outside their reserves. Over the last decade, illegal logging contributed to almost half the total roundwood production (Koffi Smith 1996; Birikorang 2001).

Selective felling of commercial species may not destroy a forest, but it does alter the ecological structure, creating a broad impact on a diverse web of species interactions. Studies undertaken in the tropical forests of Kibale National Park, Uganda, show that mechanized, selective logging has resulted in the suppression of middle and upper canopy tree species for more than 20 years after the logging took place (Struhsaker 1997). While the precise impact of the loss of commercial timber species on the ecological function of West Africa's forests is poorly understood, their loss inevitably promotes or inhibits the success of a variety of other plant and animal species. The overall change in ecological function alters the habitat of forest-dwelling chimpanzees, likely leading to a reduction in overall populations.

While many West African countries rely more and more upon replanting schemes to restore forests often seriously degraded by a combination of over-exploitation and fire, most replanting is done with exotic timber species, which grow faster than indigenous ones. The change in floristic composition due to the replanting of exotics is largely underway in many countries, with unknown long-term impacts for chimpanzee populations. In the extreme, the change in floral composition of West Africa's forests may reduce or eliminate some of the 133 plant sources of lianas, palms and trees known to be consumed by chimpanzees in West Africa (Chatelain *et al.* 2001). While chimpanzees show a remarkable ability for adaptation, the potential loss of traditional habitat and food sources will likely have a negative impact on chimpanzees in areas affected by selective logging and replanting (Marchesi *et al.* 1995). Even in areas of low intensity logging where keystone food species remain essentially untouched, densities of chimpanzees decline significantly following timber exploitation and remain low for many years (White and Tutin 2001). While it would appear that the direct impacts of selective logging on chimpanzees are lower than those derived from clear-felling, this may not be the case due to myriad indirect impacts that more often than not follow logging activities into the forest, such as road construction, hunting, and agriculture.

(Photo credit: Dirck Byler 2001)

Tree nursery of Oriental Timber Company raising native as well as exotic species, south-east Liberia.

18.5.1.2 Displacement of chimpanzee populations due to the noise and human interference surrounding logging operations

Although humans and chimpanzees have coexisted to various degrees throughout Africa, chimpanzees nearly always actively avoid humans if possible, even in places where there have been no human residents in the immediate vicinity for over 100 years (White and Tutin 2001). Noise and disturbances from logging activities heard 5–10km away will cause chimpanzees to leave their established range (White and Tutin 2001). Entire communities could likely be displaced by such activity, increasing stress demonstrated by tense, nervous behavior. Such movement of chimpanzee communities can cause conflict with neighboring social groups who aggressively defend their range. In some cases, violent conflict leading to death could be brought about from the movement of one group onto another's territory. Some studies suggest that chimpanzees displaced by humans would be cautious about revisiting areas previously used as a home range (Goodall 1986; White and Tutin 2001). In Korup forest in south-west Cameroon on the border with Nigeria, the chimpanzee density was considerably less in forest logged the previous three years, and the group size diminished from 12–20 in unlogged forest to six to 15 in the logged forest (Waltert *et al.* 2002). Thus, impacts from even minimal logging operations can continue long after the timber company has moved on. In general, timber operations leave a legacy far greater than the trees they take with them and the roads they build. Their simple presence can have a profound impact on the social organization and health of chimpanzees and other mammal species long after the last chainsaw has left.

18.5.1.3 Fragmentation and destruction of habitat from road construction and clear-cutting

The construction of roads creates fragmentation in existing habitat and barriers to chimpanzee movement throughout the forest. Selective exploitation often leads to extensive road networks since massive trunks can only be transported out of the forest via feeder trackers and logging routes. For every $10km^2$ of moist forest,

(Photo credit: Dirck Byler 2001)

Timber road, south-east Liberia.

10km of roads must be constructed to ensure transportation of logs to main highways (Martin 1991). This leads not only to habitat fragmentation but destruction of the forest itself. Logging roads are the primary reason why slash-and-burn activities by migrant farmers are located in or around timber operations.

Clearly, the destruction from clear-cutting entire swathes of forest threatens chimpanzee populations living in or near these operations at a landscape scale. Clear-cutting operations are becoming less common in West Africa as most of the unreserved forest has been converted to other land uses. The conversion of forests to other land uses destroys the structure, composition, and overall ecological character of the landscape. This drastically alters the ability of most species to survive, pushing existing species onto smaller and smaller forest fragments for which the chimpanzees are very vulnerable. A recent national chimpanzee census in Côte d'Ivoire (Marchesi *et al.* 1995) showed that forest fragments should be sufficiently large for them to persist. Furthermore, the watershed services of a forest are eliminated by clear-cutting, which leads to severe soil erosion and the further loss of arable land, not to mention the potential for future forest regeneration. All of this puts tremendous pressure on existing populations of chimpanzees. As mentioned previously, habitat loss forces separate or competing chimpanzee groups into each other's territory, causing further competition for scarce resources, reduction of food sources and conflict at times leading to death. Once an area is clear-cut, it is unlikely that the complex ecological composition and structure of the forest will be allowed to completely regenerate, putting at risk the species that once relied upon the forest habitat for survival.

18.5.2 Indirect impacts

18.5.2.1 Loss of habitat to slash-and-burn farmers following timber operations

Possibly the greatest threat impacting West Africa forests and the current distribution of chimpanzee populations is the slash-and-burn agriculture which has historically followed commercial logging in West Africa and has irrevocably destroyed and fragmented the region's forests (Ahn 1959) (see Duvall 2003, Chapter 19). This practice of clearing, cultivating and then letting land lie fallow is widespread and provides the major source of livelihood for the largely rural poor population that inhabits the forest region. Using axes and bush knives, farmers clear the forest a piece at a time, leaving the dried remains of cut vegetation to be burned. Because the land can only be worked for a short time due to pervasive poor soil type, the actual area of land cultivated is replaced as the forest retreats, creating large swathes of fallow land, unable to support timber production or agriculture. Since most unreserved forests have been converted to shifting cultivation in countries such as Côte d'Ivoire, Ghana and Nigeria, and the rural population doubles every 20 to 25 years, an enormous pressure can be seen on the lands leading to ever dwindling fallow periods, from the traditional 20 years fallow to a meager six years at present. As a result, the productivity of these soils diminishes rapidly, putting ever greater pressure on the remaining reserved forests. While agriculture is largely illegal in forest reserves and national parks, it is still undertaken in many of these areas due to weak enforcement. Increased farming leads to greater human presence, which in turn also leads to incidences of crop raiding, increased hunting pressure (Quiatt *et al.* 2002), and ever shrinking wildlife populations.

18.5.2.2 Increased hunting pressure

Commercial logging opens up pathways for bushmeat hunting, both subsistence and commercial, in areas that were previously relatively free of hunting and other human pressures. Timber operations facilitate access to hunters seeking to earn quick profits from the sale of bushmeat in urban areas. Furthermore, employees of logging companies often exploit this access to wildlife to supplement timber incomes. In Central Africa, such earnings can contribute up to 40% of the employee's income (Wilkie *et al.* 2001). The combination of hunting and habitat degradation from logging has been shown to have an especially adverse impact on primates (see Kormos, Bakarr *et al.* 2003, Chapter 21).

The process normally follows a well-defined pattern: hunting camps supplied with guns and often staffed by men

(Photo credit: Daniel Juhn)

Aerial photo of timber road and neighboring slash-and-burn agriculture, south-east Liberia, March 2002.

and women with ties to urban retailers proliferate, allowing easier access to wildlife as well as access to free transportation of meat on logging trucks. Often, these camps operate near logging operations and are staffed by timber employees seeking to maximize both revenue sources. Likewise, timber companies profit from paying lower wages since hunting provides greater earning power for employees. Timber operators are usually not educated about the pertinent wildlife laws, and, as Rose (1998) states, ''The timber industry's reliance on bushmeat to feed loggers and their inability to educate workers and govern their concessions leads to indiscriminate hunting that not only fosters the breaking of laws, but also the breaking of customs.'' This process is currently on display in Liberia and most likely took place in Côte d'Ivoire, Ghana and Nigeria a couple of decades ago. However, most of the hunting activities in other West African countries are more linked with settled villagers (indigenous and immigrants alike) surrounding the forest reserves than temporary timber-industry workers (non-locals).

A striking example is seen inside Taï National Park, Côte d'Ivoire, where hunting is rampant and bushmeat markets still flourish in the surrounding villages even though the park's management is intensively supported by GTZ (Caspary *et al.* 2001). Chimpanzees are only abundant in the areas where researchers study wildlife and where ecotourism projects include habituated chimpanzee groups that visitors can easily encounter and view. Smoked chimpanzee meat from the Taï forest is offered on the markets but sometimes originates from neighboring Liberia. In some instances it comes from as far as Sapo National Park, some 70km away. The bushmeat offered in these distant markets, in turn, can find its way as far as the capital Abidjan, some 400km to the east.

The phase in which bushmeat markets flourish – currently on display in and around Taï National Park – is typically followed by the collapse of the bushmeat trade in open markets and with outside retailers from urban centers in other regions of the country. The bushmeat is then offered at the local chop bars (restaurants) where it is also consumed. This phenomenon can be seen in forested western Ghana around reserves such as Bia National Park and Ankasa Resource Reserve, where bushmeat is not readily available and

(Photo credit: Hans-Ulrich Caspary)

Chimpanzee bushmeat offered in south-west Côte d'Ivoire.

is under restrictive control by the wildlife division (Holbech 1998). This shows a dramatic trend since large mammals including chimpanzees were still abundant at the time of establishing these conservation reserves in the early 1970s (Martin 1976, 1982) and are now facing extinction due to the ever-increasing hunting pressure.

18.6 Recommendations

18.6.1 Integrate wildlife conservation into forest reserves

Although West African forests should ideally all be protected, it is important to try to integrate wildlife conservation with timber production wherever possible. One example of how wildlife conservation has been integrated in the management of a timber production reserve is the Bossematié classified forest, Côte d'Ivoire, where ecological research focused on the distribution and abundance of faunal species has helped to determine areas with the highest importance for conservation. Biomonitoring efforts also facilitated the selection of three biological reserves within the classified forests to conserve tree genetic stocks and provide safe haven for animals (Waitkuwait 1992). A similar fauna biomonitoring programme is underway at Sapo National Park, Liberia (Waitkuwait 2001).

18.6.2 Increased participation of local communities

The participation of local people is key to effective forest management because local communities can benefit from restored future levels of non-timber forest products, including fauna. In addition to protecting the forest from outsiders, local communities can also participate in all kinds of field activities such as tree planting and monitoring. Thibault and Blaney (2001) even found that local communities are a more 'sustainable' human resource in monitoring than government agents or non-governmental organization members because they show more commitment and their activities are maintained over longer periods. However, integrating forest management with the economic activities of local communities is not always successful. In Okomu forest reserve in

south-west Nigeria, managers attempted to integrate conservation and agriculture by assisting migrant farmers in the reserve (Oates 1995). Instead of halting the human impact within the reserve, this effort attracted new immigrant farmers, which worsened the situation. The participation of the local population in forest preservation thus has its limits and is most effective when focused on involvement in protection work, tourism, sustainable-yield forestry, research and the gathering and cultivation of non-timber forest products.

18.6.3 Work with logging companies to take special protective measures against hunting

The impacts of commercial logging operations can be reduced if special measures are taken to protect those species used by primates as food sources and if safe havens for wildlife are respected. Furthermore, timber operators can play a key role in preventing hunting and educating their employees and surrounding populations in national wildlife laws and the importance of respecting local wildlife needs. The enactment and enforcement of wildlife laws both traditionally and on a national level can most likely lead to effective conservation and wildlife management.

18.6.4 Creation of new protected areas

New protected areas connected through corridors aimed at ensuring genetically viable populations are urgently required to prevent species extinctions in the future. Such an effort has been initiated in Liberia, where a joint project involving the Food and Drug Administration, Conservation International and Fauna and Flora International is being implemented to assess the state of Liberia's permanent forests and produce recommendations for the creation of new protected areas. The project focuses largely on eastern Liberia, where the largest tracks of closed forests are confined (Robinson and Suter 1999). The ultimate goal is to realize a network of protected areas consisting of national forests (timber production reserves), national parks, nature reserves and communal forests. The parks and reserves of south-east Liberia would be interconnected by corridors in a crest from the Cestos-Senkwehn riversheds at the coast in central Liberia via Sapo National Park and the Putu range ultimately reaching the Grebo forest on the border with Taï National Park in Côte d'Ivoire. Geographical Information System baseline information and data from flora and fauna inventories will be used to locate areas that require special conservation attention. These actions are urgently needed since Achard *et al.* (2002) found high annual deforestation rates of 1.1–2.9% in south-east Liberia and south-west Côte d'Ivoire over the period of 1990–1997.

18.7 Conclusions

Logging impacts chimpanzees directly through habitat loss, alteration of ecological structure, loss of food sources and displacement due to noise and human activities. Additionally, the most severe impacts on chimpanzees are facilitated indirectly through timber operations. Slash-and-burn agriculture follows pathways opened up by logging, severely degrading already damaged forests. As illustrated in Liberia, bushmeat hunting frequently occurs alongside logging camps, providing timber industry employees and other entrepreneurs ready access to cash and food. Since most West Africans have a preference for bushmeat, hunting is silencing the forests of the sounds of wildlife and leading to local extinctions. Population pressure and the demand from distant bushmeat markets are so great that sustainable harvesting remains a distant dream.

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Chapter 19

Agriculture and Chimpanzee Survival in West Africa

Chris Duvall

19.1 Introduction

Agriculture and chimpanzees are not inherently incompatible. Indeed, farming has been practiced in parts of the current chimpanzee range for at least 2,000 years (Clark and Brandt 1984), and chimpanzees still coexist stably with farmers in several areas. Yet during the past century there has been a massive defaunation of West Africa, caused in part by the expansion of agricultural environments unsuitable for most wildlife species (Happold 1995). Although the nature and rate of landscape change due to agriculture is likely to vary between sites due to social and ecological variation (e.g., Fairhead and Leach 1996; Nyerges 1996; Bassett and Koli Bi 2000), there is general consensus on why modern agriculture has severely affected wildlife populations (cf. Happold 1995). In the past century, agriculture has become a threat to the survival of chimpanzees mainly because the area of cultivated land has expanded at the expense of chimpanzee habitat, due ultimately to processes initiated by human demographic, technological, economic, and political change (cf. Turner *et al.* 1990). These processes remain active and produce varying rates of habitat loss throughout West Africa, depending on the specific social and ecological context of a given site.

19.2 Causes of impacts on chimpanzees

19.2.1 Demographic changes

Demographic change, particularly population growth, has led directly to the expansion of area under cultivation at the expense of mainly forest vegetation throughout the world (e.g., Turner *et al.* 1990; Rock 1996; A. Wood *et al.* 2000). Food production in Africa has remained stagnant for the last 40 years relative to population growth (Sanchez 2002), and African nations have generally attempted to increase production by increasing the area of cultivated land (Bilsborrow and Ogendo 1992). From 1985–1998, areal expansion of agricultural land in Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Senegal, and Sierra Leone exceeded 39% (calculated from data in FAO 2001). In these countries (excluding Mali, where a large portion of land is not arable), agricultural land covers 15% of the total surface area (calculated from FAO 2001), although its distribution is uneven. The highest percentages of land devoted to agriculture (30–60%) occur in the rainforest and adjacent areas to the north; the northern parts of chimpanzee range (southern Senegal, southern Mali, and northern Guinea) host less agricultural land (A. Wood *et al.* 2000).

In Africa agriculture generally has expanded into areas of former wildlife habitat (Happold 1995). In West Africa, this often has included protected areas because historically wildlife conservation has been secondary to agricultural production for colonial and independent governments (East and Estes 1990; Roth and Dupuy 1990). Much of the current range of *P. t. verus* lies in areas where population growth is leading to the expansion of agriculture into agroecologically marginal land (Weber *et al.* 1996). Such land-use change is particularly significant because substantial wildlife populations may survive in these marginal areas (Happold 1995), as has been suggested for chimpanzees in Mali (Duvall 2000). Significantly, agricultural expansion often follows logging in forested areas, because logging operations improve access to these areas and reduce the labor needed to clear fields. Additionally, in many parts of West Africa, demographic change has led to increased competition for agricultural land, causing individual farmers to modify previous farming practices with unforeseen consequences for the quality of wildlife habitat. For instance, in northern Sierra Leone, within known chimpanzee range near Outamba-Kilimi National Park, Nyerges (1989, 1996) has shown that competition for preferred field sites has led to different clearing practices that deflect vegetation succession away from forest and toward open woodland.

19.2.2 Agricultural technology

Although population growth is probably the main ultimate cause of chimpanzee habitat loss to agriculture in West Africa, several other factors also contribute to land-use change. In many instances, African nations have sought to increase food production by introducing new agricultural technology. Such technological changes have had direct, negative consequences for wildlife, including chimpanzees. For instance, the Manantali Dam in south-western Mali, which was built in part to allow irrigated rice cultivation, flooded several hundred square kilometers of riparian and *Borassus* palm

(Photo credit: Tatyana Humle)

Corn fields grow along the edge of the forest in Nimba mountains. The encroachment of agriculture on forest habitat is a principal threat to chimpanzees in this region.

forest that were probably valuable chimpanzee habitat (Moore 1985; Warshall 1989). Such massive development projects also tend to disrupt indigenous social systems, an effect that often leads to ecologically unsustainable changes in agricultural or hunting practices (e.g., Nyerges 1997; Koenig and Diarra 1998). Smaller-scale technological change also may affect farming practices, with negative consequences for wildlife. For example, the introduction of plows in many areas has caused farmers to clear more trees from their fields, deflecting fallow succession away from preexisting forest types, or has led simply to increased clearing for agriculture (Boffa 1999, 2000).

19.2.3 Economics

Significantly, the decisions individual farmers make about resource use are increasingly constrained by external factors that reflect profound political and economic change throughout the region. Unfortunately, many aspects of modern politics and economics in the developing world tend to encourage unsustainable use of natural resources (e.g., Blaikie and Brookfield 1987; Turner *et al.* 1990; S. Wood *et al.* 2000). Expansion of the cash economy has increased the value of manufactured goods, which in many areas has decreased the value of products derived from wild plants, and thus the value of the vegetation types where these plants are found (e.g., Boffa 1999; Schreckenberg 2000). Often, growth of the cash economy parallels growth of market demand for agricultural products, which may lead to the expansion of cultivated areas (Weber *et al.* 1996), as happened in the rainforest zones of Ghana and Côte d'Ivoire in the 1970s and 1980s due to high international cocoa prices. More frequently, however, economic crises – caused by market collapse, structural adjustment, or currency devaluation – have caused farmers to alter agricultural practices in ecologically unsustainable ways (Reardon *et al.* 1999; Sunderlin *et al.* 2000). For instance, in Côte d'Ivoire, following the crash of cocoa and cotton prices in the 1980s and currency devaluation in 1994, rural incomes dropped precipitously (Cogneau and Collange 1998; Bassett 2001), and expansion of agriculture, especially into protected areas such as Taï and Comoé National Parks, increased (Roth and Hoppe-Dominik 1990; Boesch and Boesch-Achermann 2000b; Bassett 2001). Throughout the developing world, loss of wildlife habitat to agriculture may stem from the macroeconomic policies of international financial institutions (S. Wood *et al.* 2000), which have mandated structural adjustment programs for nearly all West African countries, with negative consequences for the ecological sustainability of agriculture in many areas (e.g., Koenig and Diarra 1998; Reardon *et al.* 1999).

19.2.4 Agriculture and hunting

Finally, agriculture may threaten chimpanzees not only through loss of habitat, but also through hunting if the animal is considered a crop pest (see Humle 2003c, Chapter 20). Chimpanzees may consume domestic crops, particularly fruits and grains, as has been reported from Bossou, Guinea (Sugiyama and Koman 1992). In other situations, humans and chimpanzees may compete for wild plant foods, especially when agricultural produce is in short supply (Duvall 2000; Pruetz 2002). In either case, in areas where the animal is considered a threat to human food security, its local survival is less likely to depend on the rate of habitat loss than on the effectiveness of human efforts to eliminate agricultural pests.

19.3 Recommendations

19.3.1 Enforce protected area boundaries

The land area covered by farmland varies throughout West Africa, with the highest percentages found along the edges of the West African rainforest block (A. Wood *et al.* 2000). The rate of deforestation in West Africa is high (see Parren and Byler 2003, Chapter 18), and there are few areas in the rainforest zone where the flora and fauna remain relatively

intact. Agricultural encroachment (or other disturbances such as logging or hunting) should not be tolerated in existing protected areas, particularly those in the rainforest block due to their high value to international biodiversity conservation (Bakarr, Bailey *et al.* 2001). West Africa's protected areas network will not be able to protect sustainable chimpanzee populations in the face of continued habitat loss due to agriculture.

19.3.2 Promote intensification in areas with high population density

West African nations must increase food production to meet the needs of their growing populations. To do this without sacrificing biological diversity, agricultural development initiatives must focus on intensifying production in areas that already have a high density of agricultural land rather than encouraging expansion of commercial cultivation into new areas. Successful intensification will rely not just on an improved availability of implements and other inputs, but perhaps also on economic (Koenig and Diarra 1998) and land tenure (Schroeder 1999) reforms.

19.3.3 Assess variable impacts of different farming practices

Finally, conservationists must recognize that the impact of agriculture on chimpanzee habitat varies depending on vegetation ecology and human practices. While the impacts of logging and hunting on chimpanzee populations have been well studied, the effects of different agricultural practices are poorly known (Cowlishaw and Dunbar 2000). Research is needed to understand how different farming practices affect chimpanzee populations, so that agricultural activities may be proactively integrated in conservation initiatives occurring outside of protected areas.

19.4 Conclusions

The historic expansion of the area under cultivation in West Africa represents a trend that is likely to continue into the near future, at least in general, across the region (A. Wood *et al.* 2000). The continued coexistence of farmers and chimpanzees relies, in part, on improving the efficiency of agriculture so that humans may improve their standards of living while decreasing the persistent need to claim areas of chimpanzee habitat in the hopes of increasing food production.

Chapter 20

Chimpanzees and Crop Raiding in West Africa

Tatyana Humle

20.1 Introduction

The conversion of land, particularly forest habitats, to agriculture has resulted in increasing conflicts between humans and wildlife in Africa (Lee *et al.* 1986). This increase in areas of land used for agriculture and permanent crops, mainly driven by population growth or large influxes of immigrants into certain regions, has been a trend in most African countries since the 1950s (Bilsborrow and Ogendo 1992). A consequence of such habitat degradation and fragmentation is an increase in crop raiding by forest-dwelling animals. Crop raiding can cause substantial losses to farmers (Newmark *et al.* 1994) and poses a threat to wildlife via consequential human retaliation. Susceptibility to crop raiding has been linked to many factors, particularly proximity of cultivated fields to forest boundaries and types of crops grown (Hill 1997). Chimpanzees inhabiting environments adjacent to human habitation or agricultural settlements have been observed and reported to raid crops in several regions of Africa (Yamagiwa *et al.* 1992; Hill 1997; Yamakoshi 1999; Greengrass 2000). Their remarkable ecological and behavioral flexibility, their propensity for cooperative behavior, and their omnivorous diet have enabled them to successfully exploit agricultural environments that are impinging on their natural habitat.

Although recognized crop raiders in certain regions, chimpanzees are not usually considered a major pest, since other vertebrates such as rodents, wild pigs, bushpigs, elephants and other species of primates, such as baboons *Papio anubis*, vervet monkeys *Cercopithecus aethiops* and redtail monkeys *C. ascanius*, often cause greater damage to crops (Hill 1997; Naughton-Treves 1998). Such surveys though have so far mainly focused on regions of East Africa (Hill 1997, 2000; Naughton-Treves, 1998; Naughton-Treves *et al.* 1998; Saj *et al.* 2001). Very little information and data on crop raiding by chimpanzees or other wild animals in areas of West Africa have been gathered and published.

20.2 Chimpanzee crop raiding in West Africa

Generally, chimpanzee communities inhabiting large protected areas, such as Parc National du Niokolo Koba at Mt. Assirik in Senegal and Taï National Park in Côte d'Ivoire, do not raid crops, since crops are not available within their home ranges (Mt. Assirik: W.C. McGrew, pers. comm.; Taï: Boesch and Boesch-Achermann 2000b). In addition these protected areas provide chimpanzees with a sufficiently large surface area for their survival and needs and limit the extent of human-chimpanzee encounters to instances of illegal poaching and hunting, usually aimed at other wildlife species (e.g., Boesch and Boesch-Achermann 2000b). However, in many regions of West Africa, protected areas are lacking or are too small, and farming is commonplace and on the increase, causing further habitat loss and fragmentation. In these areas, chimpanzees are observed competing with humans over natural resources and raiding crops.

One example of where chimpanzees and humans overlap extensively in their use of forest resources is in the Tomboronkoto region of south-eastern Senegal, with the Fongoli community of savanna-dwelling chimpanzees. These chimpanzees coexist with humans belonging to the Bédik, Malinké, and Fulani groups (Pruetz 2002). Within the 50km^2 study area, surveyed by Pruetz and colleagues as part of the Miami Assirik Pan Project, there are four villages ranging in size from less than 15 to more than 100 inhabitants (Pruetz 2002). Pruetz (2002) suggested that as many as 17 species of plants are consumed here both by chimpanzees and humans, comprising 21 edible parts.

One of these plant foods is a forest liana called *Saba senegalensis.* This species may act as a keystone resource (*sensu* Terborgh 1986) for both chimpanzees and humans in this region. It is a prominent fruit species in the diet of chimpanzees, especially between the months of May to July when other fruits are scarce. It also serves as a 'cash crop' for humans, providing a source of income for households during the dry season, a period of hardship for most families in the area (Pruetz 2002). The chimpanzee may act as an important seed disperser for this species of plant, since the seeds usually appear undamaged in the feces. However, it was estimated that humans remove approximately 75,000 *Saba* fruits per month during peak fruiting (Pruetz 2002). Most of the seeds thus removed contribute to the decline in the reproductive potential of this liana species and may eventually significantly reduce fruit availability for the chimpanzees. Continued unsustainable harvesting by humans of this fruit could potentially encourage chimpanzees to consume these fruits when still unripe or force them to seek alternative sources of food, including crops, such as millet, corn and peanuts that are grown in the region (Pruetz 2002).

(Photo credit: Tatyana Humle)

Chimpanzees feed on corn at the edge of the forest. Because of ongoing habitat destruction, more and more chimpanzees are raiding domestic crops to supplement their daily diet.

For many generations, chimpanzees have coexisted alongside humans in this area, in spite of competition over natural food resources and water. This peaceful coexistence has been in part due to a cultural taboo against hunting of chimpanzees in this region. However, an increase in instances of crop raiding in the region could change people's attitudes and increase intolerance of chimpanzees by humans.

Another example of the overlap in use of food resources between chimpanzees and humans is the Bossou community of chimpanzees in south-eastern Guinea. These chimpanzees live in close proximity to the village of Bossou, home to several hundred inhabitants. The habitat of the chimpanzees is comprised of small hills dominated by primary and secondary forest encircling the village and covering approximately five km^2 and is surrounded by swamps and cultivated fields. Nevertheless, the presence of gallery forests enables the chimpanzees to extend their home range to about $15km^2$, nearly reaching the foothills of the Nimba Mountains that harbor other chimpanzee communities (Shimada 2000; Humle and Matsuzawa 2001).

In this area, humans harvest for consumption 23 species of forest plants that are also consumed by the chimpanzees (Sugiyama and Koman 1992). However, this extraction is performed at such low levels that it does not appear to present a competitive scenario between chimpanzees and local people. Nevertheless, Bossou chimpanzees have easy access to agricultural fields and cultivated plant species present in the outskirts of the village or further afield. Due to this proximity between cultivated fields and the forest edge, chimpanzees at Bossou readily raid crops in the area, especially during the rainy season (May to September) when fruits in their natural habitat are scarce (Yamakoshi 1999; Takemoto 2002). Indeed, Yamakoshi (1999) pointed out that Bossou chimpanzees depended heavily on human-influenced habitat during the fruit-scarce season. Such habitats include secondary forest, scrub forest, orchards and cultivated fields. Sugiyama and Koman (1992) noted that chimpanzees at Bossou consume 29 species of cultivated plants (Table 20.1), some raided directly from fields or orchards and some also available from abandoned fields, which recover after several years and become scrub and secondary forest. Takemoto (2002) noted that cultivated fruits comprise 6.4% of the annual diet of Bossou chimpanzees and are thus fully integrated in their dietary repertoire, although their seasonal proportion in the diet can fluctuate quite significantly (Yamakoshi 1999). These chimpanzees can thus cause non-negligible losses to farmers, and this situation has yielded increased complaints from farmers. The extent of this damage, though, still remains to be determined and for conservation purposes and the future of the Bossou chimpanzee community should be carefully assessed.

Although the Manon people living in the area consider the chimpanzees as one of their totems and respect them as the reincarnation of their ancestors, they often will deter chimpanzees from raiding their crops, especially by shouting and making noise. A recent influx since the 1990s of Liberian refugees in the area has worsened the situation. Some of the hillsides have been converted to agricultural fields, thus further fragmenting the chimpanzees' habitat and causing habitat loss. This habitat encroachment may result in the chimpanzees raiding crops more frequently. However, refugees and other immigrants to the region, who do not have the same taboos or customs as the local Manon people, generally display greater intolerance towards the chimpanzees. Some have been observed employing more drastic measures to prevent them from raiding their fields, such as throwing stones either directly by hand or with the aid of slingshots. Many farmers in the area are poor and rely on agriculture for subsistence and for petty trade, which enables them to acquire some cash for non-consumable products. Thus, for farmers, it is essential that crop raiding episodes by chimpanzees and other wildlife in the area, especially cane rats *Thryonomys swinderianus*, are discouraged and kept at low levels.

Crop raiding by chimpanzees has also been reported from other areas of Guinea, where chimpanzees consume rice and millet and destroy large quantities of grapefruit (Dunnett *et al.* 1970). Bourlière *et al.* (1974) also noted that chimpanzees raid crops in the Lamto region of Côte d'Ivoire. In the Nimba Mountains in Côte d'Ivoire, chimpanzees regularly approach the village of Yealé at the border of the reserve to access secondary forest fruits and raid cacao fields, a major

Table 20.1. List of cultigens consumed by chimpanzees at Bossou, Guinea, and parts eaten by both chimpanzees and humans.

Scientific Name	Common Name	Part consumed by:	
		Chimpanzees	Humans
Ananasa comosus	Pineapple	Fruit, Pith	Fruit
Annona muricata		Fruit	Fruit
Arachis hypogaea	Peanut	Seed	Seed
Cajanus cajan		Seed	Seed
Carica papaya	Papaya	Fruit, Petiole	Fruit
Citrus aurantifolia	Orange	Fruit	Fruit
Citrus grandis	Grapefruit	Fruit	Fruit
Citrus reticulata	Mandarin	Fruit	Fruit
Cocos nucifera	Coconut	Fruit	Fruit
Cola nitida	Cola	Young Leaf, Fruit	Leaf, Fruit
Cucumis melo		Fruit	Fruit
Cucurbita pepo		Seed	Seed
Hibiscus esculentus	Okra	Fruit, Flower, Leaf	Fruit, Leaf
Hibiscus sabdariffa		Flower	Flower
Ipomoea batatas	Sweet Potato	Tubor	Tubor
Manihot esculenta	Cassava	Tubor, Flower	Tubor
Manihot glaziovii	Cassava	Tubor	Leaf
Manihot utilissima	Cassava	Tubor	Tubor
Musa sapientum	Banana	Pith, Fruit	Fruit
Musa sinensis	Banana	Pith, Fruit	Fruit
Oryza sp.	Rice	Petiole	Seed
Elaeis guineensis	Oil Palm	Petiole, Seed, Fruit, Flower, Heart	Seed, Fruit, Flower, Sap
Phaseolus lunatus	Beans	Seeds, Young Leaf	Seed
Psidium guajava	Guava	Fruit, Young Leaf	Fruit
Saccharum officinarum		Pith	Pith
Solanum lycopersium		Fruit	Fruit
Solanum macrocarpon		Fruit	Fruit
Solanum nodiflorum		Fruit	Leaf
Theobroma cacao	Cacao	Fruit	Fruit
Zea mays	Corn	Fruit	Fruit
Raphia gracilis	Raphia	Pulp, Sap	Pulp, Sap

cash crop for local people which is always grown in close proximity to the forest edge (T. Humle, pers. obs.). Chimpanzees in the area have also been reported by farmers to eat papaya, pineapple, oranges and cassava. However, such instances of crop raiding tend to be correlated with times when fruit availability in the forest is at its lowest, since when fruits are abundant within the reserve, chimpanzees are more rarely observed in the vicinity of the village (T. Humle, pers. obs.).

20.3 Lessons from East Africa

In the Gombe National Park in Tanzania, habitat encroachment by humans resulting from pressure for increased agricultural activities has been proposed as the cause for a sudden decline in numbers among one of the chimpanzee communities in the southern region of the park (Greengrass 2000). The definitive cause of this decline still remains undetermined. Further surveys will establish whether the Burundian immigrants, who are prime settlers in the area, hunt chimpanzees or not. Some people in the area may also resort to poisoning to deter animals from raiding their crops, as suggested by the unconfirmed report of the discovery of two dead chimpanzees still lying in their nests (Greengrass 2000). The home range of this chimpanzee community originally extended beyond the boundaries of the park. Loss of forested habitat, which used to provide them with their dietary requirements, has encouraged the chimpanzees to raid crops, such as bananas, palm fruit and mangoes that are now cultivated on the forest edge (Greengrass 2000). This situation in the Gombe National Park confirms the necessity for a thorough assessment of home ranges of chimpanzee communities before establishing park boundaries.

20.4 Recommendations

20.4.1 Conduct assessments of chimpanzee crop raiding and its effect on farmers

With continued population growth in many regions of West Africa, and the resultant need for increasing amounts of land to be used for cultivation, it is likely that the existing conflict between people and chimpanzees will continue to escalate. Infield (1988a, b) has suggested that crop raiding conflict issues could reinforce the attitude among farmers that conservation programs and the establishment of conservation areas actually contribute to their subsistence problems rather than decrease them. Such a situation confirms the real need for detailed assessments of the extent and the impact of chimpanzee crop raiding in different areas and its effect on the sustainable livelihood of regional farmers, in terms of actual crop losses and the economical and energetic costs of protecting these crops (Hill 2000).

20.4.2 Careful evaluation of park boundaries to minimize conflict between humans and chimpanzees

More importantly, in order to reduce the likelihood of such conflicts, it is critical that in some regions, detailed studies of chimpanzee community's home ranges, ecology and diet are carried out before establishing boundaries of new reserves or national parks that will provide important refuges for chimpanzees and guarantee their future conservation. It may also be important to take into account the current or projected future influx of refugees or immigrants into certain areas.

20.4.3 Provide practical and economic solutions and management strategies

Such studies as mentioned above should also help provide practical and economical solutions and produce better management strategies, thus encouraging local people's support for and compliance with conservation policy and practice. For example, as a result of a detailed study of crop raiding by several species of primates in the region of Kibale in Uganda, East Africa, Naughton *et al.* (1998) have recommended that palatable crops are best planted beyond 500m from the forest edge. This simple strategy should help reduce the frequency of crop raiding by wildlife, including chimpanzees, in the region.

20.5 Conclusions

Although in many areas, people have coexisted with chimpanzees for hundreds of years, an increase in human population density, and a decrease in chimpanzee habitat through logging or agriculture, is resulting in increased sharing of resources between humans and chimpanzees, which in turn results in increased possibilities of conflict. Greater knowledge of basic chimpanzee ecology in these regions and a deeper understanding of the effects of crop raiding on farmers can lead to recommendations to reduce the likelihood of competition. Recommendations aimed at reducing the likelihood of crop raiding by chimpanzees particularly along forest edges can be conveyed to local farmers through conservation education programs and have been shown in other areas of Africa to make a significant difference.

Chapter 21

Bushmeat Hunting as a Threat to Chimpanzees in West Africa

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21.1 Introduction

Bushmeat hunting, or the hunting of wildlife for commercial trade for meat, is one of the greatest threats to wildlife today. Wildlife has been hunted as a food source ever since people first inhabited rainforests about 40,000 years ago (Robinson *et al.* 1999). However, several factors have combined to turn what was perhaps once a sustainable practice into one that is decimating the world's population of large mammals. First, human populations have grown, thus increasing the demand for bushmeat. Second, the harvesting of wildlife has been facilitated in the last few decades with the opening up of previously inaccessible areas, primarily by logging companies (see Parren and Byler 2003, Chapter 18). Logging activities are often accompanied by a transient population of hundreds of workers who have little long-term interest in the surrounding natural resources. Workers in logging companies are often encouraged to hunt wildlife to supplement their diets. In addition, the transport of the meat has become increasingly easy through the improvement of roads and increased traffic. In addition to these direct impacts, wildlife populations have become increasingly vulnerable as a result of the decrease in habitat through logging as well as agriculture and the sprawl of cities.

Although there have been a few studies since the 1960s (Martin 1991; Ntiamoa-Baidu 1997; Caspary 1999; Bakarr, da Fonseca *et al.* 2001), our understanding of the bushmeat trade in West Africa is still poor. The majority of studies on bushmeat are based on information from the Congo basin (Equatorial Guinea, Gabon, the Democratic Republic of Congo, Congo and Cameroon), where the bushmeat trade has devastated wildlife populations (e.g., Wilkie and Carpenter 1999; Fa *et al.* 1995; Noss 1997). The bushmeat trade warrants similar attention in West Africa, where it has been equally devastating. Indeed, ''empty forest syndrome,'' which refers to forests that, while intact, contain very little wildlife, is an increasingly common occurrence in West Africa.

One of the reasons that so little is understood about the bushmeat trade in West Africa is that little quantitative information exists. Furthermore, the problem is difficult to solve because it is both complex and dynamic. It is complex in that there are an enormous number of variables affecting the degree of the threat, including economics, religion, culture, legislation, accessibility, distance to markets, human migration, human population density, the species involved. It is dynamic because the market is constantly fluctuating, and the value of bushmeat may change at any moment, depending on world markets and movements of people. In order to be able to design coherent, sound strategies to address the bushmeat trade, more information on markets and preferences is needed.

What we do know is that those species most impacted by the bushmeat trade are those that are large bodied, long-lived and slow to reproduce. Chimpanzees fit all of these criteria and are one of these most vulnerable species. The following examines what is known of bushmeat hunting in West Africa (with particular reference to chimpanzees), compares bushmeat hunting in West Africa to other regions of Africa and provides possible solutions for addressing the bushmeat trade in this region and for this species.

21.2 Chimpanzees and the bushmeat trade

As a biodiversity hotspot, West African forests have one of the highest diversity of mammals anywhere in the world. Unfortunately, the densities of larger mammals in West Africa are extremely low (Asibey 1974), and therefore populations are very sensitive to the removal of individuals. Certain species such as the chimpanzee are particularly vulnerable to hunting. Because they reproduce extremely slowly, chimpanzee populations do not bounce back as quickly as some species when hunted. Chimpanzees also tend to occur in very low densities compared to many mammal species, and they have extremely low productivity rates of about one infant per every three to five years for females between the ages of 20 and 23 (Sugiyama 1994a). Chimpanzees are also quite conspicuous and therefore easy to hunt.

In Central Africa, only a small part of the meat found in markets – between 0.03 and 1.94% of carcasses (Table 21.1) – comes from chimpanzees. The situation is similar in West Africa. In Côte d'Ivoire for example, of more than 3,500 animals seized from poachers in Taï National Park between 1993 and 1997, only 0.09% were chimpanzees (Caspary 1999). In Liberia, of 1,150 carcasses recorded in

Table 21.1. Proportional representation of primate and ape carcasses from bushmeat surveys in West and Central Africa.

Country	Number of carcasses recorded	% ape carcasses[a]	Reference
Equatorial Guinea – Rio Muni	6,440	0.05%	Fa *et al.* 1995
Congo – Brazzaville	15,141	1.94%	Malonga 1996
Gabon – Libreville	5,031	0.1%	Steel 1994
Congo – Villages around Odzala National Park	1,497	0.94%	Vanwijnsberghe 1996
Côte d'Ivoire – Villages around Taï National Park	3,500	0.09%	Caspary 1999
Liberia, Monrovia	1,150	0.03%	Anstey 1991b

[a] In all countries Apes could refer to gorillas and/or chimpanzee, except in Liberia, where Apes could only be chimpanzees.

bushmeat markets in Monrovia, only 0.03% were chimpanzees (Anstey 1991b). However, these estimates do not necessarily indicate low hunting pressure. The sale of ape meat is often hidden and therefore not surveyed because hunters are aware that it is illegal (Steel 1994). Moreover, apes are often eaten in villages and never make it to the markets because carcasses are large and difficult to carry. Finally, meat in markets can be hard to identify because it is often smoked. Consequently, the proportion of chimpanzee meat in bushmeat markets could be greater than reported.

21.3 Taboos against eating chimpanzee meat

Whether or not chimpanzees are hunted for meat varies greatly from country to country, region to region and even village to village. Whether or not chimpanzee meat is eaten seems to be affected by cultural and religious taboos as well as personal choice. The Muslim religion forbids the eating of the meat of primates and pigs. Because a large percentage of the population of West African countries is Muslim, chimpanzees are not hunted by local populations in many areas throughout West Africa. For example, Teleki (1980) found that antelopes were the preferred species of meat in the north of Sierra Leone, where the majority of the population is Muslim, whereas primates were viewed as a delicacy in south-east Sierra Leone, where the population is predominantly Christian. Ham (1998) found that chimpanzees were rarely hunted in the Fouta Djallon, a region of Guinea that is mostly Muslim, whereas chimpanzees are more frequently eaten in the south-east of the country, where Christianity is more common.

It must be noted however, that religion does not always affect whether chimpanzees are hunted. Animist tribes in south-western, western and eastern Côte d'Ivoire consider chimpanzees as totem. Alternatively, in northern Côte d'Ivoire around Comoé National Park, where people are mostly Muslim, poachers shoot all species including primates, which are often their favorite target.

As well as religious prohibitions, various traditional and cultural taboos in West Africa prohibit the eating of chimpanzees. Table 21.2 provides some examples of regions where chimpanzees are not generally eaten. In communities throughout West Africa, stories and legends about chimpanzees and their similarities to human have existed for generations. The role that chimpanzees play in the folklore of these societies illustrates the cultural importance of chimpanzees to people in West Africa. It is important to recognize that the disappearance of chimpanzees from this region would be a cultural loss as well as a loss to the ecosystem.

Conservationists should also be aware that emphasizing the similarities between humans and chimpanzees can sometimes have negative consequences. Many people are fascinated by chimpanzees' resemblance to humans, and decide to keep them as pets in order to both admire and mock these similarities. As history has shown, chimpanzees have been used as entertainment objects in humorous and derogatory ways – often their ''humanness'' is put on dispay by dressing them in clothes and forcing them to act out laborious tasks in a not quite human manner. ''*U wowo lek baboo*'' (You're as ugly as a chimpanzee) is a common Krio expression used to curse someone or describe their ugliness.

Unfortunately, taboos against eating chimpanzees do not exist everywhere in West Africa. In some parts of Sierra Leone, for example, hunting chimpanzees is not traditionally outlawed. Richards (1996b), relates some of the discussions and interviews he made among some Mende hunters in the Gola and Kangari Hills forest reserves, where a certain amount of caution and distrust is felt towards chimpanzees, both because of the possible threat of attacks against humans – women and children in particular-as well as the relationship to politically – motivated sorcery know as

Table 21.2. Examples of local taboos on eating chimpanzees.

Country	Locality	Taboo
Guinea	Fouta Djallon	People of the Fulani ethnic group throughout West Africa, but especially in the Fouta Djallon, do not generally eat chimpanzee meat. It is said that chimpanzees were once humans that God changed into chimpanzees. Therefore, anyone capable of killing a chimpanzee is also capable of killing a human (Ham 1998).
Guinea	Bossou	The Manon community living near Bossou do not hunt or eat chimpanzees as they believe that they are reincarnations of their ancestors (Humle 2003b, Chapter 20).
Guinea-Bissau	Boé region	Chimpanzees are not generally eaten in Guinea Bissau because they are believed to be too similar to humans (Gippoliti and Dell'Omo 1995). In the Boé region in particular, people say that chimpanzees shelter the spirit of elders (Gippoliti *et al.* 2003, Chapter 8).
Sierra Leone	Outamba-Kilimi	The people living around Outamba-Kilimi National Park generally consider it taboo to hunt chimpanzees because of the similarity between chimpanzees and humans. Eating them for pleasure is considered vile. The Susu peoples living in this area believe that chimpanzees share the same basic political, social and religious structures as humans and assume that they adhere to the same spiritual convictions and social rules. Hunters have recounted anecdotes of disturbing the crowning ceremonies of paramount chimpanzee chiefs, who were visibly heads of the community because they were graying adults, or of observing chimpanzee females giving birth, surrounded by a "fence" of other females. In both instances the observer respected their privacy and quietly slipped out of sight. In addition, traditional healers have related their knowledge of chimpanzees' use of leaves, bark and other vegetation to cure ailments and diseases (Alp 1994).
Liberia	Sapo	The Wedjeh clan along the northern boundary of Sapo National Park consider themselves relatives of chimpanzees. They believe that they have learned knowledge from chimpanzees about forest skills and therefore forbid the hunting of chimpanzees. In the Pynestown and Kpanyan districts of Dinoe county it is also considered taboo to eat chimpanzees (Nisbett *et al.* 2003, Chapter 18).
Senegal		The consumption of chimpanzee meat is uncommon throughout Senegal (Carter *et al.* 2003, Chapter 5).
Côte d'Ivoire	Taï National Park Iles Ehotiles National Park	Oubi and Wê native communities along the northern and western boundaries of Taï National Park and some clans of Agni Sanwi around Iles Ehotile National Park do not eat chimpanzee meat. They consider chimpanzees to be relatives.

''*ngolo-hinda*'' (literally ''chimpanzee business''). Chimpanzees are also sometimes hunted for medicinal or magical properties. In certain parts of Guinea, for example, the blood of chimpanzees is thought to cure epilepsy, and the meat is believed to make a young child strong (Ham 1998). Chimpanzee skulls are sometimes sold in Nigeria for magic (King 1994).

Even where local taboos against hunting chimpanzees do exist, chimpanzees are by no means fully protected from hunters in West Africa. In most areas, the state owns the protected areas where chimpanzees are often found, and local communities are most often given access to natural resources in protected areas. Little incentive exists, moreover, for populations to manage these resources sustainably or to protect them from foreign exploitation. For example,

while people in the Fouta Djallon of Guinea do not generally eat primates, many of the ethnic groups in the south-east and coastal areas of Guinea do. Consequenly, people from south-eastern Guinea come to the Fouta Djallon to kill primates, smoke the meat and transport it to their home region, where it is consumed (Ham, 1998; Caterson *et al.* 2001).

Similarly, in Sierra Leone, Teleki (1980) observed that while the bushmeat trade within Sierra Leone was limited, Liberian migrants would come to Sierra Leone specifically to export smoked meat, especially primates. According to Teleki (1980), most of the market hunting and trapping that takes place in Sierra Leone is done by Liberians who operate as far west as Freetown Peninsula and as far north as Magburake and Sefado. Teleki (1980) observed truckloads of bushmeat, carrying between 2,000 and 3,000 smoked monkey carcasses to Bassa settlements among the Mano River. Many of these villages specialize in meat production, and one out of every five grass huts were smokehouses. In one village, he observed 200lbs of bushmeat. In the Gola reserve, Teleki (1980) observed hunters out every night. Liberians are believed to be among the highest consumers of bushmeat in the region, extending their hunting into the neighboring countries of Sierra Leone and Côte d'Ivoire (Oates and Davies 1986).

21.4 Bushmeat hunting and human welfare

In West Africa, wildlife is hunted for four main reasons: tradition, crop protection, protein and income. Because many of the countries in West Africa are among the world's poorest, any solutions to the bushmeat trade must provide alternative food and income sources for local communities. In the Congo basin, bushmeat is estimated to contribute 30–80% of protein consumed by forest-dwelling families (Koppert *et al.* 1996). Little information exists on the importance of the role of bushmeat as protein in West Africa. Household consumption in Liberia is estimated to be about 0.28 kg/person/day. It is thought that in West Africa, an average of about 8kg of bushmeat is eaten per person per year, or about 22g per day. Bushmeat consumption rates are lower in West African than in Central Africa, and in West Africa bushmeat is a less important protein source than fish. However, bushmeat is often preferred over fish as a traditional food.

Most studies on the economics of the bushmeat trade come from Central Africa. Bushmeat accounts for an estimated 33% of village income in Cameroon (Infield 1988a). In Congo, almost half of Bantu and Pygmy households around Nouable Ndouki National Park earned income from selling bushmeat (Eves 1996). Less information exists on the economics of the bushmeat trade in West Africa. Estimates of the economic value of bushmeat in West Africa range from $42 million US in Liberia to $30–$50 million US in Ghana (Table 21.3). At the time of Anstey's study, commercial trade in bushmeat was worth more than timber revenues in Liberia (Anstey 1991b). In 1996 in Côte d'Ivoire, the annual value of bushmeat production was estimated at 77 billion FCFA, which is about 1.4% of the country's gross domestic product (Caspary 2001). The 1996 bushmeat trade in Côte d'Ivoire consisted of 35.5 million animals and approximately 120,000 tons of carcasses (Caspary 1999).

The bushmeat trade in West Africa is a huge problem that must be addressed if species of wildlife are not to disappear from this region forever. The solutions may be complex and must consider the livelihoods and welfare of local communities. Given the low amount of meat from chimpanzees in the markets in West Africa, forbidding the consumption of chimpanzee meat should not have a significant impact on the welfare of humans. The complete cessation of eating chimpanzee meat could, on the contrary, minimize risks to health, because chimpanzees carry many of the same diseases as humans. For example, the source of an outbreak of the deadly Ebola fever in north-east Gabon that killed 13 people was traced to a dead chimpanzee that had been found and eaten (Formenty *et al.* 2003, Chapter 23).

21.5 Recommendations

21.5.1 Strengthen capacity of wildlife departments in West Africa

Government bodies dedicated to the protection of species from the bushmeat trade are usually understaffed and underfunded, making it impossible in many cases for government officials to effectively police the bushmeat trade. Due to poor salaries and lack of reward or recognition within the current system, officials are often unengaged in the issue

Table 21.3. Variation in annual estimates of bushmeat value in West and Central Africa.

Location	Price	Reference
Gabon	$3 million US in markets and $21 million US through rural consumption	Steel (1994)
Liberia	$24 million US and $42 million US when including subsistence hunting	Anstey (1991b)

of bushmeat trade and unmotivated to combat it. International non-governmental organizations should work more closely with the government offices responsible for the protection of wildlife by supporting capacity-building exercises and ensuring that proper equipment is available so that they are able to do their job.

21.5.2 Increased understanding of the bushmeat trade in West Africa

Basic information on the bushmeat trade in West Africa is urgently needed, including information on markets, trade routes, economics and protein needs. This type of information could help us better understand the threat of the bushmeat trade and design effective actions to address it.

21.5.3 Explore alternative sources of protein

Bushmeat is the only source of protein for many people in West Africa. It is necessary, therefore, to explore alternative sources of protein.

21.5.4 Integrate concerns about hunting into the design of community conservation projects

In many protected areas throughout West Africa, local people do not have the ability to exclude outsiders from using their resources (Noss 1997). It is therefore necessary to work with local communities to promote community conservation measures that give them greater ownership over their resources and thus the incentive to protect them better.

21.5.5 Increase awareness about the bushmeat trade and greater law enforcement

The urban demand for bushmeat must be reduced, through greater law enforcement and increased awareness and education about the issues, especially those concerning the health risks of eating bushmeat.

21.5.6 Introduce and enforce laws of conduct for logging companies

In those areas where bushmeat hunting is exacerbated by the presence of logging companies, it is important to work with logging companies to get them to comply with a national code of conduct. Green labeling of such companies can help to improve their image and the incentive for them to want to enforce such regulations.

21.5.7 Promote ecotourism in West Africa

It is possible that one of the reasons that bushmeat hunting is more prevalent in West Africa than in East Africa is that in East Africa wildlife has brought in other income, such as from tourism, whereas this has been rarely the case in West Africa (Caspary 2001). If increased tourism could be promoted, and if the revenue generated could go to local people, it would help to make wildlife more valuable alive than dead.

21.6 Conclusions

Even low-level hunting can have devastating effects on chimpanzee populations due to their slow reproductive rate. Chimpanzees are protected from hunting by both domestic and international laws, but these laws must be amended to remove any possible loopholes that could allow chimpanzees to still be hunted. The laws should also be better enforced, with stricter penalties for infractions. West Africa provides a favorable environment for education and awareness campaigns about the protection of chimpanzees, because in many regions, people have traditional or religious taboos against eating chimpanzee meat, that can be reinforced. However, West African countries are among the world's poorest, and therefore alternative sources of protein to bushmeat and solutions for the problems of crop raiding should be sought in any activities aiming to mitigate the bushmeat trade in this region.

Chapter 22

Orphan Chimpanzees in West Africa: Experiences and Prospects for Viability in Chimpanzee Rehabilitation

Janis Carter

22.1 Introduction

One pressure that threatens the survival of wild chimpanzees in West Africa is the illegal commercial trafficking of baby chimpanzees. Capturing young chimpanzees requires the killing of the mother and often that of other family members. Estimates indicate that for every baby reaching the final destination of sale as many as ten additional chimpanzees may perish. The loss of reproductive age females has a devastating impact on the reproductive capacity of the community, reducing further its ability to overcome losses.

In some West African countries the trade in bushmeat poses an even greater threat to chimpanzee survival while further compounding the dilemma of what to do with orphan chimpanzees. Killing female chimpanzees with nursing infants reaps double gains for the hunter. Whereas the body of the mother chimpanzee is dried and sold by the kilogram, the orphan chimpanzee is considered to have more value in the illegal traffic of live babies. Though more a by-product than a direct target, the recent increase in orphaned chimpanzees is attributed to the growing bushmeat crisis.

As African governments develop more awareness and concern for their natural resources, they are reviewing, strengthening and enforcing legislation designed to protect wildlife. In the case of chimpanzees, an initial consequence of more rigid law enforcement is the growing number of confiscated individuals that are wards of the state. Though critical to enforcing legislation, the act of confiscation is hindered by the lack of finances for the care of confiscated individuals.

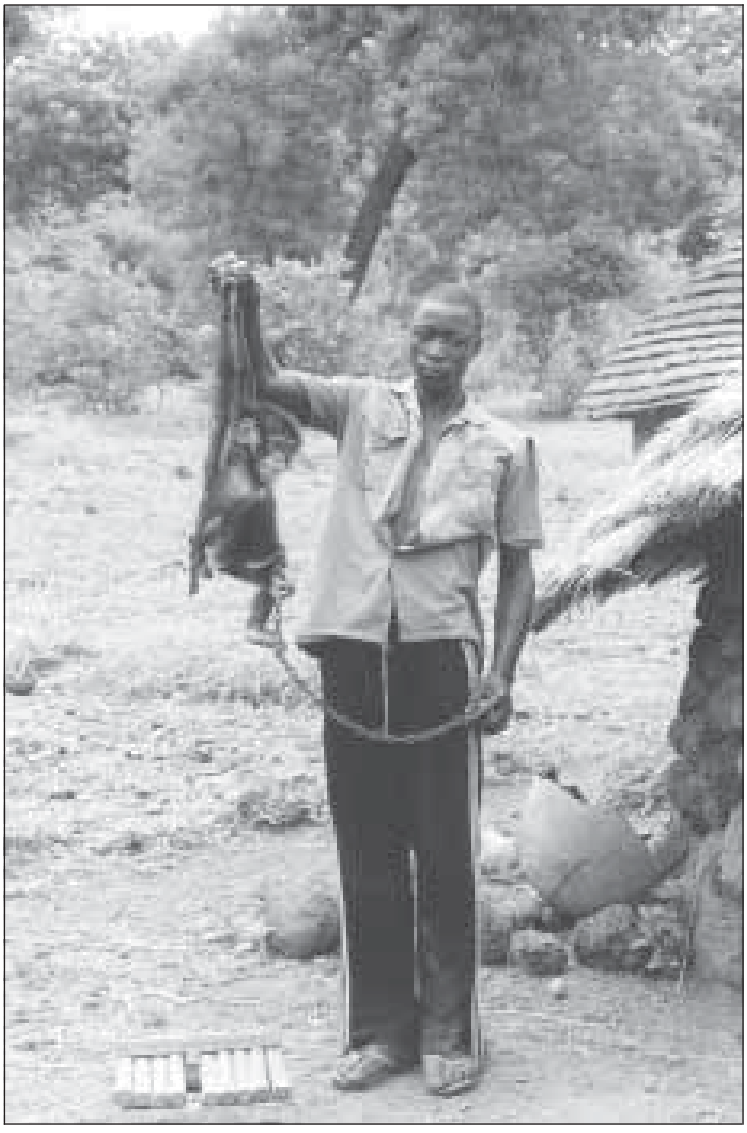
The controversy over what to do with confiscated and unwanted wildlife is addressed in a lengthy policy statement by International Union for the Conservation of Nature. Suggested options include; (1) euthanasia, (2) placement in either biomedical facilities, research or zoos, (3) resale of individual with profits directed to conservation efforts for the species, (4) captivity in country-of-origin sanctuaries and (5) release to the wild. When dealing with endangered species, in this case chimpanzees, the first alternative is not considered ethically sound. Alternatives two and three are not consistent with the rationale underlying the existing legislation protecting wild chimpanzees and could, if allowed, perpetuate trade by providing potential loopholes for access to chimpanzees by commercial consumers. The placement of confiscated individuals in rehabilitation facilities (either sanctuaries or release programs) located within the species' natural range, is both morally and technically sound, and reduces any possibility of loopholes while sending a clear message to all that chimpanzees belong in Africa.

The role of rehabilitation projects in the conservation of chimpanzees and other apes has been extensively debated. Can rehabilitation serve as a significant source of animals to resupply the wild population and save the species? Or is rehabilitation simply an empty gesture when massive habitat destruction continues at an accelerating rate? Would funds used to save and rehabilitate individual animals be better spent preserving a wild population? Does the reintroduction of groups of released animals jeopardize the existence of wild populations of chimpanzees, other wildlife and their ecosystems?

Critics say rehabilitation is unscientific, too time consuming and too risky and costly both in human and financial terms. They also argue that its media visibility puts too much focus on the more emotive and appealing orphan and takes the emphasis away from the more serious plight of the species.

Proponents of rehabilitation argue that it plays the following roles; (1) it compliments the enforcement of protective legislation by providing permanent placement for confiscated animals, (2) it serves as a valuable tool in conservation education and (3) creates a public concern and awareness for the plight of the wild chimpanzee population. Rehabilitation has also been defended as the most moral and technically sound solution to the dilemma of what to do with chimpanzees who have been confiscated or discarded as pets, performers or research subjects.

Even if one accepts rehabilitation as a moral imperative or as a logical extension of conservation efforts, under what conditions is it technically feasible? Can it ever be financially viable? While a thorough discussion of these questions is beyond the scope of the present chapter, the issues necessarily underlie assessments of past and current rehabilitation projects. This chapter seeks to justify the role of



(Photo credit: Janis Carter)

Orphan chimpanzee in Senegal.

rehabilitation in the conservation of wild chimpanzees, examines and compares past and present efforts in West Africa and concludes with a list of realistic recommendations to better orient this new field to provide the maximum protection for both captive and wild individuals.

22.2 Rehabilitation of chimpanzees in West Africa

Efforts to rehabilitate chimpanzees in West Africa include placement in sanctuaries as well as reintroduction to the wild. Sanctuaries provide nutritious food, fellow peers and varying degrees of freedom, from spacious cages to enormous outdoor electric enclosures. Though these changes are all distinct improvements in the life of abandoned or confiscated orphans, they are still a form of captivity, which by nature is dependent on human and financial resources. On the other end of the continuum, release to the wild comes with greater risks yet minimal dependency on human or financial input. The self-sufficiency and independence of a free life provides rehabilitated chimpanzees with a more secure future, at least on par with that of existing wild populations.

Although release to the wild is the ideal to move toward, it is not always possible. For a start, not all wild-caught chimpanzees can revert back to a wild life. Their capacity to respond to rehabilitation efforts depends on several variables, including their age and the conditions and duration of their captivity. Ensuring that chimpanzees are disease-free is an absolute requirement, one that if ignored or underestimated could cost the existence of a wild population. In addition, chimpanzees exhibiting behavioral abnormalities and those having suffered physical disabilities or deformities are not suitable candidates for reintroduction into the wild. Nevertheless these individuals are just as deserving of a good life as their healthier colleagues. Sanctuaries provide a home and a life for these individuals.

Another harsh reality is that even if orphaned chimpanzees are physically, mentally and emotionally equipped to return to a wild life there may not be suitable wild areas left for their release. As attractive as release to the wild sounds, finding appropriate release sites requires consideration of several variables beyond the ability of captive chimpanzees to revert to a wild life. Chimpanzees have specific ecological requirements, including large areas of appropriate habitat and vegetation to provide sufficient resources for food, water, nesting and shelter. Care must be taken not to exceed the carrying capacity of the forest area where the release is planned; creating pressures on the habitat and competition for indigenous populations of chimpanzees, other primates, other wildlife species and human neighbors. Due to the territorial nature of chimpanzees it is more reasonable to expect success from introducing chimpanzees to an area not currently supporting wild conspecifics. In addition, reintroduced chimpanzees with past captive experience or even those who have been habituated to the presence of humans for many years are often aggressive and potentially dangerous towards humans. To protect both humans and chimpanzees, release sites must be either remote or separated by geographic or natural barriers, such as islands. Finally, care must be taken in assessing the impact the released individuals could have on the neighboring human population, whose acceptance and support is vital to the success of such an endeavor. Consideration of all these factors is

critical in the selection of a suitable site and in the long-term success of a release effort. This demanding list of criteria reduces the possibilities of locating release sites. Like it or not, in today's world release to the wild is for the elite, whereas sanctuary life is for the masses.

The growing need for sanctuaries is evident in the number represented at the 2002 annual meeting of the Pan-African Sanctuaries Alliance. Of the 17 African sanctuaries present, five are either located in the Western chimpanzee range countries or care only for the Western chimpanzee subspecies. With an overall total occupancy of nearly 200 individuals, these five sanctuaries are being asked to make space for more orphaned chimpanzees, including victims from both the commercial trade in babies and the bushmeat crisis. Already bursting at their seams, sanctuaries are calling out for help.

The following two sections examine and compare past and present efforts at rehabilitating chimpanzees in West Africa.

22.3 Rehabilitation experiences: those that have come and gone

The following describes the results of five past attempts to rehabilitate chimpanzees in Western Chimpanzee range countries, namely Bia National Park in Ghana, Niokolo Koba in Senegal, VILAB in Liberia, Asagny Island in Côte d'Ivoire and Kerfalya Island in Guinea. Mention is made of two more sanctuaries; one in Liberia, which barely got started before it was destroyed, and another at the Konkolobi Island Sanctuary in Ghana, which was cancelled in spite of large financial investments.

22.3.1 Bia National Park, Ghana, 1972

In 1972, a group of six young confiscated chimpanzees were socialized as a group with the intention of releasing them within Bia National Park in Ghana (Rucks 1976). Little information exists on the details of this effort, though it has been reported that the release attempt failed due to lack of preparation and supervision. Because of a lack of information, it is not possible to rank this project on risks or costs.

22.3.2 Niokolo Koba, Senegal, 1974 to 1979

Perhaps one of the most illuminating studies was carried out at Mt. Assirik, in Parc National du Niokolo-Koba, Senegal, by Stella Brewer. Brewer's original idea was to release chimpanzees confiscated by her father, Eddie Brewer, in his role as the Gambia's Director of Wildlife Conservation. She soon expanded her gates, accepting five chimpanzees from zoos in England as well as a private pet from Italy. At sporadic intervals between 1972 and 1977, Brewer and her team released seven female and eight male chimpanzees. Ranging in age from 2.5 to 11 years, 13 chimpanzees were wild caught and two born in captivity. Extensive time and effort was put into socializing the individuals, providing emotional and physical support during the entire release process. After the first two years, the progress of the released individuals was monitored closely. Due to travel stress and difficulties in transportation, three additional adolescent female chimpanzees died within 24 hours of their arrival at the release site. Five males disappeared in the first several months and were never seen again. In late 1978, attacks by the resident wild chimpanzees of Mt. Assirik on the released chimpanzees became more aggressive and more frequent. In response to these attacks, 8 chimpanzees (seven of the original 15 and one offspring) were transferred to River Gambia National Park in The Gambia initially as a temporary holding measure while searching for a new release site. The story of this group continues under the section on the Chimpanzee Rehabilitation Project at River Gambia National Park. This effort is noted for high risks to the individuals released, high human inputs, low financial costs and low monitoring for the initial two years.

22.3.3 VILAB, Robertsfield, Liberia, 1978 to 1984

Motivated by the high costs of maintaining chimpanzees after their usefulness as research subjects had expired, the New York Blood Center's VILAB developed a program to release up to 150 chimpanzees. Although this total was not reached, nearly 60 chimpanzees were released on three small coastal islands near the mouth of the Little Bassa River located near the VILAB facility in Robertsfield. Twenty more were released later in Côte d'Ivoire.

The releases conducted by VILAB were characterized by expensive habitat modification to form islands and to construct water systems for drinking water. Released chimpanzees had increased freedom of movement, yet they remained totally dependent on humans for their survival. Chimpanzees were pre-socialized in groups prior to their release. The first release was conducted in 1978. Eighteen chimpanzees were released on a 5ha island. To ensure that the group would not wander off the island at low tide, canals were dug and a permanent water system constructed. Over the following two years, four chimpanzees died from aggressive interactions or drowning. In 1983 the second release took place on a 4.7ha island. The first group released consisted of 20 chimpanzees (nine females and 11 males). Four more chimpanzees were introduced a month later. Over the first

year a total of eight animals were recorded dead or disappeared. The final release was conducted on a third island in 1986. Provisioning of the island chimpanzees was continued until the civil war made the situation impossible. The number of VILAB chimpanzees killed during the war is unknown. In 1995, the surviving chimpanzees were recaptured and transferred back to the station at Robertsfield. During the civil war, rebels murdered a senior VILAB staff member, responsible for some of the innovative ideas for the release of the laboratory chimpanzees. The early VILAB releases are noted for their low risks to released individuals, incredibly high financial input, high human input in terms of technology, and high on progress monitoring. With the onset of the war, the risks for the released animals and human caregivers increased to the maximum possible, and the evaluation of their progress dropped to the minimum.

22.3.4 Azagny National Park, Côte d'Ivoire, 1983

In 1983 VILAB II released another group of chimpanzees in Côte d'Ivoire. Claiming that an additional objective in this release was to restock the wild chimpanzee population of Azagny National Park, the New York Blood Center released 20 chimpanzees on a 169ha island in the Bandama river near Azagny National Park. The chimpanzees ranged in age from 7–11 years, with an equal number of males and females. During the first three weeks after release, eight chimpanzees died or disappeared. Cause of death was suspected to be severe diarrhea from an outbreak of shigella. Three more chimpanzees died in the following months, making a total of six known deaths and five disappearances. One year after the initial release, nine survivors were transferred to a smaller island, which was originally a peninsula modified by digging a canal. Wildlife authorities in Côte d'Ivoire refused permission for VILAB to conduct further releases on the grounds that it could jeopardize the existing wild population of chimpanzees. Two of the original 20 released chimpanzees still survive today in the company of their two offspring. As all stable funding for the release has been withdrawn, the survival of these four chimpanzees depends on the kindness and generosity of a neighboring farmer who continues to feed and care for them when he can. The VILAB release in Côte d'Ivoire is also high in financial costs, high in risks to released chimpanzees, low in human investment once chimpanzees were released, and low in progress monitoring. Azagny Island might have been more cost effective if closer monitoring and health support services had been provided immediately after the release, especially given the initial investments already made in prerelease socialization in Liberia.

22.3.5 Friends of Animals, Liberia, 1990

In 1989, Friends of Animals established an animal orphanage in the Sapo National Park in south-eastern Liberia with the intention of rehabilitating orphans of various species, including chimpanzees, for eventual release to the wild. It was also hoped that the center could receive illegally exported wildlife confiscated by the United States Fish and Wildlife Service in New York. When the civil war broke out in 1990 the facility was destroyed and the animals residing in it all killed; including one baby chimpanzee. This activity was not in process long enough to evaluate but one can infer that the financial costs were probably high and would continue in that vein.

22.3.6 Help, Guinea, 1988 to 1993

In 1992, after caring for unwanted and confiscated chimpanzees for several years, Charlotte Dorkenoo established the non-governmental organization ''Help Guinea.'' In December of the same year, Dorkenoo released 12 chimpanzees (six males and six females) on the 1ha island of Kerfalya located in the Konkoure River. Twelve younger chimpanzees remained at her residence nearby. Unsuccessful in her struggle to obtain sufficient funds to operate her sanctuary, Dorkenoo finally abandoned the project, fleeing the country with her favorite chimpanzee. The 23 chimpanzees left behind became the responsibility of the Department of Water and Forests in Guinea. Not prepared to take on the sudden costs of maintaining the chimpanzees, the Guinea Government requested the emergency assistance of J. Carter, who was based in Gambia. The younger chimpanzees were temporarily housed with a group of Veterinaires Sans Frontieres based in Dabola Guinea while Carter sought funds to cover basic maintenance costs. The group released on Kerfalya was provisioned regularly by a caretaker hired from the village nearby. Veterinaires Sans Frontieres volunteers visited as often as possible. This unsatisfactory arrangement continued for at least two years until Carter began implementation of the European Union-funded Projet de Conservation des Chimpanzés, which established a rehabilitation center as one of its components. Although no evidence exists to explain what happened, ten chimpanzees died or disappeared from Kerfalya Island during the two-year interim. The two female chimpanzees remaining on the island were provisioned until their deaths in 1999 and 2000. The younger chimpanzees, which had by this time already been housed in three previous locations and cared for by a variety of keepers, were finally transferred to Parc du Haut Niger at the rehabilitation center established by the Projet de Conservation des Chimpanzés. Their saga continues in the next section. Prior to Dorkenoo's departure this project represented low risks to the chimpanzees, high human investment, low financial costs, and low progress monitoring. Once Dorkenoo departed, the human investment level

dropped for the adult group of chimpanzees, and their risks increased dramatically.

22.3.7 Friends of Animals, Ghana, 1997

In 1997 Friends of Animals began steps to establish a rehabilitation project for captive chimpanzees in Ghana's Volta Region at the 27.5ha Konkolobi Island Sanctuary located off the shores of Ntumda-Nkonya village in Lake Volta. Friends of Animals, in collaboration with Primarily Primates, intended to transfer six to eight chimpanzees from Primarily Primate's facility in Texas to Konkolobi Island Sanctuary. These individuals would be closely monitored until it was determined whether they could be reintroduced into the wild at another location in Ghana. If not, the island would become their permanent home. Large sums of money were spent on developing the island sanctuary and an area on the mainland that would be used as the office base for the project. Buildings and roads were constructed and trees and crops were planted to feed and support the chimpanzees on the island. In 2000, before any chimpanzees were transferred to the island, the government of Ghana, due to irresolvable conflicts between neighboring villages, canceled the project. Although this project never materialized, pre-release activities indicate post release would carry low risks to chimpanzees released, high human input, very high financial costs, and most likely high progress monitoring.

These pioneering efforts of releasing chimpanzees to the wild in West Africa were by far the most ambitious and carried the greatest risks. None, however, achieved their stated objectives of returning chimpanzees to the wild. On closure, three projects (Niokolo Koba, Senegal, VILAB, Liberia, and Help, Guinea) transferred the surviving chimpanzees to laboratories or new release centers to begin yet again their process of rehabilitation. At one site (Friends of Animals, Liberia) the only chimpanzee in the facility died during the civil war. Too little information is available about one site (Bia National Park) to know what happened, and at one site the project was never realized (Friends of Animals, Ghana). Obstacles to success included inappropriate release sites, complications related to civil wars, lack of funding, and in a few cases critical dependency on human support. Although not very successful in the sense of saving chimpanzees lives, the importance of these pioneering efforts is the lessons they provide for those that came after.

22.4 Current rehabilitation efforts: those with staying power

Of the 12 rehabilitation projects attempted in West Africa, five are functional today. Three of these centers are located in the range of the Western Chimpanzee in the countries of The Gambia, Sierra Leone and Guinea. These more conservative efforts are noted for their reduction of risks, greater dependency on humans and a higher rate of success in terms of individuals saved. Mention is made of two additional centers representing the *vellerosus* subspecies; one center is located in Nigeria and the other in Cameroon.

22.4.1 Chimpanzee Rehabilitation Project, River Gambia National Park, The Gambia, 1979

The longest running rehabilitation project in West Africa was established on the islands of River Gambia National Park in 1979. Two social groups of chimpanzees were released at roughly the same time on neighboring islands in early 1979. One was the group of eight chimpanzees relocated from Niokolo Koba to The Gambia by Stella Brewer. The second group was introduced by Janis Carter and consisted of nine chimpanzees including the ex-sign language star Lucy. These groups functioned independently until 1986, when both chimpanzees and directors merged to form one project. During this time third and fourth social groups were released on two more islands, making a current total of 62 chimpanzees living in four social groups on three protected islands. Two more chimpanzees reside in the pre-release facility on the mainland. Prior to the establishment of the sanctuaries in Sierra Leone and Guinea, the Chimpanzee Rehabilitation Project served as the only center in West Africa for accepting chimpanzees for rehabilitation (also see Carter 2003a, Chapter 7).

Over a span of more than two decades the Chimpanzee Rehabilitation Project released 47 chimpanzees, some confiscated in The Gambia, some from neighboring countries and others from abroad. Three of the 47 were captive-born females, one was released at maturity and two at adolescence. Two of these females lived in freedom for more than ten years before they disappeared. One of them reproduced, and now her offspring has reached maturity herself. Of the original 47 chimpanzees released on the island, 18 are still in residence. Fifty-five chimpanzees were born to the original released population, eleven of these died in their first nine years of life. Of the 44 island births which have survived, 39 of them are first generation offspring and five are second generation offspring. There are presently 17 reproducing females with an average birth interval of 64.4 months. Infant survival rate (infancy defined as birth through age five) is 86%. As recorded for wild chimpanzees, there are fluctuations in group membership as well as permanent transfers of females reaching reproductive age. Though food supplementation of the four groups has been minimal over the past 23 years, this policy is under review for one of the four groups. Integration of new chimpanzees to the current four

social groups is problematic and risky. Funds for basic operating costs are barely met through the ''Adopt A Chimp'' newsletter. Due to limited land space in The Gambia, there are no plans of expanding rehabilitation activities elsewhere within the country.

An environmental education program was initiated in 1987 to secure the future of the naturally reproducing chimpanzee population and their habitat. Educational activities including slide presentations, nature awareness outings, and scout nature clubs target both adults and youths of 19 villages located in close proximity to the islands. A major emphasis is being put on additional community development activities in the next few years in order to improve the standard of living of the neighboring human population as a means of reducing pressures on the deteriorating natural environment.

The efforts of the Chimpanzee Rehabilitation Project have impacted the conservation of chimpanzees through; (1) the successful reintroduction of this species to a natural habitat within their historical range[1], (2) the elimination of the illegal trade of young chimpanzees in The Gambia, (3) the increased protection of other primate and wildlife species and (4) reduction of deforestation in and near River Gambia National Park. The major characteristics which distinguish this project from others are the low financial costs, the total free ranging nature of the chimpanzees, reduced contact and intervention by humans and the long duration of close monitoring.

22.4.2 Tacugama, Sierra Leone, 1996

Bala and Sharmila Amarasekaran began parenting unwanted chimpanzees in 1988. In 1996, their family of seven chimpanzees became the founding members of what is now named Tacugama Sanctuary. From 1996 onwards, an average of five to six baby chimpanzees were received at the center every year. The last 24 months of post war Sierra Leone have doubled this figure to an average of one chimpanzee a month. Most confiscated chimpanzees range from one to eight years old with an average age of two to three. As of June 2003, Tacugama Sanctuary houses 63 chimpanzees. Thirty-six of this total spend their days in three electric enclosures covering a total of 4ha of forest. They spend their sleeping hours indoors. Twenty-seven are awaiting transfer to a new enclosure. Fed four times daily, all chimpanzees are completely dependent on humans.

The continued presence of Tacugama Sanctuary is vital to the conservation of chimpanzees in Sierra Leone. Although the government has successfully abolished the traffic in baby chimpanzees in the capitol of Freetown, this is not the case for areas upcountry. During the five years of civil unrest, roughly 65% of the country was in rebel hands and subsequently without law enforcement. With the end of the war, these areas are beginning to open up, and travel to and from Freetown has become more regular. Due to the long period without law or sensitization, animal traders carrying chimpanzees to Freetown for sale are ignorant of both the illegality of their act and the consequences.

The exponential increase in the number of orphans in post war Sierra Leone is thought to be a product of both the bushmeat trade and the commercial traffic in baby chimpanzees. If each baby chimpanzee arriving at Tacugama Sanctuary represents the loss of ten others, Sierra Leone is losing as many as ten chimpanzees a month, and up to 120 chimpanzees a year. Taking into consideration only the losses from the illegal trafficking of baby chimpanzees, the estimated 1,500–2,500 chimpanzees in Sierra Leone could be decimated in less than 15 years time.

Another equally frightening perspective is the fact that, barring natural reproduction and using the conservative rate of receiving only six chimpanzees a year, the chimpanzee population at Tacugama Sanctuary will reach more than 100 chimpanzees in the next six years. Already struggling to cover the costs of the 63 chimpanzees under their care, Tacugama will be hard put to stretch funds to cover new arrivals.

The major asset of Tacugama is that creating space for acceptance of more chimpanzees is still feasible. The limiting factor is the lack of funds to partition off more blocks of forest to accommodate the increased flow of orphans from within the country and possibly those from neighboring countries. More to the point is the question of how to provide an assurance to the organization responsible for wildlife conservation in Sierra Leone that funds will be provided for the next 50 years or more.

This center ranks low on risks to individual chimpanzees, moderate on financial costs, moderate on human resource inputs and high on monitoring.

22.4.3 Chimpanzee Conservation Center, Guinea, 1999 to present Projet de Conservation des Chimpanzés en Guinée, Guinea, 1996 to 1999

In September 1996, the Projet de Conservation des Chimpanzés en Guinée rehabilitation center was established in the Parc du Haut Niger located in Faranah, Guinea. The founding members of this group were the young chimpanzees abandoned by the non-governmental organization Help Guinea. Additional orphans were confiscated by government authorities or donated by private owners, including those collected by E. Raballand, who later took over direction of this project from J. Carter in 1999.

[1] However, please see Butynski *et al.* (2003, Chapter 1)

The primary goal of the Chimpanzee Conservation Center is to support and rehabilitate orphaned and confiscated chimpanzees in Guinea. As of June 2003, there are currently 35 chimpanzees undergoing resocialization at the Center with the intention of reintroducing them to the wild. These chimpanzees are housed in four separate groups. The older group is composed of 16 chimpanzees; 14 ranging in age from 12 to 18 and two offspring 2.5 and 3.5 years of age. This group lives in a satellite cage connected to a 3ha forest enclosure. A teenage group, composed of five ten-year-olds, resides in a satellite cage accompanied by a 1ha forest enclosure. Eight younger chimpanzees, ranging in age from two to seven years, are housed in a caged facility. They are taken for walks in the neighboring forest for three hours every morning. Two additional adult male chimpanzees, who are not candidates for reintroduction, are housed together in their own 0.5ha enclosure. A separate facility serves as a quarantine for one ten-month-old baby. Platforms have been constructed in the forest enclosures to allow chimpanzees to nest above the ground without destroying the vegetation. Platforms and a jungle gym apparatus have been constructed for the younger group's portion of the enclosure. All animals are fed four times a day and receive routine veterinary care. The Chimpanzee Conservation Center has a no-breeding-in-captivity policy. Thus, all cycling females are on birth control pills. Preliminary surveys have identified a potential release site. This center is noted for low risks to individual chimpanzees, moderate financial costs, moderate human resource inputs and high on monitoring.

22.4.4 Drill Rehabilitation and Breeding Center, Nigeria, 1991 to present

Liza Gadsby and Peter Jenkins established the Drill Rehabilitation and Breeding Center in Calabar, Nigeria, in 1991. A recovery and captive breeding program for the highly endangered drill monkey, this center also cares for orphan chimpanzees. Though the project was officially launched in 1991 with five drill monkeys and four chimpanzees, the first chimpanzee was actually acquired as early as 1988. The project has received 26 chimpanzees, of which three died from disease or trauma, and two escaped and were not seen again. As of March 2003, the project maintains 21 chimpanzees.

Chimpanzees of the Drill Rehabilitation and Breeding Center live in one of two settings: a nursery/quarantine located at the project headquarters in Calabar and the field site located near Afi Mountain Sanctuary, six hours from the headquarters. Four chimpanzees aging from one to three years currently reside in the nursery facility. The field site includes a holding area, a 2ha forest enclosure, and a new 20ha forest enclosure in the final stages of construction. The holding area currently houses six chimpanzees ranging in age from 5–24 years. Having completed their quarantine, these chimpanzees are destined for release to the new 20ha enclosure. The holding facility will form the satellite off the new enclosure. The remaining 11 chimpanzees living in the two-hectare forest enclosure are heavily supplemented to reduce wear and tear on their physical environment and to augment the limited natural forage available. Life in this forest enclosure offers freedom of movement, limited foraging and drinking water from a natural stream.

The Drill Rehabilitation and Breeding Center is located in the *P.t.vellerosus* subspecies range of Nigeria. However, due to the close geographic proximity of the *P.t.verus* range and the presence of wildlife smuggling in Nigeria, chimpanzees received by the center represent three subspecies. Though all DRBC chimpanzees have not been tested genetically, the majority are presumed to be *P.t.vellerosus* with at least one confirmed *P.t.verus* and one confirmed *troglodytes.*

The Drill Rehabilitation and Breeding Center has also been instrumental in the establishment of Afi Mountain Wildlife Sanctuary, a forest contiguous with the project forest site, which supports a number of primate species including *P.t. vellerosus.* Discussions of releasing captive chimpanzees into Afi Mountain Sanctuary have not progressed due to the mixture of subspecies in the Drill Rehabilitation and Breeding Center social groups and the threat of uncontrolled hunting. However, the presence of the Drill Rehabilitation and Breeding Center has a direct impact on chimpanzee conservation through sensitizing and changing people's attitudes to chimpanzees in an area where they are eaten and facilitating law enforcement for the protection of both wild and captive living chimpanzees. The DRBC works in tandem with Limbe Wildlife Center, located in Cameroon and discussed below. This project can be characterized by a history of moderate financial investment, high human resource input, low risk to individual chimpanzees and high conservation value.

22.4.5 Limbe Wildlife Center, Cameroon, 1994

P. Jenkins and L. Gadsby are also responsible for the establishment of Cameroon's Limbe Wildlife Center. Created in 1994, the purpose of the Center was to improve the living conditions of animals residing in the Limbe Zoo, provide a facility for confiscated wildlife and develop a center for education. As of March 2003, the Center supports 27 chimpanzees ranging in age from infants to adolescents. Half of the group was previously held as pets, whereas roughly 30% were confiscated from bars and hotels. Although located in *P.t. vellerosus* habitat, LWC chimpanzees represent a mixed population of roughly half *troglodytes* and half *P.t. vellerosus.* The chimpanzees live in two social groups, occupying areas of 0.05 and 1ha respectively. Several forest areas are being considered for future release of these chimpanzees.

The educational activities conducted by the Cameroon's Limbe Wildlife Center have proven to be effective tools for helping to conserve chimpanzees. Located near the capital of Douala, more than 30,000 people visit the center annually. Educational activities are conducted on site (guided tours, weekly nature club meetings and annual workshops) and as outreach programs (school visits, formation of environmental clubs and development of education packets for teachers). More than 100 schools and 11,000 students were visited by the outreach program in 2000. The number of students reached by the program nearly doubled in 2002. In summary, the Cameroon's Limbe Wildlife Center plays an important role in conserving chimpanzees in Nigeria and other countries by facilitating law enforcement and developing awareness and support through education.

22.5 Other sites in Africa

Although other chimpanzee orphanages exist across Africa, this chapter focuses primarily on those addressing the needs of Western chimpanzees. There are however two rehabilitation efforts that merit special mention as they provide information useful for understanding why some rehabilitation efforts are successful while others are not. These are Rubondo Island, Tanzania, and Habitat Ecologique et Liberté des Primates, Congo.

22.5.1 Rubondo Island, Tanzania, 1966

Although not conducted in the Western chimpanzee range, the release of chimpanzees on Rubondo Island merits attention here because it represents the first effort to reintroduce chimpanzees to the wild. Furthermore, by some measures it has proven to be the most successful release of chimpanzees to date.

As early as 1966, captive chimpanzees were released on Rubondo Island in Lake Victoria. Information on the experience is limited, but it is understood that a total of 17 chimpanzees with ages ranging from 4 to 12 years were released on the 240km^2 island over a period of four years. Virtually the only factor that these chimpanzees had in common was that they were caught in the wild. Each of them had spent varying periods of time in captivity and the conditions of their captive life ranged from living in social groups in zoos to solitary confinement. They received little or no pre-release socialization with one another and no attention in the way of supplementary feeding, medical attention or survival training following release. Though there were no indigenous chimpanzees among the existing fauna on the island, the habitat was similar to that in other areas of the region that contained wild chimpanzees. A small human population practicing fishing and subsistence farming were relocated prior to the release of the chimpanzees. Consequently, the only human inhabitants on the island were park rangers and volunteer foresters.

Although the chimpanzees of Rubondo were not systematically monitored after their release, sightings were recorded infrequently over the years. Two individual male chimpanzees were shot due to aggressive encounters with humans. The number of chimpanzees introduced on the islands between 1966 and 1969 had increased to at least 20 in 1985 (Borner 1985). At least two of the current population were identified as members of the original release group. Unfortunately no information is available on the background of these individuals or the fates of the other members of the original group.

The Rubondo study provides future release efforts with a jewel to covet. In the early years of the initial release on Rubondo, there were several recorded cases of aggression exhibited by the released chimpanzees towards humans. Though a common reaction for chimpanzees having lengthy intimate contact with humans, this characteristic does not allow for easy co-habitation between released chimpanzees and humans. However, the behavior of the island-born generation appears to have reverted back to that of wild chimpanzees in that they exhibit an instinctive fear rather than aggression towards humans. Therefore, if human contact is kept to a minimum, offspring of rehabilitated chimpanzees could be released in open forests without the fear of aggression towards humans.

The Rubondo Island release ranks high on risks to individual chimpanzees, low on human resource input, low on financial costs, low on progress monitoring and high on gains to conservation. To date, there has not been a single other effort conducted with such high risks to the individuals yet reaping equally high gains in terms of maintaining population size.

22.5.2 Habitat Ecologique et Liberté des Primates, Republic of Congo

Although not located in West Africa, a release conducted by a Congo-based association merits mention as a successful and responsible model for the release of chimpanzees to the wild. Since 1989, Aliette Jamart cared for orphaned chimpanzees confiscated by the Congolese government. In 1991, Jamart created the Habitat Ecologique et Liberté des Primates Association with the aim of returning captive primates to the wild, helping with conservation education and providing assistance for anti-poaching activities. In the same year, the association acquired three forested islands on the Conkouati lagoon. The islands served as an ideal site for an interim stage of rehabilitation by providing the chimpanzees with freedom of movement in a natural forested environment. Though nutritional supplementation was required, contact with humans was kept to a minimum. A final release site called the Triangle was identified in Conkouati-Douli

National Park. A significant feature of this site is that wild chimpanzees lived in this area at a low density.

From 1996 to 1999, 37 of the total 48 chimpanzees under the care of Habitat Ecologique et Liberté des Primates were transferred from the islands and released into the open forest of the Triangle. Prior to release all individuals underwent extensive medical and genetic screening. Several members of the group were equipped with radio collars to allow reliable post-release monitoring. Data were collected on their ranging, diet and behavior patterns. Of the 37 released chimpanzees, 27 have been successfully reintroduced, one birth has been recorded, three are confirmed dead and the status of seven individuals is unknown. In addition to a 73% success rate, the presence of the reintroduced chimpanzees and the release team have increased the protection of the resident wildlife and the habitat. Though not yet complete, this success story is the strongest evidence to date that a release can serve to benefit the individual as well as have positive implications for the species as a whole.

The Habitat Ecologique et Liberté des Primates release ranks high on the risk scale for the individuals released, high on human resource input (for a definite time period), medium on financial costs, high on progress monitoring and high on gains to conservation.

22.6 An analysis of the successes and failures

Throughout the various trials discussed above, it has been proven that many, though not all, captive-held chimpanzees have the capacity to recover from the negative effects of captivity and develop coping strategies necessary for life in the wild. It has even been shown that some captive-born chimpanzees can revert to a wild life given the appropriate training, time and circumstances for release. Of the early efforts which were monitored closely, there is a considerable range in the response of chimpanzees coming from different backgrounds; the intensity and complexity of the effort increase, possibly exponentially, as the individual's age and period in captivity increases. The assertion that response capacity is closely related to age and origin is logical and might be accepted by most students of rehabilitation without major debate. The technical feasibility of rehabilitating chimpanzees with low response capacity, e.g., mature individuals born and raised in captivity using more intense and extended rehabilitation methods, is a much more debatable proposition and tips the scales on the welfare side.

Whereas it has been proven technically feasible to rehabilitate chimpanzees of varied backgrounds, the location of appropriate release sites has not been as successful. The closing down of Brewer's release project in Niokolo Koba had a dampening effect on future efforts to release chimpanzees in areas supporting wild conspecifics. Closer inspection of the specific circumstances of the release in Niokolo Koba indicate that the indigenous population was already living in a marginal habitat, and the introduction of more chimpanzees most likely exceeded the fragile balance. Nevertheless, it was 20 years before another release of chimpanzees was attempted in an area already supporting wild chimpanzees. The success thus far achieved by the Congo effort offers hope that under specific conditions some captive chimpanzees can be released in areas with wild chimpanzees. While this release reopens doors to future possibilities, it emphasizes the need to address various responsibilities including those to the released individuals, the habitat, the indigenous wildlife and the human population.

The criteria involved in the selection of both appropriate release sites and suitable release candidates are demanding and can limit the expansion of rehabilitation efforts. For this reason, release on islands that do not support wild chimpanzees might be the only option for the majority of captive-held individuals. However, it has been suggested that in most cases the introduction of captive chimpanzees on islands without wild conspecifics is more an issue of welfare and has no direct conservation value. While island introductions may not impact on restocking wild populations they serve the conservation of their species through education and awareness.

Although ideal for rehabilitating chimpanzees, there is clearly a limited supply of islands in Africa which are suitable and available for this purpose. And why should governments and local residents give up such land for use in rehabilitation projects anyway? There are few if any immediate benefits to such sacrifices beyond contributing to the survival of one of humankind's closest relatives. But where does this stand in the minds of rural Africans and policymakers, most of whose countries have faced declining real incomes over the past three decades. As Africa becomes increasingly less able to pay for essential imports and even feed itself, the prospects for its wildlife grow dimmer and rehabilitation efforts appear to have little prospect, especially those as demanding as chimpanzee rehabilitation. The survival of such efforts rests upon their ability to have governments and local residents in the vicinity of the projects perceive them as beneficial in a concrete sense. At most, African governments can only be expected to provide the legal leverage to get the ball rolling, while costs must be covered by those with an invested interest in saving chimpanzees. Herein lies another obstacle to the expansion of rehabilitation efforts and the future of captive held chimpanzees. Who is responsible for saving unwanted and orphaned chimpanzees in Africa?

22.7 Bridging the gap

Though an ideal solution to the controversy over placement of confiscated chimpanzees, the field of rehabilitation is fraught with difficulties of its own. For more than 25 years, rehabilitation has tried to carve out its own identity while weathering criticisms levied by academics and conservationists alike. While many criticisms are valid, some are more applicable to specific projects. Nonetheless, the stigma is carried by all.

Relegated to a secondary rather than complementary position of importance as a conservation measure, rehabilitation has held little credibility with funding organizations. Difficulties in accessing funds have made most rehabilitation efforts unattractive to professionals. Indeed, until very recently, few primatologists or conservation organizations provided support to or justification for rehabilitation efforts. This near disdain by those harboring conservation moneys has contributed to the image of sanctuaries as the domain of do-gooders and volunteers. As a result the precariously underfunded and overworked project staff have little time to write and publish findings, reducing further their legitimacy for requesting funds from the academic or conservation sector and missing valuable opportunities to provide guidelines and standards for newly established projects. In spite of these hardships, some centers continue to function by the sheer determination of a handful of people. But much more is needed to deal effectively with today's crisis.

Western chimpanzees continue to be hunted for meat, babies continue to be captured and confiscated, and facilities for their placement and care continue to be critically lacking. Evidence indicates a clear correlation between law enforcement and the reduction of the capture and sale of chimpanzees. If protective efforts are effective, the number of chimpanzees confiscated by governments will gradually reduce as well as the need to expand or create new facilities for their placement. Of even greater significance is the fact that the drain on the wild population imposed by the commercial trade in baby chimpanzees will come to a halt. If the price of stopping the traffic in baby chimpanzees is greater support for law enforcement and sanctuaries, then certainly conservation organizations can afford and justify these costs.

Western chimpanzees are highly endangered. Ensuring their survival requires the simultaneous implementation of multiple and varied strategies. Sanctuaries and release programs represent only one approach. Placement and care of orphaned chimpanzees in sanctuaries is an effective and humane means to reducing the illegal traffic in baby chimpanzees. Although not all sanctuaries were established with a conservation aim, most can evolve to serve this purpose with guidance and financial support. Mutual respect and collaboration between the various approaches taken by academics, conservationists and sanctuaries is essential to the protection and long-term survival of wild chimpanzees. Bridging this gap is a first step in the united effort needed to ensure the survival of western chimpanzees.

The following actions are recommended to raise the standards of rehabilitation efforts and improve and create a more productive working relationship between the various sectors concerned with or involved in chimpanzee survival.

22.8 Recommendations

22.8.1 All sanctuaries should be licensed as accredited facilities by a committee of experts representing rehabilitation, chimpanzee medical issues, education activities, conservationists, ecologists and government agencies responsible for wildlife

In order to improve standards of sanctuaries, a system of licensing and regulation needs to be developed. Criteria for approval must include professional standards. Routine evaluations must be conducted for regulation of standards. Approval will qualify centers for various benefits including the application for specific funds, facilitation of Convention on International Trade in Endangered Species regulations for transfer of chimpanzees between sanctuaries and assistance with medical testing (see below).

22.8.2 Formalize relationships between range states to facilitate the exchange and placement of individual chimpanzees between centers and to return individuals to subspecies range of origin

As some centers have the hope of reintroducing their charges to the wild, a system should be put in place whereby all chimpanzees accepted by sanctuaries are tested genetically and, if possible, returned to their appropriate subspecies range. Chimpanzees already part of a social group should not be extracted for this purpose, but records should be kept for future options.

Due to the varying response capacities of confiscated or orphaned chimpanzees, individuals might be better suited for one specific style of rehabilitation over another. Decisions of placement should always be in the best interest of the needs of the individual chimpanzee. Members of the licensing committee along with representatives from the three centers in West Africa could form a review committee.

22.8.3 Create a mechanism by which sanctuaries dealing with seriously ill chimpanzees can send either blood or tissue samples to laboratories for analysis and diagnosis

A serious problem plaguing many rehabilitation centers located in remote areas is the lack of sophisticated medical equipment for disease diagnosis. Routine tests such as fecal analysis and basic blood work can be done on site by trained staff. More advanced testing including blood chemistries, cultures and pathology or histology work is difficult to access for even humans in Africa, much less chimpanzees. A formal relationship with a medical facility either in West Africa or outside should be put in place whereby accredited sanctuaries registered with range countries can be issued permits on short notice to send samples for diagnosis. This would save valuable time in diagnosing rarer or unusual diseases and prevent the loss of more individuals.

22.8.4 Create a new sanctuary

Of the three centers located in the *P.t. verus* subspecies range; only one (Tacugama in Sierra Leone) is capable of expanding spatially and accommodating more chimpanzees. However, even if this center could raise the funds for expansion, it would be obligated to continue to accept the regular flow of chimpanzees from within its own national boundaries. A new center is needed within the *P.t. verus* subspecies range to accommodate the orphans confiscated or donated by owners in the various range countries and perhaps incorporate the chimpanzees living in sub-optimal conditions in zoo facilities within the range.

22.8.5 Provide greater support and training to national staff

Rehabilitation centers are long-term efforts, and working closely with emotionally damaged or young, developing chimpanzees is more productive if there is continuity with caregivers. For various reasons, rehabilitation centers often rely on the assistance of expatriate volunteers, often giving these individuals a status which is higher in the management hierarchy than that of the long-term national staff. Reliance on such a framework is not only irrational but can jeopardize the stability of a project; particularly in the politically volatile region of West Africa, where expatriate evacuations have become routine. More attention needs to be given to the training of national staff to increase their skills and capacity so as to ensure their long- term presence in a project as well as their ability to manage the effort in the absence of their foreign counterparts.

22.9 Conclusions

Accepting the premise that caring for discarded or confiscated chimpanzees is not only a moral imperative but also a logical extension of conservation efforts, this chapter has focused on reviewing past and present efforts at rehabilitation in West Africa. It is argued that rehabilitation is a viable option under some specific and carefully monitored conditions. The commercial traffic of chimpanzees is responsible for hundreds of orphaned chimpanzees in need of help in West Africa today. This threat represents a significant drain on the population of wild chimpanzees and needs to be addressed within any strategy aiming to ensure the survival of this species in West Africa.

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Chapter 23

Infectious Diseases in West Africa: A Common Threat to Chimpanzees and Humans

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23.1 Introduction

Despite extraordinary medical progress in this century, infectious disease remains a serious threat to human health, leading all other causes of death worldwide. The annual cumulative number of deaths due to major infectious and parasitic diseases is estimated to be 13.3 million in children and young adults.

Recent reports of deadly outbreaks in chimpanzees *Pan troglodytes* and gorillas *Gorilla gorilla* from Gabon and the People's Republic of Congo remind us that diseases are also a major threat for great ape communities (Vogel 2003; Walsh 2003). Parasitic and more recently, bacterial and viral infectious diseases have been reported in apes with the development of field study sites and long-term surveys of these populations.

For infectious and parasitic diseases, the species boundary between humans and chimpanzees is one of the most easy to cross. The remarkable genetic and physiological similarities between chimpanzees and humans explain why they may be easily infected by the same viral, bacterial, parasitic or fungal pathogens. Most of the infectious agents affecting great apes can affect humans and vice versa; one can count more than 140 diseases that humans share with the great apes (Wolfe *et al.* 1998; Butynski 2001).

23.2 HIV1 and SIVcpz, AIDS as a zoonosis

HIV-1 and HIV-2 are of zoonotic origin, with their closest simian relatives in the chimpanzee and the sooty mangabey *Cercocebus atys*, respectively. The human immunodeficiency virus (HIV) epidemic and the resulting burden of HIV-related opportunistic infections is overwhelmingly a problem of developing countries, where 95% of HIV-infected people live.

There is serological or molecular evidence of Simian immunodeficiency viruses (SIVs) for at least 30 African primate species (including chimpanzees), and serological or molecular evidences for SIVs having been reported in at least 30 African non-human primates. Sequence similarity of fully characterized viruses allows the classification of SIVs and HIVs into six approximately equidistant phylogenetic lineages. If certain SIV lineages have co-evolved with their hosts, there are also multiple examples of cross-species transmissions from simians to humans, and between different simian species (Peeters *et al.* 2002).

Patas monkeys *Erythrocebus patas* in West Africa and chacma baboons *Papio ursinus* in South Africa are infected with an SIV from the local sympatric vervet monkeys *Cercopithecus aethiops pygerythrus.* In addition, full-length genome sequencing of SIVs from *Cercopithecus aethiops sabaeus* monkeys (SIVsab), red-capped mangabeys *Cercocebus torquatus* (SIVrcm), mandrills *Mandrillus sphinx* (SIVmnd2) and greater spot-nosed monkeys *Cercopithecus nictitans* (SIVgsn) revealed a possible recombinant structure of their genome.

These observations suggest that both cross-species transmission and co-infection with highly divergent viral strains have existed since the beginning of the evolution of primate lentiviruses. Cross-species transmission could possibly happen again in human populations or among species of non-human primates.

Educational campaigns urging the local population to avoid contact with non-human primates and especially the hunting, handling, and eating of the meat of non-human primates could help prevent new SIV introductions and subsequent pathogen mutations in humans. Initial education efforts in the People's Republic of Congo have resulted in a decrease in non-human primate hunting and consumption by villagers provided with information regarding disease transmission risks.

No serological or molecular evidence for SIVs have been reported in wild West African chimpanzees *P.t. verus*, but the possibility that a monkey SIV could cross the species border and infect West African chimpanzee populations is real. Nothing can be done to avoid this transfer of SIV among species endemic to West Africa, but strict control measures preventing the movement and release of chimpanzees or other primates from other parts of Africa can help reduce this risk of introducing new pathogenic forms.

(Photo credit: Annelisa Kilbourn)

Test kits like the one shown above use fecal samples from gorillas to screen for the presence of adenovirus and other viral diseases that are common to humans but harmful to gorillas.

(Photo credit: Annelisa Kilbourn)

As part of the Wildlife Conservation Society gorilla health program in central Africa, local scientists are trained to analyze biological samples collected from western lowland gorillas in the region.

Little is known about the natural course of SIVcpz in wild chimpanzee populations. The study of the natural infection and spread of SIVcpz in chimpanzee populations may help the search for new vaccines or strategies against HIV/AIDS and its related opportunistic infections. However, these studies should not put at risk an endangered species like the chimpanzee. These studies should be designed carefully and handled properly in total consideration of conservation issues. Studies linked with long-term scientific research sites on chimpanzees should be encouraged. We must strongly discourage biomedical research programs that would go into remote forests to collect samples from chimpanzees and leave behind potentially deadly human pathogens (see below).

23.3 Ebola Virus: an emerging disease but a serious threat for chimpanzees

In November 1994, a new subtype of Ebola virus was isolated in a primate specialist working on chimpanzees in Taï National Park, Côte-d'Ivoire (Formenty *et al.* 1999a, b). It was assumed that the patient became infected while conducting a necropsy on a chimpanzee that died of Ebola virus. The chimpanzee belonged to a community which had been monitored since 1989 by a group of primatologists (Boesch and Boesch-Achermann 2000b). In November 1994 the group of chimpanzees had suffered an epidemic of Ebola virus; approximately 25 percent of the 43 chimpanzees in the study community disappeared in a few weeks.

Ebola-specific immunohistochemical staining and electron microscopy were positive on tissue sections of one autopsied chimpanzee. Demographic, epidemiologic and ecological investigations were compatible with a point-source epidemic. Activities associated with case-contact (touching dead bodies or grooming) do not constitute significant risk factors, whereas consumption of meat does. The relative risk of meat consumption was 5.2, with a 95% confidence interval (1.3 −21.1). It is likely that the chimpanzees had become infected while hunting and eating red colobus monkeys *Piliocolobus badius.* Red colobus serve as an intermediate host for the Ebola virus after becoming infected by the true (but currently unknown) reservoir in the forest canopy.

These studies prove Ebola virus to be present in the Taï forest within a well-defined area that includes chimpanzees. This information has thus served as the justification to begin long-term investigations in the Taï forest to seek the natural reservoir host of the Ebola virus.

The 1994 Ebola epidemic was the first one described in nature. The demographic and epidemic patterns of this chimpanzee community suggest that another epidemic due to Ebola might have occurred in 1992 (Boesch and Boesch-Acherman 2000b).

In Gabon, mortality among gorillas and chimpanzees was recorded in the Minkebe Forest during an Ebola outbreak in November 1994. Several great apes were found dead by villagers who were contaminated after butchering and eating several gorillas and at least one chimpanzee (J. Amblard, pers. comm.). The disease outbreak in Ogooue-Ivindo Province in north-east Gabon was recognized in December 1994, and the last case occurred on 9 February 1995. There were a total of 51 cases and 31 deaths in the human population.

The following year (1996), two more outbreaks of Ebola were reported from Gabon in the same province where Ebola Haemorrhagic Fever appeared in 1994. Late January 1996, 18 persons became ill after butchering a chimpanzee found dead in the forest. In total, there were 31 cases, of which 21 died. The third human epidemic of Ebola in Gabon

(Photo credit: Pierre Formenty, The World Health Organization)

Wearing protective clothes and respirator to perform the autopsy of a chimpanzee in Taï National Park during the *Streptococcus pneumoniae* outbreak in May 1999. Post-mortem examinations and sample collections should be conducted by qualified individuals following international biosafety recommendations.

lasted from July 1996 until January 1997. It was reported that several dead chimpanzees were again found in the forests bordering the villages of the index cases (Georges-Courbot *et al.* 1997). This epidemic included a total of 60 cases and 45 deaths.

During the first Ebola outbreaks in Gabon, index cases seem to have become infected after touching, butchering and eating gorillas or chimpanzees found dead in the forest. These dead apes were all found in the same forest complex ''the Minkebe Massif Forestier.'' The spatial and temporal distributions of these deaths suggest that one long-lasting and probably mobile Ebola outbreak might have occurred in the ape populations from 1994 until 1996, or that Ebola virus was repetitively introduced in the same area throughout the years. Demographic studies by the World Wildlife Fund and S. Lahm (pers. comm.) in the Minkebe forests show that the chimpanzee and gorilla populations decreased 100-fold from 1993 to 1998, due most probably to repetitive outbreaks of Ebola. The data suggest that thousands of chimpanzees and gorillas have died in these forests in five years, with infectious diseases killing more at this time than any other documented cause (Huybregts *et al.* 2000).

From October 2001 until June 2002, dead chimpanzees and gorillas were recorded in the forest bordering villages where Ebola outbreak(s) were ongoing. Several consecutive Ebola outbreaks in Gabon and Congo were again linked with the consumption of gorillas or chimpanzees. At least four separate incidents of humans handling or consuming either gorillas or chimpanzees lead to human index cases followed by infection of dozens of others in contact with infected people. During this period, a total of 122 Ebola Haemorrhagic Fever cases were reported (65 cases and 53 deaths in Gabon; 57 cases and 42 deaths in Congo) (WHO 2002). Hunters and villagers in the area reported observing at least 50 gorilla and 12 chimpanzee carcasses.

There is no evidence to suggest that gorillas or chimpanzees survive infection with Ebola virus, thus reinforcing the evidence that great apes do not serve as a reservoir for the virus. Limited serological testing of gorillas in northern Congo and of chimpanzees in the Taï forest of Côte d'Ivoire have shown healthy appearing individuals to have no previous infection with Ebola virus

The outbreaks in great apes seem to always precede Ebola outbreaks in humans. Thus, great apes could be used as ''sentinel species'' for alerting the public health authorities. The possibility exists that a wider range of species of wildlife within the rainforest are affected by the virus (non-human primates, predators, scavengers). Therefore, investigation of every animal found dead in the rain forest could be used as an early warning system for infectious diseases like Ebola.

During the 1994 Ebola Hemorrhagic Fever outbreak, high mortality rates occurred among chimpanzees in Taï National Park; the Ebola Hemorrhagic Fever virus was probably responsible for a dramatic decrease of chimpanzee populations in north-east Gabon. Because of this, Ebola virus appears to be a serious threat to the conservation of chimpanzees in the rainforest of Africa.

23.4 Acute respiratory syndrome outbreaks: complex interactions between great apes and humans?

Several outbreaks of respiratory disease in apes were reported over the last few decades (Wallis and Lee 1999; Butynski 2001). In 1988, an outbreak among the mountain gorillas *Gorilla beringei* of the Virunga Volcanoes killed six animals and sickened 27 more in Rwanda. The animals were sneezing, coughing and dying; from the clinical profile, epidemiology and pathology it appeared to be measles. Although blood and tissue samples were obtained from one gorilla, the source of the disease was never identified, but investigators feel that the disease was most probably of human origin (Sholley and Hastings 1989).

In 1996, during one outbreak among chimpanzees at Gombe National Park, Tanzania, 11 chimpanzees succumbed to respiratory infections. The chimpanzees were all members of a group that were handed food in an effort to habituate them. It is speculated that sick workers may have infected the chimpanzees (Wallis and Lee 1999).

Although anecdotal accounts abound about recent outbreaks, hard data are lacking to identify human exposure as the true source. In captivity, gorillas and chimpanzees commonly develop respiratory infections when caretakers or visitors are shedding respiratory pathogens.

In May 1999, the World Health Organization and the Max Planck Institute investigated an epidemic of acute respiratory disease that spread among the Taï National Park wild chimpanzee community that suffered the Ebola outbreak in November 1994 (P. Formenty and C. Boesch, pers. comm.). The disease was highly contagious and highly lethal and characterized by a few skin lesions, coryza, cough, dyspnea and fatigue. The clinical and necropsy findings were consistent with an acute respiratory disease like measles. We were able to conduct three necropsies and collected specimens for analysis. Suspected human measles outbreaks were reported in several villages around Taï National Park a few weeks before the chimpanzee outbreak, but no human case was confirmed in the laboratory. Highly contagious acute arthritis outbreaks with high morbidity rates were also reported in these villages weeks before the chimpanzee outbreak.

The tests performed in laboratories (virology, serology, pathology) allowed the exclusion of measles virus and other respiratory viruses as the cause of the respiratory infection outbreak in the Taï Forest chimpanzees. *Streptococcus pneumoniae* (pneumococcus) was isolated from the lung of one chimpanzee and it was felt that *S. pneumoniae* was the probable cause of the outbreak. As most humans are asymptomatic carriers of *S. pneumoniae*, it is very likely that this Taï chimpanzee was infected either by people working in the park or by outside visitors.

''Observer effect'' is recognized to affect the findings in many types of research, but the implications for the health of animals has been poorly explored. The serious consequences of the possibility for research and tourism of wild apes causing low-level, chronic stress and/or the inadvertent introduction of disease agents warrants scientifically sound investigation (Butynski and Kalina 1998). The assumption that observers are able to recognize visual signs of low level chronic stress if it is occurring is presumptuous at best, and does not provide a scientifically sound justification for placing ape populations at risk.

Unlike Ebola virus, *S. pneumoniae* and other common human respiratory pathogens are well understood and prevention of their spread is feasible. Most of the factors in the *S. pneumoniae* outbreak seemed to be of human origin (the infectious agent, its introduction in the chimpanzee population, and possibly a background of chronic stress). This clearly illustrates the potential problem of human responsibility in infectious disease outbreaks in great apes (Butynski 2001).

Humans still have much to learn from the study of natural outbreaks of infectious diseases in wild great apes. However, just as with great apes held in captivity, humans can be the source of these outbreaks in the wild. Despite the lack of complete information on the cause and ecology of every possible disease of wild great apes, we do have enough information to know that we can reduce the risk of disease introductions to wild great apes by reducing the presence of

common infectious pathogens in humans living nearby and/or working in areas where great apes are located, and by establishing guidelines and procedures that would greatly reduce the transmission of diseases from humans to great apes.

23.4.1 Tuberculosis

The bacterium that causes tuberculosis in humans affects all species of great apes and typically causes fatal results. Great apes are extremely susceptible to human tuberculosis. The most common source of infection in primates is from humans shedding the organism (in sputum, respiratory secretions, and in feces). The organism can live in the environment for extremely long periods of time when kept warm and shaded from sunlight. Researchers and park staff should be screened to ensure they are not infected and shedding tuberculosis organisms prior to being allowed to work in areas where chimpanzees live (Woodford *et al.* 2002).

23.4.2 "Polio-like" virus outbreaks

In 1966, an outbreak of a polio-like virus occurred in the Gombe chimpanzees. Six to nine chimpanzees died from the disease and at least six others were paralyzed for life. It was not possible to determine whether the epidemic was part of a natural cycle or the result of disease transmission.

In 1964, a similar outbreak, without confirmed etiology, was described in Beni, Democratic Republic of Congo (DRC), where seven of 48 chimpanzees were handicapped by limb paralysis (Wallis and Lee 1999).

23.4.3 Monkeypox

A human monkeypox infection transmitted by a chimpanzee was reported in 1983 in eastern DRC. The victim, a six-month-old baby, had been bitten by a wild chimpanzee while her mother was hunting monkeys in a cassava field surrounded by dense forest (Mutombo 1983).

In January 1987, a suspected monkeypox outbreak was reported in the research chimpanzee community in Taï National Park, affecting five individuals and presumably killing one (Boesch and Boesch-Achermann 2000b). Typical orthopoxvirus scars were identified in several monkeys found dead in the forest by the World Health Organization Ebola Project (P. Formenty, pers. obs.), confirming the endemicity of the monkeypox virus in Taï Forest. But the small number of cases recorded by C. Boesch (five cases in 20 years, one death) seems to show that monkeypox is not an acute threat such as Ebola or *S. pneumoniae.*

23.5 Recommendations

23.5.1 Set up a formal and strong collaboration between wildlife health and public health authorities

Wildlife health and human health professionals need to develop between them a formal collaboration at national and international levels that will benefit both sides. This collaboration should be developed as well at the local level, between the people in charge of management of the protected areas and those in charge of the public health sector. This collaboration will help to provide comprehensive preventive medicine and response efforts targeting protected areas and surrounding communities.

Health education needs to be provided to researchers and park staff so they can effectively participate in preventing the introduction of disease and respond appropriately to changes in wildlife and human health. As mentioned above, Ebola outbreaks in great apes typically precede Ebola outbreaks in humans. Thus, chimpanzees, gorillas and bonobos could play the role of sentinel species for alerting the public health authorities. As a rule, any outbreak in wild great apes should be reported to public health personnel, who should use this information to alert local populations. The response and control of infectious disease outbreaks of human or wild animal origin need to be coordinated between wildlife and human health authorities. A network of human and wildlife professionals could be established to exchange information and expertise in this area: information on infectious disease outbreaks should be reported and shared to allow the best management possible of outbreaks in both human and wildlife populations. A common plan to control outbreaks should be prepared.

23.5.2 Conduct further studies on infectious diseases in wild chimpanzees

Chimpanzee health studies should be designed and conducted by trained professionals. The sensitization of the primatologists and the people working closely with apes to the threats of infectious diseases have to remain a priority to allow the timely reporting of outbreaks and other information and the effective response to epidemics. Rumors of chimpanzee outbreaks should be systematically verified with field investigations, and the diagnostics should be confirmed in the laboratory. Human health professionals could help in this verification process. Non-invasive methods to detect antigens of infectious agents and antibodies produced in response to these should be developed to improve infectious disease monitoring and pathogen identification. Investigations to evaluate and monitor stress levels due to repeated close human contact on habituated communities

should also be conducted by measuring adrenal gland activity in wild chimpanzees.

For each national park, the management team should assess the health status of their wildlife populations, and the assessments should serve as a base for preventive medicine guidelines. Post-mortem examinations and sample collections should be conducted by qualified individuals following international biosafety recommendations (e.g., wearing protective clothing, gowns, aprons, facemasks, rubber gloves, boots) on all chimpanzees and other wildlife species found dead. After each necropsy, the body should be disinfected and buried or cremated (CDC and WHO 1998). Post-mortem examinations should be done in the field as often as possible. Due to biohazards, transport of dead animals out of their natural habitat for necropsy purpose should be strongly discouraged.

The transport of diagnostic specimens by any mode of transport both nationally and internationally should follow the international regulations for the transport of infectious materials, which are based upon the Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods (WHO 1997). The International Air Transport Association reflects these recommendations in its regulations (International Air Transport Association 2001). Diagnostic specimens should be packaged in a three-part system that is capable of passing the performance test standard. The system comprises a primary receptacle (water-tight), a secondary receptacle (water-tight) and an outer packaging.

23.5.3 Prevent the introduction of pathogens in chimpanzee populations

People working in or entering national parks (park staff, researchers, etc.) should be appropriately vaccinated on the basis of human and wildlife health needs; vaccinations should include tuberculosis, measles, mumps, rubella, yellow fever, tetanus, rabies and polio. Human populations living around parks and reserves should be similarly vaccinated; a healthy human population around parks will decrease the chance of introducing human pathogens in the chimpanzee population. Of special concern, researchers and park staff should be tested or vaccinated for tuberculosis, and infected humans should not be allowed to work in areas with chimpanzees. No domestic animals should be allowed to enter park areas. In the case of ape-based tourism, the existing visitor regulations should be reinforced and strictly applied to reduce the risk of disease transmission between humans and apes. Feces, vomit and other human debris or wastes should be removed from areas where chimpanzees may come in contact with it or buried at a depth where other animals will not uncover and allow chimpanzee contact.

23.6 Conclusions

Infectious diseases, either of natural source (e.g., Ebola, monkeypox) or of human origin (e.g., *S. pneumoniae*, measles, poliovirus, tuberculosis), constitute a real threat to the chimpanzee populations in West Africa. In human health, the professional assessment of the importance of infectious diseases has greatly influenced public health practices and structures with, for example, the establishment of independent Food Safety agencies in many countries, the identification of health research themes, and the allocation of resources at both national and international levels. Similarly, the assessment of infectious disease threats in West African chimpanzees should lead to the development of protective measures to make sure that the contact with potentially dangerous pathogens can be avoided. For example, as is done in the Taï Chimpanzee Project, field assistants and researchers should be vaccinated against potentially dangerous diseases. Introduction of new pathogens can be limited by establishing hygiene measures to clean rubber boots or shoes and all field clothes (C. Boesch, pers. comm.). This program should also consider the other chimpanzee populations of Central and East Africa and all great apes living in Africa: gorillas and bonobos *Pan paniscus.* It is now essential that all governmental authorities, research institutes and non-governmental organizations involved in conservation of chimpanzees realize the importance of the threat that infectious diseases represent to chimpanzees but also to all non-human primates.

Chapter 24

Policy Recommendations for Chimpanzee Protection in West Africa

Cyril F. Kormos

24.1 Introduction

This chapter proposes a legislative and policy action plan to protect chimpanzees in the West Africa forest region and is based on the policy recommendations from the preceding chapters, a desk review of wildlife and forestry laws and policies in select countries and a review of regional conservation analyses that have been conducted in recent years. This chapter addresses two important elements of threats to chimpanzees and proposes recommendations: The first is habitat loss and destruction; the second is hunting for commercial bushmeat trade or subsistence, the pet trade, traditional medicinal purposes and medical research.

Two caveats are in order. The first is that because a number of legislative and policy analyses to improve species protection in West Africa (Teleki 1993; Bakarr, da Fonseca *et al.* 2001) have been generated in recent years, some of the proposals covered in this chapter are not new, although they are even more pressing today given the continued loss of habitat and the escalating bushmeat crisis. This chapter attempts to strike a balance between re-emphasizing certain policy reforms while at the same time introducing several more novel concepts (particularly with respect to forest fragmentation and conservation concessions) that have been developing in the last several years.

A second caveat, noted in several of the country chapters, is that new legislation without the will and capacity to enforce it is largely useless. In most cases, financial resources, training, equipment and communications campaigns to improve the application of the law in the field and in the courts is more urgent than drafting a more precise law. Nonetheless, there are several obvious instances where legislative change is required. For example, amending Sierra Leone's contradictory provisions on chimpanzee protection and eliminating medical loopholes regarding chimpanzee capture in Senegal and Guinea are priorities. There are also instances where excessively stringent regulations may need to be reconsidered, for example in the case of wildlife laws that deny local populations any say in the regulation of wildlife (as mentioned in Duvall *et al.* 2003, Chapter 6 and in Caspary *et al.* 2001). Finally, drafting more effective legislation is also useful if done in anticipation of better resources and improved mechanisms to enforce it.

Although there is consensus throughout the preceding chapters that habitat loss through agricultural expansion and hunting are the two principle threats to chimpanzee populations, there is some variation between countries and within countries as to which seems to be the most serious threat and the top priority to address. Ranking threats is admittedly a somewhat imprecise exercise given that levels of threat vary over time and from location to location. For example, threats to a chimpanzee population might depend on whether that population is in a predominantly Muslim part of a country, where they are less likely to be hunted, or whether harvests in a country are plentiful, thus decreasing the likelihood that chimpanzees and humans will be in competition for subsistence plant gathering. In addition, in many cases both direct and indirect threats must be addressed together, as both are significant.

Nonetheless, characterizing and prioritizing the types of threat as carefully as possible is important to ensure that conservation resources are targeted effectively. A rough assessment indicates that Senegal, Guinea Bissau, Côte d'Ivoire and Liberia listed habitat loss as the primary problem, whereas Guinea, Sierra Leone and Nigeria listed hunting first. Further work to refine the threat analysis where information is currently lacking would be useful.

24.2 Habitat protection

24.2.1 The need for new protected areas

Expansion of existing protected areas and the creation of new protected areas is a clear need throughout the region. Several proposals for new areas based on chimpanzee habitat assessments are contained in the preceding chapters. Data on chimpanzee habitat should be combined with priorities for other threatened and endangered species to produce integrated proposals for new parks in the region. Given that the governments of Ghana, Guinea, Côte d'Ivoire and Liberia are already considering expansions of existing parks, as well as creating new parks, and given that only a relatively small percentage of West African forests are currently under protection consistent with IUCN designations, there is

certainly an opportunity for new areas to be created with the specific objective of chimpanzee protection. Although resources for park management in the region are scarce, the fact remains that even a park with few resources is better than no park at all, and that protected areas remain the best and most viable long-term plan for managing biodiversity in the region (Bruner *et al.* 2001).

24.2.2 Conservation concessions

Given the extreme fragmentation of the forest ecosystem, and the fact that designating a new protected area is often a lengthy political process, conservation concessions might be a mechanism for increasing capacity of the forest services in the region, as well as expanding habitats under protection.

Conservation concessions involve the purchase of forest concessions for protection rather than timber extraction. The conservation concession is purchased for the same term as a logging concession, and with an obligation to compensate the forest service for the income that would have been generated had timber been extracted. Aside from the income for the forest service and the conservation benefits, conservation concessions also provide an opportunity for non-governmental organizations to work with foresters to manage forests for biodiversity values, thereby increasing the forest service's technical expertise and helping to bridge the gap between foresters and protected area managers. They also require less time for approval than does declaring a new national park, which can be useful when forests are under severe threat. The limitation of a conservation concession is that it does not offer the permanent protected status and does not have the visibility of a national park.

The policy recommendation in this instance is therefore to assess the potential for conservation concessions in each country. Because forest codes are usually silent on whether extraction must actually occur if a concession is purchased, assessing the potential for conservation concessions will involve meeting with forestry officials to clarify this point and to gauge their interest in this mechanism. As with trust funds, the limiting factor of course is the availability of capital. Approaching forestry officials regarding conservation concessions without having funding in hand to purchase conservation concessions may be counter-productive, serving only to raise expectations needlessly.

24.2.3 Increased capacity to manage existing protected areas and landscape connectivity

The need for better capacity to manage and enforce existing protected areas and forest resources has been well documented and need not be reviewed in detail here. However, in light of findings on the dynamics of fragmented forests, it is useful to emphasize the need for careful management of the remaining fragmented ecosystems in West Africa and the need for a landscape approach to management.

Maintaining connectivity between fragments and maintaining fragments as large as possible are key to preserving remaining forests in the region. In practice this means protecting each viable fragment whenever possible, but it also means more intensive management of the surrounding matrix to prevent the degradation of forest remnants. This involves a range of measures designed to prevent the creation of abrupt forest edges, including maintaining gallery forests, protecting against logging on steep slopes to prevent erosion, limiting agricultural pesticide runoff, maintaining buffer zones between forest fragments and crops, and fire prevention. A review of forestry legislation in West Africa reveals that provisions for most of these elements exist. Aside from problems with enforcement, however, they are not integrated into a cohesive whole designed to ensure the viability of forest remnants and their biodiversity in a highly fragmented landscape. Management guidelines specifically designed to achieve the goal of managing the matrix, rather than focusing exclusively on the remaining patches, would be a significant step forward.

24.3 Chimpanzee protection – preventing the hunting and capture of chimpanzees

Although protected areas are the most effective tool for safeguarding chimpanzees in West Africa, numerous populations will remain vulnerable unless protective measures against hunting and live capture are undertaken. The preceding chapters indicated that chimpanzees are hunted; (1) as a source of bushmeat, (2) because they are agricultural pests (they engage in crop raiding), (3) because they compete with humans for subsistence plants and (4) for the pet trade. Capture of chimpanzees for scientific research had a significant impact on chimpanzee populations in the past, and those effects may still be felt in some areas, but chimpanzees are no longer used for scientific experimentation. The particular reasons for which chimpanzees are hunted vary from country to country and within countries.

With few exceptions (Sierra Leone is currently amending its legislation to provide full protection, and Senegal has a scientific research exception) chimpanzees are protected throughout their range. However, there are a number of problems with enforcement in the region, ranging from ensuring the manpower, training and logistical resources to enforce regulations to strengthening the regulations themselves. Implementation capacity is weak throughout West Africa. Enforcement is only effective if every level of the enforcement system, from policing to the judiciary, is

functioning, and training must be conducted at all levels, from park rangers and forestry agents to the judges who must apply the wildlife protection laws and other natural resource laws.

Reviewing the laws and regulations themselves is also necessary. It is critical to ensure that the species lists are up-to-date, and that the penalties for violating wildlife laws are sufficiently stringent to act as a deterrent, i.e., that fines are sufficiently high and that both the bushmeat as well as the weapons used to capture or kill it can be confiscated. It is also critical to ensure that the scope of the law is sufficiently broad. In some cases, wildlife protection and protected areas are linked too closely, so that protection is only afforded within protected areas (Kormos and Bakarr 2001).

Another problem with wildlife protection laws is that they are not always tailored to local custom and tradition and do not always take local conditions, e.g., the need for protein or the history of wildlife management in a particular area, into account. This problem has been noted by Herbinger *et al.* (2003, Chapter 12). Although progress has been made in this respect in some countries, such as Senegal and Guinea, taking this philosophy to an extreme, as in Sierra Leone, where hunting is allowed in a number of non-hunting forest reserves, can be counter-productive (Grubb *et al.* 1998). What is certain, however, is that enforcement must be to some degree adapted to local needs, and must be complemented with outreach programs and compensation to make it more effective.

Indeed, there are indications that community-level work focusing on the traditional importance of wildlife can be a very effective way of raising awareness. Though in its early stages, reports from Ghana indicate that an initiative using traditional totems as a way of emphasizing the importance of wildlife has been a very useful way to convey a conservation message at the community level. Strict enforcement of chimpanzee protection laws, critical to the protection of chimpanzee populations, can be greatly facilitated if culturally appropriate mechanisms are used to raise awareness about the need for conservation.

Projects to identify where the enforcement systems break down, with funding attached to help resolve the problems, are urgently needed. The nature of the problem will vary: in some instances training judges and providing forestry agents with transportation will be more urgent. In other cases enforcement efforts will consist largely of awareness-raising campaigns and compensation to local communities for loss of hunting revenues. In other instances all of the above will be required. In all cases, however, a precise diagnosis of where the chain of enforcement breaks down is critically important.

24.4 Conclusions and recommendations

The two sections above highlight a range of possible improvements in habitat protection and protection against hunting and provide a summary of some of the most pressing, direct measures that can be taken to provide better chimpanzee protection. This is, however, a general, and only partial listing of measures. As mentioned in the Guinea chapter with reference to mining in the Nimba region, the indirect impacts of extractive projects and infrastructure development projects can be potentially devastating. Effective protection of habitat and species therefore depends on a broad range of policies, from regulations prescribing environmental impact assessment reviews for projects, to industry best practices guidelines, to government agricultural policies, to forestry policies. These are clearly too voluminous to review in depth in this chapter. However, these topics were considered during workshop discussions and accordingly are reflected in the country-by-country recommendations listed above.

Chapter 25

Recommendations for Censusing Chimpanzee Populations in Forests

Andrew J. Plumptre

25.1 Introduction

Harmonization of the methods for surveying chimpanzees across Africa is essential so that results can be compared and trends can be detected over time. Counting chimpanzees in forests, however, is a difficult task. Compared to other primates, chimpanzees live at low densities (0.2–2.0 per km^2) in the wild, and hence are rarely seen. We are therefore forced to rely on indirect signs to census them. Thankfully, because chimpanzees of ages three and older build nests, we can estimate the number of adults and juvenile animals in an area by counting nests. Several methods of nest counting have been developed over the years, and I present in this chapter an overview of these methods and what I consider to be the most accurate method, which we use to census chimpanzee populations in Uganda.

25.2 History of chimpanzee census methods

Chimpanzee densities were initially calculated by tracking habituated or semi-habituated animals in order to develop estimates of their home range size (Reynolds and Reynolds 1965). This method is problematic, however, because it requires that the researcher come to know the home range in question well, a task that can require many years of work, and it assumes that adjacent ranges abutt exactly with the range under study. For example, a study on chimpanzee home range size published after ten years of study in the Kibale forest (Chapman and Wrangham 1993) was almost immediately rendered inaccurate by subsequent research which showed that the ranges of many of the chimpanzees in this area were much larger than indicated in the 1993 publication.

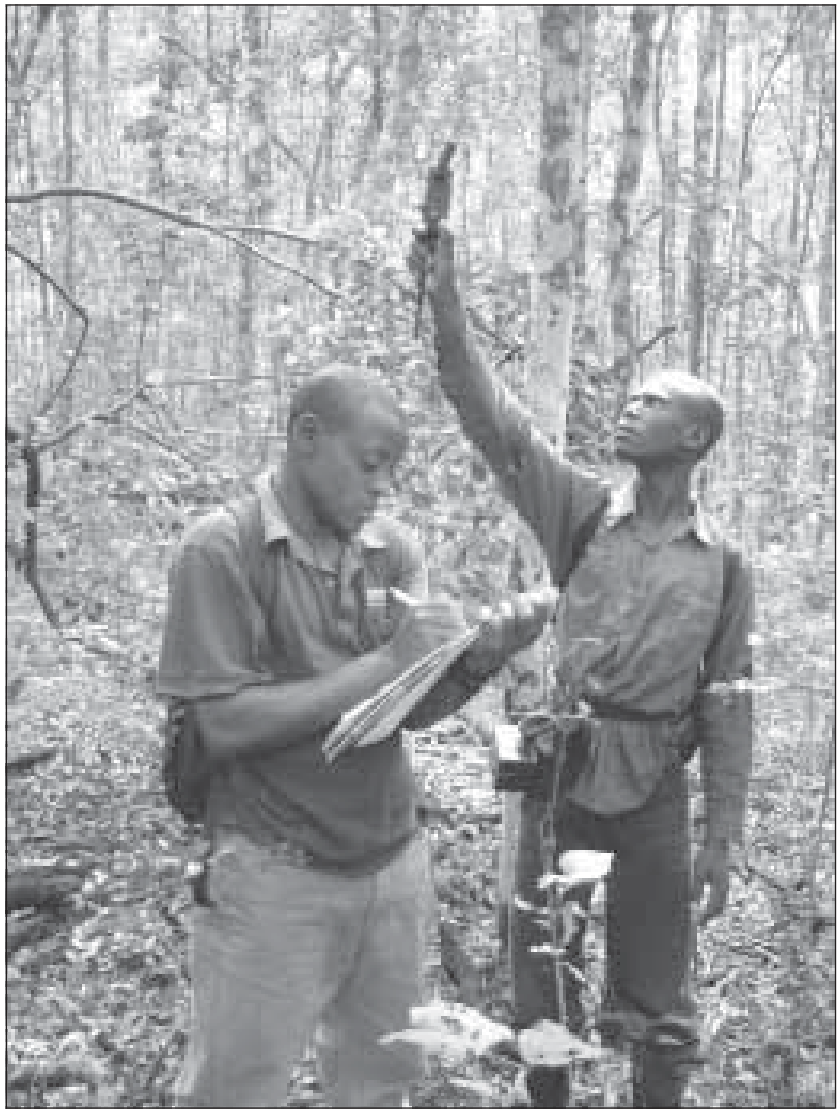
Nest counting techniques have been used in many sites in Africa. Ghiglieri (1984) was one of the first to use this technique to census the chimpanzees in part of Kibale forest in western Uganda. A modification of his technique was used in Gabon to undertake a nationwide census of chimpanzees (Tutin and Fernandez 1984). Working with Vernon Reynolds, I further modified the technique and developed an alternative and more accurate method of nest counting, which we called the ''marked nest count'' method (Plumptre and Reynolds 1996, 1997).

25.2.1 Standing crop counts

The standard nest count technique as developed by Ghiglieri (1984) and Tutin and Fernandez (1984) and used many times subsequently (e.g., Hashimoto 1995) involves walking transects and calculating a density of nests found along the transects. This density figure is then used along with the rate of nest decay to estimate the population density of chimpanzees. However, nest decay rates can be highly variable (Plumptre and Reynolds 1996). In Budongo Forest in Uganda, for instance, nests have been observed to decay in as few as ten and as many as 154 days. Estimates that people have obtained from this standard nest count techniques have rarely acknowledged potential errors and have never incorporated the errors associated with the wide variations in nest decay rates to calculate confidence limits. In addition, calculating nest decay rates at a site is time consuming if researchers have to wait 154 days or longer until the last nest decays. When the process of monitoring nests for decay begins is also important – if researchers begin monitoring decay rates at the same time they start counting nests, then they will not be monitoring the decay rates that led to the current standing crop of nests being counted. While it is unclear precisely when nest decay monitoring should begin in relation to the nest count, I advocate that it precede the nest count by at least one to two months. We termed this count technique the ''standing crop count'' because it involves a one-time visit to an area to determine the density of nests at the time of the visit.

25.2.2 Marked nest counts

One way to avoid having to calculate nest decay rate is to revisit transects regularly and count the number of nests that appear over time. In Uganda we have developed transects in several forests that we visit every two weeks over a period of about three to four months. On the first walk along the transect we count and mark all nests with a ribbon and stake



(Photo credit: Andrew J. Plumptre)

Field assistants collecting GPS data at a nest site.

below the nest. This allows us to calculate the ''standing crop count'' for comparison. We then perform a second transect walk soon afterwards to ensure we have not missed any old nests. On every subsequent visit we only count new nests which are unmarked and then mark them so that they are not counted in future visits. About six visits over a period of about 3–4 months are required to obtain a reasonable sample size for 40km of transects in Uganda. In Central and West Africa, it is likely that 80–120km of transects would be needed to obtain a sufficient sample size because chimpanzee densities are lower there. A sufficient sample size consists of about 50 sightings of new nests (not including the first count) along the transects.

25.3 Methods in detail

Regardless of the method used (marked nests or standing crop), a protocol needs to be followed for transect nest counts. This protocol should dictate that transects be located in some form of random or stratified-random manner in the area to be censused. Transect stratification can be based upon habitat types, if these are known, or the area can be divided into equal-sized blocks and a transect located randomly within each block. Transects are usually cut through the forest following a compass bearing. The aim when cutting transects is to ensure that they are located in an unbiased and random manner.

Once the transects are cut, they should be walked at a speed no faster than about 1km per hour to ensure that nests are not missed. Other primates and wildlife can also be censused while walking the transects in order to better understand what fauna is present in the study area.

25.3.1 Area searched

There are two ways to extrapolate nest counts from a transect walk to estimate the density of nests. The easier way is to identify the distance at which all nests are detected on either side of the transect and use this width on either side of the transect to form a strip of forest of known area that is searched. In practice this is about 10m for forests in Uganda. Thus, the area searched can be calculated simply as:

Area = Length of transect in meters × 2 (referring to both sides of the transect) × 10m

The drawback of this calculation is that nests that can be observed beyond the 10m limit are not included and thus a longer distance has to be walked to obtain a sample size of 50 nests or more. As an alternative, in Uganda we use standard ''distance sampling'' methods. We record the perpendicular distance from the transect to the nest for each sighting and then use the computer package *DISTANCE* to estimate the total nest density. When you plot the number of nests seen against the distance from the transect line the numbers drop off after about 10m because nests are missed.

DISTANCE models this drop off in sightings of nests by fitting a curve to the data and then calculates the density using the equation of the fitted curve (Buckland *et al.* 1993).

25.3.2 Recording nests

When performing a census, nest sightings are recorded as follows: Any sighting of a chimpanzee nest is recorded on a data sheet. The nest is also marked with a colored ribbon that is tied to the corresponding tree (below the nest if possible). We also cut a short stake, shave its bark at the top and place in the ground directly below the nest. The perpendicular distance is then measured with a tape measure to the nearest meter and recorded on the data sheet. We use the following criteria to assign an age to the nest in order to determine if it was missed on previous censuses:

1. New = Intact nest with green leaves within the cup
2. Old = Mostly intact nest with brown leaves
3. Very Old = Observable gaps in the cup of the nest due to leaf loss

The nest's distance along the transect is also recorded. When carrying out marked nest counts, observers are asked to highlight on their data sheets any old unmarked nests. This allows us to check our previous data sheets to see if the nest was marked with a ribbon and stake that were subsequently lost, although it is rare that both are lost.

25.3.3 Data analyses

If perpendicular distances are measured as part of the census, the data can be analyzed using the software application *DISTANCE*, which is available free of charge and can be downloaded or ordered from the *DISTANCE* web site (www.ruwpa.st-and.ac.uk/distance). Some training is required to learn how to use this software, but good documentation is available on the web site. Buckland *et al.'s* book (1993) is also a helpful guide. Researchers who do not have access to *DISTANCE* will need to use the first method described above under ''Areas searched,'' namely, they will need to determine the point from the transect at which sightings drop off and only analyze the nests found within this distance. This is done by plotting the data as a histogram of the number of nests sighted at two-meter intervals from the center of the transect.

When analyzing standing crop nest counts with *DISTANCE*, bear in mind the following:

1. Nests are entered individually and not as groups, so the sample size is always one. Be sure to specify that the data are not in groups in order to ensure that the software functions properly.
2. The ''effort'' value is equal to the length walked on the transects since the transects will only have been walked once.

When analyzing marked nest count data, bear in mind the following:

1. The count from the first walk of the transect should not be included. Include only subsequent walks, i.e., only newly produced nests.
2. The ''effort'' is equal only to the length of the transect. (If live primates are being counted on the line then the effort is equal to the total distance walked, i.e., the length of the transect multiplied by the number of times it was walked.) Although the transects have been walked several times in reality we are interested in the number of nests that have appeared over a period of x days (usually about 90–120 days) and would walk the transect once at the end of this time if we could. However, because nests decay we need to visit several times to account for all the nests that are made.
3. *DISTANCE* will calculate a density estimate of nests produced over the time of the survey (time between first and last walk of the transect). Divide this estimate by the number of days elapsed to calculate the density of nests produced each day.

Most chimpanzee studies assume that each adult or juvenile chimpanzee in the group builds one nest each night. Detailed studies in Budongo Forest, however, indicate that chimpanzees will sometimes reuse nests and at other times build two or more nests in a day. On average these factors tend to cancel each other out, and in the Budongo study the rate of nest production was measured as 1.09 nests each day (Plumptre and Reynolds 1997). Therefore, in Budongo, the overall nest density figure needs to be divided by 1.09 to determine the number of juvenile and adult chimpanzees. Obtaining similar data from other sites with habituated chimpanzees would be useful for comparisons with Budongo, but for now this is the only measurement we have. Moreover, in the Budongo chimpanzee community we studied, about 14% of the chimpanzees were under the age of three. These chimpanzees rarely build nests, choosing instead to sleep with their mothers. Consequently, any density estimates based on nests must either acknowledge that the estimate applies only to adult and juvenile chimpanzees or multiply the estimate by the percentage of infants from habituated communities in similar forests in order to account for infant chimpanzees.

25.4 Which method to use

Standing crop counts are cheaper to conduct than marked nest counts because they only require one visit to a site. However, if nest decay rates are to be calculated on site

rather than borrowing decay rates from other sites, as is commonly done, the costs will not differ greatly because both require that the researcher stay on site for at least three or four months. Marked nest counts are generally more accurate because the decay rates of nests do not need to be factored in, provided sample sizes of about 50+ new nests are obtained. If the sample size is lower than 50, then the accuracy of marked nest counts will not be much different from standing crop counts. However, if a standing crop count is carried out on the first transect walk, the marked nest count method can be abandoned later in favor of a standing crop count if very few new nests are found. I therefore recommend that researchers always plan to use a marked nest method initially and then abandon it if the sample sizes are very low.

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Appendix II

Chimpanzee Density Estimates for National Parks and Reserves in Côte d'Ivoire

Location	Latitude Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density per km^2	Estimated chimpanzee population	Source	Evidence
Taï National Park (peripherical area)	5°09′–6°09′N/ 6°48′–7°26′W	426,000	164,000	0.4	656	Marchesi *et al.* 1995	Census/Nest counts
Taï National Park (central area)	5°09′–6°09′N/ 6°48′–7°26′W	426,000	262,000	1.47	3,851	Marchesi *et al.* 1995	Census/Nest counts
Taï National Park (Audrenisrou)	5°09′–6°09′N/ 6°48′–7°26′W	454,000*	262,000	1.72	3,851	Marchesi *et al.* 1995	Census/Nest counts
Taï National Park (Nipla)	5°09′–6°09′N/ 6°48′–7°26′W	454,000	262,000	1.06	3,851	Marchesi *et al.* 1995	Census/Nest counts
Taï National Park	5°09′–6°09′N/ 6°48′–7°26′W	340,000	340,000	0.5	1,700	Hoppe-Dominik 1991	Mean density for protected areas
Taï National Park (Zone de protection)	5°09′–6°09′N/ 6°48′–7°26′W	66,000	?	0.2	130	Hoppe-Dominik 1991	Mean density for protected areas (corrected for poaching, agriculture, settlements, road constructions)
Comoé National Park (Western Part)	8°50′N-9°06′N/3°01-4°04′W	50,000	10,700	4.39	470	Marchesi *et al.* 1995	Census/Nest counts
Comoé National Park (Amaradougou)	8°50′N-9°06′N/3°01-4°04′W	1,149,150	10,700	3.26	470	Marchesi *et al.* 1995	Census/Nest counts
Comoé National Park (Kolonkoko)	8°50′N-9°06′N/3°01-4°04′W	1,149,150	10,700	2.72	470	Marchesi *et al.* 1995	Census/Nest counts
Comoé National Park (south-west/west)	8°50′N-9°06′N/3°01-4°04′W	1,150,000	?	0.02	250	Hoppe-Dominik 1991	Mean density for classified forests of Soudanian belt (corrected for poaching, agriculture, settlements, road constructions)
Marahoué National Park	6°53′–7°14′N/ 5°46′–6°10′W	101,000	85,820	1.64	1,407	Marchesi *et al.* 1995	Mean density for NP of Guinean belt
Marahoué National Park	6°53′–7°14′N/ 5°46′–6°10′W	101,000	85,820	6.39	1,407	Marchesi *et al.* 1995	Census/Nest counts

Location	Latitude Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density per km^2	Estimated chimpanzee population	Source	Evidence
Marahoué National Park	6°53′–7°14′N/ 5°46′–6°10′W	90,000	90,000	0.3	300	Hoppe-Dominik 1991	Mean density for protected areas (corrected for poaching, agriculture, settlements, road constructions)
Marahoué National Park	6°53′–7°14′N/ 5°46′–6°10′W	90,000	90,000	1 nest/4 hearings	?	Schulenberg *et al.* 1999	Rapid Assessment Programme
Mont Sangbé National Park (north. part)	8°02′N/ 7°24′W	95,000	700	1.13	<10	Herbinger, unpubl. rep. 2001	Census/Nest counts
Mont Sangbé National Park (south. part)	8°02′N/ 7°24′W	95,000	3,400	7.62	260	Herbinger, unpubl. Rep. 2001	Census/Nest counts
Mont Sangbé National Park (all transects)	7°51′–8°01′N/ 7°21′–7°18′W	95,000	4,100	5.7	235	Herbinger, unpubl. Rep. 2001	Census/Nest counts
Mont Sangbé National Park (south. part)	7°51′–8°01′N/ 7°21′–7°18′W	95,000	3,360	1.64	55	Marchesi *et al.* 1995	Mean density for national parks of Guinean belt
Mont Sangbé National Park	7°51′–8°01′N/ 7°21′–7°18′W	95,000	?	0.1	100	Hoppe-Dominik 1991	Mean density for protected areas (corrected for poaching, agriculture, settlements, road constructions)
Mont Péko National Park	7°01′N/ 7°16′W	34,000	20,000	1.6	320	Herbinger, unpubl. rep. 2001	Census/Nest counts
Mont Péko National Park	7°01′N/ 7°16′W	34,000	19,500	0.4	78	Marchesi *et al.* 1995	Mean density for degraded classified forest
Mont Péko National Park	7°01′N/ 7°16′W	34,000	27,200	0.2	70	Hoppe-Dominik 1991	Mean density for protected areas (corrected for poaching, agriculture, settlements, road constructions)
D'Azagny National Park	5°13′N/ 4°53′W	21,740	3,500	1.64	57	Marchesi *et al.* 1995	Mean density for national parks of Guinean belt

Location	Latitude Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density per km^2	Estimated chimpanzee population	Source	Evidence
D'Azagny National Park	5°13′N/ 4°53′W	20,000	20,000	0.15	30	Hoppe-Dominik 1991	Mean density for prot. Areas (corrected for poaching, agriculture, settlements, road constructions)
Banco National Park	5°21′–5°25′N/ 4°01′–4°05′W	3,000	3,000	0	0	Marchesi *et al.* 1995	Presumed missing
Banco National Park	5°21′–5°25′N/ 4°01′–4°05′W	3,000	3,000	0.4*	12*	J. Frederic, pers comm. 2001	Studied nut cracking/pers. comm.
Banco National Park	5°21′–5°25′N/ 4°01′–4°05′W	3,000	3,000	0.2	6	Hoppe-Dominik 1991	Pers. comm.
Mount Nimba Nature Reserve	7°34′N/ 8°25′W	5,000	4,520	1.31	59	Marchesi *et al.* 1995	Census/Nest counts
Mount Nimba Nature Reserve	7°34′N/ 8°25′W	5,000	4,520	0.5	50	Hoppe-Dominik 1991	Mean density for protected areas
Haut Bandama Fauna Reserve	8°27′N/ 5°29′W	123,000	28,030	1.07	300	Marchesi *et al.* 1995	Mean density for classified forests of Soudanian belt
N'Zo Fauna Reserve	6°08′N/ 7°15′W	73,000	73,000	0.4	292	Marchesi *et al.* 1995	Mean density for degraded classified forests
N'Zo Fauna Reserve	6°08′N/ 7°15′W	73,000	73,000	0.5	350	Hoppe-Dominik 1991	Mean density for protected areas
Total NP & Reserves		**2,057,790**	**658,170**		**7,225**	**Marchesi *et al.* 1995**	

* = calculated or estimated by Herbinger, not by Marchesi *et al.* 1995

Appendix III

Chimpanzee Density Estimates for Classified and Unprotected Forests in Côte d'Ivoire

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density/ km^2	Total population	Source	Evidence
Duékoué Classified Forest	6°38′N/ 7°07′W	53.600**	39,717	0.68	270*	Marchesi *et al.* 1995	Nests
Mt Kopé	4°59′N/ 7°27′W	5,000	5,000	1.67	84*	Marchesi *et al.* 1995	Nests
Monogaga Classified Forest	4°48′N/ 6°26′W	39,660	34,385	0.45	155*	Marchesi *et al.* 1995	Nests
Monogaga Classified Forest	see above	35,000	?	0.5	175	Hoppe-Dominik 1991	Mean density for protected areas
Nizoro Classified Forest	5°51′N/ 5°56′W	10.000**	3,660	0.06	<10*	Marchesi *et al.* 1995	Nests
Dagbégo (Dassiékro Classified Forest	5°05′N/ 5°31′W	ca 6.500*	5,408	1.02	55*	Marchesi *et al.* 1995	Nests
Go Classified Forest	5°50′N/ 5°31′W	60.000**	36,000	0.28	101*	Marchesi *et al.* 1995	Nests
Go Classified Forest	5°46′N/ 5°03′W	60,000	21,000	0.2	120	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Bossematié Classified Forest	6°20′–6°35′N/ 3°20′–3°35′W	22,200	17,893	0.51	91*	Marchesi *et al.* 1995	Nests
Gbapleu (Tiapleu Classified Forest)	7°27′N/ 8°14′W	38.000**	28.500*	0.4*	114*	Marchesi *et al.* 1995	Survey/ Questionnaires
Blépleu (Sangouiné Classified Forest)	7°23′N/ 7°49′W	40.000**	30.000*	0.4*	120*	Marchesi *et al.* 1995	Survey/ Questionnaires
Mt Tonkouri Classified Forest	7°25′N/ 7°38′W	4.200**	3.150*	0.4*	13*	Marchesi *et al.* 1995	Survey/ Questionnaires
Mt Bétro Classified Forest	6°39′N/ 7°54′W			0.4*		Marchesi *et al.* 1995	Survey/ Questionnaires
Mt Zoa (Scio Classified Forest)	6°47′N/ 7°49′W	133.800**	100.350*	0.4*	402*	Marchesi *et al.* 1995	Survey/ Questionnaires

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density/ km^2	Total population	Source	Evidence
Scio Classified Forest	6°76′N/ 7°84′W	133,800	80,280	0.1	160	Hoppe-Dominik 1991	Mean density. for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Guiniadou (Niegré Classified Forest)	5°30′N/ 6°03′W	105.600**	79.200*	0.4*	317*	Marchesi *et al.* 1995	Survey/ Questionnaires
Kouadiokro (Niegré Classified Forest)	5°30′N/ 6°03′W	105.600**	79.200*	0.4*	317*	Marchesi *et al.* 1995	Survey/ Questionnaires
Niegre Classified Forest	5°42′N/ 6°21′W	100,800	69,552	0.3	350	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Mopri Classified Forest	5°80′N/ 4°96′W	33.000**	24.750*	0.4*	99*	Marchesi *et al.* 1995	Survey/ Questionnaires
Mopri Classified Forest	5°48′N/ 4°58′W	33.000**	?	0.1	30	Hoppe-Dominik 1991	Mean density. for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Irobo Classified Forest	5°29′N/ 4°44′W	24.500**	18.375*	0.4*	74*	Marchesi *et al.* 1995	Survey/ Questionnaires
Irobo Classified Forest	5°48′N/ 4°73′W	24.500**	?	0.1	25	Hoppe-Dominik 1991	Nests
Songan Classified Forest	5°46′–6°12′N/ 3°12′–3°26′W	38,189	28.642*	0.4*	114*	Marchesi *et al.* 1995	Survey/ Questionnaires
Songan Classified Forest	5°46′–6°12′N/ 3°12′–3°26′W	31,000	25,730	0.4	130	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density/ km^2	Total population	Source	Evidence
Tamin Classified Forest	5°49′N/ 3°15′W	46,300	11,575	0.1	60	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Mabi Classified Forest	5°54′N/ 3°35′W	63,000	39,910	0.3	180	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Yaya Classified Forest	5°39′N/ 3°36′W	29,400	24,402	0.4	120	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Haute Dodo Classified Forest	4°41′–5°19′N/ 7°01′–7°25′W	236,733	177.550*	0.4*	710*	J. Sanderson, pers.comm.	Camera trap
Haute Dodo Classified Forest	4°41′–5°19′N/ 7°01′–7°25′W	109,400	84,238	0.4	400	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Rapide Grah Classified Forest	5°04′N/ 6°53′W	204,200	?	0.3	600	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions) pers. obs.
Goulaleu Classified Forest	6°40′N/ 8°20′W	9,600	?	0.5	50	Hoppe-Dominik 1991	Mean density for protected areas
Cavally-Goin Classified Forest	6°05′N/ 7°45′W	189,000	151,200	0.4	750	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density/ km^2	Total population	Source	Evidence
Haut Sassandra Classified Forest	7°02′N/ 6°55′W	102,400	81,920	0.4	400	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Hana Classified Forest	?	72,000	?	0.1	70	Hoppe-Dominik 1991	Mean density for prot. areas, (corrected for poaching, agriculture, settlements, road constructions). /per. obs.
Bolo Classified Forest	5°20′N/ 6°00′W	8,800	5,104	0.3	25	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Sangoue Classified Forest	6°12′N/ 5°28′W	36,200	36,200	0.1	40	Hoppe-Dominik 1991	Census/Nest counts
Sanaimbo Classified Forest	6°36′N/ 4°30′W	5,200	?	0.09	5	Hoppe-Dominik 1991	Census/Nest counts
Foumbou Classified Forest	8°51′N/ 5°57′W	6,000	?	0.2	120	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Boundiali-Pale Classified Forest	9°39′N/ 6°40′W	38,300	?	0.2	85	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Fresco Kotrohou Village II westwards	5°06′N/ 5°45′W			0.32		Hoppe-Dominik 1991	Nests
Bacanou II southeast (near Sikensi)	5°36′N/ 4°38′W			0.08		Hoppe-Dominik 1991	Tracks, nests
Forest at Bandama (Tene plantations)	6°32′N/ 5°28′W			0.11		Hoppe-Dominik 1991	Nests

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chimpanzee density/ km^2	Total population	Source	Evidence
Port Gauthier CF	5°09′N/ 5°25′W			Present		Hoppe-Dominik 1991	Tracks
Tioko (west bank of Boubou river)	5°13′N/ 5°14′W			Present		Hoppe-Dominik 1991	Tracks
Sebso	7°30′N/ 4°01′W			Present		Hoppe-Dominik 1991	Tracks, excrement, heard
Konambo northwards	6°40′N/ 4°35′W			Present		Hoppe-Dominik 1991	Tracks
Assahara-Soungassou northwards	6°40′N/ 4°30′W			Present		Hoppe-Dominik 1991	Tracks
Fresco	5°04′N/ 5°34′W			Present		Hoppe-Dominik 1991	Pers. obs.
Fetekro (District Gagnoa)	7°48′N/ 4°49′W			Present		Hoppe-Dominik 1991	Chimpanzee shot
Vatoua (Cantonnement Danane)	7°04′N/ 8°06′W			Present		Hoppe-Dominik 1991	Chimpanzee shot
South of Toulepleu	6°34′N/ 8°24′W			Present		Hoppe-Dominik 1991	Pers. comm. F.Joulian
Okrouyo	5°46′N/ 6°24′W			Present		Hoppe-Dominik 1991	Pers. comm. P.Soubre
Boubou	5°18′N/ 4°23′W			Present		Hoppe-Dominik 1991	Pers. comm. P. Boubo
Ehania	?			Present		Hoppe-Dominik 1991	Pers. comm. P. Ehania
Haut Bandama Est Classified Forest	8°25′N/ 5°26′W			Present		Hoppe-Dominik 1991	Questionnaire
(Yeleu)	6°58′N/ 8°03′W			(Present)		Hoppe-Dominik 1991	Young chimpanzee caught/sold
(Abonoua)	?			(Present)		Hoppe-Dominik 1991	Child wounded by chimpanzee
Forest bordering Liberia (close to Taï)				Present		Villagers Taï 2001	Pers. comm.
Djidoubaye ('Village forest')	6°05′N/ 7°29′W	15–20	20	Present	<10*	Villagers Taï 2001	Pers. comm.
Total Classified and Unprotected Forests			1,635,400		6511	Marchesi *et al.* 1995	Mean density for different habitat types
Guinean Belt: Classified Forest			1,378,800		4517	Marchesi *et al.* 1995	Mean density for different habitat types
Guinean Belt: Unprotected forest			142,300		771	Marchesi *et al.* 1995	Mean density for different habitat types

Classified and unprotected forests	Latitude/ Longitude	Total area (ha)	Forested area (ha)	Chim-panzee density/ km^2	Total population	Source	Evidence
Soudanian Belt: Classified Forest			109,800		1175	Marchesi *et al.* 1995	Mean density for different habitat types
Soudanian Belt: Unprotected Forest			4,500		48	Marchesi *et al.* 1995	Mean density for different habitat types
Total 'Protected Area' (National Parks, Classified Forests)			3,368,100		6856	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Rain Forest, Coastal Savanna			1,934,800		6001	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Guinea Savanna, Forest-Savanna Mosaic			185,000		400	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Sudan Savanna			1,248,300		455	Hoppe-Dominik 1991	Mean density for protected areas, (corrected for poaching, agriculture, settlements, road constructions).
Total Unprotected Area			26,481,800		5011	Hoppe-Dominik 1991	Mean density for unprotected areas
Rain Forest			13,538,500		4691	Hoppe-Dominik 1991	Mean density for unprotected areas
Guinea Zone			3,212,200		160	Hoppe-Dominik 1991	Mean density for unprotected areas
Sudan Zone			9,731,100		160	Hoppe-Dominik 1991	Mean density for unprotected areas

* = calculated or estimated by Herbinger, not by Marchesi *et al.* 1995

** = from both Roth and Hoppe-Dominik 1987

Appendix IV

IUCN/SSC Action Plans for the Conservation of Biological Diversity

Action Plan for African Primate Conservation: 1986–1990. Compiled by J.F. Oates. IUCN/SSC Primate Specialist Group, 1986, 41 pp. (out of print)

Action Plan for Asian Primate Conservation: 1987–1991. Compiled by A.A. Eudey. IUCN/SSC Primate Specialist Group, 1987, 65 pp. (out of print)

Antelopes. Global Survey and Regional Action Plans. Part 1. East and Northeast Africa. Compiled by R. East. IUCN/SSC Antelope Specialist Group, 1988, 96 pp. (out of print)

Dolphins, Porpoises and Whales. An Action Plan for the Conservation of Biological Diversity: 1988–1992. Second Edition. Compiled by W.F. Perrin. IUCN/SSC Cetacean Specialist Group, 1989, 27 pp. (out of print)

The Kouprey. An Action Plan for its Conservation. Edited by J.R. MacKinnon and S.N. Stuart. IUCN/SSC Asian Wild Cattle Specialist Group, 1988, 19 pp. (out of print)

Weasels, Civets, Mongooses and their Relatives. An Action Plan for the Conservation of Mustelids and Viverrids. Compiled by A. Schreiber, R. Wirth, M. Riffel and H. van Rompaey. IUCN/SSC Mustelid and Viverrid Specialist Group, 1989, 99 pp. (out of print.)

Antelopes. Global Survey and Regional Action Plans. Part 2. Southern and South-central Africa. Compiled by R. East. IUCN/SSC Antelope Specialist Group, 1989, 96 pp. (out of print)

Asian Rhinos. An Action Plan for their Conservation. Compiled by Mohd Khan bin Momin Khan. IUCN/SSC Asian Rhino Specialist Group, 1989, 23 pp. (out of print)

Tortoises and Freshwater Turtles. An Action Plan for their Conservation. Compiled by the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, 1989, 47 pp.

African Elephants and Rhinos. Status Survey and Conservation Action Plan. Compiled by D.H.M. Cumming, R.F. du Toit and S.N. Stuart. IUCN/SSC African Elephant and Rhino Specialist Group, 1990, 73 pp. (out of print)

Foxes, Wolves, Jackals, and Dogs. An Action Plan for the Conservation of Canids. Compiled by J.R. Ginsberg and D.W. Macdonald. IUCN/SSC Canid and Wolf Specialist Groups, 1990, 116 pp. (out of print)

The Asian Elephant. An Action Plan for its Conservation. Compiled by C. Santiapillai and P. Jackson. IUCN/SSC Asian Elephant Specialist Group, 1990, 79 pp.

Antelopes. Global Survey and Regional Action Plans. Part 3. West and Central Africa. Compiled by R. East. IUCN/SSC Antelope Specialist Group, 1990, 171 pp.

Otters. An Action Plan for their Conservation. Edited P. Foster-Turley, S. Macdonald and C. Maso. IUCN/SSC Otter Specialist Group, 1990, 126 pp. (out of print)

Rabbits, Hares and Pikas. Status Survey and Conservation Action Plan. Compiled and edited by J.A. Chapman, J.E.C. Flux. IUCN/SSC Lagomorph Specialist Group, 1990, 168 pp.

African Insectivora and Elephant-Shrews. An Action Plan for their Conservation. Compiled by M.E. Nicoll and G.B. Rathbun. IUCN/SSC Insectivore, Tree-Shrew and Elephant-Shrew Specialist Group, 1990, 53 pp.

Swallowtail Butterflies. An Action Plan for their Conservation. Compiled by T.R. New and N.M. Collins. IUCN/SSC Lepidoptera Specialist Group, 1991, 36 pp.

Crocodiles. An Action Plan for their Conservation. Compiled by J. Thorbjarnarson and edited by H. Messel, F.W. King and J.P. Ross. IUCN/SSC Crocodile Specialist Group, 1992, 136 pp.

South American Camelids. An Action Plan for their Conservation. Compiled and edited by H. Torres. IUCN/SSC South American Camelid Specialist Group, 1992, 58 pp.

Australasian Marsupials and Monotremes. An Action Plan for their Conservation. Compiled by M. Kennedy. IUCN/SSC Australasian Marsupial and Monotreme Specialist Group, 1992, 103 pp.

Lemurs of Madagascar. An Action Plan for their Conservation: 1993–1999. Compiled by R.A. Mittermeier, W.R. Konstant, M.E. Nicoll, O. Langrand. IUCN/SSC Primate Specialist Group, 1992, 58 pp. (out of print)

Zebras, Asses and Horses. An Action Plan for the Conservation of Wild Equids. Edited by P. Duncan. IUCN/SSC Equid Specialist Group, 1992, 36 pp.

Old World Fruit Bats. An Action Plan for their Conservation. Compiled by S. Mickleburgh, A.M. Hutson and P.A. Racey. IUCN/SSC Chiroptera Specialist Group, 1992, 252 pp. (out of print)

Seals, Fur Seals, Sea Lions, and Walrus. Status Survey and Conservation Action Plan. Peter Reijnders, Sophie Brasseur, Jaap van der Toorn, Peter van der Wolf, Ian Boyd, John Harwood, David Lavigne and Lloyd Lowry. IUCN/SSC Seal Specialist Group, 1993, 88 pp.

Pigs, Peccaries, and Hippos. Status Survey and Conservation Action Plan. Edited by William L.R. Oliver. IUCN/SSC Pigs and Peccaries Specialist Group. IUCN/SSC Hippo Specialist Group, 1993, 202 pp.

Pecaries. Extraido de Pigs, Peccaries, and Hippos: Status Survey and Conservation Action Plan (1993). Editado por William L.R. Oliver. IUCN/CSE Groupo de Especialistas en Puercos y Pecaries, 1996, 58pp.

The Red Panda, Olingos, Coatis, Raccoons, and their Relatives. Status Survey and Conservation Action Plan for Procyonids and Ailurids. (In English and Spanish) Compiled by Angela R. Glatston. IUCN/SSC Mustelid, Viverrid, and Procyonid Specialist Group, 1994, 103 pp.

Dolphins, Porpoises, and Whales. 1994–1998 Action Plan for the Conservation of Cetaceans. Compiled by Randall R. Reeves and Stephen Leatherwood. IUCN/SSC Cetacean Specialist Group, 1994, 91 pp.

Megapodes. An Action Plan for their Conservation 1995–1999. Compiled by René W.R.J.Dekker, Philip J.K.McGowan and the WPA/Birdlife/SSC Megapode Specialist Group, 1995, 41 pp.

Partridges, Quails, Francolins, Snowcocks and Guineafowl. Status survey and Conservation Action Plan 1995–1999. Compiled by Philip J.K. McGowan, Simon D. Dowell, John P. Carroll and Nicholas J.A. Aebischer and the WPA/BirdLife/SSC Partridge, Quail and Francoliln Specialist Group. 1995, 102 pp.

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