The Land Chief's embers: ethnobotany of Batéké fire regimes, savanna vegetation and resource use in Gabon

by

Gretchen Marie Walters

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I, Gretchen Marie Walters, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed: _____

In particular, collaboration with the people and extended families of following villages was necessary for this work: Ekouyi, Kebiri, Lewou, Mboua, Mbouma, Malundu, Saaye, and Walla. The aid of these research assistants was also critical for presenting the social context of this thesis: S. Touladjan, D. Kewemie, and L. Makouka.

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Abstract

Anthropogenic fire regimes and society are linked: social change modifies fire application which then impacts ecosystems. In the past 40 years, savanna burning has changed markedly around the world as policies, laws, and cultures change. This thesis explores the links between fire regime and culture by analysing the decline of the fire-based Bateke land chief's authority in Gabon. Unlike other parts of sub-Saharan Africa where colonial anti-fire policies have been strict and punitive, fire policy in Gabon has been lax. As such, today's savanna fires are neither suppressed nor managed, and their value to the local economy and national conservation is not yet fully recognised. This thesis addresses the changing role of the Bateke as savanna keepers, the effects of their fire regimes on their savanna ecosystem, and the contribution of fire to biodiversity and present day fire-foraging. The effects of the fire regime on the ecosystem are explored through plant collection, participant observation, surveys, interviews, and finally vegetation plots analysing the impacts of different fire treatments. The land chief's authority was part of a magico-religious system where land fertility was guaranteed by conducting rituals and proper burning procedures. This system effectively ended in the late 1960s during a tumultuous time in Bateke history, resulting in a change in fire culture and hence fire regime. The fires under the land chief system were regulated, annual, dry season hunting occurrences conducted by the community and part of maintaining land fertility. By contrast, today's fires are lit by individuals who are no longer under the land chief's authority. Hence, these fires are unregulated, occurring at all times of the year and often semi-annually. Generally, burning stimulates tree resprouting and clears mature grass. However annual and semi-annual fires have different levels of resprout survival based on resprout size, fire intensity, and patchiness. More frequent fires are less intense, creating patches which serve as micro-sites favouring stem survival. In terms of plant diversity, the savannas maintain a flora that is unique for Gabon, though not rare worldwide. The dry-season seems to be the most important season to burn in order to maintain this diversity. Anthropogenic fire is important for Bateke livelihoods where fire and foraging are related; 80% of survey respondents link fire and food. Today's foraging traditions make fire important for Bateke livelihoods, despite being less connected to land fertility rituals of the past. Taking a national view, most protected savannas in Gabon are not managed by fire and some managers do not recognise its importance to local livelihoods and culture. The land chief system, though probably not designed to protect resources, may offer lessons of fire control in a cultural context of contemporary management of protected areas.

Dedication

To Chris Wilks (1946 - 2008) who walked the ecosystems of Gabon for over 30 years and aided in their study and conservation.

To Egid Ngollo (~1944 - 2008) who burned the Bateke Plateaux savannas all of his life.

And to Papa Olivier who helped me in my sandy, sunny village at every step of the way.

You will find yourself in unfamiliar territory at first, where the vastness is disquieting, the starkness leaves you empty, you will walk among rocks that tell time differently. Your skin will burn and your hair will lighten. You will find a waterhole and kneel with cupped hands. The reflection you see will not be of the person you once were. Neither is the land.

Terry Tempest Williams, Pieces of White Shell 1984: 18

Preface

Woods punctuating the plains. From the air it looks like small isolated forests dotting a quilt of grasses and trees in south-eastern Gabon. Ancient forest remnants? Recently constructed forest? The Bateke people's village forests are attributed to village establishment and demarcate clan domains. However, the savannas stretching out between these copses are something else. Regularly or *too* regularly burned in some people's opinions, they were subject to magnificent night fires in the long dry season registered on the satellite monitoring system which sent researchers email updates of fire occurrences. Firemapper could tell me about a fire five km south of Ekouyi-Mbouma village but couldn't say why it has been set. Such a monitoring system is impressive in recording fire frequency but cannot explain why people burn.

I had seen the fires happening adjacent to the gallery forests during my botanical research conducted there since 2001. I had previous experience with fire and vegetation issues, having been "red carded" by the U.S. Forest Service and served as a botanist on a fire effects crew in a U.S. National Park. However, I had not considered researching the role of savanna fire in tropical Africa. One evening, at the *Projet Protection des Gorilles* (PPG) camp, I was talking to Liz Pearson, a good friend, and project director. She expressed her concern about the hunters fires and the potential of hunter-gorilla interaction. I now saw the need for a better understanding of fire in this ecosystem.

When a national park was established and included the PPG area, hunting and associated fire setting within the park became a conservation and management issue. At this time, the Wildlife Conservation Society (WCS) undertook technical assistance to the park. Conceptual models were introduced; management was discussed. Soon, an environmental education campaign was begun. In my first month of doctoral fieldwork, I witnessed this campaign encouraging the local population to burn once a year. Upon what basis was this expertise given? None. My colleague, the director of the programme, admitted that he had no information about local fire-setting and was doing the best that he could. Now we know that his guess was not so far from what historically happened. However, it was clear that no one understood the links between culture and fire ecology. This became my research subject not only because I saw the errors that park management was likely to make if they restricted burning from the savanna but also because I saw the opportunity of documenting the last remnants of a historical burning practice. By contrast, in my native U.S.A. we had banned burning and evicted Native Americans before we understood the system dynamics or even asked them how and why they burned. So, after years of collecting plants in the area, I set up my research based in a nearby Bateke village to explore the area's human fire-ecology.

Acknowledgements

So many evenings in Ekouyi-Mbouma (EM) I would find myself sitting with various mamas and papas...around Ma Bea's outdoor fire, sitting on Ma Ndelikesse' doorstep by the light of her lamp or sharing a litre of pineapple wine with Da Ossuba. One evening, while cracking *nta* seeds with Ma Jeanette, she sadly stated, "Nana Gretchen, we will be so isolated once you are gone." And now that I have left Ekouyi, I find it is I that am isolated. There is no nightly hearth beneath the stars; there is no sense of belonging to a group of people—holding mutual responsibility for each other's well being. How much I yearn for the evening gatherings in EM. To the people of the Bateke Plateaux, thank you for sharing with me your community.

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Pronunciation of Lategе terms

The Lategе words in this thesis follow the work of Pauline Linton who is currently researching a Lategе dictionary (Linton 2001; Linton 2004; Linton 2006; Linton 2009a; Linton 2009b; Linton 2010). The following guide uses French pronunciation as a base and is paraphrased from Linton's work (Linton 2007; 2010). In Lategе, there are 20 phonemes for consonants, five for single vowels, and five for double vowels. There are 32 labial, palatal, and pre-nasal combined consonnants. For a linguistic treatment of these sounds, please consult Linton 2010.

Lategе is written in an alphabet of 25 characters:

A, B, D, Dz, E, F, G, I, K, L, M, N, Ny, Ñ, O, P, Pf, R, S, T, Ts, U, V, W, Y

Most Lategе words in the thesis are derived from Linton's work on non-verbs (Linton 2009a); however, when not listed by Linton, the author has transcribed them.

Using French pronunciation as a basis, these are the following vowel and consonant sounds:

- Five vowels: a, e, i, o, u. Double vowels indicate a longer pronunciation of the vowel sound indicated.
- Fifteen consonants: b, d, f, g, k, l, m, n, ñ, p, s, t, v, w, y.
- Four consonant combinations: pf, ts, dz, and ny.

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Acronyms used in the text

AEF	*Afrique Equatoriale Française*
ANPN	*Agence National des Parcs Nationaux*
PNPB	Bateke Plateaux National Park
CIRMF	*Centre Internationale de Recherche Médicale de Franceville*
COMILOG	*Compagnie Minière de l'Ogooué*
COMUF	*Compagnie des Mines d'Uranium de Franceville*
ENEF	*Ecole National des Eaux et Forêts*
NGO	non governmental organisation
NP	national park
PA	protected area
PDG	*Partie Démocratique Gabonaise*
PPG	*Projet Protection des Gorilles*
UN	United Nations
WCS	Wildlife Conservation Society

Chapter 1. Introduction: fire, people, and vegetation

> Of first importance is the necessity of retrieving knowledge of the fire uses and fire methods of the native people before this age old wisdom is lost forever.
>
> Komarek 1972

> How do humans alter fire regimes, often promoting, but also consciously or inadvertently, suppressing fires?
>
> Bond et al. 2004: 534

Introduction

Organised and purposeful savanna burning is a disappearing heritage world-wide. In some places, only elders remain knowledgeable of past fire-setting practices, themselves representing the smouldering embers of a disappearing system. In parts of the world, fire was once the primary tool used to subsist; used as a technique for hunting, grazing, gathering, and agriculture it was intimately linked to human survival. However, while these practices remained part of southern economies, northern economies abandoned subsistence fires and came to consider fire mainly as a destroyer of vegetation. This forgotten knowledge by northerners led them to perceive local fire-setting practices in a negative light. When Europeans began colonising new lands, they did not realise that these landscapes were shaped by local fire practices. Rather than allowing local fire-use to continue, fire-suppression became policy. These policies have transformed landscapes, stigmatised local fire use, and led to unprecedented changes in fire regimes.[1] This history and practice of indigenous fire-use and governmental fire-suppression have led us to focus on how and why anthropogenic fire regimes change and how this affects ecosystems, which are central issues in fire regime studies.

However, fire is an extremely emotive topic, often polarizing anthropologists, ecologists, conservationists, and policy-makers. This has led to disputes amongst these groups about the role of fire in West Africa, Madagascar, India, and elsewhere. In some historical cases, researchers with fire experience in one context have unintentionally misused this experience in a new and different situation, causing a chain reaction of misinterpretation by policy-makers and land managers. The political ecology of fire-setting varies from place to place and must be understood in relation to the international context, customary fire-use, interactions of these fire regimes with local vegetation and climate, and national policy. Fire interacts differently in each

[1] Some anti-fire policies (such as the American Smokey the Bear Campaign) in northern countries still are present in the citizen's psyche despite a transition to a fire-for-management approach (Kauffman 2004). Anti-fire campaigns are still taken up by some southern countries (Matthews 2005; McDaniel et al. 2002).

of these complex cases. What is certain is that fire-use needs to be understood on a place-by-place basis, taking into account these cited factors. These next sections discuss each of these factors in some detail.

Fire regime change

"Natural" and anthropogenic fires

Fires can be started by natural causes such as lightning or by humans. When people colonise new lands, the fire regime often switches from strictly natural to one that includes anthropogenic fires. Vegetation modellers indicate that for Central Africa, average "natural" fire return time (the time for a fire to return to the same area)[2] is estimated at once every 25-50 years[3]. However, fire frequencies observed by researchers over the last century in Central African savannas were far greater than models estimated, returning every 1-12 years (Thonicke et al. 2001). Savannas were and are the arenas where these fire regimes take hold. It is in these places that fire becomes part of the "nature/society interface" (Dolidon 2007: 4).

Despite the potential for lightning to start "natural" fires today, human influence on fire return is far greater. Globally, humans are regarded as the main source of fire, accounting for 59-95% of ignitions (FAO 2007a: 7). It is estimated that 68% of Africa's surface area burns every year (Roy et al. 2008). When considering the Guinean savannas alone, 52% burn annually (Eva and Lambin 1998). Some African fire regimes are changing (FAO 1999), sometimes burning more or less frequently, with some fires burning uncontrolled through the night (Cahoon et al. 1992).

Fire regime is a term used to describe the characteristic fires in a given site (Whelan 2002: 47). The classification of fire regimes includes variations in ignition, fire intensity and behaviour, typical fire size, fire return intervals, and ecological effects (Goldammer and de Ronde 2004)[4]. Typically, fire regime change occurs when there are changes to the institutions governing fire-setting or to the environment. In a global estimation of fire impacts, the Nature Conservancy estimates that 84% of today's ecosystems are affected by "altered fire regimes", which are defined as "the extent to which current patterns of fire have departed from the natural, historical or *ecologically acceptable* (their emphasis) ranges of variation in key fire regime attributes (e.g., fire frequency, severity) associated with and characteristic of different ecosystems." (Global Fire Initiative 2004: 3). These are considered to be fire-dependent ecosystems (as contrasted with fire-sensitive tropical forests). The Nature Conservancy argues that 77% of African savannas have altered fire regimes (Global Fire Initiative 2004)[5]. Reasons for regime alteration are myriad but national policy change is the top of the list. Only 3% of sources of regime

[2] Records averaged over 1901-1998.
[3] For forests, this interval is far greater at once per 200-400 years.
[4] For For definition of fire terms, see Appendix 8.
[5] Solutions to altered fire regimes include prescribed fire, integration of historically appropriate frequencies and methods, and fire suppression, depending on the needs of the ecosystem (Global Fire Initiative 2004).

alteration in fire-dependent ecosystems are attributed to "traditional fire use cessation" (Global Fire Initiative 2004: 7). However, this number is probably much higher.

Fire regime change and political ecology

> *Les conceptions actuelles en la matière, en voulant trop généralisés, tendent en effet à voir dans la pratique des feux, la principale cause de la régression forestière. Cette tendance à la généralisation, professée d'ailleurs par des maitres incontestés comme A. Aubréville et H. Humbert, est si ancrée dans l'esprit des gens que l'on admet, sans discussion, que les feux sont capables, à eux seuls, d'amener peu à peu et inexorablement l'Afrique Noire notamment, vers la désertification totale. Ces spécialistes, en affirmant la nocivité des feux, disent ce qu'ils ont vu dans ces territoires où les feux sont indiscutablement nocifs, mais le tort est de généraliser cette action destructrice à n'importe quel pays tropical, sans vouloir faire de sérieuses discriminations.*
>
> (Sillans 1958: 213)

Fire was long seen as a negative actor in savannas. Colonial administrations had a poor understanding of the ecosystems they managed including a lack of historical documentation and understanding of impacts of changes in rainfall and climate. This lack of information led to erroneous conclusions about the causes of deforestation (Fairhead & Leach 1998) and desertification (Aubréville 1949; Aubréville 1962; Leach and Mearns 1996), the two processes with which savanna environments were seen as primarily linked. This interaction of politics and utilisation of local natural resources within the context of the history and ecology of a region is called political ecology. The political ecology of anti-fire policies led to changes in fire regimes in many countries in sub-Saharan Africa, Australia, and North America.

In Australia, the majority of the continent has a degraded fire regime due to suppressed Aboriginal burning practices (Bird et al. 2008; Bradstock et al. 2002)[6]. A similar suppression of indigenous fire occurred in the United States (Pyne 2000; Williams 2000b). There, vast tracts of prairie are now converted to forest in the absence of fire (Nowacki & Abrams 2008) and fire suppression policies have resulted in uncontrollable conflagrations (Dellasala et al. 2004).

In a review of 1990s West African fire policy and practice some form of subsistence fire was shown to have been ruled illegal in Burkina Faso, Mali, Senegal, and Benin (Schmitz 1996). These laws were attempts by state governments to centralise control over savanna burning. Such approaches have limited the extent to which local people can use fire for managing their natural resources. In several countries, research has since concluded that anthropogenic fire is an important tool for managing resources and protecting villages from late-season fires, and some policies are now changing.

[6] This regime threatens 19 plant and 51 bird species (Keith et al. 2002).

In the case of Guinea-Conakry's forest-savanna mosaic, local use of fire had been banned since colonial times. Fire was misunderstood and thought to be a threat to colonial forest resources (Aubréville 1949). According to Fairhead and Leach's monograph on customary and colonial understandings of the forest-savanna mosaic, most colonial administrators and later Guinean government authorities believed that the savannas were "ex-forest" and were invading the existing forest at a rapid rate due to anthropogenic burning. Through careful historic and ethnographic documentation, Fairhead and Leach have described a forest-savanna mosaic that has co-existed for centuries with anthropogenic fire, where deforestation was not happening and villagers were actively creating forest around village sites (Fairhead & Leach 1996). This work has brought a new perspective to the political ecology of customary resource use and human impacts on the forest-savanna mosaic.

In Mali, an era of a presidential anti-fire campaign in the 1980s resulted in banning all fire-use. Local people suffered heavily from this policy, paying heavy fines and enduring constant animosity from forestry officials (Laris 2004). Research on current fire use shows that a customary and intentional practice of lighting early fires prevents destructive late season fires from sweeping through the countryside (Laris 2002). Fire control is now being decentralized to village level in Mali (Laris and Bakkouri 2008).

In Ivory Coast, despite annual fires, the forest is encroaching on the savanna (Gautier 1990). A dominance of savannisation rhetoric has tipped the policy balance in Ivory Coast away from savanna environments and in favour of forests, despite some local stakeholders' dependence on savanna environments (Bassett and Bi Zuéli 2000; Bassett and Crummey 2003: 68).

The Malagasy grasslands, long suspected of having anthropogenic origins due to their secondary species composition (Lowry et al. 2005), are considered by some researchers to be ancient remnants of the fire-driven Miocene savanna expansion as proven by the presence of endemic savanna species (Bond et al. 2008). When looking at the case of extensive loss of Malagasy littoral forest (Consiglio et al. 2006), coupled with the linking of highland fires to vegetation loss there (Klein 2002), the situation in Madagascar of forest loss and anthropogenic fire-use across multiple vegetation zones renders a country-wide analysis of the situation difficult. An analysis of the political ecology of fire-use shows that the peasant and the state are at a stalemate concerning appropriate fire use (Kull 2004). Perceptions of anthropogenic versus natural vegetation in Madagascar and elsewhere have made assessments difficult for conservation groups who seek to preserve natural ecosystems; fire becomes an agent of undesirable landscape modification despite its centrality to local subsistence (Kull 2004). However, when fire is considered in both a biological and social context, the role of burning has been proposed as useful to management of Madagascar's dry forests (Bloesch 1999).

Perhaps for lack of local studies on fire, many international agencies send mixed messages about fire policy, fire's utility to local people, and its impact on the environment. This is borne out in the recent FAO Global Fire Assessment which concludes in their Africa section that wildfires make the poorest people more vulnerable (FAO 2007a: 37). The FAO makes no connection between burning and foraging in that report. By contrast, the Global Fire Initiative has published an entire report on livelihoods and fire management (Global Fire Initiative 2006). In a recent report by USAID, fire is regarded as a threat to three of their focal Central African ecosystems, indicating that anthropogenic fires have become too frequent and are degrading biodiversity (USAID-CARPE 2006: 173) . From this assessment, we see that local fire use can be ill-characterised by policy or, on the other end of the scale, can become the focus of policy reports. Since it seems almost impossible to generalise about the impact of fire-use, it is important that the political ecology of local burning be studied, and these results publicised and made available to policy-makers.

Fire regime change, land-use, and society

Descriptions of fire regime change occurring in conjunction with land-use or societal change are rare in the literature. In one case from Australia, the change in fire-use by aboriginal peoples caused a shift in the monsoon season (Miller et al. 2006). In a study of land-use and fire-setting spanning six continents over the course of 2,000 years, fire frequency was tightly connected to both land use and policy (Marlon et al. 2008). In African savannas, consequences of departures from the historic fire regime (and associated land-use change) are less explored (Butz 2009; Lewis 1989a). Many researchers observe an annual fire cycle (e.g. Thonicke et al. 2001). However, fire research is often oriented towards the scientific understanding of regimes in the context of prescribed fire for management or for succession, while often ignoring the local fire regime in operation. Despite the large role that anthropogenic fire plays in African savannas, local customary fire regimes remain largely un-documented (Sheuyange et al. 2005). Important South African investigations on fire ecology have created a considerable body of knowledge oriented towards savanna management (e.g. du Toit et al. 2003; van Booysen and Tainton 1984). However, the fire regimes investigated there are not normally anthropogenic ones.

Research concerning resource governance and institutional change suggests that the resource use of many societies tends to change when there are fundamental shifts in how societies govern resource access (Ostrom 1990). I will explore this theme later in this thesis in relation to fire use.

Fire regime change, environmental and climate change

Fire regime change is intimately linked to increases in the amount of oxygen in the atmosphere which favoured fire. Starting more than five million years ago there was a global expansion of grasslands linked to climate change (Maley 2001), seasonal rainfall change (Osborne 2008), and

fire (Keeley and Rundel 2005; Morley and Richards 1993). This change in atmosphere caused fire to become more frequent with grasslands expanding and causing a diversification in species richness in Madagascar during the Miocene (Bond et al. 2008). Fire became common 400,000 years ago (Bird and Cali 1998). The fire regime present at that time is classified as "natural" and was most likely driven by lightning.

In Central Africa, periods of aridity alternating with humid phases at times favoured more savanna or more forest (Maley 2001). In studies on historic vegetation change, the presence of charcoal in pollen cores is an indicator of slash and burn cultivation within the forest (Ngomanda et al. 2009; Brncic et al. 2007). During the arid phases, anthropogenic fire may have played a role in reducing forest succession rates (Brncic et al. 2009), but for at least the past 2500 years, the forest extent in northern Republic of Congo has been constant (Brncic et al. 2007). Increased fire at different time periods is thought to have had an effect on vegetation, though in this case, not converting it to savanna. In Cameroon, palynological studies found evidence of increased seasonality which may have favoured Bantu expansion into the forest, but this expansion did not result in savanna cover; in that dataset, evidence of fire was absent (Ngomanda et al. 2009). What is clear from these studies is that the climate can favour particular vegetation types which may allow for ease of cultivation and may allow fire to become more common. However, there is no evidence of anthropogenic activities alone being responsible for past savanna cover.

Today, climate continues to impact fire behaviour. Nearly every decade, fire makes a mark on the Earth's surface and in its history. In times of cyclical drought, fires become more frequent and cause major destruction of tropical forests (Malhi et al. 2009). Savanna fires, particularly during periods of episodic droughts, can enter into fire-sensitive areas such as tropical forests[7]. During drought years such as 1998, both Brazil's and Indonesia's forests suffered heavy losses when savanna and cultivation fires entered the drought-dry forests (Allen 2006; Dennis et al. 2005; McDaniel et al. 2002). In Ghana, ENSO[8]-related reduced rainfall made fighting tropical forest fire a priority there as the 1982 droughts gave way to forest fires the following year (Swaine 1992)[9]. However, overall, wetter cycles support more grassy vegetation and are thus subject to more fire, as in the case of North American prairie fire frequency during the past 4,500 years (Brown et al. 2005). In relation to future climatic changes in Central Africa, it is predicted that where rainfall variation is greatest, fires will be more frequent and cause the

[7] Due to the high rainfall in Gabon, destructive forest and savanna fires have not been a problem in the recent past. However, one simulation of extreme climate change in the next 100 years suggests that Gabon's coastal forest-savanna mosaic could be in a similar situation (Delire et al. 2008).
[8] El Niño-Southern Ossilation.
[9] Africa-wide drought is episodic, affecting a wide-variety of ecosystems in particular years (Shrove 1977).

expansion of savanna (Delire et al. 2008) as the fire season lengthens and extreme weather events become more common (Liu et al. 2010).

These issues make fire a topic worth understanding in every area: as climate and policy change over time, fire may come to play a more important role than previously. Whether dealing with recent catastrophic fires in the Australian bush, in Yellowstone's coniferous forest, or in the Amazonian rainforest, fire touches many countries and peoples. In the context of global concern about climate change, emissions, and carbon stocks, fires become the object of studies on climate (Langmann et al. 2008). Due to this complexity, fire research has produced a voluminous literature and now is subdivided into several disciplines, including climatology, biogeochemistry, remote sensing, vegetation ecology, human ecology, fire management and policy amongst others.

Anthropogenic fire regimes: subsistence and culture

Subsistence fires

Foraging with fire is an age-old subsistence strategy used by many cultures over time.[10] According to archaeological evidence, direct use of fire by humans dates to over one million years ago (Brain and Sillen 1988).[11] However, anthropogenic use probably pre-dates this, with savanna fires being detected much earlier. Since then, fire has been used for a variety of subsistence strategies. The best-known examples are Australian Aboriginal foraging-fires which have been part of livelihoods for over 40,000 years (Bird R.B. et al. 2008; Jones 1969; Kershaw 1986). While such long histories of foraging fires are not generally available for most groups and places, recent work relating to the past few hundred years indicates that fire uses were diverse in North America where they shaped fire-adapted landscapes (Nowacki and Abrams 2008; Schoolcraft 1955; Williams 2000a). Burning there was conducted often for reasons of subsistence, but sometimes for war or pleasure (Krech 1999); it was these fires that shaped the period's landscape.

Fire's contribution to livelihoods has altered over time. Despite early European cultures once depending on fire as a tool for annual cultivation cycles (Pyne 1995), the "geography of fire" has changed; biomass burning for subsistence has largely been replaced by fossil biomass fires in the north (Pyne 2001a: 164-5). Today, it is mostly the developing countries in sub-Saharan Africa, south-east Asia, and South America that continue to rely on biomass burning.

Today's fire-setting practices continue to be important to livelihoods. Fire-use research indicates that like the cases above, fire is often directly related to livelihoods (Eriksen 2007). While many researchers strictly focus on fire practices in order to understand their relevance to

[10] Here, foraging is used to describe collectively hunting, fishing, and gathering (Corimer 2006: 344).
[11] This fire was thought to have been used for cooking.

biodiversity management (e.g. Braithwaite 1991; Burrows and Christensen 1990), others have looked further into the utility of these fires for local people (Hill et al. 1999; Russell-Smith et al. 1997), including for hunting (Bird et al. 2008) and gathering in order to "maximise food production" (Latz and Griffin 1978: 78). When people are asked why they burn, studies from east, west, and southern Africa report mostly livelihood-related uses including range management, thatch production, habitat maintenance, predator-cover reduction, gathering, hunting, agricultural production, firebreak creation, and path-clearing (Butz 2009; Fairhead and Leach 1996: 230-1; Hough 1993; Laris 2002; Mbow et al. 2000)[12]. Similar trends have been found in North America where over 70 uses of fire have been catalogued for Native Americans (Lewis 1973), many of which included management for gathering food plants (Salmón 2000) or fibres (Anderson 2005).

Subsistence traditions link people to their land and are often outwardly manifested in their gathering traditions. For the Maori, this is called *mahinga kai* or "food works", which is the act of gathering and using resources in a particular place, while considering the health of these resources (Panelli and Tipa 2009). In this way, people, land, food, and ritual are united. This idea is particularly well expressed by Panelli and Tipa (2009) where they describe tribal lands as the basis upon which local resources ultimately shape cultural identity and beliefs while supporting land uses for food and ceremonies. This idea of interconnectedness is sometimes called "foodways", which refers to the chain of cultural practices surrounding harvesting of foods in particular ways ranging from gathering rituals to preparation and consumption (Nabhan 2008). Such traditions mean that people must have an intimate knowledge of the landscape from which they harvest these resources; amongst the Inuit, these are called "country foods", implying a detailed knowledge of the country from which they are sourced (Gombay 2005). For some Aboriginal groups, "the gathering of traditional food reinforces identity because the very action of harvesting and eating is linked to specific places, stories, and ceremonial events" (Johnston 2007: 494). This approach takes an edible species beyond its ecology and examines it in the context of a culture's subsistence practices, beliefs, and foraging traditions, providing a way of understanding the local value of a landscape. Although I will examine this in detail much later, citing some examples here is helpful. In some cultures there is a connection between land rights and foraging with fire. The Yolngu Aborigines believe that when burning is properly conducted on ancestral lands, yams can be gathered in these areas and shared with families linked to the burned areas. However, if one focuses either strictly on fire-setting or on foraging, the context and cultural significance of the actions are missed: fire-ecologists and other outsiders may only see fire-setting or seemingly random yam gathering without

[12] I do not suggest that all or even most intentional fires are lit for subsistence, but it seems that a significant proportion of them are. However, large areas can be accidentally burned. For example, Kruger National Park's main problem with local fire is trans-migrant campfires that burn out of control (Biggs 2005).

understanding the cultural significance of the burning (Verran 2002). In this sense, fire ecology studies need to be conducted in the context of an understanding of culture, vegetation, and burning.

Beyond subsistence traditions many societies have ancestor-based land values. This concept has been called "kincentric ecology" in the Tarahumara tradition of the American south-west which "pertains to the manner in which indigenous people view themselves as part of an extended ecological family that shares ancestry and origins" (Salmón 2000: 1332). For the Koyukon of north-western Canada, people are not only attached to a habitat type but also to specific places within the habitat that form part of their family history; moving away from these places would result in lost connections to the land (Watson and Huntington 2008). Amongst the Aboriginal peoples, all of their lands have a history and a link to their cosmology (Rose 1996). For the Comcáac of northern Mexico, the land to which they are most connected is not where they currently live but their *ihízitim* or the land associated with their ancestors (Nabhan 2003). In these examples, land plays a central role in how people define themselves.

Cultural concepts of fires

Fire use, in many cases, is linked to rituals or ceremonies essential for ensuring land tenure and local customs (Hall 1984). Fire is represented in names of places such as Malawi, which means "Fire flames" (Schoffeleers 1971: 281) or in referring to Africa as the "fire continent" (Komarek 1972: 475). Fire is a fundamental force not only in the environment but in society. Perhaps because fire is utilitarian while also a force in nature, fire plays numerous roles in rituals throughout the world. For example, amongst the Padhola people of Uganda, god sent fire to man to cook and begin a settled life, as such, in their Bura shrines, the sacred fire must never be extinguished (Ogot 1972). This dual utility to subsistence and cosmology is common in other cultures. For the Nyakyusa people of Tanzania and Malawi, fire was from a divine source (Wright 1972). Amongst the Lozi of Zambia, "fire is the source of life" (Mainga 1972: 97) providing not only warmth, cooking, and light, but also being associated with the death and life of kings. For the Bemba people, fire played a role in installing divine kings, including lighting the "fire of the land" (Richards 1968: 29). Fire can be symbolic of the ancestors, as in the case of Turkana culture where stars signify fires lit by the dead (Broch-Due 1999).

Ethnographic works mention fire, sometimes only in passing, and often in a single sentence. For example, in Turner's (1967) work on symbolism in the Ndembu culture of Zambia, fires form part of circumcision ceremonies yet are mentioned only in a few, scattered places. In Lewis' work on symbolism amongst the Mbenjele of Congo-Brazzaville, fires are extinguished for the ritual of the *massana* of *Malobe* performed during new moon nights (Lewis 2002). While symbolism of blood and semen are examined in these works, fire remains in the

background as a mysterious force that plays a largely unexamined part in ritual. This suggests that the symbolism of fire perhaps merits a cross-cultural study of its own.

The following represent works that mention fire in a single sentence in the context of larger stories on ritual or history. For the Ihanzu, men and women have shared roles in starting ritual fires (Sanders 1999). For the Maasai, initiation huts which housed young men are burned down to symbolise the young man's transition to manhood (Ranger and Kimambo 1972). For the Pogoro of Tanzania, fire is a vector of fertility associated with hearth-making (Green 1999). The Datooga of Tanzania use fire to define the value of a woman (Blystad 1999). In these rituals, Jacobson-Widding proposes that fire allows one to become "temporarily abnormal" and gain a ritualistic persona (1999). In Gabon, this seems to be true of the usage of fire during *bwiti* ceremonies [particularly Dissoumba and Missoko branches] (Fernandez 1982; pers. obs.).

For Schoffleers (Schoffeleers 1971), one of the few researchers to consider the significance of bush fire, fire plays a role in cosmology, rites of passage, and religion. These ideas fit well with the above examples. Specifically, he proposed that fire was part of an annual cycle representing destructive-creative forces (see also Kaspin 1999) and that the symbolism of fire may have motivated the people of Malawi to burn the bush (Schoffeleers 1971).

Ethnographies of fire-use seem to be particularly rare or only embedded within more general works (Dolidon 2007; Dugast 2008; Pyne 2009). However, some examples can be gleaned from larger works. In Senegal, Serer fire-estates were created by the first occupants of new lands who lit bush fires to establish their initial residence. "This original fire set the terms of claims to use and control the land. The burnt space came to represent the fire estate controlled by the founder-migrant's lineage" (Galvan 2004: 52-3). For other groups, fires are essential for land restoration. Both the Bwaba of Burkina Faso and the Bassar of Togo use savanna fire rituals to purify their lands (Dugast 2008). In Australia, the concept of "caring for country" (Rose 1996: 63) indicates that burned landscapes are those that are tended (Johnston 2007). Thus, the state of the landscape is connected to burning by particular descendants of the land; these fires and lands are then used for sustenance. Some fire-setting strategies for livelihoods are conducted in particular ways to ensure land fertility and maintain a connection to the ancestors. With the proper observance of certain fire-related gathering and hunting procedures, some groups perceive that land fertility is favoured. From these studies, it is clear that it is difficult to study fire-use in isolation from other factors, including subsistence and ritual. Fire is a force that humans have used which in turn has shaped the inhabited landscape. This is referred to as biocultural heritage or the "habitats whose present features are due to cultural action in time and space" (Persic and Martin 2007: 8). Thus a society's landscape bears the mark of cultural usage, linking, in fire's case, the structure of ecosystems to fire regime. In this thesis, I will investigate the land chief's role in regulating fire; this will be examined for its fundamental

importance to Bateke subsistence, to the maintenance of land-fertility, and to its effect on the ecosystem. However, much work in fire ecology has been conducted without considering local burn regimes, customary fire-control, or cultural burning rationales. In the next section I explore the impact of fire-use on vegetation.

Fire regimes and vegetation

Savannas defined

Savannas are generally defined as grassland ecosystems with a woody component. There has been much debate over the *exact* meaning of this definition with schools of thought classifying savannas as more herbaceous or more arborescent. The present discussion is not meant to be exhaustive, since the concepts on savanna classification and etymology have been covered by others (Solbrig 1996; White 1983; Bourliere & Hadley 1983;Menaut 1983). Bourlière suggests that due to the confusion over the various meaning of the word "savanna", and whether trees are included or not, a precise definition cannot be used (see also White 1983). However, savanna is a useful term, but needs to be defined with reference to the system in which it is used. Two concepts are presented here that relate most to the present work.

Savanna definitions were in a state of flux in the 1950s. For Central Africa, the Yangambi Conference was a defining moment. They defined savannas as follows:

> Formations of grasses at least 80cm high, forming a continuous layer dominating a lower stratum. Usually burnt annually. Leaves of grasses flat, basal, and cauline. Woody plants usually present.
>
> (Conseil Scientifique pour l'Afrique 1956)

Later, Frank White's work sought to define and map African vegetation according to centres of endemism. He meticulously described and mapped each of these centres, along with their vegetation classification. He particularly avoided the use of the word savanna, preferring something closer to "grassland". He divided African herbaceous formations into two categories based on the percentage of woody cover:

> Grassland: Land covered with grasses and other herbs, either without woody plants or the latter not covering more than 10 per cent of the ground
>
> Wooded grassland: Land covered with grasses and other herbs, with woody plants covering between 10 and 40 per cent of the ground.
>
> (White 1983: 46)

In the savannas of Gabon, this woody component can be quite variable, even within a few hundred meters, thus rendering separation into White's two formations difficult (Ndong 2005). Due to these difficulties, a more general definition will be employed:

> Tropical and subtropical formations where the grass stratum is continuous and important, occasionally interrupted by trees and shrubs, where bush fires occur from time to time and where the main growth patterns are closely associated with alternating wet and dry seasons.
>
> (Bourliere & Hadley 1983)

Tropical savanna distribution and drivers

Tropical savannas are found primarily in Africa, South America, Australia, and the Indian subcontinent. In Africa, savannas (woodlands and grasslands) comprise almost 50% of the landscape (Mayaux et al. 2004).

Generally speaking, savannas are found in areas that are transition zones between forest and desert areas. This fact has been at the centre of debates of savanna origin for several decades. The vegetation of some of these areas, particularly the edges, can transition into forest or desert states, a process which can be accelerated by changes in climate or disturbance. Other savannas are edaphic, that is, locally controlled by soil factors such as nutrition.

Rainfall in tropical savanna areas can range between 200 mm and 1500 mm with a dry season length of 3-9 months. Soils are variable and disturbance by grazers and fire are noteworthy. All of these factors relate to the distribution of today's savannas.

Typically there are four "determinants" that drive the formation and maintenance of savannas. The two primary determinants are plant available moisture and plant-available nutrients, followed by the secondary factors of disturbance by fire and herbivory (Solbrig, et al. 1996).

Where the primary determinants have high values, transitions to forest vegetation are expected, where these values are low, savanna will become desert. High rainfall in nutrient-poor savannas can also change vegetation structure. The secondary determinants of fire and herbivory also interact to create the savannas of today.

In a landmark synthetic review and analysis of datasets from over 800 African savanna studies (Sankaran et al. 2005), savannas grouped into those which were stable, depending on rainfall alone (< 650mm/yr) to maintain savanna structure versus those that were unstable (rainfall >650mm/yr.), requiring disturbance to maintain savanna structure. For unstable savannas, such as those in the study site, fire was found to be the largest determinant. Fire return periods significantly affected woody cover, with areas experiencing higher fire frequency generally having less woody cover[13].

[13] The exceptions to this were sites in the Kalahari sands where woody density increased with fire frequency.

The main debate about the woody cover in mesic[14] savannas is why and how trees and grass co-exist in areas where trees should dominate. No single factor alone such as fire or soil can explain the existence of savannas. While some researchers have attributed the co-existence to competition of root systems (Walters 1954 cited in Scholes and Archer 1997) or to trees inhibiting grass production beneath their canopies (Mordelet et al. 1995), these models are insufficient (Scholes and Archer 1997). Complex interactions over time (Menaut et al. 1990) may yield a variety of patterns. Such complexity demands a synthesis of all existing models to explain tree-grass co-existence (Walker 1987; Scholes and Archer 1997). One such unifying concept is that of the "ecological buffering mechanism" (Jeltsch and Weber 2000) which states that there are processes which stop the transition of savanna into other biomes such as forest or desert. The mechanisms at work are disturbances such as fire which prevent transition to forest and establishment of micro-sites[15] which prevent transition to grassland (Jeltsch and Weber 2000). In other models, fire frequency can be facilitated by grasses or trees which can encourage vegetation transition states (Beckage et al. 2009). Savannas and forests are currently transitioning from one to the other, resulting in "large feedbacks to the earth-atmosphere system" (Bond 2008: 653). Thus, in addition to the ecological buffering system at work, the context of savanna existence is also related to today's climate as it was in the past (eg. previous sections).

In savanna systems where ungulate or elephant populations are higher, these herbivores can transform woody structure (Augustine and McNaughton 2004; Holdo 2006; Holdo 2007; Van de Koppel and Prins 1998), break up the savanna grass cover resulting in fragmented fires (Augustine & McNaughton 1998), increase insect diversity (Joern et al. 2005) and, overall, create a more productive system (McNaughton 1979). In many forb diversity studies, grazing in combination with fire increases forb diversity (Augustine and McNaughton 1998; Fuhlendorf & Engle 2004; Fynn et al. 2005). In Ivory Coast, the reduction in grazers has occurred on a large scale due to poaching (Fischer and Linsenmair 2001). This is believed to have reduced patchiness of the grass layer and, in conjunction with altered fire regimes, is suspected to affect savanna structure (Hennenberg et al. 2006).

Cattle densities can be high in some areas of Central Africa, where peoples such as the Fulani have high stocking rates (Boutrais 1994). In such instances, grazing effects can be profound. Grazing can simulate wildlife effects on vegetation cover (Young et al. 2004). In Burkina Faso, herbaceous diversity was not significantly impacted by burning, wood cutting, or cattle grazing, but only became significant when burning was combined with one of the other treatments. Even

[14] Mesic savannas are moist, such as those in Gabon which range from 1500 – 3000 mm rainfall per year.
[15] Micro-sites are areas which have conditions favouring tree establishment and survival. Examples of micro-sites include small elevations and depressions, termitaria, dung piles, swamps (Jeltsche and Weber 2000).

then, this was site specific (Savadogo et al. 2008); a similar effect was reported in Benin (Biaou 2009).

Grazing by domestic and wild animals alike can have a secondary effect through seeds transported in dung. These dung piles play a large role in seed dissemination in savanna environments. In Tanzania, elephant dung plays an important role in the recruitment of savanna species (Gonthier 2007).

Termitaria have been shown to increase nutrients and thus aid in grass establishment in savannas (Jouquet et al. 2005). Termitaria may be sites used by savanna elephants as nutrient resources (Ruggiero and Fay 1994); given the role of elephant grazing in modifying savanna structure (see above), the link with termitaria is important. Recently, termitaria were demonstrated to be a refuge for woody plants in savanna environments disturbed by fire and grazing and to promote woody species, tree density, and distribution (Traoré et al. 2008).

Fire and the forest edge in West and Central Africa

Many savanna fires today are thought to sustain savanna in places where forest would normally dominate (Bond et al. 2004). These are the conclusions reached when researchers exclude fire from tropical savannas for years, resulting in increased tree density (e.g. Collin 1951; Swaine et al. 1992). Indeed, in areas where rainfall exceeds 650 mm per year, fire is the major factor maintaining African savannas (Sankaran et al. 2005). Yet studies throughout Central and West Africa suggest a wide variation in the direction of forest-savanna succession, largely depending on what vegetation type is being studied.

The West and Central African savannas are not uniform in fire behaviour, ecology, or climate (and therefore vegetation type), despite the geographical areas of "West and Central Africa" often being grouped together and conjuring images of ecosystem uniformity. In this part of Africa, there are broadly three vegetation zones that will be discussed. These zones underpin many of the results presented in the next section; without an understanding of which vegetation zone is being discussed, misinterpretation of studies can occur (Avenard 1969). Botanist Frank White's (1979, 1983) classification of vegetation for Africa describes two major zones for West and Central Africa: the Guineo-Congolian and Sudanian regional centres of endemism and a transition zone (hereafter referred to as "Transition") in between them (Fig. 1). These zones differ in rainfall, vegetation, and susceptibility to fire (Table 1). However, length of dry season must also be taken into consideration since this factor, combined with annual rainfall, can determine whether there is savanna or forest *within* a given vegetation zone (Avenard 1969: 38).

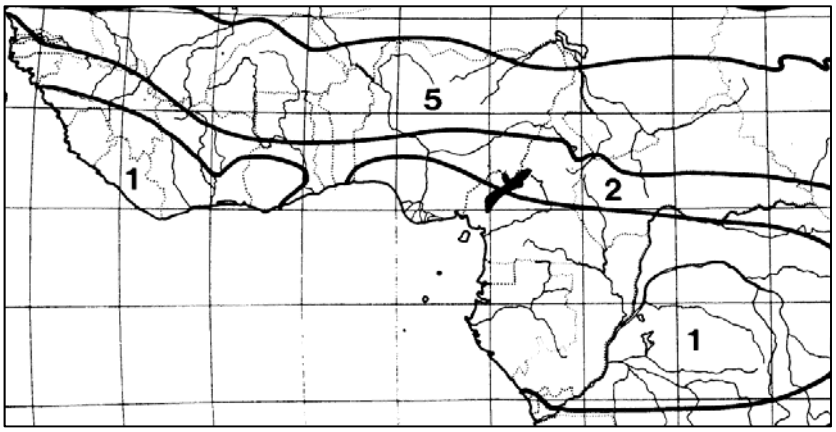


Fig. 1. Vegetation zones for west and central Africa. "1" refers to the Guineo-Congolian zone, "2" to the Guineo-Congolian-Sudania transition zone, and "5" to the Sudanian zone. Map is from White 1979: 18.

Vegetation Zone	Precipitation range (mm per year)	Notes
Guineo-Congolian zone	1,200 – 3,000	Includes the thesis study site and all other studies cited for Central African forest advance.
Guineo-Congolian-Sudania transition zone	Intermediate	Includes some studies of West African forest-savanna loss and gain. Includes the Dahomey Gap and Accra Plains.
Sudanian zone	500 – 1,400	Includes some studies of West African forest-savanna loss and gain

Table 1. Characteristics of the vegetation zones of West and Central Africa.

Much of what is known today about fire's effects on vegetation in Central and West Africa is derived either from studies of forest-savanna edge dynamics or from fire-exclusion studies within the Sudano-Guinean savannas. The fire exclusion studies from the savannas in the Guineo-Congolian and Transition savannas of Ivory Coast, Nigeria, and Ghana almost always conclude that without fire, the savanna would become forest (Aubréville 1953; Brookman-Amissah et al. 1980; Louppe et al. 1995; Ramsay and Rose-Innes 1963; Swaine et al. 1992). Early dry season burning can promote tree growth by reducing damaging later dry season fires (Louppe et al. 1995) through the breaking up of the savanna sward into a mosaic of burned and un-burned grasses (Laris 2002). However, research from the forest-savanna edge is not so unanimous. Differences emerge when explored area by area.

In many West African countries, the forest-savanna mosaic is a place where deforestation is blamed on local people and where vegetation history is sometimes forgotten (Fairhead and Leach 1998). Fire suppression has historically been a colonial priority and has in some cases recently been required to mitigate forest loss. However, vegetation type and climate in combination with local fire-use can produce different results as seen in the following examples which span vegetation types and political units. In Ghana, the forest edge is composed of fire-

sensitive dry forest; forest loss was exacerbated by drought in the 1970s and 1980s making fire control a priority (Swaine 1992). In Ghana, conservation effort is oriented towards forest protection, with fire being considered as a direct threat to forest diversity (Swaine 1992). Due to ENSO-related drought in 1983, 29% of protected forest has been lost through fire (Global Fire Initiative 2004).[16] Given the state of Ghana's dry forest loss, the Ghanaian government requested intervention from international organisations to develop fire control strategies in the context of fire-use required for local subsistence (Pyne 1999). However, the situation remains complex since some areas of Ghana exhibit forest expansion while others contract in response to anthropogenic pressures (pers. comm. F. Dowsett-Lemaire, 2009). In the Ivory Coast, fire issues remain ambiguous. It is there that Aubréville originally established his plots to understand fire-vegetation dynamics in the northern Transition, concluding that protection of savanna from fire resulted in forest succession (Louppe et al. 1995). However, recent work in the Transition indicates that fire there may not cause forest loss (Goetze et al. 2006; Hennenberg et al. 2006), and evidence from the moister part of the Transition indicates that current burn regimes do not seem to stop forest encroachment (Gautier 1990; Menaut et al. 1990).[17] In Guinea-Conakry, a century of savannisation narrative was contradicted when the Kissi and Kuranko savanna peoples in the heart of the Transition savanna were shown to increase overall forest cover through the planting of village forests and protecting them from fire (Fairhead & Leach 1996). However, in a similar ecosystem in adjacent Sierra Leone, the people of Kilimi settle near forests (and do not create them), with their subsistence activities decreasing local forest cover over time (Nyerges and Green 2000). In these four countries, there are mixtures of national policies, local burning practices, and vegetation responses, perhaps calling for case-studies throughout the region in order to understand the human ecology of fire.

West African cases are very different from those in Central Africa in their approaches to and problems with fire. With a tendency in West Africa towards high population density and cyclical drought where fire can enter the forest, governments establish a hard line towards local fire use, sometimes to the detriment of local people. Fighting fire to protect diminishing forest has an urgency in West Africa that is not seen in Central Africa, where forests remain largely unaffected by fires.

Central African countries are covered in moist forest and the surrounding savannas that have been studied are part of the Guineo-Congolian centre of endemism. Fire is generally not a concern and hardly registers in continental fire analyses (Barbosa et al. 1999) or FAO global fire assessments (FAO 2007a). Savanna expansion aided by fire or climate have been debated in the past (often based on conjecture, see Avenard 1969), with researchers reporting contradictory

[16] Compare this to Ghana's annual rate of forest loss between 1990-2005 of 2% (FAO 2007b).
[17] In Brazil, recent work reports that fires at the forest edge of the Cerrado do not cause savannisation; forest edges can persist adjacent to savannas with frequent fire (Hoffmann et al. 2009).

results of both forest advance and regression in the Central Africa Republic (Boulvert 1990; Sillans 1958), in the Democratic Republic of Congo (Pendleton 1949: 376; Lebrun 1936 cited in Backeus 1992), and in the Republic of Congo (Duvigneaud 1949; Koechlin 1961a: 77, 276; Sautter 1966: 514-15). Administrators and foresters were convinced of the anthropogenic origin of savanna vegetation (Aubréville 1962; Pellegrin and Le Testu 1938). However, forest advance, though rare in continental Africa (Barnes 1990; Hopkins 1992), is common in Central Africa (Maley 1990). Recent scientific studies based on a variety of methods, all coming from the forest-savanna edge, attest to forest advance in Gabon, Republic of Congo, and Cameroon. There, forest gains on the savanna despite fire use; fire-resistant species at the forest edge may also protect the forest (Dowsett-Lemaire 1996; Koechlin 1961a: 59). Some coastal forest in Gabon is the result of recent expansion occurring in the past 500-1000 years (Delègue et al. 2001); forest expansion is also active in central Gabon's savannas (Nana 2005). Encroachment is active in southern and central Cameroon (Guillet et al. 2001; Mitchard et al. 2009; Vincens et al. 2000), in the coastal forest of Republic of Congo (Dowsett and Dowsett-Lemaire 1991; Favier et al. 2004), and in central Republic of Congo (Sautter 1966: 515). Forest advance into Congolese Mayombe savanna occurs at a rate as high as 50 m per century (Schwartz et al. 1996). Fire slows forest progression but does not stop it (de Foresta 1990), and active protection of the forest edge has been found to speed up colonisation by forest (King et al. 1997). From this summary of Central African research, it is evident that fire has had a limited role to play in recent forest expansion and contraction and, perhaps because of this, almost no studies in Central Africa have looked at the fire-vegetation dynamics away from the forest edge and within the savanna itself.

Certainly studies in both West and Central Africa suggest that trends in savannisation or forest advance vary region by region, supporting the assessment that "it may be concluded that the existence of peri-forest savanna in lowland Africa cannot be explained by a general principle but rather has to be investigated from site to site" (Backeus 1992: 347).

West African plot studies and fire policy

In West Africa, savanna studies of fire suppression formed the basis for colonial policy. Fire studies were conducted on fire regimes in savanna areas to determine policy throughout West and Central Africa, with plots being established in the Ivory Coast, Nigeria, Democratic Republic of Congo, and elsewhere (Aubréville 1953; Collin 1951; Louppe et al. 1995; Ramsay & Rose-Innes 1963). Driven by concerns about the effects of local fire use on forest extent, these studies were largely conducted with pre-determined fire regimes that did not always correspond to local traditions (Laris and Wardell 2006). These savanna experiments were based upon the idea that the timing of annual fire-setting was the major factor in tree cover, and experiments were set up to address the "fire triad", or the effects of early dry season burning, late dry season burning, and suppression (Laris and Wardell 2006). Led by illustrious colonial

botanists such as Aubréville, results from the plot studies supported a policy of fire suppression, as clearly evidenced in the proceedings of the InterAfrican Forestry Conference in 1951 (Perriguey 1951; Colin 1951). Such experiments attested to the succession of savanna to forest in the absence of fire but did not necessarily determine the impacts on savanna vegetation of indigenous fire regimes themselves.[18]

Two of the most commonly investigated fire regimes are early and late dry season fires. The majority of studies on these regimes were interested in fire's capacity to arrest forest expansion. These regimes were represented in early colonial studies in West Africa (Laris & Wardell 2006) but may also be part of subsistence strategies used by local people (Laris 2002; Mbow et al. 2000). When fires are burned throughout the season, the savanna becomes fragmented into burned and unburned areas. The newly burned areas stop large, damaging late-season fires from sweeping through an entire landscape while also creating serial grazing sites for grazers (Laris 2002; Bucini and Lambin 2002). Early fires cannot completely burn since some of the vegetation is still green, whereas later in the season, most vegetation is completely dry. In one study in Nigeria, early season burns destroyed only 25% of the vegetation while late season burns destroyed up to 96% (Hopkins 1965) (Table. 2). Other studies that have considered early and late dry season fires in Africa are myriad (Brookman-Amissah 1980; Bucini and Lambin 2002; Chidumayo 2006; Govender 2006; Hopkins 1965; Kennan 1972; Laris 2002; Louppe et al. 1995; Nikiema 2005; Trapnell 1959; Ramsay and Rose-Innes 1963; Rose-Innes 1972; Scott 1972; van Rensburg 1972; Zida 2008).[19]

Fire regime	Early Dry Season	Late Dry Season	Suppression
Tree Survival	4-25%	1-4%	100%; replaced by forest species
Fuel characteristics	Mature, green	Mature, dry	Mature, very dry

Table. 2. Characterisation of commonly investigated fire regimes.

In the Central African savannas, annual dry season fire is the most commonly reported regime (e.g. Sillans 1958: 258); burned areas can account for up to 80% of the Sudano-Zambezian zone (Lock 1998) or even as much as 100% (Koechlin 1961a) for the Guineo-Congolian forest-savanna mosaic. For Central African savannas, fires reach their peak in the long dry season.

[18] One notable exception of fire-regime work occurring at the same time was that done by ecologist Colin Trapnell (1959). He documents the local timing and reasons of savanna firing in Zambia and places his understanding of fire regimes of early and late dry season fires in this context. His inter-disciplinary work with agronomists and anthropologists is well-known (Gluckman 1965).

[19] Others, such as the Marondera experiment in Zimbabwe, only studied late dry season fires (Furley et al. 2008).

African fire regime studies often focus on the ability of stems to escape "topkill", or stem mortality of fire resistant trees (Trollope 1984). Post-fire tree survival increases with stem height, enabling it to escape the "fire trap" (Higgins et al. 2000). Those juvenile stems that are of insufficient height to escape the flame-front are called "gullivers" (Bond and van Wilgen 1996; Higgins et al. 2007), often being less than 2 m tall (Higgins et al. 2000). There are several ways for a gulliver to escape the fire trap, including protection from fire by growing in savanna plantations (Laris 2008), high rainfall promoting rapid growth, fire suppression, and termite activity (Higgins et al. 2000). Other scenarios potentially offer escape routes yet remain undocumented.

The above studies collectively create a misleading impression that only annual, dry season fire regimes exist. Generally neither non-dry season regimes nor semi-annual regimes are investigated.[20] Reports of such regimes are rare; for example, around Garoua in Cameroon, fire passes two to three times per year in the same place (van der Zon 1992: 59). However I have seen no African studies looking at the impacts of this kind of regime. Indeed, the impacts of repeated burning on vegetation remain one of the outstanding questions in fire ecology (Whelan 2002: 134).

Study Questions

Thus far, it has been shown that fire has the capacity to shape vegetation types while also contributing to livelihoods. However, fires can also be interpreted as being destructive of forest vegetation and being lit without purpose. Recent changes in fire regimes have been enacted through policy change, institutional change, land-use change as well as in response to environmental changes. Some policies have been the basis for large-scale land conversion, catastrophic fires, and have sometimes side-lined subsistence burning. It is certain that local fire regimes need to be investigated in light of the historic ways in which fire was applied, the cultural history of the area, vegetation type and climate, and responses by the ecosystem.

This thesis will use the case of Gabon to examine how fire regime change occurs, how the Bateke use fire today, and what impact this has on savanna structure and diversity. As I will show in the next chapter, Gabon's fire laws are ambiguous on certain accounts and overall have not been enforced. Fire is not perceived as a direct threat to forest resources and so is not a fundamental part of national policy. This makes Gabon a perfect place to explore fire in the absence of much of the colonial policy that has stigmatised fire use in West Africa. Furthermore, the national park system in Gabon was only created in 2002 and fire management of savannas is nearly absent, making it a good setting for evaluating the potential of fire management in the context of local burning methods. The biocultural heritage of Gabon's

[20] For example, Beckage et al. 2009 only models fire frequencies which are annual or less and do not consider the possibility of sem-annual fires.

Bateke Plateaux area is presented as a case study within this thesis to understand tropical grassland fire in a changing cultural context. The Bateke land chief system utilised dry season burning until recently, and many of the people burning these savannas today were not displaced from their home lands during village resettlement plans. They continue to reside in or near their historic hunting and burning domains, making them more likely than their urban relatives to forage with fire and participate in land fertility ceremonies once used across the whole territory.

This study addresses the following questions in the Batéké Plateaux[21]:

How did fire regime change occur?

How is fire currently used?

How does fire regime change impact vegetation structure and species diversity?

This thesis is structured accordingly. The first part (Chapters 1-3) introduces the theme of fire regime change, the study site, and methods. Chapters 4-6 address the political ecology of the land chief system, with particular reference to fire management, how it operated, why it declined, and how people burn today. For these chapters, an ethnographic style is adopted, utilising interviews, observations from participant observation, and surveys, as described in the methods section (Chapter 3).

The next set of chapters (Chapters 7-8) deals with the impacts of Bateke burning on savanna vegetation. This part of the thesis follows a more ecological style of writing and individual chapters include the methods and statistical analysis.

[21] In this thesis, "Plateaux" is used to refer to the geographic entity of the Batéké Plateaux area. However, "plateau" may be used singularly or "plateaus" in its English plural when discussing parts of this geographic area.

Chapter 2: Study site: history and ecology

This chapter summarises the history and ecology of the study site. A shortened biological context is given here and addressed at length in other chapters. A longer localised history of the Bateke people follows. The subsistence economy of the villages in the study site is then described.

Gabon

Gabon is a small country located in equatorial Central Africa. Comprising 257,000 km^2 and only 1.3 million people (UN Statistics Division 2009), its population density is one of the lowest on the continent, a subject which has been well studied in the recent past (Sautter 1966). The GDP ranges between $14,208 (FAO 2009) and $3,940 per capita in 2004 (World Bank 2006); however, income is unequally distributed as indicated by a Gini index value of 0.39 (World Bank 2006)[22]. This imbalance was highlighted recently when former president Omar Bongo-Ondimba died in 2009, after 41 years of rule, as one of the richest men in the world due to oil rents despite a poor rural population (BBC 2009; BBC World Service 2009). Despite this gross inequality, little civil unrest has occurred since independence from the French on August 17, 1960. Major income is garnered from the exportation of raw materials such as oil, timber, and manganese. Agricultural output is low, with less than 1% of land being cultivated (US Department of State 2009); most food sold in urban markets is sourced from Cameroon, France, or elsewhere (Rich 2007). However, the 2008 Ibrahim Index ranks Gabon number 20, with a rather low score in the sustainable economic opportunity category[23]. Gabon ranked mid-range in the Human Development Index in 2009 at 103 out of 182 countries (http://hdr.undp.org/en/statistics/).

Life expectancy is between 52-54 years of age and is low given the wealth of the country (World Bank 2006). Little attention is given to formal education; in 2000, 65.5% of mothers had received no formal education (World Bank 2006).

Major religions include Christianity, Islam, and several forms of traditional religion. There are more than 40 Bantu-speaking peoples and several pygmy groups living in this small nation. In terms of language diversity, it is one of the most language-diverse countries for its size (Loh and Harmon 2005).

[22] The Gini index measures inequality of wealth and ranges between 0 and 1, with 0 being perfect equality and 1 being perfect inequality. European countries have values between 0.24 and 0.36 while for the US and Mexico, they are near 0.40.

[23] The Ibrahim Index measures quality of governance in African countries based on scores for safety, human rights, economic opportunity, and human development, www.moibrahimfoundation.org.

Gabon's environment is composed of coastal mangroves, lowland and mountainous forest (covering 80% of the surface), and savanna. Deforestation rates are some of the lowest in Central Africa. Only 1% of these forests are affected by fires (FAO 2005: 63).

The biological context

The Bateke Plateaux is a geographical area extending across three Central African countries roughly bounded by the cities of Franceville, Gabon; Brazzaville, Republic of Congo; and Kinshasa, Democratic Republic of Congo (DRC). The plateaus themselves are a series of six elevated areas located primarily in the Republic of Congo. In Gabon, the Bateke Plateaux area comprises the foothills of these largely Congolese plateaus (Fig. 1). In this thesis, place names are spelled according to the following sources: Gabon's touristic map (Institut Géographique National 1994) and Congo's general map (CERGEC 1993). For the spelling of village names within the study site (some of which are excluded from the previous resources), names from the last census are used (Lékoni Prefecture Archives 2006).

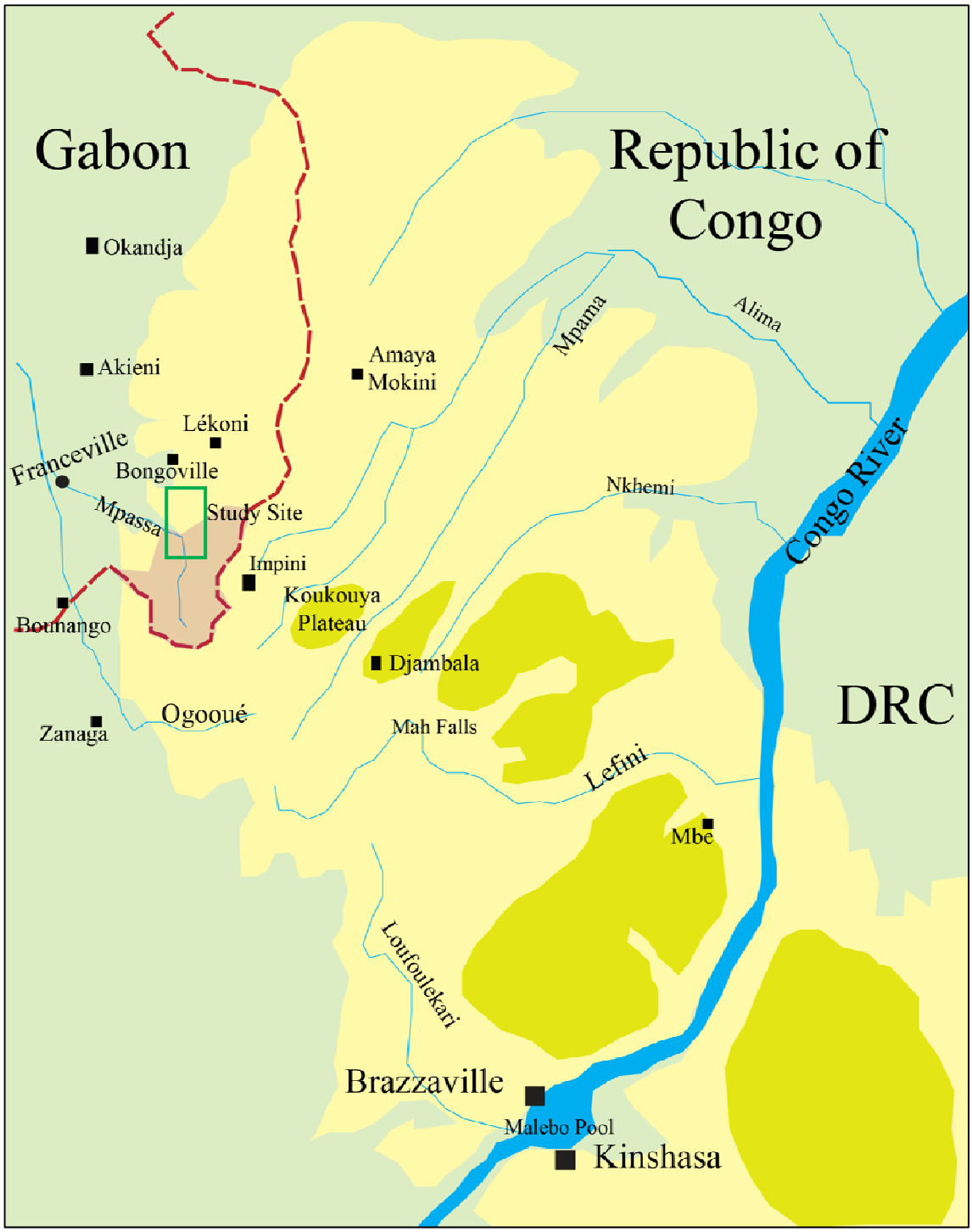


Fig. 1. The Bateke Plateaux geographical area. The plateaus are signalled in yellow, while the Kalahari sands are in off-white. This area is nearly synonymous with savanna cover. In pink is the Bateke Plateaux National Park. This map is used with the kind permission of J.P. Vande Weghe and is an adaptation the one presented in Vande Weghe 2008: 23.

Soils and Geology

Dominated by grassland and riparian forests, these plateaus are part of an ancient sand dune system called the Kalahari Sands (Haddon 2000). The Kalahari Sands system finds its northern-most extension in Central Africa (Haddon 2000). The plateaus are composed of two layers of sands including aeolian deposits from the Tertiary period from the Kalahari Desert and a second

layer of ochre sands (Peyrot 1991). The sands represent some of the deepest sand deposits in the world. In Gabon, they form the divide between the Ogooué and Congo River basins.

These sands and their savannas end abruptly in south-eastern Gabon where rainforest on laterite soils begins. This meeting of two substrates favours a forest-savanna mosaic which creates a diversity of habitats for both forest and grassland dwelling people, plants, and animals.

The Bateke Plateaux landscape also comprises numerous cirques which are attributed to erosion related to exceptional rainfall events in the past; these cirques are in various stages of re-vegetation (Schwartz and Lanfranchi 1990: 169).

The sands have a high percolation rate resulting in heavy water loss despite high rainfall. This high rainfall sometimes confuses vegetation modellers whose models predict forest cover for the plateau area (see Delire et al. 2008). In the Kalahari Sands in Zimbabwe, sand depth and soil moisture have the greatest effect on vegetation structure (Childes and Walker 1987). Despite this, in a continental wide comparison of savannas, the Kalahari Sands had a higher than expected density of trees (Sankaran et al. 2005). This may be partially explained by rooting depth (Holdo and Timberlake 2008).

Rainfall and Climate

Gabon's rainfall varies from 3,300 mm per year on the coast to as little as 1,500 mm in parts of the interior (White 1983: 73). In 2006, the rainfall records from PPG on the Mpassa River measured 2,650 mm. In 2008-2009, records from the Ekouyi –Mbouma study site measured 2,890 mm (Fig. 2). Both of these measurements exceed the ranges normally reported for the area including 2,000-2,250 (Vande Weghe 2008: 33), 1000-2,000 (White 1983: 73), 1,800-2,000 (Mpoinza and Samba-Kimbata 1990: 36), or "greater than 1600 mm" (Schwartz and Lanfranchi 1990: 169). In the plateau area, rains seem to be quite variable depending on whether one is on a major river valley bottom, like the Mpassa, where the 2,600 mm per year occurred or whether on a tributary of the Mpassa, as in the case of the 2,890 mm reading at the village of Ekouyi[24]. Irregularity is to be expected between years, however, rainfall variation in the Plateaux Bateke is exceptional and can vary by more than 15% between years (a variability only rivalled by Mt. Cameroon) (Mpounza and Samba-Kimbata 1990: 39).

According to PPG records, daytime temperatures were nearly constant 2004 – 2006 ranging between 24.4 – 26.8˚C. However, night time temperatures vary seasonally, being notably colder than daytime temperatures in the dry season.

[24] PPG also indicated that in their experience, the rain varied along the Mpassa River, with more rainfall occurring upstream towards the former village of Mboua/Camp Mbie (pers. comm. L. Pearson). Rainfall on the savanna hilltops is probably less; many times when conducting fieldwork I witnessed rainfall along the river valleys that failed to reach the nearby summits. Rainstorms predictably followed the Mpassa river, sometimes missing Ekouyi altogether.

Wind direction and storm fronts also change seasonally, with dry season winds coming from the south-west and rainy season winds coming from the north-west.[25]

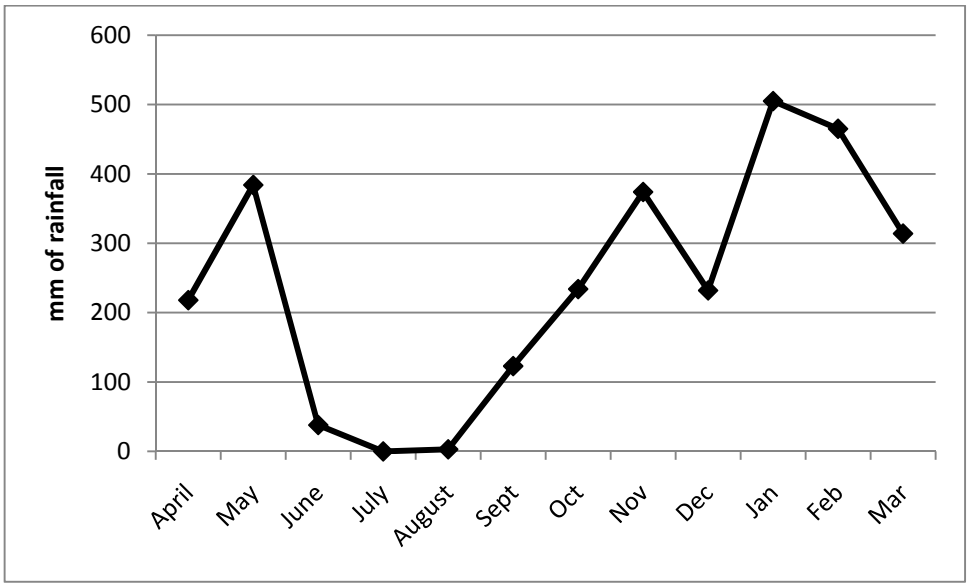


Fig. 2. Rainfall in the Ekouyi area from April 2008-March 2009.

Fauna

Faunal diversity is not exceptionally rich, but the species assemblage is unusual for this part of Gabon. In this region, lions once roamed the savanna, Grimm's duiker finds its range limit (Kingdon 1997), as do numerous plant species more common in the Zambesian vegetation to the south. The most common animal species in these savannas are Grimm's Duiker (*Sylvicapra grimmia)*, Side-striped Jackal *(Canis adustus)*, Yellow-backed Duiker (*Cephalophus silvicultor)*, and to a lesser extent the African Civet (*Civettictis civetta)*, Forest Buffalo (*Syncerus caffer* subsp. *nanus)* and Red River Hog (*Potamochoerus porcus)* (Bout 2006).

Flora

New plant species endemic to the Plateaux forests have been discovered (Stone et al. 2006) as well as in the savanna (see Chapter 7), but most grassland species are not endemic to the area (Walters et al. 2006). The savanna vegetation ecology has been studied in depth, particularly around Brazzaville (Koechlin 1961a; Koechlin 1957). In the Plateaux Bateke, several habitats exist including a variety of grasslands (humid, woody, and herbaceous). These are scattered between copses and riparian forests. These savannas end where the major forest block begins (see White 1983). There seems to be little correspondence between sand type and savanna type, particularly in the open and shrubby types. Therefore, catena drawings have not been given.

[25] This is notable, as during dry seasons the winds are so strong that villagers construct outdoor fire shelters protecting their fires from south-western winds.

Herbaceous savanna (*kape*)

This category represents grassland without a major woody component (e.g. except for occasional individuals of *Annona senegalensis*) (Fig. 3a). Grasses can vary in dominance and include a mixture of *Anadelphia afzeliana* (Rendle) Stapf, *Ctenium newtonii* Hack, *Elionurus hirtifolius* Hack., *Loudetia simplex* (Nees) Hubb, *Melinis nerviglumis* (Franch.) Zizka, *Panicum juncifolium* Stapf**,** *Schizachyrium thollonii* (Franch.) Stapf, and *Sporobolus congoensis* Franch. Recently burned grasslands are often populated by several sedge and bulb species. Bird species specific to this savanna type include (pers. comm. P. Christy) Hourtarde, *ololo mpini*, pectoral patch Cisticola, Flappet Lark, Cisticola Teke (new species and endemic to the plateaus), Malbrants lark, and Swamp Nightjar.

Wooded savanna (*mpila*)

Wooded grassland abuts the edge of the forest and is dominated by the savanna trees *Hymenocardia acida* Tul. and *Annona senegalensis* Pers., with less frequent tree species representing *Maprounea africana* Müll. Arg., *Ochna afzelii* R. Br. ex Oliv., *Bridelia ferruginea* Benth., *Syzygium guineense* (Willd.) DC., and *Vitex madiensis* Oliv. Sometimes beneath the canopy of *Albizia adianthifolia* (Schumach.) W. Wight trees dense stands of *Aframomum alboviolaceum* (Ridl.) K. Schum. and *Hyparrhenia cyanescens* (Stapf) Stapf can be found in association with a large termite mound (Fig. 3b). Bird species specific to this area include (pers. comm. P. Christy): Sooty Chat, Fiscal Shrike, White Browed Scrub Robin, Amathyst Sunbird, Rattling Cisticola, Cabanis Bunting, Striped Kingfisher, Cape Turtle Dove, Pale Flycatcher, and Fork-tailed Drongo.

Humid grassland (*yohro*)

Some hills form catchments where wet grasslands or peat bogs form (Makany 1972). These are dominated by herbaceous species of *Xyris* spp., *Utricularia* spp., *Mesanthemum radicans* (Benth.) Korn., and are sometimes associated with the woody species *Clappertonia ficifolia* Decne (Fig. 3c).

Copses (*kadjia*)

Copses are small forests that are often former village sites, frequently located on hill tops. The vegetation of these is mainly secondary species including *Oncoba welwitschii* Oliv., *Vernonia conferta* Benth., *Laccosperma secundiflorum* (P.Beauv.) Kuntze**,** *Gnetum africanum* Welw**.**, *Dioscorea praehensilis* Benth. and *Millettia laurentii* De Wild**..** Fruit trees can also be present including avocado and *sapho* **(***Dacryodes edulis* (G. Don) H.J. Lam). These areas are sometimes cultivated and sometimes used as sources of gathered materials for basketry, leaf sauces, and wild fruits. The canopies of these copses are often punctured by emergent oil palms; these testify that a given copse was formerly a village site (Fig. 3d).

Recent forest

This type of forest is at the forest-savanna edge and includes many of the above species as well as stands of *Aucoumea klaineana* Pierre, *Chaetocarpus africanus* Pax, and isolated *Hymenocardia acida* trees (Fig. 3 f.).

Forest edge

A lot of the forest in the plateau area is along rivers which extend like fingers from the central forest block. Thus forest edge is a major part of the vegetation. Species typical of this habitat include *Pteridium aquilinum* (L.) Kuhn**,** *Sapium cornutum* Pax, *Vernonia conferta, Combretum inflatum* Jongkind *and* various genera of the Connaraceae family (Figs. 3 c, d, e, f).

Forest (*swara*)

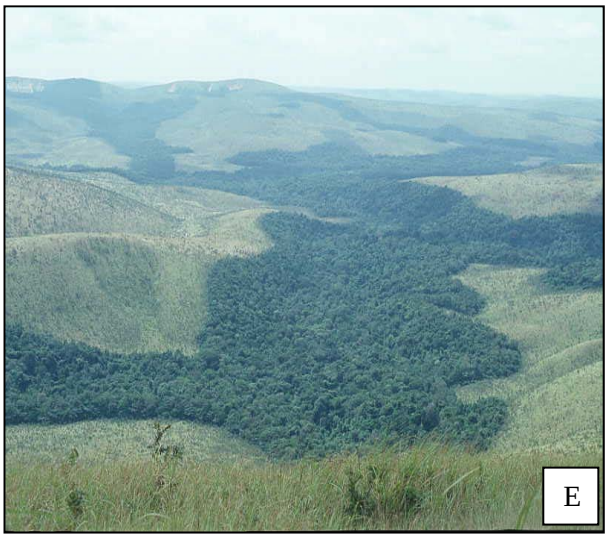
The forest zone to the west of these savannas includes the dominant species of *Greenwayodendron suaveolens* (Engl. & Diels) Verdc, *Dacryodes yangambiensis* Louis & Tr., *Diospyros iturensis* (Gürke) Letouzey & F.White, *Garcinia mannii* Oliv., *Santiria trimera* (Oliv.) Aubrév., *Pentaclethra eetveldeana* De Wild. & T.Durand, and *Aucoumea klaineana.* A high presence of slowly dispersing Caesalpinioid legumes such as *Bikinia pellegrinii* (A. Chev.) Wieringa**,** *Didelotia africana* Baill., *Oddoniodendron micranthum* (Harms) Baker f., *Plagiosiphon emarginatus* (Hutch. & Dalziel) J. Léonard, *Gilbertiodendron* cf *stipulaceum* (Benth.) J.Léonard, and *Tessmannia lescrauwaetii* (De Wild.) Harms means that these forests are older (Leal et al. 2007). Certainly forests in this area show genetic signals of coming from two centres of diversity (Born 2007); this signifies that plateau area vegetation has a dynamic history. The forest understory is characterised by several species of *Memecylon* and *Palisota* (Fig. 3f).

Riparian forest

Rivers are bordered by gallery forest containing *Dichaetanthera strigosa* (Cogn.) Jacques, and *Impatiens irvingii* Hook. f. Wetlands adjacent to river beds sometimes contain nearly monospecific stands of *Loudetia phragmatoides* Hochst.and *Aframomum angustifolium* K.Schum. If these forests are along tributaries to a larger river, they often contain the additional species of *Anonidium mannii* (D. Oliver) Engl. & Diels, *Barteria dewevrei* De Wild. & T. Durand, *Uapaca paludosa* Aubreville & Landri. Riparian swamps contain two species of *Raphia* (Figs. 3c, 3e).

Fig. 3. Vegetation and landscape types:

A. *Kape* savanna.
B. *Mpila* savanna.
C. Yohro savanna with riparian forest in the background.
D. Old village copses within the savanna. Note variation in savanna tree density in the foreground and then between the copses.
E. Riparian forest.
F. *Swara* forest at the edge of the sandy plateau.
G. Cirque.



The north-western Bateke peoples

The Bateke people occupy a series of savanna plateaus spanning more than 120,000 km^2 across south-eastern Gabon, central Republic of Congo, and south-western Democratic Republic of Congo (Dupré & Pinçon 1997). These plateaus also represent distinct Bantu language groups in the B70-B79 range (Guthrie 1953). Numerous attempts have been made to classify the languages and thus the people, with various authors attempting to subdivide them into as many as 16 sub-groups (Sautter 1960) or as few as Guthrie's ten. Work conducted by the Summer Institute of Linguistics (Linton 2008) over the past 10 years in both the Republic of Congo and Gabon indicates that there are 12 language subgroups comprising approximately 390,000 speakers in the three countries.

In the area of study, there are two language sub-groups: the Tsitsege and Tege/northern Teke (also called "Teke of the Haut Alima") (Sautter 1960). For these groups SIL gives the following estimates: 15,745 speakers for the Tege (including Kaningui as a dialect), and 2,000 for the Tsitsege (or Batsitsege). Mouguiama-Daouda (2007) concurs with this classification, recognizing these two as the only Bateke dialects in Gabon. However, the Kaningui group remains disputed. Mouguiama-Daouda indicates that the Kaningui are a separate group (B602), more related to the Mbete; this contrasts with Raponda-Walker who indicates that the term *andininghi* is a pejorative term given by the Mbete who chased the Bakaningi out of their territory (Raponda-Walker 1996). Bakaningi informants from the study site indicate that they are a forest people chased to their present location by old wars; however, Ebouli (2001), a Bateke historian, holds that the Bakaningi are a Bateke subgroup. Despite the difficulty in classifying this particular group, I pool them with the other two Bateke groups in the study area. In this study, I will generally refer to the Bateke of Gabon as the "north-western Bateke", encompassing the Bateke-Alima, the Batsitsege, and the Bakaningi subgroups of the forest-savanna mosaic in Gabon. However, where practices within this grouping differ, I will refer to specific sub-groups.

Despite similarities of language being shared amongst Bateke, many customs are not. The north-western Bateke characterised in this study reside in the ecotone of the major forest block of Gabon and the vast Bateke Plateaux savannas of Congo. They are relatively recent newcomers in this forest-savanna environment; it seems that some cultural mixing has occurred which distinguishes them from their eastern Bateke counterparts.

The north-western Bateke have a linguistic divergence from the eastern Bateke, only sharing 70-80% of their vocabulary (Linton 2008; Vansina 1973). The language differences are concurrent with many other differences found between the two sides of the plateaus. As Guiral (1889: 239) pointed out in reporting on his trek across the plateaus, "*les Batéké de Nkouna diffèrent*

complètement des Batékés de Franceville"[26]. To better understand the social context, it is beneficial to discuss the similarities and differences between the north-western Bateke and the eastern Bateke groups in light of history, politics, economics, and cosmology. This analysis will be based on various historical and anthropological works on the Bateke. Previous anthropological works have been undertaken in various areas of the plateaus, including the works of Vansina amongst the Tio of Congo (1973), Bonnafé in the Koukouya Plateau of Congo (1978), Soret's work on the eastern Bateke of Congo (Soret 1973), Trezenem's study of the Bateke-Balali, Congo (1940), Dupré's (numerous works but chiefly 1972, 1984; Dupré and Pinçon 1997; Dupré and Féau 1998) work amongst the Tsayi of Congo, and several recent works amongst the Bateke-Alima of Gabon (Ebouli 2001; Loëffler 1975, and Makouka 2008). More than half of the work on the Bateke has taken place in the Republic of Congo. This leads to a somewhat unbalanced understanding of Bateke culture, as most link the Bateke singularly with their historically renowned kingdom with whose leader the French signed a treaty to control the Congo trade in 1880 (Brunschwig 1972; de Brazza 1880; Pakenham 1991).

Sautter noted that:

> *Les 'plateaux Batéké ' ne représente donc que la portion centrale, le cœur géographique du pays Téké. Les fractions des plateaux ont été intégrée pour la plupart, de façon étroite, a l'ancien 'royaume' du Makoko; les autres Batéké avaient ave lui des liens plus lâches, ou vivaient complètement à l'écart. Enfin, les techniques de production et le style de vie montrent des variations significatives, qui ne sont sans doute pas toujours sous la dépendance du milieu. Tout ceci montre, dans les Batéké, un groupe charnière, forme peut-être d'éléments hétérogènes incomplètement amalgames, soumis en tout cas a des influences diverses suivant les régions.*
>
> (Sautter 1960: 10-11)

Ebouli writes, in his synthesis of north-western Bateke history and political structure,

> *L'écologie a eu des effets sur l'histoire ; l'un des clivages est celui qui a distingué les téké Nkuna à ceux des plateaux. Les différences portaient aussi bien sur les ethnonymes, les activités, les structures politiques que sur les mythes qui les fondaient.*
>
> (Ebouli 2001: 17)

To better understand this "transition group", I will start with a brief summary of Bateke history and then describe in detail the major differences between the eastern Bateke of the *Onkoo*'s (*Makoko*) kingdom and the north-western Bateke outside of the kingdom.

[26] Nkouna was the Bateke area where Brazzaville was later founded (Ibalico 1954).

The Plateaux Bateke as a low-population density area

The low population density of the Bateke Plateaux and several other portions of French Equatorial Africa (AEF) was a conundrum to geographer Gilles Sautter (1966). Despite a generally higher density in savanna (3.05 people/km^2) versus forest areas (1.19people/km^2), the plateaus by comparison had only 0.75 people per km^2 (Sautter 1966: 113). After examining several possibilities that could explain this situation, including low animal density, low water availability, migration, catastrophic disease events, the slave trade, populations linked to kingdoms (which may afford inhabitants a level of protection) and soil quality (Sautter 1960: 997; Sautter 1966: 48), he argued that limited water only reduced settlement by non-Bateke populations and that former disease could have played a role (Sautter 1960). He concluded, in reflecting on the population anomalies amongst high and low population density plateaus:

> *Le plateau bien situé, à proximité des débouchés, est mal peuplé ; le plateau bien peuplé est mal situé. Malheureusement, les situations de ce genre, loin d'être l'exception, sont plutôt la règle en Afrique centrale. Elles offrent l'image, en petit, de ce que l'A.E.F. elle-même était en grand, avec le Tchad bien peuplé et le Gabon vide.*
>
> (Sautter 1960: 48)

Later work on population statistics in the AEF indicate that statistics were faulty for a variety of reasons; however, overall, the AEF was sparsely populated, and during the colonial era, Gabon's population decreased in the 1920s by comparison with neighboring countries (Headrick 1990).

Bateke early migrations

Vansina's (1990) seminal work on Central African history based on linguistic analysis provides a synthesis of Equatorial African history. Early large-scale Bantu migrations into the Bateke Plateaux ended around 1000 AD; smaller migrations continued influenced by politics and resources. During this early phase in history, Vansina (1990) notes the development of nature spirit-linked land tenure and the rise of early more centralised political structures.[27] The first metal-working and plantation burning in the Haut Ogooue were noted in 400 B.C. (Clist 1995).

Establishment of the Bateke kingdom: domains ruled by land spirits

In M-C. Dupré's comprehensive work on Bateke history as viewed through the lens of metal working, she describes six periods in Bateke history from 1000 AD to present (Dupré and Pinçon 1997). With data contributed from archaeological findings at the edges of the Bateke kingdom, historical notes, and oral history from the Bateke Tsayi of Zanaga, Congo, Dupré

[27] This migration story differs substantially from that offered by southern Bateke myth which indicates that there was joint establishment of several ethnic groups including the Kongo, Bateke, and Vili peoples (Ebouli 2001; Soret 1973). Soret indicates that this myth matches observations by the Portuguese in the 1500s (1973: fig. 35), however, this analysis predates that of the linguistic one offered by Vansina. Others indicate that the Bateke were the first occupants, after the Pygmies, in Central Congo, which may be an attempt to claim to be first occupiers of the land (Ndinga-Mbo 1981: 75).

proposes a cyclical history centring on the "dilemma of man versus riches" (1997:199). Throughout the six phases proposed, there is a bi-cephalous rule with a tendency towards one or the other of two poles: that of frugality represented by the village chief and that of excess represented by the land chief. The tendency was driven externally by factors of resource extraction, trade, and foreign influence. In the following section I try to mesh Dupré's and Vansina's perspectives on Bateke history.

Early in Bateke history, around 1000 AD, metal working was prominent and the mediator between humans and the land spirits was the *ngaa*, or medicine man. Land spirits, or *nkira*, were a source of political power in the landscape, mediated by a land chief, or *ngantse*. Vansina notes that this was the first step in the emergence of the savanna kingdoms south of the equatorial rainforest (Vansina 1990). Around 1100AD, there is the first centralisation of power on the plateaus with the introduction of a supreme land spirit: the *Nkwe Mbali*, symbolised by the lion. This spirit, also called the "Lion's court" is, to this day, spiritually centred on the Lefini River's Mah Falls, in the Republic of Congo where six anvils are buried. These anvils represent the power of the Bateke ruler, the *Onkoo* (or *Makoko*[28]) and five *ngaa*. At this point, there is a centralisation of power over four plateaus (between Mbe and the Koukouya Plateau) and the formation of the Bateke kingdom which ruled over the 12 domains (subdivisions of land ruled by land chiefs) of the Mbe Plateau where the *Onkoo* lived. Elsewhere in the savannas south of the equatorial rain forest, the Kongo and Loango kingdoms were developing in line with the Tio (eastern Bateke) kingdom, which Vansina dates to the 1300s. The Bateke kingdom is the least centralised of the three, where the land chiefs autonomously held sway over their territories, mediating between the nature spirits and humankind. Land chiefs also existed in the Kongo kingdom, but there they were directly accountable to the king. Where the Bateke based their rule on a nature spirit, the adjacent kingdoms ruled by virtue of their ancestors. The geographical area associated with *nkira* coincides almost exactly with that of the geographical distribution of Bateke people. In contrast, the Teke-derived *nkani* political structure (based on judges) expanded well beyond the borders of the Tio Kingdom (Vansina 1990: 148).

According to Dupré and Pinçon, by 1200-1400 AD trade relations were developing for the first time at the Bateke kingdom's edges. Migrations towards the south occur and it is a time of warfare against the Kongo kingdom. During the 1500s commerce on the Congo River becomes important with the opening of the large market at Malebo Pool (between Brazzaville and Kinshasa). At this point, the *Onkoo* strikes a deal with a major Bateke river trader of the Congo named Ngobila. Ngobila, who formerly paid tribute to the *Onkoo*, is now liberated from this duty and is the only person besides the *Onkoo* empowered to wear the sacred lion skin. The Loango are trading partners with the Bateke in the interior and the Portuguese observations in

[28] The *Onkoo* was a title given to a position, like king. The 17th *Onkoo* was enthroned in 2005.

1598 are the first written accounts of the Bateke and other peoples (Pigafetta and Lopés 1883). The Portuguese enter into trade with the Loango kingdom and export slaves to Brazil (Pinçon 1991). At this point, the slave trade becomes a diversifying factor in the economy; it equalizes the status of people, reducing the concentration of power in the elite groups by creating a merchant middle class (Vansina 1990).

Separation of the north western Bateke from the Tio Kingdom: Amaya Mokini and the rise of the leopard

During the 1600-1700s economic activity destabilizes the authority of the *Onkoo*; additionally a series of powerful cults are introduced in various plateaus which compete with the *Onkoo*'s authority. The major challenge is the introduction of a powerful cult surrounding 12 *nkobi* fetish boxes; these infiltrated the Tio Kingdom along the Likouala trade route, most likely originating with the Loango Lemba cult (Vansina 1990). Vansina indicates that the Atlantic trade increased riches dramatically, allowing rulers to buy the *nkobi* fetishes. By 1750, this allowed the Bateke on the northern edge of the Tio kingdom to adopt this alternative source of power and become independent from the kingdom.

It is at this time that the spiritual centre of *Amaya Mokini* gains prominence; it is the highest point on the Ogooué-Congo River drainage divide and the centre of north-western Bateke *mpu* or power. The *Nkani* gain power and form a decentralised ruling system based on "small states organised in community villages under the authority of a chief" (Ebouli 2001: 32). This creates a series of hierarchies that Ebouli classifies in descending order as country (*kasi*) to land (*ntse*) to village (*mpuru*) to house (*ndjo*); each level having a leader. This is in stark contrast to the Tio Kingdom in which power is strictly centralised at Mbé[29].

As a further contrast to the *Onkoo*'s *Nkwe Mbali*, Amaya Mokini is called *Nkwe a Nzami* or the "Court of God". According to Dupré and Pinçon (1997), Moubie, a Bateke-Tsayi hero, was one of the first to discover the power of Amaya, an act which soon attracted the attention of the Koukouya, the Teke-Alima, the Ntsabi, and even the *Onkoo* himself[30]. In myth, Amaya is an area named after the son from an illegitimate union between the wife of an *nkani* and a land chief named Amaya. Dupré and Pinçon (1997) indicate that this form of myth telling, in which many political terms are layered, is typical in Bateke history. A place of mystic origins, stories of Amaya Mokini are still kept by the *ebaningi*, the former emissaries of the land chief (Le Bomin 2004).

[29] A contrasting history (made by earlier works based largely on oral history) proposes that Amaya Mokini is the primordial emergence site for the Bateke (Cabrol n.d. : 20; Soret 1973: 112).
[30] In one story, of the 12 *mpu* (powers), Moubie obtained the strongest one, represented by the red and black parrot, while the *Onkoo* received the second strongest signified by raphia (Dupré and Pinçon 1997).

Amaya Mokini represents a departure from the rule by the Tio Kingdom. Tio authority is replaced by the *Nkani*, an initiation brotherhood (Ebouli 2001) whose power is based on the leopard (Dupré and Pinçon 1997). "One sees how the trips to Amaya Mokini served to re-organise the relationships between diverse Teke groups" (Dupré and Pinçon 1997: 74). From the rise of Amaya as an alternative Teke power base, a series of new political structures are cast in the different subgroups. The Koukouya Plateau sees the rise of the leopard and the introduction of the sky lords who fought it (Bonnafé 1978). The coming of the sky lords changed the way in which the land chief ruled, creating a bi-cephalous system, where earth and sky lords ruled together. Further to the south, the discoverer of Amaya's power moves into Teke-Tsayi country, bringing the *Nzineke* lords and a political structure organised around the Moubial chiefs (Dupré 1990; Dupré and Pinçon 1997). Leopard symbolism penetrates many parts of the area, creating new political alliances and replacing the lion of the Tio Kingdom in many plateaus except Mbé itself.

These events mark the disintegration of the *Onkoo*'s power. For the Tsayi, Dupré (1997) notes that there were out-migrations from the Koukouya Plateau to avoid the tribute relationship with the *Onkoo*. Further separating the eastern Bateke from those of the edges, around 1840 a series of border wars broke out between the northern Teke, the Mbede, and Mboshi (Vansina 1990). The Mboshi pushed the north-western Bateke out of the Alima area and into the present day Lékoni area (Dupré & Pinçon 1997; Lotte 1953), which in turn pushed the N'dumu towards Franceville (Milleto 1951).

The *Onkoo* and de Brazza: 1880

Despite wars and a loss of supporters, the *Onkoo* still held sway over the Pool area on the Congo River. During these perturbations in and around the Kingdom, de Brazza was exploring the plateaus in the trading interests of the French (de Brazza 1888; de Brazza 1887). In de Brazza's travel notes, he carefully delimited the extent of the Bateke kingdom (Brunschwig 1972:52; 30 Oct 1880 de Brazza). Brunschwig notes that these limits stretched from Nkhemi River south to Malebo Pool and then inland to the Mpama River near the Koukouya Plateau (see Fig. 1). He further notes that the Mfuunu of Congo-Kinshasa, the Nguugalu of the River, and the Koukouya all recognized the importance of the *Onkoo* but did not have a tribute relationship with him and were not represented in his court (Brunschwig 1972: 52). It was during this time of reduced influence of the Tio Kingdom that the French signed a trade treaty with the Bateke of the Pool (de Brazza 1880)[31]. A year later, in 1881, Stanley made an

[31] See also the recent popular accounts of de Brazza's explorations (Dion 2006; Merlet 1990).

agreement with a powerful Teke ivory trader named Ngaliema to establish a post in present day Kinshasa (Pakenham 1992: 151)[32].

By 1884, the signatory *Onkoo* had died (Dolisie 1927), prompting the French to guess the identity of the new successor and how he would influence trade. The Bateke still controlled the Pool despite pressure from the Bobangi river traders. Vansina writes that eight years after signing the treaty, the competition with the European economy significantly reduced Tio trading power (Vansina 1973: Chapter XI). Guiral in 1889 noted the preference by Central Africans for European wares and the competition this created for locally-made items. As the Congo River trade gained importance, trade by river replaced traditional overland trade that used foot paths which had once connected the Tio and Loango kingdoms (Vansina 1973).

During this time of increased trade in the Pool area, the Bateke began to withdraw from the trade economy and moved into the plateaus. While the Bobangi river traders pushed into the Pool, there were increased Bateke migrations northward out of the Tio Kingdom. Vansina (1973: 496) notes that,

> Like the impact of the environment, the impact of external trade can be found in all aspects of life. It was so serious that in the 1880s the ecological balance between man and his environment on the plains was disturbed.

This disturbance was linked to low labour availability to grow food for the urban market, and malnutrition. Dupré interprets this withdrawal as a return to the land spirits because the Bateke attributed the sleeping sickness epidemic that had struck the plateaus to their neglect.

Concessions and the rural exodus: 1900s

According to Papy, the interior plateaus held little economic interest for the French, resulting in their reduced contact with the Bateke than compared with neighbouring groups (1949). Coquery-Vidrovitch's work on the concession system in the AEF gives some insight into the reduced economic development in the area.

In the Alima area, oil palm plantations and *Ongokea* fruit gathering operations were introduced, however the French considered the Bateke to be indifferent, not intelligent, and great sorcerers. The Bateke themselves chose to withdraw rather than submit to the French who they felt had deposed their ruler. Coquery-Vidrovitch (1972) indicates that the French left the Congo "backcountry" somewhat untouched, maintaining only weak activities in the plateaus. The Bateke themselves seemed to be particularly resistant to these activities to the degree that they are even called, "losers".

[32] Stanley noted that the left bank was very prosperous containing the settlements of Nshasha, Nkunda, and Ntamo while the right bank (the side ruled by the *Onkoo*) "was inhabited by the wild Bateke who are generally accused of being cannibals" (Stanley 1883: 535).

> *Les perdants étaient les Batéké, refoulés par les Balali-Bassoundi et relégués sur leur plateau depuis que l'autorité coloniale, ayant obtenue du Makoko la souveraineté du pays, ne ressentait plus la nécessite de les protéger.*
>
> Coquery-Vidrovitch 1972 : 74

While other populations in Congo were used as labourers in mineral exploitation, particularly copper, "*le plateau Batéké, peuple de Téké, d'Achikuya, de Tegué (sur l'Alima) et de Djikini (sur le Kouyou), resta longtemps fermé* » Coquery-Vidrovitch 1972 : 82-3. The Bateke were seen as having scattered villages that conducted irregular commerce with the concessions. In particular, the Koukouya Plateau was known as "*le refuge de toutes les fortes tetes*" (Moyen-Congo *Rapport Annuel* 1913 cited in Coquery-Vidrovitch 1972:83).

Coquery-Vidrovitch (1972) summarizes the privatisation of colonial enterprises which occurred in the AEF. Her account gives an interesting perspective on the Bateke role in this process. The colonial government soon saw that privatisation was perhaps the best way to deal with the immense and costly operation of managing a colony. Thus, large concessions were given out to various firms in the name of exploiting timber, minerals, or rubber. The largest one near the study site area was the *Société de Haut Ogooué*. Beginning in 1897, the SHO exported rubber, cacao, and timber. By 1903, there were 38 concessions; by 1920, 43. Small concessions of less than 10,000 ha were also established in the Lefini area for the extraction of rubber. All failed. Additional concessions in the Franceville area included the *Société d'Entreprise Africaine* and the *Concession d'Exploitation Forestière Africaines*. These concessions had rough working conditions; concession owners did not spend money in structural improvement. The rough life in the concessions along with the lack of local investment led to a severe decrease in the quality of local life.

Labour was in short supply and the interior populations were unruly. Pourtier's comprehensive modern history of Gabon portrays the situation well (Pourtier 1989a; Pourtier 1989b). Franceville was a 22-day walk from Ndjolé Gabon, the last navigable portion of the Ogooué River outside of Libreville. This made Franceville distant from the colonial capital and one of the least administrated areas of the colony. The plateaus were equally remote from Brazzaville, making them the least administered part of Congo, even in the 1960s (Sautter 1960). These plateaus therefore fell between the colonial administrations of Libreville and Brazzaville; parts of them would be attached to one or the other capital as needed. In 1903, Gabon was carved out of the AEF, including the Haut Ogooué Province which contained the western Bateke Plateaux area. The remote region caused many problems for the administration including a tax revolt in 1915. In 1925, the Haut Ogooué was transferred to Congo following the advice of the General Inspector of the Colonies, Picanon, who proposed that the plateaus become part of Congo to which it was economically and geographically linked—a philosophy which was part of the doctrine of "*sphere d'action*" which prioritized economy over geography (Pourtier 1989). The

inhabitants were considered to be an important labour source for the construction of the Congo-Ocean Railroad. The province was expected to supply 1,200 workers (Pourtier 1989a: 121).

Generally, there were problems not only of finding enough manual labour but also of feeding the workers, something that was not new to the French administration that had fought food shortages since the inception of the colony. Historian Jeremy Rich writes that even de Brazza's expeditions to the interior had a significant impact on the food supply in Libreville (Rich 2007). Many "solutions" were found to such chronic shortages including the importation of rice and the conscription of agricultural labour and foodstuffs from local populations. However, Coquery-Vidrovitch reports that the Bateke and the Mboshi were not eager to increase their planting areas. In 1919, a lack of a dry season in the plateaus created a manioc famine along the Alima River which continued until 1925. Rich reports that writings of priests in Gabon at that time indicate that the famine of 1924 was one of the worst that the Haut Ogooué (and Estuary) had seen in 19 years (2007:17). This caused a destabilisation of supply of the workforce and food to the concessions (Sautter 1960). Following WWI, there was a severe decrease in profits for the concessionary companies. Near Franceville, by the 1930s many concessions were abandoned.

Bateke of Congo sidelined in their former territories (1950s)

Brazzaville was established on Bateke territory but, rather than working with resident Bateke, the French brought in labourers from neighbouring ethnic groups. In Potopoto, a workers' city developed outside Brazzaville, the Bateke numbered 3,200 out of 37,800 workers. In 1950, the Bateke numbered 4,000 to the 16,000 Balali (Sautter 1966: 384). This didn't sit well with the Bateke residents, who proclaimed,

> *de Brazza a dit que cette terre était aux Bateke. Brazza a signé la grande paix avec les Bateke. Je dis, moi, aux Balali: cette terre n'est pas à toi, tu es un voleur.*
>
> Papy 1949 : 128[33]

This sentiment held by the Bateke is in sharp contrast to their position in Brazzaville society. There, they were mostly manual labourers, rarely becoming specialised workers (unlike other groups) and thus earning them a bad reputation by others (Papy 1949). In 1950, Sautter reports that the urban Bateke male population were more likely than other ethnic groups to occupy the lower posts of house-boys or manual labour; relatively few specialised in a trade (Sautter 1966: 571).

[33] These sentiments have been sung by Bateke musician **"**N'gantshie" Strervos Niarcos of Kinshasa, and descendent of the *Roi* Ngaliema, former land chief of Kinshasa in the 1880s. Niarcos sang of Bateke land loss on his album "Bateke". However, he most notably sang about the *Religion Kitende*, a cult devoted to European clothing (pers. comm. J. Trappido, 2009).

Mbé, the capital of the Bateke kingdom, was cut off from Brazzaville until the 1960s when the road was improved. Strangely, the Bateke who were once the major trading partners of the French had dispersed either into their remote and "inhospitable" plateaus or into an urban society where they were mere labourers (Sautter 1966: 384). Some consider that the Bateke lost out in modern Congo society, despite being the first negotiators with de Brazza and Stanley (Sautter 1966: 385).

Bateke of Gabon link to mineral wealth: rural exodus and demography

In 1946, the Haut Ogooué was transferred back to Gabon in the interests of providing labour for the *Compagnie Minière de l'Ogooué* (COMILOG) manganese mines, a move that they hoped would provide 2,120 workers (Pourtier 1989). The concession's effect on local demography was so negative that much of Franceville was emptied of its male population. At the time Franceville, one of the most north-western Bateke cities, contained 6,000 Bateke out of 21,000 inhabitants. The French were particularly concerned about the lack of manual labour. In a demographic analysis, it was indicated that while population growth was generally low by comparison with other African countries, the Bateke had the highest birth and infant death rates. Lotte (1953) attributed the latter result to poor living conditions in Franceville. When he looked at the role of emigration, the Bateke migration patterns did not match those of the neighbouring forest people who migrated to known centres of concession activity such as Dolisie or Pointe Noire.

> *L'émigration des Bateke a un caractère différent, qui tient plutôt à un défaut de fixation au sol. Ils se déplacent facilement dans la pseudo-steppe sablonneuse qui constitue leur habitat et s'étend jusqu'au Pool, ou Brazzaville, centre Batéké important, joue d'un puisant aimant.*
>
> Lotte 1953 : 175

Lotte goes to the extent of even proposing that concessions accept whole families as a work unit, since most men of reproductive age had already left the village. The loss of men from town and country had reproductive and social consequences as "*Les hommes jeunes et adultes qui constituent la masse migration, représentent à la fois l'élément reproducteur et l'élément social dynamique de la population* (Lotte 1953:176)." Lotte supported emigration to the city, where life was cleaner while also asking, « *comment nourrir les villes, les chantiers, les entreprises, c'est-à-dire le champ de culture démographique qui apparait rentable, si les compagnes sont vides* »? (Lotte 1953 : 179)

The role of initiation rites in regulating post-colonial society in the Haut Ogooué

The advent of colonial employment created a Gabonese class of people earning salaries for the first time, transforming village society. Georges Dupré describes a situation in the northern Haut Ogooué, in Okandja in the 1940s, where the influx of money destabilized Obamba society;

salary-related sorcery accusations increased in villages. To deal with this, a new movement was derived from the older tradition of the Ngabula cult to create the *Njobi* cult. This cult became widespread, reaching the plateaus in the 1950s; today, it is still a dominant cult in Gabon's plateau area and recently played a major part in state politics (Ngolet 2000). Informant Sebastian Naliba talks about the displacement of existing rites by *Njobi*; sacred objects were physically removed from their houses and replaced by those relating to *Njobi* (Rec-1). The creation of *Njobi* was not unusual; several other examples of cults sprang into existence at the same time (Dupré 1977; Gray 2002; Cinnamon 2002). These were attempts by the Obamba and other groups to stabilise their society in the wake of colonial interference. Some administrators advocated maintaining these societies in order to stabilise the remote and unruly interior. According to one administrator, forbidding such traditions without effective European replacements would have only been folly (Even 1937) as such traditions were essential in regulating societies. In the case of the Gabonese Bateke and their forest neighbours the Obamba, these cults included *Mungala* (or *Ongala*) and *Ngo* (Raponda-Walker & Sillans 1962).

Independence in Gabon

The 1960s was another decade of change for the Bateke of the Haut Ogooué. Gabon became an independent state in 1960, as did Congo and many other West African nations. The Haut Ogooué Province remained a part of Gabon much to the consternation of Congo, particularly as the province was the centre of several manganese and uranium mining enterprises. This led to the anti-Gabon Congolese football match riots in the early 1960s, indicating that cross-border politics entered into the local people's sporting realm (Pourtier 1989a: 134). The loss of the Haut Ogooué was also a geographical change in focus for the Gabonese Bateke. Having always been more oriented towards Brazzaville, and being a savanna rather than a forest people, the change in orientation back towards Gabon was probably strange at first. However, in 1967, Omar Bongo-Ondimba (now deceased) came to power as president of Gabon. Of Bateke origin, Bongo's home-based economic development of his native province created much more economic opportunity for the province than it would have otherwise seen had it remained in Congo (Pourtier 1989b).

Régroupement

The *régroupement* (or resettlement) efforts that had started in 1910 in Libreville finally found their way to the Haut Ogooué in the 1960s. *Régroupement* is the politically and economically motivated policy of forcing villages to "regroup" in larger settlements near roads to ensure health and education (as well as to create a controllable work force for the state). Coquery-Vidrovitch cites the Lieutenant-Governor of Gabon (1972:493) as writing to his administrators, "*Il apparait comme une nécessité impérieuse de créer des centres important de population. Vous devrez donc vous attacher à faire comprendre aux indigènes l'intérêt qu'il y a pour eux a se regrouper et à renoncer a leur traditionnel méthode de dispersion."* The reorganization and

the subsequent stagnation of space that followed in the intervening years was astounding. According to Pourtier, 4,111 villages were reduced to 770 (with 500-1000 inhabitants in each new village). According to a 1940s map from Monseigneur Adam published in Pourtier (1989b: 111), the villages in the study site had not yet been grouped and were occupying roadless areas on the map. In the 1950s many of the smaller villages apparent on aerial photos were still scattered in the remote savanna (Institut Géographique National 1954). The *régroupement* of the 1960s caused a realignment of villages along roads, reorganizing societal space. This left large voids of "uninhabited" lands in the interior of Gabon. Papy (1949) reports that the Bateke in Congo didn't like to be moved from their lands; they considered other lands to be cursed. In fact, there are several cases of local Bateke being originally regrouped to forested areas. Some groups refused the government's proposal and moved back to their lands in the remote savannas. The specific cases of the study site will be reviewed later.

Economic developments of Bongo's province and the rural exodus

Sven Wunder (2003) and others have studied the impacts of the rural exodus on Gabonese village societies. This exodus was most often related to urban job opportunities causing young and middle aged men to leave the village in search of work. In the Congolese Plateaux of the 1960s, Sautter found that in five villages he censused, the 15-35 years age group of men constituted only 18% of village populations; the number one reason for leaving the village was to find work with the Congo-Ocean Railroad (Sautter 1960). According to UN population statistics, Congo shows a steady increase in the percentage of urban population, crossing the 50% urbanized population mark sometime in the 1980s. However, Gabon's trend shows an extreme increase in urbanization between the 1970s and the 1990s, with urban population going from 32% to 69.1% (UN 2005) (Fig. 4).

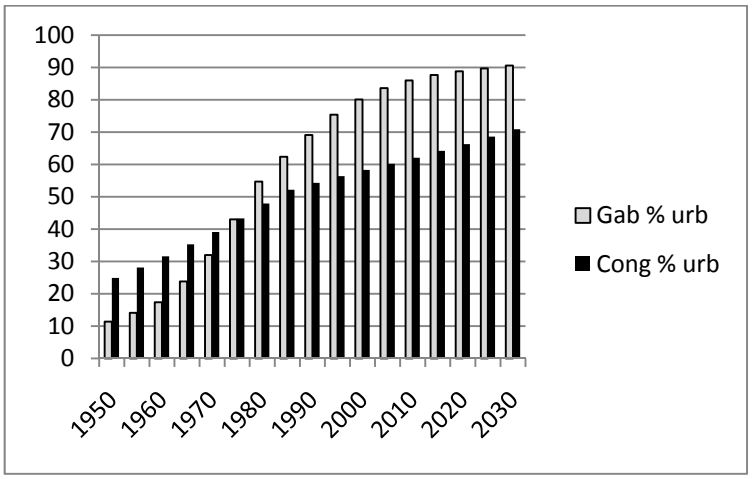


Fig. 4. Population growth statistics for Gabon and Congo (figure drawn from UN 2005 study statistics for Congo and Gabon).

Wunder (2003) writes that this surge in urbanization was driven by mining and oil extraction centres, causing the population of Libreville to double every decade since 1950. Rural

emigrants flowed steadily to the towns of Libreville, Port Gentil, and Franceville leaving most provinces in a state of negative population growth, especially for the age group of 20-45 year old men. Wunder (2003) writes that between 1950 and 1975 Gabon went from the least urbanized to the second most urbanized country in Africa. It is this depopulating of the countryside with the abandonment of village agriculture that he argues has encouraged a regeneration of forest in Gabon.

In the 1970s a series of developments in the Haut Ogooué gave the area an economic boost. According to Pourtier (1989b), these activities almost rendered the province economically independent and certainly competitive on the international market. A short summary of the economic power of the province includes two major mining operations (COMILOG and *Compagnie des Mines d'Uranium de Franceville* [COMUF]); a sugar factory; the international relay station of Radio France International; and the *Centre Intérnationale de Recherche Médicale de Franceville* (CIRMF). In 1973, Bongo-Ondimba ordered the construction of a national railroad to create not only national unity but also to give Franceville the access it needed to the capital. More importantly, it also provided a Gabonese route of export of COMILOG's manganese, which was previously exported via Congo's railroad. Thus, Pourtier (1989b) reports, these activities resulted in a 66% urbanised population for the province, with a significant emptying of the villages in the 1980s.

Régroupement and the rural exodus also contributed to the emptying of the countryside in Congo of its youth (Vansina 1973). Those on the plateaus, however, retained their subsistence economy, societal links and maintained side-by-side ideologies of western and traditional medicine (Vansina 1973). Papy saw this in a negative light, favouring the urban African ideals tempered by European contact. Papy wrote of Congo in the 1940s:

> *De Mbé à Potopoto quels saisissants contrastent! A Mbé, ou quelques cases d'argile et de branches se perdent parmi les hautes herbes, viennent palabrer autour d'un Makoko sans autorités, les chefs de village; et les sorciers y sont puissants…A Potopoto, immense ville noire, grouille tout un peuple qui leur imiter les manières d'Europe; des chefs occultes rallient les mecontents et les déracinés: comme dans toutes les villes indigènes de l'Afrique d'aujourd'hui, grandies au contact d'agglomérations européennes, s'y dissolvent les vieilles sociétés, se propagent des mots d'ordre, fermentent des idées nouvelles.*
>
> (Papy 1949:134)

As the young people left the village for the city, the village traditions were dying out, a subject that I will develop in a later chapter.

Presidential politics in Gabon and Congo *vis-à-vis* the Bateke

In terms of politics, current president (and son of recently deceased president) Ali-Ben Bongo's party, the *Partie Démocratique Gabonaise* (PDG) is naturally strong in his home province.

With every campaign, elites return to their villages to bring home the vote. With a strong sense of enabling his ethnic group, a minority in Gabon, Bongo family politics have favoured the economic development of urban centres and the nearly 100% political support of the PDG in villages. In a recent election, the Haut Ogooué gave the PDG candidates more than 90% of the vote, with urban support at 71%. In this case, the Haut Ogooué was the 3rd highest province with PDG majority in Gabon (l'Union 2008a; l'Union 2008b; l'Union 2008c). PDG politics in the Haut Ogooué are favoured by rural people; the Party maintains several representatives in each village, including one for the youth. Women are targeted through dance groups such as "*Akini Maya*" where they proudly wear PDG paraphernalia and sing the party line. This music is often heard playing, from the remotest villages to Bateke neighbourhoods to quartiers in distant Libreville. Such a dynamic exchange of economic and political advancement with the countryside has secured the President a place in the hearts of many Haut Ogooué residents. As a result, many elites give back to their village communities by providing job placement, assistance with health issues, and other basic needs. In the Department of the Plateaux in the Haut Ogooué, nearly every village has a relative amongst the urban elite who spends their vacation in the village. This presence provides links to urban services[34].

These economic and political approaches in Gabon's portion of the Bateke plateau area, something which has held sway for 40 years now, are quite different from those of the Congolese Plateau in adjacent Republic of Congo. This part of the plateaus does not incur the same favour from the current president, Denis Sassou Nguesso, who is not Bateke. Despite a marital alliance between Sassou's daughter and Bongo-Ondimba, or the succession of his son, Ali Bongo Ondimba, to presidential power in late 2009, the future of this part of the Plateaux is not as economically bright (Afrique Centrale Info 2005a; Afrique Centrale Info 2005b; Mouayini Opou 2005) as its Gabonese partner. In crossing into Congo, and only 40 km from the study villages in Gabon, one notes the immediate difference of the Congolese north-western Bateke economic position: nearly all houses are constructed with palm fronds as opposed to the aluminium construction in Gabon's Bateke villages. The latter type of housing popular amongst Bateke relatives in Gabon would be preferred in Congo if there was the financial means to do it (pers. obs. Impini, Congo). A second striking difference is the demography of these Congolese villages: there are significant numbers of young men residing outside of urban centres. This reversal of the rural exodus is potentially in response to the two wars in the 1990s, when youth returned to the villages (pers. comm. N. Mabiala), or simply that Brazzaville has little to offer in terms of employment (pers. comm. A. Ayiliga). When asked why there are fewer state benefits to the Plateaux villages, several villagers noted a lack of village-linked ministers in Brazzaville.

[34] In one case, an elite member provided all the corrugated aluminium sheets needed to reconstruct a village in another site. In another case, a school was constructed and a private teacher employed.

In the Republic of Congo, the Bateke hold a significant part of the national vote, estimated at 40%. While the *Onkoo* no longer holds political power, he continues to influence the Congolese Bateke. Vansina (1972:470) indicates that, "During the reign of Illoo I (the *Onkoo* in power in 1880), the Tio kingdom became a part of a larger whole which was to evolve into the AEF and later into the Republic of Congo. Gradually Tio political history becomes more and more unreal as the new political structure took over one function after another of government." Despite lack of a real political role in present day Congolese society, the *Onkoo* holds an honorary role of power based on the *Nkwe Mbali nkira* spirit, sometimes referred to as a "nkirocracy" (Mouayini Opou 2005: 46). In 2005, following the death of the 16th *Onkoo*, Sassou tried illegitimately to name a successor to the Bateke throne, an act reserved for the Bateke court itself. Furthermore, the candidate was a presidential magician who intended to reside outside of the traditional village of Mbé. This act outraged the Bateke who interpreted it as a political act to control their vote[35]; Sassou's "king" was soon replaced by a court-chosen successor (Afrique Centrale Info 2005a; Afrique Centrale Info 2005b). It is ironic that one of the formerly most powerful kings of Central Africa is now only a figurehead in modern Bateke society and even then only at the edges of the modern political arena. Such a play for the Congolese Bateke vote shows just how different the politics are for the Bateke in Gabon who, essentially have a "king" for president[36].

Conversion refused

The literature on missionary efforts in the plateaus is scant; however a few anecdotal observations help place missionary efforts into perspective. In the 1640s, King Garcia II Alfonso of Kongo was denied his request to Rome to establish missions in Kongo and in the *Onkoo*'s country (Battell 1901: 127). When comparing the cases of the Kongo and the Bateke, Soret states that,

> *Les royaumes de Congo qui, pendant deux siècles et plus ont été parcourus par les missionnaires, ne possédaient plus, lors de la pénétration vraie, un siècle et demi plus tard, un seul catholique. On y forgeait encore des crucifix mais ceux-ci étaient destinés à servir de bâtons de commandement. Le pays téké serait encore plus vite revenu ses fétiches, à ses ancêtres.*
>
> (Soret 1973:145).

During his work in the Mbé Plateau in the 1960s, Vansina noted that the Bateke in Congo still believed strongly in *Nkwe Mbali*, having resisted French attempts to reduce pagan beliefs. *Nkwe Mbali* is still strong in today's Congo (pers. comm. P. Linton-SIL). Vansina (1973:489) indicates that

[35] Indeed, the courting of the *Onkoo* to gain the Bateke vote had begun with the first Congolese president, Youlou (Bernault 1996: 276-277).
[36] Recently deceased President Omar Bongo-Ondimba was succeded by his son, Ali Ben Bongo in mid-2009.

> The Tio had never adopted Christianity. The under-population of the area had made the missionary effort not worthwhile until much later. Moreover early resistance had convinced the missionaries that there was not much hope. The impact of modern life on this remote plateau had not prompted the desire for a new foreign cult. In fact much had happened which had strengthened the old religion.

Papy suggests that, in comparison to their neighbouring groups, the Bateke refused Christianity and generally did not interest themselves in European things until much later (Papy 1949).

In Gabon, the plateau area was little proselytised until the 1980s, with larger missions remaining in the town of Franceville. Lékoni was only a town along the way to another mission post (pers comm. Père Alexandre, St. Hilaire Parish, FCV, March 2008). Today in the Gabonese Bateke villages, Christianity and traditional practices exist side-by-side. Some churchgoers actively refuse to use their former talents of sorcery divination while others resist the church altogether indicating that "*Njobi* is enough". Despite local claims, certain non-Christian traditional practices such as sorcery accusations and initiation rites are found in villages today. This picture does not seem that different from the one painted by Vansina in the 1960s for the Bateke villages in the Mbé area. When contrasting modern medicine with traditional belief he writes,

> The best illustration was perhaps the case of the child which was being cured by a dancing *ngaa* while the medical nurse was giving it an injection in the arm. "There may be microbes", said the king, "but my *Nkwe Mbali* is stronger than all of them".
>
> (Vansina 1973: 490)

Indeed, many in the study area indicate that when western medicine fails, they fall back on anti-sorcery and traditional methods of healing.

Ecotone cultural mixing

Ever since the earliest migrations into the study site area, the contact between forest and savanna peoples was noteworthy. In the case of the Bateke-Tsayi, their founder *Moukaga nga Kabele* was the first to enter the Chaillu forest, bringing with him the politics of Teke land appropriation. This resulted in what Dupré and Pinçon call the "Tekeisation of the forest" (1997: 66).

However, while the idea of ruling land by negotiating with land spirits did not extend greatly beyond Teke lands in general, the Teke concept of *nkani* rule penetrated into the interior forests of Gabon. The term *nkani* is fraught with polysemy; in proto-Bantu this indicates leader or judge, however Vansina's analysis of the Teke term indicates that the meaning has changed often with geography and ethnic group. In the Teke-Alima lands, the term means "chief". However, moving southward, the term takes on a feudal implication of "vassal chief". Upon entering usage in neighbouring forest groups, the term simply means "big man" (Vansina 1990).

Nonetheless, Teke political systems extended out of the savanna and reached into the heart of the Gabonese forest.

While political institutions were finding their way out of the kingdom, initiation rites were coming in. Despite *Onkila* (Dupré and Féau 1998: 242-251; Sallée 1978) being native to Teke territory (Vansina 1990: 148, 164), other rites originated in neighbouring areas. In her attempt to characterise Bateke music, musicologist Sylvie Le Bomin tried to identify music which was exogenous. Teke music is distinguished by polyphonic singing and the utilisation of the calabash as a maraca. However, certain music encountered in the Plateaux did not fit this description. Raponda-Walker, a Gabonese-English priest noted that he believed that the *Mungala* was an Obamba-Bateke male initiation rite (Raponda-Walker & Sillans 1962). However, upon closer analysis, Le Bomin was able to conclude that songs coming from the Mungala tradition were in fact of Obamba origin (2004). M-C. Dupré indicates that *Mungala* came into Tsayi territory from the north and derived from Akele traditions (Dupré 1990). This forest people's rite joins the ranks of other forest initiations and beliefs common in north-western Teke country including the *Njobi* of the Obamba.

Conservation context

A history of conservation acts in the Bateke Plateaux area

Gabon's initial protected areas were hunting reserves that had been created between 1962 – 1971 (Wilks 1990). Following the Johannesburg World Summit on Sustainable Development in 2002, Gabon established its park system, in part based on the work of American and British ecologists Mike Fay, Lee White (see Quammen 2003), and Chris Wilks (1990). Each of these people worked with Gabonese teams to identify Gabon's most important ecosystems based on transect methods surveying the flora and fauna. The most prized areas were those exhibiting high densities of animals, high plant biodiversity, or areas affording coastal protection. Social surveys were also completed (Angoué et al. 2002) in an effort to locate parks far from villages.[37]

When created, the parks severely lacked the resources to manage these areas, as the simultaneous creation was unsuspected and therefore unplanned (see Quammen 2003). With suddenly 13 parks to manage, there was an immediate need for assistance. The parks with long-term NGO and research partners are those that seem to be successful in management, research and tourism. However, despite many western aid organisations contributing funding to projects that could be carried out in the parks, little of the money was actually dedicated to park management. Gabon has recently been recipient of a World Bank Global Environmental Facility

[37] There is a debate on whether eviction occurred during the creation of new parks in 2002 (Brockington and Igoe 2006; Curran et al. 2009; Maisels et al. 2007; Sunderland et al. 2008). It is the case that certain areas that were previously reserves (but later given park status) had during their pre-park history evicted residents (Cernea and Schmidt-Soltau 2006; Schmidt-Soltau 2003). However, to my knowledge, this did not occur during the creation of Gabon's parks in 2002 and certainly not in the case of PNPB.

grant for its national parks. For the first time, a dedicated sum of money will be set aside for the parks. State-funded budgets for the parks are also slowly increasing.

Conservation acts in the Bateke Plateaux: Gabon and Congo

Currently, the *Parc National Plateaux Bateke* (PNPB) is the only park protecting the Guineo-Congolian forest-savanna mosaic habitat (Vande Weghe 2009). The Bateke Plateaux area was first proposed for conservation due to its unique landscape, its amenability to tourism (Roger et al. 2006), and the presence of unique animals (Wilks 1990). Wilks (1990) indicated that, at the time, the area was little explored noting specifically that the flora was unknown. According to Wilks' argument for protection of biological diversity, protecting animal species unique to Gabon was a rationale for conservation in the Bateke Plateaux. Wilks was a forester and keenly interested in plants and their distributions. During later work on the tree flora of Gabon, he indicated that the south-eastern forests flanking the plateaus contained species with which he was unfamiliar (pers. comm.). Since Wilk's 1990 assessment of the Bateke Plateaux area, much work has been done on the flora and this has revealed some interesting phytogeographical patterns (Walters et al. 2006; Walters et al.in prep.) including species with the same distributions as the animal for which the Gabon plateau area is considered to be noteworthy: Grimm's duiker.

Present day conservation policies differ on each side of the border. In Gabon, the PNPB has a twin goal of preserving the forest-savanna mosaic and its associated cultural heritage (PNPB Partenaires 2006). This park is still in its early phases of development but has the long term support of the *Projet Protection des Gorilles*-Gabon (PPG) which is committed to supporting anti-poaching patrols throughout the park. Other partners include the Wildlife Conservation Society (WCS), *Centre Internationale de Recherche Medicale de Franceville* (CIRMF), and the Missouri Botanical Garden. Soon, plans for a presidentially-supported research station will be carried out and ecotourism is being developed.

In Congo, there is a proposition for a cross-border park contiguous with PNPB. This would make current border conflicts with Congolese hunters in PNPB less problematic; however, the proposal has been stalled for several years owing to the presidential forestry concessions located in the proposed park. WCS-Congo is the primary partner in this new area.

In the south-central plateaus towards Brazzaville is the Lefini Reserve, one of the oldest in Africa. On its northern border, yet outside the park, the Lefini Rapids are located, home of the *Nkwe Mbali*, a site still important to the *Onkoo*. This area is overhunted by non-residents and there is talk of trying to change the park boundaries to include this sacred site. Negotiations with the *Onkoo* will be required. PPG-Congo and WCS-Congo are the primary partners of this site.

Commercialised illegal hunting is the biggest problem for PNPB (Aczel 2006; Aczel 2007a) with both the Gabonese and the Congolese implicated. Studies by WCS on both sides of the border show the importance of bush meat to the local people while also considering the commercial nature of the business (Ampolo 2007; Ikamba 2005a; Okoundzi 2004). Conservation activities in the area are presenting local people with some job opportunities. Messages against commercialised hunting are clear (Ikamba 2006). These views are accepted when concerned with hunting by outsiders in village territories; however, these are not accepted when implicating urban relatives hunting near the villages.

The pre-park landscape

Like many parks in Gabon, the PNPB landscape was long inhabited by humans (Cinnamon 2003). In the park old village forests dot the landscape; many of these villages were relocated to roadsides during Gabon's *régroupemen*t phase in the 1960s. A report (Angoué 2002 cited in Brockington & Igoe 2006) suggests that there were 89 people evicted from PNPB. However, never during the course of this fieldwork did villagers mention this. When talking of resettlement, they talked only of Gabon's *régroupement* policy in the 1960s. However, post-*régroupement* and even as recently as the 1990s, Bateke returned to their ancestral savannas to fish, hunt, and gather. Some of the savannas in which the current park projects are located are still considered to be "under the control" of present day land chiefs who now live outside the park. This sentiment is shared by villagers in adjacent Congo who claim ancestral hunting and fishing rights up to Lac Loulou within PNPB (Gami 2003: 19) and talk of days when the Gabonese and Congolese met within these areas to exchange goods. The local Bateke around PNPB talk about this landscape's history by citing names of villages, old trails, weekly markets, old hunting savannas, and places where liana bridges once crossed the Mpassa. Even if today there are no villages present in PNPB, the Bateke still remember what it was like to live there.

The Bateke historically set fires to hunt the *ntsa* (Grimm's duiker) both in and outside the area that is now PNPB. This animal is now fully protected under Gabonese law (Décret 28 juillet 1994); however, this law is rarely enforced. This species is a conservation focus of PNPB. *Ntsa* meat and horns hold a place within Bateke culture, often being a meat of choice for ceremonies. The horns serve at times for simple tools but also as whistles for driving the rain away or making music. In the past, *ntsa* was part of the bride-price.

Villages in the study

In the north-western plateau area, 10-15 villages straddle the Gabon-Congo border. This study focuses on five villages on the Gabonese side and centred on Ekouyi-Mbouma, Lewou, Kebiri, and Saaye. These villages are isolated from regular taxi service yet are closest to the buffer zone (an undelimited zone that is 5 km from PNPB boundaries). All were targets of the PNPB's recent environmental education programme and some inhabitants work for the park. Most of

the study was focused on the domains around Mbouma, particularly Kankuru Domain[38], with complementary insights from Nkomo, Vagha, and Akimi Domains. These were areas once under the colonial and customary jurisdiction of superior land chief and first *Chef de Canton* Sylvestre Kakogho (see Cabrol n.d. and Ebouli 2001). Ancillary observations and interviews were made in the nearby town of Lékoni and in the city of Franceville. Additional insights were gathered by visiting the villages of Walla, Mboua, and Malundu of the resettled Batsitsege group who were living within PNPB approximately 80 years ago. Park-related observations were made while interacting with village elders who attended PNPB meetings.

Ekouyi-Mbouma is located 30 km south of Lékoni (the regional seat of authority); it contains roughly 100 people, many of whom regularly visit relatives or have a second home in Lékoni or Franceville. As the hyphenated name suggests, it is a *régroupement* of two villages (Mbouma and Ekouyi) formed in 1967, each having had several previous village locations. Mbouma is the seat of Kankuru Domain, and the recently-deceased village chief and the current canton chief are both guardians of this domain. Mbouma is a village composed of savanna Teke-Alima, while Ekouyi is a settlement of forest Teke-Bakaningi (Fig. 5).

Subsistence practices: cultivation and foraging

Resource use: habitat and season

In this section I will summarize the subsistence economy of the north-western Bateke. Some of these sections are shorter than others, particularly the savanna hunting and gathering portions, since entire chapters are dedicated to these subjects later. Village life is still largely independent from the local and international market economies, particularly in terms of food-stuffs. While clothing, lighting, some housing materials, soaps, and metal-ware are now almost exclusively purchased in town, food is still grown, hunted, fished, or gathered. Few of these foods are sold commercially on a regular basis. These seasonal activities are summarised in Table 1.

[38] Domains are lands formerly represented by land chiefs; see Chapter 4.

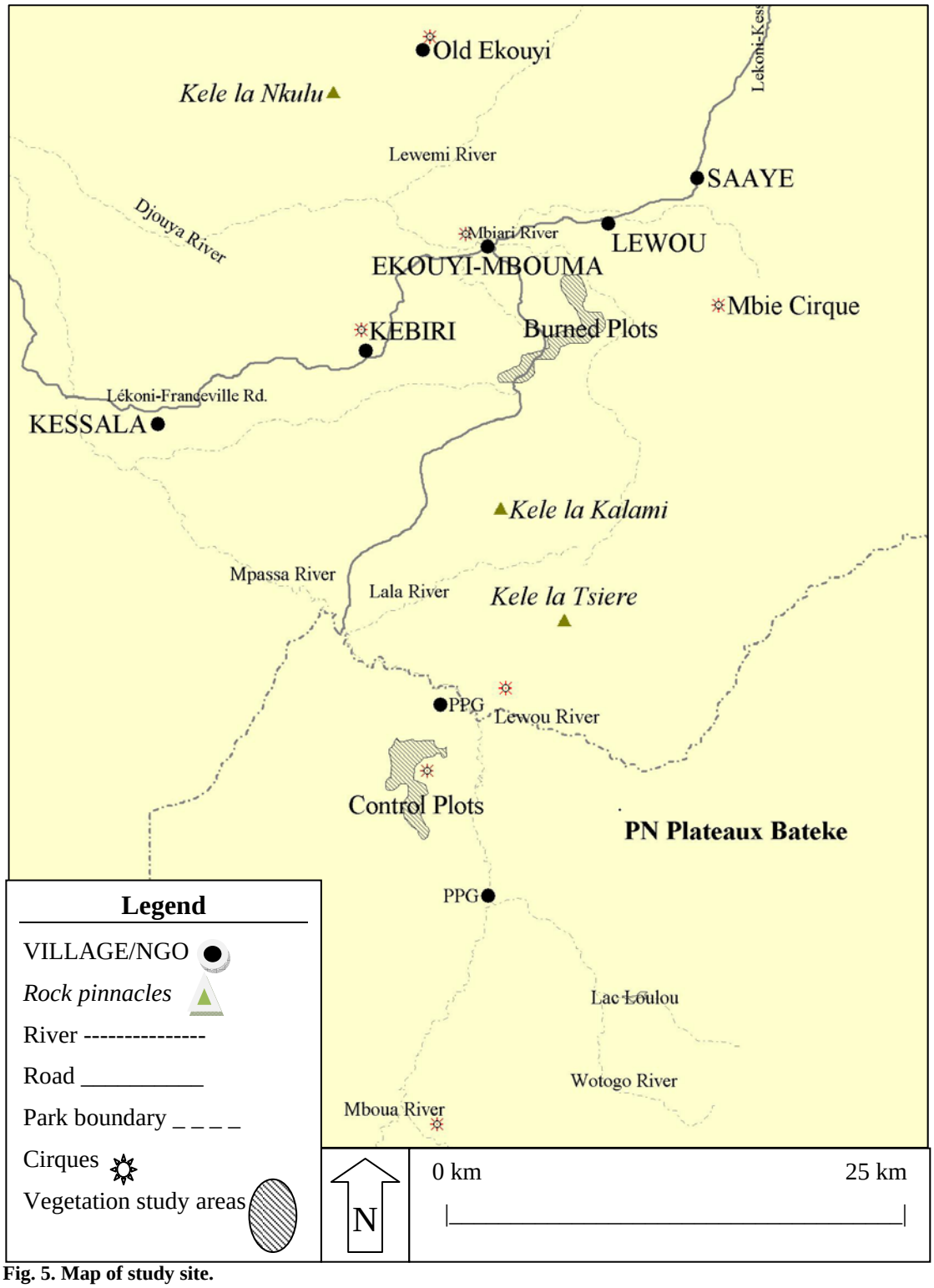


Fig. 5. Map of study site.

Month	Season	Forest Plantation	Savanna plantation	Village trees	Gather	Hunt	Fishing	Aseasonal activities
Jan.	*ma okari* (1 week dry season)				*evura* & *mpimpa* caterpillar			*nkumu*, other hunting, fishing, palm wine, palm oil, *okana*
Feb.		Harvest *ntiangui* leaves	Harvest sesame and tobacco					
March	*ma Olumi* (2 week dry-season)		Harvest peanuts	*atanga*, avocado	*Olu, nkulu, ondimba, ambroho, mfuluru ntundu*	Abdim's Stork		
April								
May					Cicadas			
June	*kassibi*	Clear small trees					Bucket fishing in savanna pools	
July		Cut down large trees. Begin harvesting last year's manioc	Harvest yams		Grasshopper	Historic *ntsa* hunt		
August		Burn dried felled trees						
Sept.	m*vula ntiumi*	Plant forest crops and pineapple			Mushroom, scarabs, yam tips			
Oct.			Clear grass	Avocado	Termites, caterpillar			
Nov.			Plant savanna crops		caterpillar			
Dec.		Harvest pineapple			Cola, caterpillar			

Table 1. Bateke Calendar of cultivation, hunting, fishing, and gathering periods

Cultivation

Cultivation occurs in several forms over the year. These seasons were well described by Vansina (1973) and this section will serve as a small contrast to his observations made in the eastern Mbe Plateau near Brazzaville. There are two large-scale types of cultivation that are conducted: forest plantations (*ngwunu*) and savanna plantations (*ntieni*). Additionally there are small gardens behind houses in the village (*obugha*). Trees are planted throughout the village.

Aerial photos of the 1950s from the study site indicate that both forest and savanna plantations were being both used as they are today (Institut Géographique National 1954).[39]

In all of Gabon, the Bateke and Obamba versions of manioc are the most prized. Non-Bateke visiting Bateke towns will buy *batons de manioc* en masse to bring home as this manioc preparation is preferable being larger and softer. The manioc preparation, also known as *chicouangue* in Congo, is the result of an intensive multi-step process. First, the roots are harvested and the root bark partially removed. These roots are then soaked in flowing water for approximately four days. On the final day, working from manioc processing stations (wooden stands erected in small rivers), women take the now-softened roots and crumble them into moist fibres which are then sifted; this results in fine wet flour which is kept for processing later. The fibres are discarded. Brought then to the kitchen, the sifted paste is first wrapped in leaves or plastic sacks and placed in a basket and cooked in a large pot. Once cooked, this paste is mixed with some manioc from the previous week's batch and kneaded three times on the *kapumba* board, a large wooden board with grooves. This paste is now fine enough for consumption. At this point, the paste is rolled into large cylinders and wrapped in leaves (*Cyrtosperma senegalense* (Schott) Engl.**,** *Vernonia conferta,* but preferably Marantaceae leaves which last longer (*Megaphrynium* sp.). The batons are now ready for the final steaming in a large pot.

In cities, manioc flour for baton production is ground in mills; however many people insist that the *kapumba* version yields a softer and more desirable product. When village women travel to cities on extended stays, they will often buy filtered manioc and process *chicouangue* batons for sale, helping pay for their visit in town.

Other products of manioc include *fufu* flour, *ndua* (filtered tuber with palm fruits, *nkulu*), fried manioc paste with sugar, and salted grilled paste *kakwo eka*[40].

Forest plantations (*ngwunu*)

These plantations are the major source of cultivated foods. These are generally jointly managed by married persons who split the labour into the male role of cutting down the large trees in the new plantation, and the female role of planting, weeding, and harvesting. Sometimes single women desiring a plantation will solicit labour from the youth or unmarried men and compensate them with food, alcohol, or money. Some members of the elite as well as city-dwellers from the village will engage the village women's association to make plantations in their absence. Additionally, some women will go into town to help their urban relatives make

[39] However, a transition from only savanna plantations to a mixed savanna-forest plantation system may have occurred in the early 1900s in response to famine (pers. comm. J.M. Ebouli).
[40] For an idea on the diversity of manioc preparations in a neighboring area in Congo, see Hombassa 1976.

plantations there or to make smaller secondary plantations for their own consumption during frequent town stays.

Early in the long dry season in June, men and women set about clearing the brush in the sub-canopy of the forest. By early July, the men begin the task of chopping down the large trees. The vegetation is left to dry and by mid-August the plantations are ready to burn. Planting begins in September or October.

As reported elsewhere in the literature (Vansina 1973, de Brazza 1880 cited in Brunschwig 1972), plantation devastation by animals is common. In the case of the study site, bush pigs regularly ravage the fields of Ekouyi-Mbouma; elephants are the main enemy of cultivation in Kebiri. In some cases, a plantation can be largely consumed by bush pigs or elephants forcing families to buy sacks of *fufu* from neighbouring villages or start new *antieni* plantations to compensate for their losses.

Crops planted in *ngwunu* include manioc (*Manihot esculenta* Crantz), three to four varieties of forest yams (*Dioscorea* sp.), calabash (*Lagenaria* sp.), small amounts of corn (*Zea mays* L.), *Talinum triangulare* (Jacq.) Willd., *Basella alba* L., *Celosia argentea* L., *Solanum* sp. (*ntiangui*) and gourds for their oil seeds (*Cucumeropsis mannii* Naudin). Extensive plantations of pineapple **(***Ananas comosus* (L.) Merr.) are planted, something that began in the 1950s. These are used for wine making. Formerly, wine was only made from the naturalised and smaller species of *Ananas sativus* Schult. & Schult. f. which is found in the forest, some hunting camps, and old village sites. Some women still gather these pineapples, which are sweeter, for wine making. This is locally referred to as the Bateke pineapple (*kantu ategе*)[41].

Due to *régroupement* policy, voluntary village migration stopped in the 1960s and villages are now permanently settled. This permanence requires a different type of agriculture necessitating field rotation for plantations[42]. In the Koukouya Plateau, Guillot (1980) notes that cash-crop agriculture was being conducted in these former village sites and, in his opinion, destroying their character. In the Ekouyi-Mbouma area, adjacent former village sites are now heavily forested. These abandoned sites were locally noted as containing the richest soil. Villagers conducted their forest agriculture (as opposed to their savanna agriculture) on a two-step rotational basis: they rotated their forest plantation sites between a riparian area called Oka (on the Oka River) and their former village-forest sites. Minor rotations to new forest plantations occurred every year within the same forest. However, major rotations back to the former cultivation forest occurred only every five to seven years, after the current site no longer had

[41]Pneapples were imported by the Portuguese by the 1600s (Russell-Wood 1998: 170), like manioc (ibid. p. 167). See also Vansina 1990: 211-214.
[42] This is more important for forest plantations since there is less forest than savanna area available for cultivation.

sufficient space for new cultivation to occur. In one portion of Oka that had been cultivated 20 years ago, a dense thicket was growing and would most likely be brought back into the cultivation cycle once it had rested for a sufficient time. Thus, during my stay, villagers in Mbouma were largely cultivating in Oka forest and were just this last year returning to the former Mbouma village site to cultivate after a period of seven years.

Savanna cultivation (*antieni*)

Following the planting of *ngwunu*, in October and November women create plantations or *antieni*. These plantations are largely for yams but may also contain manioc. This process occurs in new savanna not far from the village but outside the goat grazing zone. *Antieni* (sometimes called *apayi* or *ekala*) can be created in groups or alone. The process consists of using a large hoe to overturn the sod, creating long furrows (*ekala*) numbering about 20 in the average plantation. These furrows are then planted with at least three varieties of savanna yam (e.g. *mva*) and one variety of a tuber (*njolo)* in the mint family. Also planted are Bateke groundnuts (*Vigna subterranea* (L.) Verdc.), oseille (*Rumex* sp.), tobacco (*Nicotiana* sp.), and sesame (*Sesamum radiatum* Schumach. & Thonn.*)*. The knife which was used to divide the yam roots which were planted is left in the savanna plantations, struck in the ground, until the first leaves of the yams grow. This ensures success of the plantation.

These plantations require little maintenance. Once they are planted, they are left until the harvest period: February-March for the leaf and seed crops, and July-August for the root crops. *Antieni* are guarded against predation (particularly against bush pig) and by burning of the tall grass surrounding the plantation just after it is planted. This also avoids accidental fires later destroying the crops.

Dawn gardens (*obugha*)

Behind houses in the village, small vegetable or medicinal plant gardens are created. Vansina called these small easily-accessible areas, “dawn gardens”. These are surrounded by fences to keep the goats out, and the soil is often improved by the addition of vegetable compost. Vegetables cultivated include aubergine (*Solanum sp.)*, oseille, hot peppers (*Capsicum anuum* L.), taro (*Colocasia esculenta* (L.) Schott), and sometimes tomatoes (*Lycopersicon* sp.). Medicinal plants include non-natives such as *Sansevieria* Thunb., *njuma-njuma (Ocimum sp.),* and *Lantana camara* L. Banana trees (*Musa* sp.) are sometimes planted in these gardens to commemorate a birth. It is here that the placenta of the new-born is buried; later, when severely sick, this person may have a healing ceremony conducted under his/her tree.

Cultivated fruit trees

Non-native fruit trees are often planted in village forests. These trees sometimes indicate the former homesteads of deceased relatives. The primary tree species planted are mango

(*Mangifera indica* L.), avocado (*Persea americana* Mill.)**,** oil palm (*Elaeis guineensis* Jacq.**)**, and *atanga* (*Dacryodes edulis*) trees. Despite their scattered nature throughout the village, fruit trees always have an owner who has a right to the harvest. The harvest of these trees is normally consumed by the owner's household, but sometimes surplus fruit may be sold.

Oil palm, one of the most important plants in village life, yields many products including oil, fruit, fibre, and fermentable sap. Only a few decades ago, the cutting down of an oil palm to make palm wine was forbidden since a tree provided much more than wine. Wine was only harvested by climbing to the top and securing the sap without killing the tree. Now, oil palms are regularly cut down for making palm wine.

Gathering

The Bateke identify strongly, like most cultures, with their prepared foods: the defining dish is *nkumu ofula* with manioc. *Nkumu* (*Gnetum africanum*), a secondary forest and forest edge liana, is gathered several times a week and consumed as an accompaniment to cassava for approximately four out of seven main meals per week. Not rare in Central Africa, it is overharvested in many countries such as Cameroon where harvest bans have been considered by the government (Fondoun and Tiki Manga 2000); in the Republic of Congo, *Gnetum* is becoming scarce and harvesting is unregulated (N'zala et al. 2006: 156). In Gabon, while it is present on the outskirts of Libreville, Bateke there insist that Librevillois are not as familiar with *nkumu* and thus it remains in abundance near the capital.[43] However, the low population density in the western plateau area means that *nkumu* is always readily available. It can be gathered opportunistically; separate gathering trips can be made in search of it alone, but it can always be reached within a short walk of the compound.

Nkumu defines the Bateke of this part of Gabon for several reasons, being the meal of choice by locals and elites. It is always available, it is transportable over long journeys, being light and long-lasting, and the fine leaf shavings required for cooking are a technique that Bateke women must master in order to survive. *Nkumu* gathering and cutting sessions are social events, allowing women to socialise. *Nkumu* is prepared with insect or mammalian proteins. These foodways link them strongly to their environment, whose savanna-forest boundaries are influenced by fire and in which fire is used either directly to hunt or gather or used to encourage edible new-growth for targeted organisms.

Most people who have worked with and studied the Bateke talk most about either their cultivation or their hunting activities (Sautter 1960). Gathering is less often mentioned and never as a mainstay. Bonnafé (1987: 91-2) notes that de Brazza was much relieved when he came to the Koukouya Plateau since the soil was richer and could provide more abundant

[43] Although this is changing as city-folk are becoming familiar with it.

cultivated food than the sandy and poorer soils that he had been walking through in Teke-Alima territory. Bonnafé, despite de Brazza's attention to the cultivated foods of the Koukouya Plateau, is one of the few to look extensively at the auxiliary activities linked with Bateke diet. He describes in detail the other systems of alimentation from fruit trees, gathering of insects, and hunting, viewing them as subsistence activities that pre-dated agriculture. He notes that these activities were much more important for the Teke-Alima, whose soil and associated agricultural production was poorer (Bonnafé 1987: 212).

Aside from Bonnafé, anthropologists have often glossed over gathering. In another assessment, Soret indicates that the eastern Bateke have a food base of manioc with gathering being far less important. For him, the Bateke do not depend on gathering; he indicates termites and the *evura* caterpillar being the exceptions, and does not mention *nkumu* (Soret 1973: 223). Murdock (1959: 861), in his synthesis of African cultures, does not mention any form of subsistence other than agriculture and minor husbandry for the Bateke.[44] For Vansina, the Bateke were also primarily cultivators. The major difference with Vansina's observations of Tio diet, as compared with the Teke-Alima, is the importance of cultivated vegetables in the daily meal.

> Major crops yielded perhaps as much as 90 per cent of the total output of food. The vegetables were relatively important, since they formed part of the daily diet, but perhaps the most common vegetable was the young leaves of the cassava plant.
>
> (Vansina 1973: 113)

By sharp contrast, the north-western Bateke hold a gathered leaf as the most important: *nkumu*. While for a woman, most of a day's hours are consumed by the intensive processing of cassava roots, this primary starch is accompanied most of the time with a gathered leaf. In Vansina's analysis of the Tio in the Mbé Plateau, there is no mention of such a singularly important gathered resource. In fact, he does not mention *nkumu* at all.[45]

Gathered foods constitute a significant portion of food consumed in the western plateau area. The importance of the savanna gathered foods will be discussed in greater detail in a later chapter. Here I summarise some of the other gathered resources (see Table 1 above).

Caterpillars: seasonal caterpillars are collected in the forest and savanna and sometimes serve as significant substitutions for proteins in a meal. Sims, a linguist who worked in the Brazzaville area in the 1880s, noted numerous words for collected caterpillars differentiated by season and habitat and pointed to the importance of this particular gathered resource (1886). Vansina (1973: 130) indicated six species were gathered by the Tio. For the north-western Bateke these include: *evura* and *mpimpa* in December, *kankele* and *ntsaba* in November, *ntsienstiele* in September and March, and *mbwo*, edible larvae, all year.

[44] His assessment is a review of the literature and not based on direct observation.
[45] Nor *koko*, the Congolese equivalent term for *nkumu*.

Insects: during the month of May, cicadas (*anjie)* are dug from the ground. In July and August, several species of grasshoppers are gathered. With the first rains, small scarab beetles (*ngininga)* are gathered for the first few days only. A month later, men gather termites.

Mushrooms: There are two major mushroom seasons: March for *ambroho* which grows in the forest, and September for *tutsa* which grows with the first rains in the savannas. Additionally, there are other mushrooms which are gathered throughout the year, such as *ntende* which grows on dead wood. These are dried, finely sliced, and then added to leaf sauces.

Leaves and fiddleheads: In addition to *nkumu*, other leaves are gathered throughout the year including those of *Impatiens irvingii*, *Pteridium aquilinum* fronds, *Hymenocardia ulmoides* Oliv., *Urera trinervis* (Hochst.) Friis & K. Immelman, and others.

Stem-tips: Throughout the year, the tips of *okana*, a rattan, are cut and eaten as a "wild asparagus" (*Laccosperma secundiflorum*). In September *ntina* is gathered. This is a wild yam species (*Dioscorea praehensilis*) that grows in secondary forests and in plantations. It is much more common in Congo but prized in the western plateau area due to its rarity.

Spices and condiments: Two major condiments and seasonings are sought: *ondimba* **(***Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill.**)** and *oyigi* **(***Scyphocephalium ochocoa* Warb.**).** Both are derived from the seeds of forest trees and are processed by soaking in water and then pulverising. *Ondimb*a is used as a sauce thickener, rendering it glutinous. It is preferred in fish and mushroom dishes. *Oyigi* is used as a seasoning in sauces, and in hot pepper condiment. Villagers in the savanna will travel to Bateke forest villages in search of these two spices.

Drink-related plants: "*bois amer*" or *oyali/mwalu* (*Garcinia kola* Heckel) is used in the fermentation process of palm and pineapple wine-making. The highest demand for this product is during the New Year when the pineapple harvest is at its height. This resource is becoming scarce around the villages, forcing people to walk longer distances to obtain this product. As it a forest species, people living in this largely savanna environment must walk far. Harvesting pressure has negatively impacted other Central African populations (Guedje et al. 2007); in the study site, harvest pressure is high.

Some plants are eaten immediately prior to drinking or eating in order to render tastes either sweetened or cold. Plants which favour a cool sensation include the stem *ndoantsara* (*Piper guineense* Schumach. & Thonn.) and secondly an herb in the Asteraceae family. *Synsepalum stipulatum* (Radlk.) Engl.) is used for sweetening tastes.

Textiles: Raphia is woven from a *Raphia* species locally called *pigi.* From this species, palm fronds are also used for house construction, wine making, and edible-larvae gathering. Another

Raphia species, called *mbaya,* produces *nkulu* fruits which are eaten as a snack or with soaked manioc root.

For basketry, three species of rattan are used. *Kakaga* (*Eremospatha cabrae* De Wild.) is used for *njili* fishing nets. Two other species are used for all other baskets: *ongori (Eremospatha haullevilleana* De Wild.) and *elwo* (*Oncocalamus macrospathus* Burret). Some of these are found in old village sites or in riparian forests. However, *ongori* is sourced from the forest block and constitutes a traded commodity by the villages of Kebiri and Ekouyi, which are located near or have traditional occupation sites in the forest.

Forest and forest-edge fruits: Savanna fruits will be discussed in Chapter 6. However, some forest fruits are also gathered. These include several species of *Landolphia* called *kabu, avuma (Landolphia* cf. *bruneelii* (De Wild.) Pichon), and *ondambi.* With the addition of *Landolphia* cf. *lanceolata* (K. Schum.) Pichon from the savanna, there are a total of four edible *Landolphia* species in the study site. Another popular forest fruit is *Gambeya lacourtiana* (De Wild.) Aubrév. & Pellegr. which is brought from Bateke forest villages to those in the savanna. Kola trees are naturalised but gathered seasonally (*Cola* cf. *acuminata* (P. Beauv.) Schott & Endl.).

Hunting

Hunting is a passion for the Bateke. Since part of this study is related to the savanna hunting tradition, this form of hunting will be described in detail later. Below, I outline trapping, net, and gun hunting techniques used in the forest.

Trapping: Cable traps are sometimes set around plantations or along trap-lines. These are checked regularly. Animals trapped this way include porcupine or small gazelles.

Gun hunting: sometimes men will hunt alone in the savanna or forest with guns. These can be short excursions or long expeditions on foot, involving camping. Prey of various sizes is targeted including medium-sized birds.

Net hunting in the forest: This type of hunting is done by groups of 6-7 men. The party uses a long light-weight net (now made of synthetic materials and purchased ready-made) and dogs to hunt porcupine and small antelope. Previously, stouter nets called *awungu* were used to catch bush-pig, a craft which was introduced to the Bateke by the neighbouring Obamba forest people at a time when bush pig were devastating their plantations. Today, these stout nets are no longer used nor are bush pig caught in anything but traps or with guns. However, net hunting for porcupine continues. Post hunt, long lengths of these nets can be found drying in the sun behind houses.

Use of dogs: hunting with dogs is the norm. Formerly dogs would wear *ndimbi* bells that would aid hunters in distinguishing their dogs in the forest. Today, dogs are used to drive game into nets or to run down game that has been shot.

Fishing

Fish supplements the animal protein in diet throughout the year. While salted and smoked fish are sometimes bought in town, fresh fish is regularly caught with a variety of methods. Sometimes a solitary affair, most active fishing occurs by people working in groups.

Passive fishing: the capture of fish in the absence of the fisher by means of nets, traps, or hooks.

Lassoua: these narrow cone-shaped traps are constructed from palm fibres. During the rainy season, just before a heavy rain, dams are built across small rivers and these traps are placed within the dam to catch fish.

Kayoubi: This trap is a round cage with a one-way entry. Bait is placed inside and the cage is submerged in water to attract fish and frogs. A small door on the side aids removal of the catch.

Night-hooks: At nightfall, men will set baited hooks in small rivers to catch catfish. The lines are checked the following morning.

Nets: Small nets are sometimes installed in small rivers. These are in places of easy access where the net-owner can check them regularly, such as next to the manioc processing stations.

Active fishing: the capture of fish when the fisher is present.

*Bucke*t (*kayuba*): This can occur in rivers or in floodplains. When conducted in rivers, the river is dammed off and emptied with buckets to harvest the fish that are left behind. Often these areas are near the manioc processing stands in the river, and the walls are left mostly intact. Thus fishing can occur easily following manioc processing at the end of the day. The wall is reinstated, and groups of women will use buckets to empty all the water inside the barrier. In the floodplain, during the dry season when the lakes in the savannas and floodplains are beginning to dry up, women will dam and empty portions of these.

Stream diversion: sometimes men will make small ox-bows out of forest streams to privatise a fishing spot. Once near Saaye, a major river (the Obia) was diverted for a day by women to capture fish in the drying river-bed.

Pole fishing: This type of fishing is done throughout the year in rivers and lakes.

Noodling: searching submerged holes in river banks for catfish. Holes are located and the fisher inserts ones hand into the hole, blindly immobilising the fish's fins and stingers, and removes it.

Sometimes fishers' bodies are nearly fully submerged during this activity. This form of fishing yields large fish.

Vegetation mat searching: Vegetation mats may also be searched. Working waist deep in the river, women will uproot all the vegetation in a small stretch and simultaneously flip it over. Then, the vegetation mat is systematically searched for hiding fish.

Basket (njili)
In drier times of the year, but not necessarily during the long dry season, groups of women will go fishing with baskets called *njili*. These are essentially mats that have been folded in half and bound together to create rectangular, loose-weave baskets. The mouth is widened with a coil of liana. Small lakes and portions of oxbow lakes are dammed with aquatic plants and earth. Then, all vegetation is removed from the interior of the lake. One to two smaller *njili* are installed in these dams with their mouths facing inwards towards the fishing area. Groups of two then pull larger *njili* between them to dredge the bottom of the lake, stopping regularly to upright the basket and remove fish, frogs, tadpoles, and trailing vegetation. Every hour or so, the *njili* in the dams are "rushed", meaning that a two-some will drag their large *njili* towards the end basket, forcing some fish to rush into it. The two baskets are simultaneously uprighted and the fish removed. The final hour is spent noodling.

This type of fishing is an all-day affair requiring a group of about 8 women. All sizes of small and large fish are kept, as are frogs and tadpoles. The catch is divided evenly amongst all fisherwomen. Often fresh fish is prepared quickly over a fire and eaten just before heading home that evening.

Grazing

The north-western Bateke today are not known for their husbandry. Currently, villages only keep chickens for meat, eggs, and occasional sacrifices, and goats almost strictly for sacrifices. Sometimes goats are sold to urban West African Muslims during Tabaski (Eid). The goats are free-ranging, grazing up to three kilometres from the village.[46] For this reason, plantations, unless fenced, are placed beyond the grazing distance. Previously pigs were kept, but this was banned when the recently deceased president converted to Islam. The Bateke of Congo, by contrast, keep pigs.

Distances from village for resource extraction

For most subsistence activities, certain distances must be travelled from the village before one encounters the right habitat. Essentially, there are zones of utilisation around the village. Grazing by goats occurs in a radius of approximately three kilometres from the village centre.

[46] Goats are rarely eaten; once when hungry village dogs attacked and killed a goat, only the teenagers (one of which was the owner) partook of the meat.

Beyond this zone, forest and savanna plantations are established. Beyond the cultivation area, people hunt.

Hunting can occur up to 25 kilometres from the village, necessitating hunting camps. The main camp is 11 kilometres from Ekouyi-Mbouma. Hunting is the furthest-ranging activity of all. Some trap lines are installed in forests up to six kilometres away; these can be checked in a single day's journey on foot.

Forest resources such as *oyali* are found eight kilometres or more from the village, normally requiring overnight trips. Fishing is nearly always done on day trips and can occur at river sites within the village up to distances of three to eight kilometres. Previously group fishing expeditions were done in the dry season at the nearby Mpassa River, which is 30 kilometres from the village and now in the PNPB. There are memories of amicable encounters with Koukouya hunters and of constructing liana bridges at narrow points on the Mpassa River. These fishing excursions no longer happen since the area is now a national park. Fishing now occurs closer to the village, almost exclusively in the floodplain of the Djouya River or its tributaries.

Savanna resources are gathered at distances of zero to ten kilometres, but can extend to 25 km. Distances of eight to eleven kilometres or greater require camping overnight. Hunting at a distance on foot is difficult, requiring either several porters or smoking the meat on site in order to deliver it back to the village (Table 2).

Activity	Habitat	Distance range from village
cultivation	forest	2-3km
cultivation	savanna	2-3km
fishing-bucket	floodplain and forested rivers	Next to village, next to manioc filtering stations in rivers
fishing-cane	floodplain	2-3km
fishing-net	floodplain	0- 3km
fishing-set hooks	forested rivers	0-0.5km
gathering *Gnetum africanum* (*nkumu*)	forests and forest edge	Next to village, in plantations and during expeditions
gathering plants (*Landolphia* spp., *Laccosperma secundiflorum*)	forests and forest edge	0-9 km
gathering fruits	savanna	0-5 km
gathering (*Garcinia kola)*	forests	9-20 km
gathering grasshoppers (*ampari*)	savanna	0.5-12 km
gathering scarab beetles (*kanginiña*)	savanna	5 km
gathering caterpillars (*kankele*)	savanna	5-12 km
gathering caterpillars (*evura*)	plantation/village trees	0-1 km
grazing by goats	savanna	0-2 km
hunting	forest	Next to village to 10+km
hunting	savanna	2-25 km
rituals	forest & savanna	0-11 km

Table 2. Activities, habitats, and activity distances in the Plateaux landscape around Ekouyi-Mbouma village.

Chapter 3: Methods

Research permission, timeline, and resources

Research permission

Gabon's research policy requires researchers to be linked to a national institution in addition to having permission from the *Centre National de Recherche Scientifique et Technique*. Research permission was granted and activities were hosted by the *Institut de Pharmacopée et Médécines Traditionelles*, which houses the *Herbier National*. Permission was granted through my link with the Missouri Botanical Garden, at which I remained a quarter-time employee during my thesis. Permission to work in national parks is accorded by the director of each park. Permission to work in villages was accorded by the prefecture and the c*hef de régroupement.*

Time period and locations of the study

This study took place over a period of 18 months between June 2006 and September 2008, with two further short visits in January 2009 and January 2010. In total, 15 months were spent in Ekouyi-Mbouma village and the surrounding villages of Saaye, Lewou, and Kebiri, including one month in PNPB (constituting one to two week trips over 12 months). Two brief visits to interview forest Bateke near Boumango at Mboua, Walla, Malundu I and II were conducted in July and September 2008. Park management interviews were conducted over a period of two months in Lékoni, Lopé, and Libreville, Gabon and in Lékana, Republic of Congo. To understand the extent to which findings from this study were relevant to the heart of the Bateke Plateaux in Congo, visits to Impini, Lékana, and Djambala, Republic of Congo were conducted in May 2008.

Resources consulted

During the course of the study, various libraries and archives were consulted including, in France, the *Centre des Archives Outre-Mer*, Aix-en-Provence; the *Musée National d'Histoire Naturelle* (*Phanérogamie* and the *Bibliotheque Centrale*), Paris; the *Institute National de Cartographie*, Paris; the School of Oriental and African Studies, London; the Royal Anthropological Society Library, London; and the British Library, London; the *Centre Culturel Française de Sainte Exupéry*, Libreville; Omar Bongo University's Department of Anthropology, Libreville; the Law Library of Patrice Christy, Libreville; and the Prefecture Archives, Lékoni. I also consulted the herbaria and botanical libraries of the Missouri Botanical Garden, the National Botanic Garden of Belgium, the Royal Botanical Garden Edinburgh, the Royal Botanic Garden Kew, and the Herbarium Nationaal Nederland-Wageningen. I also consulted the personal library of Paul Latham in Dunkeld, Scotland.

Study site selection and field assistance

Site selection for village base

The village from which a large portion of this study was conducted was selected based on observations during previous botanical work in the area, conversations with local people and input from long-time residents employed by NGOs active in the area. I am particularly indebted to my friend, Onas Egiles, for his organisation of my first contacts in that village; we first became friends during a mission to PNPB in 2001. The village, Ekouyi-Mbouma, was first visited during the pilot study phase of the project from June-September 2006. During this time, I focused on learning the language, gaining confidence of the local people, and participating in gathering activities. I also located vegetation study areas near the village.

Sites for vegetation studies

Vegetation studies were conducted in three sites and are referred to as the forb-study, the fire-manipulation study, and the control. These sites were used to evaluate both forb diversity and post-fire re-growth of *Hymenocardia* sprouts. The site history of each of these areas is described in the relevant chapters.

Field assistance

The village fire practices survey was conducted over a period of five months and largely under the direction of Stevens Touladjan, a member of the Obamba ethnic group and hailing from a village whose people are distantly related to the chief's family in Ekouyi. S. Touladjan translated during interviews and transcribed them later into French. Loic Makouka assisted in making contact with the Bateke of Mboua, Walla, and Malundu I and II. He translated interviews and videoed others, later translating some of them. During these formal interviews, gifts of drinks (a custom) were given. Additionally, participants were given photos and copies of the recorded interviews (and even copies of the film made in Mboua by L. Makouka).

Vegetation surveys were assisted by Djo Kewemie. He also translated several interviews with his father, Mbouma's then village chief and one of the guardians of the Kankuru Domain.

Marcellin Nkabi organised and translated interviews with the elders of Ekouyi and Lékoni. He also supplemented these interviews with personal insights later when I interviewed him. Similar assistance was given by Marius Assieme of Lewou village when working with their elders.

Social methods

Participant observation and informal interviews

Despite having a central village base in Ekouyi-Mbouma, I also worked in the nearby villages of Saaye, Lewou, and Kebiri. Informal interviews happened all the time and in every place,

including in my kitchen, in other people's kitchens, at water sources, during car-rides, and on gathering expeditions. I tried to participate in the events that represent Bateke life on the plateaus; this included attending or participating in the following: one funeral (Saaye), one mourning ceremony (Ekouyi), three *retraits de deuil* (two in Lékoni, one in Ekouyi-Mbouma), several births (Lékoni), one *ndogho* ceremony, two *Njobi* plantation dances, Christmas at Ekouyi-Mbouma, New Year's celebrations at Lewou with members of the local elite, two independence-day celebrations in Ekouyi-Mbouma, and several political events (30th anniversary of Akini Maya, campaign and election of the *Conseil Départementale*, the governor's fete in Kebiri).

For the first five weeks of field work, I lived in part of the *chef de canton*'s compound, in a corrugated aluminium house. During this time, I had my own compound constructed of palm fronds. This compound was located in between the *chef de canton* and the *chef de régroupement's* compounds and right on the edge of the Ekouyi-Mbouma village boundary. This central placement allowed me to participate in village activities. I cooked most of my own meals but also shared meals with the Ongassia family around their fire. My meals were a mix of western and Bateke foods. At first, I drew my own water from a nearby source using the Bateke method of transport via basket. I also washed my clothes and dishes in the streams designated for these purposes. Later, I employed people to assist me with dish washing and laundry as these seemingly simple tasks took too much of my research time and I, unlike most Bateke, lived alone (and therefore could not share the workload with a whole compound). The local cash infusion to the village was appreciated. From these experiences I know a little bit about the effort required to live in the area and much about the challenges of living in aluminium or palm housing.

My understanding of park-village interactions is based on conversations with friends and colleagues who work in PNPB (both Bateke and non-Bateke), and by attending three park meetings that were also attended by local chiefs (two in Lékoni and one in Lékana). I also hosted at Ekouyi-Mbouma on at least five occasions researchers on birds and insects, a guidebook writer, as well as a visit by Gabonese artist Georges Mbourou who conducted part of his arts-in-the-parks tour from Ekouyi-Mbouma.

My understanding of land-fertility rituals is limited due to initiation and gender barriers as well as the rarity of ceremonies conducted. Many land-fertility ceremonies are for male initiates only. I was able to attend two public *Njobi* plantation ceremonies (October 2006 and October 2007) but, other than this, all of my other information on ritual comes from informal discussions with willing informants (related to *Ambwongo, Okoo,* and hunt-related magic). My understanding of sacred landscape places (and their relation to land fertility) also comes from informal discussions with informants. I specifically did not request to see sacred places or

attend certain ceremonies since this request would have been perceived as inappropriate and potentially causing environmental catastrophe. Considering the ecological imbalance perceived by the villagers during the study period, my requests might have led to conclusions linking me to decreased environmental productivity. Similar things had occurred in the past with visitors; to this day people believe that the *mamiwata* have abandoned several cirques due to the actions of a foreigner in them. Other limitations in observing public ceremonies come from the fact that many are now practised infrequently, at best every few years. Thus, most ceremonies were not conducted during the span of my thesis research in Ekouyi-Mbouma.

My understanding of health issues is based on my friendship with the village nurse, Nadège, facilitation of several medical evacuations to Lékoni (involving the residents of several villages), two hospital transfers for births, and participation in two *Onkila* ceremonies (one treating the psychological issues of mourning and one treating physical pain).

My understanding of rural-urban family links comes from being welcomed into the second homes of villagers and their families in Bongoville, Libreville, Franceville, Lékoni, and by their relatives in Impini and Lékana in Congo. I interacted with relatives visiting from the United States as well as the Gabonese mining town, Moanda. I often met with villagers and members of the elite in Libreville, Lékoni, or Franceville to understand their stories and update them on my activities. Visits by my husband, brother, colleagues, and friends offered the villagers a view into my life. Some Bateke friends in Libreville are frequent invitees to our home north of Libreville.

My understanding of foodways is based on direct participation in wine making, fishing expeditions in Saaye and Ekouyi-Mbouma (bucket-emptying in ponds and rivers, catfish noodling, cane-fishing, and *njili* fishing), gathering and cutting of *nkumu* for village celebrations, and gathering of grasshoppers, caterpillars, mushrooms, and plants. My savanna yam plantation is in its third season. And while I am adept at filtering manioc flour, I cannot yet manage to knead the flour into batons on the finely crafted *kapumba* boards.

It is these experiences, besides the everyday ones, upon which I base my general observations of Bateke life. I made daily entries into an Access database organised to record village activities, gathering activities, weather, research activities, and journal entries. This resulted in more than 800 entries (some are simple entries, others lengthy); I draw upon these to enrich my understanding of Bateke life. For a lexicon of Latege terms, see Appendix 7.

Formal interviews

Formal interviews were conducted with 38 people. During these interviews, I always had an interpreter, one of four people: L. Makouka, S. Touladjan, M. Nkabi, or D. Kewemie. This process allowed me to understand the language, but also to allow these translators to recount to

others what I was talking about with elders. These interviews were recorded. Later, for the interviews at Mboua, Walla, and Malundu I and II, L. Makouka verbally translated these to me as I made notes. All the others were transcribed by Stevens Touladjan.

Some interviews were conducted as "driving interviews" whereby we transported elders to various sites relevant to the interview topic so that they could better explain Teke human ecology. This work was done with a translator on site and then was later transcribed. These are referred to in the text by code and listed in Appendix 2. The names of all informants have been changed in the text since prior to thesis submission I was unable to request my informants' permission for their use.

Surveys in villages

To understand the current and historical savanna resource utilisation and burning practices in the study site, a survey was conducted in five villages from May-October 2007, including Ekouyi-Mbouma, Kebiri, Lewou, and Saaye. The initial questionnaire was tested in a nearby village outside the study site (Abouyi) in February 2007. This survey constituted 122 respondents aged 16 and older; the refusal rate was less than 5%. Respondents were split almost equally between male and female. Given the small size of the study population, these results were analysed using descriptive statistics.

Presenting results and collaboration with the Bateke society in Gabon

Recent works on TEK and the impact of these studies on local people have highlighted ways forward in documenting and using local knowledge (Shackeroff and Campbell 2007). This literature suggests not only collaborative research agreements with the community but also discusses the utility of the research to the community itself. They propose scientifically collaborating with the community in question.

Throughout the fieldwork for this thesis, the process has been conducted in collaboration with Bateke people on many levels. First, the local authorities granted permission for the study to be carried out in several villages. There were expectations by the Bateke community that this work would explain the importance of burning in their society and how it might be useful for managing the nearby park. The communities in question shared much information with me; during this time, several people became key informants. Later, some of these people contributed to ideas that enhanced the research and have helped in the development of new avenues for research. This has resulted in the beginnings of scientific collaboration (see Chapter 9). It is recognised that the social data and observations presented here belong to the Bateke people. My interpretation as a westerner is limited but enhanced by their contributions to interpretation and active research. And in one case already, I have co-published with local people, recognising that it is their knowledge that I am in fact publicising (Walters et al. 2008).

Some future publications will be co-authored with local people, and they will form part of a scientific collaboration to further some of the work done in this thesis, constituting what Shackeroff and Campbell (2007) indicate as "true collaboration" (e.g. Watson and Huntington 2008). This kind of collaboration, already experienced in this study, has elucidated certain perspectives of Bateke history. Particularly useful were the translations and discussions with S. Touladjan and L. Makouka. In Appendix 2, you will see that several of the recorded interviews are based on Makouka's work. Without this collaboration, understanding of the Bateke of Boumango would have been limited. Furthermore, this kind of collaboration will help one avoid viewing results in a context relevant only to the primary investigator. Finally, the community's voice is better represented by having the members of the community participate (see Bannerjee and Linstead 2004). In the course of this work, several other local social scientists and historians were encountered and a new collaboration is occurring (see Chapter 9). Results of the study were presented to the villages in the study site in January 2010 (Walters and Touladjan 2009).

Botanical and ecological methods

Botanical vouchers and synonymy

All non-cultivated plants referred to or seen used were collected, pressed, and recorded according to standard botanical procedures (Liesner 1995) and initially identified at the *Herbier National du Gabon*. Full plant identifications were completed at the Royal Botanic Gardens Kew, the Missouri Botanical Garden, the National Botanic Garden of Belgium, and the Herbarium Nationaal-Wageningen, Holland, where vouchers were deposited (Appendix 5).[47] New species and records were added to the ongoing checklist for the area (Walters 2007a; Walters in prep. a) as well as an upcoming publication (Walters et al. in prep. b). Cultivated plants were sometimes collected and identified if they were not commonly known. Common plants such as pineapple, avocado, and oil palm were not vouchered. Many of the cultivated plants were identified with the aid of works on cultivated plants in Africa (Grubben and Denton 2004; Latham 2004). Plant names were checked against Missouri Botanical Garden's online TROPICOS database for spelling and nomenclature (www.tropicos.org). Synonymy follows the Gabon checklist (Sosef et al. 2005). Family and generic circumscriptions follow the Angiosperm Phylogeny Group (Stevens 2001). Within the same section of the thesis, I indicate the full botanical name first but follow this with the genus abbreviated followed by the specific epithet. For example: *Hymenocardia acida* will be abbreviated as *H. acida*. The first mention of a botanical name includes the author. At all time when the name is used subsequently, the author is omitted (unless in a chart). Vouchers for most species mentioned in the text are in Appendices 4 and 5.

[47] The distribution of vouchers depended entirely on whether the vouchers were fertile, how many there were, and where the identification was made.

Ecological methods

In keeping with a more ecological approach to writing the vegetation chapters, methods relating to those parts of the study are described in these chapters. In terms of the vegetation structure study (Chapter 8), replication of the fire treatments would have been desirable. However, given that this was a multi-disciplinary study, I was unable to do this. True replication would have required so much time that the thesis would have focused strictly on community ecology and fire (or had to hire several field assistants). Given these restrictions, I hope I have found a balance between the two approaches.

Chapter 4: "What is the Chief thinking?": former fire-setting and the land chief system

L'identité Teke, elle, se fonde dans une technique politique d'appropriation de la terre.

Dupré 1997:184

[The fire drive], *c'est pour les Bateke le meilleur moment de l'année.*

Sautter 1960:28

Introduction

The first written descriptions of the landscape of the Bateke plateau area talk of vast savannas dotted with woodlands and riparian areas; this landscape suggested to many first-time observers that the forest once was far more prevalent than at the time of their writing.

> *Lorsqu'on voit les opulents tronçons de forêts concentrés sur les pentes des vallées, aux bords des fleuves et des rivières ou en étroites lanières sur les plateaux autour de villages, on ne pourrait se rendre compte de leur présence, sans avoir la conviction que toute la région, les plaines élevées aussi bien que les gorges, furent d'abord garnies de forêts. Ce défrichement systématiquement pratiqué, suivi de l'incendie non moins systématiquement répété des herbes, c'est la double cause de l'aspect dénudé de ces vastes territoires; l'un les déboise, l'autre les empêche de se reboiser.*
>
> (Dupont 1889 cited in Sautter 1966)

However, if one looks beyond perceptions by outsiders and investigate landscape views and local burning practices with informants, a more accurate picture of what was occurring in the Bateke biocultural landscape might emerge.

The Teke-Alima push into the forest-savanna mosaic

Savanna fires have occurred in the Bateke Plateaux areas since at least 2100 BP (Schwartz 1988). However, there is limited information on who was burning and how this was conducted. The Teke-Alima migrated into their present day area only in 1840. How was savanna burning conducted at that time? Having been pushed westward by the Mboshi, the Teke-Alima themselves displaced the Ndumu who were then in the Lékoni area on the Lower Mpassa River. However, the Upper Mpassa, where the groups in the study area settled, was uninhabited at that time (Deschamps 1962: 58). It is difficult to say what sort of fire practices the Ndumu might have had when they were resident in the Lékoni area; some argue that the Ndumu are related to the Teke linguistically and culturally (Ebouli 2001) and therefore it is possible that they would have had similar savanna burning practices. Despite this lack of information, there is much to

be said about the various fire practices employed by the eastern Teke, practices which are very similar to those that were used only 40 years ago by the Teke-Alima of the study area.

Perceptions of Bateke fire by European explorers

Early explorers of the Bateke Plateaux area in the 1880s were struck by the many uses of fire in the landscape. In de Brazza's dry season crossing of the plateaus between Franceville and Brazzaville in 1880, he repeatedly noted observations of fire-use in his c*arnet de route* (Brunschwig 1972). His descriptions discuss the link to the ecosystem; de Brazza even notes the sheer beauty and his amazement at large fires. Nearly all of his observations, those of an outsider who didn't speak the language, are applicable today.

On July 5, 1880, near the Mpassa and Lewou Rivers in the study area, he notes the hunting food chain produced by the Bateke fires:

> *Les Bateke, à l'époque ou les herbes sont sèches et qu'on les brule, chassent le gibier, refoule, ainsi dans la brousse. En même temps que les hommes tous les éperviers se mettent en chasse des petits oiseaux et les hirondelles en chasses des insectes.*
>
> (Brunschwig 1972: 20)

A week later on July 17, he discusses the problem of tall grass hiding potential attackers:

> *Aux approches du village on voit une vallée fait de main d'homme entre deux talus en terre comme défense. La broussaille et les hautes herbes non-brulées empêchent de voir a cote et on est a la merci des gens qui seraient embusques derrière le talus…*
>
> (Brunschwig 1972: 22)

One month later, de Brazza is still trying to figure out what all this burning is about. On August 13, he writes,

> *Nous passons dans des herbes que le Chef brule. Est-ce que c'est un signal, est ce que c'est pour dégager la route au retour? Qu'est ce que le chef a donc dans sa tête?*
>
> (Brunschwig 1972: 38)

On August 15 when de Brazza is on a several-day walk with Chief Ngampo, de Brazza talks of the show that a fire makes, praising the sounds and sights of the flames:

> *Le chef se repose dans une petite brousse de 80m de diamètre au milieu de très hautes herbes. Le chef a brule toutes les herbes sur nos derrières pour dégage [la] route pour notre retour. Pendant que nous nus reposons et mangeons, le chef envoie bruler les herbes. Mais le fils du chef a mis l'herbe tout au tour de la brousse et c'est un beau spectacle entoure par le feu dont la flamme monte à 5 metres de hauteur,*

> *c'est un bruit épouvantable produit par l'éclat de l'herbe entre les nœuds de l'herbe qui est presque aussi grande que des roseaux.*
>
> (Brunschwig 1972: 40)

Guiral describes the dry season fire-drive in a negative light:

> *Les Bateke se livrent aussi à des chasses moins nobles. Vers le mois de septembre, quand les prairies sont desséchées par le soleil, ils mettent le feu aux herbes en ménageant, du côté d'ou vient le vent, un petit espace ou ils posent des filets maintenus sans une position verticale par des bâtons fiches en terre de distance en distance. Une foule de petits rongeurs, qui habitent les prairies, pousses par l'incendie, se rassemblent dans l'espace réservé ou l'on a tendu les filets, et sont massacrés sans pitié.*
>
> (Guiral 1889: 154)

Through these quotes, it becomes clear that de Brazza and Guiral were viewing Bateke burning through multiple lenses. They saw how it was used and noted its links with bird ecology; however there was some misunderstanding of the purpose and effect of the fires. De Brazza's "What is the Chief thinking?" is a good place to start analysing the historical use of fire in the plateaus. To do that, one must understand the way in which the fire-drive worked, how it was controlled by the political system, and its link to land fertility. This next section will describe burning and the political system in the 1880-1960 period in the wider plateau area.

Tenure and resource-access in wider Central Africa

In the case of the study site, land tenure is linked to how burning was controlled. This section will explore the connections between tenure and burning within the framework of how collective tenure worked. Biebuyck (1963b: 86-90) gives a summary of common land tenure practices in Africa. Generally there was an interweaving of land rights, including who has rights to allocate land to strangers, rights to cultivate, rights to the harvest, and rights to planted tree harvests. This was compounded by inheritance rights and the hierarchy of the political system. Biebuyck indicates that the present tenure systems include a mix of modern and past subsistence strategies including hunting, gathering, cultivation, and animal husbandry. These represent the integration that these societies achieved when facing past changes in economies; rather than fully switching livelihood activities, they integrated new techniques into their existing ones.[48]

Communal land was often divided into units. In this study I will refer to the domain which, in the context of the study site and adjacent areas, was ruled by a land chief who regulated

[48] This form of integration was mapped out by Vansina (1990), who indicates that the migration of Bantu-speaking peoples was facilitated by the successive integration of new forms of agriculture, such as banana cultivation, as well as new gathering techniques appropriated from the local people.

resource-use. The domain was linked to the community's ancestors and therefore constituted a magico-religious space. Lands were used by the collective; tenure was at the same time communal and individualistic. Biebuyck (1963a: 14) describes it as,

> *Communautaire dans le sens que les droits individuels dépendaient des relations sociales et l'individu et de son appartenance a un group ayant son organisation sociale propre; 'individuel' dans le sens que, a tout moment, des personnes particulières avaient des droits définis de participer a l'usage et de partager le produit de lopins de terre particulaires.*

Use cannot be understood without understanding either the historical, lineage-based context. Summing it up, Biebuyck (1963a: 1) states:

> *L'association étroite entre la terre et une communauté composée par les membres défunts, vivants, et à naitre des groupes titulaires de droits et qui est condensée dans cette affirmation devenue classique d'un chef Nigérien: 'je conçois que la terre appartient a une vaste famille, dont de nombreux membres sont morts, quelques un sont vivants et d'innombrables sont à naitre.*

In Vansina's description of the Kuba land tenure system from southern Democratic Republic of Congo's Kasai region, he discusses a system very much like the Teke one but which lacked an ancestor cult, having only a nature cult called *ngesh*. Vansina indicates that the Kuba Kingdom operated like a "federation of tribes", with villages being composed of several matrilineages belonging to different clans. The village was the smallest political unit and, as in the Teke system, was grouped with other villages into chiefdoms. These areas were delimited by natural features such as rivers and forests. The individual had cultivation rights, plant products always belonged to the planter of the tree, and game reserves belonged to the matrilineage. The gains from collective hunting and fishing expeditions were shared according to the participants' roles. Land was not attributed to foreigners. A difference here is the lack of an obligatory part of the hunted animal to be given to the land chief, as in the Teke system. However, tribute did exist on other levels for the Kuba, being paid in two forms: royal tribute to the king in the forms of elephant tusks and leopard skins for the right to occupy the land, as was done in the central portion of the Teke kingdom, and an annual tribute of foodstuffs given to lower chiefs to maintain the political system (Vansina 1963). Among the Teke, in contrast to the Kuba, the presence of a Teke ancestor cult is significant and will be addressed later.

In Soret's (1963) description of Kongo tenure in the south of the Republic of Congo, he describes a system based on lineages which was very similar to that of the Teke system. The main difference was that the king had absolute power over all lands and, when princes died, their domains reverted back to the king. However, the god-king type of power became decentralised after war with the Portuguese and invasion by the Yagas (Vansina 1966: 64-69), and was further weakened by village resettlement and population increases.

Soret (1963) discussed how the Teke reacted to the invasions by the Bembe and Balali-Bassoundi-Bakongo into their southern lands; the Teke always ceded lands, often accepting small payments such as a calabash of palm wine and only asking for rights to visit their dead. He cited the specific cases of recent Teke losses on the left bank of the Djili River and of the Bassoundi obtaining the source of the Lefini, the river which contained the *Nkwe Mbali*. However, in cases where the domain was lost long ago, the cemeteries are forgotten, as happened on the right bank of the Loufoulekari River. Soret likened these exercises of Teke ceding domains to newcomers to the French legal concept called *bail emphytéotique,* or a 99-year lease. The user has all the rights of an owner for 99 years, but afterwards the domain reverts back to the owner.

Among the Nzebi, a matrilineal group of the forest-savanna areas of south-central Gabon, territorial domains (*itsuku*) were also delimited by forests and rivers. Here, there was also a layering of usufruct rights to the domains, which was overseen by the village chief and the clan chief (Jean 1975). Mwiri, a male initiation rite, was seen as being key in regulating resource overuse, creating "local nature reserves" where hunting and fishing activities were forbidden for years at a time (Raponda-Walker and Sillans 1962). However, there seems to have been a distinct absence of hierarchy of any level higher than the local territory, the Nzebi having a more forest-type organisation as opposed to that which is more common in the savanna kingdoms.

Political power and the appropriation of landscape of the Teke-Alima of Gabon

The above examples place the Teke system within a comparative context of similar savanna land tenure systems among neighbouring peoples. The specific example of the north-western Teke landscape organisation will be described in detail including the spatial, political, and cosmological dimensions as they relate to natural resource use, particularly that involving savanna burning.

Amaya Mokini: source of western Teke power and domain partitioning

I have already shown the effect that Amaya Mokini had on the decentralisation of the kingdom at Mbé (see Chapter 2). The power of Amaya was so effective that even the *Onkoo* was reported to come to Amaya, an act which seemed to serve to reorganise power (see Dupré and Pinçon 1997). Cabrol also argues that the area between Lékoni and Abala was the birthplace of the Bateke Kingdom in the 13th century, an area not far from Amaya Mokini, and that it wasn't until the 16th century that the power of the *Onkoo* rose to unite the Bateke of the plateau with the Bateke of the river. Thus, Amaya becomes an important place in Teke history (Cabrol n.d.) and a reference point for the Teke-Alima of Gabon. It is there that many elders report having paid visits in the past to sort out problems. It remains a place of great mystery today. The stories of

this place are kept by the *ebaningi*, the former emissaries of the *mfumu antse*, or supreme land chief. They are the repository of the origin story of Amaya, the place where *mpu* or power was created and the place of Bateke primordial emergence (Le Bomin 2004). According to Village Chief Onkagui of Saaye, "This is the fundamental power for all the Teke" (Rec-2). It was from there that the Bateke domains were first divided.

The decentralised north western Teke system: Bateke outside the authority of the *Onkoo*

Unlike the centralised political system of the eastern Bateke, united under the authority of the *Onkoo*, the north-western Bateke were decentralised and did not recognize the *Onkoo* as a major authority (Deschamps 1962: 63). The north-western Bateke used the *nkani* system of chiefdoms, which was based on an initiation group that ruled small associations of village communities (Ebouli 2001). These communities were organised on the basis of domains or *ntse*. Each domain had a chief, as indicated on early explorer maps from expeditions to the Bateke Plateaux in the late 1800s. In one map, showing the rivers Alima and Ogooué between which the Teke-Alima live (then and now), numerous domains (*ntse*) are noted with the proprietor's name listed (Pobeguin 1888). These domains refer to the territory over which the land chief, or *ngantse*, presided (Vansina: *Ngáantsii;* Sims: *Nganscie*; de Brazza: *Nn'ga-ntché)*. The land chief was the person in charge of a particular domain and responsible for protecting the area from witchcraft, authorizing hunting and burning privileges, settling disputes, and collecting tribute. According to Vansina (1973: 323), "The authority of the squire [land chief] derived from the 'unbreakable mystical bond' which had always existed between the squire and the nkira [land spirit] of the domain".

This system, which was largely decentralised, was perceived by some outsiders as evidence that the north-western Bateke lacked unity as an ethnic group, with chiefs really only having power over their own domain (Badier 1929). However, the inhabitants within a domain were perceived to be tightly knit, as expressed in de Brazza's observations

> *Les habitations sont disséminées; le ravin profond ou le cours d'eau est la barrière opposée ici aux entreprises des voisins. C'est aux frontières naturelles de son district que le Bateke défend ses plantations et son village. De la son habitude d'une plus grande dépendance sous un chef; de la cette cohésion des habitants du même ntche (terre).*
>
> (de Brazza 1887: 56)

De Brazza (1888: 341) also reported that there were often disputes between domains and gave the example of the people of N'jayole's Domain who didn't venture onto the domain on the right bank of the Lékoni River.

While the north-western Bateke were not unified under one ruler, they were unified under their land chiefs. According to Ebouli's work, there was a hierarchy of rule. The basis of the rule was the house, or localised lineage (*ndzo*). Several lineages were grouped into a village, or *pugu*. These villages were then grouped into a domain. These domains were ultimately grouped into a country, or *kasi* (Ebouli 2001). At each level of the hierarchy, there was a chief. However, in terms of the domain system, I will consider only the land chief and the supreme land chief.

Hierarchy of rule and domain organisation

The land chief ruled his domain but also was ruled by a supreme land chief. Informants often compare the present day state system to the customary one; one informant indicated that the supreme land chief was like today's *chef de canton*, who administers numerous villages.[49] This comparison is pretty accurate when looking at the arrangement of Teke-Alima domains in the late 19th century. According to archival documents, the current villages and expanse of the Canton Djouya correspond almost exactly to the lands once ruled by a supreme land chief. Ebouli (2001: 97-101) noted that at the end of the 19th century, there were 3 *kasi* occupied by the Teke-Alima in Gabon including:

- *Kasi* M'Bongo including Bongoville-Lékoni comprising six domains and 41 villages
- *Kasi* Kakogo including Akou-Kessala-Mbouma-Saaye comprising three domains, 16 villages
- *Kasi* Piti towards Akieni comprising six domains and 38 villages

Kakogo, the last supreme land chief of the study site, ruled over three domains and associated villages including:

- Domain Akou: villages Akou (Opana) and Leba
- Domain Kessala: villages Kessala, Mbie, Kalami, Keouaga, Kiga, Lehou, Eouono, M'boua, Ossuona
- Domain Bouma-Saaye: villages Saaye, Bouma, Ekouyi, Ossele, Tchoulou

There was a status difference between the ruler and the ruled (Ebouli 2001: 46), defined in terms of initiations, power, and who paid tribute to whom. Tribute was one of the most remembered rights of the land chief reported by informants. Even if someone said little else about the land chief, they almost always said that a hind-quarter of a hunted animal must be given to him.

[49] The *canton* is a political unit introduced by the French colonial government; it is under the authority of a *chef de canton*. This will be explored later.

The *oulwa* and the number of domains

The overriding symbol of the land chief political system was that of the *oulwa*, a metal torque worn by the supreme land chief. This ornament figures in de Brazza's photos of the *Onkoo* at Mbé and can be seen in private collections (Dupré and Féau 1998). The original *oulwa* were made by the *Onkoo*'s blacksmith. Each tooth represented a domain under the control of the wearer of the torque. Thus the *Onkoo* wore a 12-pointed *oulwa* representing the 12 domains under his command on the Plateaux Mbé (Dupré & Féau 1998).

Dupré and Féau give an analysis of the evolving fashion of the *oulwa*. When the Congo River became a stronger centre of trade and there was an influx of wealth that destabilised the traditional economy, the *nouveau riche* were able to buy *oulwa*. For example, de Brazza noted in 1880 that he had seen a torque worn by Ngascumo, someone who was not a supreme land chief. This led Dupré and Féau (1998) to conclude that the *oulwa* became modernised and no longer only signified a supreme land chief's position. As the supreme land chiefs were buried with their *oulwa* and a new one was made for the successor, the new ones were made in the metal in vogue during the period. De Brazza greatly admired these *oulwa* and commissioned one for himself which contained 17 points, most likely signifying the 17 domains around Ncuna, the area where he negotiated on behalf of the French to establish Brazzaville (Dupré & Féau 1998). In the Koukouya Plateau, Bonnafé (1988: 10) reports a dozen domains. In the Ekouyi-Mbouma area, there are more than ten. However, there, the *oulwa* had only been seen by those of previous generations, with stories passing down to today's elders.

The other symbols of power of a land chief included circles painted around their eyes to see the "other world", an anvil, a buffalo-tail fly whisk, a long pipe, bracelets of elephant hair, caps with feathers, and blue beads (Vansina 1973: 334). Cabrol (n.d.) adds to this list wigs of fibre with goat horns, cowry shells, and porcelain beads.[50] Kinata (2001: 30) indicates that a crown and colour were significant parts of the land chief dress. All of these symbols appear to be part of various powerful cults present at the time. When Cabrol's picture of a land chief was presented to Etienne Nturi, a picture containing a mixture of symbols from cowry shells to red cloth to fly whisk, raphia, and crocodile teeth torques, his answer was that the person pictured had been initiated into many cults and was not necessarily a land chief. A picture of the Koukouya sky chiefs includes the leopard raphia (woven raphia with multiple colours and textures), a leopard cap, a long pipe, and a ceremonial knife carried on the shoulder (Bonnafé 1978). The land chief also had a domain fetish, which Cabrol (n.d.) calls the "father of the domain", or *tara mantsie,* which facilitated the communication between the living and the dead. I will explore this in a coming section.

[50] de Brazza (1887: 54) noted the raphia wig with horns as a symbol of the land chief's office.

Land chiefs and land fertility

Connection with land spirits and ancestors: fecundity and fire

The land chief system was a magico-political one involving a balance between the spiritual powers of the domain spirits (and ancestors) and the physical well-being of the constituent villages. There was a tight link between spiritual and physical order, which then impacted the productivity of the domain in terms of sufficient food-supply secured through hunting, gathering, and cultivation. Vansina (1990) hypothesises that the emergence of the *nkira* spirit-domain ethos arose around 1000 AD. This link between spirits and physical landscapes made the domain a " *C'était un espace géographique, agricole, cultural et cultuel*" (Ebouli 2001:57).

According to Vansina, the land chief of the Teke-Tio had no right to agricultural products, only dealing with land issues relative to hunting, fishing, and gathering. By contrast, amongst the north-western Teke, the land chief played the economic role of guaranteeing the fertility of the domain, "*Il est chargé d'appliquer et de faire respecter les règles de gestion de la terre.*" (Ebouli 2001: 29). This included guaranteeing agricultural fertility as well as success in hunting, gathering and fishing expeditions.

The mystical Teke landscape

If one sits and listens to stories of the lives of the recently deceased, one learns that there were magical powers to be reckoned with in the landscape: it is, for the Teke, a land of miracles. Waters, certain forests, certain animals, and cirques are linked with ancestral spirits. One could say it was a land of talking crocodiles, water spirits, fire spirits, and underwater villages. Biebuyck (1963a: 36) indicates that in many parts of Africa, the sacred aspect of lands can be catalogued quite generally to include initiation ceremony sites, cemeteries, haunted woods, primordial emergence sites, and old village locales. Another writes that the Teke cosmology operates on three levels: monotheism, nature spirits, and ancestors, with the landscape inhabited by spirits that preferred large rocks, caves, waterfalls, whirlpools, and large trees (Cabrol n.d.).

In the Ekouyi-Mbouma area, each domain has its sacred places, places where ceremonies are conducted or where spirits or ancestors live. Each domain has a physical mediator between the living and the ancestors and spirits. In the case of Kankuru Domain, it is *Njua Mba*. *Njua Mba* is kept in the Kankuru *olebe*, the temple-like structure where domain rituals take place.[51] In the case of Kankuru, the sacred wood is called Kasswele, the purported dual source of two rivers. A lake in the forest, its waters are high in the dry season and low in the wet season. The presence of non-members of the Kankuru clan is forbidden. The lake itself is inhabited by the ancestors and so the water removed for domain-related ceremonies is sacred water.

[51] In this *olebe*, the preparation of manioc is forbidden, as is the presence of menstruating women.

Cirques are also considered to be sacred places (Fig. 3g., Chapter. 2). Several villages are or were located at the edge of or in the shadows of these sandy cirques. Areas of active erosion, the multi-coloured sand layers are particularly noticeable after a heavy rainfall has removed older layers. *Mamiwata*, or water spirits used to live in the cirques associated with Ekouyi-Mbouma and Kebiri villages. Entering the cirques is risky; many people expressed fear of entering and angering the spirits. In previous times, cirques were also seen as a form of protection of the villages: numerous informants have cited stories where villagers fled to the safety of the cirque to avoid colonial forces. During one of the world wars, French armies scoured the local area for German supporters leading to a massacre in the Mbie Cirque south of the current Lewou village site. Other cirques, such as the large one near Lékoni, are explained by a common lake-origin story amongst the Bateke. In this story, a village located in the current location of the lake was flooded, with the only survivors being the single family who fed and listened to the counsel of the dirty and hungry foreigner passing through the village. This same story is used to explain the existence of the lakes near the current regrouped village of Saaye as well as the former village site of Wotogo near Lac Loulou in the PNBP. One can still speak to the inhabitants of these inundated villages by ingesting some of the beach sand, speaking to the waters, and blowing kola onto the water's surface, which induces the inhabitants to rise to the surface. If one wants to swim in these waters, one can eat the stem of *Costus dewevrei* De Wildemann & T. Durand to transform oneself into a crocodile.[52] Others could summon crocodiles by name to lake shores to receive sacrifices of chickens in times of need. According to Dusseljé (1910), the crocodile housed the spirits of former chiefs who have transfigured themselves to kill their enemies. One lake in the study also gave testimony to the power of a former land chief; in a dispute about lake access between the two villages of Allieme and Saaye, the land chief purportedly said that the lake would decide and would move to the lands where it belonged. Thus today, one crosses a dry pan between the two villages, with the lake having migrated towards the lands of the preferred village (Rec-2)

The *opfu* were spirits appearing in both day and night. Translated into French by informants as, "the devil", there was sometimes a fear associated with the presence of the *opfu*. *Opfu* might signal their presence by a bad and characteristic smell, giving one a chance to ward it off by speaking the right words. *Opfu* might also be out in the savanna, such as during a storm when the sunlight penetrates the clouds to illuminate a single spot in the distance. Once, when I was gathering grasshoppers with the women of Ekouyi-Mbouma, a dust devil began blowing up the recently charred remains of the savanna around us. As the wind advanced towards us, some women became slightly alarmed and indicated that this was an *opfu* who meant harm. The final example of an *opfu* that I will give is that of the night fire called *obwan*. There are three types

[52] The Bateke in Brazzaville were known to be "friends of crocodiles and hippos" and duly feared (Sautter 1966: 385).

of *obwan*: savanna, forest, and water, listed in increasing order of danger. Some informants who have seen the savanna *obwan* indicate that it is a noisy fire that rapidly changes colour, shape, and location. It comes with the intention of doing harm and may be sent by someone to do so. When Kanini recounted his experience with the water *obwan*, he said that he had been at the Lewemi River with his younger brother when the *obwan* appeared. He was able to ward it off with words but fell ill upon returning to the village (former Mboua site). His father, Apaya, was obliged to heal him (Rec-3).

Rocky outcrops are also important mystical places. These are sandstone outcrops in the Kalahari sands and are rare in occurrence in the study site (but more common in the plateaus in the Republic of Congo). There are three such outcrops in the study area: *Kele la Kalami* (Kimi Domain), *Kele la Tsiere* (Nkomo Domain), and *Kele la Nkulu* (Ekouyi Domain). The most powerful one in the area is the highest, *Kele la Kalami*, named for the nearby former village site of Kalami. I visited *Kele la Kalami* several times, always with a member of the Akimi clan. The site itself is noteworthy to biologists since it houses the only known nesting site in Gabon of the African rock martin and is one of two sites for the rare *Polystachya dendrobifolium*, an orchid normally found in East Africa. It is also the grazing ground of a small buffalo population. However, the cultural significance of the site is also great: *Kele* is seen as a site of protection for the people. In the words of Etienne Nturi, "*Kele* is like the guardian of the domain" (Rec-4). The highest point in the area at over 730 m; it can be seen from a great distance. Informants indicate that it used to be much higher but the largest pinnacle had been broken. According to Onkadi, it had been broken when it was shown to white people (Rec-5). On one visit, a guardian Etienne Nturi of Akimi asked that we bring an offering of red wine. This was poured on the ground, quenching the thirst of the ancestors. I have been warned not to remove any pieces of the rock outcropping from the site; there was fear of people selling portions of the stone and, if discovered, the act would end in the death of the offender. Pieces of this rock had been once used by Supreme Land Chief Okoundzi to heal sickness, (Rec-5).

Such cirques, copses, and rock outcrops were and still are the landmarks of the countryside. At a long distance one can position oneself within the landscape by reference to them, such as the site of *Kele la Nkulu* viewed from the Lékoni-Bongoville road. They are also the physical evidence of the mystical aspect of the landscape: something integral to present-day Teke ethos.

Domain rituals

There are several ways in which rituals are used to ask blessings for or to resolve problems of ecological balance. These rituals may be conducted in a preventative way to avoid later problems in the domain or may be conducted as a way to solve problems of domain fertility.

Ambwongo: offering ceremony

This ceremony is performed in the case of specific problems in the domain and involves an offering for a transgression against the domain. Alternatively, *Ambwongo* can be a preventative offering to request a blessing for the fire-drive, or for a specific undertaking.[53] This ceremony is performed by the land chief in concert with initiates of the *Ngo* cult (leopard cult). Performed in the *olebe* of Kankuru Domain, it may only be attended by initiates. The ceremony is conducted in the presence of *Njua Mba.*[54] It is the adoration of this fetish that maintains balance with the ecosystem. Regular lighting of the *olebe* fire by village members of the *Ngo* cult occurred every few months. This *olebe* had been dismantled and rebuilt in the current Mbouma site when the village last moved in the 1960s. This ceremony was formerly conducted just before the communal hunt to "work out the domain demons", (Rec-6). If this wasn't done, then one's hunt might not be successful. In Vagha Domain, their domain fetish is described as a bell, something that each domain possesses.[55] This fetish is called *Fvouhou* and, as Pierre Anza described it, this is his *mpu* or power which enables him to protect the domain. He gave the example of his response in the case that a lion was ravaging the domain. He would take his bell and go to the Ntchoulou River with offerings of kola nut, tobacco, salt and oil. He would cry out to the ancestors for protection. He would then repeat this action in the cirque behind the village. After this, safety for the people of the domain would be ensured.

Okoo: domain ceremony in the old village site

This ceremony is a blessing ritual that is preventative. It is conducted to avoid catastrophe, poor harvests, and unsuccessful hunts. It can be done before a trip or to ask for good performance at school, but it is rarely curative. Most often, it involves three circles of people: the land chief, those close to the land chief, and foreigners (including slaves and even rich people).

According to Nturi (Rec-7), *Okoo* was often preceded by *Ambwongo*. During *Ambwongo*, people of the village would be called together to talk to the ancestors. Offerings of kola, tobacco, and wine would be made in the *olebe*. *Okoo* would then occur in the former village site of Mbouma, at the cemetery. There, the villagers would clean the cemetery, leave offerings of food and a chicken.[56] Informants did not remember this happening for several years.

In addition to this type of *Okoo*, others have talked about a regular pre-cultivation ceremony that occurred to ask a blessing on the agricultural efforts in the domain. Normally at every agricultural season, one would ritually plant an *ekala*, a single-row savanna plantation with representative plants of each crop. A ceremony would be conducted wherein the land chief

[53] I have been told several times that Ambwongo was conducted to bless my work just prior to my moving to the village.
[54] *Njua Mba* means "the hot cooking pot".
[55] Others indicate that not every domain had a land fetish.
[56] Sometimes the sacrificing of a chicken is called *ndogho* and may be used to resolve family issues as well.

would sprinkle water from Kasswele on the ritual plantation, normally situated in the old village site of Mbouma. According to Etienne Nturi, in drawing the water at Kasswele, the gatherer would speak to the water, identifying himself by his family and clan. He would explain the purpose of gathering the water and then invite the ancestors present in the water to attend *Okoo*. Thus, the ancestors being poured on the ritual plantation was seen as a benediction on the agricultural production of the domain (Rec-8).

However, Mbouma, the principal village today in Kankuru Domain, is part of a *régroupement* of two villages, the other being Ekouyi, a group of Teke-Kaningui of forest origins and therefore more closely linked to rites of forest peoples (such as *Njobi*). The people of Ekouyi regularly organised an *Okoo Njobi* plantation blessing ceremony. During my time in Ekouyi-Mbouma, this ceremony occurred twice and there were plans to conduct another one between the first rains and the last planting, sometime in October or November 2008. In 2007 (but not in 2006), the village chief of Mbouma, who was also the guardian of Kankuru, also attended these *Njobi* plantation dances. Normally an antelope was hunted for this event and played a part in the private portion of the ceremony. The public ceremony was held in the *Njobi olebe* in Ekouyi, while on the following day, the private ceremony, attended only by *Njobi* initiates, was held in a sacred place in the forest. Thus, while the forest Teke of Ekouyi attended to their plantation ceremonies via the rite of *Njobi*, the savanna Teke of Mbouma had seemingly neglected their *Okoo* ceremony.

Resolving issues with the ancestors when the domain is infertile

In Kankuru Domain, the land chief is directly involved in all things related to the productivity of the domain whether it is agriculture, hunting, fishing, or gathering. When domain production is low, whether this is a poor harvest of gathered resources or the ravaging of plantations by wild animals, *Okoo* is performed. During my time there, villagers complained that their fields were being ravaged by bush pigs, act that were creating a manioc famine; furthermore the *kankele* caterpillar and *nginginga* beetle gathering had not been productive in recent years. Additionally, Kasswele's waters had become congested with plant material, which was interpreted as a sign of domain negligence.

Some blame people's neglect of the sacred wood for the ecological imbalance they experience in the domain. Others believe that fault lay in neglect of *Njua Mba*. Yet others blamed the general disregard for domain interdictions, or "*ekele ba ntsie*" (Ebouli 2001: 48), such as the crossing of the village by menstruating women, and the consumption of *Aframomum* fruits and the preparation of manioc leaves within the village borders.

In order to make amends with the ancestors of Kankuru Domain, Mbia thought that it might be best to bring water from another sacred wood called Oyaninga to restore Kasswele, along with

sacrifices of kola and red wine. This action in concert with *Ambwongo* and *Okoo* might restore domain fertility.

People of Kankuru were becoming more vocal about the problems in the domain and the guardians of the domain were due to organise *Okoo* in late 2008 to address these problems. However, this probably did not happen as planned, since one of the Kankuru guardians died on September 13, 2008.[57]

Becoming a land chief: Kanini climbs the *Miyali*

As Pierre Anza says, "Each savanna has its chief", a position that was passed down from father to son. Often these areas were referred to by the nearest river course, as in the "*Plaine de Nkouli*", the site of some vegetation work during the study. While Anza is the present-day land chief of Vagha Domain, the land chief of Kankuru, Tolo, is deceased. This domain is now jointly managed by his descendents. To understand the land chief tradition from which the present day situation devolved, it is useful to comment on the past chiefs mentioned in oral history and in the archives.

According to oral accounts given to Deschamps, the first Teke-Alima inhabitants of the area settled along the Mpassa, Lékoni, and Lelani Rivers; it was like this when de Brazza encountered them for the first time (Deschamps 1962: 61). In the late 1880s, the greater study area fell into the *kasi* of four supreme land chiefs: M'Bongo, Kakogho, and Piti (Gabon National Archives cited in Ebouli 2001[58]), and Okoundzi.

In the early 1900s, many of the Teke villages were clustered along the Mpassa River in what is today's PNPB. Okoundzi controlled villages along the upper Mpassa River including Mboua, Walla, Missami 1, Missami 2, and Kewaga.[59] Kakogho commanded the lands of the present day Canton Djouya, including villages on the lower Mpassa River, and those villages along the Mpassa tributaries, the Lewou and Lala Rivers.

Kakogho, a native of Kessala 1, was known by many informants as a supreme land chief and a great magician. He was greatly respected and feared, being able to be in multiple places at one time, as well as being able to send lions to attack enemies. He was purportedly named as one of the first canton chiefs of the area because of his good relationship with the French. However, he ran into hard times when he was imprisoned for the mysterious death of his son. When released, he moved his large family to Impini village 40 km from the study site in present day Republic of Congo. He was succeeded by Samba and then Oula Francois, both of Saaye; however, when voting became the way to determine succession to the *canton* chieftaincy, the

[57] One week after I concluded the main portion of my thesis research in Ekouyi-Mbouma.
[58] The Gabon National Archives were closed for reconstruction during the entire study.
[59] In popular books, normally the first three supreme land chiefs are recognised (Cabrol n.d.; Oligui 2007). Kakogho's name is particularly used to name schools and dispensaries in the greater study area.

power passed from its hereditary line to Mbouma's Filibert Ongassia, who is presently canton chief yet also a guardian of Kankuru Domain.

Okoundzi was a supreme land chief of the upper Mpassa River area and is fondly remembered by his descendents in the Mboua area today. A native of the village of Walla, he too was chosen to be a *chef de canton* for his mastery of difficult situations. According to the people of Mboua and Walla, Okoundzi was Kakogho's predecessor. Okoudzi died during a dispute between neighbouring groups. It was Kakagho that brought this news to the French and was named his successor.

Today, Kanini is a land chief within Okoundzi's territory. In remembering the day that he succeeded his father Apaya as land chief of Mboua village domain he talks of "climbing the Miyali"; he was approximately 14 in the early 1930s. According to Kanini, the land chief ceremony took place in Maya Domain. It was a large ceremony to which Kanini rode in Kakogho's pallet; Kakagho was the supreme land chief and the first cousin of Kanini (the fathers of Kakagho and Kanini were brothers). The pallet was used for transporting powerful men and made out of four *miyali* woods.[60]

Here there is a demonstrated layering of facts and memories of two groups of Bateke that once ruled portions of the banks of the Mpassa River. More work should be done to clarify the life stories of these former leaders. What is clear is that areas of savanna were ruled in a hierarchical fashion. Often the supreme land chief was not only a political ruler but able to exercise magico-religious control. This dual capacity likely reinforced his ability to interact with ancestors and nature spirits and thus maintained the domain's fertility. In two cases, the French favoured working through these customary rulers, seemingly co-opting the function and geographical extent of the customary chief's power.

Spatial description and organisation of domains

Spatial delimitation of Koukouya domains

Domains are delimited by rivers and copses. Bonnafé studied the Koukouya domains in Congo, a bordering group to the Teke-Alima. According to him, these copses represented matrilineages, but were patrilineally inherited (1978).[61] *"La notion de Terre avait un double sens : le territoire ou des habitants vivent et travaillent, mais aussi un effectif humain reparti en plusieurs lignages*" (Bonnafé 1978: 14). Rights to the copse ended with death, and Bonnafé indicates that, for the Koukouya, inheritance of these copses ended in about three generations. The land

[60] According to Samuel Onkadi (Rec-5), the Batsitsege were the only ones that climbed the *miyali* (but see Kinata 2001: 30).

[61] Patrilineal versus matrilineal descent in the Bateke groups seems to be poorly understood, with a confused literature. Descent seems to be based on localised matrilineages (*njo*), but ritualised offices pass through the male line. This situation is further complicated by the advent of the *canton* chieftancies.

chief had the right to dispose of "dead copses". These copses may then be given to men for cultivation, as opposed to the open savanna where areas were cultivated by women.

In my study site there were ten domains with publicly known limits, cited by naming rivers, ridges, and copses.[62] In one group interview held with representatives of the adjacent Kankuru and Nkomo Domains, there was no doubt about their borders and their former responsibilities in keeping these borders clear for fire-drive hunting activities to take place.

Size of domains

In the Ekouyi-Mbouma area, the domains are of various sizes with Vagha and Nkomo being the largest in the area; Kankuru is medium-sized and the smallest are Kimi and Akou. Village chief Daniel Ololo talks of the sizes of domains in various ways: surface area (as in the previous sentence), in terms of area burned (Kankuru had more savanna to burn than Vagha which had more forest), or population size of a domain (Kimi had the most people). This gives a richer picture of how domains were viewed; however, Ololo indicates that all land chiefs, irrespective of extent or nature of area ruled, were equal in status (Rec-9).

Some informants indicate that domains could be used as a form of payment of fines, particularly those associated with bloodshed. If a member from one domain was killed in another domain, then the offended domain might acquire a portion of the offending one. The giving of a woman in marriage might also occur (Rec-10). In the Koukouya Plateau, Guillot indicates that domains were until recently sometimes exchanged for services or debts. However, this was not practised anymore since copses were being increasingly used for production of cash crops (Guillot 1980).

In the Ekouyi-Mbouma area, domains are never thought of as "dying", since they are passed on from generation to generation. In a discussion amongst villagers about the Ambouli Domain near the village, all of whose inheritors currently lived in town, the "death of a domain" was hotly debated. Some said that the owners of this domain were still owners despite their living in town and no longer residing in or near the domain itself.

Hunting and agricultural areas defined

In the past and today, there is little overlap in cultivated and hunting areas. According to Vansina (1973), for the Tio, cultivation was forbidden in hunting areas, with hunting taking up the largest portion of the landscape (see also Sautter 1960). Biebuyck (1963a) indicates that although agriculture and other subsistence methods had been integrated into livelihoods, replacing the importance of hunting, the hunting that remained operated essentially in the political or ritualistic sphere.

[62] Kankuru, Nkomo, Kimi, Vagha, Akini, Akou, Ambouli, and Ekouyi with additional lands surrounding Saaye *régroupement* including Ambouli and Mbie.

In terms of resource areas used versus nutrition extracted, it would be hard to argue that this was a good investment. For example, Kankuru Domain measures about 104 km^2. Historically, when the fire-drive was enacted, cultivation and hunting areas would have been separated by practicality: the fires and the hunt itself would have destroyed fields. According to aerial photographs, these fields occupied greater areas around villages in the 1950s than today, consistent with a larger and less urbanized population. However, it seems that cultivation and hunting spaces were respected and were most likely not a point of dispute given the wide expanses and low population densities of the plateau area.

Today, cultivation occurs within two kilometres of Ekouyi-Mbouma with hunting still being conducted in the part of the domain outside of agricultural areas; it is not forbidden to hunt in a cultivation area. Other subsistence methods seem to be far more important in daily life than hunting, such as cultivation, fishing, and the gathering of leaves and insects; each of these activities requires much less land than hunting.

How the eastern Bateke groups were burning

Given that the Teke-Alima only migrated into the forest-savanna mosaic in the 1840s, and that there are documented burning practices of the Teke in the central portion of the plateaus from which the Teke-Alima migrated, it is quite probable that they imported their burning system to the study area based on their previous experience elsewhere. Sautter noted that while net hunting in the forest was a very common practice from Franceville to Zanaga and Sibiti and all the way to Ewo and Mbé,

> *La chasse au feu, dans la savane, est plus originale. On la retrouve cependant, au Moyen-Congo, chez les Bacougni du Niari. Sur le plateau, elle n'a guère Heu qu'au sud de Mbé, dans une région où J'autorité intacte: des chefferies traditionnelles empêche des mises à feu prématurées.*
>
> (Sautter 1960: 27)

However, insights from other works broaden the understanding of fire usage throughout the plateau area. Here I will discuss what has been documented about central plateau burning in the 19th and 20th centuries.

Historic control of fire: rotation and fire-setting

Several ethnographic and explorer accounts discuss the ways in which fire-setting was controlled in the plateaus. According to these writings, the land chief had strict control over when and where fires were lit (Vansina 1973; Vansina 1966; Sautter 1960). The largest fires were set during the long-dry season from July to September as part of the communal fire-drive hunts (Guiral 1889; Papy 1949; Sautter 1960; Vansina 1973). Vansina further noted a short fire season in February for hunting Adbim's stork. This seems to imply that most fires were set only once per year, as cited by de Brazza's colleague, de Chavannes (1886). Areas were

reported to be left as unburned "refugia" in order to provide protection for animals (Vansina 1973; Sautter 1960). Some Bateke groups left areas unburned for a period of two to five years and then rotated the area back into annual burning, while others seem to have burned the same areas year after year, without rotation (Sautter 1960). Sautter was the only person to make notes on fire size and number; he reported during his stay an average estimated fire size of two to four square kilometres, noting over 200 such fires around four to five villages. This information is summarized in Table 1, wherein the two final rows present, for contrast, the characteristics of the burning system employed by the Teke-Alima in the study area during the 1920-1960s and today, as reported by informants during this study.

Source	de Chavannes 1886	Guiral 1889	Papy 1949	Sautter 1960	Koechlin 1961a	Vansina 1973	Current study 1920-1960s	Current study 1960s – today
Land chief controls fire-setting	--	--	--	yes	--	yes	yes	no
Premature fire permitted	--	--	--	no	--	--	no	yes
"Refuge" for animals	--	--	--	--	--	yes	yes	no
Unburned areas rotated	--	--	--	No	--	--	yes	no
Length of time areas not burned	--	--	--	--	--	1+ years	1-5 years	0
Size of burn	--	--	--	2-4 km^2	--	--	*ewa* size[63]	variable
Frequency per year	1	--	--	--	1-2	--	0-1	1-3
Seasons burned	--	Long - dry	Long - dry	Long-dry	Jan. – Sept.	Feb. (stork) & Long-dry	March (stork) & Long-dry	All
Teke group	--	--	--	Tio	--	Tio	Teke-Alima	Teke-Alima

Table 1. A comparison of fire seasons, spatial organisation reported in the literature.

Fire distribution in space and time

How did burning happen during the fire-drive? This section describes the seasonality, frequency, and control over these fires. Vansina's ethnographic study of the Bateke Tio group

[63] A burn unit within the domain; see next sections.

indicated a disproportional love of hunting amongst the Tio. Despite the fact that both agricultural and gathering practices supply a greater portion of the food supply (Vansina 1973), these practices were neither as esteemed nor as ritualised as hunting. Not even the male activity of trapping merited rituals like hunting (Vansina 1973). Hunters in the past garbed themselves in raphia skirts and were armed with weapons such as arrows, spears, lances, and flint-lock rifles (Papy 1949). According to Vansina, hunting by spear and net occurred throughout the early wet season from July to January, when the grass was not too high. Trapping occurred in the short dry season in January-February. Fire drives occurred in the dry season from May to September and was a group activity involving men, women, and children. However, there were some differences in hunting methods between the Teke-Alima and the Tio. Hunting in the forest-savanna mosaic for the Teke-Alima meant that the communal fire-drive occurred during the mid-dry season in July and August. Towards October, when the grass was resprouting from the dry season fires, a second type of net hunting called *antiama* occurred in the plains. From February to March[64], during the Abdim stork migration, fires and *aliga* glue (from *Omphalocarpum procerum* P. Beauv.) were used to attract and trap birds in the riparian forests and nearby savannas.[65] However, in the forest, hunting was done throughout the year, involving both solitary trap-lining as well as communal net hunting for porcupine and later red river hogs, a practice adopted from the Obamba during a time when the Teke plantations were being eaten by bush-pigs. However, the most famous form of hunting was the communal dry season fire drive.

The authority over the timing of a fire-drive ultimately rested with the land chief. Most of the domain was reserved for the dry season fire-drive. However, a land chief could decide not to burn his domain that year. Present day land chief of Vagha Domain, Pierre Anza (Rec-11), explains the thinking like this,

> Ah! This year, no, we are not going to burn Vagha. I refuse.

He then sends the news to the other villages, telling them that Vagha is not burning their savannas. He continues the story indicating that while the other domains are conducting fire drives,

> I stay at home, resting easy. Vagha will stay like this [unburned] at least for two to three years. When I say, 'No, two years is already a long time, this year, we must burn it,

he then summons the people of neighbouring villages to come for the hunt. He continues,

[64] However, I along with others in PNPB spotted these in late January this year; this is earliest known record for Gabon (pers. comm. P. Christy).
[65] See also Soret 1959: 806 for a case of this type of hunting by neighboring Laadi, Sundi, and Kongo peoples.

> This year, we are burning Vagha, we kill the animals. Tomorrow or after tomorrow, to burn Vagha again, no. When one burns too much, the animals run far away. One must first leave it [unburned], at least two to three years, in order for the animals that have gone towards Congo [approximately 20 kilometres from Anza's Domain] to return. Men that burn time and again, this is not good.

The communal fire drive

Hunting magic

Ensuring success in the hunt happened in at two levels: individual and communal. There were pre-hunt communal ceremonies as well as individual efforts to obtain nefarious forms of fetishes. Vansina (1973) depicts the preparation for the hunt as follows: hunting prowess was typically increased by charms, amulets, and rituals, often dependent upon the collection and utilization of specific plants. Hunters offered prayers to their *ikwii* (ancestors) and the *nkira* (nature spirits), consulted medicine men, and recited mantras to guarantee a successful hunt. According to informants, a good hunt indicates success in life, the blessing of the ancestors, and harmony with the natural world. Certainly hunters of Kankuru Domain required the blessing of the ancestors to have a good hunt, but not everyone resorted to the darker methods to obtain it. A few people, who were notoriously good hunters in the recent past, were also thought to have been sorcerers, using forms of magic to ensure success in their hunt in inappropriate ways. Nturi warned that those who utilised amulets should be wary of the requirements to make the amulet work: it might "eat your family", exacting the blood of relatives (Rec-7). In a more benign method of ensuring hunter success, one would appease the spirits of deceased twins in the family, something that was perceived to be a powerful tool for family protection. This, as Mbia pointed out, might involve gifts of palm oil to the deceased. Otherwise, their wrath might result in poor hunting.

When I asked what it meant to have a bad hunting performance, Nturi replied that it might just mean that god did not intend for one to have a good hunt, and it might be time to wait awhile. However, if the problem was pervasive across the domain, then a communal *Okoo* ceremony might be conducted.

According to Kanini, individual problems in the hunt could also arise when there were problems between the hunter and a member of the village. Additionally, one might consult a magician who might suggest hunting in a different part of the forest (Rec-12).

Preparation of the area to be burned

The area to be burned was designated well before fire season, with packets of grass called *ajigi* attached to shrubs indicating the limit to be burned. *Ebaningi*[66] were sent from village to village

[66] The *ebanighi* were messengers of the land chief.

proclaiming the limits to be burned and that unauthorised fires were not welcome. Others have reported burning fire-breaks along these limits during the rainy season, towards the month of April. Additional firebreaks were made around areas near the village that would be set aside for grasshopper gathering.

Making and repairing the nets

According to Martin Sia, one of the few remaining possessors of a hunting net used in the fire-drive, the work in maintaining such nets was serious. Nets for hunting various animals were called by different names and certainly had differing constructions. The net used in the fire-drive was specifically for the *ntsa* (*Sylvicapra grimmia*), and called *kia*. Making these nets involved gathering copious quantities of suitable plants including *okoura*, *ofouli*, and *oposso* plants.[67] The plant was collected, and the bark removed and dried. This was then attached to a pole and beaten until soft. At this point, the material could be made into twine, by rolling the bark against the inner thigh until it began to intertwine with itself. Net making and repairing needed to be done by July to ensure that they were ready for the fire drive. The making of nets was not a specialty: every hunter knew how and they were made communally (Rec-13).

Pre-hunt ritual

Prior to the hunt, the ritual *olobo* was performed. *Olobo* is a hunting song and ritual at the same time requesting protection from the ancestors, safety during the hunt, and, of course, success (Le Bomin 2004). As Mbia explained to me, it was at this ceremony that he was selected to be an *otiugui*, or fire igniter. The *olobo,* according to *Otiugui* Antoine Mbia, was a song that only three of Kankuru Domain still mastered (at the time of this writing, only two remain since Chief Etienne Nturi died September 13, 2008). Le Bomin (2004) presents Pierre Sallée's recording of the *olobo* song from the Bateke Plateaux in the 1960s.

According to the elders of Walla village, the night before the hunt the organiser of the hunt, the land chief, would talk to the ancestors to request their blessing on the hunt, endowing it with success by providing much quarry and no accidents (Rec-14). Samuel Onkadi said that if the organiser asked for 20 animals, then the hunt would be stopped when the hunt obtained those 20, even if early in the day. In effect, he says, the land chief was the conduit through which the ancestors were speaking about the hunt (Rec-5).

According to Sebastian Naliba, there were different rituals for hunting in the forest versus the savanna: *Issami-issami* was conducted in the forest, whereas *olobo* was conducted in the savanna. Kanini gave several examples of the *Issami-issami* dance when I visited him; these songs indicated how the hunt would unfold (Rec-15).

[67] Other informants from Ekouyi have cited *lampunea (Clappertonia polyandra* (K. Schumm.) Bech.) or *languri (Triumfetta cordifolia* A. Rich) for making cord or nets.

The day of the hunt, Mbia says that the land chiefs of all the domains involved in the hunt would meet at a common place. He gave the example of the villages of Saaye, Allieme, Lewou, and Nkiga meeting at Kougou hunting camp (*ossie*), a copse at the limit of Nkomo and Kankuru Domains, where the burning for Nkomo Domain started. There, at Kougou hunting camp, one would see great dances and a magician for each domain (see Deschamps 1962: 64). Every domain had their land-spirit, including Vagha, Nkomo and Kimi. The goal of these ceremonies was for each domain to deal with its land-spirits, as every domain must do in order to ensure a successful hunt. Each land chief would have brought their own *otiugui* for lighting of the fires for their domain. Around 9 am, when the grass was dry, the hunt would commence.

The hunt itself

Bonnafé (1987: 224-226) gives details on the Koukouya Plateau hunt, which resembles that of the Teke-Alima in the study area. Here, I draw on informants, complemented by Bonnafé's description at times to give a detailed account of the former Teke-Alima fire-drive once enacted in the study site.

For domains that were to be burned, it was done in a specific way. Each domain would be burned piece by piece in the mid-dry season (July or August). The land chief would send out messengers to villages in adjacent areas, indicating the day of the hunt with a string tied with a number of knots equal to the days until the hunt would start. This would give enough time for the women to prepare manioc, the plateau staple whose preparation requires five days. Hunters and their wives would then unite at a given place, normally an established hunting camp. Each hunter would bring a net; since 40-50 hunters participated, this meant that 40-50 nets would be joined end to end. According to Dusseljé (1910), these nets extended for kilometres. Bonnafé notes that each net in the Koukouya Plateau measured 20-30 metres by two metres (Bonnafé 1987: 224). In one case, an *ewa* in Kankuru Domain measured 12.9 kilometres in circumference, with an area of 7.3 km^2. The nets were staked out in a back-burned area called an *obli* to avoid the burning of the nets. M. Sia indicates that the nets were secured on top and bottom, using y-shaped *epandi* sticks at the bottom and *ofuli* strings to attach them.

Hunters were positioned inside the back burn-area inside leaf camouflage huts called *katui* that were made of *ololo* leaves (*Annona senegalensis).* The hunter was positioned in front of his own net. Other hunters were on the outside of the net (beyond the area to be burned), with clubs and spears in hand. Fire specialists, the *otiugui*, were instructed to run a lighting relay (1-2 per half of the fire perimeter) along the edge of the horseshoe-shaped area to be burned, while singing out in a high voice a song that set the cadence of the fire so that it was set at an equal pace along both sides.

The *otiugui*'s flames set a great fire, burning with the direction of the wind, *mba ya olumi*. Animals that had been hiding in the tall dry grass ran away from the fire and into the nets, being hurried finally onward into the nets with the cry of the camouflaged men hidden in the *katui*. Women walking behind the flames would also cry out; this encouraged animals not to dash back through the advancing flame front. The hunters outside the net would spear or hit the animals on the head as they arrived in the nets. Women would follow the flames, picking up any small animals that had been killed such as rodents and grasshoppers. These burn units were called *ewa*. Approximately three were burned per day, each having known limits. At night, people would gather for a few hours in the evenings for storytelling. Once the burning for a given area of the domain was done, everyone moved to the next camp, these being regular hunting camp copses used every time the domain was burned. In the final camping spot, the meat of the hunt was divided. In Nkomo and Kankuru Domains, the *ossie* were used in a particular order, with the final one where meat was divided always being the same, copses Mpiini and Kasswele respectively. The meat was divided into three portions for the following groups: *otiugui*, hunters at the nets, and the land chief. Upon returning to the village, this could then be shared with other villagers. According to Kanini, "When one eats alone, your domain is cursed" (Rec-12).

Once a domain was burned and the next was due to be burned, the same hunters continued the process. Participation in this hunt was done by people of all adjacent domains called in by the land chief. The people of Lewou estimate that it took about a week to burn Nkomo Domain. Kankuru Domain would take 3 days to burn, burning 2-3 *ewa* per day (Rec-16). Burning was a dangerous activity for everyone, from the lighters to the hunters; accidents occurred sufficiently frequently to be recalled regularly in our surveys, even being cited as one of the reasons that this form of hunting was no longer practised.

In our interviews in five villages, most reported that the last communal hunt in which they participated was in the late 1960s. The only exception to this was the re-creation of a fire-drive in 2004 by an urban relative of the village.

Fire specialists: *otiugui*

Specialists for each domain, the *otiugui*, were used to burn these areas. Essentially, these were some of the best runners in the area, since the igniters had to run a quarter to half of the perimeter of the area to be burned. People estimate this distance to have been about two kilometres through the savanna.[68] According to the elders from Walla village "We don't give the mission to a weak man; if he is, he will get burned!" (Rec-14).

[68] One *ewa* I measured had a circumference of 12.8 km^2. This perimeter would have been divided into thirds: one for the net and two for the *otiugui.* If there were four total *otiugui* (two per side), each would have run approximately 2.1 km^2.

According to Jean Paul Andza, an *otiugui* from Vagha Domain, he was chosen to be an *otiugui* because it was an inherited spirit (*opfu*) within his family: his grandfather had been the first in the family to be an *otiugui*. His *opfu* was the guinea fowl. Jean Paul was noted by others as having once been able to run as fast as his hunting dogs when hunting guinea fowl. Another known *otiugui* is the deceased Ankwa of Lewou. He had inherited the spirit of the cyclone, named *ondjigi*. He was purportedly the fastest runner in the area at the time (Rec-10).

While some *otiugui* were chosen for their speed, others were chosen because of their regard for tradition and hierarchy. Antoine Mbia reports that he was chosen for his intelligence despite his small size. If one ran too fast, the burning would not occur at the right pace: one had to run a distance, then stop and look at how the fire was coming along. They also could not see the runner on the other side of the *ewa*, and so they had to assess their progress indirectly (Rec-17). During a pre-hunt ceremony in the *olebe* of the domain, the chiefs had gathered together including Tolo the land chief of Kankuru. Chief Tolo had asked Mbia's father permission that his son be an *otiugui*. He was one of two selected for the job replacing the older *otiugui* who were now unable to perform the duty. They gave offerings of red wine and sang until early evening. The next day the hunt began (Rec-6).

Along with the selection of an *otiugui*, there was a certain amount of knowledge imparted. According to Mbia (Rec-18), he was taught by his father how to burn by dates: he who burns an area knows the dates [to burn]. There is no name for this practice in Lategе. This seems to be somewhat in conflict with the practice of a land chief setting dates for burning and may be a result of the degradation of the control over burning. For Mbia, one of the most active burners in Mbouma and one who conscientiously burns for gathering and hunting purposes today, he says that "grass matures in nine months, like the pregnancy of a woman". The months were sometimes counted by sticks attached on a string in the *olebe*, to help mark the year's passing. Mbia further indicates that the limits of the e*wa* were shown to them by their elders. These limits are still known today despite the practice of burning having been abandoned (Rec-17).

Additionally, the *otiugui* seemed to possess an increased knowledge of the names of savanna grass species, as well as savanna types. Each grass species has a name, and certain grassland types are known to be better burners, due to their earlier drying tufts at the base of the plant.

To be *otiugui*, one must have been part of the land chief's clan. People generally could name quite a number of these traditional igniters, but while there were many named, few were still living. As the post was no longer needed, the associated knowledge was also dying. Once, in a discussion amongst a variety of age groups where Mbia was the eldest, he began talking about the way in which they formerly lit savannas by using a particular grass species, *osenegue,* to make the *onya*, broom-like bunches of grass used to start fires. People, especially the middle-

aged men, listened with interest, saying they had not known these details before. Only 40 years ago, it would have been this age-group and younger that would have been the new generation of *otiugui*.

Off-take

For all of the effort that the hunt required, some reports of the fire-drive indicate a variable yield. Sautter (1960) cited only 14 animals taken in the eight hunts in which he participated amongst the eastern Teke, which he calculated to be half an antelope per square kilometre. In Kankuru Domain, Mbia remembers obtaining perhaps ten *ntsa* per day (Rec-16); this was for a domain that burned within three days. Alna remembers as many as 50 animals being shared out at the end of a hunt on a domain (Rec-19), with Nkomo Domain taking five days to burn. Dusseljé (1910) reports that as many as 40 animals could be taken per day in Teke-Alima territory. Once the meat was shared out at the final *ossie*, it would seem that there was not much to share amongst the 40-50 hunters and their families. The largest portion always went to the land chief. When I asked Alna if people were disgruntled to have to give the land chief so much of the off-take, he said no, for without the land chief there would not have been the savannas reserved for the hunt. Another factor that isn't considered here is the collateral off-take of the fires in rodents, birds, and grasshoppers: the woman's take. According to Alna, it was this together with the hunted meat that sustained the families through the immediate post-hunting phase of planting their fields; at that time, food was normally low and workload high.

Antiama hunting: rainy season post- fire savanna hunting

A form of savanna net hunting that occurred after the fire-drive in August was called the *antiama* hunt and was performed by the hunters in October. Kanini describes this as a passive hunt where nets were used to hunt animals grazing in the new pastures created by the fire-drive (Rec-12). By contrast, Alna (Rec-19) indicates that hunting in the savanna only happened in August and October and at no other time of the year.[69]

In the past, when one needed meat during the rest of the year, the Bateke hunted in the forests. Today, the more forest-oriented Bateke use trap lines; however the tradition of communal net hunting for porcupine is still practised by the people of all the villages in the study site.

Burning outside the *ewa*

Most areas of the domain were set aside in *ewa* for the dry season hunt; other portions of the domain would be burned at other times. These activities occurred in the space between the village and the *ewa* or along riverside savannas and consisted of cultivation, grasshopper gathering, and Abdim's stork hunting.

[69] This difference in opinion may have been due to different hunting practices on Kanini's upper Mpassa River and Alna's lower Mpassa River catchments.

Adbim's stork hunting

Just around the time of the second small dry season, Abdim's stork (*Ciconia abdimii)* migrates through Teke territory (van Perlo 2002). Following the edge of the forest, it is only in Teke territory that they are hunted (pers. comm. P. Christy). Vansina (1973) is the only written work that reports this type of hunting.[70] For the north-western Bateke, there were two ways to hunt Abdim's stork: burning and glue traps. The former was practised amongst the Teke in the Saaye area whereas the latter was practised by the Teke from Ekouyi-Mbouma and Kebiri, in what Mbia refers to as a preference for using glue and not guns for this hunt.

The primary diet of adult and nestling Abdim's alike is grasshoppers (Falk et al. 2006). This is well-known amongst the Teke who indicate that the storks are attracted to recently burned savannas to devour the dead grasshoppers, even being attracted to such areas by the smoke columns. Once having eaten, the storks then fly to the nearest water source to drink. They often were seen spending their days on the river and flying to the savanna at night to sleep. Thus, parts of some domains would be allocated for burning during this time, but only savannas near rivers.

A second way to hunt the storks was using *linga* glue from the fruits of the *oura* tree (*Omphalocarpum procerum).* Glue was extracted and placed on branches of trees near the river in the early morning. Landing birds would be unable to take off. Mbia remembers capturing as many as 14 at a time. The meat was eaten and the plumes were used for the *nguja* headdress and *Njobi* dances. They were formerly plentiful along the Lewou and Djouya Rivers but today, according to Mbia, they are now mostly found along the Mpassa and towards Ossouélé village (Rec-20), where the hunting technique is different and access is controlled. Their disappearance locally is attributed by one hunter to overhunting.

Grasshopper gathering

Today, the only active use of fire for food collection is that of grasshopper gathering during the long dry season. Today, this is a female group activity. However, in the recent past, this activity was conducted inside the *ewa* during the fire drive, as well as outside of the burn units. When I asked villagers of Kebiri, a village where grasshopper gathering is an important economic activity, I was told that in the past, areas near the village were outside the burn units and activities such as grasshopper fires could occur without authorisation. In fact, this use was a planned activity, as fire breaks were burned as early as March-April to ensure that dry season fires would not burn the area intended for gathering (Rec-17). Grasshopper gathering will be examined in greater detail in a following chapter on savanna resources.

Cultivation fires

[70] Though Bonnafé does talk of hunting birds with glue.

Cultivation fires were also part of the fires in the domain: though in the forest, they were part of the tenure and resource use of the domain and under the land chief's responsibility. These fires are set in late August, before the rains come, and about two weeks before one intends to plant, thus ensuring that the soil is still warm.[71] After two weeks, one would make a trial planting of five plants called *me tuna njobo*. This practice, as referred to in Lategе, indicates that it is a ritual to avoid the civet, *njobo*, cursing one's plantation.

One of the problems that might arise was the escaping of plantation fires into savanna and vice versa. The spread of fires from plantation to savanna was observed at least once during my stay in Ekouyi-Mbouma, though because the adjacent savanna had been burned only a few months earlier, the fire was not very intense. Other informants indicate that plantation fires might go into the adjacent forest and burn the leaf litter for long periods of time. A final problem encountered with this type of fire was the spreading of fire between new and older plantations, thus killing the manioc crop of the older plantation. [72]

According to one study of Nzebi cultivation practices in the forest-savanna area of southern Gabon, annual savanna fires also occurred there (Jean 1975). However, the Nzebi left a row of old manioc between the plantation and the savanna to avoid this. Similarly, the Bakongo left a stand of trees between their plantations and savanna (Sautter 1966). I have seen this practice amongst the cultivators of Mbouma. However, in some cases, fire still spreads.

Historic burning penalties

The Teke-Alima people were resolute in not burning in the off-season or without authorisation. Sautter (1960) notes that Bateke were so serious about fire regulation that they stopped granting usage of their territories to the bordering Balali people, who had tended to burn the Teke hunting reserves.

When the land chief's power was at its peak, he controlled large portions of the savanna in his lands which were restricted to annual burning. Severe penalties were employed for burning these areas without authorisation. In the study site, informants remember well the fines and consequences associated with unauthorised burning, including making peace with ancestral spirits, heavy fines in raphia cloths, (see Dupré 1994) and, for those who were not financially able, payment in the form of slavery or the loss of a daughter in marriage. Mouayani Opou lists forfeiting a daughter for a debt or a crime as one of five marriage types practised amongst the Bateke (Mouayini Opou 2005); there are still a few women near the study area who were married under these circumstances. One can compare these fines to those of the Ossouélé area,

[71] Burning dates are different according to soil type: sandy soils in the study area are burned later than the laterite soils in nearby Franceville plantations.

[72] This happened once during the study and went without consequence. In the urban areas of Franceville and Lékoni, such an action carried a fine of 150,000-200,000 CFA, if the offenders could be caught and proven guilty.

northeast of the study site; in 1929 the land chief was able to levy high fines in the case of theft including being sold into slavery to the Koukouya. The theft of a goat incurred a fine of 20 raphia cloths, a stolen gun exacted 30, and chickens and hoes required only 10 raphia cloths (Badier 1929). These fines, in comparison to those for unauthorised burning, demonstrate the seriousness of pyro-crimes which resulted in the loss of women and bride-wealth in the form of raphia cloths from the lineage. However, the act of unauthorised burning also had spiritual consequences that would be manifested by sickness or death and required penance for angering the ancestors. When we asked villagers who had seen the land chief system active what fines and consequences they remembered, these included everything from slavery to sickness (see Table 2).

Unauthorised burning was a grave offense because it was considered to be a transgression against the ancestors of the domain. In one example given by Dominic Ekan in which he hypothesizes about fire burning into his lands, he indicates that members of the offending domain would have to make amends with him by giving wine and money. He would take the offering of the wine, call the people of the domain and enter into the Vagha *olebe*, pouring out the wine and asking for pardon. In this case, the offending domain supplied the material means for Vagha to make amends with their ancestors.

Table 2. Fines and consequences associated with pre-independence unauthorised burning.

Fines
Payment in money or raphia to the land chief
Payment of daughter in marriage
Sacrifice of goats, chickens, red wine to ancestors as directed by the land chief
Consequences
Sickness
Death
Slavery
Loss of daughter in marriage
Loss of money
Wrath of the land chief
Wrath of other villagers

In fact, it was not just unauthorised burning that carried heavy fines for the domain. Jean Mathieu Anza and Jerome Ntieli remember when the people of one domain falsely claimed the death of a family member in another domain. Once discovered, the family of the offending domain who had taken part in the ruse had to give a woman as payment to the other domain. In a less dramatic case, they recalled an offense of a hunter from Mbie in Nkomo Domain being charged numerous hind-quarters of hunted animals (an amount that exceeded his means to pay the fine) for his habit of continually hunting without authorisation. Even women who had fished

in lakes without authorisation were sometimes levied a fine of their catch or even the fruits of their plantations (Rec-10).

Lightning strikes: non-anthropogenic ignition

Discussing savanna fires cannot go without mention of "natural" fires caused by lightning strikes. Several times in the course of fieldwork, people would recount, even without asking, personal encounters with lightning. One woman saw lightning strike a tree and catch it on fire just prior to a rainstorm. Another man, immediately after leaving his seat in an *olebe*, found that the dog next to it had been struck dead by lightning, the man himself having sustained hair loss. He remembers the lightning forming a ball and travelling out of the *olebe* to the next tree top. However, the worst was the account of one woman's husband being struck dead while eating next to her, his hand still clenched around a piece of manioc.

Can these lightning strikes start savanna fires? One eco-guard in nearby PNPB attests to having seen lightning strike near the workers quarters at Camp Mbie, starting a small fire (pers. comm. F. Mouzinga). It was soon put out by the ensuing rainstorm.

In African savannas, lightning can be a significant form of ignition; lightning is most prevalent on the equator during the rainy season in October-November (Komarek 1972). Although rarely reported on a local scale (Tutin et al. 1996), continental-wide studies suggest that lightning strikes occur evenly in areas south of the Sahara, sometimes causing fires (Komarek 1972). In the hilltop village of Kebiri, the chief reported nine strikes in living memory, including the aforementioned human fatality. However, it may be the location that partially drives it, as there were fewer lightning strikes reported from villages in valleys. Most of the lighting strikes reported for the study area appear to have occurred during rain storms, wherein the rains would extinguish the fires.

Conclusion

As seen in the preceding sections, the Teke-Alima of Gabon practised a form of land tenure common in Central Africa savannas. The clan's lands were managed by the land chief who regulated access to and maintained fertility of resources. This was a magico-religious system that involved ceremonies and rites being regularly conducted. While these ceremonies continue today, some are becoming rare.

Most informants during the study indicate that their last participation in a fire-drive occurred in the late 1960s. This was at a tumultuous time in Gabonese history when villages were being re-located to roadsides, when youth were moving to urban centres, and when new Gabon state laws were being introduced in place of customary law. It was at this point that the land chief system seems to have collapsed.

Today, despite most people surveyed knowing the word *ngantse*, there were numerous younger respondents who did not know what his historic function was. Most land chiefs are now dead, and the remaining ones are elderly. Domain traditions are kept by fewer and fewer people. As Etienne Nturi put it in terms of Kankuru Domain, "The land chiefs are over; the only ones left are we, the *petit-fils*" (Rec-4). In the following chapter I will explore why this system fell into disuse in the late 1960s.

Chapter 5: Unravelling of the land chief System and its fire regime

> *Avant l'indépendance, les chasseurs ne pouvaient pas bruler la plaine comme ils brulent aujourd'hui, n'avaient pas peur de bruler le* lasele.[73] *Mais aujourd'hui, mon fils, on fait comme on veut.*
>
> Mbia to S. Touladjan, 2007

Introduction

As seen in Chapter 4, the land chief system valued fire not only as a hunting technique but also as a tool to ensure land fertility. Fire use was strictly regulated and when improperly used was perceived to unleash catastrophe on the offenders and the domain itself. The use of land rituals today is reduced despite occasional domain fertility problems. This chapter will explore the political ecology of the land chief system showing how politics, laws, state initiatives, and new technology contributed to the decline of controlled fire use and ultimately resulting in a change in the fire regime.

Fire today: passive and aseasonal fires

Today, fires burn in nearly every season in the savannas of the Bateke Plateaux. When one considers the seasonality of fires today across the plateaus from Lékoni, Gabon to Léfini, Congo (University of Maryland 2006), fires peak in the long-dry season (June – September), which is the season of game hunting, grasshopper collection, and forest plantation burning. There is a very small secondary peak in the short-dry season (January to February), when the use of fire for hunting Abdim's Stork may occur and when vegetation is more fire-prone.[74] Despite the peaks, there is fire activity at all times of the year, though notably less in October and November when little is left to burn and the beginning of the rainy season is stimulating growth after the many dry-season fires (Fig. 1). According to one study, literature on burning seasons in the tropics is misleading, often reporting on the detectable peak of fire activity; however, "...experience in tropical countries shows that burning can be observed almost whenever and wherever there is plant material dry enough to burn" (Andreae and Goldammer 1992: 85). In the Bateke Plateaux area, this nearly continuous savanna firing differs greatly from the annual long-dry season fire regime maintained in the land chief era only 40 years ago.

Today's fires are no longer actively used to drive game into nets; rather, fire is a passive tool, used to create grazing sites of re-growing grass to which grazing game is later attracted. The hunting off-take is not immediate as it once was with the fire drive. In comparing the

[73] *Lasele* was the general term for unburned area of the savanna destined to be burned by the land chief during the fire-drive.

[74] From this point forward, all fires mentioned are in the savanna (as opposed to forest) unless otherwise stated.

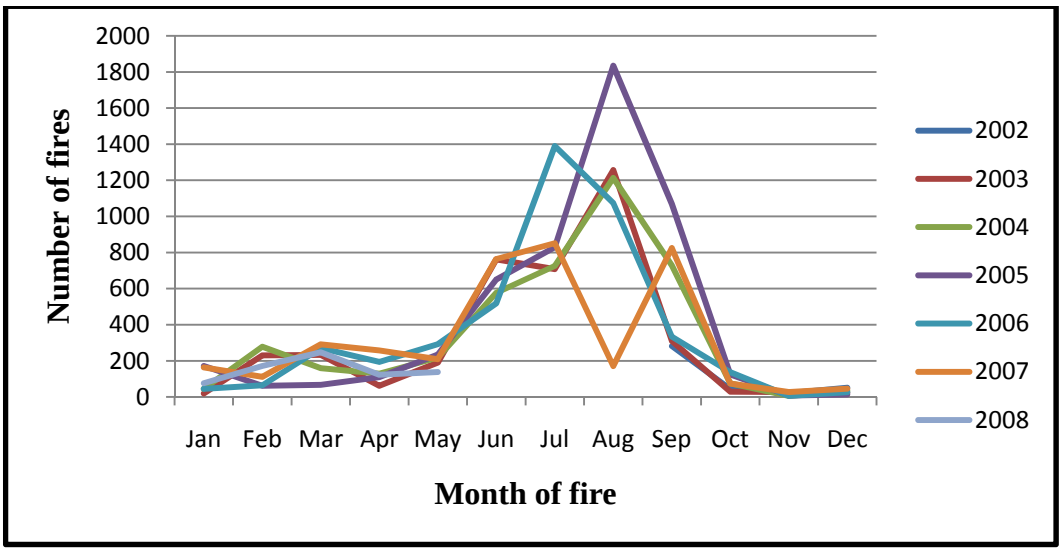


Figure 1. Fire seasons 2002-2008 in the Bateke Plateaux (data from Univ. of Maryland Firemapper 2006).

land chief fire regime versus today's regime, one sees a shift in seasonality from annual to semi-annual fires. The annual fires were most likely fewer in number and in size, occurring only in the long dry season, whereas today's fires are numerous, in all seasons, and larger in extent, sometimes crossing domains (see Chapter 8). This shift in fire regime was generated by a change within the Bateke political system. While the past fire regime used a low-tech, but highly organised communal method, today's system is high-tech (guns) and almost lacking in social organisation. Today's fires are motivated by commercialised and subsistence hunting, political activity, foraging, and pleasure. In this chapter, I will explore the reasons behind this shift in fire regime and its links to Bateke societal and environmental change. There are many reasons that the land chiefs lost authority, and it seems unlikely that a single factor was the main cause. The factors that I discuss below include the rural exodus, gun introduction, induction of colonial and state laws, *régroupement*, and the rise of the *chef de canton* system. Each will be discussed in turn. Today, little real traditional authority exists over local land tenure, resource economics, and politics, with only the magico-religious portions of customary authority barely remaining. This fragmentation of traditional authority had significant consequences for the fire regime, as I will later show.

The colonial replacements of customary rulers

Customary chiefs, prior to European contact, had an accepted role in society. These leaders, whether they were heads of lineages, villages, or domains, had roles in regulating societal and environmental problems. In the case of the Bateke-Tsayi, there were two main chiefs who worked together to achieve social, spiritual, and ecological harmony: the *nga ntse* (land chief) was the master of land fertility while the *nga bate* was the master of the people (Dupré & Pinçon 1997: 188). In the case of the Teke-Alima, there is the *okuru a ndzo*, the master of the lineage, the *nga pugu* the manager of inter-lineage conflicts within the village, and the *nga ntse*, who manages land fertility and the ancestors (Ebouli 2001: 29). The highest in the territorial

hierarchy was the supreme land chief, who ruled several domains, collectively called *kasi* (Ebouli 2001: 90). At the end of the 19th century, there were four *kasi* in the wider study area (Ebouli 2001: 97-101). Bateke society was regulated by this hierarchy of power and the way it mapped onto space. As seen in Chapter 4, the land chief's role in maintaining land fertility was important and demanded proper hunting and burning procedures. However, societal organization in Central Africa was turned on its head with contact first with European traders and later with colonial administrators.

It is well-known that the Atlantic slave trade induced different monetary and ruling structures in Bantu-speaking societies (Vansina 1990). Some also emphasize the importance of this trade in restructuring chieftaincies. However, as colonial administrations became firmly established, European innovations were imposed on Central African societies, leading to what Vansina called the "death of the Equatorial tradition" (Vansina 1990: 247).

> Even while they were conquering the area, the Europeans were implementing their concept of a modern state with its centralized bureaucratic and, in the colonies, autocratic government. They justified the conquest in the name of a "civilizing mission." Colonial agents and missionaries continually invoked this principle to destroy most outward manifestations of the old tradition. At the same time they first built their own cognitive view of rural African society and then imposed it on daily life before or during the 1920s. The only concession to the equatorial way of life was to preserve some cultural flotsam and jetsam, and to erect a structure labeled customary law, which was utterly foreign to the spirit of the former tradition. Customary law was the headstone on its grave.
>
> Vansina 1990: 239

According to West African colonial administrator Robert Delavignette, the French loved the idea of applying their concept of civilization to Africa, yet this was incongruous with reality. He states (Delavignette 1950: 21): "The peoples we call primitive possessed a state which strictly regulated every detail of the relations between individuals and authority." According to historian Christopher Gray, colonial administrations had a completely different concept of space from those being colonized: African clan relations collided with European "modern territoriality" (Gray 2002: 2). While the European administrators tried to define ethnic territories based on maps, the African groups of southern Gabon defined their space through matrilineal clan relationships, creating social territories which were relatively independent of space (Gray 2002: 35). According to Bohannan (1963), there was the mismatch between European and African land cultures. He explained that Europeans have a direct correlation between a map of a territory and ownership and from this basis assume social position. However, most African societies have a direct relationship between map and the social organisation and then infer ownership. The gulf between African and European laws was a misunderstanding of the social contexts and how this related to geographical space.

To rectify this, colonial powers conducted studies on ethnic groups and land tenure systems to order the colonised space. In the Democratic Republic of Congo, colonial ethnographies made a blueprint of patrilineal society, however, in French colonies, the village was the administrative unit, grouped into cantons led by chiefs appointed by the French (Vansina 1990: 246). This difference in concepts of territories and power between Europeans and Central Africans led to many problems. For example, the French assumed that Teke were matrilineal and therefore nominated the *mpfo andzo* (lineage leader) as colonial village chiefs; however, the French were vexed as they could not understand why these chiefs could only effectively direct their matrilineage and not the entire settlement (Vansina 1973: 479).

For the Bateke, the reorganization of their territory began with de Brazza's voyages where he became an "inventor of space" (see Gray 2002: 104; Pourtier 1989a: 83), with his exploration, mapping, and treaties opening their and other's territories to French colonisation. The French first administered the colony through posts in the interior but started formally organising the AEF into administrative units called "circumscriptions" in 1909 (N'nah 1981: 45). The next level of administration, called the "*canton*", was installed in 1920 (Gray 2002: 204). In the Haut Ogooué, Franceville's post was created in 1880s (Fourneau 1886) and the canton chiefs were first given authority between 1920-34 (Ongala 2005: 54). Lékoni did not receive its first post until 1947 (Ongala 2005: 56). *Cantons* were first organised around perceived ethnicities and labelled as such (Ongala 2005: 56).[75] Colonial attempts to describe ethnicities created several problems. For example, it created hierarchies of preferred ethnicities (Gray 2002: 209) where some ethnic groups were preferred collaborators with the French (Ongala 2005: 71).[76] Sometimes ethnicities were mixed within a canton causing serious problems. According to Onkadi (Rec-5), when the French consulted non-chiefs, the result was what he called a bad partitioning of domains [cantons]. For example, in the case of the Bongoville area with cantons which mixed Teke and Obamba peoples, fights arose between administrative and customary chiefs over domains (Oligui 2007: 84) . These were resolved by re-attachment of certain villages to an adjacent canton with which they were more ethnically similar. At first, as customary chiefs died, the French nominated traditional authorities to represent the state; these were chosen for their likelihood to work well with the French colonial government (Geschiere 1982), an act being described as the "suppression of traditional chief-hood" (N'nah 1981: 47). Many of these chiefs were ones that the population could not accept as legitimate (Oligui 2007: 84), and this sentiment forced these chiefs to rely heavily on French authority to back them up (Gray 2002: 205). In the Republic of Congo, some chiefs were perceived by administrators to be war chiefs, but essentially were trapped between customary expectations by the population and administrative expectations by the French (Kinata 2001: 53). Delavignette (1950: 74) tells us

[75] These were later renamed after rivers in 1958 (Ongala 2005: 56). The study site is currently located in the Canton Djouya but was previously called "Canton Bateke II" (Ongala 2005: 72).
[76] In the Franceville area, the Ndumu were the preferred ethnic collaborators (Ongala 2005: 55).

that in his West African experience of 20 years, there is often a "straw chief" *and* a land chief: the first is the administrative face, but the second one is who must be part of all negotiations, as it is he who is viewed by locals as the first inhabitant of the land, and thus central to customary dealings. Delavignette (1950: 71) considers this person to be the real chief, saying, "In all territorial administration the native chiefs act as cogwheels between the colonial authority and the native peoples."

In 1936, the Haut Ogooué comprised 13 cantons, each with six to ten domains (Ongala 2005: 55). The *chef de canton* was charged with transmission of information between villagers and the *chef de department* (and he was also an auxiliary of the *chef de subdivision*), he also collected taxes (Ongala 2005: 62)[77]. Despite original canton chiefs being selected from respected families with customary authority, by 1937 fluency in French and a basic understanding of administration became the primary requirements of the post (Ongala 2005: 73). In the Haut Ogooué, the French then placed in power secretaries that had formerly served under the canton chiefs; these new literate leaders were not respected by the population since they did not carry the customary authority of their predecessors (Ongala 2005: 73). However, in the study area, it seems that the last land chief was named to the status of *chef de canton* in 1947, in part because he had good relations with the French as well as power over a territory stretching across the current canton of the study site.[78] In southern Gabon, the backlash against the state-appointed administrators was dealt with through leopard-men attacks instigated by customary chiefs against state-appointed chiefs (Gray 2002: 200). The administration didn't recognise these attacks as a sign of a society in distress (Gray 2002: 200). Gray (2002: 218) takes these leopard attacks, as well as the evolution of healing cults at that time, as a response by the Africans to control the supernatural world, thus keeping the equatorial tradition alive. Additionally many rituals were outlawed, which made Africans feel that witchcraft was left unchecked (Vansina 1990: 246).

Post WW II, the French began to favour working with literate elites, sidelining state-appointed customary chiefs yet again (Gray 2002: 213; Kinata 2001: 129). In Fougamou, locals requested the appointed of a younger canton chief who could understand colonial law (Gray 2002: 213). In the case of the Maka in Cameroon, colonial schooling and France's desire for a literate group of rulers created an imbalance of power in villages. Geschiere (1982) details the power transfer from traditional authorities to French-proclaimed chiefs to modern urbanised village elite. The elite were derived from a pool of schooled villagers who obtained diplomas and positions in the civil service. This has created a situation where these newly educated and affluent villagers become local elites when they returned to their villages. Their high status gave them the ability

[77] Tax collection by customary chiefs had begun prior to the establishment of canton chiefs in the early 1900s (Gray 2002: 203). The elders of Walla remember well the stories about their supreme land chief once collecting taxes for the French (Rec-14).
[78] Today this area covers 18 villages; historically, it had16.

to make village decisions despite the presence of a non-literate chief officially representing the state.

The major exception to this pattern was Ngalifourou who was named canton chief in 1918 when her husband, the last autonomous *Onkoo*, died. She maintained this power until her death in 1958, working with the French to nominate successive *Onkoo*s. During this time, she was so powerful that "kings had become less than cantons" (Vansina 1973: 475). It was only after her death followed by a weak successor, that the throne increased again in power (Vansina 1973: 472-478).

As the legitimacy of both customary and administrative chiefs came under question by colonial administration and the local population, customary rule became impossible to maintain within the colonial realm. Without customary rulers, societal organization drastically changed. This was certainly true of Bateke land chiefs. I will consider this in the coming sections, considering the context of the declining authority of the land chief and society's response to gun access, state laws, the rural exodus, and resettlement.

The law and its application: theory meets reality

The first land chief encountered in the literature on the plateaus is de Brazza's interview with Land Chief N'jayolé (Brazza 1888):

> *Mon apparition au long avait été depuis longtemps signalé; néanmoins N'jayole se donne la satisfaction de me faire attendre. Lorsqu'il pensa que cette pause avait inspire une haute idée de sa personne, il parut, entoure des chefs de terres voisines, parents ou amis, réunis pour lui faire honneur. Dans cette circonstance N'jayole avait exhume la coiffure de grande cérémonie, sorte de perruque en fibres textiles, rappelant un casque; les appendices qui la surmontaient, vus a distance, ressemblaient a des cornes C'est la le signe distinctif du nn'ga-ntche, chef de terre, qui a sous sa dépendance tous les villages du district.*
>
> (Brazza 1887: 54)

De Brazza soon realized that his operations in Bateke territory would only be successful if authorized by the land chief, and not the village chiefs (1889: 342). When the French needed aid, they contacted the land chief to organise porters between Franceville and Brazzaville (Dupré and Féau 1998: 33). Their utility in organising the local population was probably what laid the foundation for the French colonial administration's decision in 1947 to name the last supreme land chief as the first c*hef de canton* of the study area's Canton Djouya. This area represents almost exactly the terrain of the last supreme land chief, Kakogho. Many informants equate the past office of land chief to the present-day office of the *chef de canton.* However, this meant that the land chief was now representing the French powers and not his own or Bateke interests. The fire-drive ended in the study site in the late 1960s. When we asked people in five villages in the study site born prior to 1960 why they thought the fire-drives have

stopped, they indicated the following as important factors: the introduction of guns, changes in the immediate post-independence law, and the rural exodus. Indeed, these changes to Bateke society occurred in the 1960s and were co-incidental with the end of the fire-drive.

Informants recall this shift from customary to state rule in a negative light. Not only were these former-customary-chiefs-now-state-administrators involved in resettlement policy, something that will be explored later, but also in tax collection.[79] During this transitional era, many inter-village disputes erupted, some involving bloodshed and misunderstandings with French colonial administrators. Some *chefs du canton* were imprisoned for various "crimes", including the death of people on their own lands.[80] Accounts by informants are mirrored in histories of Gabon's initial struggles against colonial rule. It has been called a "regime of terror" (Oligui 2007: 86). Specific accounts of tax revolts leading to bloodshed are reported elsewhere in Gabon (N'nah 1981) and for the Teke-Tsayi in Congo (Dupré 1990).

Informants related their memories from this time of forestry agents and prefects visiting the villages to inform the villages of their reduced land rights. It was a time of confusion, fear, and uncertainty for villagers and their leaders. In an interview with the Chief of Kebiri, Daniel Ololo, age 77, (Rec-9), the negative sentiments of the transition from customary to colonial and state law are poignant:

> ST: Papa, why do we no longer hunt like before?[81]
>
> D : We no longer hunt like this because when Bongo [the recently deceased Bateke president] came, all the domains became his, the land chiefs are all dead, and he told us not to burn the savanna. If you burn and someone is hurt, the chief of that land will be arrested; he will die in prison. This is why we no longer burn the savanna.
>
> The land chiefs are dead, even the people who placed their nets are dead. Look at these villages, there is no one. But if you need to burn, who are you going to burn with? This is why we have left the *lasele*.
>
> We must forget about these domains. But today if a child says that this domain is his father's and if someone dies by a gunshot and if one calls [to ask for an explanation] the land chief will go to prison. We must no longer count on these domains. All the children who have remained, we all refused saying that the owners of these domains are all dead. We the younger ones will follow the ways of the white man. There are no more domains.

[79] The informants at Boumango had a particularly rich oral history of this rule transition, though not experienced directly by them. From these recollections, there was a blurring of state tax and customary tribute with it being unclear when customary payment stopped and colonial taxes began.
[80] This is particularly relevant to one of the most revered land chief/*chef de canton*, Sylvestre Kakogho who was imprisoned for the unexplained death of his son. The death was assumed to be mystical by the Teke.
[81] "ST" refers to Stevens Touladjan, who participated in this interview as a translator.

The office of *chef de canton* was one that seemed to bring nothing but trouble for Bateke society. The land chief could not exercise customary authority over fire and resource use and the *chef de canton* was blamed for all problems occurring in his canton. Ruling in any post was at best difficult during this era.

Guns and fire: the changing Bateke biocultural landscape

> *Les gens ont arête de bruler la plaine parce que les vieux étaient déjà fatigués et l'apparition des fusils. Aujourd'hui je compte que chaque jeune homme a un fusil donc le brulage est fini.*
>
> Gorgie, 2007, translated by S. Touladjan

The fire-drive was historically conducted with nets, spears, and clubs. However, when guns became readily available, hunting practices changed. Guns allowed individuals to hunt at will and eradicated the community's dependence on the nets of their neighbors. Thus, communal net hunts were replaced by solitary gun hunts. Here I will take a closer look at when guns became available to commoners in the plateaus and the implications for the fire regime.

In a thesis about fire, society, and the ecosystem, why discuss guns? I suggest that when guns entered Bateke society on a large scale, they revolutionised the culture of fire. Coincident also with the arrival of guns was the extinction of several species (see Appendix 3) and a change in the fire regime. Gun access meant that the communal hunt was no longer necessary to obtain dry season meat and, following this logic, communal fire control was no longer necessary. In other parts of Gabon, the introduction of hunting permits made many forego hunting traditions and protocol, hunting on other's lands and not giving tribute to the owners. Non-owners of guns were noted as being more likely to follow traditional rules (Jean 1975).

Tracking of guns and their prevalence in the AEF is not difficult: colonial administrators and explorers were interested in who was armed and who wasn't; expatriate hunters were interested in local hunting techniques and often commented on gun abundance; and historians were interested in links between guns and politics. Based on these sources, there are two phases of local gun history: pre- and post-independence.

Hunting techniques in the plateaus are numerous, as in other areas. Snares, spears, pit traps, glue, nets, and fire all play a role in the ways whereby people accessed animal resources. In most cases, as seen in the preceding chapter, hunting was an organized affair with disobedience perceived to have a negative impact on domain fertility. However, as guns became common, the historic power structures that organized hunting and ensured land fertility broke down. The large-scale introduction of the 12-gauge shotgun occurred in living memory of many informants, suggesting that guns were rare in the plateaus prior to independence. According to many researchers, they were. Historian Florence Bernault indicates:

> *Les armes étaient inégalement répandues selon les régions. Assez rare sur les Plateaux Bateke, ou la chasse collective au filet et a la lance avait résisté à la pénétration technique, les fusils étaient au contraire nombreux entre le cours du Niari et de la Bouenze, en pays Beembe particulièrement.*
>
> (Bernault 1996: 312)

Many explorers, when walking between Franceville and Brazzaville in the 1880s, noted that the Bateke had few guns, with spears and bows and arrows being more common (Ballay 1885; Decazes 1885). While the north-western Bateke were well-versed in the fabrication of spears and arrows, obtaining their iron ore from the neighbouring Obamba, Guiral (1889: 163) specifically notes that they were not fabricating guns at this time. They later learned this craft, according to informants, from gun-makers in neighbouring territories or in Brazzaville.

Guns were in demand everywhere by the 1880s, with the Koukouya traders sourcing them from the Pool and the Yombe area (Vansina 1973: 271). However, according to de Brazza and Vansina, guns were primarily sourced from the coast. De Brazza noted that in areas neighbouring Teke country (Balali and Bayaja), European guns had already replaced local guns (Brazza 1887: 60). De Brazza noted that the Aboma, a people bordering the Bateke, were very interested in gun knowledge, often asking to try the explorers' guns (Brunschwig 1972: 26 [1880]); he also noted that the Angingilli were owners of guns (Brunschwig 1972: 27 [1880]). By 1910, the Teke-Alima owned flintlocks; knives, spears, and poison arrow hunting were still common (Dusseljé 1910). In the Pool area, the first Bateke dictionaries show a detailed vocabulary for gun parts in the mid-1880s. Vansina (1973: 269) was astounded by the development of Bateke gun terminology which totalled 44 words for gun parts (Calloc'h 1911: 225-6). Vansina (1973: 269) takes this as evidence, along with trade numbers from the coast, that guns were firmly established at the Pool by the 1880s. The northern and eastern Teke were trading local goods to bring guns into the plateaus in the late 1800s (Bonnafé 1987: 80). As slaves and ivory left the plateaus, guns and powder entered (Ebouli 2001: 55). Thus, on the one hand, explorers wrote that the Bateke had proportionally fewer guns that their neighbouring groups while at the same time anthropologists talk of the increasing gun trade into the plateaus.

Some of the incongruity amongst these reports may come from understanding the links between gun ownership and social status. Guns were often owned by people of high status (Bernault 1996: 311), explaining why de Brazza found guns at the *Onkoo*'s residence in Mbé (Brunschwig 1972: 63) and why the Koukouya's sky lords had a corps of people who had special access to arms but did not own the guns themselves (Bonnafé 1987: 59). Vansina indicates that guns were one of the highest forms of trade "currency", ranking just below slaves and ivory (1973: 304-5). Thus, guns would not have been owned by everyone but only by those who could afford it. This pattern of elite ownership of guns continued into the late colonial era, but for different

reasons: in the AEF gun ownership was illegal for the commoners until the late 1950s (Bernault 1996: 286).

According to Bernault, gun ownership was severely limited during the colonial era, with only administrators and village chiefs having access to them. For a brief period, between 1919 and 1925, guns were legally sold in the AEF; then gun ownership was only allowed under permit, something costly and difficult to obtain. Even if one had a gun, hunting was only possible with a hunting permit (Bernault 1996: 313). By independence, the Gabonese population was eager to obtain guns more freely. Gun purchase policies from the colonial period were reversed and became a political issue. Gun acquisition became part of political campaigns by the first Gabonese president Leon M'Ba who, in an early pre-independence campaign, offered 4,000 guns to supporters (Bernault 1996: 314). By 1961, state politics in both Gabon and Congo used guns to foster votes and reduce support for the opposition. While the Congolese gave guns to supporters, the Gabonese forbade sales to opponents (Bernault 1996: 315).

Informants from the study area remember well when and how they obtained their first guns. Forged guns produced by local metal-smiths were considered to be dangerous, but even someone from Lewou had gone to Brazzaville to learn the craft. Alna, who lived in both the Gabonese and Congolese parts of the plateaus during this time, remembers the gun-oriented political campaigns of the first presidents of both countries. He remembers Leon M'Ba offering gun access to those with a permit, with the 12-gauge costing 16,000 CFA. At the same time in Congo, no permits were required; he acquired his first gun in Brazzaville for 25,000 CFA.

Antoine Mbia (Rec-17) remembers when the local authorities started visiting villages and banning the fire-drive in the late 1950s. The first orders to abandon the fire-drive were given by the *préfet* to the land chief in the hope that fewer animals would be killed. They believed that the fire-drive killed too many animals and proposed that local people should start using guns to kill only one or two animals as needed. However, at this time in 1955, only local chiefs could have access to guns. For Ekouyi-Mbouma, the first guns were owned by the village chiefs Onkanda of Ekouyi and Tolo of Mbouma (Tolo was the last land chief of Kankuru Domain). After independence, Mbia remembers the increased availability of the 12-gauge, attributed to the former president, Bongo-Ondimba, who gave preferential gun access to the Bateke.

The replacement of communal net hunting with solitary gun hunting was not immediate or geographically ubiquitous. Badier (1929) noted that net hunting was being replaced by muzzle loaders in the 1920s near the Ossouélé area, north of Lékoni. In the 1960s in the Mbe Plateau, hunting was mixing gun technology with tradition: Sautter reports during one fire-drive that 150 hunters participated with 50 guns and 30 nets (Sautter 1960: 28). In the 1950s, one French

hunter describes a series of “traditional hunts” from central Gabon but commented that guns were changing hunting traditions:

> *A l'heure actuelle, je ne crois pas que de telles chasses soient encore pratiquées [referring to Bakele and Pygmy hunting methods]. La poudre est entrée en scène.....*
>
> (Weite 1954: 138)

According to a recent study in the Haut Ogooué of forest Obamba and Bateke hunters, net hunting accounts for 10.4% of all hunting today, with net hunting for porcupine being particularly high (Carpeneto et al. 2007). This is similar to the study area (50 km south) where the only form of communal hunting done today is in the forest for porcupine. The savanna net hunting with fire is extinct and, along with it, the near-annual fire regime.

Gun and hunting laws

In 1929, hunting laws became part of AEF legislation. By 1936 (*Décret 13 octobre* 1936), there were hunting limits for buffalo and antelopes while elephant hunting required a permit. A distinction was made between owning a gun and using it for hunting, requiring separate permits. In 1936, hunting with spotlights (at night), from cars, or with the aid of fire were all forbidden. Subsistence hunting was permitted up to five kilometres from the village with locally crafted weapons (Article 13), and was considered to be a native right. Hunting in protected areas was forbidden while subsistence hunting within the canton was tolerated. The five kilometre law was particularly applicable when hunting animals that had posed a threat to villagers, such as lions (pers. comm. P. Christy).

This law was then followed by additional laws adding restraints on hunting, including the introduction of hunting seasons (as determined by *Gouverneur Général*) and the banning of commercial hunting (*Décret 27 mars* 1944). The fire-drive was still forbidden; although other forms of collective hunting were permitted but could now be regulated by the Governor (Article 11). This was followed three years later by a law which limited governmental controls over excessive hunting for periods of five years or less (*Décret 18 novembre* 1947). This latter part was particularly used to limit the unnecessary destruction of wildlife (pers. comm. P. Christy).

A decade later, hunting zones were identified in the law, including the present day Congolese portion of the Bateke Plateaux stretching from Zanaga to the Ogooué. Additionally, this law specifies that net hunting is only allowed in the forest, and not in the savanna (*Décret 687* 1956).

When Gabon gained independence, many laws from the AEF were transferred into Gabon state law. The law continued to allow hunting as long as it was conducted with locally made

materials. A permit was required to hunt with guns while hunting from cars, with fire, and with spotlights at night continued to be forbidden (*Décret 8 juin* 1960).

Gabon's present day forestry code forbids hunting without a permit, in closed season, in protected areas, from a car or plane, at night (with or without lights), with nets, fire or pits[82], and with metallic cable traps (*Loi* N0016/01 2001). In 1994, a decree protecting threatened species in Gabon came into play (*Décret 4 mars* 1987); this decree was then modified to include endangered species such as Grimm's Duiker (*Décret 28 juillet* 1994), the main target of the Bateke fire drive. Hunting laws continually evolved, reducing customary controls over time and centralising hunting authority at the state level. Despite this, these state laws are rarely enforced, leaving hunting in the plateau area in an almost lawless state.

Fire Laws

Fire was a sensitive issue in the colonial era and was seen as a threat to forest resources; it was to be controlled at all costs. Forests were a colonial resource for timber and destruction of potential income via fire was taken seriously (Consigny 1937a; Consigny 1937b). Several colonial-era researchers studied this issue intensively (de Wildman 1938; Humbert 1938; Pitot 1953). However, almost all of these works were anti-fire in perspective and were written from the colonial view of fire *control* and not the local view point of fire *use*, as was typical of the era (Wardell et al. 2004). The 1951 pan-African meeting of forestry officials, attended by colonial forester Aubréville among others, is particularly interesting (Perriguey 1951). During this conference, numerous anti-fire cases were presented from French, English, Portuguese, and Spanish colonies (e.g. Collin 1951). At around that time, one curious case is presented where the Belgian colonial administration favoured the indigenous practice of *nkunku* which protected savannas from fire with the goal of creating forest for future cultivation (Biernaux 1954). Anti-fire policies were established and acted upon in many West African countries under French administration (Laris 2004; Mbow et al. 2000; Schmitz 1996); however, in Gabon they were largely not enforced.

In the AEF, bush fire, or *feu de brousse*, is a generic term meaning fire applied to either forest or savanna. Bush fire was outlawed in 1904 (*Décret 10 mars* 1904). This decree was followed several decades later by another decree which stipulated that legal fires now included fire for establishing plantations and villages. These fires could not be abandoned; all other fires were forbidden. Fires were allowed with permission from the *chef de subdivision*, were required to be delimited by a fire break and to be burned in calm weather conditions in the presence of the *chef*. If an unauthorised fire was detected, all able-bodied males within a five kilometres distance were required to extinguish it. The fines associated with illegal fires were 16-5000 CFA and imprisonment from 16 days to two years (*Décret 80* 1941). Five years later bush fire

[82] This Code does not specify if in forest or savanna.

was addressed in the forestry law for the AEF (*Décret 46-1.161* 1946). Section VI is entitled "*feux de brousse: incendie de forêt*", primarily addressing fires in forests. However, Article 24 states "It is forbidden to carry or light fires outside of habitations and buildings in the interior, and at a distance of 500 m from *forêts classées*[83], situated on the edge of savannas or in savanna zones." Furthermore, authorised fires required 20 m firebreaks at the perimeter. The only fires tolerated are listed in Title 2/Section VI and include fires for pasture management, cleaning of lands, and agriculture.

According to the present-day forestry code, fire drives are forbidden. Forested lands are divided into two types: industrial/production forests and rural/subsistence forests or lands (Article 12). Chapter IV defines customary rights to forest resources. Traditional hunting (for subsistence) is allowed as is the usage of guns and other tools listed in the code. Article 156-162 defines community forests and how they can be created upon request. The customary rights of collection of construction materials, fire wood, secondary forest resources (bark, latex, mushrooms, medicines, edible plants, rocks, and lianas), artisanal hunting and fishing, savanna pastures, subsistence agriculture, and grazing rights near water are all permissible (Article 252). However, the status of setting savanna fires for subsistence (gathering and passive hunting) remains ambiguous.

While these laws are sometimes clear about penalties for hunting and burning, they are not always enforced. Fire drives are unlawful under Gabonese law, yet no generalised burning law remains applicable. Even if it were, enforcement possibilities are limited. By contrast, the land chief achieved control over fire application and savanna hunting seasons within his domain. This legitimacy was partly possible through a graduated sanction system, whereby graver actions had graver punishments; this is considered to be one of the elements that make such systems enforceable (Ostrom 1990: 90). When asked about the penalties associated with unauthorised burning prior to independence, answers included sorcery-related death and the forfeiting of daughters in marriage (see Chapter 4), linking action with penalty in a symbolic system. By contrast, 88% of the respondents indicated that there are no penalties for savanna burning without authorisation today[84]. During the study, children lit a fire in the village, burning down tourist housing, and nearly damaging my own house. These actions went without consequence.[85] Thus, essentially today, there are no government-enforced and rarely village-enforced consequences for burning.

[83] A *forêt classée* was a forest managed by the Department of Water and Forests, not necessarily a protected area.
[84] Today, there are penalties for forest plantation fires which spread to adjacent plantations. However, these are more likely to be enforced in cities, if the crime can be proved (150,000 cfa was a typical fine cited for Franceville).
[85] Notably, relations with the tourist operator were stagnant; had my house burned, there would have been a reparatory action such as rebuilding my house.

Land tenure laws

As early as 1899, the French established legal rights over unoccupied forest in Gabon, based on the idea of "vacant lands without masters" (Jaffré 2003: 203). This decree was especially useful in organising early colonial forestry concessions. However, as seen in Chapter 2, the Bateke Plateaux was one of the most remote areas for both the Brazzaville and Libreville administrations; this was the least administered part of the AEF (Pourtier 1989a; Pourtier 1989b; Sautter 1960). Compounded by the Bateke refusing to trade or give labour and the financial failure of nearby concessions (Coquery-Vidrovitch 1972), the Bateke and their plateaus were left alone[86].

Between 1925 and 1946, the Haut Ogooué was under the Congolese portion of the AEF and so the Bateke Plateaux fell under the Moyen-Congo's administration. During that time, the colonial administration was attempting to deal with private property and tenure issues. The colonial government perceived the migratory village establishment by many ethnicities as evidence of lack of "attachment to land" (Kinata 2001: 44). This form of village migration is well documented for the Bateke (Guillot 1980; Soret 1973: 295). The notion of un-occupied land was seen by Vansina as an integral part of Bateke society. He disagreed with Sautter that the Bateke Plateaux were "under-populated" (Sautter 1966: 965), insisting that, "The notion of overpopulation is relative to a society and an economy: the Tio used land very extensively (Vansina 1973: 494)." These large tracts were used for making new settlements as old villages fissioned. However, once occupied, land tenure for the Bateke was communal and resource access organised by the land chief.

In 1920, a decree allowed Congolese to sell their property, while recognising that some of these lands were communally owned. By 1938, another law was established which allowed the registration of customary lands. According to the *Régime Forestier* for the AEF (*Décret no. 46-1.161* 1946), forests that were vacant and without masters were said to belong to the state's private domain. According to Soret's (1973: 168) summary of customary property rights for the eastern Teke in the Republic of Congo, private property and usufruct rights existed, but the owning of land was collective. One could cede all the rights over the land except ownership. Ceding of lands for use was what Soret likened to a 99-year lease. The Bateke always retained rights to visit the dead and considered lands only to be on loan (Soret 1963: 293). According to Soret (1973: 173), the Teke didn't lack land and permitted others to use it.

In Gabon, the notion of vacant land was imported from French law (pers. comm. P. Christy). According to Article 539 in Gabon's Civil Code, vacant lands belong to the state. Article 542 recognizes communal property but only for occupied lands. In the 1960s just after

[86] Despite being largely covered in savanna, forested areas do exist in the Teke-Tsayi area near Zanaga, Congo. Today, this area is being exploited by forestry companies.

independence, a series of laws gave most land rights to the government, revoking all customary land laws. This law indicated that all territory outside of village jurisdiction fell under state law (1963). A few years later, a law enabled villages to control and exploit lands for subsistence up to five kilometres from the village centre (*Décret 77* 1967). As seen in Chapter 4, in the study site Bateke customary rights included many layers of ownership including individual plantations, fruit trees, and some fishing holes and communal rights to hunting, gathering, and river fishing localities. The concept of land tenure in the colonial law and modern law was and is drastically different from the Teke concepts[87]. These laws noticeably conflicted with the land chief's representation of communal tenure. Colonial laws and administrations were able to reduce traditional authority by refusing to accept customary concepts of communal land use and tenure.

Rural Exodus

Many informants believed that as many youth left the village to become employed in town there were fewer able elders to carry out the fire drives. In fact, many Gabonese migrated to urban centres just after independence and then subsequently during the oil boom (Wunder 2003).[88] According to UN statistics, the urban population in Gabon nearly doubled in size between 1955 and 1965 coinciding with the biggest move from rural to urban areas (Chapter 2, Fig. 3; United Nations 2005). Wunder points to many issues arising from the urban migration, namely leaving an aging rural population with few men of working-age (20-45). In effect, this leaves large parts of rural Gabon with a population of elders, women, and children, typical of the villages in the study site. Bonnafé (1978) attributes the reduction of male activities in the Koukouya Plateau largely to the forced labour of the colonial era. Sautter concurs with this conclusion, indicating that many of the plateaus were potentially depleted of their population from forced labour associated with the construction of the Brazzaville-Pointe Noire railroad (Sautter 1966). These ideas concur with informants' experience in that as fewer young men were present in the village, the communal fire-drive fell out of practice.

Régroupement: population centralisation and estrangement

Régroupement or forced resettlement from the domain to the roadside is another issue contributing to the decline of traditional land tenure and the associated fire regime. The *régroupement* policy literally emptied the countryside of its villages, estranging them from their ancestral lands. In comparing village maps pre- and post-*régroupement*, villages that were once

[87] Other groups' concepts of land tenure in the context of colonisation of Gabon are explored further in (Pourtier 1989a: 209).

[88] The impact of the rural exodus can be seen by comparing savanna plantations in the 1950s to today. In aerial images from the study site (Institut Géographique National 1954), one sees that the average village had many more plantations than do present day villages. With comparable photos for today or current savanna plantation counts, one could arrive at a local estimation of depopulation in recent years.

scattered throughout Gabon are almost solely grouped along roads (Pourtier 1989b: 114).[89] Gray (2002: 226) indicates that this physical alignment of villages along roads also meant a cultural re-alignment.

In the past, small villages tended to form around matrilineal groups, typically not numbering more than 100 people. These populations were quite mobile, relocating village sites every six to seven years. Numerous copses (small village forests) dot the Teke savanna landscape. These are a visible testimony to historic settlement and migration patterns (Fairhead & Leach 1996; Guillot 1980). Such past movements were the result of villages dividing in response to limited resources (such as sufficient cultivation area, or water supply), sorcery accusations (Vansina 1973), death in the village, or the overcrowding by shade trees.[90] Villages might only relocate a few hundred metres from the first site in some cases (Soret 1973: 295). In the study area, most copses are named as former village sites; these contain a distinct flora, most notably with oil palm trees protruding through the canopy (see Chapter 8). These copses are the visible evidence of recent past voluntary Bateke migration. These movements were drastically changed in the 1960s when the new Gabonese government enacted *régroupement* policy in the study area. Thus, for the past 40 years, rather than moving every half-decade, most villages have remained in their 1967 location.

Régroupement was a development rationale adopted first by the French and later by the Gabonese state to control the rural population. In many cases in the AEF, *régroupement* was not a pleasant experience, often involving forced relocation and often not resulting in the desired effect of a more effective government (Burnham 1975). In many parts of Gabon, *régroupement* was carried out in the 1970s by the post-colonial government (Wunder 2003). Such a late start of village reorganization left many Bateke villages situated in their ancestral lands longer, than those that had been resettled at the policy's inception. In the case of the study site, *régroupement* only occurred in 1967 when several villages were forced to move to a new location, thus disconnecting them from locally based natural resource knowledge of nearby cultivation, fishing, hunting, or gathering sites. This relocation to new sites probably disrupted the way in which the land chief system functioned, displacing people from hunting domains and probably changing the way hunting occurred in these domains. Since people no longer lived in their domains and as customary rule waned, hunting and burning traditions changed. This is particularly notable in the case of the Mboua resettlement: these now-forest Teke no longer hunt or gather in their domain.

[89] The exceptional cases of Pygmy villages in the mountains of Central Gabon continue to remain off roads.
[90] The north-western Bateke prefer villages in open environments.

One physical results of *régroupement* is the cessation of the cyclical creation of new village sites and their associated forests. Local *régroupement* dates coincide with the last fire drives, showing a correlation between this policy and the change in fire regime.

The consequences of accepting or refusing to move from the domain

> *En décrétant la transplantation ou la réinstallation de certains groupes, on avait, quelquefois sous-estimé l'attachement profond des populations à leur sol natal, la xénophobie éventuelle des tribus devant recevoir les paysans immigrants, l'inadaptation des immigrants au nouveau milieu socioculturel.*
>
> (Biebuyck 1963a: 47)

In the case of the study site, many of the villages that were once along the Mpassa River corridor (Deschamps 1962: 61) had continued their migration westward toward the forest edge. The Teke groups of the upper and lower Mpassa migrated differently towards the forest and migrated in groups with their land chiefs: those under Kakogho and those under Okoundzi's group. Today, the Okoundzi group are along a major forest road today near Boumango with non-Bateke neighbours. By contrast, today those under Kakogho largely remain in the savannas with other Bateke, and only sometimes migrated to the road; these are the villagers of the Canton Djouya, including Ekouyi-Mbouma village. Villagers in Ekouyi-Mbouma initially resettled to a proposed road site, this one being not far from their domains (and sometimes still in them). However, the road site was changed prior to construction. Many villagers refused to move a second time and remained on what is still today an irregularly travelled sandy track. Those that accepted the proposal moved a second time into the semi-forested Bongoville area along a main road and became strangers in a new ecosystem in the forest.

Generally, these moves caused an estrangement of people from their domains, and sometimes the associated ecosystems, particularly for those who were dislodged from the savanna to the forest, or vice versa. Some informants indicate that several villages regrouped to the forest roads, but later some people voluntarily moved back to their former village sites in the savanna, not being able to cope with forest existence.[91]

When Land Chief Kanini recounted the settlement of his village from his domain to forested Boumango, he indicated that the Bawumbu people told them "Go back home to your domains" (Rec-12). Furthermore, the Bawumbu initially forbade cultivating and gathering activities by the Teke immigrants.[92] For many years, these Teke went back to their domain to conduct fire

[91] Today, the people who remained by the roadside (particularly the Bongoville Bateke) still practise savanna cultivation and savanna burial, which requires travelling a considerable distance from the forested town.

[92] Eventually cultivation rights were granted, but the Teke had not brought cuttings to plant and were obliged to buy them from their hosts.

drives and gathering activities. However, their children and grandchildren no longer know about these activities or the foods associated with them such as grasshopper gathering or pineapple wine making, traditions that they carried out when based in their savanna domain. Such extreme movements and changes of environments demanded a change in the way that these people lived, forcing savanna inhabitants and forest inhabitants to switch subsistence techniques and strategies.

In the study site village, a reverse situation happened: a Bakaningi forest village (Ekouyi) was regrouped with a Teke-Alima savanna village (Mbouma) in the domains of the Teke-Alima. During our survey when we asked Ekouyi residents about their burning practices, they sometimes became frustrated, indicating that they knew the forest better than the savanna. Many indicated that they learned how to burn the savanna when they were resettled to the Mbouma area. Prior to resettlement, Teke from the savanna would burn the savanna portions of Ekouyi's land. Today, both women and men from Ekouyi burn the savanna. However, Ekouyi residents recognize that those of Mbouma are fire specialists, maintaining their domain fetishes. The residents of Ekouyi remain the forest specialists, particularly of forest initiation rites. *Régroupement* had the power not only to change subsistence strategies but also to juxtapose the people of different ecosystems along with their religious views and customs.[93]

People who have resettled elsewhere still lay claim to domains where they formerly resided. Kanini's village Mboua was formerly located in western PNPB but eventually relocated some 40 kilometres to the west in the forested zone near Boumango.[94] Mboua was the seat of the land chief of what is now a portion of PNPB. Kanini, the land chief in question, had in recent years disputed park jurisdiction over this ancestral hunting area.

Likewise, just across the border in Congo, hunters recently interviewed in several villages in the Lékana area, a mix of *Koukouya* and *Teke-Alima* subgroups, lay claim to ancestral hunting rights in the eastern part of the park, east of Lac Loulou (Gami 2003). They continue to hunt there, despite efforts to stop poaching within the park. In Gami's report (2003), they delineate their current hunting territory by their historic boundary at Lac Loulou in PNPB.[95]

[93] However, these traditions are less likely to be maintained when villages have been regrouped to main roads. Many attend the numerous road side churches and are suspicious of discussing past traditions. While they have regular taxi service and better access to health care and education, their traditions have declined more quickly than the Bateke that stayed in the savanna and away from main roads.

[94] This move was probably done in several steps, the first being voluntary, and the latter being forced resettlement.

[95] However, illegal hunters have been found throughout the park, some of which may be from Lékana. This situation is complicated by commercialised hunting (by both Gabonese and Congolese), support of illegal hunting by members of the elite, lack of a visible international or park border in places, and historic concepts of national and customary limits. It is beyond the scope of this study to address these issues.

In the study site, for those that remained closer to their domains, there is still no paved road or regular taxi service. They seem to have kept closer contacts with their land traditions. They are within walking distance from the domains where they historically carried out hunting and gathering activities and therefore maintain cultural links to their native ecosystem (see Chapter 2). The land chiefs are nearly extinct, but their descendents, the "sons of the land chief", keep the flame alive, rekindling fire in the land chief's *olebe*, conducting land fertility ceremonies, and appeasing the domain fetish (see Chapter 4).

Politically motivated fires

> *Quand les agents des Eaux et Forets sont arrivés, ils nous ont interdite la chasse, mais on brulait toujours la plaine quant le président arrivait pour lui trouver quelque chose à manger.*
>
> Anonymous, May 2007, my translation

During my field work, I observed a relationship between hospitality, politics, and the hunt; I often was witness to the intense links of the urban-political elite with their native villages. These elites spent vacations there and contributed to increasing the quality of life of the village by improving access to medical supplies, urban medical care, education, employment, and entertainment.[96] These gifts were often given on behalf of native politicians; these acts forged links between family and politics, influencing the villagers to support the president's PDG. In these villages, there is 100% support, this province being the former and present president's native territory. Some elites, through their home villages, become re-rooted in tradition, often having been uprooted during their years abroad for education or work. This is not unique to the plateau area. I have witnessed this phenomenon of *"valorisation de la vie rurale"* in many provinces throughout Gabon. This is an informal agriculturalism ideal favoured by urban elites where they publicly promote rural values by bringing urban events to their native villages.[97] In addition to the new roots and political support gained by the urban elite, they enjoy power over village decisions and access to traditional medicine and sorcery consultations.

Elite-villager interaction can have an impact on burning and utilization of village resources. Some members of the elite are known hunters (Aczel 2007b), which has caused some negative interactions between local elites and conservation organisations. Additionally, some political activities in the villages led to fires related to hunting when a village hosts a political campaign visit requiring a meal of game. For example, during my time in the village, I saw several rainy season savanna firings conducted expressly for political events. Villagers linked fires in

[96] This included the purchasing of satellite dishes, televisions, support of local football teams, and the throwing of holiday and political celebrations.
[97] This includes internationally acclaimed musicians organising major open-air village concerts and nationally known artists organising village master-classes.

January, March, and May of 2007 with political events and politicians.[98] Aside from the January and March short-dry season fires, the May fires were conducted during the rainy season, at a time when survey respondents had indicated that it was not a good season to burn. This demonstrates that today, fire-setting has fewer links to preferred fire seasons: rather it is sometimes driven by politics and hospitality. This use of fire is not considered by the Bateke in any sense to be negative. Once I investigate the social dynamics of hunting, the causality becomes clearer. As one informant explained to me, hunting epitomises hospitality for the Bateke. It makes me ashamed, he told me, to serve guests dishes without meat. This informant went on to explain that when a visitor arrives in a village, villagers hunt for them, whether asked to do so or not. This has certainly been the case for me when village hosts have spontaneously (not at my request) conducted a hospitality hunt on my behalf[99], as well as for many other guests to Ekouyi-Mbouma, including Gabonese and foreign visitors alike. The acts of burning and hunting establish an economic bond between the villager and the elite. If an elite requests meat, villagers accommodate him: the elite class gives the village social security and access to other goods and services not available in the village. Hunting related to fire is an integral part of village hospitality and socio-political activity today.[100]

In order to understand fully the regional hunting pressures, one must also take into account the commercial bush meat trade and its relation to villages. This study was conducted at the village level and thus a broader analysis of the situation is not possible. Much of the hunting and associated firing that occurred in the northern-most part of the study site was probably related to the urban, Lékoni-based bush-meat trade. Occasionally these and other hunters from Franceville would conduct night hunts in the heart of the study site, but these were viewed negatively by villagers. The hunters passed speedily during the day or night, never stopping in the villages to ask permission to hunt. Fires set by urban hunters are seen by local authorities as a threat to the ecosystem (Ikamba 2005b) and fires set by commercial Congolese hunters are seen as a cross-border illegal activity (Gami 2003). Although some hunters enrage villagers by displaying obvious disregard for them, inciting villages to set nail-traps, other urban hunters are relatives who return to the village on vacation occasionally hunting or accepting hospitality game. Commercial hunting is not a simple urban supply-demand relationship, but may involve urban elites, who may involve related villagers in legal and illegal arrangements. Further exploration of these links would require more study and is beyond the scope of this dissertation. However, this aspect needs to be thoroughly understood; this would provide a social context to some of the conservation issues in the wider plateau area.

[98] When inquiring about the burn history of particular parts of the savanna, informants would identify fires as "the governor's or *préfet*'s fire", indicating that it was linked to hunting for the political celebration the politician gave in his home village.
[99] Villagers may alternatively offer smoked meats or village poultry.
[100] Although hospitality meats do not need to be savanna based (i.e. involve burning). They can also be the result of communal porcupine hunts, solitary bird hunting, or from trap lines.

The land chiefs today in the *Département des Plateaux*, Gabon

The land chiefs no longer exist today in their traditional form. They are now what many call the "sons of the land chief" and no longer have absolute authority. Today, traditional authority has evolved to include village-linked members of the urban political elite who may resemble former land chiefs in terms of authority and respect.

In one particular case in the study area, a member of the elite is viewed as a modern land chief by many inhabitants of several villages, despite this not corresponding to his status in traditional terms. This member of the elite is native to the area but has high political and ministerial appointments in the capital city. He spends two holidays a year in the village and directs several local political events. He values the Bateke culture and finances local and regional cultural events. He was honoured with land chief songs during one *Njobi* plantation blessing that I attended; he often organised ceremonies in the old village site to keep the domain in balance. In talking with him about his role in his home village (and other villages), he said that in order to have the confidence of the people, one must spend time with them. He continued by saying that in his village he is the only person who is able to make village interdictions regarding plantation placement and savanna burning.[101] A few years ago, this elite member sponsored a fire-drive re-enactment to teach the youth about former hunting practices.[102] In many ways, this elite person's fascination with tradition keeps some alive. Youth are generally not much interested in tradition; however, when brought together by a respected middle-aged man from the village, the knowledge transfer appears to be heightened. Through this elite person's direction, the youth are re-learning some of the traditions of the past as they participate in these elite-guided domain ceremonies.

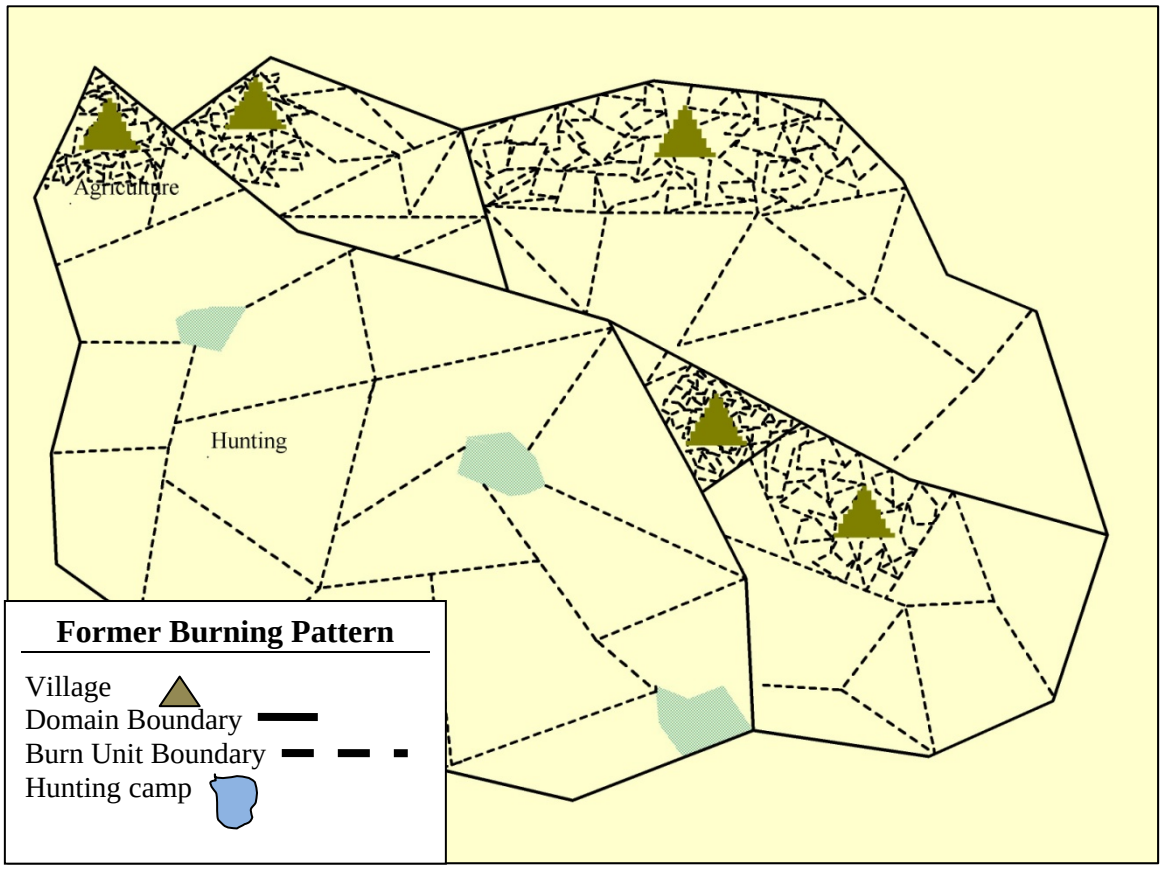
Geschiere (1982) and others note that often there is a common identity between the urban and rural villagers. This seems to be the case in the study site. Elites gain cultural grounding and political support while giving access to urban opportunities. As these elites often hold sway in individual villages, development and conservation efforts might be better served by additionally consulting with these important members of the extended village family in order to foster collaboration or at least a dialogue. The opinions of elites on village matters are often greatly valued by villagers.[103] However, the full context of the elite's position must be taken into

[101] It is only around this village that I have witnessed villagers avoiding burning areas in order to wait for the command of a chief.
[102] This led to several young men being very knowledgeable informants in this study (and at first skewing the results), thus demonstrating the value of elites investing in their villages in activities which aid traditional knowledge transfer.
[103] Members of the elite are also connected to some illegal hunting activities (Aczel 2007b) and so working with them may be required in understanding issues (such as illegal hunting) that go beyond the scope of the village and extend beyond the power of village leaders to control, despite activities sometimes taking place on their lands.

account since elsewhere local partnerships have been shown to favour big government rather than local voices (Ribot et al. 2006).

The plateaus as a common pool resource today: implications for the fire regime

Under the land chief system, savanna fires were controlled by the land chief, customary fire laws were respected, and several village communities participated in the annual fire drive resulting in a mosaic of fire that was bound by domains (fig. 2a). Today, the land chiefs no longer have the ability to marshal or control people. Domains are no longer respected, and while hunting fires typically peak at the end of the large dry season as they did in the past, they have become less seasonal and unregulated; fires often extend beyond customary domain boundaries (fig. 2b). The decline of the land chief system goes beyond modification of the social fabric: it has modified the ecosystem.



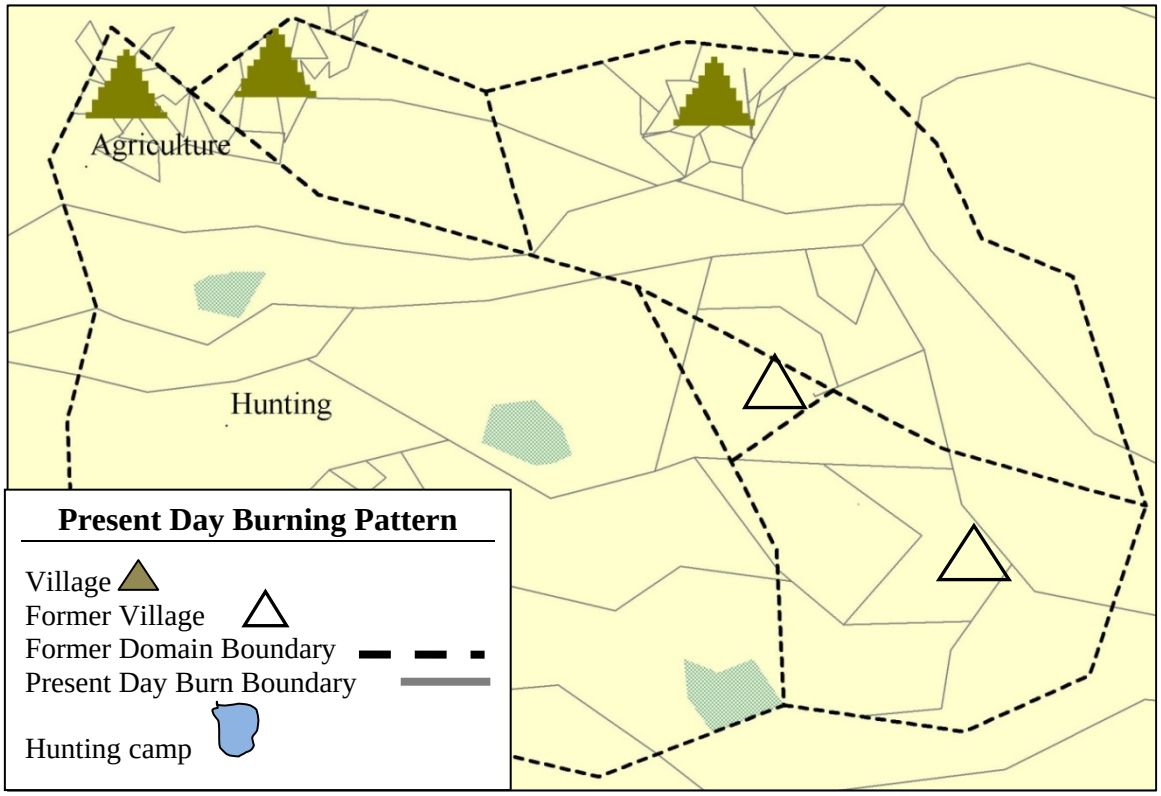


Fig. 2 a. Former burning pattern where fires were contained within domain boundaries and had prescribed *ewa* boundaries. Fig. 2b. Present-day burning pattern where fires no longer conform to domain or *ewa* boundaries.

These savannas have been transformed from common pool resources to open access which allows hunting by anyone coming from anywhere and burned at any time. The asymmetrical combination of affluence and prestige on the Gabonese side of the border and the war-related poverty in the Republic of Congo leave the landscape overhunted (Gami 2003) and without local land chiefs. Like elsewhere in south-Central Africa, traditional hunting has been replaced by an entrepreneurial form directed by urbanite elites (Marks 1979).

However, in the absence of effective customary or state regulation, individuals are able to hunt and burn several times per year (Fig. 3). As semi-annual fire regime is driven by politics, elites, and both individual and commercial hunting.[104] The consequence for the changed fire regime means that firing happens at any season when vegetation can be burned for any reason.

[104] The only communal fire activity conducted today is grasshopper gathering (see Chapter 6).

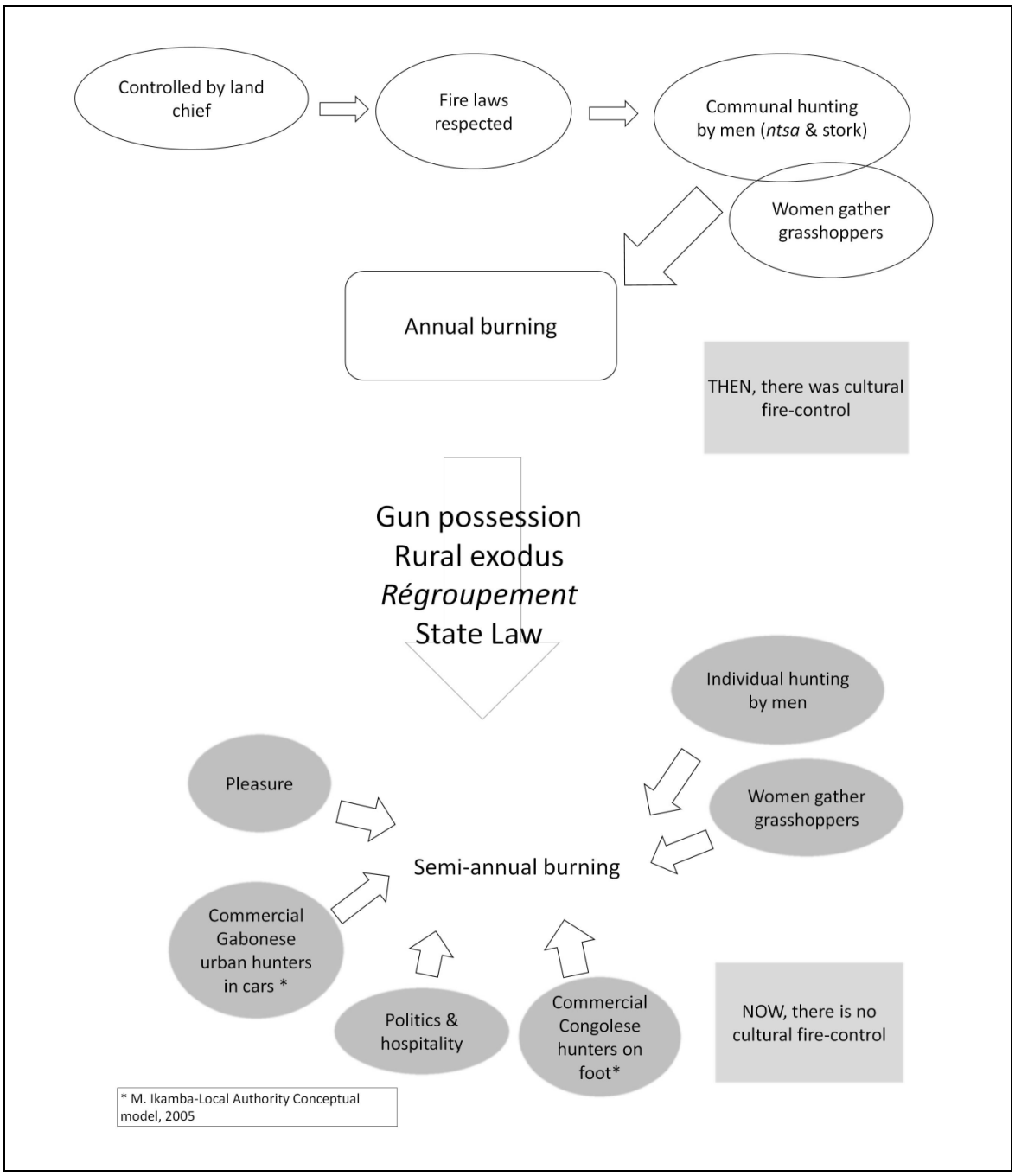


Figure 3. Evolution of the fire regime based on socio-political changes to the land chief's authority.

Conclusion

Changes to the political ecology of the plateau area resulted in the reorganization of village chiefs and indirect rule which contributed to the downfall of the land chief system; this coincided with the introduction of guns, the rural exodus, and changes in state law. While the territory ruled had the same borders, the authority to rule it became quite different. First colonial law and later Gabon state laws were the highest legal reference for authority; at a fundamental level, the land chief was challenged to rule his customary territory according to foreign laws. These laws related to hunting and fire-setting, activities that the land chief once controlled. Furthermore, his office meant that he was officially responsible for any problems within his canton. Finally, the population that had once migrated as needed was permanently

resettled along roads and often away from the historic domains; some land chiefs were no longer locally resident. The rural exodus exacerbated the situation by removing young men who once would have formed the core of the hunting and fire-setting efforts directed by the land chief. This was further complicated by the rise of an elite class that had little to do with traditional power structures. All of these issues operated in concert, weakening the customary office of land chief and ultimately his sway over when and how his domain was to be burned. In the Koukouya Plateau, Bonnafé (1978: 28) wrote that today's land chiefs work the fields, whereas in past they were political and spiritual leaders. This de-coupling of the political and spiritual realms had an impact on burning which in turn impacted the landscape. The next few chapters analyse these impacts.

Chapter 6: Fire and foraging in the Bateke Plateaux cultural landscape

A register of fire is a litany of rural life.

(Pyne 1999)

In the previous chapters, I have discussed the role of the land chief in organising resource access and maintaining land fertility and have considered his regulation of annual fires. The magico-political aspects of the land chief's power, as well as his customary authority over the domain, were largely overturned in the 1960s. The current fire regime is now annual to semi-annual. However, gathering with fire remains active in the plateau area. This chapter will consider why burning occurs today, how it is used for foraging, and the local importance of the savanna landscape.

Introduction

Why are Central African savannas important? According to ecological views in the early 20th century, post-disturbance land progressed through a linear set of succession stages before returning to its original form as "climax" vegetation, which was generally forest (Clements 1916). This idea was carried into European forestry (Laris and Wardell 2008: 286); foresters, charged with managing colonial timber resources perceived savannas as former forest that had not yet reached its climax (Aubréville 1949: 309). Areas were to be protected from fire at all costs (Chapter 1). From the time of colonial rule, economics based on external trade has driven how land was valued in Gabon (and elsewhere)[105]. Forestry in Gabon was developed in the colonial era in 1900 (Jaffré 2003) and remains an important part of today's economy, with one third of forests having been demarcated into concessions in 1997 (Collomb et al. 2000). This number will probably increase as forest revenue will help make up for the loss of oil rent in the near future (Wunder 2003: 50). Since contact with traders, there has never been a time when Gabon's forests and forest products have not been valued by external markets.

For European commercial ranchers, savannas were seen as a potential source of revenue. Much time was spent in Central Africa discerning the utility of native grasses for pasture, finding that the native grasses were of limited forage value (Descoings 1961a; Descoings 1961b; Descoings 1974; Descoings 1975b; Koechlin 1961a; Koechlin 1961b), or sometimes that small areas were acceptable for pasture, as in Ouesso, Republic of Congo (Descoings 1986), and even sometimes concluding that the soil was also insufficient for agriculture (Koechlin 1961a). In the Guinean savannas of Central Africa, traditions of animal husbandry are rare, the soils are poor, and the

[105] Value is defined here as in the *New Oxford Dictionary of English* as, "the regard that something is held to deserve; the importance or preciousness of something" (Pearsall 1999).

grasses of low forage value; indigenous pastoralism is more common in the higher quality pastures of the Sudanian and Sahelian zones (van der Zon 1992). Disease is also a limiting factor (Scoones and Wolmer 2006). Gabon's stocking rates are relatively low, with only 3,500 head of cattle versus Cameroon's 2.9 million; the Gabonese herds are not managed by locals but often by Fulani herdsmen (FAO 1977). The Niari valley in southern Republic of Congo seemed to be potentially profitable (Koechlin 1961b), but the urban market was too costly to reach and the local market was non-existent (Sautter 1966: 697). Thus, for ranchers too, the Central African savannas were of little value and certainly not as productive for the national and colonial economies as forests.

African savannas continue to be perceived by outsiders to have low-value. This is most noticeable in new conservation, development, and research projects focusing on carbon stocks, bio fuels, and industrial tree plantations where savannas are planted with trees or are encouraged to succeed to forest (Godefroid 2009; Jindal 2004; Pérez et al. 2005; Posner et al. 2009; Williams et al. 2008).[106] This is in stark contrast to regions where forests today are being considered for their potential worth in payment of ecosystem services (Wunder and Wertz-Kanounnikoff 2009) including crop pollination (Ricketts et al. 2004), carbon stocks (Lewis and et al. 2009) and water provision (Naidoo et al. 2008).[107] These laudable efforts by conservationists to place monetary values on land for conservation (Balmford et al. 2002) to combat the extractive approaches to these same lands, however, reinforces the global view of money-based landscape values while devaluing local views and uses of these same landscapes.

> Consequently, where loss of tropical forests and their diversity is of wide public concern, loss of grassy vegetation to croplands and plantations has proceeded with little opposition. Indeed afforestation of grasslands is increasingly promoted as a public good--a means of combating climate change through carbon sequestration.
>
> (Bond and Parr in press)

These observations over the past century beg the questions, what is the value of a savanna? And if it is valuable, to whom and why?

When examined more closely, savanna landscapes are useful to local people. In one administrator's words describing a situation in West Africa:

> In the dry season the savanna appears to be uncultivated; it unrolls itself like a shaggy carpet, bristling with thorn, bumpy with ant-hills and embellished with arcades of trees along the watercourses. And in the smoky atmosphere of burnt-out fires, in which the flames of bush fires still flicker, the European cannot detect any farmland. But if he

[106] A contrast to this is the ranching industry in South America and Europe where unimproved (i.e. low fertilizer and non-native seed inputs) savannas are of high economic value and thought to be incompatible with biodiversity conservation (Hodgson et al. 2005).
[107] Though Naidoo et al. 2009 does address grassland production for ranching.

> flies over this same country in the rainy season he will see from the plane a pattern of furrows, hillocks and level fields.
>
> What we thought was bush was really a stretch of fallow-land.
>
> (Delavignette 1950: 109)

In this quote, the value of a savanna was not evident to an administrator until he understood how the land was used; the savanna on its own was just "bush".[108] Value is inherently subjective by definition. Despite the savanna having little value for the forester, ecologist, or rancher, local people used and use these lands for cultivation, hunting, fishing, gathering, and rituals thus forming a "cultural landscape" which combines a group's place-based history with their usage of natural resources (UNESCO World Heritage Centre 2008). This definition places cultural meaning on landscapes independent of external economic pressures. In the case of the Bateke, their past rituals and current livelihood activities in the savanna indicate that these areas must be important to their subsistence strategies and to their culture, whether a foreign market values them or not.[109]

Bateke as savanna resource-users

The Bateke people value savannas less for their external market values and more for the utility of select species in that landscape and the role of these species in rituals and traditions in the domain. Fire-use, foraging, and foodways[110] thus link people to their savanna lands and environments. This chapter will evaluate the local value of savannas to the Bateke in terms of gathered resources, paying particular attention to the effect of foraging fires.

In the previous two chapters, I explored the historic use of fire in the savanna landscape. It is clear that the Bateke use the vast spaces of savanna surrounding the copses and riparian forests. Around the Ekouyi-Mbouma area, the Bateke use parts of the forest and savanna for agriculture, opportunistic grazing of goats, hunting, gathering, fishing, and rituals (see Chapter 2). While much resource use occurs today within a few kilometres of the village, hunting, most caterpillar collection, and *bois amer* (*Garcinia kola*)[111] gathering all occur at distances greater than this (see Chapter 2, Table. 2). The Bateke burn these savannas for many reasons in addition to resource extraction. What are these reasons?

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[108] Bush is a negative word often implying the uncivilized, uncultivated, wild, and primitive (Pearsall 1999). Turning this comparison on its head, one may wonder about the reaction by these savanna dwellers to the French countryside. Would they have seen the administrator's home landscape as useful?

[109] The Plateaus were relatively unexploited during the colonial era. With failing concessions, resistant people, low agricultural value (except the Koukouya Plateau), and little forest, the remote plateaus were left largely alone by the colonial administration (see Chapter 2).

[110] Foodways are the usages of food by a people including gathering, processing, and consumption traditions.

[111] *Bois amer* is a wood used to ferment palm wine and is in high demand throughout Gabon. It is no surprise that in a forest-savanna mosaic this forest resource would now be found at much greater distances, given that it is a forest species and the gatherers live in savanna.

Today's perception and practice of burning

In our survey about fire practice today and in the past, almost all respondents indicated that they burn the savanna today. Reasons for burning can be categorised into subsistence activities (hunting, gathering, cultivation), safety (visibility, reptile habitat removal, path clearing), and for pleasure (creation of a beautiful which turns green post-fire and fun of burning dry grass) (Table 1).

Those answers related to subsistence comprise nearly all of the reasons for pre-Independence burning. This was the era when the land chief system was still in force, when burning was regulated and the fire regime was annual. There was no option of burning for an individual's pleasure since there were serious consequences for such acts. While it is acknowledged that respondents were relying on memories of 40 years earlier, it is interesting to note that there were no negative reasons given for past burning.[112]

Pre-independence burning rationale (informant born pre-1960)	Current **general** rationale for burning (all respondents)	Current **individualistic** rationale for burning (all respondents)
1. Grasshopper gathering	1. Clearing paths	1. Clearing paths
2. Hunting (fire drive)	2. In disorder (negative)	2. Grasshopper gathering[113]
3. Savanna plantation	3. Hunting (creating pasture)	3. Hunting (creating pasture)[114]
4. Rodent gathering	4. Grasshopper gathering	4. Dead grass removal
5. Clearing paths	5. Savanna regeneration	5. In disorder (negative)
6. To eat	6. Savanna plantation	6. Savanna regeneration
7. Caterpillar gathering	7. To eat	7. Landscape beautification
8. Bird hunting	8. Caterpillar gathering	8. Visibility
	9. Visibility	9. Protection from reptiles
	10. Fun	
	11. Protection from reptiles	
	12. Mushroom gathering	
	13. Dead grass removal	
	14. Rodent gathering	
	15. Bird hunting	

Table 1: Reasons in order of importance for past, present general, and present specific savanna burning.

[112] Though a few suggested in another part of the survey that one reason the fire drive stopped was because people were killed in fires.

[113] The high frequency of answers specific to grasshopper gathering may be related to the timing of the survey since it was grasshopper gathering season.

[114] Despite hunting being the third most frequent reason given for burning today, this is the main reason that the savanna is burned. Many hunters feel stigmatised by hunting and may not have wanted to admit it during a formal survey. However, during informal conversations, many would discuss it more freely.

Subsistence is also an important component of present day burning, although the top answer for today's burning was for path-clearing. Beyond subsistence, fires are set for other reasons. Security is important and so early season fires are lit around areas to protect them from later season fires, particularly straw houses and *fufu* stands[115]. Fires are also used to clear paths for ease of walking and visibility. Visibility was historically important during times of war or when predatory animals were present, such as the now-locally extinct lion (see Appendix 3). Reptiles are feared and so villagers burn to clear vegetation around the village to increase visibility and reduce reptile habitat.

When respondents were asked *in general* why the Bateke people burn today, they prioritized the following reasons: clearing paths, "in disorder" (negative), hunting, and grasshopper gathering. When inquiring why *individual* respondents burned, the top four answers changed in order: clearing paths, grasshopper gathering, hunting, and dead grass removal. Informants and respondents alike often noted the beauty of a post-fire landscape when the new grass was green. Only six indicated a negative view of their own burning. Negative views of burning were often reported by elders who had seen the transition from the land chief fire regime to the present day situation. For them, burning without a clear benefit is considered to be a negative use of fire. However, much burning was and is for subsistence and forms part of today's Bateke food culture. For the Bateke, burning was and is a way to obtain food. As stated by Tricia:

> *Si la plaine est brulée on peut trouver les feuilles d'*Albizia*, chenilles, et sauterelles.*
>
> Tricia, Age 55, translated by S. Touladjan[116]

Many respondents indicated that burning and foraging were linked, particularly in the past:

> *Avant les mamans brulaient la plaine pour chercher les sauterelles et les hommes pour la chasse. Mais après les sauterelles, les nouvelles pousses d'herbe appellent les chenilles* ntsienstiele**.**
>
> Gorgie, age 67, translated by S. Touladjan

When asked if there were differences in the way people burned today versus in the past, one elder said that burning reasons remained the same:

> *Aujourd'hui les gens brulent la plaine pour les mêmes raisons donc la chasse, les champignons et toute la nourriture que la plaine peut nous donner.*
>
> Yaja, age 83, translated by S. Touladjan

[115] *Fufu* is a form of processed manioc root in the form of sun-dried or smoked flour lumps; the stands are wooden platforms where *fufu* is sun-dried in the savanna at the village edge.
[116] These quotes are all translated from the survey which was conducted by S. Touladjan in Bateke and French.

However, the reasons people burn today are not the same as those of the past. While people today remember past burning as almost exclusively linked to food, many today indicated that people burn for pleasure. Some cited a lack of respect, stating particularly that the youth burned in disorderly fashions. According to one middle-aged man:

> *Aujourd'hui, les gens brulent dans le désordre. Il n'y a plus des limites et il n'y a plus personne qui peut ordonner les désordres de ce genre de gens. Ils font ce qu'ils veulent.*
>
> Ndigi, age 35, translated by S. Touladjan

Some associated this with fewer gathered resources:

> *Avant le brulage de la plane donnait à manger mais les jeunes d'aujourd'hui gaspillent la plaine ; ils brulent pour rien.*
>
> Fronti, age 59, translated by S. Touladjan

As Osse, age 52, noted (translated by S. Touladjan), "*Aujourd'hui brulant la plaine ne donne plus à manger comme avant* ».[117]

Bateke savanna foodways

Many savanna foods form part of Bateke food traditions, or foodways. While some traditional food rituals still exist today, other foods have lost part of their foraging ritual. This is particularly true of the *ntsa*.

***Ntsa*: linking ritual, burning, and land fertility**

For the case of the Bateke fire-drive (Chapter 4), foraging with fire was not only a technique for enhancing hunting proficiency but also linked the living Bateke to their ancestors. Abundant harvesting, correct foraging procedures and rituals, and respect for the ancestors were inextricably linked. As such, the fire-drive tradition links the Bateke to their savanna environment and was a cultural anchor ensuring land fertility and peace. The Bateke fire-drive specifically targeted the *ntsa* (*Silvicapra grimmia*).

The *ntsa* is one of the conservation conundrums of the Gabonese plateau area: common everywhere else in sub-Saharan Africa, it finds its range limit in Gabon and is thus fully protected there (Décret 28 juillet 1994). Its meat and horns being important for ceremonies, it remains highly sought after by illegal hunters. The meat of the *ntsa* is considered to be extremely flavourful and suitable for wedding celebrations and other ceremonies. Guiral (1889) noted time and again the blowing of horn-whistles to stop rain storms; this still is practiced today in the study area. Vansina noted that the meat was important for the bride-price of the eastern Bateke (Vansina 1973: 92).

[117] Whether this is due to the practices of disorderly burning or another factor remains unclear.

The *ntsa* represents for the Bateke a food that was the foundation of a particular gathering tradition that was once part of the fire-drive. By correctly practising pre-hunt rituals such as *olobo* or *Ambwongo*, the hunt was blessed by the ancestors and land spirits. By going through post-hunt rituals such as meat-sharing, respect was given to the land chief and the hunt participators. Today, the ritual part of the communal *ntsa* hunt is non-existent.

The commercialisation of *ntsa* hunting with guns is one way which has disconnected the ritualised from the physical practice of hunting. This animal is rare today on the plateaus. However, villagers from the study site report that former populations of the *ntsa* were much larger; one informant compared their abundance to village goat herds, a concept unthinkable today. When I consulted with researchers who had conducted bush meat market surveys in the Franceville area, they confirmed that *ntsa* rarely was sold there. Such meat normally had a client before it was hunted; if not, hunters knew how to find clients outside of the public marketplace (pers. comm. S. Touladjan). Thus, *ntsa* meat represents a significant but hidden market in the area.[118] Some villagers blame urban hunters for the decrease in populations. What is clear is that the way in which *ntsa* is hunted today bears no relationship to the fire-drive ritual and procedure. I discuss in the concluding section the implications of the changes to the hunting ritual and the loss of cultural diversity. However, *ntsa* is not the only savanna food of Bateke foodways. I will explore these species next.

Bateke gathering foodways

While other anthropologists focused on cultivation as a basis for Bateke subsistence (Chapter 2), Vansina (as did Bonnafé) considered gathering to have been important. He notes,

> [The Tio] underestimated the amount of time spent in collecting, because it was often done while people were going about for other purposes. It is hard to express in percentages how much food was gathered for how much cultivated but one can surmise that most of the snacks (fruits), half of the greens, which were part of every meal, and most of the sauces came from wild produce.
>
> (Vansina 1973: 132)

He offers a long list of eight fruits, ten leafy vegetables, six caterpillars, termites, and cicadas as gathered foods, a list based largely on Calloc'h's dictionary (Calloc'h 1911), listed in Tio with no scientific names. He is the only anthropologist to have mentioned gathered plants yet doesn't describe methods of gathering.[119] Most of Bateke country, whether in Gabon or the Republic of Congo, comprises savanna. This means that a portion of all Bateke village livelihoods are derived from savanna resources. What are these resources? When we asked people in five

[118] There are unconfirmed reports of elites in Libreville ordering *ntsa* meat for their tables. Given that this animal only lives in the plateau area, the effect may be overwhelming for Gabon's populations.
[119] Vansina's study was a mixture of history and anthropology, thus he spent six months in the field and did not include a dry season. Much of his insight comes from historical accounts and not by direct observation.

villages to list the foods that they found in the savanna, the list included more than 25 items[120]. These responses ranged from bush meat to insects and fruits, representing a range of seasons and fire-foraging methods (see Table 2).

Category	local name	scientific name (or order/family)	Direct or indirect burning	Number of respondents (N = 122)
Insect-larva	*kankele*	(Saturniidae family)	D-D	99
Insect-juvenile/ adults	*ampari*	Several species	D-I	98
Insect-larva	*ntsienstiele*	Unknown	D-D	62
Insect-adults	*kanginiña*	*Cetoine* sp.	I	56
Insect-larva	*evura*	*Anthuea* sp.	I	42
insect	*kuraku (C)*	Unknown	I	17
fungi	*tutsa*	Unknown	I	15
plant	*olu*	*Albizia adianthifolia*	D-D, I	15
plant	*kura*	*Hymenocardia acida*	D-D	6
	evatu	Unknown	I	5
animal	rats	Several species	D-I	4
animal	*nyama*	Several species	I[121]	4
plant	*kaburi /mfuluru*	*Landolphia* cf. *lanceolata*	I	3
Animal (bird)	*amkumbi*	*Ciconia abdimii*	D-I	3
Insect-adults	*Cigale/anjie*	(Orthoptera order)	I	3
Insect-larva	*etsaba*	(Psychidae family)	I	3
Insect-adults	*ntsama*	*Macrotermes* sp.	I	3
plant	*mbama*	*Cogniauxia podolaena*	I	2
plant	*ebli*	*Parinari capensis*	I	2
plant	*ntundu ntiegue*	*Afromomum alboviolaceum*	I	1
Insect-juvenile/ adults	*crickets verts*	Unknown	I	1
plant	*efu*	*Anisophyllea quangensis*	I	1
other		Unknown	I	4

Table 2. A listing of foods in order of importance derived from the savanna. Foods from Congo are noted with a "C". The letter "I" denotes fire used indirectly to obtain food; "D-I" means "direct-immediate"; "D-D" means "direct-delayed". Categories were determined by me and not by informants and so do not reflect folk taxonomy.

[120] More than 25 species are represented. For example, many gave "bushmeat" as an answer; this represents more than one species.

[121] Bushmeat today is only hunted passively with fire whereas, historically, fire was actively used to drive animals into hunting nets.

For these foods, foraging and fire are linked in three ways according to the application of fire and the timing of the resource's harvest post-fire:

Indirect: fire (both foraging and non-foraging burns) maintains the savanna habitat in which many gathered and hunted organisms are found.

Direct-delayed: fire is intentionally applied to gain a resource that appears weeks or months after application. Examples: creation of forage for caterpillar species several months post-fire; creation of forage for grazing animals days and weeks post-fire.

Direct-immediate: fire is intentionally applied to gain a resource the same day. Examples: attracting Abdim's stork with smoke and singed grasshoppers, attraction of game to cinders, grasshopper gathering.

Eighty-five percent of the respondents talked directly of or implied links between foraging and fire. In the surveyed responses, for the majority (73%) of the foods listed, fire is indirectly used. In these cases, during the course of the entire survey, fire was never stated as a tool to harvest these particular species. However, in the case of both direct-immediate and direct-delayed foods, both categories were smaller, only comprising 12% and 15% respectively. Historically the majority of the burning occurred for hunting as a direct-immediate technique. It might be said that the rest of the species were a side-benefit of the purposeful burning for a few target animal species; far more species were encouraged by fire than the few where fire was intentionally used as a harvest tool.

Despite changes in burning reasons or methods, fire and foraging are still linked. This next section examines cases, each representing methods of burning. Caterpillar-gatherers benefit from direct-delayed burning; grasshopper-gatherers from direct-immediate burning; and fruit-gatherers from indirect burning.

Fire-foraging and foodways

Direct-delayed: Caterpillar gathering

Invertebrate sources of protein are often considered bizarre fare by outsiders. Our first reports of Bateke diet come from the de Brazza era in the late 1800s. French explorers were publishing copious accounts of their explorations, describing African life in infinite detail and from the European perspective. Ballay interpreted the eating of such foods as evidence of a lack of meat:

> *Ils chassent peu, le gibier étant fort rare, mais ils font néanmoins volontiers des provisions considérables des rats, d'insectes, de sauterelles, de chenilles, de termites ailes, dont ils sont très friands.*

(Ballay 1885: 282)

On the eating of insects and caterpillars, Guiral was particularly verbose. He was awestruck that a society could consider "meat" to be of an insect nature. However, later he reverses his opinion on the eating of caterpillars and insects: [122]

> *En parlant de la chasse, j'ai indiqué diverses sortes de gibier qui inspireraient aux Européens un insurmontable dégoût et dont les Batékés font cependant grand cas. C'est ainsi qu'ils mangent avec délices des rats grillés avec leur peau et leurs entrailles, des crapauds qu'ils ont exposés tout vivants il la fumée du foyer, des sauterelles séchées au soleil, de grosses chenilles jaunes qu'ils récoltent assez abondamment sur un arbre spécia1. Souvent, lorsque je demandais à acheter de la viande, on m'offrait de ces animaux, en me promettant que j'en serais satisfait. Mais à côté de ces espèces, que les Batékés peuvent se procurer assez facilement et qui sont pour eux une ressource alimentaire à peu près assurée, il en est d'autres plus rares qu'ils sont loin de dédaigner. Par exemple, il y a chez eux de gros coléoptères de la famille des cétoines, magnifiques insectes dont les amateurs européens donneraient un prix très élevé : dépouillés des parties dures de leur carapace et cuits sous la cendre, ces insectes constituent une nourriture exquise, et que nous appellerions un « extra », que les gourmets du pays tiennent en haute estime. Peut-être, après tout, les Batékés ont-ils raison d'estimer des aliments que nos préjugés nous font trouver aussi répugnants que bizarres; mais je n'ai pas osé, pour m'en assurer, gouter à toutes ces bonnes choses, et je ne connais la « succulence » des crapauds et des chenilles que pour l'avoir entendu vanter.*

(Guiral 1889: 160)

In addition to these biases from the north, there are also prejudices against eating invertebrates from forest peoples in Central Africa. Forest people, who comprise most of the Gabonese population, generally do not eat caterpillars, larvae or insects as much as do savanna people. In Gabon, the Bateke are sometimes persecuted for consuming these organisms. In one story, a Bateke woman in the Lékoni market was selling small scarabs, *kanginiña*, a prized food during the first days of the rainy season. She was accused by the non-Bateke Préfet of selling flies.[123] Further afield, when Bateke share invertebrate foods in Libreville, they do so quietly, as such food is considered bizarre by forest-origin urbanites. Nonetheless, the Bateke also disdain consuming land snails, a prized fare of many forest people in northern Gabon. Such extreme reactions to foods show that people are tightly linked to what they eat and often judge others on the basis of their preferred foods.

[122] Perhaps de Brazza and Guiral were not aware that spiders were formerly found in the diets of their European counterparts (Berland 1953; Chevalier 1953; Merle 1958). Other invertebrates are delicacies today such as crabs, mussels, prawns, and snails.

[123] Because of this accusation, when searching for *kanginiña* in the markets, one must ask since these delicacies are stored beneath the market tables and away from the eyes of outsiders who might misinterpret the sale of "flies".

The importance of invertebrate protein

Consumption of insects is common in many parts of the world, often comprising important levels of protein in diets (Latham 2003). Some argue that insect consumption is necessary for savanna people who no longer have anything to hunt, however studies from forested areas indicate otherwise. The Mvae forest people of Cameroon have individual preference for larvae; caterpillars are only "moderately" consumed (Dounias 1993). Dounias contrasted this reduced taste for invertebrates with those of the Aka pygmies of the Central African Republic. There are 14 species of caterpillars, ten species of grasshoppers, cicadas, crickets, eight species of larvae, and four of termites (Bahuchet 1985). Forest Bantu people can generally be considered as consuming far fewer invertebrates than their hunter-gatherer forest co-inhabitants, but neither group is renowned as are people of the savanna for such consumption.

In savanna areas of southern Democratic Republic of Congo, the Kwango eat some 30 species of caterpillar but are known for marketing only a few (Leleup and Daems 1969). The Mopane worm of southern Africa is the subject of a multi-million rand business (Munthali and Mughogho 1992; Toms and Thagwana 2005). In Kinshasa, 70% of people consume caterpillars (Balinga et al. 2004).

The Bateke gather several caterpillars, but here I will focus on the main savanna one: *kankele*. *Kankele* is a Saturniidae family sphinx-type moth whose major food plant at the larval stage is *ololo* (*Annona senegalensis*). *Ololo* is one of the co-dominant shrubs in the savannas of Gabon's Bateke Plateaux area. Not a dense wood, these shrubs are not used for fire-wood. Their fruits are edible but low in sugar and only eaten sporadically. Bateke views them primarily as the host plant for *kankele;* when burned, the shrub resprouts tender leaves which the larvae readily consume. For years, Antoine Mbia has been lighting particular savannas in July for *kankele* gathering in November, something that he was taught by his father. Despite the fact that fires no longer have a controlled calendar, many people surveyed indicated that burning was essential in order to gather it.

In order to gather *kankele,* groups of approximately five women leave on all-day (sometimes overnight) expeditions. One common site for gathering *kankele* requires leaving before dawn. It takes three hours and the fording of two rivers to arrive at this savanna adjacent to the red cirque of a former Ekouyi village site. In this place, some of the eldest women in the village have gathered since they were young. *Kankele* are easily located, despite hanging on the underside of *ololo* leaves: their scat on the sand below betrays them. With single-handed swipes and shakes, Bateke women will gather, eviscerate, and stow each larvae in a receptacle. Gathering this way, a woman makes several slow walks around the savanna, almost always in sight of the others, sometimes waiting out rain showers in nearby stands of trees. The women return to the village

just after nightfall. It is now, after an arduous day of gathering, that some women begin the time-consuming task of cleaning, cooking, and smoking their prey.

These caterpillars are gathered for several weeks. They can be stored for months and can also be sold by villagers in the Franceville and Lékoni markets for 100 CFA per pile[124] (or twice that amount if a resident market woman re-sells a village woman's caterpillars). A few years ago, when *kankele* abundance was greater, one woman reported making 7,000 CFA in a season (approximately £7).

Caterpillars have been demonstrated to be high in protein and were proposed as a cash crop in the 1950s (Merle 1958). When the declining abundance of some species was noted in the Kwango area of the Democratic Republic of Congo, investigators linked this to the demise of the traditional authorities who once controlled fires (Leleup & Daems 1969: 19). Unseasonal fires were thought to injure the subterranean larvae of the Saturniidae in the Kwango area, as well as failing to provide tender leaf forage at the right time. While the researchers said their calendar would not be applicable in other areas of the plateaus where fire was less intense, the link between fire and tender leaf production for some feeding Saturniidae species was established in the literature (Leleup & Daems 1969: 16).

Direct-immediate: Grasshopper gathering

The most visually arresting use of fire today in Gabon's plateau area is that of grasshopper gathering. Every long dry season, when the stands of dry grass are full of nymph grasshoppers, Bateke women sally forth on full-day expeditions systematically burning small patches of the savanna and gathering the grasshoppers. This form of gathering was done historically either during the communal *ntsa* hunt or in peri-village savannas outside the *ewa* (see Chapter 4). In the former case, these fires were expansive and controlled by the *otiugui*. The women were left only to gather and had nothing to do with the burning itself. Today, these foraging fires occur anywhere that *ampari* have been scouted. Bonnafé is one of the few to discuss this form of fire-foraging, though he gives little detail on the men's technique of savanna circle-fires which resembles the technique used by the women in the study area today. He focused more on the women's Koukouya hole-digging method combined with fire for gathering grasshoppers (Bonnafé 1987: 214).[125]

As when gathering caterpillars, Bateke women will spend entire days, sometimes camping over night, to gather grasshoppers in the middle of the long dry season. Unlike the men who today burn without worrying about putting their fires out, women lighting grasshopper fires always limit the surface area burnt with the idea of conserving a grasshopper-rich spot of savanna for

[124] A pile is constituted by what can be contained by the smallest empty tomato paste cans, which are used as a common form of measurement.
[125] Fire-foraging for grasshoppers is also reported for parts of West Africa (Dugast 2008).

the following day's gathering expedition (Rec-21). In this way, groups of four to ten women will depart early in the morning to an area where they have recently estimated high grasshopper abundance. These areas can be close to the village or several kilometres away. On the numerous occasions when I participated in this event, we left between four and six in the morning, arriving at our destination while the dew was still on the ground. This gives women a chance to build a small fire for warmth and to socialise. Once the conditions are judged right for burning (low humidity and low wind), *ntieli*, long stems of dry grass to use as an ignition torch, are gathered. Belongings are safely stowed in recently burned areas. Lighting is performed by two or more people, either walking along the perimeter of the burn or walking up the middle of the area to be burned (this latter burn type is called *onya*). As the wind takes the fire away from the ignition point in a head-fire (*mba ya olumi*), branches of *ongalaga* (*Hymenocardia acida*) trees are used to beat out the advancing flames.[126] Quite often, these fires take place within a complicated mosaic of already burned grass and so fires burn out for lack of fuel. Gorgie likens the role of fire to that of a hunting dog:

> When you hunt, it is the dogs that will flush out the bush meat so that it falls into the nets. For *ampari*, it is the same thing: if you encircle them with fire, the ones caught in the middle die.
>
> 25 Sept 2007, my translation

As the flames rush forward, a dark column of smoke at the head of the fire, dotted with grasshoppers attempting flight, fills the sky. Sometimes, insectivorous birds join in the hunt, themselves chased by birds of prey. This sight of grasshoppers causes great joy and whooping by the women. Once the flames are finally put out, the women gather the dead nymph-stage grasshoppers one by one. By rough calculations, the density of grasshoppers on the post-fire ground can be up to 50 per square metre. There are several varieties in Bateke terminology such as *tsara, gokolo, kadula, jele,* and *anai* (Rec-22). Sometimes an adult is found. Once back home, the cinders are washed away and the grasshoppers are lightly boiled in salted water and then dried in the sun in flat, wide *kadjigi* baskets set out on rooftops.

According to Gorgie and others, there was also a former, fireless method of grasshopper collection using a basket (*otsu*) to gather wingless grasshoppers (*kafouyi*). One would run through the savanna with the basket held in front, weaving it back and forth, catching the grasshoppers as they attempted to jump away (Rec-23). This is no longer practised.

This fire-foraging practice is today only common with those Bateke who still live in the savannas. For some villages, such as Kebiri, grasshopper gathering constitutes an important part of their cash incomes (along with dried termite and basketry sales). For other villages, grasshoppers are mainly consumed at home. For yet other Bateke villages no longer in the

[126] Most of the time we were successful; once we were not.

savanna, grasshopper consumption is no longer part of their diet or culture. I visited a community of Bateke in Malundu I who were resettled in the forested area near Boumango to talk with them about their memories of hunting and gathering in the present-day PNPB. It was only the elderly who could identify *ampari* that I showed them; the children handled the small insects with wonder. When these Bateke left their savannas for the forest, they were forced to abandon many of the savanna foods and traditions I have described here (Rec-24) (Chapter 5).

Indirect: *Olu, mfuluru,* and *ntundu*

Another contribution that fire makes to Bateke livelihoods is that of enhancing the growth of gathered fruits and leaves. I have never heard of or observed fire being lit to manage the growth of any edible plant; although, surveyed villagers linked fire with the growth of *olu* specifically, and with the others generally. *Olu* (*Albizia adianthifolia)* is a leguminous savanna tree that is widespread in tropical Africa. It is generally considered by ecologists and botanists to be a species of secondary savannas and disturbed forests (Hawthorne and Jongkind 2006: 854). Ethnobotanists recognise several uses of this plant including medicinal, subsistence, and as a host plant of edible caterpillars (Latham 2004: 20). The leaves of *olu* contain as much as 10.81g of protein per 100 g; this is twice that of *Gnetum africanum* (Mbemba and Remacle 1992: 23).

In the study area, *olu* groves are not that common, thus some villages (where these concentrations occur) eat more *olu* than others. Gathering of *olu* is done primarily after fire has passed through an area and the new leaves are resprouting, although it will also resprout if coppiced. *Olu* is a main dish, mixed with meat, fish, or invertebrates, and eaten with manioc. *Olu* leaves are never sold in markets, probably owing to its lack of shelf-life.

Mfuluru is another example of a food benefit derived from fire. *Landolphia lanceolata* is common in the lower Guinean savannas. Bunches of *mfuluru* (sometimes called *kaburi,* depending on its state of ripeness) are sold in the Franceville market. Elsewhere *mfuluru* is reported to be sold in markets in DRC (Latham 2004: 176) and is used by traditional healers in Congo-Brazzaville as a successful malaria treatment (Mbatchi et al. 2006). In Ekouyi, the fruits are broken and the succulent flesh around the seeds is extracted. This is mixed with either sugar or a Maggi cube and consumed as a meal accompanied by a manioc staple.

Likewise, the fruits of *ntundu*[127] (*Aframomum alboviolaceum*), the savanna ginger, are broken and the flesh and seeds mixed with sugar or Maggi and eaten as a meal with manioc[128]. *Ntundu* can also be eaten as a snack opportunistically next to a savanna path. In several villages, tradition holds that the red fruit coats attract lightning strikes and so there are bans on bringing

[127] The common name *ntundu* is nearly identical to that used in Bas-Kongo, *ntundulu* (Latham 2004: 16).
[128] It is curious to note that in all of Gabon, it is primarily the Franceville-Lékoni area where fruits are consumed as a main meal (pers. comm. A. Souza, Director of IPHAMETRA); elsewhere, fruits are only a relish or snack. One can add the three other *Landolphia* species from the forest edge to this list of maindish fruits.

them into some villages. This species of fruit (and other *Aframomum* species) is sometimes sold in the market. *Ntundu* is found from Senegal to Sudan, Mozambique and Angola (Harris et al. 2003) and is very common. Populations of these plants are found under the shade of *olu* trees, often forming dense stands. These, together with *olu,* are the beginnings of forest succession within the heart of the savanna itself.

These are just some of the savanna plants used as food by the Bateke people. While, this discussion (and this study) focuses on savanna resources, readers should understand that the Bateke use forest resources as well. For example, one of the more common forest species eaten is *okana* (*Laccosperma secundiflorum*). Again, this is a rather common palm in the lower Guinea forests important to livelihoods. Its young canes are sold along the road between Lékoni and Franceville and south towards Boumango, as well as in Franceville's market. This is another case where common plants and not rare ones are important in Bateke diet.[129]

Conclusion

These savannas have a cultural and subsistence importance that is central to Bateke existence in these areas today. Understanding the context of the changes that Bateke foodways have undergone is critical. The Bateke land chief maintained land fertility by observing rituals and regulating resource use. The domains had and have sacred portions where rituals are carried out; part of the rituals associated with the land chief was the correct use of fire in the fire-drive aimed at *ntsa*. These fire-drives were the most orchestrated use of fire in the whole domain. The quarry itself was some of the most sought after meat. It was probably this part of Bateke foodways that was the most important for the Bateke in linking them to their land. Unfortunately, this tradition has disappeared with the decline of the land chief's authority. With this decline of the land fertility practice, *ntsa* began to be hunted non-communally and commercially.

However, *ntsa* is not the only part of Bateke foodways. This chapter has covered several other traditions that are connected to burning the domain, including *ampari* which used to be part of the fire-drive but is now conducted in isolated fire-foraging forays. The break-down of the fire-drive ritual and procedure has resulted in an almost complete separation of once communal male and female foraging activities. Other traditions linked to fire-foraging have been discussed; these traditions form part of Bateke savanna foodways today, with customs linking gatherers and consumers in a chain of food selection, preparation, and consumption.

[129] The Bateke use plants from many habitats and further study on this resource partitioning by habitat would be interesting.

The traditions involving the fire-foraging practices of *kankele*, *ampari*, and others are emblematic of Bateke traditions; these foods and practices tie the Bateke people to their savanna environment. These fire practices are anchored in land tenure practices and subsistence traditions that previously ensured land fertility and contentment of the ancestors. Today, these practices are conducted almost exclusively for subsistence. Historically and today, foraging with fire has been one of the largest forces impacting plateau area vegetation. I will explore the interaction between Bateke burning and vegetation in the next two chapters.

Chapter 7: Fire and flora: herbaceous diversity and fire regime[130]

> One may conclude that fire has been used by man to influence his geography and environment during his entire career as a human. Furthermore, it is impossible to understand clearly the distribution and history of vegetation of the earth's land surface without careful consideration as fire as a universal factor influencing the plant geography of the world.
>
> (Stewart 1963)

Introduction

What is the value of the Bateke Plateaux savanna flora to the national flora of Gabon and how do anthropogenic fires affect it? Chapter 6 demonstrated that the value of the savanna for the local people is high since it is a source of sustenance and part of local food culture. Fire is used by the Bateke to extract some savanna resources; however fire use for specific savanna resources may impact a larger set of savanna species. This chapter will explore how Bateke fire application shapes the Bateke Plateau area savanna plant diversity and specifically address the national contribution to the flora.

Biological value of savannas

In Africa, Frank White defined vegetation types based on centres of plant species endemism, where 50% or more of the flora is endemic and exceeds more than 1,000 endemic plant species (White 1979: 17). In his seminal work, a vegetation map of Africa, he defines ten such centres (White 1983). For Central Africa, the Guineo-Congolian centre of endemism stretches from the forested areas of Ghana southward along the coast to Gabon and inland to the Democratic Republic of Congo, containing approximately 8,000 species of which 80% are endemic (White 1983: 71-85). In Gabon, 80% of the national territory is forested; the highest species diversity (and highest number of endemics) is contained in the forested mountain areas (Sosef 1994). Gabon's Bateke Plateaux is situated within this regional centre of endemism. In this centre, few of its endemic species are found in the savanna.[131] Grasslands within this area are termed "secondary" by White, though some small patches are considered to be edaphic. In White's description of the secondary grasslands, he describes them as areas that were once forest but which have been destroyed by cultivation and hunting fires and now contain fire-resistant

[130] Portions of this chapter were presented in Walters 2010 during the AETFAT congress.

[131] Not all savannas are species poor. One of the richest tropical savannas is the Brazilian *cerrado* (Da Silva and Bates 2002). This area is considered to be currently in a state of forest encroachment (Marimon et al. 2006) and a place where local and national fire management has played significant roles (Mistry et al. 2005; Pyne 1995: 60). Fire is proposed there as a management tool to maintain diversity and the forest-*cerrado* ecotone (Durigan and Ratter 2006). The *cerrado* savannas are a hotspot and of international conservation concern. On the global list, the *cerrado* is one of the few places that is primarily herbaceous in cover. Forests generally contain the largest portion of biodiversity and are also the most threatened, thus making up the majority of hotspots (Myers et al. 2000).

trees[132]. He indicates further that the secondary grasslands fringing the forest (i.e. as at the study site) "show considerable local variation in floristic composition, but most of their constituent species are widespread and occur both north and south of the equator." (White 1983: 85)[133] From this description of the vegetation, one would assume that there is nothing much of interest in the flora of the Bateke Plateaux and that although the savanna flora might be different from others, the plant distributions are so widespread that not many plants would be rare. Assertions such as this, in addition to the high diversity and endemism of the forest, led many botanists not to pay much attention to savannas[134]. However, in some cases, savanna species that are widespread elsewhere in sub-Saharan Africa find their range limit in Gabon and contribute to the national level of plant diversity. Thus, while in terms of global rarity from a biodiversity standpoint these savannas are less valuable, nationally, they may be more important. Closer inspection might provide some interesting insights into the national value of the Bateke flora and its context in conservation. How can this biological value be assessed?

Global and national values of savannas

One way to evaluate the biodiversity of an area is to assign values based on the global distribution of a species. Referred to as a Star Rating (Hawthorne 1996), this system is one way of looking at the worth of a species. Based on the rarity of the species, a country may have more "responsibility" for protecting that species (Hawthorne 1996: 116). For endemic species, the responsibility is high; for more widespread species, low. However, another way to look at responsibility is in relation to the protection of *any* species within a country's borders. This ideology plays out well when conservation groups are concerned about the rare mammals within Gabonese savannas: *Silvicapra grimmia* and *Kobus ellipsiprymnus*. Both of these species are quite common in sub-Saharan Africa but are rare in Gabon. If they became locally extinct in Gabon, the global impact to conservation would be low since these species occur in many other countries. However, the loss of these animals from Gabonese savannas might have local impacts and, certainly, some Gabonese cultures might lose emblematic animals and NGOs their flagship species. It is the same with many savanna plants in Gabon: their distributions carry them beyond Gabon's borders, but in Gabon, they might be rare or potentially important to local ecosystems, culture and subsistence.

The Bateke Plateaux area was first proposed for conservation due to its unique (for Gabon) landscape, its amenability to tourism, and the presence of unique (again, for Gabon) animals (Wilks 1990). Despite little floristic work being done at the time, new work suggests that many plateau savanna species share the same distribution as the animals for which the plateau area is

[132] However, my previous chapters show that this idea has now been disproved; these savannas were created by past climatic events.
[133] He lists tree and grass species (but provides no list of forbs) which are exceptions to this rule.
[134] However, in general terms in African conservation, savannas outside the forest belt are well conserved, in part for their important animal populations (Burgess et al. 2005).

protected. These species, while not globally rare, are rare in Gabon making them potentially important to Gabonese conservation (Vande Weghe 2009). One way to understand the value of a flora is to assess its uniqueness within the national flora of Gabon by understanding how many savanna species from the plateau area are found elsewhere within Gabonese savannas. Once this degree of similarity is understood, I can then assess the meaning of this similarity in local, national, and global contexts.

Methods

The annually and triennially burned forb study areas were located at 600 m in elevation. In each area, five hilltops were selected and revisited each season. Hilltop selection controlled for differences in drainage, sand type, rainfall patterns, and associated vegetation differences.

To understand the differences in forb diversity in burned and unburned areas, a method sensitive to changes in herbaceous communities was used (Stohlgren et al. 2002). On each of the five hilltops, plot sites were selected using a random walk method. A random azimuth was ascertained and then followed a random number of steps (Johnson 2008). In each site, three circular plots of a radius of 7.32 m were established. Each plot consisted of three sub-plots measuring 1 m^2 each and placed at 4.57 m from the centre point at 30º, 150º, and 270º (Fig. 1).

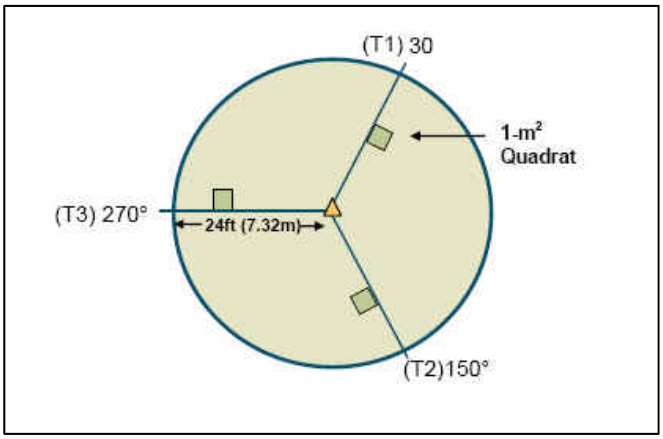


Fig. 1. Plot set up (Stohlgren et al. 2002).

In each subplot, the percentage of cover per species of forb was recorded. Finally, all herb species unrecorded in the 3 subplots but found in the circular plot were listed. These subplots were pooled for comparison. Each treatment was visited in the long-dry (July 07), mid-rainy (December 07), and late-rainy (April 08) seasons producing two sets of data across three seasons. Each treatment comprised 45 pooled plots across all seasons and a total of 90 plots per comparison of season or burn treatment (Table. 1).

		Season			Plot totals
		Long-dry	**Mid-rainy**	**Late-rainy**	**Total plots per burn treatment**
Burn Treatment	**Burned**	15 plots	15 plots	15 plots	**45 plots**
	Unburned	15 plots	15 plots	15 plots	**45 plots**
Totals plots per season		**30 plots**	**30 plots**	**30 plots**	**90 total plots per comparison**

Table 1. Replication of plots by burn treatment and season.

Species numbers from the three subplots were grouped together into a single cumulative plot; this became the unit for comparison. Only forbs were used from the data set (information on woody species had also been gathered)[135]. Thus, for each of the three seasons, 30 plots could be compared; for each burn treatment, 45 plots could be compared. A total of 90 plots were available for comparison (Table 1). Normality was tested by calculating the mean and standard deviation per treatment and then determining if 70% of the values fell within this range (Fowler et al. 1998). Variances were homogenous according to both Levene's and Bartlett's tests. A two-factor ANOVA was conducted with two burn treatments (annual and no-burn) and three season treatments (dry, mid-rainy, and late-rainy seasons). Each treatment contained five hilltop blocks, each containing 15 plots for a total of 45 plots (with 44 degrees of freedom per treatment-season). Post-hoc Tukey's tests were conducted amongst the seasons, the only factors that were significant.

Species diversity based on individual species was compared using Jaccard's similarity Index on species lists by season and by burn treatment. The Jaccard Similarity Index is computed as follows:

$$s_{i,j} = \frac{c}{a + b + c}$$

Where c is the number of species in common, a is the number of species occurring in treatment i and b is the number of species occurring in treatment j (Gotelli and Ellison 2004).

Inter-park savanna species comparisons

A comparison of the similarity of species was made among four savanna parks. Species lists from the checklists of Pongara (Dauby et al. 2008), Loango (Harris et al. in prep.), Lopé (McPherson and White 1995), and Bateke (Walters et al. in prep. a) were obtained. The savanna taxa were selected from these lists. The lists of Loango and Pongara were merged as

[135] A forb is defined as a non-grass and non-woody plant.

these represent coastal parks that are geographically proximal. The lists were synonymised according to the Gabon Checklist (Sosef et al. 2005). I pooled savanna species from each list into a global list of 453 species, representing 9.6 % of the Gabon flora.[136] The Jaccard similarity index (as above) was used to compare similarity between parks.[137] For these analyses, only species that were fully determined without doubt were used; this removed 14 species from the comparison.

Star rating system

Species distribution information was researched in botanical references such as national or regional floras and sometimes the original species description. These distributions were then categorised into star ratings taking into consideration national and international rarity as well as ecology and taxonomy. The following categories from the star rating scale are displayed in Table 2 (adapted from Hawthorne 1996: 116). Based on the survey results (Chapter 3), the seven plants listed in Table 2 of Chapter 6 are used (Table 5, this chapter). For a listing of all Bateke savanna species star ratings, see Appendix 6.

Star	No. Degree Squares in Africa	Notes
Black	1.6 ± 0.5	Rare internationally and rare in Gabon. Urgent conservation attention required.
Gold	7.8 ± 3.8	Rather rare internationally and locally. Conservation attention required.
Blue	24.5 ± 12.6	Widespread internationally, but rare in Gabon; widespread in Gabon but rare internationally. Some conservation attention from Gabon required.
Red	39.6 ± 16	Common.
Green	69.2 ± 49.8	No conservation concern.

Table 2. Star ratings detailed by range of distribution.

Floristic similarity of savanna floras

Koechlin first described Gabon's savannas according to grass and woody dominants and included coastal, enclosed interior, and vast interior savannas (Koechlin 1962). In recent years, several protected areas containing savannas representative of these areas have been inventoried including Loango and Pongara National Parks on the coast; Lopé National Park, containing a large enclosed savanna in the interior; and the Plateaux Bateke, part of the vast continental

[136] According to the Gabon Checklist, in 2005, there were 4,710 species (Sosef et al. 2005).
[137] Given that lists only provide presence of species and not frequencies or numbers of plants, one cannot further compare them with other indices such as the Shannon-Weiner index. However, rarity inferred from the star system is possible.

interior savannas. This makes the comparison of these savanna types possible.[138] Clearly, these savannas are extremely dissimilar in composition, not having more than 15% of their species in common (see Table 3). When considering all three sites, only 18 species are shared (4.1 %).

	Site		
	Lopé (N = 217)	Bateke (N = 175)	Loango-Pongara (N = 173)
Lopé	--	14.9%	14.0%
Bateke	--	--	14.1%
Loango-Pongara	--	--	--

Table 3. Comparison of savanna floras from three sites using the Jaccard Similarity Index. Total species numbers per site are noted in parentheses.

This simple analysis shows that indeed, as White said, the savanna floras are divergent. This result is similar to those achieved in inselberg studies in Lower Guinea. These areas are like savannas in that they are also isolated herbaceous plant communities within the Lower Guinea forest. They show extreme dissimilarity in species composition with species similarity declining with distance; this is thought to be driven by past vegetation change (Parmentier et al. 200; Parmentier et al. 2006a; Parmentier et al. 2006b). The diversity differences of the savannas in my study are probably related to both the short- and long-term site history. Diversity differences might be related to the ages and deposition history of the savannas substrates. The coastal sands were deposited more recently, in the Quaternary, due to marine deposition or other factors (UNESCO 1987: 10). However, in Bateke, these sands were probably deposited in the Tertiary by aeolian events (Peyrot 1991). In another analysis, the savannas of Lopé and Mouila are predicted by climatic models while the coastal and Bateke savannas are proposed to be driven by edaphic factors (Droissart 2009:233). What does this divergent diversity mean in the context of Bateke? Are these savannas full of wide-spread species or are there some rare species in that species matrix?

Global rarity and Bateke savanna species

There are different ways to evaluate diversity including species numbers, phylogenetic distance, or species distributions. Classical ecological studies have focused on alpha, beta, and gamma diversity, an approach which used the ideals of competitive exclusion and niche theory (Whittaker 1972).[139] These analyses are still used by ecologists as a way to understand species richness (Parmentier et al. 2007). However, species numbers are not normally enough information in order to compare areas, since not all species are equal. Some species, due to their evolutionary history or geographical distribution, are rarer than other species (Vane-Wright

[138] Dauby et al. (2008: 78-9) noted that such a savanna comparison would be useful.
[139] Alpha diversity is the diversity in a single place. Beta diversity is difference in species richness in habitat gradients. Gamma diversity is the total diversity of a geographic area (Whittaker 1972).

et al. 1991). To account for these differences, taxonomic weighting was proposed. Various attempts to analyse the phylogenetic diversity of species or suites of species have been attempted (Faith 1992). Some efforts are being made to apply phylogenetic analyses to whole communities (Hardy and Senterre 2007) while others indicate that we are still a few decades away from having enough data to attempt this for most areas (Mace et al. 2003). Recently, one analysis found the comparisons of traditional species richness, endemism, and phylogenetic diversity to be equivalent in one study area for one family (Jaramillo 2007), implying that traditional approaches of comparing richness and endemism might still be valuable methods.

Botanists continue to place national floras within a global context by citing numbers of species and rates of endemism for areas (Davis et al. 2009). Such comparisons help the scientific and conservation communities to identify diverse areas and gaps in their knowledge to orient future collecting (Sosef et al. 2005). However, besides endemism, these accounts do not take into consideration the wider distribution of taxa. To account for this, some botanists have been using the Gold Star System to evaluate the "bio-quality" of a species (Hawthorne 1996; Hawthorne and Abu-Juam 1995). This allows taxa to be evaluated based on their distribution range. This approach has been used in plant checklists[140] in Cameroon (Cable and Cheek 1998; Tchouto et al. 2006), Gabon (Sosef et al. 2004) and Central America (Gordon et al. 2004). Nearly every previous approach using the Star System has been for forested communities, with the first for an herbaceous community, the *cerrado*, in progress (W. Hawthorne, pers. comm.).

Grassland communities in Central Africa are thought not to be as diverse, containing very widespread species. This often leads botanists to spend less time in savannas than forests during inventories, which is understandable given the wide divergence of species diversity between the two habitats. In the Mount Cameroon Checklist (Cable 1998), the authors indicate that they spent only one day in the "lower mountain savanna and grassland" and relied on the literature to make a full vegetation description.

I am not proposing that Central Africa savannas are as diverse as its forests. The high rates of endemism in forests are well known, particularly in mountainous areas (Sosef 1994) and riparian areas (Leal 2004) which may have served as refugia for rare species during past climatic cycles. However, I *do* suggest that savanna vegetation might contain some surprisingly rare species and that more attention ought to be paid to these habitats. This was noted in a recent new species description from a wet savanna in Equatorial Guinea, where the author noted that these areas were underexplored botanically (Phillips 2000: 199); this observation was also made for the Niari and Plateaux Bateke savannas (Descoings 1975a). Indeed, more than 30 recent plant species records for the Gabon flora come from savanna inventories (Walters et al. in prep. b).

[140] Though sometimes modified, as in Sosef et al. 2004.

The Bateke savannas contain 183 herbaceous and woody species.[141] Forty-seven of these species (or 26% of the savanna species) are rare in Gabon, being only known from the Haut Ogooué Province. However, all 47 of these species have distributions extending beyond the borders of Gabon. When considering the global rarity of these species, majority of species are green stars, or widely distributed, which is normal in most floras (pers. comm. W. Hawthorne) (see Appendix 6). However, there are six black and gold-starred species; these seem to be limited by edaphic conditions related to the Kalahari Sands substrate or to wet savannas with one related to burning (Table 4).

Family	**Species**	**Star**	**Factor limiting distribution**
Apocynaceae	*Asclepias occidentalis* Goyder	Gold	Post-fire emergence; Kalahari Sands Specialist
Cyperaceae	*Scleria baroni-clarkei* De Wild	Gold	Unknown
Eriocaulaceae	*Syngonanthus ngoweensis* Lecomte	Black	Moist Savanna
Eriocaulaceae	*Syngonanthus schlechteri* Ruhl.	Gold	Moist Savanna
Fabaceae	*Eriosema* sp. nov.van der Maesen & G.M. Walters	Black	Kalahari Sands Specialist
Verbenaceae	*Clerodendrum* sp. nov P. Bamps & G.M. Walters	Gold	Kalahari Sands Specialist

Table 4. Bateke Plateaux globally rare species.

By contrast, the plant species which are most used by the Bateke for subsistence from the survey (see Chapter 6) are not globally rare, each meriting a green star (Table 5). Of these, several are rare in Gabon, being only known from the Bateke Plateau area. Many of these plants are fire dependent, including *Hymenocardia acida*, *Parinari capensis* Harv., *Landolphia lanceolata*, and *Anisophyllea quangensis* Engl. ex Henriq (Koechlin 1961a: 60). Several of these species are also considered to be adapted to sandy soils and xeric conditions, including *P. capensis*, *A. quangensis* and *L. lanceolata* (Descoings 1975a). While *Annona senegalensis* resists fire, it tends to suffer more than the other species; by contrast, fire helps develop *A. quangensis* carpets (Koechlin 1961a: 91). In this next section, I will consider the effect of fire and seasonality on plant diversity in the plateau area, taking into consideration rarity and usage.

[141] This estimate is based on a draft checklist (Walters 2007a) with additions from this dissertation work. This does not include species from the forest-savanna edge.

Family	Species	Star	Rare in Gabon	Local part used
Anisophyllaceae	*Anisophyllea quangensis* Engl. ex Henriq	Green	Yes	Fruits
Annonaceae	*Annona senegalensis* Pers.	Green	No	Fruits
Apocynaceae	*Landolphia lanceolata* (K. Schum.) Pichon	Green	Yes	Fruits
Chrysobalanaceae	*Parinari capensis* Harv.	Green	Yes	Fruits
Cucurbitaceae	*Cogniauxia podolaena* Baill.	Green	No	Fruits
Euphorbiaceae	*Hymenocardia acida* Tul.	Green	Yes	Fruits
Fabaceae	*Albizia adianthifolia* (Schumach.) W. Wight	Green	No	Leaves
Zingiberaceae	*Aframomum alboviolaceum* (Ridl.) K. Schum.	Green	No	Fruits

Table 5. The savanna species used for subsistence.

Fire and forb diversity

Early studies from the Bateke Plateau area describe various aspects of the flora in relation to fire. Duvigneaud (1949) noted that the dry season flora was the most important one, with a flush of bulbs and forbs coming forth post-fire.

> *Le passage annuel du feu de brousse, au début ou au milieu de la saison sèche, a pour résultat d'accentuer le contraste et de le farroner a un point tel qu'il s'est créé une alternance saisonnière de végétation absolument remarquable: en saison des pluies, la formation est presque purement herbeuse; les graminées cespiteuses dominent largement; puis cela sèche, brunit, le feu survient qui transforme le tout en un enduit, noir de cendres couvrant l'entièreté du sol d'un manteau macabre, alors, en un temps très court, les pousses des suffrutex rhizomateuses développent leurs frondaisons en une véritable mer d'un beau vert brillant et bientôt fleurissant; la formation s'allume des milles fleurs multicolores d'un nombre souvent très grands de géophytes bulbeux ou rhizomateux.*
>
> (Duvigneaud 1949: 9-10)

Koechlin agreed, indicating that grasses flowered at the beginning of the year, with dicotyledons flowering in the dry season (Koechlin 1961a: 60). However, studies on forb diversity in savannas and its relationship to fire are limited; this is perhaps due to lack of ability for rapid identification during plant surveys or lack of data collection in all seasons, particularly post-fire when many forbs emerge (Bond and Parr *in press).* Forbs often exhibit fire-related traits such as underground storage organs which release leaves post-fire (White 1993; Menaut 1983) and so attention to seasonality of surveys is particularly warranted (Bond and Parr *in press*). Due to this basic lack of information on forb biology, it is not surprising that interactions between fire and forbs are even less known.

In studies in other grasslands around the world, fire does not consistently affect forb diversity. In South Africa, fire regimes have had no effect on forb diversity, although there are distinct fire tolerant and fire intolerant floras (Uys et al. 2008). In a North American prairie study, annual

burning consistently favoured the lowest forb diversity, with these species being only a subset of the flora for less frequently burned sites (Collins et al. 1995; Kucera and Koelling 1964). In other studies in the North American prairie, burning or not burning did not result in different forb diversity at all (Dix 1960). In Ghana, forb diversity was similar for all burn regimes tested, though greatest on protected plots (Brookman-Amissah et al. 1980). In Ethiopian grasslands, again no connection was found between fire regime and species composition of a site (Jacobs and Schloeder 2008).

In several studies, only when burning was combined with grazing was forb diversity affected (Fuhlendorf and Engle 2004; Fynn et al. 2005). In Burkina Faso, herbaceous diversity was not significantly impacted by burning, wood cutting, or grazing, but only became significant when burning was combined with one of the other treatments and even then, was site specific (Savadogo et al. 2008); a similar effect was reported in Benin (Biaou 2009).

In South Africa, the only treatments to affect forb diversity were the "extreme" ones of wet season fires, annual burning, and fire exclusion; in general, fire regime had little effect on the herbaceous plant community of Kruger National Park (van Wilgen et al. 2007). Effects of fire on forb diversity may be more extreme in areas of lower rainfall (Chidumayo 1997; Furley et al. 2008). Uys (2008: 490) proposes that site by site studies need to be made since no trends seem to emerge.

Many forb studies look at species numbers, rarely looking at the type of species present in the burn treatments. Some of the above studies suggested that species were replaced by others depending on burn regime, or that species within a burn treatment were only a subset of the larger species pool. My fire-forb study was conducted only on savanna hilltops in shrubby savanna in order to control for sand type, water drainage capacity, and vegetation type. Therefore, this part of the study only represents a subset of all possible savanna species: 60 species are represented comprising 33% of the overall savanna flora (see Appendix 4). When comparing species numbers, there is little effect of burning on species diversity. When plant species by season and burn treatment were tested in a 2-Way ANOVA, only season was significantly different. Neither burning alone nor the interaction between burning and season was significant (Table 6).

Source	Type III SS	df	Mean Squares	F-ratio	p-value
BURN	6.533	1	6.533	2.378	0.124
SEASON	34.956	2	17.478	6.361	0.002*
BURN x SEASON	8.956	2	4.478	1.630	0.198
Error	725.422	264	2.748		

Table 6. 2-Way ANOVA results showing that only season was a significant factor in affecting species diversity. An asterisk "*" denotes significance.

When Tukey's HSD was used to determine which seasons were most significant, the dry season differed significantly from both rainy season measures, while the rainy seasons were not significantly different from one another (Table 7).

	Dry	Mid Rainy	Late Rainy
Dry	0.00	--	--
Mid Rainy	0.036*	0.00	--
Late Rainy	0.002*	0.584	0.00

Table 7. Tukey's HSD was used to determine which seasons were significantly different from each other in terms of species numbers. Here, the p-values are displayed. An asterisk "*" denotes significance.

Indeed, when the species lists of burn treatments are compared, using Jaccard's Similarity Coefficient, the dry season is the most divergent, having only 31.8% species in common with the other seasons (Table 8). However, when species lists were pooled by season alone, the dry and late-rainy season were the most dissimilar (Table 9). This suggests that burning in the dry season potentially promotes the most diverse species assemblage.

	Burned-Unburned
Dry	31.8%
Mid-Rainy	45%
Late Rainy	50%

Table 8. Jaccard similarity index of species similarity between burned and unburned treatments by season.

	Late Rainy	Dry	Mid-Rainy
Late Rainy	--	--	--
Dry	36%	--	--
Mid-Rainy	50%	44%	--

Table 9. Jaccard similarity index of species similarity between seasons.

What species drive this difference? In a simple analysis of listing species and their uniqueness by treatment and season, 16 species are found only in burned areas, while two occur only in unburned areas. The dry season has the highest number of unique species at five, while the late rainy season comprises three, and the mid-rainy has only one unique species (Table 10).

Are these species unusual and do they deserve special attention for management? According to the Star System, all of these species are rated as Green or Blue and therefore not globally rare. However, eight of these species are rare for Gabon. Additionally, there are other species within the savanna flora which are rare in the plateaus. Given that the study sites for this forb study included only a small subset of savanna habitats, further studies are warranted for management of rarer species.

Species	Rare in Gabon	Star	Burn	Un-burned	Dry	Mid-Rainy	Late Rainy
Glossostelma lisianthoides (Decne.) Bullock	Yes	Green			X		
Xysmalobium holubii Scott-Elliot	Yes	Green	X			X	
Helichrysum mechowianum Klatt var. *ceres* (S.Moore) Beentje	Yes	Green	X				
Vernonia guineensis Benth.	No	Green		X			
Polycarpaea eriantha Hochst. ex A. Rich.	No	Green	X				
Crotalaria glauca Willd.	No	Green	X				
Desmodium barbatum Benth. var. *dimorphum* (Baker) Schubert	No	Green					
Eriosema glomeratum (Guill. & Perr.) Hook. f	No	Green	X				
Eriosema pellegrini Tisserant	Yes	Green	X				
Eriosema shirense Baker f.	Yes	Green	X				
Unknown Walters 1831	?	?	X		X		
Macrotyloma biflorum (Schum. & Thonn.) Hepper var. *biflorum*	No	Green	X				
Tephrosia flexuosa G. Don	No	Green	X		X		
Vernonia daphnifolia O. Hoffm.	Yes	Blue	X				
Vigna oblongifolia A.Rich.	Yes	Green	X				
Dipcadi viride (L.) Moench	Yes	Green	X		X		
Curculigo pilosa (Schumach. & Thonn.) Engl.	No	Green	X				
Unknown Walters 1950	?	?		X			
Ocimum sp. Walters 1944	?	?		X			
Disa sp.	?	?					X
Polygala acicularis Oliv.	No	Green					
Kohautia kimuenzae (De Wild.) Bremek.	?	?	X				X
Buchnera paucidentata Engl. ex. Skan	Yes	Blue					X
Striga bilabiata (Thunb.) Kuntze subsp. *bilabiata*	Yes	Green			X		
Totals			16	2	5	1	3

Table 10. Species unique to season and burning treatments. Stars, rarity in Gabon, and treatment are considered. For a list of all species in the plot study, see Appendix 4.

The rarest of plateau species, those which carry black or gold stars (Table 4), are not represented in the list of species unique by season or burning (Table 10). There are two reasons for this. First, two species (*Syngonanthus* spp.) are found only in humid savannas, a habitat not represented in the forb-fire study and not normally subject to burning. Secondly, though globally rare, two species are common in the savannas. *Eriosema sp. nov.* and *Clerodendrum* sp. nov. are Bateke Plateaux area endemics (for *Eriosema* see van der Maesen and Walters in prep). They are found in all both burned and unburned areas (*Eriosema* sp. nov. is found in all

seasons; *Clerodendrum* sp. nov. is only found in the mid-rainy season); therefore, regardless of burning, they are present. By contrast, *Asclepias occidentalis*, a Bateke Plateaux endemic, appears to flower after burning, but is most restricted to the Kalahari sands (Goyder 2009).[142] These three taxa coincide with the northern Kalahari sands which were deposited in the Tertiary (Peyrot 1991); however, fire may not have been very common until only about 3,500 years ago when Bantu-speaking people began migrating into the area. Despite the presence of fire in the plateaus for the past few hundred years, the fact that fire is not part of the biology of these plateau endemic species suggests that fire was perhaps introduced much later to the plateau area and has therefore not been a factor in speciation. In the Cape flora fire is only one of many possible drivers of speciation (Linder 2003; Linder 2005).[143] In a recent study, fire was proposed to drive the speciation of two lineages of the savanna orchid *Disa* in the Cape flora; estimated to have speciated 16.7 mya during the Miocene, during which fire was first introduced into the Cape area (Bytebier et al. 2010). Such studies indicate that fire must be a relatively old part of the ecosystem to drive speciation.

Conclusion

Local burning for subsistence shapes the ecosystem beyond the few species targeted with fire. Burning regenerates the vegetation in different seasons and affects the herbaceous plant diversity most in the dry season. The plants the Bateke most use in the savanna are also not rare. Their species biology suggests that they are fire-dependent. Many of the other, non-subsistence savanna species are not globally rare. However, one quarter of Bateke Plateau area savanna plants are unique for Gabon. The two plateau endemics do not appear to be affected by fire treatment, with both *Eriosema* sp. nov. and *Clerodendrum* sp. nov. being two of the most common species encountered in the study site in both burned and unburned areas.

[142] *A. occidentalis* is a new species for the Plateaux and a specimen from this study is a paratype as cited in Goyder 2009. It was the second collection since the 1950s of the species. It's IUCN status is "Near Threatened".

[143] In investigations of the tree flora of the area, phytogeographic patterns suggest that the Bateke area was once more associated with the forests of Congolia (Walters et al. in prep. a) as well as with two other Lower Guinea forests (Born 2007). It appears that several floras converge in the plateau area. Savanna formation and fire may have played a role in the evolution of the flora, but this remains to be investigated.

Chapter 8: Burning and vegetation structure: the impacts of fire regime change

> We have not re-imagined ourselves as the fire creatures we are. Other species knock over trees, dig holes in the ground, hunt, and eat plants. We do fires. We hold that power as a species monopoly. Our fire power is an index of our ecological agency—what we do that whales and wolves, oaks, and orchids cannot.
>
> (Pyne 2004a: 877)

The Bateke fire regime today differs markedly from the annual regime of the land chief system explored in Chapter 4 and certainly differs from the annual fires reported in the literature for the region. Today's Bateke fires occur annually to semi-annually and occur in both the dry and rainy seasons. How this fire regime affects savanna vegetation has not been previously evaluated. Here I examine local concepts of vegetation change, describe the present-day fire regime, and analyse the effects of repeated fires on vegetation structure.

Introduction

Fire is a major factor in shaping savanna ecosystems including North America prairies (Knapp et al. 1999), Brazilian *cerrado* (Durigan & Ratter 2006), and the Australia outback (Bradstock et al. 2002). All African savanna systems are affected by fire including those of Madagascar (Bloesch 1999), South Africa (van Booysen & Tainton 1984), East Africa (Dublin 1996), and West Africa (Laris 2002). Humans have inhabited African savannas for a long time, perhaps as long as two million years. The manipulation of fire is the factor that probably led to expanded use of these areas in Africa, first with the use of fire as a hunting and gathering tool (Harris 1980) and later as a pastoral and agricultural tool (Komarek 1972). Savanna fires in the Bateke Plateaux have occurred since at least 2100 BP (Schwartz 1988).

Rainfall is a factor interacting with fire. Precipitation increases grass growth which in turn increases fuel for fires. In tropical areas where dry seasons alternate with rainy ones fire can become widespread, particularly in the Guinean savannas (Gillon 1983). Fire return period, the frequency of fires an area typically experiences, is one factor significantly affecting the structure of African savannas. Sankaran et al. (2005) notes that areas experiencing frequent fire have less woody cover.[144] In studies in South Africa's Kruger National Park, (350-750 mm/yr rainfall), fire return period is critical to maintaining savanna structure. Fire that was too frequent encouraged constant resprouting of branches from the bases of trees, preventing saplings from

[144] This is true unless they are on Kalahari sands in which case woody density is unexplainably higher.

graduating into the larger size classes and escaping the "fire trap" (Higgins cited in Enslin et al. 2000); however, a return period of three years or more allowed saplings to grow beyond fire damage height to become trees (Enslin et al. 2000). Variation in fire intensity is critical for simultaneous growth and re-growth of trees (Govender et al. 2006). Fire intensity and frequency is also important for West African savannas. In Ivory Coast's Comoé National Park, low intensity anthropogenic annual fires were found to maintain savanna structure while not altering forest extent (Hennenberg et al. 2006). While precipitation is critical for seedling establishment (and resprouting), fire frequency is what determines the likelihood that a sapling will reach maturity (Higgins et al. 2000).

The interaction between fire and vegetation structure is primarily concerned with stems achieving a large enough size to escape fire. Variation in fire intensity may be one way which favours stem-escape, essentially by creating micro-sites where trees are favoured (sensu Jeltsch and Weber 2000). Variation in fire intensity (and fuel moisture) can lead to overall bush encroachment; as grass fuel loads decrease, so does fire intensity (Higgins et al. 2000).[145] Furthermore, repeated burning has been shown to prevent recruitment of juveniles into adult size classes (Liedloff and Cook 2007). Yet, regular fire can increase biomass in the short term, while in the long-term may result in woody extinction (Hanan et al. 2008). Fire and vegetation feedbacks at annual or less fire frequencies suggest that more frequent fires support grassland states (Beckage et al. 2009), however these models did not address semi-annual fires where vegetation and fire may interact in a different way to support vegetation states. The varying conclusions regarding the overall effect of fire on woody components of savannas in the long and short terms seems to suggest that there is room for exploration of how frequently burned savannas can support woody components. Exploring the Bateke fire regimes may yield some insights.

Methods

In this study, the dominant savanna tree *Hymenocardia acida* Tul. (Phyllanthaceae) was chosen as it represents approximately 90% of the trees in the savanna. There are an additional 5-7 woody species, but these are not abundant to be encountered in plots. Furthermore, H. acida is a typical savanna tree in that it reproduces asexually through production of resprouts (Bond and Parr *in press).* Thus, this tree was the right choice for the focus of the following fire experiments exploring fire's impact on savanna structure.

Fire frequency

To understand the seasonality of fires in the study area, I acquired a dataset of satellite-detected fire points from the University of Maryland's Firemapper system for 2000-2008. Firemapper is a satellite reporting tool which detects fire activity occurring at a scale of greater than 1 km^2.

[145] Stems may escape fire damage when fuel moisture around trees protects them (Higgins et al. 2000).

These data are managed by the University of Maryland and made available to researchers upon request. These datasets are conservative reports on fire activity since cloud cover may prevent the reporting of an active fire and smaller fires remain undetected.

In order to determine the seasonality of detected fires, Firemapper coordinates between Lékoni and Lefini from 2000-2008 were imported as shapefiles into ESRI 3.2 GIS. A subset of the coordinates were selected (14.22; -1.96 to 13.95; -1.73) corresponding to the study site village areas of Saaye to Kebiri and south towards PNPB but not including it. There are two satellites, Terra and Aqua, that report fires for the area. Firemapper indicates that Aqua may have better detection capabilities. However, to test this statement for the study site, the dataset was sorted by satellite first. For each satellite, the dates associated with each of these coordinates were counted by month per year. In only two cases did they differ; otherwise, the fire reporting was exactly the same for the satellites. Therefore, I added these two cases to the tally for Aqua and charted the seasonality.

In order to test if Firemapper detected fires around the immediate area of villages, the area around Ekouyi-Mbouma was selected for 2004-2007, resulting in little to zero reported fire activity. These fires are generally smaller in size, perhaps less than $1km^2$, and present in every season. They are typically lit around the village and savanna plantations for security. Firemapper's lack of reporting of these smaller fires indicates that another type of analysis is needed to understand peri-village fires. Thus photo-point yielded supplementary information (see next section).

The underestimation of small burned areas is not uncommon in frequently burned savanna, in part due to the inconsistencies when trying to reconcile low and high resolution data in a single study; this often results in a "low-resolution bias" (Boschetti et al. 2004b). Differences in the spatial resolution of such datasets can result in orders of magnitude difference in burned areas (Boschetti et al. 2004a). Fire mosaics in particular are said to pose a specific problem for satellite detection methodologies, in part because they do not consider local burning practices. When coarse-resolution detection is used, as much as 90% of a patchy burned area can be underestimated (Laris 2005). As such, the Firemapper data must be taken with caution as its detection limit is for fires affecting areas greater than $1km^2$.

Photo points

To understand if fires were repeated 1-3 times in the same area each year, I took photos from five fixed locations every four months: September 2007, January 2008, April 2008, and September 2008. These photos were analysed and frequency of fire per area was noted.

Resprouting

To determine the effects of historic and present day fire regimes on *Hymenocardia acida* resprouting a fire experiment was conducted. In one of the forb study sites, a single area that had burned in July 2007 was delimited by a large fire break into three separate study areas. These areas were paired with a fourth area in the PNPB which had not burned for three years. In each area, 15 permanent 1 m^2 plots were established, located with a GPS point, and tagged. Before and after each treatment, all resprouts were measured for diameter above the basal swelling, and height above ground level. As height is considered to be an indicator of escaping topkill, I measured height of the growing tip above ground. In unburned areas, the stems were often bent over by the competing tall grass. These measurements were conducted every 4-5 months in July 2007, November 2007, April 2008, and September 2008. A total of 5,172 stems were measured during the course of this part of the study.

All fires were lit by Bateke hunters who regularly burn in Kankuru Domain today. We used historic and current fire burning techniques: lighting "with the wind" while using packets of lighted, dried grass to carry ignition along a desired perimeter. Fire ignition times were generally at noon to have the highest temperature and lowest relative humidity.

Fires were set to imitate the current and historical fire frequencies in the area. In treatment 1, fires were set after 9 months in the rainy season and repeated in the dry season after 4 months growth. In treatment 2, fires were lit in the early dry season after 12 months of growth. In treatment 3, fires were lit in the late dry season after 13 months of growth. In the control area, no fire had burned for 36 months. Later, an area adjacent to the control plots was burned. This equalled six treatments (Table 1).

	Treatment Area 1: 9 and 4 month return	**Treatment Area 2: 12 month return**	**Treatment Area 3: 13 month return**	**Control Area 1: 36 month no fire return**	**3 year burn: 36 month return**
July 07	x	x	x	--	--
December 2007	--	--	x	x	--
April 2008	Pre-post	--	--	x	--
July 2008	--	Pre-Post	--	--	--
August 2008	Pre-post	--	Pre-post	"Pre"	Post

Table 1. Summary of treatments per area. "X" denotes periods of data gathering for baseline comparisons. "Pre-post" indicates measurements taken immediately before and after a fire on the same plots. For the August 2008 control measure, this is in quotes as this was an unplanned fire affecting an area next to the control.

Normality was not achievable and non-parametric tests were used. Post-burn density was analysed by comparing 95% confidence intervals. Basal area was calculated for stems graphed into size classes. Basal area was calculated as:

$$BA = \pi(d^2/4)$$

Where π is approximately 3.1416 and diameter is measured above the basal swelling (Barbour et al. 1987).

Stem size classes were made. Size class distributions were averaged across 15 plots per treatment. The average size class distribution per treatment was compared using the Kolmogorov-Smirnov test. This test was chosen since it is used to compare significant differences between distributions (Dytham 2003: 77).

Survivorship by height and diameter was analysed for each treatment. The stems in each plot were categorised by size class (14 classes). Totals were taken for each size class per treatment.

Pre- and post-fire survivorship were calculated per treatment and graphed. The size classes where 100% survival occurred, was noted. Overall survivorship of stems was calculated per treatment. All statistics were computed in Systat 12.0 (2007).

History of vegetation study sites

The fire manipulation study was carried out seven kilometres south of Ekouyi village in Kankuru Domain in a savanna dominated by *Loudetia simplex* grasses. The site itself was historically an *ewa* (Bateke burn unit, see Chapter 4) and located near the *Brousse Djobo* at the limit of the Nkomo and Kankuru Domains. Therefore, the regime 50 years ago was annual. No grazing activities or cultivation would have occurred in this site in the past 50 years given that there was no village situated in the area at that time. However, perhaps 90 years ago, the nearby former village site of Ampiemi was inhabited, suggesting that at that time the study site would have been cultivated and grazed. The historic continual shifting of village sites in the Bateke Plateau area prior to resettlement suggests that the study site represents many places in the plateaus that have a serial history of cultivation/grazing followed by hunting use. In the past few years prior to the establishment of the fire manipulation experiment, the area was most likely burned annually and sometimes biannually, representing the burn regime today in the plateau area.

The control area and the area which was also burned by hunters after 36 months are located in PNPB in the "Nkouli Savanna", 25 kilometres south of the fire-manipulation site. Historically, this area was also an *ewa* but part of another domain. Aerial photos confirm that in 1954, this area was located near villages that were along the Mpassa River, but that no cultivation was in practice in the study site. However, it is quite possible that prior to 1954, cultivation and grazing could have occurred there, like the scenario given for the fire-manipulation study. In consultation with the long-term project *Projet Protection des Gorilles*, which has monitored this

area for over 10 years, it was confirmed that these savannas had not burned in the last three years. In Firemapper records, the last fire in the area was in 2005.

This was the only area which could be reasonably assured to stay in an unburned state during the study period given its location close to NGO personnel bases in the PNPB whose presence dissuade illegal hunters from burning. However, half of it was burned by illegal hunters just after a round of data collection in April 2008. All other areas in and around the park are subject to annual and semi-annual fires.

The view from the plateau

First I will discuss the ways Bateke people are known to manipulate their environment by planting trees in village forests in the middle of the savanna. This section is followed by a look at how the savanna is transformed by their burning.

Bateke as forest creators

The Bateke are a savanna people yet are known for creating forests wherever they live. The significance of these copses, how they are constructed, and how they are used in modern times has been studied. In colonial times, these copses were well described by French forester Auguste Aubréville:

> *Nous avons observé un cas très curieux et incontestable d'installation forestière dû à l'homme dans la savane pauvrement boisée à Hymenocardia acida. Le pays Batéké (Moyen Congo), vers Okoyo et Evo, est parsemé de multiples boqueteaux de forêt dense; d'un coup d'œil on peut en apercevoir 10, 20, dans le paysage. Chacun d'eux marque l'emplacement d'un ancien village. Les Batékés installent toujours leurs villages en pleine savane, ne cultivent leur manioc qu'en savane ; dans les rares vestiges de forêt ancienne qui subsistent, ils ne plantent que quelques ignames et quelques cannes à sucre ; seules les femmes cultivent, or elles ne veulent pas aller en forêt. Dans les villages, pour faire les cases, les clôtures, les indigènes utilisent des perches d'un bois de fer, le* Milletia laurentii, *arbre aux magnifiques grappes de fleurs violettes ; des Ficus aussi. Ces bois se bouturent très facilement ; les perches s'enracinent ; des palmiers à huile s'installent spontanément autour des cases ; d'autres espèces, issues de graines, viennent ensuite s'établir. Après quelques années cette végétation forestière devient trop dense au gré des Batékés qui n'aiment pas la forêt, le village se déplace un peu plus loin, en avance au sol propre. L'ancien emplacement se transforme en une dizaine d'années en un bois épais, mêlé de palmiers. Alors qu'en général les populations de la zone forestière recherchent la forêt, pour s'y cacher, s'y abriter, s'y défendre, alors qu'ils la défrichent pour cultiver, les Batékés formant une originale exception, fuient la forêt et la recréent.*
>
> (Aubréville 1949 : 318)

As eloquently stated by Aubréville, copses were physically created around new village sites established in open savanna. Native trees are not planted specifically for shade; they are used for fencing and house posts, some of which have a tendency to take root. Non-native trees, such as mango, *atanga* (*Dacryodes klaineana*) and particularly oil palm trees (*Elaeis guineensis*) are

planted for fruit, oil, and wine production. Trees and seedlings continue to grow and increase the shade of the area, eventually forcing the villagers to abandon the site.

In the study area, every copse has a name, but not all copses are former village sites. Some informants indicate that they are simply forests that "god has given us" or were developed from forest encroachment aided by bird dispersal. However, most seem to be village-derived. In many cases, new village forests keep the same village name, despite moving to a different location. Thus for Ekouyi and Mbouma, there were two recognized former sites each. However, in the case of Allieme village, family disputes were responsible for the string of adjacent copses in close proximity. These are ideas supported by Guillot's analysis of Koukouya Bateke village forests in 1980 and Soret's work on the Teke in Congo (1973). Soret indicates that there are many reasons for moving a village, including death and dispute. However, family issues were not the only reason for moving a village: the Bateke do not enjoy living in the forest. Ouesta pointed out the situation in her own compound, where her husband had planted a *kabu* vine (*Landolphia* sp.); once the vine took over (as it was rapidly doing), they would be forced to move their house since it was not a good idea to live under the trees.[146] Her husband states:

> When we construct a village, we plant. There are a lot of trees that we plant. After awhile, one sees what one would call a forest. People are then obligated to move their houses and to move to a nearby area where it is open. Little by little they leave one place; they advance. This is why we see forest everywhere, everywhere in the plateau.
>
> Alna, October 2007 (Rec-25), my translation

Previous to *régroupement* efforts, the Bateke villages in the study site would re-establish themselves every six to seven years, according to Gaston Tolo-mba, the *Chef de Canton* Djouya and resident of Mbouma. Sometimes, establishment wouldn't take effect properly, as was the case for the false start at Aele by Tolo-mba's grandfather, a site signalled by two lone *Albizia adianthifolia* trees in the savanna. However, largely due to *régroupement*, village forests are rarely created today. Today, the Ekouyi-Mbouma forest complex has been in use for over 40 years, and one can now see the recent history of the village internally, in the form a scatter of abandoned home-sites marked by trees, much as abandoned villages are scattered across the wider landscape. Despite the stagnation in migration and creation of village forests, these form useful parts of the Bateke landscape. However, most of this landscape contains savanna which is used in a very different way from forest.

[146] Ouesta has since moved her kitchen to a different and more open location in their compound.

Bateke as savanna fire-setters

Local savanna classification and forest succession

> *Les pentes et les vallées sont couvertes d'herbe, mais les graminées à tige fine qui la composent ne dépassent guère vingt-cinq centimètres de hauteur; sur les pentes, les plantes à tige ligneuse sont très rares, et c'est seulement de loin en loin qu'on rencontre un arbre rabougri. Les hauteurs où le sable manque sont tantôt couvertes de graminées arborescentes qui atteignent près de trois mètres, tantôt couronnées de forêts peu étendues, isolées comme des oasis.*

(Guiral 1889: 142)

The plateau savanna landscape is not uniform. Patches of trees, expanses of treeless plains, and islands of tall grasses are united in the vegetation tapestry described by Guiral. The tall grasses to which he refers are undoubtedly the *Hyparrhenia* species often found in small patches within the savanna and associated with groups of trees and termite mounds. The twisted nature of the trees, particularly those of the dominant *Hymenocardia acida*, is a result of the frequent burning which causes the continual loss of apical branches thus creating the twisted effect of the stem morphology. Explorer observations from this time period generally lack detail in vegetation description (despite the collection of botanical specimens), in part because of their lack of prolonged residence in the area and lack of local language. Sometimes the seemingly random groupings of *Hymenocardia* trees in the middle of the savanna surprised them; in one case in the Central African Republic, Father Tisserant thought these were perhaps relicts of former camp sites used during wars, where pickets used as temporary housing later grew into trees (Sillans 1958: 255). Whether this conjecture is true or not, groupings of these trees do occur sometimes strangely in the savanna, perhaps due to some form of previous use, or perhaps due to the fire regime. Here, local classification of savanna types and ecological units add a much richer view of plateau vegetation.

The Bateke classify their savannas broadly into two types (see Chapter 2): wooded savanna, or *mpila,* and open savanna, or *kape*. Within these types, there exists a classification of tree density within the savanna which essentially refers to stages of succession. These are as follows:

Katsio: islands of resprouts surrounding *Hymenocardia acida* trees, often forming small hillocks of dense root systems.

Njulu: isolated grouping of *H. acida* trees in the open savanna; can also be mature forest on steep slopes adjacent to the savanna

Kajia: Small copse in the middle of the savanna

On numerous occasions, I asked older inhabitants if they could indicate areas of the savanna that had become more densely populated by trees in their lifetime, in what is considered by western

ecologists to be a transition to forest. I questioned informants when we were physically present in these vegetation types, often conducting interviews while driving elders, transporting them through the landscape at distances greater than they could now walk. Yet, when asking if the *mpila* savanna had always been shrubby or had it once been *kape* savanna, they would always reply that it had always been as it is today.

The best observations of vegetation change over time were yielded by Bateke informants talking not of the large savannas comprising the domains but of the decreasing size of small savannas enclosed within the forest edge. These are called *kabala*. These environments are small and easy to identify if viewed from a savanna hilltop; forest succession is observable as the vegetation, over time, closes in on the paths through these isolated areas. Such was the case when I questioned one informant, as we walked on a trail passing through a *kabala*. Joseph Paya had noticed this process and indicated that the one through which we were passing, *Kabala ko Obiga*, would take as much as 20 years to close. It is perhaps better said in the words of Alna, a fire specialist and hunter, "The *kabala* that no longer exist. This is the forest invading them. The forest is more powerful than grass."

In fact, not only are the *kabala* becoming enclosed but the forest edge is expanding into the savanna. In a vegetation study carried out on the forest at the savanna edge in PNPB, former savanna areas had been colonized approximately 100 years ago by the pioneering tree species *Aucoumea klaineana*. *Aucoumea* establishes itself in edge and disturbed areas such as former plantations, roadsides and, in this case, savanna-forest interfaces (Leal et al. 2007). Rougier-Gabon recently conducted logging operations, targeting *Aucoumea*, in newly forested areas 40 kilometres west of the study site; these areas were formerly savanna (Chezeaux 2008). These studies suggests that fire does not stop (though it may slow) the advance of the forest edge in the area.[147]

Local fire regime classification

It is important to understand how the Bateke look at their own burning and its effect on the savanna; outside observers sometimes argue that Bateke burning is too frequent and done without a goal. Understanding the Bateke viewpoint may help clarify some, though not all, of these concerns. Chapter 6 addresses why people burn today but not how often they do it. As seen in Chapter 4, the land chief system regulated annual fires in the domain where most of the lineage's lands were burned in the long-dry season.

According to Antoine Mbia (Rec-17), today everyone burns at all times of the year. He indicates that this burning doesn't kill the *Ongalaga* (*H. acida*) rather, it regenerates *katsio*, after which edible fruits are produced called *kora*. After this, the leaves return. This process of fruit

[147] The rate of local advancement of forest now subject to logging merits future study..

and leaf production, Mbia tells us, happens whether one burns or not. This is confirmed in plot observations in unburned *katsio*. At the beginning of the rainy season, resprouting is highest. However, by the late rainy season, *katsio* leaves are yellowing and herbivory is high. By the dry season, *katsio* leaves have dropped and new leaves are being formed. The cycle of resprouting and leaf renewal continues without fire, but only at very low levels.

When inquiring about the best season in which to burn, 98% of the respondents to my five village survey indicated the dry season is best, with the wet season being the worst time to burn. However, many indicated that they also burn whenever the grass is mature and dry. Several times during the study when I was with informants who observed dry grass, they burned the savanna if the weather was right. This happened even in the rainy season. However, grass will only burn under the right conditions and depends on the grass type present, as I will show later.

In discussing typical fire-setting with two prominent fire-setters of the Kankuru Domain, present-day Bateke fire regimes are clarified. Gaston Tolo-mba describes two burn scenarios: burning in May and re-burning in December or burning in July and re-burning in March. He noted that it takes about eight months for the grasses to mature and dry at the base, making them flammable. Antoine Mbia (Rec-16) concurs with these remarks, likening the maturity of grasses to that of a woman's term of pregnancy. However, he also talks of annual burning, giving the example of burning the same area every January or every April. According to these scenarios, burning occurs both once and twice per year for Bateke hunters.

Evaluating the present-day Bateke fire regime

Fire regimes are defined by the frequency, seasonality, extent of fire given the fuel types, fuel moisture, climate, and weather conditions at a given site. The following sections will look at the modern Bateke fire regime through these concepts. The terminology here is based on official fire terms accepted by researchers and the FAO (Goldammer & de Ronde 2004). Relevant terms are summarised in Appendix 8.

How often do Bateke burn an area?

Burning frequency and patterns are not the same in peri-village savannas as in the domains. Although I am focusing on the larger phenomenon of domain burning, I will first briefly comment on peri-village burning since this type of fire-setting is observable to passers-by and must not be confused with domain fires.

Peri-village burning

Observations from Firemapper data show that burning occurs in all months of the year (see Chapter 5). However, these are for fires larger than 1 km^2. Firemapper reports almost no fires close to the villages in the study site in an eight-year dataset, despite my observations of repeated burning there. Close to the village, patches are burned numerous times per year; these

fires are noticeably smaller than those lit further away in the domains which are detectable by Firemapper (being at a scale of greater than 1 km^2). The fires close to the village are lit for various reasons including security, protection of savanna plantations, and also for pleasure.[148] In Figure 1, the difference in the fire size in peri-village and domain fires is clear. The fires in peri-village savannas can be lit throughout the year because they are dominated by shorter perennial grasses which mature and dry out in a matter of a few months (*Elionurus hirtifolius, Anadelphia afzeliana, Ctenium newtonii,* and *Schizachyrium thollonii*). Out in the domains, the dominant grasses such as *Loudetia simplex* are taller, with larger basal tufts, which require much more time to mature.[149] While fires examined in the domain were never burned in January, peri-village fires in January were numerous. Peri-village burning can occur more than two times per year in the same place, particularly around plantations in order to prevent destructive, unwanted fires.

Figure 1. Domain and peri-village fires. The single large domain fire (left) is contrasted with the small peri-village fires not detected by Firemapper (right). Maximum colour saturation of the image is used to contrast the burned areas: the differences in green (burned a few weeks ago), rust-brown (unburned), and dark brown/black (most recently burned) signal the age of the burn.

Domain burning

The fires detected by Firemapper further from the village are the ones of principal interest in this study since they affect the greatest area today and historically. One of the assumptions by outsiders today is that the Bateke burn areas repeatedly throughout the year. My photo-points in four areas of the Kankuru, Vagha, and Ambouli Domains show that fire-return occurs often at a 9-12 month interval. However, in several cases, fire return is as frequent as four months (Table 2). In all four photo-point cases, fires were lit during the rainy season. Fires were never detected in January photos (which covered the three months at the start of the rainy season) or prior to the small-dry season. When contrasted with peri-village images also taken in January (but not part of the photo-point data collection), January fires were present. Based on this

[148] Many noted that burned landscapes (especially when flush with new growth) were beautiful.
[149] Whether grass dominance is caused by fire frequency was not investigated in this dissertation.

simple exercise, I confirm that domain fires are lit in the same areas as frequently as twice per year.

Photo-Point Name	Location	Fire returns noted
Kassigi	Hunting camp in Kankuru Domain, 5 miles S of Ekouyi-Mbouma; 4 miles SE of Kebiri	10-13 months
Kebiri Valley	Valley between Kankuru and Vagha Domains, 5 miles E of Kebiri	10-12 months
Ambuli Valley	Ambouli Domain, 8 miles S of EM; 4.5 miles SE of Kebiri	4, 10 months
Rocky Valley	Kankuru Domain edge, 3.3 miles S of Ekouyi-Mbouma.	4, 9, 12 months

Table 2. Photo point locations and fire returns.

The areas represented in the photo-points are commonly burned by the aging hunters of Ekouyi-Mbouma and Kebiri. Given the information from the two informants in the previous section and this photo-point evidence, there is a mixture of fire return periods. In most cases, fire return is between 9-12 months. The only time that four month fire-returns occurred (in two cases) was when the first burn occurred at the end of the rainy season (May) and was repeated four months later at the end of the long-dry season. Fuel was able to re-grow and then dry out regardless of maturity.

Fire-return could be related to two factors: dominant grass type and fuel moisture. Burning near the village happens in every season but is only possible because those grasses have shorter life cycles and thus can be burned more frequently. In the domain, *Loudetia simplex* is the dominant grass. It requires nine to twelve months to mature, requiring these longer periods to dry out the large, tufted base and making it impossible to burn earlier. I will explore the ecological impacts of this regime next.

Fire regime and ecological effects

Now that I have confirmed that fires today occur in parts of the domain from as often as four months to as infrequently as every 13 months, I ask the question, "What are the effects of these fire regimes on *Hymenocardia acida* population structure?"

Savanna structure and fire in the Plateaux

Here, I will explore the Bateke fire regimes of semi-annual (twice per year), annual, and triennial fires (every three years) and their effects on the population structure of *H. acida*. I will first explore resprouting and stem distribution pre- and post-fire, determine the size of stems escaping topkill, and look at the role of fire patchiness in Gulliver escape.

Resprouting

Hymenocardia acida is a classic savanna tree; it is fire adapted, reproducing vegetatively by resprouting post-fire. In Koechlin's (1961a: 94) study on the Bateke Plateaus savannas, he never

saw a *H. acida* seedling. Other researchers saw so few that they could not resolve how *H. acida* reproduced (Sillans 1958: 257). During my study, I too never observed any seedlings in any of my plots. In only one account are seedlings ever described, then being considered a rare observation (Sillans 1958: 257).

In unburned Bateke savanna, the woody vegetation is crowded by high, dry grasses and tall *katsio*. Not only do dead grass tussocks accumulate, often obscuring the *H. acida* re-sprouts, but the resprouts themselves are not as actively recruited in the absence of fire. Resprouting was low throughout the year, highest in the early rainy season (November) and lowest at the end (April). In the control, the average density of resprouts per plot did not exceed 20 per m^2. These resprouts were thin-stemmed, often pressed low to the ground beneath clumps of dead grass. This actively reduced their potential height at which topkill could be avoided; additionally, they were shaded by grass.

Once savannas were burned, *H. acida* displayed intensive resprouting typical of fire-dependent species. Average resprout production two months post-fire was high at 60 per m^2. Resprout production then declined, though it was significantly different from unburned plots up to nine months post-fire. However, by month 12, there was no difference between areas that had not burned for 36 months and those that had not burned in 12 months. Without fire, only low levels of resprouting continue. However, once areas where fire had not occurred for three years were burned, resprout vigour returned (Fig. 2).

Here I have investigated the annual cycle which is typical of many present-day fires but was also typical of historic land chief fires. Post-fire resprouting is the key activity that restores the smaller size classes of *H. acida*. Now that this is demonstrated, I can ask the questions: how does fire affect the stem structure immediately post-fire and do all fires have equal impacts?

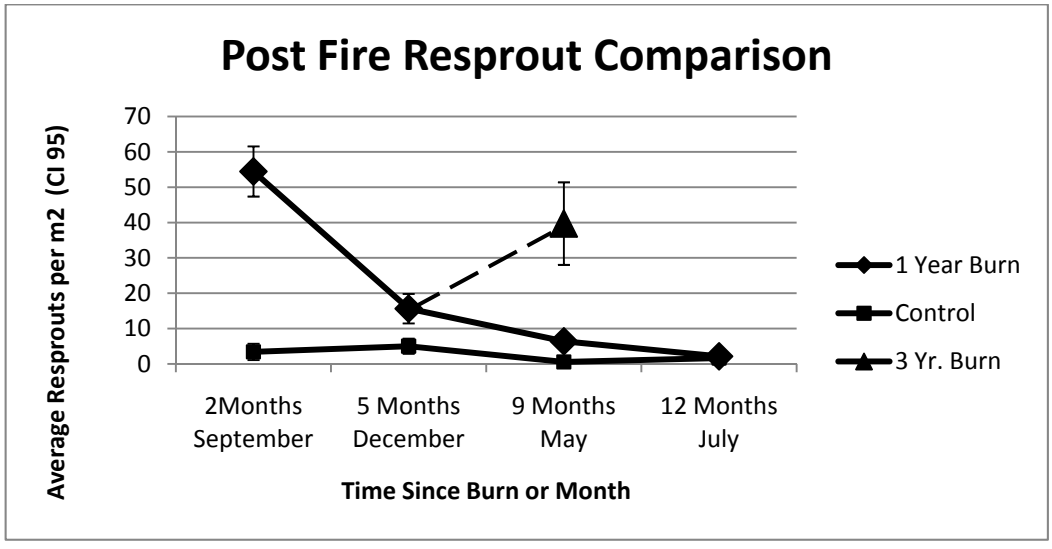


Fig. 2. Resprouting density per square metre compared across treatments. Significance is denoted by non-overlapping 95% Confidence Interval bars.

Fire regime and stem size

In order to assess how fire regimes impact the stem structure, stem height or diameter are categorised according to increasing classes to produce a size-class distribution. Communities that are continuously replacing themselves with constant reproduction, display an "reverse-J curve" where there are numerous small individuals (younger stems) and decreasing numbers of larger ones (older stems). In the following graphs, the size class distribution for height is calculated by increments of 10 cm; for diameter, three millimetres. In comparing the diameter curves for unburned savanna that were burned 12 months and 36 months ago, the same distribution emerges. The only difference between the curves is the fewer individuals in the 36 month distributions; this is probably due to intra-specific stem competition for light and water resources (Fig. 3). After 36 months of not burning, both wider and taller stems are beginning to graduate into the larger size classes.

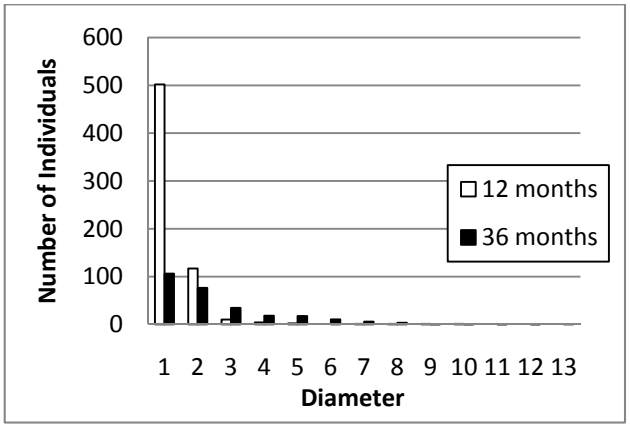
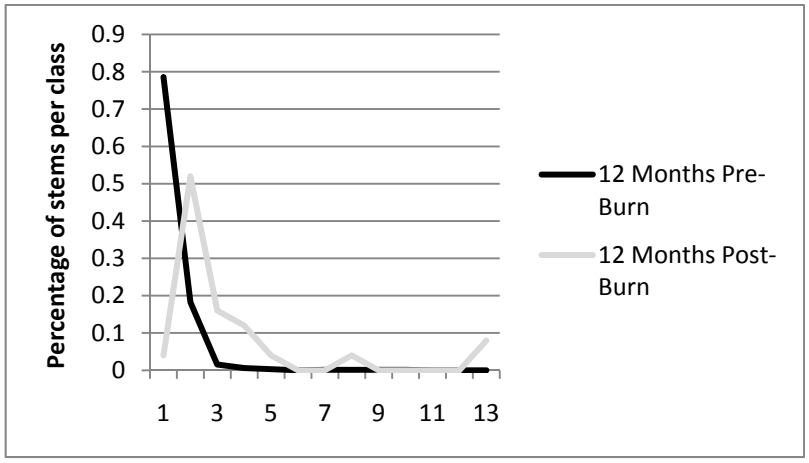


Figure 3. Diameter size class comparisons for 12 and 36 months without fire. Pre-burn comparison of diameter size class distribution of annual and triennially burned savanna.

When these savannas are burned, the structure size-class continuum is interrupted, and transformed from one of near-continuous distribution of stem sizes to one composed of only post-fire survivors.

Annual fires destroy nearly all of the smallest diameter stems, leaving disjunctions between the medium and larger classes (Fig. 4a). This disjunction is repeated in the height class distribution (Fig. 4b). Thus, the majority of post-fire surviving stems are found in the higher classes regardless of whether height or diameter is considered.



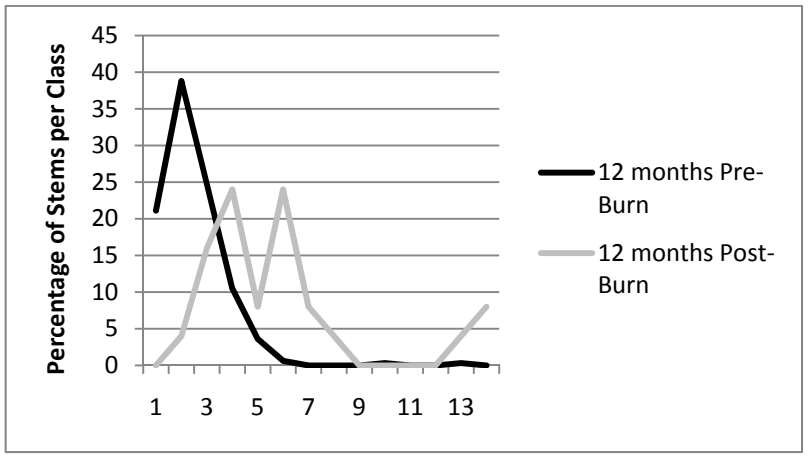


Figure 4. A. Top: diameter size class distribution shown in percentages pre- and post-annual fire. B, bottom: height size class distribution shown in percentages pre- and post-annual fire.

When the relative stems per class are compared pre- and post-burn across all treatments, a trend occurs. Both 12 and 13 month regimes result in a fragmentation of size class and an almost complete elimination of the smallest size classes. However, the post-36-month fire regime shows a spike in the lower but not the smallest size classes, indicating that this fire was survived by some relatively small stems. Both the 9 and 4 month fires show a completely different effect: the size class distributions remain the same but with reduced numbers in most classes (Fig. 5). This suggests that there is a difference between annual and non-annual regimes.

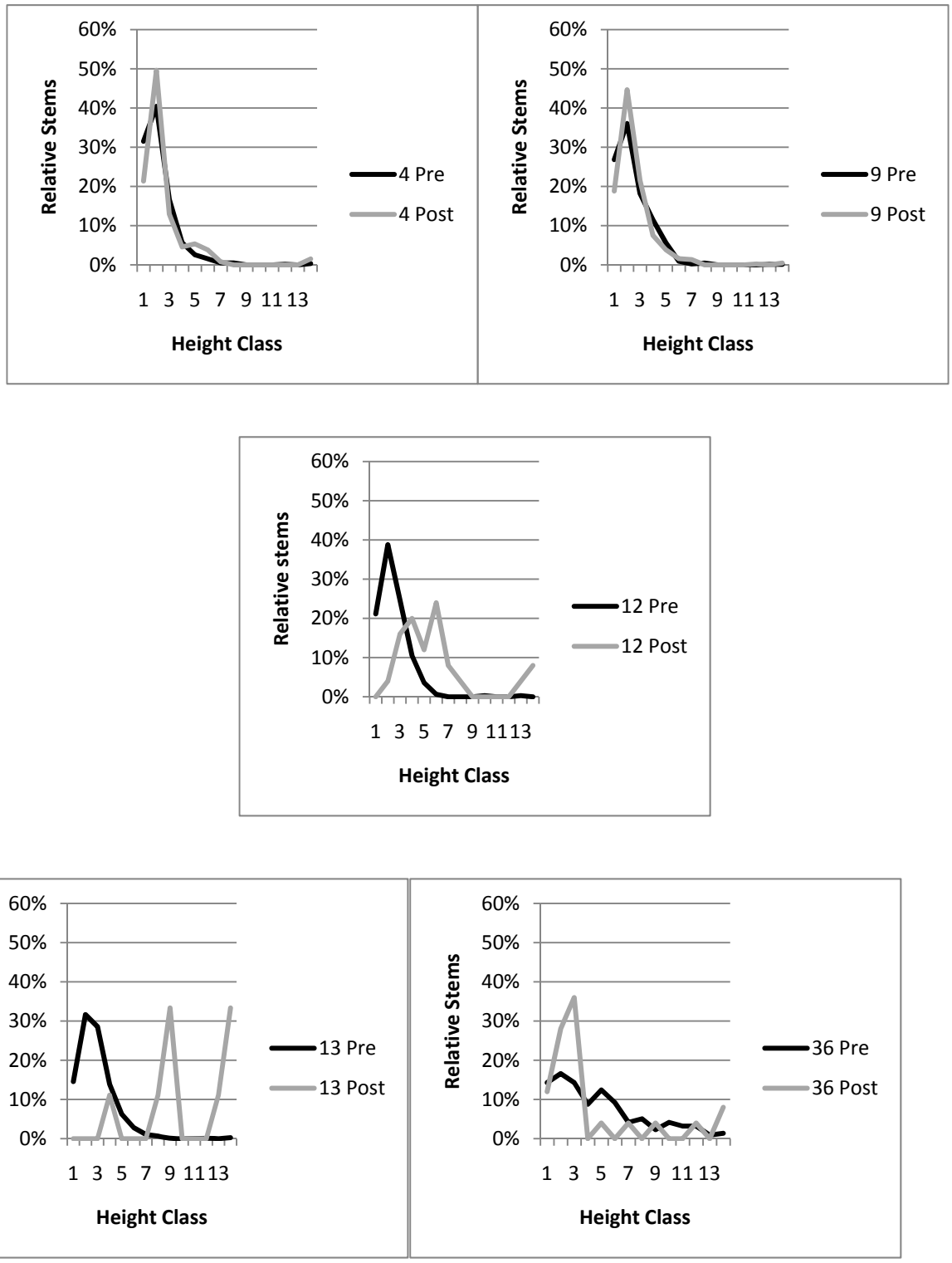


Fig. 5. Pre- and post-fire relative distributions of stems are compared.

Are these pre- and post-fire stem distributions significantly different? When basal area was compared statistically using the Kolmogorov-Smirnov test across the size classes for each treatment, the post-fire distributions were significantly different from pre-fire distributions in three cases: 12, 13, and 36 month fires. Both 9 and 4 months post-fire size class distributions were not significantly different from pre-fire distributions (Table 3).

	K-S Statistic	K-S Probability
36 Month burn	0.571	0.011*
13 Month	0.571	0.011*
12	0.500	0.038*
9	0.143	0.994
4	0.214	0.844

Table 3. Results for the comparison of basal area pre- and post-fire for each treatment. "*" denotes significance.

Topkill and fire conditions

Bateke hunters light fires in both rainy and dry seasons. In each of these seasons, air humidity and soil moisture differ. Additionally, yet equally important, grasses are at different phases of maturity.[150] One of the reasons that the four and nine month fires may have not yielded significant departures from the pre-fire size class distribution is that both of these fires burned incompletely. In both cases, the fuels were either incompletely dry or immature. This led to only 68% of the plots in the nine month late-rainy season treatment being burned and 86% in the four month treatment. All other fires burned 100% of the grass fuel. From the "failed fires", some lessons can be drawn. Indeed, following initial fires in July 2007, I attempted and failed to burn one of my fire plots after only five months of growth during the rainy season in December 2007. In both cases of the failed April 2008 fires, fuel was only partially dry after eight months of growth (Table 4).[151] It was burned successfully only in May 2008, after nine months of growth. This same area was able to be burned again four months later in August 2008, once the long-dry season had dried the immature grass.

Dry seasons are characterised by a considerable decrease in relative humidity and a decrease in fuel moisture; in this study, the days since last rainfall are high, reaching more than 50 days without rain for the 13- and 4-month fire (fires conducted on the same day, but representing different burn regimes). As a result, topkill was greatest in the 12 and 13 month fires. By contrast, rainy season fires are lit under conditions of high relative humidity, recent rainfall, and sometimes with immature fuels. Furthermore, as in the case of the 36 month fire, rainstorms the

[150] Maturity is defined as grasses at full height, in the flowering stage. Maturity is independent of fuel moisture. For example, the grasses that burn after four months of growth are short, immature, yet burnable because they are dry.
[151] In Trapnell's work (1959: 133), he reports similar failed burns in his early season plot, with failed burns three times in one particular year.

same day as the fire can extinguish them. This fire, though burning hot enough for flames to be seen from the valley below and smoke plumes to be noted from 10 kilometres away, did not burn far. Only a portion of the equally dry adjacent control savanna burned before being extinguished by rainfall.

Month since fire	Season	Date	Rel. Humid	Weather	Temp. (˚C)	Time	Wind speed m/s	Fuel maturity	Days since rain	% burn
13	Late dry	28 Aug 08	28-23	overcast	32	11:40	0-1.4	Mature, dry	58	100
4	Late dry	28 Aug 08	28-23	overcast	32	11:40	0-1.4	Im-mature (short), dry	58	86
12	Mid dry	6 Aug 08	23-32	sunny	36	12:00	0-1 (3.6)	Mature, dry	37	100
9	Late Rainy	1 may 08	66 - 54	overcast	32-37	12:00	0-0.5 (1.5)	Mature, incomplete ly dry	2	68
36	Late rainy	23 April 08	UN	UN	UN	UN	UN	Mature, dry	2	100
Failed Fires										
5	Mid rainy	Decem ber 07	UN	UN	UN	UN	UN	Im-mature, green	UN	0
8	Late rainy	2 April 08	65	overcast	32	13:00	0-1.3 (2.0)	Mature, part. dry	1	0
9	Late Rainy	30 April	67	overcast	33	15:00	0-0.5	Mature, part. dry	2	0

Table 4. Fire conditions during treatments. The 36 month fire has no recorded conditions as this was lit by poachers and therefore no warning was given enabling measurement of conditions. "UN" means that conditions were unrecorded.

Patchiness and Gulliver escape routes

Patchiness in fires is not unknown and is generally attributed to irregular water distribution (Vetaas 1992), variation in grass production (Chidumayo 1997), competition between trees and grass (Mordelet and Menaut 1995), fuel dynamics, and fire weather (Trollope et al. 2004). Sometimes patchiness occurs in early dry season fires, as it did in Zambia, where these fires were so "light" and patchy that trees as small as 0.6 m in height escaped fire damage, whereas late season fires were so hot that only stems greater than 1.8 m survived (Trapnell 1959).[152] In Nigeria, tree populations were reduced by 32% over a five year period where late fires had occurred (Hopkins 1965). Survival depends on stem growth rates and the frequency and

[152] Fire, however, is not the only driver of vegetation change in Trapnell's *miombo* woodlands. Combinations of land tenure and management techniques (including fire) can significantly affect woody cover (Chidumayo 2002). Fire cycles can change forest or savanna succession, a finding that has been supported by more recent research into the fire sensitivity of the miombo woodlands (Cauldwell & Zieger 2000).

intensity of fire (Trollope 1984). By contrast, Furley (2008) notes that increased fire frequency leads to decreased height. This is not supported in the Bateke savannas.

Patchiness of fires caused by the Bateke anthropogenic semi-annual fire regime may provide another escape route for Gullivers. Patchy fires, similar to early dry season fires, burned incompletely either due to immature fuel or poor fire weather (see Fig. 6a). After fire, those stems that survived topkill were in the larger height classes, with 50-100% surviving often in only larger size classes (Fig. 6 B, C, D). But if the fire was patchy, the survival rate was higher in smaller size classes. When the survivorship curves of post-fire stems are graphed, the link becomes even clearer (Fig. 7).

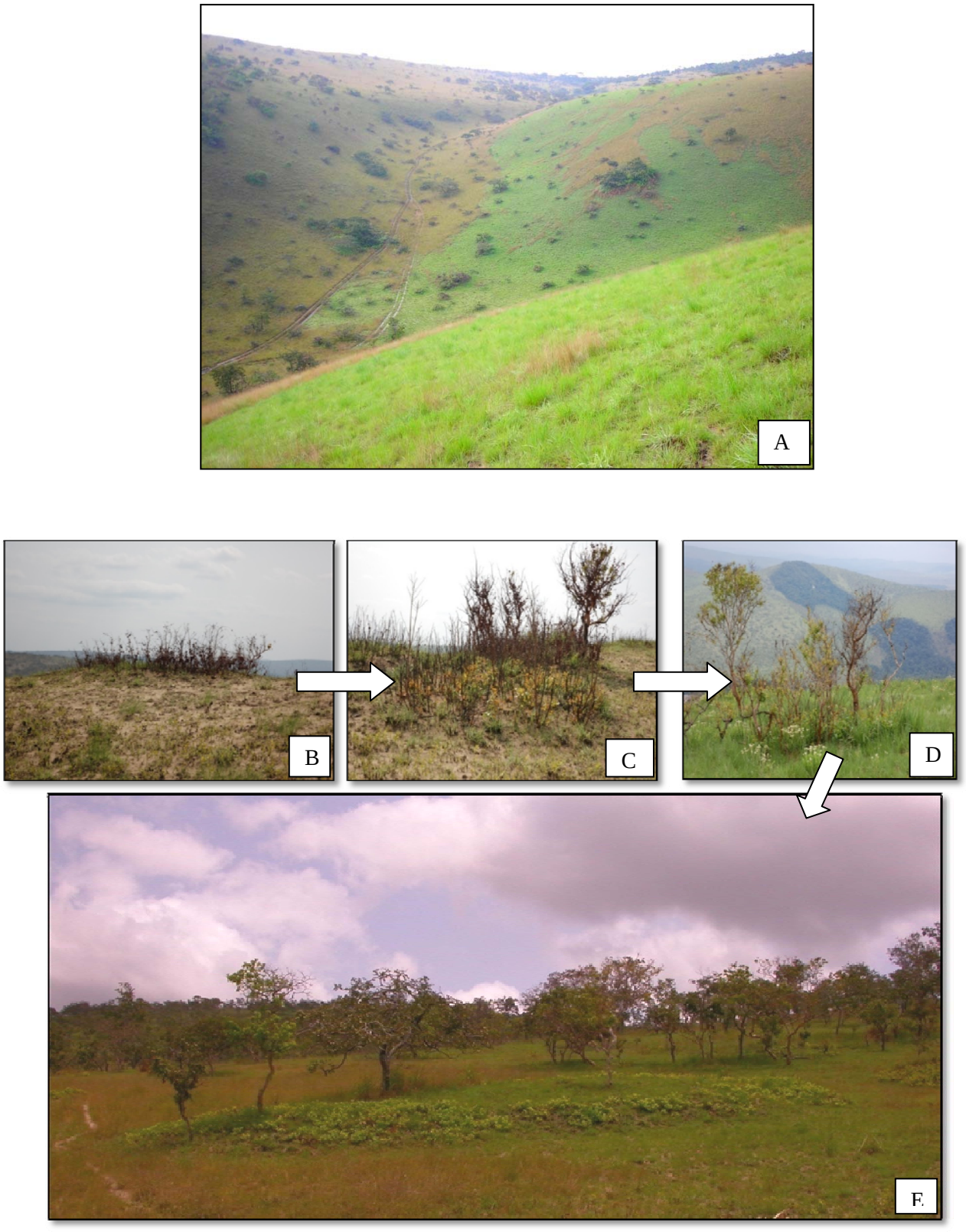


Fig. 6. *Katsio* production and patchy burning. A.) Patchy fires. Note the difference between the green (recently burned) and brown (older burn) patches of grass. B.) katsio with all stems burned. C.) katsio with some stems escaping previous fires. D.) Mature stems mixed with immature stems in the same katsio. E.) *Mpila* savanna with young katsio at base of trees.

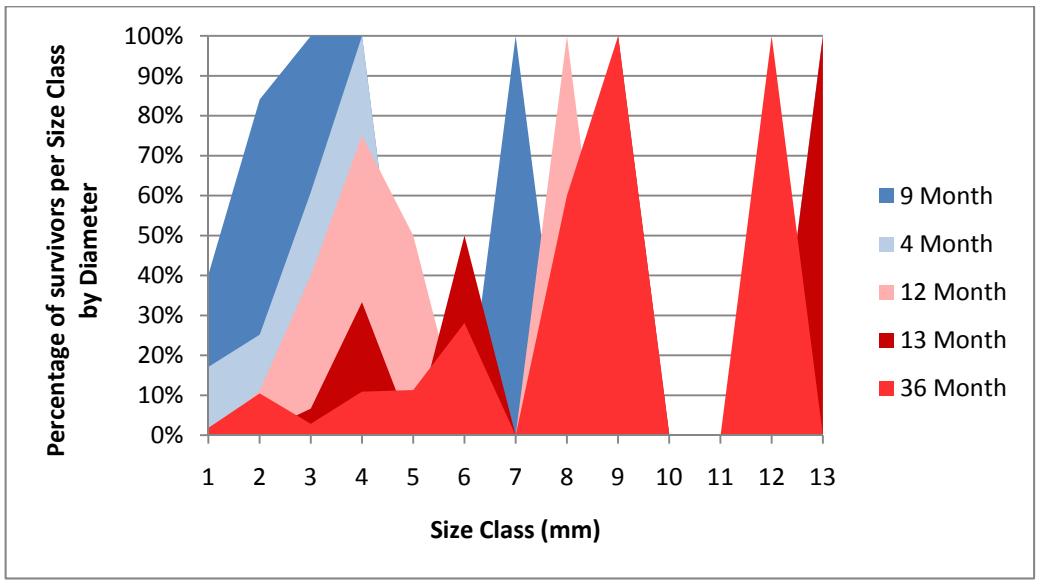


Figure 7. Survivors post-fire by size class of diameter. Complete fires represented in red hues; patchy fires are represented in blue hues.

In the plateau savannas, post-fire survivors can be quite small: in the nine month burn where 73% of the stems survived, stems as small as 0.7 mm in diameter or 61 cm tall survived (the height being similar to that reported by Trapnell in 1959). By contrast, in the 13 month fire where 1% of stems survive, only those either greater than 3.7 cm in diameter or 81 cm in height survived (Table 5). In other studies in drier southern African savannas, 50% of saplings less than 4 m tall experienced topkill (Higgins et al. 2000) while in wetter Australian savannas, 50% mortality was experienced by stems with a diameter of 0-10 cm (Prior et al. 2006).

Fire type	Lowest surviving stem diameter (cm)	Lowest surviving stem height (cm)	Post-fire stem survival
36 month	2.5	61	10%
13 month	+3.7	81	1%
12 month	2.2	51	4%
9 month	0.7	61	73%
4 month	0.7	131+	23%

Table 5. Post-fire stem measurements are given for the lowest diameter and lowest height.

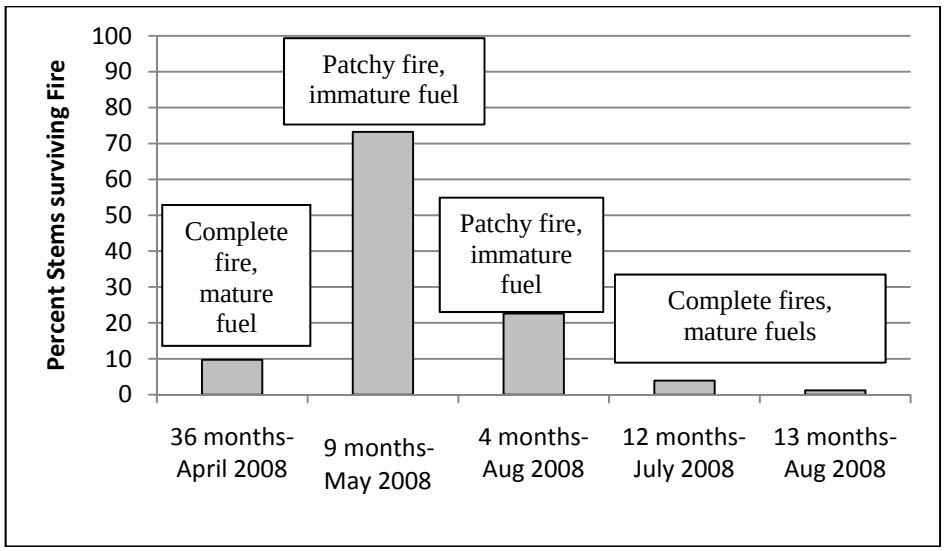


Figure 8. Comparison of post-fire stem survival, fuel maturity, and season.

Here a link between the chance that stems will survive a fire, the fuel type, and the patchiness of the fire is shown. Fires with immature fuels have higher stem survival (Fig. 8). This patchiness not only favours an escape route for juvenile stems ultimately, this type of fire regime, when repeated over time, may also result in a thickening of the bush by creating micro-sites where tree growth remains unaffected by fire for a season (Figs. 6B-E). Since fires burned frequently in the same place are less intense due to reduced fuel load, the fires either do not "carry fire" evenly throughout the fuel type, resulting in unburned patches, *or* the low intensity of the burning favours the survival of smaller stems. Either way, through patchiness or light, fuel-poor fires, tree growth is favoured.

Many fire studies talk of frequent fires on a different time scale than the one reported here. For example, Hoffmann describes *cerrado* fires every five years as too frequent and potentially favouring smaller life forms (Hoffmann 1999). However, in the Bateke Plateaux area it is different. Fires burning after 5 years would be intense affairs, but the stems would likely have escaped topkill due to growth promoted by high rainfall. This fire regime would promote woody growth due to stem growth. In the case of the semi-annual fire, these are so frequent that fuels promote patchy fires while growth between fires is limited.

Conclusions

There are four regimes of burning in the domains in the study site:

1. Annual, high intensity fires with few survivors
2. Semi-annual, low intensity patchy fires with more survivors
3. Triennial, high intensity fires with few survivors
4. No fire

In the first case, annual fires, much like the historic regime of the land chiefs, burned in the middle or latter part of the long-dry season. Those fires in the study where 100% burning occurred were set under conditions that favoured fire (low relative humidity, high temperature, mature fuel). Fires repeatedly burned in this manner would leave few stems able to escape the fire-trap. Historically, when the land chief fire regime was in operation, the only way that young stems would have survived would have been if a land chief had opted not to burn (thus, the stems survive due to fire suppression), or if the stems had been located on the *ewa* boundaries which were burned in April to delimit the burn units later in the year. The April fires would have been low in intensity and patchy, thus achieving fire-trap escape. However, in the Ivory Coast, even areas repeatedly burned over 20 years in an annual fire regime resulted in a 30% increase in woody density (Menaut et al. 1990).

In the second case of semi-annual fires, a modern fire regime, those fires in the study burned at 9 and 4 months after the last fire, burned in a patchy manner. These fires burned under sub-optimal fire conditions, where the relative humidity was high (in the case of the late rainy season fire) or the fuel was immature or green. These fires favour tree development by increasing the chances that a Gulliver will escape the fire trap. Essentially, these fires are part of the continuum of late dry season – early dry season fires regimes, representing an extreme case where fires behave like those in the early dry season (Fig. 9).

Fire regime	**Semi annual**	Early Dry Season	Late Dry Season	Suppression
Tree Survival	**25-75%**	4-25%	1-4%	100%; replace by forest species
Fuel characteristics	**Immature, green**	Mature, green	Mature, dry	Mature, very dry

Fig. 9. Fire regimes in consideration of tree survival and fuel characteristics. The fire regime explored in this chapter is in bold.

In the third scenario of triennial burning, the single fire of this nature that occurred during the study occurred in the PNPB. In this scenario, a rainy season fire ignited part of the control area, resulting in a high intensity fire. This fire burned completely despite high relative humidity. The 9 month fire burned in the same season. However, the major difference between the two fires was the maturity and dryness of the accumulated fuel. Normally, areas that remain unburned would become forest; however, if areas are left unburned for several years and then are burned, they behave like high intensity annual fires, resulting in high stem mortality.

The final regime in operation is that of no-burning. The only place within (or near) the study site where this occurred is in PNPB where no fire management plan is in place (but one is

planned), yet an active anti-poaching system exists (which, if successful, will eliminate poacher-related fire frequency). Areas remaining unburned typically transition into forest.

When the land chief was in place, regular village migrations continued. One finds old village sites quite close to the last *ewa*. Given what is known about the demands for nearby agricultural and grazing space, the configuration of *ewa* in the domain must have been fluid. As villages moved in space and time, former agricultural areas became hunting domains and past domains become present agricultural areas. If this analysis is correct, then the historic burn regimes in the study site would have fluctuated over time, creating a mosaic of burn histories over time and space and contributing in the long-term to vegetation structure.

Chapter 9: Conclusion

> We understand the history [of the land chiefs] because we have spent evenings listening to our fathers stories.
>
> Walla village elders, July 2008, my translation

This thesis has explored fire regime change, the value of fire to Bateke culture, and the effect of fire-use on the Bateke Plateaux savanna structure and flora. Here I draw some conclusions about each of these subjects.

Bateke Cultural and subsistence fire

Investigating why people burn

Studies of why people burn savannas seem to be limited. There are only a handful of cases for the whole continent of Africa which have been scientifically published. Undoubtedly, there are many in the gray literature. These studies are essential for understanding the local perspective of burning. In only one area in Gabon have surveys been conducted around a park to understand why people burn. These studies indicated that burning by locals was important for foraging, hunting, cultivation, and safety (Richard 2007; Mbega 2009). Both studies was conducted in short time periods, yet yielded important information. In informal interviews with park managers of Gabon's savanna parks, most burning experience by managers and NGO partners was through management and although respondents could list practical reasons why local people would burn, they themselves had not burned for these reasons (Appendix 9). Perhaps the disparity of burn experience between managers and local people explains the perception by managers of some local people burning "without a goal". Verifying these assumptions is relatively easy. Similar surveys could be conducted around other Gabonese parks to understand why people burn, how fire is linked to their livelihoods, whether it has an impact on park management, and whether there are local ecological lessons to be learned.

Burning as a heritage: the wisdom of the *olebe*

Fundamental to Bateke society is a culture of fire. The proper use of fire was once the foundation of land fertility beliefs and fire-foraging practices. While many of these rituals have passed away, there are embers that remain. These embers are largely in the form of memories of the elders and in the continuation of certain land fertility rites. The passing of knowledge

with the eventual death of these elders leaves the ritual side of fire-use and land fertility in danger of extinction. As stated in the introductory quote by the elders of Walla, they learned their history through spending time with their elders[153]. This could be called the "wisdom of the *olebe*". The *olebe* serves two purposes in Bateke culture: as a meeting place for the men (for women, the equivalent is the kitchen) and secondly as the place where the land fetish was kept and adored. In this way, the *olebe* is the place where the flame of the domain fetish is still kept alive through regular lighting of the *olebe* fire by Kankuru guardians. The wisdom of the *olebe* sharply declined in the 1960s when Bateke society was experiencing upheaval. Indeed, informants cited "lack of youth" as one reason that the fire-drive ended. However, this "lack of youth" did more than reduce man-power for communal hunts; it reduced the pool of people who would serve with the land chief in customary offices such as *otiugui* or assist in ceremonies such as *Ambwongo*. Indeed, today only a few in Kankuru remember the *olobo* song. Today there are few middle-aged men to pass on the knowledge between youth and elders. As this knowledge diminishes, a portion of the culture is lost.

Much of this knowledge is spiritual and yet is linked to foodway diversity (Berry 1981; Nabhan 2008: 10). The fire-drive not only maintained domain fertility but provided food to families in a critical time during the preparation of plantations. However, some of these traditions are being lost and Bateke foodways are losing their diversity, particularly through outside pressures of territory loss, loss of ability to manage resources and habitats, population changes, and laws against some practices; these are pressures experienced by other societies resulting in similar losses elsewhere (Turner and Turner 2007). The loss of local knowledge is considered to be the first step in the erosion of food diversity and diet; this is a phenomenon occurring in many developing countries today (Brand et al. 1990; Wells and Martin 2008; Williams et al. 2001). Bateke foodways continue but in a much less diverse manner and are far less connected to ritual and land fertility. In a striking example, the loss of the land chief's authority over the communal fire-drive has separated a once-joint fire-foraging affair into individual male hunting sorties and female group grasshopper gathering forays. The land chief's diminished authority can be viewed as one of the root causes of the reduction of communal activities as well as regulation of burning and hunting.

Was the land chief system a form of resource conservation?

Often traditional land tenure-resource management systems are considered to be a form of environmental conservation. Many ethnographies on small-scale societies report subsistence activities that result in conservation. According to some researchers, while many societies have practices which result in conservation, unless conservation is a *planned* outcome of the strategy then these practices cannot be classified as conservation; these researchers have found few

[153] This is compared to Sabinot's reflexion of coastal southern Gabonese cultures where today rural people watch television rather than exchange knowledge around an evening fire (Sabinot 2008: 223).

examples of purposeful conservation in small societies (Smith and Wishnie 2000; Krech 2005). By contrast, other researchers indicate that there are no general patterns and that while some societies practice conservation; others do not (Johannes 2002). Yet others propose that societies may learn from their mistakes through resource depletion or cumulative ecological knowledge in order to develop conservation ethics (Berkes and Turner 2006).

In the literature and in discussing the fire-drive with informants, many described the system as creating a "refuge" for the *ntsa* by setting aside parts of the hunting domain as unburned for 1-5 years (see Vansina 1973: 122). One informant referred to it as a "*technique de conservation*". *Ntsa*, the most-sought animal by the Teke, requires tall grass to hide their young and also needs burned areas for grazing. The refuge created by unburned areas may be key in maintaining habitat essential for duiker populations; however, in the case of the land chief system, land fertility was the main objective of the fire-drive. In Teke savanna ecology, the presence and abundance of *ntsa* was primarily related to land fertility and the contentment of the ancestors. Bateke hunting concepts are not so different from those of the Ndembu.

> The hunt is more than a food quest; it is a religious activity. It is preceded and followed by the performance of rites and is believed to be beset with perils of an ultra-human order.
>
> Turner 1967: 280

For many societies the first objective of hunting is not subsistence. Certainly it does not always represent the largest component of a society's diet; there is also a social dimension, as for the Bisa of Zambia (Marks 1977).

The contrast in outsider perceptions of the context of hunting may be best expressed by looking briefly at a debate on North American bison hunting. Anthropologist Shepard Krech (1999: 171) indicates that for some Native American groups, understanding deer hunting meant understanding the belief that the more that were hunted, the more would became available for future hunts. In this sense, limiting the hunt was not a goal or necessity. One highly contested traditional use of resources is that of the buffalo drive where Native American horsemen would drive herds of buffalo over cliffs in a single hunt. Krech evaluates historic findings and concludes that this was not an ecologically sound practice. However, historian Jack Brink argues that the buffalo jumps were part of a wider cultural practice of communal hunting and ancestor worship (Brink 2008):

> The question is: what was the proper way to conduct a hunt so that the spirit world was kept in balance, thus ensuring that future hunting efforts would be successful?
>
> (Brink 2008: 156)

He continues by commenting that "a tremendous amount of effort, and spiritual belief went into planning, organizing, and executing communal kills" (Brink 2008: 157). Thus the preparation was as important as the hunt itself. In this example cosmology and ecology are intertwined. Considering only one side constrains understanding. Likewise, considering the Teke fire-drive outside of the land chief's authority reduces our understanding of the practice to mass-hunt via controlled fire. However, the primary results of a properly conducted fire-drive and of the land chief's authority was landscape fertility. Indirectly, some historical actions may have regulated off-take, access and burning. However, the main goal was not planned conservation in the western sense. From this thesis, it is clear that there were consequences when the land chief's authority was reduced. Today, the commercial bush-meat trade results in overhunting *ntsa* while burning is at the whim of the individual.

There is scant data to suggest either conservation or conversely species eradication as being a consequence of the fire-drive. In one instance, the Teke of central Republic of Congo are reported to have hunted out areas and to have left them to be cultivated by the Kongo (Kiener 1922 cited in Kinata 2001). However, more data would be needed in order to truly understand the context at that time. Certainly, humans have been responsible for much extermination (Grayson 2001) and in the plateau area, the Bateke, have caused the local extinction of several species since guns were introduced (Appendix 3; Henschel 2006). It is certain that resource access is modified as societies change. Today's resource access systems operate in a very different context (Cordell 1993).

It has been suggested that societies have always dealt with distress and upheaval and that knowledge systems are generated and renewed when finding solutions to these shocks (Berkes and Turner 2006; Pandey 2004). However in the case of the Bateke, the 1960s was a time when a foreign government and modernisation were acting in concert. There seemed to be little choice for the land chiefs, but to abandon customary rule. In the past, the Bateke had carried the fire drive practice with them through their migration across the plateaus as well as when they were pushed by the Mboshi to new lands in the study site. Bateke history is rich with innovation in the face of hardship (see Chapter 2). However, this ability to innovate seemed to have been reduced first when they lost the trade in the Pool area and removed themselves to the interior plateaus in the 1880s (Vansina 1973, Chapter 2) and then again in the 1920s when many Bantu peoples are described as experiencing the death of the equatorial tradition (Vansina 1990, but see Gray 2002). At times they innovated and at times they withdrew. The 1960s appears to be a case where the Bateke withdrew their customary control over lands and fire, leaving very little in place that resembled the former system.

Ecosystem effects of fire

Indigenous fire regimes are rarely studied. This thesis documents the effect of the Bateke regime on savannas in the study site. Particularly, it has been demonstrated that semi-annual wet and dry season fires result in patchy, cool fires. Such a fire regime is an extreme form of early dry season burning, which is also burns at lower temperatures that late, dry-season fires. Changes in the fire regime from late, dry season to semi-annual seems to favour tree establishment. In essence such patches create micro-sites (sensu Jeltsch and Weber 2000) and so semi-annual burning could be viewed as an ecological buffering mechanism where annual fires prevent forest establishment, but semi-annual fires within the same zone favour it. This conclusion is contrary to results for models of fires occurring annually or less; in such models burning of immature fuel and its implications for tree-grass co-existence is not considered (eg. Beckage et al. 2009). Consideration of indigenous fire regimes in modelling and ecological studies is important if scientists are really to understand fire effects on eco-systems.

One of the unknowns in this savanna ecosystem is how grazing and fire once interacted to shape the flora. Grazing pressure in the Bateke savannas would have been far greater in the past (see Appendix 3). European explorers recounted many encounters with buffalo herds, hippopotami, and elephants; these observations seem to be very high in comparison to today's animal populations. These numbers have decreased (Bout 2006) in recent decades as guns were introduced to the plateaus (Chapter 5) and the commercial bush meat trade increased. One can only imagine what the vegetation structure and floristic diversity of the plateau savannas would be like if grazers were still a prominent part of the ecosystem.

Study limitations

In relation to the vegetation portion of the study, it must be considered that fires behave very differently, even when conducted in the same season on the same day (Whelan 2002: 4). The fact that the fire treatments in this study were not replicated makes their interpretation limited. Further investigation of repeated burning in the plateau should be conducted under replication. It must be noted that replication was not possible as time was divided amongst social and biological components of the study. Replication of burn treatments would have warranted a full-time biological study. It was decided to conduct this portion of the study without replication in order to have a synthetic bio-cultural understanding of changing Bateke fire regimes and their impacts on vegetation.

In terms of the anthropological portions of this study, it must be conceded that the story is never fully told or the work completely done. As stated in the methods section, there were limitations to accessing information about rituals. Given that part of this thesis argues that ritual formed the basis of the land fertility beliefs, a deeper understanding of these rituals would be desirable. Future studies by male initiates might help clarify some points.

Additionally, limitations of foreign language comprehension, particularly at the beginning of the study are unavoidable. However, continued time spent in the study area in the future will help confirm ideas reported here or nascent ideas yet unreported. A deep understanding of this bio-cultural landscape will only come with many more years of fieldwork in collaboration with the Bateke people.

Study applications

Implications for managing Gabon's savannas

Gabon Parks have decided to use fire as a management tool and to create fire management plans. However, the research to do this is lacking in some areas. Research for management does not have to be highly-replicated experiments but rather can be completed in some cases by local personnel advised by researchers. My survey (Appendix 9) also showed that the park with a fire management plan had difficulties just like those without plans. This suggests that proper training in fire techniques, fire management, and sanctions for improper lighting outside of a plan are lacking. During the course of this survey, a few people suggested that Gabon Parks start fire management in a few parks and demonstrated its success before trying to manage all six. It is also best to start where the infrastructure and research are already in place, or where the savannas are small enough to work with and not fraught with the problems of international borders or park boundaries which have mid-savanna limits, as opposed to rivers or forest (otherwise, fire may carry from inside the park to outside the park or the country). While Gabon has the capacity to carry out the research necessary to enact a fire plan, knowledge on enacting a fire plan successfully is lacking. Other countries in sub-Saharan Africa have, for years, worked in this domain. Gabon Parks should consider consulting with managers of national parks in South Africa. I would also advise that Gabonese students conduct fire research in and around parks, thus increasing the capacity within Gabon to manage the situation (Walters et al. 2010). Including aspects of social and biological studies will place burning within a bio-cultural context, an appropriate approach to preserving savannas important to Gabon's human and vegetation history.

In recent years, UNESCO and others have recognized the link between biological and cultural diversity, stating that "each culture possesses its own set of representations, knowledge and cultural practices which depend upon specific elements of biodiversity for their continued existence and expression" (Persic and Martin 2007: 7). In some savannas today, this diversity forms a "cultural landscape" (UNESCO World Heritage Centre 2008). In recognition of this, many researchers have sought to consider both local and western forms of landscape management. In many cases, it is possible to study the social context of land management systems (Panelli and Tipa 2009; Tipa and Nelson 2008) and integrate local perspectives into western-style management (e.g. Sheuyange et al. 2005; Berkes et al. 2000).

PBNP has a mission to conserve the cultural value of the ecosystem. There is a cultural value of the savanna which is central to Bateke livelihoods and culture. Firing savannas is a core Bateke behaviour central to survival and to traditions. Working with local ideas and the local people to achieve a fire plan may prove useful for managing as well as maintaining traditions and adhering to the vision of park management.[154] This could be done by integrating parts of the Bateke fire system, such as techniques, terminology, and expertise, into the fire plan. This could include utilising the controlled ring fires employed by locals to collect grasshoppers in order to create the patch mosaic burning proposed by current fire management research (Parr and Brockett 1999). Additionally, using the hierarchical model of the fire chief system along with some of the related terminology may be possible. Many of the modern terms for fire management have their equivalents in Bateke including "burn unit" and "burn domain", all being under the control of a "fire chief". Such hierarchy finds repetition in South African, Togolese, and American systems (Biggs 2005: 14; Drees et al. 2006; Nadjombe 1992). Using these terms and understandings would fulfil both parts of PBNP's management plan: to preserve the savannas while also valuing cultural heritage. Finally, teams of Bateke firesetters could be employed for a few weeks in target seasons to conduct an activity that they know well how to manage. During the course of the study, many local people indicated their wish that the park would consider burning as a management option, believing that the park was against burning. Furthermore, some hoped that they might be consulted to help with the burning, since they considered themselves to be knowledgeable about the subject. These actions could simultaneously value the culture of fire-setting in the Bateke Plateaux area, while enforcing a fire plan in a cultural context. The draft management plan itself notes that local people can be involved in burning if working with park personnel. As noted by another researcher promoting biocultural diversity:

> If the link between cultural and biological diversity is to be in any way maintained, strengthened, or restored, indigenous peoples must be included in the management and conservation of the world's remaining biological riches.
>
> (Nabhan 2000: 1294)

In terms of integration of cultural fire into management, Kakadu NP's research in Australia is noteworthy. Research on Aboriginal fire effects on some of these savannas has created a basis for managing with fire (Anderen et al. 1998; Gill et al. 2003). Interest in establishing fire regimes based on local use over time and in conjunction with lightning strikes (Braithwaite and Estbergs 1985) has supported working with locals to determine possible fire use (Braithwaite

[154] However, it is imperative to understand the context of this knowledge (Shackeroff and Campbell 2007). The goals of local burning and prescribed fire for western management may not be the same (see Verran 2002).

1996). Research on Aboriginal firing techniques has shown that hunter-gatherer fire regimes are useful for management (Russell-Smith et al. 1997). In 1991, the stated objective for fire management in Kakadu National Park was to "maintain, as far as practicable, traditional *bininj* [Aboriginal] burning regimes within the Park" (cited in Russell-Smith et al. 1997). Incorporating this knowledge was not easy at the outset, since there were different ideas that managers and Aborigines had about fire in the ecosystem (Lewis 1989b). Despite these issues, Australia's incorporation of traditional fire regimes into protected area management 18 years ago is noteworthy. Recent reports indicate greater acceptance of traditional methods of fire-setting (Yibarbuk et al. 2001). Since then, the park system has studied the possibility of integrating local concepts of land management into park management (Rose et al. 2003; Rose 2003). New evidence provides support for the importance of small scale, Aboriginal hunting fires in maintaining landscape heterogeneity (Bird et al. 2008). However, the management goals, whether cultural or biological, must be clear in order to work (Parr et al. 2009).

Integration of local knowledge into management does not presuppose a wholesale use of an historic management system, but wise use of information from all systems (modern and historic) to manage an area (Drew 2005: 1287). The use of local knowledge must always be applied in light of ecosystem effects since local resource use systems do not necessarily lead to *better* use of resources. Thus these knowledge systems, if to be applied to management, should first be analyzed for an appropriate fit with management's needs (Huntington 2000). On the other hand, managers might also consider local systems and, if applicable, integrate them into modern management systems. The user must always be aware of the full context of the system (Turner et al. 2000: 1275).

Future work

This thesis on recent Bateke fire history generates more questions than it set out to answer. In terms of fire ecology, patchiness in fires needs to be characterised across the landscape as well as the characteristics of seasonal fires in terms of temperature, wind speed, fuel moisture, and other parameters. A study of woody density in these savannas using historic and modern aerial photographs would also help in understanding how burning may impact density over time. These studies would collectively aid our concepts of the role of repeated burning in generating unburned patches where gullivers may escape topkill.

Understanding the fire-ecology related to the dominant tree species, *Hymenocardia acida*, is also important. Despite numerous observations on the apparent lack of success in seed germination, there have been no studies in the autecology of the species, particularly *vis-a-vis* its fire biology. Such knowledge would be interesting in helping to model the response by the species to fire regimes and understand the woody character of the savannas where it dominates.

Once the fire plan is developed, more research may be required regarding species fire biology. This study summarises what is known for some groups. More work may need to be conducted when managing for specific organisms. For example, studies on insect populations, diversity and fire may be useful.

Understanding fire behaviour in a cultural and climatic setting across the plateaus would also be beneficial. This study only represents the case of the north-western Bateke in Gabon where the rainfall is high and particular fire-setting patterns and savanna livelihoods exist. From discussions with colleagues in Congo, the rainfall patterns in Lefini Reserve and the associated fire issues are different (pers. comm. F. Ikoli, 2008). Additionally, changes in the socio-economic situation of the Bateke in crossing the Gabon-Congo border, and are apparent and fire-setting and savanna subsistence methods are likely different on both sides of the border. Cultural fire-setting practices amongst other Bateke groups appear to be different in the central plateaus (pers. comm. A. Ampolo, 2008). Across the plateau Bateke subgroups may maintain different fire regimes, perceive their domains differently, and the climate and vegetation may differ, despite being part of the Bateke Plateaux area. This axis of investigation is considered to be the next step in understanding cultural management of resources (Hames 2007). Thus, the wider context of fire-setting in the Bateke Plateaux needs to be understood and no generalisations should be made unless there are representative studies conducted throughout the plateau area first.

In terms of the landscape's historical ecology, there is a vivid Bateke environmental and cultural ethic that remains to be described and documented. Other researchers, particularly J.M. Ebouli have begun working on this issue. *Régroupement* has played a significant role in changing resource bases, language, and identity amongst some Bateke. A study of the subsistence changes elicited by *régroupement*, particularly of moving people between savanna and forest, would be interesting in helping us understand how local people adapt to new ecosystems. Secondly, documenting the historical migration of the north-western Bateke, prior to *régroupement,* would be of interest. The savanna landscape can be read as a history book readable in the former domains, copses, and sacred sites. This knowledge is rapidly being lost and now is largely only readable by consulting old colonial maps of the area or talking to elders. However, the history behind these moves is important to Bateke history. Without understanding the history of the area, the social context of the landscape is lost. A concerted effort to document this history in collaboration with the people should be made (see Tipa and Nelson 2008).

Village copses provide a time-series of tree establishment across the Bateke Plateaux, as one moves from east to west, the village forests decrease in age. These forests in the middle of the savanna may have restricted gene-flow between village forests. Thus, a molecular ecological

study of haplotype evolution of trees species commonly planted in village copses (eg. *Millettia laurentii* De Wild.) may show an interaction between human-aided plant establishment and species micro-evolution.

Given the sensitivity of the topic of *ntsa* hunting in the study site at the time, it was difficult to conduct interviews about this topic. *Ntsa* was of historic importance to the Bateke people and continues to be a sought-after meat. Understanding the cultural importance of this species underlies the historic fire-drive and the current problem of illegal and over-hunting. There may be much more importance, besides taste preference, attached to *ntsa*, as suggested by the literature. With future time spent in the plateaus with the Bateke people, it may be possible to delve into this subject.

In terms of vegetation history, the area appears to be dynamic and to represent a convergence of at least three forests and one major savanna type (Walters et al. in prep. a). Primarily, the documentation of forest species from Congolia in what is normally considered to be Lower Guinea forests suggests that the limit of Congolia may be found, in part, near the study site. This convergence of vegetation types makes the area noteworthy for conservation of vegetation history. More work on clarifying the limits of Congolia outside of the study site would be useful.

Finally, a synthesis of fire-vegetation studies needs to be done for Africa. The many studies that have been conducted over the past century report contrasting results, sometimes for the same vegetation zone during the same time period. An understanding of the climate at the time of study, the methods used, the cultural context of burning, the general vegetation zone (and the specific vegetation type in the study site), the national and international policy context of the research, and the extent of generalisation of results of each study is critical to understand fire-vegetation dynamics for all regions of sub-Saharan Africa. Such a study is best done in collaboration with other researchers from several regions who intimately know the regional political ecology and research and can properly interpret studies in their political and environmental contexts. Until such a synthesis is done, less-informed researchers will errantly apply fire-vegetation study results from one area to another.

However, all of these projects should be conducted with the idea of the landscape as the unit of analysis (Balée and Erickson 2006: 3), wherein people and habitats are considered as contributors to a single story.

How does fire regime change occur?

In returning to William Bond's question in the introductory quote, how does regime modification happen? In the case of the Bateke, was it intentional or sudden? Peri-village burning probably has not changed much, given that the fire issues are still the same: protection

of villages and plantations from late season, unwanted fires. However, the fire regime in the domains has changed drastically in the past 40 years. Given the variety of dates when informants indicated they had last participated or seen a fire-drive, the fire-drives seem to have slowly diminished in the 1960s. As the political ecology of fire-setting changed in the Plateau, land chiefs relinquished control over their lands to the Gabonese state, another fire regime emerged governed by the individual. This regime change was a by-product of societal change. Today fewer youth understand the historic role of fire in Bateke society and few elders remain who conduct land fertility ceremonies. Today's land chiefs are almost non-existent and some are nominally replaced by elites. The individualistic burning today results in a collage of burning intentions played out in the plateau's savannas.

Local, historic fire knowledge is disappearing in the plateaus and elsewhere in Gabon. In the management survey (Appendix 9), it was clear that many Gabonese managers now acquire their burning knowledge through western education, despite having grown up in savannas where burning occurred. Their understanding of village burning practices has become influenced by western education. In the village, there is little knowledge transfer about local burning techniques and there are few to no sanctions for burns that result in disasters (lost plantations or house-fires). Bateke society's fire management is dying out, leaving the land chief's embers. What the society will do with these embers remains to be seen. Consequently, there is at present little transfer of knowledge between elders and youth[155] and also between western-trained people and local people. Perhaps a first step would be to set up a dialogue between these parties to foster an exchange about local burning, thus breathing life back into these historic flames.

[155] See Ndinga Oba 2003 for an interesting example.

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Appendix 1: Translation of French Quotes

These are my translations unless otherwise noted.

Chapter 1

> The current understanding of the matter, without generalising too much, tends to identify fire-setting the principle cause of forest regression. This tendency to generalise, professed by some of the uncontested specialists like Aubréville and Humbert, is so anchored in people's minds that it is stated, without discussion, that fires alone are capable of leading Africa into total desertification.
>
> These specialists, in affirming the negative effects of fire, say that they have seen in certain territories where fires are indisputably destructive. However, it is a mistake to generalise this action to all tropical countries without making important distinctions.
>
> (Sillans 1958: 213)

Chapter 2

> The Nkouna Bateke are completely different from the Bateke of Franceville.
>
> (Guiral 1889: 239)

> The 'Bateke Plateaux' represent only the central portion, the geographical heart of Teke country. Parts of the Plateaux have been strictly integrated into the former 'Kingdom' of the *Makoko*; the other Bateke have loose ties, or live completely on the outside...in the end, the production techniques and the style of living show significant variations, that without doubt are linked to the dependence on the milieu. This shows that the Bateke are a transitional group, formed of perhaps heterogeneous elements incompletely amalgamated, and subject to diverse regional influences
>
> (Sautter 1960: 10-11)

> The ecology has had an effect on the history; one of the divisions is that which distinguishes the Teke Nkouna from those on the Plateaux. The differences carry through into their ethnic names, activities, political structures, and founding myths
>
> (Ebouli 2001:17)

> The well-situated plateau, near markets, is poorly settled [Mbe]; the highly populated plateau is poorly-situated [Koukouya]. Unfortunately, situations like this are far from the exception but are the rule in Central Africa. They give a picture in miniature of what the AEF is on a grand scale, with Chad being densely populated and Gabon empty.
>
> (Sautter 1960: 48)

The Bateke were losers relegated to their plateaus after the colonial government obtained authority from the *Makoko*, the sovereignty of the country, and [the French] no longer felt necessary to protect it.

(Coquery-Vidrovitch 1972:75)

Teke-Achikuya, Teke-Alima, Djikini of the Kouyou were long closed to these operations.

(Coquery-Vidrovitch 1972:82)

The refuge of the most stubborn people.

(Moyen-Congo *Rapport Annuel* 1913 cited in Coquery-Vidrovitch 1972:83).

de Brazza told us that this land was for the Bateke. Brazza signed a peace pact with the Bateke. Me, I say to the Balali: this land doesn't belong to you, you are a thief.

(Papy 1949: 128)

The Bateke emigration had a different character, them being attached to their sandy soil. They move about easily in their sandy steppe which stretches from the Pool, or Brazzaville, a large Bateke population centre which is a strong magnet.

(Lotte 1953:175)

young men and adults who constitute the mass migration represent simultaneously the reproductive element and social dynamic of the population

(Lotte 1953 : 176)

How can we feed the cities with an empty countryside?

(Lotte 1953:179)

It seems as an absolute necessity to create large population centres. You should try to make the indigenous people understand that it is in their own interest that they regroup and renounce their traditional method of dispersion

(Coquery-Vidrovitch 1972 : 493)

From Mbé to Potopoto, what a striking contrast! At Mbé, where there are a few mud houses lost in the tall grass, a few men sit in counsel around the powerless *Onkoo*. The sorcerers are strong. At Potopoto, an immense black city, full of people imitating European ways, like all large indigenous cities in Africa today, the older societies are dissolving, ideas of order are propagating, and new ideas are fermenting.

(Papy 1949 :134)

The Kongo Kingdom, which after two centuries and more of being evangelised possessed no more than a single Catholic one and half centuries later. Bateke country would return even more quickly to its fetishes and ancestors

(Soret 1973 : 145)

Chapter 4

Bateke identity is based on a political technique of land appropriation.

(Dupré and Pinçon 1997: 184)

[The fire drive] for the Bateke, is the best moment of the year.

(Sautter 1960: 28)

As soon as one sees the opulent slices of forest concentrated on the valley sides at the edge of the rivers or in narrow patches on the plateaus around villages, one cannot understand their presence without having the conviction that the entire region, the elevated plains as well as the gorges, was at first covered by forest. The systematic clearing followed by systematic repeated burning of grass is the double cause of these vast denuded territories: one process causes deforestation while the other stops afforestation.

(Dupont 1889 cited in Sautter 1966)

The Bateke, at the time when the grass is dry, burn, hunting the animals, and so force back the bush. At the same time as the men, hawks hunt the small birds and the sparrows hunt for insects

(Brunschwig 1972: 20)

In approaching the village one sees a man-made valley between two slopes of earth, used as a defence. The undergrowth and tall unburned grass prevent one from seeing to the sides and one is at the mercy of the people who would ambush us.

(Brunschwig 1972 : 22)

We are walking through the grass that the chief is burning. Is this a signal? Is it to clear the path? What does the chief have in mind?

(Brunschwig 1972 : 38)

The chief rests in a small patch of woods of 80 m in diameter in the middle of the tall grass. The chief has burned all the grass behind us to clear the path for our return. While we are taking a rest and eating, the chief sends people to burn the grass. The son of the chief has lit all the grass around the woods on fire and it's a beautiful show all around as the flames are five m in height. It's a terrible noise, the sound of the bursting nodes of the grasses, grass that is almost as tall as reeds.

(Brunschwig 1972 : 40)

The Bateke also have less noble means of hunting. Towards the month of September, when the prairies are dried by the sun, they burn all the grass, letting the wind carry the flames forward. In a small space, they install their nets, supported every so often by stakes in the earth. A group of small rodents who live in the prairies, flushed out by the fire, find themselves in the area of the nets and are massacred without pity.

(Guiral 1889: 154)

community in the sense that individual rights depended on the social relationships of the individual and in the individuals' belonging to a hierarchical social group; individual in the sense that, at any moment, certain people had defined rights to use the domain and share its products from particular parts of the domain.

(Biebuyck 1963: 14)

the association between land and a community composed of its deceased, living, and future land holders is condensed in this classic affirmation by a Nigerian chief, 'I conceive that the land belongs to a vast family, in which numerous members are dead, some are living, and innumerable are yet to be born.'

(Biebuyck 1963 : 1)

The habitations are dispersed; the deep ravine or water course is the barrier between neighbours. It is at these natural barriers of the district that the Bateke defend their plantations and their village. From there, its inhabitants are dependent upon a chief, unifying the inhabitants of the same *ntche*.

(de Brazza 1887: 56)

This was a geographical, cultivation, cultural, and cult space.

(Ebouli 2001: 57)

being charged with the application and the enforcement of respect for the rules of managing the domain

(Ebouli 2001: 29)

The domain had a double meaning: the territory where the inhabitants lived and worked but also a landscape representing several lineages

(Bonnafé 1978: 14)

The fire-drive in the savanna is unusual. One only finds this in middle Congo, practised by the Bacougni of the Niari. On the Plateaux, it barely happens except south of Mbé, in a region where the intact traditional chiefdoms prevent premature fires.

(Sautter 1960 : 27)

Chapter 5

Before Independence, hunters could not burn the savanna like they burn today not having fear of burning the *lasele*. But today, my son, one does what one wants.

(Mbia to S. Touladjan, 2007)

My presence had long been signalled. However, N'jayolé was satisfying himself by making me wait. When he thought that this pause had inspired enough of an idea about his high clout, he appeared, surrounded by the land chiefs of neighbouring lands, relatives, friends, all united in his honour. In this circumstance, N'jayolé had dug out the head dress for a big ceremony, a kind of wig made of fibrous textiles, reminding one of a helmet. The appendages extended upwards and seen from a distance, resembled horns. This is the distinctive sign of an *nn'ga-ntche*, land chief, who had under his rule, all the villages of the district.

(de Brazza 1887: 54)

They stopped burning the savanna because the elders were tired and because of the arrival of guns. Today, one expects every young man to have a gun, so burning no longer exists.

(Gorgie 2007)

Guns were unequally dispersed in the region. Rather rare in the Bateke Plateaux, where the collective net hunt and the spear have resisted the penetration of new techniques, guns were to the contrary numerous in the Niari valley and in the Bouenze, particularly in Beembe country.

(Bernault 1996: 312)

At the present time, I don't believe that such [traditional] hunts are still practised. Gunpowder has entered on the scene...

(Weite 1954: 138)

By decreeing transplanting or reinstatement of certain groups, one has sometimes underestimated the deep attachment by a population for their native soil, the possible xenophobia of tribes having to receive immigrant villagers, and the lack of adaptation by immigrants to their new socio-cultural milieu.

(Biebuyck 1963: 47)

When the forestry agents arrived [in the village], they forbade the hunt. But, we always burned the savanna when the president arrived to find him something to eat.

(Anonymous, May 2007)

In the past, the mamas would burn the savanna to look for ampari and the men to hunt. After ampari, the new sprouts would call the *ntsienstiele***.**

(Gorgie, age 67)

If the savanna is burned, one can find *olu*, *kankele* and *ampari*.

(Tricia, age 55)

Today, people burn for the same reasons, thus for hunting, mushrooms and all the food that the savanna can give us. One must burn the savanna to have food.

(Yaja, age 83)

Today, people burn in disorder. There are no more limits and there is no one who can give orders of this kind. These people are doing what they want.

(Ndigi, age 35)

Before, burning the savanna fed us, but today the youth are wasting the savanna. They are burning for no reason.

(Fronti, age 59)

Today, savanna burning no longer gives us food as it used to do.

(Osse, age 52)

Chapter 6

They hunt little, meat being really rare, they however voluntarily eat considerable amounts of rats, insects, grasshoppers, caterpillars, winged termites, all of which they are really fond.

(Ballay 1885: 282)

In speaking of the hunt, I have indicated many types of wild meat that elicited from Europeans an insurmountable disgust; however, the Bateke were extremely fond of these foods. Thus, they eat with gusto grilled rats with their skin and entrails, toads that were smoked alive, sun-dried grasshoppers, and fat yellow caterpillars that they abundantly gather on a special tree. Often, as soon as I asked to buy meat, they offered me these animals, promising me that I would be satisfied. Besides these species that the Bateke can rather easily procure and which are a food resource that is assured, there are others that are rarer that they are far from despising. For example, there are large scarab beetles of the cetoines family, magnificent insects for which European amateurs would pay a very high price: stripped of its hard carapace and cooked on cinders, these insects constitute an exquisite food, that we will call “extra”, that the gourmets of the country esteem highly. Perhaps, after all, the Bateke have reason to esteem food that our prejudices find repugnant and bizarre. I didn’t dare taste all of these good things, but I know about the “succulence” of toads and caterpillars based on the way people have been singing their praises.

(Guiral 1889: 160)

Chapter 7

The annual passage of bush fire, at the beginning or middle of the dry season, results in an accentuating of contrast to such a degree that an absolutely remarkable seasonal alternation is created. In the wet season, the vegetation is purely herbaceous; the large

grasses dominate; then, this dries, browns, the fire passes and transforms the whole into a black coating of cinders, covering the whole soil with a dark and macabre layer. Then, after a very short time, the sprouts of rhizomatous suffrutices develop their foliage into a beautiful sea of shining green, and soon in flower. The vegetation becomes ablaze with a thousand multi-coloured flowers, often including a number of very large bulbs.

(Duvigneaud 1949: 9-10)

Chapter 8

We observed a very curious case, incontestably the installation of the forest by people in poorly wooded savanna of *Hymenocardia acida*. Bateke country (Middle Congo), near Okoyo and Evo, is scattered with islands of dense forest; at a glance one can see 10, 20 in the landscape. Each one marks the site of an old village. The Bateke always install their villages in savanna and cultivate their manioc only in savanna; in the rare vestiges of ancient forest which remain, they only plant a few yams, and some sugar cane; only the women cultivate, and they do not want to enter the forest. In the villages, to make their houses and fences the inhabitants use poles of iron-wood, *Millettia laurentii* and *Ficus* sp. These trees propagate by cuttings very easily, the poles take root, oil palms spontaneously establish around houses, other species disseminated by seed subsequently establish. After a few years, this forest vegetation becomes too dense for the taste of the Bateke, who do not like forest, and the village is moved a little further, in clean savanna. The old site transforms in a dozen years into a thick wood, mixed with palms. Whereas in general the populations of the forest zone seek forest for hiding in, living in, and for defence, and clearing it for cultivation, the Bateke form an original exception, fleeing the forest, and re-creating it.

(Aubréville 1949: 318, translated by Fairhead & Leach 1996: 290)

The slopes and valleys are covered with grass, but the grass has a fine stem that barely exceeds 25 cm in height. On the slopes, woody plants are rare, and it is only from time to time that one meets a twisted tree. The heights, where the sands are less, are covered with tree-like grasses that attain almost three meters; these are sometimes small stretches isolated like an oasis.

(Guiral 1889: 142)

Appendix 9

Fire management: Fire is a management tool used by park personnel or by local people working with the park administration. All fires should be foreseen in a fire management plan annexed to the park management plan.

(Lope NP Plan 2006 : 31)

The conservation of the Loango NP ecosystems, in an eco-regional context and with the participation of all the stakeholders, favouring the development of ecotourism

(Loango NP Plan 2007 : 28)

Conservation of the forest-savanna mosaic and of priority species of PNPB in order to value the Bateke cultural heritage, assuring this in a cross-border context.

(PBNP Plan 2008: 21)

Appendix 2 : Recorded Interviews

#	Date of interview	Name of informant	Birth year, place of experience	Location of interview	Subject(s)	Notes
Rec-1	01 August 2008	S. Naliba	Walla	Franceville	fire drive, land tenure, Okoundzi	L. Makouka's recording
Rec-2	14 August 2008	Saaye Elders	variable, former Saaye Lands	Saaye	domain rituals, land chiefs, *Régroupement*	
Rec-3	02 July 2008	Kanini	~1918, Mboua	Malundu 1	*Obwan opfu*	
Rec-4	01 July 2007	E. Nturi	~1930, Kankuru, Kimi Domain	Mbouma	Kimi Domain; land chiefs	
Rec-5	27 July 2008	S. Onkadi	Mboua Lands	Franceville		L. Makouka's recording
Rec-6	13 August 2008	Mbia	~1944, Kankuru Domain	Mbouma	*Otiugui*	
Rec-7	27 September 2007	E. Nturi	~1930, Kankuru, Kimi Domain	Mbouma	*okoo*, land chiefs, hunting medicines	
Rec-8	20 August 2008	E. Nturi	~1930, Kankuru, Kimi Domain	Mbouma	domain rituals, *Régroupement*	
Rec-9	04 October 2007	D. Ololo	~1932, Vagha Domain	Kebiri	hunting, land chief power passing to Bongo, *ewa*, raphia, *regroupment*	
Rec-10	19 November 2007	J-M. Anza (w/ J. Ntieli)	1936, Vagha Domain, Lewu	Lekoni	*otiugui*, communal fire drive	
Rec-11	20 August 2008	P. Anza	~1950, Vagha Domain	Kebiri	Domain rituals	
Rec-12	01 July 2008	Kanini	~1918, Mboua	Malundu 1, near Boumango	*fire drive*, *Régroupement*	
Rec-13	16 September 2007	M. Sia	~1944, Akou, Nkika villages	Saaye	hunting net making	
Rec-14	25 July 2008	Walla Elders	variable, former Walla Lands	current Walla, near Boumango	fire drive, Okoundzi	
Rec-15	01 July 2008	Kanini	~1918, Mboua	Malundu 1	Issami issami songs	
Rec-16	02 May 2008	Mbia	~1944, Kankuru Domain	Mbouma	fire drive	
Rec-17	30 September 2007	Mbia	~1945, Kankuru Domain	Mbouma	*Otiugui*, fire setting	

Rec-18	31 December 2007	Mbia	~1944, Kankuru Domain	Mbouma	fire setting
Rec-19	09 July 2007	Alna	1941, Nkomo Domain	Lewou	hunting, *otiugui*
Rec-20	25 March 2008	Mbia	~1944, Kankuru Domain	Mbouma	Stork hunting
Rec-21	04 October 2007	S. Nkunu	~1942, Vagha Domain	Kibiri	grasshopper gathering
Rec-22	25 September 2007	Gorgie	~1942	Ekouyi	grasshopper gathering
Rec-23	30 September 2007	N. Kele & Ngadi	1949 &~1935, Ekouyi	Ekouyi	grasshopper gathering
Rec-24	01 July 2008	Malundu 1 Women	variable 1930 +, Mboua Lands	Malundu 1	gathering and cultivation
Rec-25	02 October 2007	Alna & S. Liya	Nkomo Domain	former Mbie village site	village establishment; copses

Appendix 3: Other changes in the Bateke landscape: perceptions of local animal extinctions and population reductions

Although the Bateke recognize their role in forest creation, the same cannot be said for their role in animal extinctions. While forests have played a role in conceptualising family history and territorial limits, the animal population trends in areas in which hunting was conducted are not seen in the same way. Yet these hunting fires in part, maintained the savanna habitat of some of these animals. Verbal and written accounts have documented the local extinction of lion, reedbuck, and hippo in the past 60 years. This Appendix considers Bateke perception and western scientific ideas about each of the locally extinct species, as well as extant species that are specifically hunted with fire, or which depend on burned habitats, such as Abdim's Stork, Cape buffalo, and Grimm's duiker.

Many organisms in this part of the Plateaux, including the animals cited above, are considered to have southern or eastern biogeographical affinities. Such affinities in part define the Bateke Plateaux landscape in terms of creating unusual mixtures and range extensions of southern savanna and western forest species for plants (Walters et al. 2006), birds (Christy 2001; King 2007), insects (pers. comm. G. vande Weghe), and mammals (Malbrant and Maclatchy 1947; Malbrant and Maclatchy 1949). In part, these distributions are linked to the expansion of the forest since the last ice age where the forest block re-expanded from small patches in mountainous areas (Maley 2001). Such forest retraction is believed to have blocked interbreeding between southern and northern groups of the same species, creating distinct populations ("refugia") of various plants and animals (Born 2007; Malbrant & Maclatchy 1947; Sosef 1994). This is one reason why the area is interesting for Central African conservation measures: rare records of organisms at the savanna-forest edge which are considered to be genetically distinct (e.g. Smith et al. 1997).

However, these animals are valued in different ways by the Bateke residents, who refer to animals and meat with a single word: *nyama* meaning meat (to be eaten) as well as animals (to be hunted), or in completely other terms, as mystical creatures. The multiple meanings make the situation complex when conservation NGO's try to encourage conservation of endangered animals that are classified linguistically as edible. Whatever category they may be attributed to, animals were noted to be present in varying abundances by explorers in region, particularly those of the West African Mission led by de Brazza in the early 1880's. As Guiral, one of de Brazza's companions wrote,

> Bateke country having been much explored, the large mammals there are very much less abundant than those of certain other parts of the Ogooué, for example in the forests of the Obamba people. There is, however, on the right bank of the Alima, near Lekeli, a plateau covered in grassland and clear forest, where the buffalo are very numerous. This is in the same place where, I have been told, one finds most often, the remarkable

> lion with the black mane and pronounced tail. On the opposite bank of the Alima, the large African leopard is rather common. Antelope are rare. However, the gorilla, very abundant 3 days walking south of Franceville, isn't found in Bateke country, because they do not have virgin forest
>
> (Guiral 1889: 152-153, my translation)

However, others in de Brazza's contingent had different ideas of the abundance of animal life. Chavannes, in talking of the protein content of the Bateke diet, first notes with disgust that larvae and insects were consumed, however, he later changes his mind understanding the role of various animal proteins in their diet. His list of animals hunted is paltry by comparison:

> Hunted foods: a few cane rats, and once a year... at the time when they burn the tall grasses of the plains, the bush hogs and a few antelopes are encircled by long nets and killed with spears. There are wild buffalo in the wooded valleys that feed into the streams all along the Alima River.
>
> (Chavannes 1935: 94, my translation)

Ballay adds to this stream of thought that while insect consumption was significant that men, "hunted little, with bush meat being really rare" (Ballay 1885: 283, my translation). Nonetheless, hunting was still conducted readily, especially by explorers; thus accounts of animal observations and associated hunting is common in the AEF literature giving later readers a sense of which animals inhabited the Plateaux (Augias 1928; Dheur 1938; Dheur 1939; Ramecourt 1930; Recherches Congolaises 1938; Vassal 1923; Weite 1954) and the Pool (Dybowski 1893: 76-9). Guiral himself brags about a hunt not far from the study area:

> ...In the Ikabo Valley, I was forced to stop to conduct a hunt which had nothing noble about it. Certainly, my readers would quiver with horror and disgust if I told them the number of murders that I committed that day there.
>
> (Guiral 1889: 147, my translation)

Gilles Sautter, a geographer who spent time in Bateke country in the 1960s participated in eight fire-drive hunts, in which only 14 animals were taken (Sautter 1960). He was surprised at the enormous effort expended for such a small off-take. Regardless of whether there were many or few animals, several which were previously reported in much greater numbers are now extinct. These will be discussed below in addition to a few other animals key to the Bateke landscape, some of which depend on fire from the annual fire drives to maintain their habitat or provide food.

The Lion

Vansina (1973: 3) wrote of the Plateaux as being "the home of the Tio and the Lions." Lions had been previously noted in large numbers in the area (Ney 1887) and even in greater Gabon

(Henschel 2006). Lions in the Gabonese Plateaux were hunted to extinction only in 1993 (pers. comm. P. Ngavoura) with unconfirmed reports of lions as recently as 2007 (Henschel 2006). Differences in opinion about the value of lions in the landscape between conservationists and locals is summed up by one informant, "I don't understand why white people love lions so much." For him, it was a relief for the final three lions that were circulating in the area in the 1980's to have been extirpated. According to informants in the Ekouyi-Mbouma area, lions were formerly encountered on hunts and sometimes their roaring was heard by people in their villages. Lions were at one time very common in the study site, forcing explorers in the 1880s to light fires at night to keep them away when travelling between Léconi and Franceville (Guiral 1889).

Lions, in fact, were more often discussed with me in terms of their mystical context than their physical one, something that is not unique to the Bateke (Marks 1984). In the Ekouyi-Mbouma area, one informant indicated that a very powerful man, the former *ngântsè* Kakogho, was able to conjure lions out of rats stored in a calabash to hunt dinner. While this same villager had heard lions roaring in the 1960s, he explained their disappearance as linked with the disappearance of the strong leaders. Another informant supported this view of lion extinction in saying that the men who transfigured themselves into lions are no longer alive. His son likened the extinction to a car accident: if you are killed in a car wreck, the car could no longer move without the driver. Vansina (1973:201) writes that at the death of such lion-human pairs, the lion would roar out. My informant continued by saying that these men had acquired their transfiguration ability through fetishes and used this power to kill people. It is no wonder that lions were not particularly liked in the area. However, Bateke working for PBNP have counselled the park to consult magicians to conjure up lions if they wanted to see them in the park (pers. comm. P. Aczel). Given this fear of mystical lions, informants said that they do not eat lions nor keep their skins: only the claws were of interest (probably for medicine and fetishes). This lack of interest in the lion skin is intriguing as it represents a very different view from that of accounts written from the centre of the Bateke kingdom in the Republic of Congo.

In other parts of the Bateke kingdom, the lion skin is linked directly with the power of the Onkõo (Mouayini Opou 2005), or king of the eastern Bateke. The lion skin and teeth, along with the skins of the panther and civet were considered noble tribute (Mouayini Opou 2005; Vansina 1973). Rituals for the proper treatment of killed lions involved complex dances honouring former chiefs. As Vansina states (Vansina 1973: 126):

> The Tio feared the lion beyond all reason and thought that the king could send these animals in prides to attack anyone he disliked…the greatest of all nature spirits was called *Nkwé Mbali*: "the Lion's Court".

Thus the king had the lions of the Plateaux under his control, and Vansina writes that in 1960 the Onkõo had been rumoured to send lions to destroy parts of Brazzaville as a reminder of his power (Vansina 1973: 377). The centre of the lion-spirit was near Mbe at the Mah Falls of the Lefini River, the ancestral home of the *Makoko* (Vansina 1973) and still today a place of reverence (Mouayini Opou 2005; Vansina 1973) . For the eastern Bateke, the lion skin represents the king, with lion skins being sent to him from all lands (Vansina 1973:387). However, for the western Bateke, it is primarily the claws that were important according to one informant. Guiral writes that in the 1880s the Bateke were often seen wearing necklaces of these claws as a protection against the attacks of lions (1889: 177).

The fear of lion attacks was common in eastern part of the Plateaux. Vansina writes that large charm gardens called *nkiini* were constructed to protect villages from the threats of lions, lightening, leopards, and witches (Vansina 1973:77-8). Thus, the categorization of lions with other things considered to be harmful is important, for it seems to be through this lens that the Bateke today, in part, view these beasts.

Lightning is considered to be a tool of sorcerers and something that could be sent out to attack others. Most recently this was directly observed starting a fire in PBNP (pers. comm. F. Mouzinga). Additionally, the village of Kebiri has noted nine lightening strikes in living memory, one of which struck a man dead. Lightning is perceived even today as being "sent out" from places like Léconi, where strong sorcerers are present. This is in part why people ward off rain storms by blowing the horns of the duiker *ntsa (Sylvacapra grimmia)*.

Leopards are also classified with lions and are considered to be dangerous in a mystical sense. At one point they were more common, even preying upon the goats around the villages in the Ekouyi-Mbouma area. However, leopards are more than physical organisms and often have dark powers ascribed to their beings. The *Ngô* (leopard) cult is one of the most powerful of male initiation rites in the western Plateaux. Leopard symbolism was once a much feared source of attacks in colonial AEF (Gray 2002; Le Testu 1938; Rich 2001). In the case of the Bateke, it is a terrifying power to have or to be set upon by. For the Koukouya, an era of their history was ushered in when they were rescued by the Sky Lords from the attacks of a leopard-man (Bonnafé 1978). Today, the *Onkoo* wears the skin of the leopard as a symbol of the power of his office (Mouayini Opou 2005) in the eastern Plateaux, while in the west, the leopard symbolizes a type of male sorcery.

Lions historically were not perceived as ordinary creatures of the material world and were distinctly associated with powerful people, whose intentions were not always positive. My informants lead me to believe that they also view lions in this manner and do not miss their

presence around the village. By contrast, their local extinction is considered to be a loss to the genetic diversity of the greater lion population, and a loss for conservation efforts.

The Reedbuck

The *nkara ntsa* (*Redunca arundinum)*, a Bateke name referring to the animal as being the "grandmother of *ntsa"* (*Sylvicapra grimmia*) was noted to have small population levels throughout the AEF, including Gabon and Congo in the 1940s. This particular form was more like southern populations, supporting a more southern affinity in terms of biogeography (Malbrant & Maclatchy 1949). In any event, the reedbuck populations reported for the AEF in Gabon in the 1940s are now locally extinct in the Bateke Plateaux (Bout 2006). Bout writes that informants aged in their 60s from the Gabon Bateke Plateaux area (this study area) have indicated that the last time that they saw the animals was when they were very young.

In my personal conversations these and other informants said they last saw the reedbuck when they were young or were told about it by their parents. In one case, the Chef of Mbouma indicated that he had only ever hunted the *nkara ntsa* in the current park area, and that the last time he had done that had been in the 1960's. For this particular animal, neither the horns nor the skin were particularly useful, especially since the horn was curved. Its decline was attributed to hunting pressure by some informants, and it was most likely one of the animals hunted during the fire drives.

The Hippopotamus

The hippo (*Hippopotamus amphibious)* can be referred to in two ways in Bateke, *nyama andza* or *mvoubi*[156]. The former simply means "water beast". In the Ekouyi-Mbouma area, this animal has not been seen by older informants since their youth and is inferred to have become extinct in the 1960s. Many elders have never seen a hippopotamus, but information about a large water animal is still transferred to youth. When children were presented with pictures of animals, they were confused by pictures of both hippos and rhinos, incorrectly identifying a hippo. In fact, the last record of the hippopotamus in the area comes from informants formerly living along the Lewou River. They tell the story of hunting five hippos that had recently come into the area (Bout 2006). I have confirmed this story with the informants themselves.

Other animal species whose abundance has changed in Bateke memory

The Cape buffalo (*Syncerus caffer)* or *Nza*

Buffalo were once more common than they are now. In the 1880s herds were reported in the western Plateaus:

> One perceives a vast stretch of country. This region is very poor in vegetation; the sandy mountains are covered with small grasses for as far as the eye can see, one

[156] This is not to be confused with the phrase, *nyama ndjele*, or "strong beasts" which are water genies.

> perceives neither tree nor shrub. From the higher points, one sees several herds of buffalo of 15-20 head.
>
> (Guiral 1889:183, my translation)

In the 1940s, Papy noted and photographed a buffalo hunt in the Koukouya plateau area. By then, a commercialized hunting trade was being conducted between the Lékana and Brazzaville area (Papy 1949). Today, in the study area, buffalo are not common and in the nearby park are only found in the areas least affected by hunters (Bout 2006).

During my stay, a lone buffalo left tracks through the savanna. This was rather a curiosity, as they are rarely sighted around the village today. This invited some commentary from one of the chiefs, who said that when he had first been resettled to the site when he was 18 (in the 1960s) there had been many. When I was conducting several driving interviews towards *Kele la Kalami*, herds of 4-6 were spotted. My informants were very pleased to see these herds running across the landscape; it seemed as if it had been a while since they had had such a view. Unfortunately, later there was talk of hunting this population for the New Year's celebration and the bullets were requested from non-family elite, politically and economically interested in the village. To my knowledge, no cartridges were delivered, and these buffalo were not hunted by the villagers. But it does demonstrate the eagerness to hunt certain animals despite the fact that such large mammals are infrequently seen in the area. During my entire field time since 2001, though I had seen tracks in the park near watering holes, the sightings at Kele were my first. The rarity of sightings in the park is directly attributed to hunting pressure (Bout 2006).

***Ntsa*: an endangered animal in Gabon since 1994**

Most of the information regarding *ntsa* was covered in the main body of the thesis. Here I will add only a few other observations. Savanna fires and *ntsa* habitat show an interesting correlation. In an 18-month study of mammals in PBNP, Bout found the highest concentrations of *ntsa* in areas that were regularly burned and in areas that had not been burned for several years (Bout 2006). This supports the ecological literature and is backed by Bateke informants. The *ntsa* needs both tall grass to hide new-borns and recently burned areas for grazing. The diet of the *ntsa* consists primarily of dicotyledonous material or of non-grasses (Spencer 1995), attaining figures of up to 83% of their diet (Gagnon and Chew 2000). Dicotyledons are plants which are not grasses or bulbs, both of which are components of the Plateaux flora. Dicots in the case of the Plateaux flora include herbs, post-fire sprouts of *Hymenocardia* trees, and fire resprouts of *mbli-ntsa*, or Ntsa's cola (*Parinari capensis).* The final plant listed is a small woody mat-forming plant consumed by *ntsa* , which is most likely encouraged by the passage of long dry season fires (see Koechlin 1961), as opposed to the flush of grasses common after short dry season fires. This long dry season flush coincides with the period in which *ntsa* is most hunted.

Fire creates grazing sites in the Plateaux: when the old grass is burned away, the young shoots attract gazelles that graze, with many informants claiming that game arrives the next day to feed on the cinders of the recent fire. Fires also encourage the resprouting of the savanna dominant, *Hymenocardia acida*, which informants indicate hide young *ntsa*. This is similar to the claim by some informants that unburned areas also serve as refuges for young *ntsa*. Scientific studies confirm this indicating that females need tall herbs (i.e. unburned areas) prior to calving (Estes 1999) and that most prefer having easy access to tall grass (Keyner 1969).

Thus Bateke hunters and western scientists concur on the need of the *ntsa* for both burned and unburned habitats for their life cycle. Pressure on the *ntsa* previously was linked to the fire drive but is now linked to urban hunters often supplying elite clients.

Abdim's Stork (*Ciconia abdimii)*

Abdim's Stork purportedly has a range of approximately 10,000,000 km^2 and 300,000-600,000 individuals. Its distribution ranges from southern to west and eastern Africa, as far north as Saudi Arabia. According to the IUCN, they have an endangered species status of "least concern."

Along their migration route between west and southern Africa, following the forest-savanna mosaic, Abdim's is hunted *only* in the Plateaux (pers. comm. P. Christy). Just after the short dry season, Abdim's Stork (*Ciconia abdimii)* migrates through Téké territory (van Perlo 2002). According to informants, fires are set near the end of February. Insects, particularly grasshoppers, attacking the new foliage, attract these storks, which in turn are hunted by the Téké. These storks require water after feeding, so are most likely to be hunted in adjacent areas. The primary diet of adult Abdim's and nestling alike, is grasshoppers (Falk et al. 2006). Prior to this study, Vansina (1973: 125) was the only written work that reports this type of hunting.

The passage of fire is critical to creating bird habitat for several other bird species. The Temmink Courser (*Cursorius temminckii),* Senegal Plover *(Vanellus lugubri),* Common Nightjar *(Caprimulgus fossii)* all require low vegetation for successful reproduction (pers. comm. Patrice Christy). However, fires should also be avoided at other times of the year for those species which reproduce in high vegetation. In the two earlier cases, the birds are not hunted, yet require the intervention of anthropogenic fire in their life cycle (Christy 2008).

Appendix 4. Plot species, vouchers, seasonality, and burn regime

			Burn Regime and Season					
			Burn	No Burn	Burn	No Burn	Burn	No Burn
Family	Species	Walters' voucher no.	Dry	Dry	Late-Rainy	Late-Rainy	Mid-Rainy	Mid-Rainy
Anisophyllaceae	*Anisophyllea quangensis* Engl. ex Henriq.	1226	x	x	x	x	x	x
Apocynaceae	*Cryptolepis oblongifolia* (Meisn.) Schltr.	1899	x	x	x	x	x	x
Apocynaceae	*Landolphia lanceolata* (K. Schum.) Pichon	1869	x	x	x		x	
Apocynaceae	*Asclepias occidentalis* Goyder	1947	x					
Apocynaceae	*Xysmalobium holubii* Scott-Elliot	1888					x	
Asteraceae	*Bidens oligoflora* (Klatt) Wild	1936		x				
Asteraceae	*Emilia longiramea* (S.Moore) C.Jeffrey	1900	x			x		x
Asteraceae	*Helichrysum mechowianum* Klatt var. *ceres* (S.Moore) Beentje	1935	x		x			
Asteraceae	*Stomatanthes africanus* (Oliv. & Hiern) King & Robinson	1889	x		x	x	x	x
Asteraceae	*Vernonia daphnifolia* O. Hoffm.	1850			x		x	
Asteraceae	*Vernonia glaberrima* Welw. ex O. Hoffm.	1835	x	x		x	x	
Asteraceae	*Vernonia guineensis* Benth.	1832	x		x			
Asteraceae	*Vernonia potamophila* Baker	2102					x	
Caryophyllaceae	*Polycarpaea eriantha* Hochst. ex A. Rich.	1820			x		x	
Chrysobalanaceae	*Parinari capensis* Harv.	1843	x	x	x	x	x	x
Commelinaceae	*Cyanotis longifolia* Benth. var. *gracilis* (Schnell) Schnell	1113	x		x	x	x	x
Fabaceae	*Chamaecrista mimosoides* (L.) Greene	1482	x	x	x	x	x	x
Fabaceae	*Desmodium barbatum* Benth. var. *dimorphum*	1893	x	x		x	x	x

	(Baker) Schubert							
Fabaceae	*Dolichos subcapitatus* R. Wilczek	1872	x			x	x	x
Fabaceae	*Eriosema glomeratum* (Guill. & Perr.) Hook. f	1946	x				x	
Fabaceae	*Eriosema pellegrini* Tisserant	1877	x		x		x	
Fabaceae	Eriosema shirense Baker f.	1845					x	
Fabaceae	*Eriosema* sp. nov.	1891	x	x	x	x	x	x
Fabaceae	*Indigofera congolensis* De Wild. & T.Durand var. *congolensis*	1892		x	x	x	x	
Fabaceae	*Indigofera geminata* Baker	1876	x	x	x		x	x
Fabaceae	*Macrotyloma biflorum* (Schum. & Thonn.) Hepper var. *biflorum*	2088					x	
Fabaceae	*Tephrosia flexuosa* G.Don	1950	x					
Fabaceae	*Tephrosia lupinifolia* DC.	1853	x	x	x		x	x
Fabaceae	*Tephrosia nana* Schweinf.	1897		x	x	x	x	x
Fabaceae	*Vigna multinervis* Hutch. & Dalziel	1905	x	x	x	x	x	
Fabaceae	*Vigna oblongifolia* var. *parviflora* (Welw. ex Baker) Verdc.	1847					x	
Fabaceae	*Vigna pubigera* Baker var. *pubigera*	1873		x	x	x		x
Fabaceae	*Vigna* sp.	2089			x		x	x
Gentianaceae	*Neurotheca loeselioides* (Spruce ex Prog.) Baill.	2121		x	x	x		
Asparagaceae	*Dipcadi viride* (L.) Moench	1839	x					
Hypoxidaceae	*Curculigo pilosa* (Schumach. & Thonn.) Engl.	1949	x				x	
Lamiaceae	*Ocimum* sp.	1940		x				
Lamiaceae	*Solenostemon latifolius* (Hochst. ex Benth.)	2117			x	x	x	x
Amaryllidaceae	*Scadoxus multiflorus* (Martyn) Raf.	2097	x					x

Melastomataceae	*Dissotis brazzae* Cogn.	1952	x	x	x	x	x	x
Orchidaceae	*Disa* sp.							x
Polygalaceae	*Polygala acicularis* Oliv.	1898		x	x	x	x	x
Rubiaceae	*Kohautia kimuenzae* (De Wild.) Bremek.	1831						x
Rubiaceae	*Pseudosabicea mildbraedii* (Wernham) N. Hallé	2083			x		x	x
Rubiaceae	*Spermacoce pusilla* Wall.	1875		x	x	x		
Rubiaceae	*Spermacoce stachydea* DC.	2122			x	x	x	x
Orobanchaceae	*Buchnera paucidentata* Engl. ex. Skan	1878a			x			
Orobanchaceae	*Striga asiatica* (L.) Kuntze	1808	x		x			
Orobanchaceae	*Striga bilabiata* (Thunb.) Kuntze subsp. *bilabiata*	1856	x		x	x	x	
Lamiaceae	*Clerodendrum* sp. nov.	1937	x	x			x	
Vitaceae	*Cissus guerkeana* (Büttner) T.Durand & Schinz	1943	x		x	x		x
Zingiberaceae	*Aframomum alboviolaceum* (Ridl.) K. Schum.	2127	x	x		x	x	x

Appendix 5 : Other Vouchers

Family	Species	Voucher
Anisophyllaceae	*Anisophyllea quangensis* Engl. ex. Henriq.	Walters 1226
Annonaceae	*Annona senegalensis* Pers.	Walters 902
Annonaceae	*Anonidium mannii* (D. Oliver) Engl.	Walters 1010
Annonaceae	*Greenwayodendron suaveolens* (Engl. & Diels) Verdc	Bradley 1161
Apocynaceae	*Landolphia* cf. *bruneelii* (De Wild.) Pichon	Walters 2133
Apocynaceae	*Landolphia* cf. *lanceolata* (K. Schum.) Pichon	Walters 1869
Asteraceae	*Vernonia conferta* Benth.	Stone 5011
Asteraceae	Undetermined	Walters 2124
Balsaminaceae	*Impatiens irvingii* Hook. F	Walters 2027
Burseraceae	*Dacryodes edulis* (G. Don) H.J. Lam	Bradley 1114
Burseraceae	*Dacryodes yangambiensis* Louis & Tr.	Bradley 1041
Burseraceae	*Santiria trimera* (Oliv.) Aubrév.	Bradley 1026
Chrysobalanaceae	*Parinari capensis* Harv.	Walters 1843
Clusiaceae	*Garcinia kola* Heckel	Walters 1957
Combretaceae	*Combretum inflatum* Jongkind	Walters 1018
Costaceae	*Costus dewevrei* De Wildemann & T. Durand	Walters 1155
Cucurbitaceae	*Cogniauxia podolaena* Baill.	Walters 1717
Dioscoreaceae	*Dioscorea praehensilis* Benth	Walters 1941
Eriocaulaceae	*Mesanthemum radicans* (Benth.) Korn.	Walters 1152
Phyllanthaceae	*Bridelia ferruginea* Benth	Niangadouma 134
Euphorbiaceae	*Chaetocarpus africanus* Pax	Walters 919
Phyllanthaceae	*Hymenocardia acida* Tul.	Walters 897
Phyllanthaceae	*Hymenocardia* cf. *ulmoides* Oliv.	Walters 2001
Euphorbiaceae	*Maprounea africana* Müll. Arg	Walters 1473
Euphorbiaceae	*Sapium cornutum* Pax	Bradley 1053
Phyllanthaceae	*Uapaca paludosa* Aubreville & Landri	Walters 1391
Fabaceae	*Albizia adianthifolia* (Schumach.) W. Wight	Walters 1471
Fabaceae	*Millettia laurentii* De Wild	Walters 1041
Fabaceae	*Pentaclethra eetveldeana* De Wild. & T.Durand	Walters 1027
Fabaceae	*Tessmannia lescrauwaetii* (De Wild.)	Niangadouma 574
Salicaceae	*Oncoba welwitschii* Oliv.	Walters 898
Gnetaceae	*Gnetum africanum* Welw.	Walters 938
Melastomataceae	*Dichaetanthera strigosa* (Cogn.) Jacques	Walters 1202
Myrtaceae	*Syzygium guineense* (Willd.) DC.,	Bradley 1075
Ochnaceae	*Ochna afzelii* R. Br. ex Oliv.	Walters 1280
Arecaceae	*Eremospatha cabrae* De Wild	Walters 2074
Arecaceae	*Eremospatha haullevilleana* De Wild.	Walters 1713
Arecaceae	*Laccosperma secundiflorum* (P.Beauv.) Kuntze	Walters 1121
Arecaceae	*Oncocalamus macrospathus* Burret	Walters 1711
Arecaceae	*Raphia* sp. "mbaya"	Walters 1714
Arecaceae	*Raphia* sp. "pigi"	Walters 1715
Passifloraceae	*Barteria dewevrei* De Wild. & T. Durand	Walters 1990
Piperaceae	*Piper guineense* Schumach. & Thonn:	Walters 2066
Poaceae	*Anadelphia afzeliana* (Rendle) Stapf	Walters 1818
Poaceae	*Ctenium newtonii* Hack	Walters 1807

Poaceae	*Elionurus hirtifolius* Hack	Walters 1815
Poaceae	*Hyparrhenia cyanescens* (Stapf) Stapf	Walters 1837
Poaceae	*Loudetia phragmatoides* Hochst	Bradley 1170
Poaceae	*Loudetia simplex* (Nees) Hubb	Walters 1813
Poaceae	*Melinis nerviglumis* (Franch.) Zizka	Walters 1111
Poaceae	*Panicum juncifolium* Stapf.	Walters 1812
Poaceae	*Schizachyrium thollonii* (Franch.) Stapf.	Walters 1043
Poaceae	*Sporobolus congoensis* Franch	Walters 1814
Sapotaceae	*Omphalocarpum procerum* P.Beauv. ex A.Juss.	Walters 2132
Sapotaceae	*Synsepalum stipulatum* (Radlk.) Engl.	Walters 1960
Malvaceae	*Cola* cf. *acuminata* (P. Beauv.) Schott & Endl.	Walters 2112
Malvaceae	*Clappertonia ficifolia* Decne.	Walters 1063
Malvaceae	*Clappertonia polyandra* (K. Schumm.) Bech.	Walters 2067
Malvaceae	*Triumfetta cordifolia* A. Rich	Walters 2059
Urticaceae	*Urera trinervis* (Hochst.) Friis & K.Immelman	Walters 2063
Lamiaceae	*Vitex madiensis* Oliv.	Walters 1903
Zingiberaceae	*Aframomum angustifolium* K.Schum.	Bradley 1030
Zingiberaceae	*Aframomum alboviolaceum* (Ridl.) K. Schum.	Walters 1150

Appendix 6 : Bateke Star Ratings

"HO" means these plants are found in Gabon in the Haut Ogooué province only.

Star	Rare (HO)	Family	Species
Green		Acanthaceae	*Asystasia gangetica* (L.) T. Anderson
Green	x	Anisophyllaceae	*Anisophyllea quangensis* Engl. ex Henriq.
Green		Annonaceae	*Annona senegalensis* Pers.
Green	x	Apocynaceae	*Cryptolepis oblongifolia* (Meisn.) Schltr.
Green	x	Apocynaceae	*Landolphia lanceolata* (K. Schum.) Pichon
Gold	x	Apocynaceae	*Asclepias occidentalis* D. Goyder
Green	x	Apocynaceae	*Glossostelma lisianthoides* (Decne.) Bullock
Green	x	Apocynaceae	*Gomphocarpus swynnertonii* (S.Moore) Goyder & Nicholas
Green		Apocynaceae	*Tylophora congolana* (Baill.) Bullock
Blue	x	Apocynaceae	*Xysmalobium holubii* Scott-Elliot
Green	x	Asteraceae	*Bidens oligoflora* (Klatt) Wild
Green	x	Asteraceae	*Conyza pyrrhopappa* subsp. *pyrrhopappa*
Blue	x	Asteraceae	*Emilia longiramea* (S. Moore) C. Jeffrey
Green	x	Asteraceae	*Helichrysum mechowianum* Klatt var. *ceres* (S.Moore) Beentje
Green	x	Asteraceae	*Lactuca longispicata* De Wild.
Green		Asteraceae	*Launaea rarifolia* (Oliv. & Hiern) Boulos
Blue	x	Asteraceae	*Vernonia daphnifolia* O. Hoffm.
Green	x	Asteraceae	*Vernonia glaberrima* Welw. ex O. Hoffm.
Green		Balsaminaceae	*Impatiens irvingii* Hook. f.
Green		Burmanniaceae	*Burmannia madagascariensis* Mart.
Green		Fabaceae	*Chamaecrista mimosoides* (L.) Greene (L.) Greene
Green		Caryophyllaceae	*Polycarpaea eriantha* Hochst. ex A. Rich.
Green	x	Chrysobalanaceae	*Parinari capensis* Harv.
Green		Hypericaceae	*Psorospermum febrifugum* Spach
Green		Hypericaceae	*Vismia rubescens* Oliv. var. *tomentosa* Bamps
Green		Commelinaceae	*Commelina diffusa* Burm.f.
unclassed	x	Commelinaceae	*Cyanotis longifolia* Benth. var. *gracilis* (Schnell) Schnell
Green		Convolvulaceae	*Ipomoea involucrata* P. Beauv.
Green		Cucurbitaceae	*Cogniauxia podolaena* Baill.
Green		Cyperaceae	*Bulbostylis congolensis* De Wild.
unclassed		Cyperaceae	*Bulbostylis filamentosa* (Vahl) C.B. Clarke
Green		Cyperaceae	*Bulbostylis laniceps* C.B. Clarke ex Dur. & Schinz
Green		Cyperaceae	*Cyperus amabilis* Vahl
Green		Cyperaceae	*Cyperus halpan* L.
Green		Cyperaceae	*Cyperus mapanioides* C.B. Clarke
Green		Cyperaceae	*Cyperus margaritaceus* Vahl
Green	x	Cyperaceae	*Cyperus pectinatus* Vahl
Green		Cyperaceae	*Cyperus tenax* Boeck.
Green		Cyperaceae	*Eleocharis acutangula* (Roxb.)Schultz
Green	x	Cyperaceae	*Fimbristylis complanata* (Retz.) Link
Green	x	Cyperaceae	*Fimbristylis splendida* C.B. Cl.
Green		Cyperaceae	*Fuirena umbellata* Rottb.
Green		Cyperaceae	*Hypolytrum purpurascens* Cherm.
Green	x	Cyperaceae	*Kyllinga* cf. *alata* Nees
Green		Cyperaceae	*Kyllinga odorata* Vahl var. *odorata*
Green		Cyperaceae	*Mariscus sumatrensis* (Retz.) J. Raynal
Green		Cyperaceae	*Rhynchospora candida* (Nees) Boeck.
Gold		Cyperaceae	*Scleria baroni-clarkei* De Wild.
Green		Cyperaceae	*Scleria boivinii* Steud.
Blue		Cyperaceae	*Scleria induta* Turrill
Green		Cyperaceae	*Scleria verrucosa* Willd.
Green		Droseraceae	*Drosera madagascariensis* DC.

Green		Eriocaulaceae	*Eriocaulon setaceum* L
Green		Eriocaulaceae	*Mesanthemum radicans* (Benth.) Koern.
Black		Eriocaulaceae	*Syngonanthus ngoweensis* Lecomte
Gold	x	Eriocaulaceae	*Syngonanthus schlechteri* Ruhl.
Green		Phyllanthaceae	*Bridelia ferruginea* Benth.
Green		Phyllanthaceae	*Hymenocardia acida* Tul.
Green		Euphorbiaceae	*Maprounea africana* Müll. Arg.
unclassed	x	Phyllanthaceae	*Phyllanthus gossweileri* Hutch.
Green		Fabaceae	*Albizia adianthifolia* (Schumach.) W. Wight
Green		Fabaceae	*Crotalaria glauca* Willd.
Green		Fabaceae	*Desmodium barbatum* Benth. var. *dimorphum* (Baker) Schubert
Green		Fabaceae	*Desmodium barbatum* var. *argyreum* (Welw. ex Baker) B.G. Schub.
Green		Fabaceae	*Desmodium ramosissimum* G. Don
Green	x	Fabaceae	*Dialium englerianum* Henriq.
Green		Fabaceae	*Eriosema glomeratum* (Guill. & Perr.) Hook. f
Green		Fabaceae	*Eriosema glomeratum* (Guill. & Perr.) Hook.f. var. *laurentii* (De Wild.) Baker f. De Wild.
Green	x	Fabaceae	*Eriosema pellegrini* Tisserant
Green		Fabaceae	*Eriosema shirense* Baker f.
Black	x	Fabaceae	*Eriosema* sp. nov.
Green		Fabaceae	*Indigofera congolensis* De Wild. & T.Durand var. *congolensis*
Green		Fabaceae	*Indigofera erythrogramma* Welw. ex Baker
Green		Fabaceae	*Indigofera geminata* Baker
Green		Fabaceae	*Indigofera paracapitata* J.B. Gillett
Green		Fabaceae	*Macrotyloma biflorum* (Schum. & Thonn.) Hepper var. Biflorum
Green		Fabaceae	*Sphenostylis stenocarpa* (Hochst. ex A. Rich.) Harms
Green		Fabaceae	*Tephrosia* cf. *flexuosa* G.Don
Green		Fabaceae	*Tephrosia heckmanniana* Harms (L&S says this is T. Elata)
Green		Fabaceae	*Tephrosia lupinifolia* DC.
Green		Fabaceae	*Tephrosia nana* Schweinf.
Green		Fabaceae	*Vigna comosa* Baker
Green		Fabaceae	*Vigna gracilis* (Guill. & Perr.) Hook.f.
Green		Fabaceae	*Vigna multinervis* Hutch. & Dalziel
Green		Fabaceae	*Vigna pubigera* Baker var. *pubigera*
Green		Fabaceae	*Vigna oblongifolia* A.Rich.
unclassed		Fabaceae	*Vigna* sp. 1
Green		Fabaceae	*Zornia latifolia* Sm.
Green		Gentianaceae	*Congolanthus longidens* (N.E.Br.) A.Raynal
Green		Gentianaceae	*Neurotheca loeselioides* (Spruce ex Prog.) Baill.
Green	x	Gentianaceae	*Schinziella tetragona* (Schinz) Gilg
Green		Hypericaceae	*Harungana madagascariensis* Lam. ex Poir
Green		Hypoxidaceae	*Curculigo pilosa* (Schumach. & Thonn.) Engl.
Green		Iridaceae	*Gladiolus unguiculatus* Baker
Green		Lamiaceae	*Solenostemon latifolius* (Benth.) J. K. Morton
Green	x	Lamiaceae	*Haumaniastrum caeruleum* (Oliv.) Durig. & Plancke
Green		Lentibulariaceae	*Utricularia appendiculata* E.A.Bruce
Green		Lentibulariaceae	*Utricularia benjaminiana* Oliv.
Green		Lentibulariaceae	*Utricularia gibba* L.
Green		Lentibulariaceae	*Utricularia striatula* Sm.
Green	x	Lentibulariaceae	*Utricularia tortilis* Welw. ex Oliv.
Green	x	Asphodelaceae	*Aloe buettneri* Berger
Green	x	Asparagaceae	*Dipcadi viride* (L.) Moench
Green	x	Asparagaceae	*Drimia altissima* (L.f.) Ker Gawl.
Green		Amaryllidaceae	*Scadoxus multiflorus* (Martyn) Raf.
Green		Melastomataceae	*Heterotis decumbens* (P. Beauv.) Jacq.-Fél
Green		Melastomataceae	*Dissotis brazzae Cogn.*
Green		Melastomataceae	*Dissotis congolensis* (Cogn. ex Buettn.) Jacq.-Fél.

Green		Melastomataceae	*Tristemma mauritianum* J.F. Gmel.
Green	x	Myrtaceae	*Syzygium guineense* var. *macrocarpum* Engl.
Green		Ochnaceae	*Ochna afzelii* R. Br. ex Oliv
Green		Ochnaceae	*Sauvagesia africana* (Baill.) Bamps
Green	x	Ochnaceae	*Sauvagesia erecta* L.
Green		Orchidaceae	*Eulophia angolensis* (Rchb.f.) Summerh.
Green	x	Orchidaceae	*Eulophia* cf. *aurantiaca* Rolfe
Green		Orchidaceae	*Eulophia caricifolia* (Rchb.f.) Summerh.
Green	x	Orchidaceae	*Polystachya* cf. *dendrobiiflora* Rchb. f.
unclassed		Pandanaceae	*Pandanus* cf.*candelabrum* P. Beauv.
Blue		Pedaliaceae	*Sesamum parviflorum* Seidenst.
Green		Poaceae	*Anadelphia afzeliana* (Rendle) Stapf
Green	x	Poaceae	*Andropogon festuciformis* Rendle
Green		Poaceae	*Andropogon schirensis* A.Rich.
Green		Poaceae	*Ctenium newtonii* Hack.
Green	x	Poaceae	*Digitaria gayana* (Kunth) Stapf ex Chev.
Green		Poaceae	*Digitaria leptorhachis* (Pilg.) Stapf
Green		Poaceae	*Eleusine indica* (L.) Gaertn
Green	x	Poaceae	*Elionurus hirtifolius* Hack.
Green		Poaceae	*Elionurus muticus* (Spreng.) Kuntze
Green		Poaceae	*Heteranthoecia guineensis* (Franch.) Robyns
Green		Poaceae	*Hyparrhenia cyanescens* (Stapf) Stapf
Green		Poaceae	*Hyparrhenia subplumosa* Stapf
Green	x	Poaceae	*Loudetia arundinacea* (Hochst. ex A. Rich.) Steud.
Green		Poaceae	*Loudetia phragmitoides* (Peter) C.E. Hubb
Green		Poaceae	*Loudetia simplex* (Nees) C.E. Hubb.
Green		Poaceae	*Melinis nerviglumis* (Franch.) Zizka
Green		Poaceae	*Panicum brazzavillense* Franch.
Green		Poaceae	*Panicum brevifolium* L.
Green	x	Poaceae	*Panicum juncifolium* Stapf
Green		Poaceae	*Panicum nervatum* (Franch.)Stapf
Green		Poaceae	*Schizachyrium sanguineum* (Retz.) Alston
Blue		Poaceae	*Schizachyrium thollonii* (Franch.) Stapf
Green		Poaceae	*Setaria sphacelata* (Schum.) Moss
Blue		Poaceae	*Sporobolus congoensis* Franch.
Green	x	Poaceae	*Sporobolus subtilis* Kunth
Green		Poaceae	*Trichopteryx fruticulosa* Chiov
Green		Poaceae	*Trichopteryx marungensis* Chiov
Green		Poaceae	*Urochloa comata* (Hochst. ex A.Rich.) Sosef
Green		Poaceae	*Urochloa villosa* (Lam.) T.-Q.Nguyen
Green		Polygalaceae	*Polygala acicularis* Oliv.
Green		Pteridophyta	*Dicranopteris linearis* (Burm.) Und
Green		Pteridophyta	*Lycopodiella cernua* (L.) Pic. Serm.
Green		Pteridophyta	*Lygodium microphyllum* (Cav.) R. Br.
Green		Rubiaceae	*Oldenlandia affinis* (Roem. & Schultz) DC
Blue		Rubiaceae	*Pseudosabicea mildbraedii* (Wernham) N. Hallé
Green		Rubiaceae	*Stipularia africana* P.Beauv.
Blue	x	Orobanchaceae	*Buchnera paucidentata* Engl. ex. Skan
Green		Orobanchaceae	*Cycnium adonense* E.Mey. ex Benth. subsp. *camporum* (Engl.) O.J.Hansen
Green	x	Lindeniaceae	*Lindernia* cf. *nummulariifolia* (D. Don) Wettst.
Green		Orobanchaceae	*Striga asiatica (L.) Kuntze*
Green	x	Orobanchaceae	*Striga bilabiata (Thunb.) Kuntze subsp. Bilabiata*
Green		Solanaceae	*Schwenckia americana* L.
Green		Malvaceae	*Clappertonia ficifolia* (Willd.) Decne
Green		Malvaceae	*Triumfetta cordifolia* A. Rich
Blue	x	Lamiaceae	*Clerodendrum* sp. nov.
Green		Lamiaceae	*Vitex madiensis* Oliv.
Green	x	Vitaceae	*Cissus guerkeana* (Büttner) T.Durand & Schinz
Green		Xyridaceae	*Xyris congensis* Büttner
Green		Xyridaceae	*Xyris imitatrix* Malme
Green		Zingiberaceae	*Aframomum alboviolaceum* (Ridl.) K. Schum.

Appendix 7: Lexicon of Lategе words used in the thesis.

Additional words have been added. This work constitutes the beginning of collaboration with Pauline Linton. Eventually a photographic guide to some of these words will be established.

Lategе	Definition
ajigi	A grass packet attached to trees to delimit *kawa*.
ambroho	Forest mushrooms gathered in March.
Ambwongo	The pre-hunt ritual to ensure that the hunt would be safe, successful, and blessed by the ancestors.
amkumbi	*Ciconia abdimii.* Hunted during their migration south in the small dry seasons between January to March.
ampari	Grasshoppers.
anai, gokolo, jele, kadula, tsara	Grasshopper species gathered in July and August.
anjie	Orthopteran which are gathered in May by digging holes at night.
antiama	A former type of hunting conducted in October. Kanini describes this as a passive hunt where nets were used to hunt animals grazing in the new pastures created by the fire-drive.
apayi	Savanna plantations.
avuma	Patchy burning, particularly used when a forest plantation has not completely burned.
awungu	Route of the otiugui (according to Kanini); stout nets used to hunt bush pigs, a practice learned from the forest-dwelling Obamba.
chicouangue	The type of processed manioc that the Bateke and adjacent peoples produce. Regionally it is considered to be the superior to other manioc processed into *batons*.
ebanighi	The emissaries of the land chief used to send message to villages. They are also griots which guard stories of Bateke origins.
ejumi	A fire that self-extinguishes.
ekala	Rows in a savanna plantation.
ekala ba ntsie	Domain interdictions used in order to maintain land fertility.
elwo	*Oncocalamus macrospathus.* A type of rattan used in basketry.
epandi	Y-shaped stakes used to secure the hunting nets to the ground>
evura	A type of *Anthuea* larvae harvested from the Millettia laurentii trees in December.
fufu	Manioc paste that is dried in the sun and used as a staple when *batons de manioc* are not available. In other areas such as Impini, Congo, *fufu* is smoked and called *Muteke.*
kabala	Savannas enclosed witin the forest.
kabu	*Landolphia* sp. common in study site area.
kaburi	Ripe mfuluru (*Landolphia lanceolata*).
kabvuru	Abandoned forest plantation.
kadjigi	Shallow baskets used to process foods. Typically, they are used to dry gathered foods in the sun.
kafouyi	Wingless grasshoppers formerly gathered by a basket sweep technique. This method was fireless.

kakaga	*Eremospatha cabrae*. Used to weave *njili* fishing nets.
kajia	Small copses in the middle of the savanna.
kakwo eka	Fried manioc paste with sugar, and salted. This paste is taken from the *kapumba* board before batons are made from the manioc. When fried, it is often given to children to eat.
kanginina	Cetoine species that is harvested in the savanna the first few days of the rainy season in September.
kankele	A larva in the Saturniidae family that is harvested on *Annona senegalensis* trees in savanna that has been burned a few months prior.
kantu atege	Bateke pineapple. This small pineapple is found naturalised in the riparian and copse forests of the study site. It is sweeter than the cultivated, larger variety. Expeditions are sometimes made to these naturalised populations to press wine on-site.
kape	Open savanna with few trees, though may have many *Annona senegalensis* shrubs or a few *Hymenocardia acida* trees.
kapumba	The carved board with sides upon which Bateke women knead manioc paste.
kasagi	Camp. This term is general, but may refer to a specific camp as in one case in the study site.
kassibi	The long dry season.
katsio	The islands of resprouts surrounding *Hymenocardia acida* trees, often forming small hillocks of dense root systems.
katui	The hide built in front of the net where the hunter hid during the fire-drive.
kawa/ewa	A specific area reserved for an activity such as hunting (pl. ewa).
kia	*Ntsa* hunting net (or *sia*).
kora	The fruits of *Hymenocardia acida*. These are gathered when they are very young and used to make a leaf sauce.
lasele	A large expanse of grassland reserved for the annual fire drive organized by the land chief. Also a term used today to refer to large expanses of unburned savanna. *Ba a tua lasele*: was the hunt to burn the lasele, "*là –où on aligne le filet*".
ma okari	The one week dry-season in January.
ma olumi	The two-week dry-season in March.
Makoko	The title of the customary ruler of the Tio Bateke in the Mbe Plateau near Brazzaville. Also called *Onkoo.*
mba ya olumi	Head fire ("husband fire"), lit with the wind and historically and presently used when lighting foraging fires.
mba ya okari	Backing fire ("woman's fire"), lit against the wind. Slow burning.
mbi	The hunt. *kouli*: Individual hunt (where meat was shared with village) *kandele*: Communal hunt (where meat was only shared by the 5 or so hunters); "*kindenge*" according to Onkadi, a Batsitsege.

mbaya	*Raphia* species which produce *nkulu* fruits.
mbwo	An edible larvae collected in rotting palm trees. Sometimes infested trees are burned in order to later gather these larvae.
me tuna njobo	A trial planting of five plants in a forest plantation. This practice, as the name indicates, is a ritual to avoid the civet, njobo, cursing one's plantation.
mfuluru	*Landolphia lanceolata* fruits sold in the market and eaten with manioc as a meal.
nga yulu	The Sky Lords in Koukouya history. They rescued the people from the attacks of a leopard man.
Nkwe anzami	Amaya Mokini is called *Nkwe a Nzami* or the "Court of God". This is another spiritual centre for the Bateke people.
mpfo andzo	The leader of the lineage or house.
mpila	Densely woody savanna densely populated with *H. acida*.
mpimpa	A type of *Anthuea* larvae harvested from the *Millettia laurentii* trees in December.
mpu	Power ascribed to a person. Mpu was created at Amaya Mokini.
mvula ntiumi	The beginning of the short rainy season, late September to December.
mwalu	*Bois amer*, or *Garcinia kola*, used to ferment pineapple and palm wines.
ndimbi	Hunting bells once used for dogs in order to locate them during the hunt.
ndoantsara	*Piper guineense*. Stems are dried and eaten before drinking yielding a sensation of coolness.
ndua	Filtered manioc tuber. Filtering can occur over night in a *njili* basket in a stream or simply steeped in water.
ndula	A hunting weapon with a barbed head, the wooden handle was heavier and would dislodge from the spear head when it sank into the animal. The handle (attached to the spear head by a rope) would drag behind the animal and lodge against the trees, thus curtailing it's escape
nga bate	The master of the people for the Teke-Tsayi. He worked in concert with the land chief in ruling the domain and its people.
ngaa	A medicine man or magician.
ngadi	Lightning.
ngantse	Land chief.
nga-pugu	Village chief.
nguja	Feathered headdress at *Njobi* dances.
ngwunu	Forest plantation still in use.
njobo	Civet.
njolo	Root of *Plectranthus*. Formerly more cultivated than presently.
njulu	Grouping of *Hymenocardia acida* trees in the open savanna.
njuma-njuma	*Ocimum* sp. used to assuage congestion.
nkani	Judge or part of the political structure based on judges found amongst the north-western Bateke.

Onkila	A women's healing cult. Called *Mukissi* by the Batsitsege and the Tsayi.
nkou	Pieces of wood placed at the end of the net and then the net was set upright by the *epandi.*
nkulu	Mescocarp of the fruits from the Mbaya *Raphia* tree which are boiled and dried.
Nkwe Mbali	The sacred site of the Tio at the Mah Falls in the Lefini River.
ntende	A type of forest mushroom found on dead wood. Its toughness requires that it be thinly sliced before being prepared and eaten.
ntiegue	General term for the savanna.
ntieli	Packet of dried grass used to light savanna on fire.
ntieni	Savanna plantation.
ntina	*Dioscorea praehensilis* tips. These are harvested in certain copses at the beginning of the rainy season.
ntsa	Grimm's duiker. Target of the fire-drive. This animal is the most highly esteemed, hunted animal in the Plateaus. Not only for the taste of the meat, but also for its former use in paying the bride-price, and its current use in horns warding off rain storms.
ntsaba	A type of larvae gathered in November.
ntse	Domain.
ntsienstiele	A larvae that is harvested in recently burned savanna.
obueni	The ritual used to ask pardon for grieving your fellow man. This was a rite of the living, not the dead. Offerings of cola and wine were given as compensation for one man insulting another, or even refusing a service. Mbia gave the example of the case where his father might have refused the land chief permission for Mbia to be an otiugui: this would require restitution between his father and the land chief.
obli	The term for a back burn, or safety area burn, where a fire was lit and put out, and then the net placed in the area. This was done to avoid setting fire to the net.
obugha	Small plantation behind the house.
Odala, ofrou, ompugna	Used to attach the net to the ground and to adjacent nets.
ofuli	Strings to attach the hunting net.
ojengi	Fire perimeter; also *ondili mba*: the limit to be burned.
okana	Laccosperma secundiflorum. The stem tips are cut and eaten as a "wild asparagus". This plant is eaten for subsistence but also sold commercially.
okoo	The rite of seeking restitution with one's ancestors for grievances with the domain. This could be done the day of the communal hunt or in times when there was a perceived problem with fertility in the plantations, hunting, and gathering of the domain.
okuru anjo	Lineage master for the Teke-Alima.
olobo	A song-based ritual sung prior to the fire-drive. It was conducted to ask a blessing on the hunt (safety and success).
Olu	The new leaves of either coppiced or burned *Albizia adianthifolia* trees.
ondambi	A *Landolphia* sp. gathered from the forest-savanna

	edge.
ondimba	The processed fruits of *Irvingia*. Used as a seasoning. Savanna Bateke will visit forest Bateke villages to gather these fruits and process them.
ongalaga	*Hymenocardia acida*.
ongaya	Handle of a spear.
ongori	*Eremospatha haullevilleana. A rattan* used in making baskets.
Onkoo	The title of the customary ruler of the Tio Bateke in the Mbe Plateau near Brazzaville. Also called *Makoko*.
onya	A grasshopper harvesting technique where a woman runs up the middle of the circle fire trailing a flame. This is only done if the grass is low and greener (i.e. the fire less dangerous).
ossie	Camping spot in a copse used during the fire-drive.
otiugui	A fire specialist. One of the runners trained to run the periphery of the area intended to be burned, setting it aflame. *Ntole* is another word that has been given for this office.
otsu	Basket used in fire-less grasshopper collection.
oyali	*Bois amer*, or *Garcinia kola*, used to ferment pineapple and palm wines.
oyigi	*Scyphocephalium ochocoa.* A seasoning. The seeds are left to soften in streams and then processing into "*cube indigène*". This is a seasoning sourced from forest villages.
pigi	Raphia species which produces palm fronds for house construction, sap for wine making, and edible-larvae.
tutsa	Mushroom species that is harvested the first month of the rainy season.
yohro	Ephemeral lakes in the savanna.
yuo	A simple spear, much lighter than the *ndula*. (Note: Vansina uses the term *yuo* for spears from the Mbe area, 1973: 121)

Appendix 8: Fire terminology

These definitions are based almost entirely on Goldammer and de Ronde's glossary of fire terms (2004).

Early burning	Burning early in the dry season, before leaves and undergrowth are completely dry. This is sometimes carried out as a precaution against late-season fires.
Fire behaviour	The manner in which fuel ignites, fire develops, and fire spreads and exhibits other related phenomena as determined by the interaction of fuels, weather, and topography.
Firebreak	Any natural or constructed discontinuity in a fuel bed used to stop the spread of fire. Normally there is no combustible material in the firebreak.
Fire frequency	The average number of fires or regularly occurring fire events per unit time in a designated area
Fire history	The reconstruction and interpretation of the chronological record, causes, and impacts of fire occurrence in an ecosystem in relation to the changes of past environmental, cultural and socio-economic conditions. Often elucidated by charcoal analysis, tree cores, and historical documents.
Fire-return interval	The number of years between two successive fires documented in a designated areas (i.e. the interval between two successive fire occurrences); the size of the area must be clearly specified
Fire regime	The patterns of fire occurrence, size, and severity, and sometimes, vegetation and fire effects as well, in a given area or ecosystem. It integrates various fire characteristics. A natural fire regime is the total pattern of fires over time that is characteristic of a natural region or ecosystem. The classification of fire regimes includes variations in ignition, fire intensity and behaviour, typical fire size, fire return intervals, and ecological effects.
Fire weather	Weather conditions which influence fire ignition, behaviour, and suppression. Weather parameters are dry-bulb temperature, relative humidity, wind speed and direction, precipitation, atmospheric stability, winds aloft.
Fuel	All combustible organic material.
Late burning	Fire-setting towards the end of the dry season.
Prescribed fire	A management-ignited wildland fire that burns within prescription (set area, timing) in order to achieve management objectives.
Ring fire	A fire started by igniting the full perimeter of the intended burn area so that the ensuing fronts converge toward the centre of the burn. This is very similar to the grasshopper fires set by Bateke women.

Appendix 9: A report on the current state of savanna management in Gabon's national parks

Introduction

In protected area networks in developing countries savanna management may be under-financed and/or poorly understood. Despite overall advances in ecosystem management with fire in Africa, there are still concerns, lack of technology, and misinformation. Noted fire ecologist W. Trollope indicated that in some cases in Africa knowledge of fire use may be higher amongst elders than western-trained resource managers and scientists:

> Insights into the ecology and use of fire in these [developing] countries are very poorly developed at practitioner, scientific and government levels. A possible exception to this in both countries [Kenya and Namibia] is the conventional wisdom on fire ecology that still exists in the older members of tribal communities. However, virtually no effort is being made to capture this conventional wisdom about fire ecology and it is bound to disappear with time with the demise of these senior members of society.
>
> (Trollope cited in FAO 2001: 35)

Studies have recently shown that local burning in some cases is beneficial to resource management (Bird et al. 2008; Laris 2002; Mbow et al. 2000) and that burning can be a savanna management tool (du Toit et al. 2003).

In Gabon, six out of 13 parks contain savanna habitats.[157] Given that most organisations focus on forest protection, how are savannas best conserved? And what knowledge is required to do so? And finally, what is the reality of managing these savannas given funding availability, politics, and current priorities?

An argument for the conservation of Gabon's savannas

A park system oriented towards biological conservation is meant to protect the range of habitats and rare species found throughout a defined area. For Gabon, this means protecting lowland forest, mangroves, mountain elfin forests, and interior savannas as well as many smaller features (see Wilks 1990). Twenty percent of Gabon is covered by savanna containing 9% of the flora (Walters 2010). There are three broad types of savanna differing in species composition and location including the coastal savannas, large enclosed savannas, and vast savannas linked to larger savannas in the Republic of Congo and beyond (Koechlin 1962). When we consider savanna conservation, we must consider both biological and historical arguments. Savannas, like forests, are spaces where habitat and human history coincide;

[157] In the past, two additional reserves protected south-western savannas: Ndende and Mont Kouri (Wilks 1990).

sometimes these areas are relicts of a dynamic vegetation history linked to historic human migration events. In preserving these spaces, Gabon preserves the vegetation, the associated culture, and history.

In terms of forest-savanna ecotonal history, the savannas today are largely climatic remnants of the last dry period (Maley 2001). Coastal savannas continue to close up despite regular fire intervals (Delègue et al. 2001; Favier et al. 2004), as do those of Lopé (Nana 2005; Palla in prep.) and Bateke (Leal et al. 2007). The present fire regimes of Gabon do not deter the forest from encroaching on the savanna.

In terms of savanna species richness, these areas may contain organisms at the edge of their distribution which are sometimes genetically distinct (see Smith et al. 1997). For example, Gabon's savannas contain some common sub-Saharan savanna species at the edge of their range including Grimm's Duiker and the Defassa Waterbuck *(Cobus ellipsiprymnus)*, or the savanna tree *Gardenia ternifolia* ssp. *jovis-tonantis* (Welw.) Verdc. Secondly, organisms at the edge of their distribution may differ genetically from those of the centre, such as a near-endemic tree to Gabon, *Aucoumea klaineana* (Born et al. 2008). Thus, forest-savanna ecotones may harbour distinct genetic forms of organisms; these organisms represent part of the area's ecosystem history.

In terms of the links between man and the early savannas, savannas in Gabon have been linked to the historic presence of man and continue to be important to several present day societies. Evidence of Neolithic peoples has been found in Lopé; these peoples are thought to have used savannas (Oslisy et al. 1996; Oslisy 2001; White 2001). Lopé was declared a UNESCO world heritage site in part because its savanna contains significant archaeological findings relevant to Gabon's human history. The savannas of Lopé are not alone in harbouring elements of Gabon's vegetation and human history. In the Bateke Plateaux, the opening of the savanna habitat during drier climate periods has been linked with the Bantu migration (Schwartz 1992), as it has been in adjacent Cameroon (Ngomanda et al. 2009). Several peoples have savannas in their territories, such as the Bateke. Some of these groups have cultural uses of fire which have contributed to savanna management in the recent past and today, and many savanna people derive part of their livelihoods from these areas (Walters 2010).

Along with these scientific arguments for preserving savannas there is also the practical need to consider the tourism objectives of savanna PAs. Savannas are habitats in which animals can be easily viewed and therefore these habitats are potentially lucrative for the tourism industry (Molloy 1997). Ecotourism in Gabon may be based on the rarer, hard-to-see forest animals, but guaranteeing the easy sighting of savanna species is often part of the plan.

History of savanna park management in Gabon

The only park in Gabon to manage savannas with fire is Lopé National Park (LNP) (2005). Knowledge of the Lopé ecosystem is quite developed due research on animal and plant communities by Lopé's *Station des Etudes des Gorilles et Chimpanzées*. Research has shown that savanna burning is favourable to tourist activities (Molloy 1997), to grazing buffalo populations (Korte 2008), and in maintaining copses and riparian forests as distinct vegetation types separated by savanna (Ukizintambara et al. 2007). Savannas remaining unburned are colonised by forest (White 2001); forest extent has increased by 5.3% over 14 years (or 1.06 kilometres per year) (Nana 2005: 38).[158] Current research is exploring the impact of the fire plan on vegetation types (F. Palla in prep.). However, no research, to the author's knowledge, has investigated the local burning practices by groups that historically inhabited the savannas in and around Lopé. Despite this gap, existing Lopé research has contributed to the scientific rationale for burning in the park. However, such knowledge for other parks' savannas is almost non-existent or nascent as in the case of the Bateke Plateaux which we will explore later.

What is needed to manage a savanna?

Recent funding has enabled the Gabonese National Parks Agency (ANPN) to create management plans for each park. In each park's management plan, reference to creating a fire management plan is made consistently using the following language:

> Gestion du feu : Le feu est un outil de gestion utilisé par les personnels habilités du parc et les populations locales sous le contrôle de l'administration du parc.
>
> Tous les feux doivent être prévus dans un plan de gestion du feu annexé au plan de gestion du parc.
>
> (*Conseils National des Parcs Nationaux* 2006: 31)

Only one of the six savanna parks has a fire management plan. Fire practices among Gabonese parks are not uniform. Given the long term use of fire in the landscape, understanding its biological role is critical for management. If certain landscapes are to be maintained, understanding fire treatments, fire effects, and local people's historic techniques can help manage these national parks.

Information necessary for successful management of savannas in protected areas includes knowledge of historic and present fire regimes, local burning rationales, clear management goals, and fire research on the specific effects of fire in a protected area. In this report, I present the results of interviews and surveys of those involved in managing and supporting the six savanna parks in Gabon. Such surveys can elucidate the current thinking of managers and partners on a topic (see Kilgore 1985 cited in Williams 2000b). Specifically, I consider what

[158] This level of forest succession is also seen in the coastal savannas at a rate of 20-50m per 100 years (Schwartz et al. 1996).

current managers know about savanna fire ecology and management, what they know about fire practices by local people around their PA, and what relevant training they have had. This work constitutes an assessment of savanna management in Gabon and aims to provide a basis for increasing management practices and awareness of savanna ecosystems and people. Finally, the case of savanna management research is explored in PNPB.

Methods

In order to understand the current approach to fire management in national parks in Gabon and how fire is viewed and used as a tool for management, a brief questionnaire was conducted with those involved in park management, including the park director and associated NGOs involved in park management. Between the months of December 2007 and January 2009 interviews were undertaken in each of the six parks in Gabon which contain savanna. These included Loango, Lopé, Mayumba, Moukalaba-Doudou, Plateaux Bateke, and Pongara. Mayumba was included for its 1 kilometre stretch of seaside savannas, despite it being a marine park. NGOs oriented towards environmental education and/or tourism were not interviewed since they were not considered to have a direct impact on the development of savanna management tools. This questionnaire was augmented by follow-up discussions with relevant personnel in the *Agence National des Parcs Nationaux* (ANPN), the *Ecole National des Eaux et Forêts* (ENEF), and the *Ministère des Eaux et Forêts* in Gabon and Congo.

Questions included the background and experience with fire that individuals had, their views on fire and management and their professional training. From these questions, I tried to understand the context of fire as a tool for management, whether it was viewed positively or negatively, whether respondents had grown up in a fire-prone savanna environment, and whether this was linked to their views and actions regarding the use of fire as a management tool today.

Sixteen people were formally surveyed with an additional five ancillary interviews conducted. This survey was, despite its small size, considered to be representative of the organisations and managers who manage savanna parks. In Gabon, most parks have limited staff, consisting largely of a director and sometimes a patrol team (0 – 27 people, but more likely only 5-6). As there is no hierarchy within the park (such as research or patrol coordinators), the surveys were augmented by interviewing heads of those organisations that assist each park (NGOs), and state organisations that are responsible for either management of the entire system or training personnel. In the end, it is the hierarchy of ANPN and their partner organisations that will probably have the most impact on savanna management.

Results

Knowledge of savanna fire ecology and management

Knowledge about savanna ecology and management is not consistent across parks. While most respondents were aware of the positive roles that fire can play in the ecosystem, many also expressed concern about negative impacts. Fire was thought by some to be a potential threat to the forest; however, most believed fire to be beneficial to the savanna.

Training

All respondents had received a degree in biological sciences, protected area management, or forestry. However all personnel of NGOs interviewed had obtained science degrees ranging from molecular ecology to human geography and none were trained in resource management. All those surveyed who were associated with ANPN (*Agence National des Parcs Nationaux)* held degrees were of three kinds: forestry degrees from ENEF (*Ecole National des Eaux et Forets)*, Gabon and *Ecole de Faune*, Garoua, Cameroon ("Garoua" hereafter) and M.Sc. degrees in protected area management from Canada. Only one ANPN interviewee had been trained in both science and management (Fig. 1).

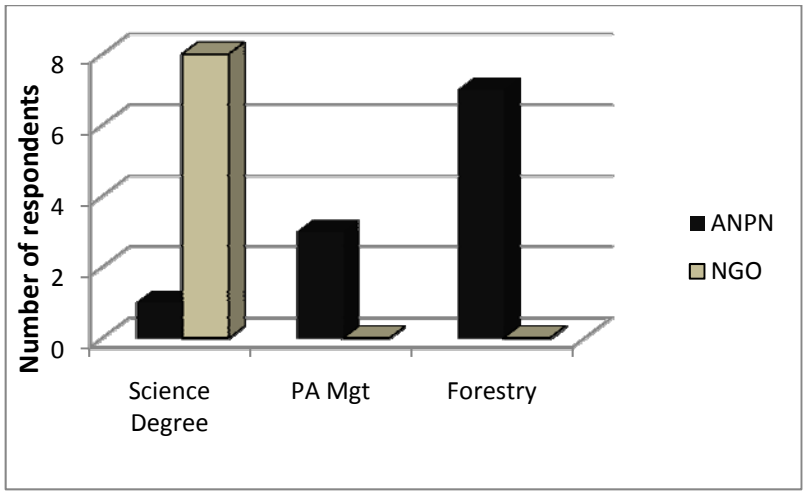

Fig. 1. Comparison of training of project managers by organisational affiliation.

Critical experiences with fire

Eight respondents had grown up in areas where savannas were burned. When asked why these areas had been burned, the most important answers were gathering and cultivation. However, when these same eight were asked about the goals of their own burning, the most frequent answer was for management. Four others had burned savannas, despite not having grown up in them, and their burning experience was also most related to management (Table 1). When questions were asked about where these experiences had occurred, some reported growing up in savanna environments that were burned while others reported having worked in savanna areas in Gabon and elsewhere in Africa. Management is a dominant experience with burning, overshadowing all other forms of fire use by respondents (Table 1). From this table, we see that

most informants indicated that most burning experience came from training at Lopé NP and Garoua Forestry School, Sette Cama/Gamba Forestry Brigade, and least frequently by direct experience.

Several people indicated that they had previously been against burning savannas but, due to a negative experience with fire exclusion (where no-burning resulted in hot, destructive fires) had changed their position to pro-fire. In one case, a respondent's research camp elsewhere in Central Africa was destroyed in a savanna fire because they had not properly placed fire breaks around their buildings. While no lives were lost, five years of data were. From this experience, the respondent realized the importance of managing fire in a fire-prone zone. In a similar experience elsewhere in Central Africa, another respondent indicated that a hunter burned a savanna area near their conservation site which they had intentionally left unburned, believing fire to be harmful to the ecosystem. The hunter's fire was extremely hot and, in the end, destroyed part of the forest near the project. This respondent now uses fire as a safety measure in the current conservation project site in Gabon to prevent damaging and unexpected fires from destroying the forest and infrastructure. Both of these cases show how suppression without management can result in disaster, but also how experience can transform management ideas.

	Reasons for savanna burning near respondent's origin	**Reasons for burning experience by savanna residents**	**Reasons for burning experience by savanna non-residents**
Gathering	5[159]	1	
Plantations	4	1	
Snake removal	2		
Ease of walking	2	1	1
Hunting	2	2	
Management	1[160]	7	3
By accident	1		1
Unspecified goal	1	2	1
Security			1
Subtotal of respondents	N = 8	N = 8	N = 4
Total burn experience		N = 12	

Table 1. Comparison of ordering of reasons why savannas were burned in places of origin versus direct experience with burning. Respondents were able to list more than one response per category.

[159] Many of these respondents had grown up in the Tchibanga area where savanna burning is linked to post-burn mushroom gathering.

[160] This person had grown up in North America where many protected savannas are managed with fire.

All parks were indicated to have burning occurring, although only one had a fire plan (Fig.2).

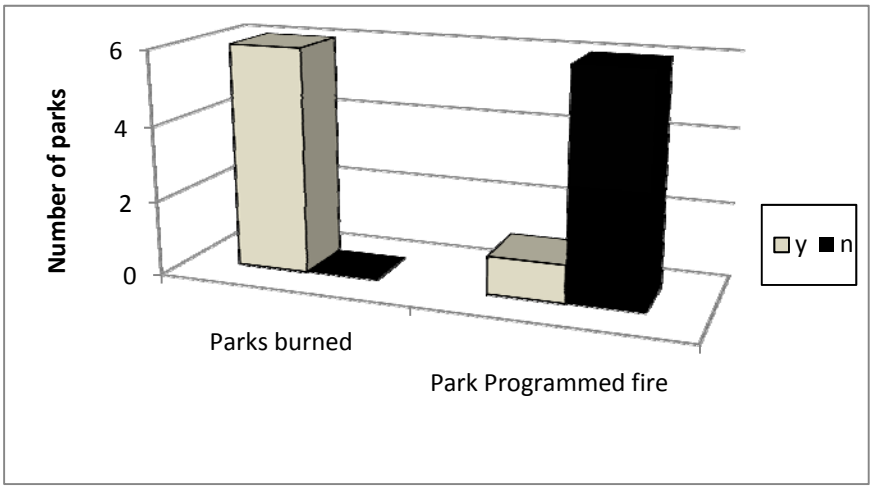

Fig. 2. Comparison of burning in Gabon's PAs: planned vs. unplanned fires.

When asked if fire was a menace to their PA, 6 out of 16 respondents said yes, worrying about unplanned and uncontrolled fires. However, nearly all believed fire to be beneficial to savannas and not a threat to forest. Many could list relevant reasons to burn savannas. In many cases, respondents indicated that they would like to burn but did not have the research to back up the decision.

When asked who was burning inside the protected areas without fire plans, the answers included poachers and villagers. Even the park with a fire plan experienced problems of the fire plan being disrespected. All parks had experienced fires in their peripheral zones. When asked why these areas were being burned, the answers in order of importance were: hunting (including fishing[161]), cleaning, without goal, regeneration (including grazing), safety, ease of walking, gathering, clearing of reptiles, beautification, and by accident (Fig. 3). Four respondents talked of the burning outside the park in a negative sense. When asked why people burned around their PA, the most commonly cited answer was for hunting, followed by clearing of dead grass, and then "without a goal".

[161] This is a local fishing technique in coastal savannas.

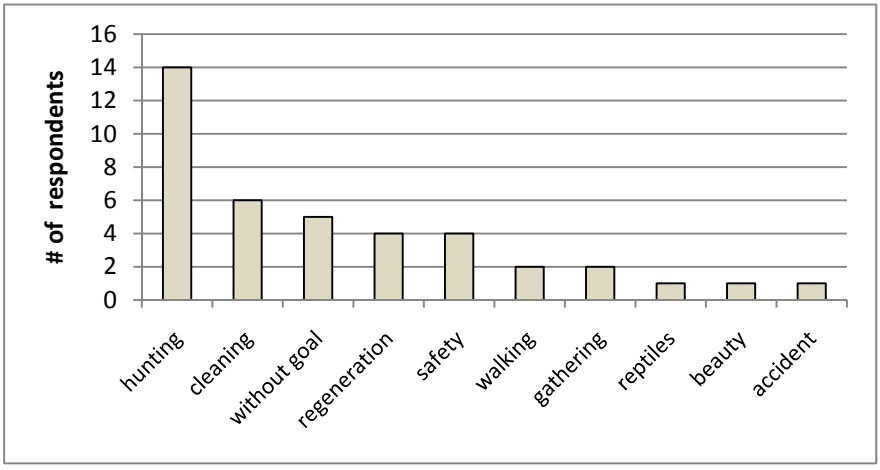

Fig. 3. Reasons given by PA staff for burning in a PA buffer zone.

Respondents in the survey were well-disposed towards using fire as a management tool. However, many expressed a need for studies to support fire for management.

Discussion

These survey answers highlight the duality of fire's effects: the consequences could be positive or negative if used too little or too much. According to South Africa's managers of Kruger National Park where more than 40 years of fire research and management has been carried out,

> Fire management practices in conservation areas have remained contentious [because] fire is an obvious ecosystem driver there are important gaps in our understanding about the actual effects of fire, and multiple practical fire management options appear to be available. These three factors imply that managers realise the importance of fire, feel the need to choose between options to manage it, but acknowledge that the decisions are currently being taken on imperfect knowledge.
>
> (Biggs 2005: 4)

Even after 40 years of research, knowledge is still considered to be imperfect. Increasing knowledge of the protected ecosystem will help set aside some concerns and allow management to take place with less uneasiness. Certainly in Gabon, savanna ecology is poorly understood. It is not that research has not been done but that this research has been forgotten, not disseminated, and not synthesised. For example, in the 1950s and 1960s, botanists conducted studies on Gabon's savannas when they were considering these areas to start cattle ranches. Thus, the savannas of Booué, southern Gabon (Koechlin 1957; Koechlin 1961b), and the Bateke Plateaux (Koechlin 1961a) have all been studied. Savanna origins have been well studied, indicating their creation during drier climates; studies on coastal and inland savanna origins and dynamics attest to the encroachment of present-day savannas by forest despite regular burning (Delègue et al. 2001; Favier et al. 2004; Lanfranchi and Schwartz 1990; Ngomanda et al. 2009; Schwartz 1992; Schwartz et al. 1996). Unusual animal distributions within these savannas were analysed in the 1940s (Malbrant and Maclatchy 1949). However, fire ecology is less known, and that small body of research has already been largely summarised in the previous section.

Perhaps it is not surprising that there is little savanna-specific information in a country where policies and conservation are more oriented towards forest-related issues. This is probably a direct outcome of the training received and exposure to scientific studies at the institutions in question.

Fire is seemingly an under-addressed topic in many northern ecology textbooks (see Bond & van Wilgen 1996). Certainly for Gabon, there would have been a stronger emphasis on forest systems, especially for those receiving forestry degrees before concentrations in PA management became available. When I interviewed Norbert Ganga, Director of Studies at ENEF, he indicated that their curriculum, while addressing protected areas, does not specialise in savanna topics (ENEF 2007). Students are expected to gain exposure to this through internships at Lopé. If respondents had been further trained at Garoua, situated in the savanna zone of northern Cameroon, their experience with burning was restricted to range management. In any of these cases, an emphasis on general savanna ecology and management would not be expected to be taught.

Many people also expressed concern for how fire affected animals, particularly birds and insects. While it is true that fire can negatively impact populations, certain species also benefit from fire. In Kruger Park's experience, the public belief that fires are harmful to animals reflected a lack of public education on the topic (Biggs 2005: 12). With additional studies about the benefits and consequences of fire in Gabon's savannas, these worries will be addressed by research and management.

Management goals and the policy context

Protected area fire policies are normally nested within national ones. In most cases in Central and West Africa, fire control was centralized by the state just after independence, with tactics among countries varying in degrees of severity. Some countries, such as Mali, Benin, and Senegal, have completely suppressed fire (Laris 2004; Schmitz 1996). However, fire policies in these West African countries are now allowing for some fire use; fire control is being devolved to local authorities, a strategy encouraged by the FAO (Frost 1999: 1).

However, in the case of Gabon, fire-use is ambiguous, with agricultural fires condoned and fire drives for hunting forbidden (Walters 2010). This leaves the national parks in an unusual situation where they may create a policy for PAs without a clear national, legal framework. Since this plan will only pertain to the park and possibly the buffer zone, it is possible that there will be conflicts with local people or other agencies that maintain areas at the park borders. If there are no boundaries to stop fire from crossing out or into the park, then the issue of fire control must be considered beyond the borders of the park alone. For this reason, understanding local burning patterns and, in some cases, working with local people, may be warranted

(SAFNET 2003: 3). The Southern Africa Fire Network advocates using an integrated fire management approach to create citizen groups knowledgeable about fire use (Held 2008; see workingonfire.org). This approach helps deal with fires in a way that empowers local people. This is in contrast to a more top-down approach with the same goal used in Togo which places fire management in the hands of local authorities (Nadjombe 1992).

Management plans within PAs

There are three approaches to dealing with fire within parks: no action, suppression, and fire management. In Gabon, all three types are currently used with varying degrees of success. Each of these approaches will be considered in turn.

No fire plan

Most parks in Gabon are currently in this position, despite the intention of creating plans. This equates to a park fire policy of "no action". That means that whoever burns, whether it be villagers, illegal hunters, or park employees, do so without rules; burning suits the person's agenda and has no reference to a wider group of people, management plan, or organisms that the fire may impact. This approach may cause safety concerns since these fires can burn infrastructure without warning and may harm people in the process. There have been cases where illegal hunters have burned areas near park camps which, without fire breaks, would have burned buildings. In another park where burning had been banned for several years, the fire policy was quickly changed when the administration decided to begin burning again. This sudden change in policy without planning proved to be dangerous as research and tourist camps were threatened by flames.

Suppression

Some parks may wish to remove anthropogenic fire from the ecosystem which they manage and let forest colonise existing savanna. For example, Loango had an informal no-burn policy for many years, with a debate amongst partners about whether the park should maintain savannas they believed to be anthropogenic. Loango's management plan has the following mission:

> *La conservation des écosystèmes du Parc national de Loango, dans un contexte écorégional et avec la participation de tous les acteurs, favorise le développement de l'écotourisme.*
>
> (*Agence National des Parcs Nationaux* 2007: 28)

Within this plan, a fire management plan is called for. The savannas of Loango support buffalo populations (Morgan 2007) and burning to create grazing sites for buffalo and visibility for tourism might be warranted (see Molloy 1997). Secondly, Loango's savannas are being colonised by *Chrysobalanus icaco* L., which forms patches of vegetation in which other colonising trees can establish (Mouandza-Mbembo and Walters 2007); *Saccoglottis gabonensis*

(Baill.) Urb. appears to be doing the same thing in southern Loango (Morgan 2005: 4). This plant may be of South American origin and has become naturalised in Gabon (Raponda-Walker 1953). However, it plays a role in forest succession in the coastal savannas in the Republic of Congo (Favier et al. 2004) and in Loango (Harris and Walters 2006). However, it is uncertain if fire can keep *C. icaco* in check; studies on the effect of fire on its regeneration are needed in order to decide how best to manage the situation. In the survey, managers and NGOs of Loango expressed interest in a fire-effects study but were unsure of the means to finance it.

In the buffer zone of Moukalaba-Doudou NP, one agricultural development NGO has banned fire for a year with the belief that burning is harmful to the soil. In a brief study of local fire use, they found that fire was important as a gathering and cultivation tool (Richard 2007), although this study was disregarded. When talking with the head of this NGO, he was open to a having a better understanding of fire in the ecosystem. However, he was very concerned about the impacts on soil, emissions, and the role of swidden agriculture in locally decreasing forest cover.[162] Another NGO recently conducted a separate study about local burning with an aim of helping the park develop a burn plan (Mbenga Mengera 2009). Even if local suppression occurs, fire still needs to be a consideration. An unburned savanna is a tinder-box; when burned it may prove to be even more damaging to forest edges since these fires burn hotter, being fuelled by dry grasses and associated litter. If there is a no-burn policy, it is very likely that one will need extensive fire-breaks or security fires to deal with accidental fires. If the park and the NGO have different approaches to fire management, then working together to avoid burning mishaps may be required.

Fire Plan

This case has already been mentioned above for Lopé NP, the only park to have a fire management plan. One of Lopé's priorities is to maintain the forest-savanna mosaic and the savannas while also focusing on other things such as ecotourism and valuing the cultural and historical patrimony (*Conseils National des Parcs Nationaux* 2006: 24). However, in meeting with partners and the director of Lopé, there were two concerns: that their burn plan was not respected by partners (with unplanned fires lit in areas not meant to be burned that year) and, secondly, that they may not be burning enough or at the right time of year since they are experiencing an undesired gain of forest over savanna. Therefore, a change in the fire plan may be warranted.

Adaptive management, learning from research, monitoring, and mistakes and adapting future management, may be the way forward (Biggs and Rogers 2003). In this context, places such as Kruger NP have changed burn policies three times in the last 90 years (Eckhardt et al. 2008;

[162] This seems to be the only place in Gabon where this is purportedly occurring since studies on the coast, Lopé, and Bateke have all concluded that the forest is in fact gaining on the savanna. Another NGO working there reports that the forests are advancing.

Woods et al. 2002). While Kruger based their policy changes on research, the US based theirs on catastrophe. After devastating fires resulting from lack of native burn regimes (Anderson 2005; Lewis 1973; Williams 2000a), suppression (Greeley 2000 [1920]), or mistakes during prescribed fire, the US has re-made their policy each time (Pyne 2001b; van Wagtendonk 1990; Wise 2002). Fire policy now includes prescribed fire for managing protected areas and utilizes data from regular monitoring missions to determine if fire regimes are effective in achieving management goals (U.S.Fish and Wildlife Service 2004). However, for Gabon, it seems that whether there is a plan, suppression, or no plan, unplanned fires regularly occur in all parks.

Fire management research

Except for localised cases, Gabon lacks core research on fire; this explains worries by many managers about the benefits and consequences of fire in their PAs.

Why people burn around a protected area

Given that fires occur in all PAs, most being unplanned, and are sometimes lit by villagers (all cases in the buffer zones), managers should seek to understand the reasons that local people burn.

These studies are relatively easy to conduct. In a park in Benin such a study clarified some of the problems between park management and local people. Using a survey of burn practices around the PA (Hough 1993), researchers found ten reasons why people were burning including managing resources, as well as revenge on the park for refusing them access. Officials from that park were encouraged to work with local people to help them solve their problems and reduce fire hazards. A similar survey around a PA in Zambia found that local people continue to burn under traditional fire chiefs for gathering, cultivation, hunting, and caterpillar breeding. The survey revealed the disparate natures of fire management by the PA and the locals and highlighted a need to work together in order to achieve some common goals (Eriksen 2007).

Lessons from the Bateke Plateaux National Park

In this section, I will consider some of the research that will be contributing to a fire plan for the PNPB.

PNPB has the following management goal:

> *La conservation des milieux de transition forêt / savane et des espèces phares du PNPB, ainsi que la valorisation du patrimoine culturel Téké, sont assurées dans un contexte transfrontalier.*
>
> (*Agence National des Parcs Nationaux* 2008: 21)

The management plan is still being revised and is currently in draft form, although reference to a fire management plan is made within this document. Prior to this, only PPG's anti-poaching teams, reports of poaching fires (e.g. Aczel 2006), and a cross-border hunter study (Gami 2003) helped in the understanding of hunting-related fires. While 75% of the park is covered in savanna, this is only currently burned for two reasons: infrastructure protection by projects, and illegal hunting to attract animals to new growth. Thus, while anti-poaching missions attempt to stop unplanned fires, there is no current fire plan to manage the savannas. If the poachers and associated burning are ever stopped, then failure to manage this savanna with fire would result in encroachment by forest, thus violating the park's management objective.

In a PNPB meeting in March 2006, the need for a fire plan was identified (*Parc National des Plateaux Bateke Partenaires* 2006). As part of this goal, a fire plan was placed into the Park's conceptual model, requiring both cultural and biological data. Prior to this focus, conservation efforts were interested in creating baseline information about the area's biodiversity. Thus, studies were generated on the fauna (Bout 2006; Christy 2001; Henschel 2006) and flora (Stone et al. 2006; Walters et al. 2006; Walters 2007a). Recently, a guidebook was published which synthesised much of this information (Vande Weghe 2008). Until recently (see Walters 2010), little research was strictly oriented towards understanding fire and its effects, with the notable exception of PPG's work. At this time, the environmental education programme working with the local people had identified fire as a threat to PNPB's biodiversity, indicating that burning was conducted only by illegal hunters and was contributing to deforestation (Ikamba 2005b). This programme publicly encouraged reducing the burn frequency to once a year (pers. comm. M. Ikamba 2006, Ikamba 2006). This campaign also focused on protecting the critically endangered Grimm's duiker, *Sylvicapra grimmia* (*ntsa*), once the main quarry of Bateke fire drives.

Thus, there were various documents that might prove useful for fire management, but there were also significant information gaps and some misunderstandings. While the movements of animals and illegal hunters were followed and a campaign was pursued to save the *ntsa* from overhunting, little was known about the effects of fire on plants, birds, or insects, or about the social context of burning in the area. Thus, since 2005, concerted efforts have been made to fill in the knowledge gaps in order to create a science-based fire plan. To that end, we required the following: knowledge of historic and present-day fire frequencies, seasonality and extent, as well as studies on local fire use and its effects on birds, mammals, and vegetation.

Burn extent, frequency, and seasonality

Analyses of Landsat images and Firemapper data points (Consiglio and Walters 2004; Ndong 2005) allowed PNPB to understand fire extent and seasonality. Fires are centred in the national park closest to the concentration of Congolese villages near the border. These fire sites have

been found to have the highest incidence of Grimm's Duiker which, informants report, seeks pasture and minerals from newly burned areas. Analysis of Firemapper data from 2000-2008 (University of Maryland 2006) shows that although fire setting in and around PNPB reaches its peak during the long dry season, fires are lit throughout the year (Walters 2007b) (Ch. 5, Fig. 1).

Vegetation and burning

Through a vegetation study, we know now that fire plays a key role in regeneration of the dominant savanna tree, *Hymenocardia acida*. This tree depends on fire to encourage new growth and to remove tall and dead grass which competes for light and nutrients. Frequent fires per year result in less-intense fires which damage fewer trees. Even with multiple fires per year, we have seen that new forest is growing in old savanna areas near the forest edge (Leal et al. 2007). This is validated by local testimony that small savanna enclaves within the forest have become forest within human memory. Thus, in the future, it will be important to monitor whether the fire plan achieves its goal of maintaining the proportion of savanna within PNPB.

Herb diversity is highest in areas burned in the dry season; however, the rarest of species in the plateau are not dependent on burning. Most of the plants for Bateke subsistence are not rare and are either fire resistant or fire dependent for their survival. Burning for diversity will require species-specific management goals.

Birds and fire

The bird study relied on the extensive knowledge of long-time birder, Patrice Christy. He assessed fire effects on birds by visiting the site during times which represented gaps in his 30-year dataset of bird observations throughout Gabon and particularly in the Lékoni area. We now know that there are 105 savanna bird species in Gabon's plateau area (Christy 2008). While some species may be threatened by fire in terms of reducing nesting habitat or destroying nests, some species benefit from or require fire.

However, to benefit the most species, Christy recommends avoiding burning during times of bird reproduction (September to March). One additional consideration is burning to aid the migration of Abdim's stork during the short-dry season (January –February). In the whole of their range the only place that these migrating birds are hunted is in the Plateaux Bateke. It may merit burning riverside savannas to provide food and habitat during their migration; however this would have to be decided in consideration of the negative effects of short-dry season fires on ground-nesting birds during that same time period (see Fuhlendorf et al. 2006; Jansen et al. 1999).[163]

[163] Regulation of local hunting of these birds in the area may also be required.

Correlation of burned areas and mammal densities

Analysis of the mammal monitoring data collected by a PNPB monitoring team elucidated some interesting patterns. The greatest hunting pressure is found in areas farthest from park camps (Bout 2006) and coincided with the most burned areas in the park. This burned area also coincides with the highest *ntsa* and jackal *Canis adustis* distributions. Concentrations of other species are found to be near park bases where they are not hunted and the savannas are not burned (Bout 2006). This provides some evidence that unburned areas are important in maintaining portions of the population safe from hunting; however, burning creates pasture needed by grazers and may increase the overall diversity of the ungulate community (Klop and Prins 2008). Bateke hunters are very familiar with the life history of *ntsa*, given that it was and is their prized quarry. Many indicate that young *ntsa* require tall grass habitat to hide in, while all *ntsa* require new forage from burning. Research concurs, indicating that females need tall herbs (unburned areas) prior to calving (Estes 1999) and that most prefer having easy access to tall grass (Keyner 1969).

Lessons from ranch managers and other parks

Parks are not the only users of fire for management; fire is currently used to manage rotational grazing sites at nearby Abeki Ranch and at others around Tchibanga (see Richard 2007). Management for grazing has long been practised and lessons from that area may be useful for some Gabon parks (de Ronde et al. 2004). Visits were made to Abeki Ranch to see how fire was used to rotate and manage grazing sites. This provided a useful demonstration of burning with and without fire breaks, sometimes using evening fires which self-extinguish as air moisture increases. We also visited Lopé NP to learn from their management practices. However, their extensive use of firebreaks to control fire seems to be an impossible strategy for burning the vast savannas of PNPB. In addition, their current use of stagnant burn units (units maintained between years) is no longer advised by emerging fire management research.

The social context of burning in the Bateke Plateaux

Based on the present work, we know that the Bateke have a heritage of burning their savannas and that NP efforts to burn plateau savannas are not the first attempt. These areas have been burned for *ntsa* and burned for at least 170 years by the Bateke people. Most if not all of the savannas within PNPB were at one point under the control of a land chief. The former Bateke land tenure system had a strong hunting component oriented towards annual fire-drives in the savannas. A hierarchical system was used to organise and burn vast areas of savanna with specific burn limits. Fire was taken seriously by the land chief who had the right to levy harsh fines for burning without authorisation. Today, this system no longer functions. What results is a lack of fire and hunting management in the plateau area today. However, this should not be mistaken for a lack of history of management. Today's fire regime differs greatly from the past when fires were lit annually; today they are lit several times per year.

Another cultural aspect of savanna use is the contribution that savanna fires make to local livelihoods. These savannas are maintained by fire, and some plants are only gathered once fire has passed through. Eighty-five per cent of people in villages around PNPB linked fire to over 25 species of gathered food. Understanding this aspect of burning around the park helps place it into context. While some people may "burn without a goal", others are burning to subsist.

Information synthesis into a plan

From the information above it seems that, historically, fires were lit nearly annually during the mid- to late- long-dry season. From our research into the ecosystem, it seems that fire benefits many animals and plants but should probably be limited to annual burning early in the dry season. This will avoid hot, destructive late season fires that damage nesting bird species and the forest edge. If conducted in a patch mosaic pattern, this would allow both unburned and burned areas to co-exist, creating grazing sites for buffalo and *ntsa*, while maintaining tall grass essential for bird nesting and *ntsa* reproduction.

In the case of PNPB there is a clear link between the structure of the savanna ecosystem and the way it has been burned. Interviewing elders resulted in understanding the cultural link between the Bateke people and their form of fire management. Using Firemapper data and interviews, we understand that a recent change in fire regime has occurred. Without this information, research on the flora and fauna would have been limited to basic effects of fire under today's regime, without an understanding of the context. Furthermore, the park's management objective of conserving Bateke cultural heritage would have been compromised. Clearly, PNPB will benefit from multi-disciplinary research oriented towards ecosystem functioning and its social context.

The main steps for PA's wishing to manage savannas with fire are (Walters et al. 2010):

1. To have a defined management goal for their savannas: is the goal to maintain the percentage of savanna? To create pasture for grazing buffalo? To maintain savanna biodiversity?
2. Identify any gaps in PA specific knowledge about the effects of fire on the ecosystem and try to enlist studies
3. Identify the historic or recent fire regime needed to accomplish the goals: are annual fires best? Early dry season? What size is needed?
4. Survey burn patterns and uses by the local population to understand the context and perhaps derive useful information
5. Identify different parts of the PA or buffer zone which may need a separate management regime (ie. around infrastructure, research, conservation, and ecotourism zones, no-management intervention zones)
6. Create burn units and decide how these will be managed
7. Identify fire officers and ensure their training
8. Enact the plan
9. Record the results
10. Monitor to see if the plan is achieving the management goal
11. Adapt fire plan if not achieving goals

Conclusions

The goal of the survey was to assess whether the current knowledge and capacity in Gabon was enough to manage protected savannas. While there are certain PAs where advances in fire management have been made, other areas are lagging behind. And despite the overall goodwill by respondents toward using fire for management, there was limited funding and technical know-how to enact plans. From the park survey, respondents had several suggestions including that each park decide their role in maintaining savannas, that wildlife impacts and appropriate burning seasons be investigated, that burn plans be based on studies and, finally, that the plans be pragmatic and enacted where resources are available.

In a recent comparison of two national parks renowned for their savannas, Kakadu and Kruger, it was found that management objectives (relative to fire among others) could only be achieved by having clear goals able to be monitored, baseline data, and sufficient resources for management (Parr et al. 2009). This is mirrored for the whole of the Australian park system, where adaptive management is stressed in a cultural context (Keith et al. 2002). In the case of Gabon, many parks are establishing goals in their management plans, however the means to collect data and manage resources is almost entirely lacking. Funding for conservation and management training in Gabon is almost strictly focused on forest resources. Despite goodwill towards savanna management, this will only be possible under the following conditions:

1. Establishment of goals that can be monitored (e.g. Parr et al. 2009)
2. A team of PA staff that can be trained in fire management methods
3. Funding to carry out the training and the management interventions

4. A reporting mechanism within ANPN to ensure that individual parks carry out management goals
5. Establishment of a core of Gabonese researchers and managers that are knowledgeable about savanna (and other) ecosystem management issues and methods

In the case of Gabon's PAs today, only point one is currently being addressed. All PAs containing savanna have placed fire-management aims into their management plans. Many parks have good intentions; however, few parks have sufficient staff to be trained in management activities. Funding is limited largely to external funders who decide management priorities. For Gabon to advance in their ability to manage their ecosystems, it needs to invest in training in ecosystem management.

Fire management is currently an afterthought to training programs. Respondents in the survey largely receive fire training as part of an internship at Lopé NP or as part of a range management course in Garoua, Cameroon. Neither place is able to give training in current fire management practice, nor is Lopé able to carry out their fire plan. Such training should be taken more seriously as savannas constitute 20% of Gabon's land surface and contain 9% of the flora. Another pitfall in savanna management (or any environmental management) is a lack of reporting about park management to the ANPN hierarchy and the sometimes idiosyncratic management that has occurred in some savannas. Decisions which are not founded on a plan or part of a reporting mechanism within ANPN means that park management is left to the direction of a single person. Perhaps the most important aspect to managing resources in the long term is appropriate training. If expertise continually comes from elsewhere, Gabon will never manage its own savannas. Management effectiveness can be increased by networking with other fire groups (FAO 2007a: 40; Global Fire Initiative 2008; SAFNET 2003). There are many students at Gabon's universities and schools who search for internships and research topics. These students can form a new generation of conservationists and managers which can manage all Gabon's ecosystems and do so in a social context. Gabon and its partners should take this goal seriously.

Based on the experiences from Bateke and Lopé NPs, we see that a team of managers, conservationists, and researchers need to engage in the process together. It requires a knowledge of the cultural context in which burning occurs and often requires a leader to organise and synthesise research and findings. Finally, financing is required to enact the plan safely. Without many of these things, a fire plan may only exist on paper. Given the success at Lopé so far, there is hope that, with some changes, their fire plan will be successful. Transfer of some of these methods to other parks could be done with an eye towards local burning methods and cultural knowledge. However, for this form of ecosystem management to be effective Gabon itself needs to ensure the training of resource managers and then the financing of

management activities so that those trained can enact what they have learned and thus manage Gabon's protected resources.

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