

Article

Assessing the Impacts of Conservation and Commercial Forestry on Livelihoods in Northern Republic of Congo

Michael Riddell

Bioclimate, Research and Development, Edinburgh, UK

Research undertaken at: Oxford University Centre for the Environment, Oxford, UK

E-mail: mikeridd@gmail.com

Abstract

Researchers often attempt to understand the social impacts of conservation interventions in isolation of broader socioeconomic, political and institutional change. However it is important to understand the variety of forces structuring livelihood impacts, and to identify how different social groups respond and adapt to changes. This article uses a case study from northern Republic of Congo, where rural livelihoods are shaped by a combination of conservation and commercial forestry activities, to understand the differential livelihood impacts of these activities on the two principal social groups, the Aka hunter-gatherers and Kaka and Bondongo farmer-fishers. The study results indicate that livelihood change is most striking in conservation-forestry villages compared to control villages, and this change is most evident among the Aka. Although commercial forestry is the principal driver of livelihood change, the enforcement of conservation regulations reduces households' access to natural capital and alters social relations. In this context the impacts of conservation were exacerbated due to the dramatic transformation of the livelihood space into which people were either economically displaced or chose to move to. Conservation interventions in similar contexts should involve people in the project design and initiate context-specific livelihood assessment and monitoring prior to and during the intervention.

Keywords: livelihoods, conservation, commercial forestry, Aka, Kaka, Bondongo, Republic of Congo

INTRODUCTION

Researchers often attempt to isolate the social impacts of conservation from other factors driving livelihood change (Ashley et al. 1999; West and Brockington 2006; Foerster et al. 2011). In reality, conservation activities rarely occur in isolation (Adams and Hutton 2007). Rural peoples' livelihoods are structured by many forces, some of which are linked to external factors such as changes in the broader economy. Individuals and households respond to the challenges such changes create by adapting their livelihood strategies in

order to continue making a living (De Haan and Zoomers 2005). Nowhere are these challenges greater than in sub-Saharan Africa where high rates of poverty in rural areas mean households often have low or diminished household asset bases, limiting their ability to adapt (Devereux et al. 2008). Rural households not only face climatic and political change, and sometimes conflict, but also a renewed surge in large-scale infrastructure projects, land acquisitions for commercial agriculture and biofuels, resource exploitation such as mining and forestry, and emerging terrestrial carbon markets in the form of REDD+ (Cotula et al. 2009; Roe et al. 2009). These forces are representative of the extension of capitalist markets into rural economies, and can lead to substantial shifts in land tenure, labour relations, and modes of production (Harvey 2010).

The argument advanced in this article is that the livelihood and social impacts of conservation can be better understood if the conservation impacts are situated within the range of different factors influencing rural livelihoods. This prevents falsely attributing impacts to conservation alone. In addition, in

Access this article online	
Quick Response Code: 	Website: www.conservationandsociety.org
	DOI: 10.4103/0972-4923.121002

regions where peoples' livelihoods are undergoing significant and rapid change, conservation practitioners will be in a better position to support sustainable livelihoods. In this article I aim to assess the livelihood impacts of conservation in the context of commercial forestry and a rapidly transforming socioeconomic context. I use a case study from northern Republic of Congo (Congo hereafter) where, like elsewhere in Central Africa, conservation activities and commercial forestry occur together. In order to illustrate the differential impacts of these activities on different social groups, I disaggregate the analysis between the region's different ethnic groups – Kaka and Bondongo farmer-fishers, and Aka hunter-gatherers.

Conservation-livelihood research

Research on the social impacts of conservation has illustrated a range of impacts related to peoples' livelihoods, including wildlife crop-raiding, involuntary displacement due to reduced access to land¹, rent-seeking behaviour of park staff, and exacerbation of existing economic inequalities, power and gender relations (Brockington 2002; West et al. 2006; Adams and Hutton 2007; Roe et al. 2009). These impacts are seldom distributed evenly within rural communities, as factors such as ethnicity, relative wealth, and gender influence an individual's susceptibility to change (Brockington et al. 2006). For example, Coad et al. (2008) argue that poorer, more resource-dependent groups bear the greatest opportunity costs of protected areas.

Conservation activities can affect household assets or capital. In many cases, new regulations restrict access to particular natural resources. Igoe (2006) suggests that, combined with the provision of conservation-related employment, the effect is often to replace households' natural capital with financial capital. Where on-the-job training occurs, conservation can also build capacity and therefore contribute to human capital, while conservation projects can also alter or reinforce local social and power relations (Vorlaufer 2002). However, as biodiversity conservation is a multi-faceted concept, only site-by-site assessments allow exact livelihood impacts to be understood (Agrawal and Redford 2006).

Livelihood impacts of conservation and commercial forestry in Central Africa

In Central Africa, the debate surrounding the social impacts of conservation in published literature has focused on involuntary displacements. Researchers argue that the formation of national parks has led to a series of compulsory displacements, with social consequences such as food insecurity and homelessness (Schmidt-Soltau 2003; Cernea and Schmidt-Soltau 2006). The extent of these displacements is still debated, and some researchers dispute these claims altogether based on the paucity of evidence upon which they were based (Maisels et al. 2007; Curran et al. 2009). Curran et al. (2009: 42) emphasise the need for research that will "objectively assess the real impact of conservation". However, researchers on either side of the debate appear to refute each other's evidence, for example

with Curran et al. (2009) criticising Schmidt-Soltau's (2009) reliance on qualitative case study data. There is clearly a need for context-specific case studies that provide objective information to inform this debate, and illustrate where and how economic or physical displacement has occurred. However, this article does not focus purely on the issue of displacement, but takes a holistic look at not only any displacement that may have occurred, but also an understanding of the livelihood impacts of this displacement and the effects of other land-use and economic changes occurring in the broader landscape. Other studies in Central Africa, as we would expect, have shown that there is a lot of variation in the degree to which conservation activities influence livelihoods. For example Hodgkinson (2009) showed that local communities, particularly Aka hunters, suffer high opportunity costs from reduced access to hunting due to the enforcement of hunting regulations by a conservation project (Hodgkinson 2009). In contrast Foerster et al. (2011) recently presented evidence from Gabon suggesting that there are no systematic differences in a range of livelihood indicators between those households that previously had claims over natural resources within national parks and those with no claims, situated further from parks.

Throughout Central Africa rural dwellers must, to varying degrees, confront other major challenges, including the socioeconomic transformations related to commercial forestry, expansion of commercial palm oil plantations, immigration, large-scale mining projects, and civil unrest (CBFP 2006). There are multiple impacts of commercial forestry, but these are rarely holistically examined from the perspective of the individual and household. They include both direct and indirect impacts, such as depletion of hardwood tree species with multiple local livelihood uses, the acceleration of road network development, the provision of employment and local services, the knock-on creation of new economic opportunities, influxes of in-migrants and immigrants, and as a result, overexploitation of wildlife and other forest resources (Wilkie et al. 2000; Poulsen et al. 2007; Logo 2010). The most rapid expansion of any road network in Central Africa is currently occurring in northern Congo (Laporte et al. 2007).

Forestry roads facilitate the expansion of the monetary economy, which has knock-on effects in previously isolated rural communities. Roads have been shown to affect hunter-gatherer ('Pygmy') communities, who often become sedentary, tend towards individual rather than communal activities, become heavily indebted to their farming neighbours, and suffer from increasing alcoholism (Bahuchet and Guillaume 1982; Kitanishi 2006).

It is within this context that national parks and associated conservation outreach programs, such as Integrated Conservation and Development Projects (ICDPs), have been implemented and now operate in northern Congo. This paper explores the livelihood impacts of the changing political economy of northern Congo in order better to understand how conservation policy can support contemporary rural livelihoods. Livelihood surveys and ethnographic methods are used to assess changes in household livelihood activities and strategies, and compare the capital of different households between villages

affected to different degrees by conservation and commercial forestry. Using two treatment sites, with conservation and forestry, and two control sites in which these activities do not take place, I generated seven hypotheses for this study based on my understanding of the context at the time. They were that treatment sites, compared to control sites, will have: (1) a greater reported change in livelihood activities; (2) an overall shift in livelihood strategy away from forest-based and towards village-based strategies, in terms of time spent residing in the forest space rather than the village space; (3) reduced access to natural capital; (4) improved human capital; (5) altered social capital to the detriment of more vulnerable groups; (6) greater financial and physical capital; and that (7) these livelihood changes will be expressed differently between the two principal ethnic groups. Although conservation and commercial forestry are fundamentally different in nature, as one aims to preserve resources while the other uses resources, in northern Congo conservation and commercial forestry spatially co-occur. This requires the use of an in-depth analysis and a mixed-methods framework in order to structure the examination of these joint impacts in order to illustrate the differential impacts of both conservation and commercial forestry. However, the research design also aims to highlight the difficulties, and sometimes the inappropriateness of applying causality to socioeconomic change in complex-socio-ecological systems with multiple drivers and feedback. Through this analysis the article aims to illustrate the need to situate our understanding of the impacts of conservation on rural livelihoods in relation to other key livelihood drivers.

MATERIALS AND METHODS

Conservation and commercial forestry in northern Congo

The study site was located in northern Congo where the landscape is dominated by forestry concessions (Forestry Management Units or FMUs) and Nouabalé-Ndoki National Park (NNNP) (Figure 1). The park forms part of the Sangha Tri-National Complex that includes Dzangha-Sangha National Park, Dzangha-Sangha Special Reserve and Ndoki National Park in the Central African Republic, and Lobeke National Park in Cameroon.

Nouabalé-Ndoki National Park was created in 1993. The Park is a joint venture between Congolese Ministry of Forest Economy and the Environment (MEFE) and Wildlife Conservation Society-Congo (WCS) (Madzou and Yako 2000). The park is situated in the region between the Sangha and Oubangui rivers which had a low human population density prior to commercial forestry activities (estimated at 0.7-0.8 individuals/sq. km) (Poulsen et al. 2007).

The philosophy underlying the park's creation was 'the conservation, in its natural state, of one of the last examples of an untouched wilderness area of lowland forest in Central Africa' (Maisels and Djoni-Djimbi 2001: 19). The buffer zone around the park was considered critical to achieving the 'rational and sustainable use of the periphery zone of

the park' in order to avoid the negative effects of human pressure (Maisels and Djoni-Djimbi 2001: 19). As an avenue to achieve this goal NNNP management engaged with two of the villages closest to the park's border; Bomassa to the west, and Makao-Linganga—the focus of this paper—to the east.

Nouabalé-Ndoki National Park outreach

Makao-Linganga village, located 45 km to the east of NNNP, was ideal as a study site to assess the joint livelihood impacts of conservation and commercial forestry due the presence of the NNNP Park-outreach conservation project since 1993, and the recent arrival of a forestry road in 2001. The park outreach activities in Makao-Linganga were coined the 'conservation village approach' by NNNP management (Maisels and Djoni-Djimbi 2001). The approach fits with the broad definition of first generation ICDPs in its linkage of local development needs to the objectives of biodiversity conservation (Adams 2004; Roe et al. 2009). Importantly, this conservation approach was originally designed for villages without forestry roads and with small and stable populations. The approach focused on conserving key wildlife species of conservation importance through the prevention of elephant hunting and attempts to ensure that hunting remained at sustainable levels (Maisels and Djoni-Djimbi 2001).

The conservation elements of the Makao-Linganga conservation project were the enforcement of Congo's pre-existing hunting regulations by rangers (ecoguards), chiefly Congolese hunting law 48/83 which includes: no night hunting; no hunting with nylon or wire snares; and no hunting of integrally protected or partially protected species without the appropriate licence (MEF 1983). Local regulations were also agreed, including prohibition of bushmeat sale from one site to another, and a permit system for gun-hunting. Licenses and guns were removed from those hunters who did not comply with local regulations, while poachers in NNNP were taken to prison in the district capital. The development elements included education, infrastructure development, and a village development fund linked to tourism revenue. Preferential employment was provided, particularly aimed at the principal farmer-fisher elephant hunters who organized commercial elephant hunting around Makao-Linganga.

All those villages involved in this study were located on the eastern bank of the Motaba River, within the Ipendja FMU which is managed by the forestry company THANRY-Congo. The company started building Sombo forestry town and sawmill on a savannah 5 km north of Makao-Linganga in 2001, the same year the forestry road reached the area. In 2006, a second road, built by Congolaise Industrielle des Bois (CIB) Forestry Company, from the Sangha River bridged the Motaba River as it crossed into Makao-Linganga.

Peoples of the Upper Motaba River Basin

The people of the Upper Motaba River Basin can be divided, albeit rather crudely, into two principal groups:

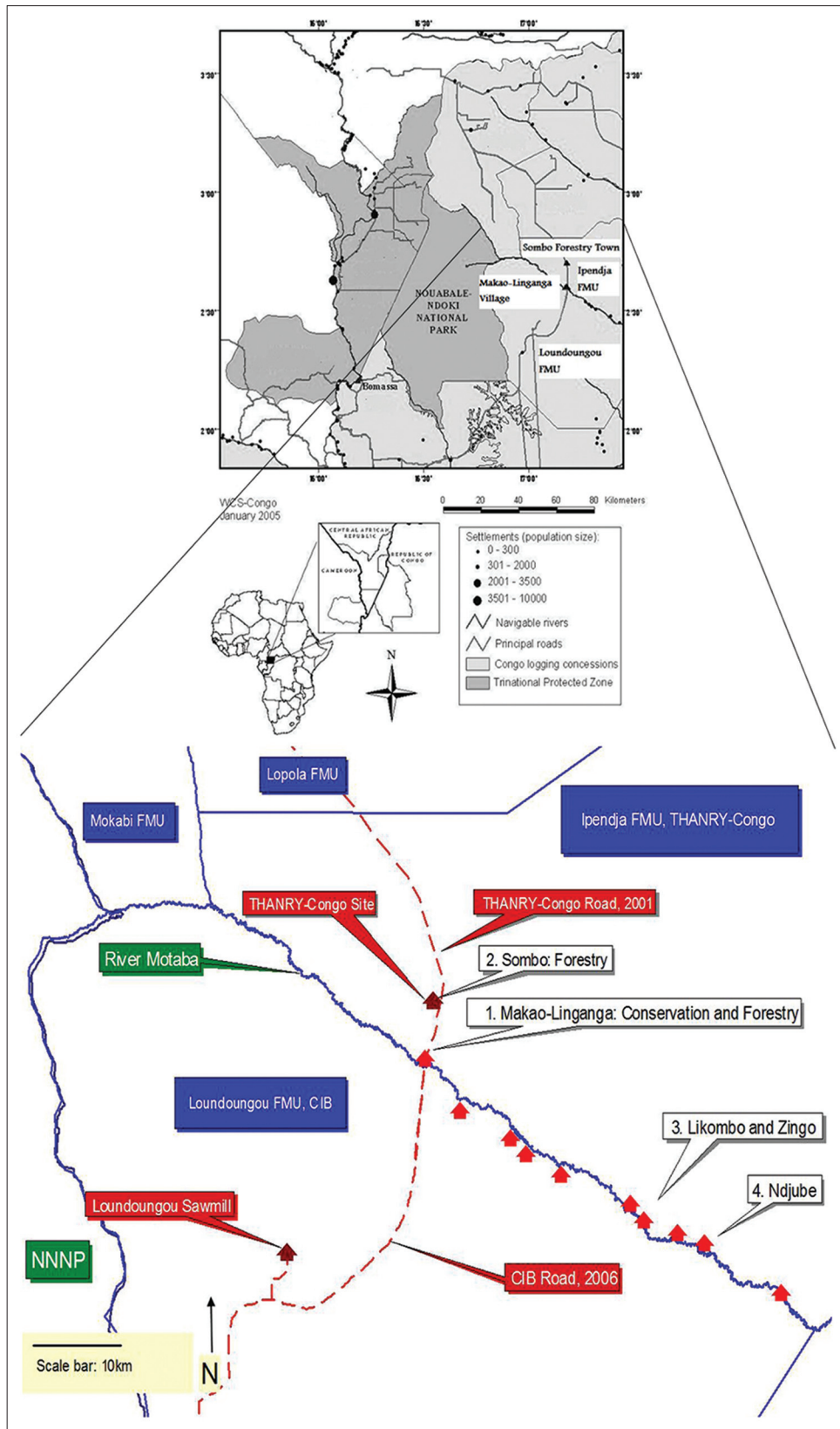


Figure 1
 Location of the four study villages on the Motaba River in relation to NNNP, forestry roads, and other villages on the Upper Motaba

Bantu-speaking farmer-fishers and the Aka-Mbendjelé hunter-gatherers (Madzou and Yako 2000). Farmer-fishers

are generally village-based agriculturalists and fishers, with a delayed-return production system. The predominant

ethnic groups on the Upper Motaba River are the Kaka and Bondongo (Table 1).

The Aka-Mbendjelé hunter-gatherers, or ‘Pygmies’ are referred to as Aka here following from the terminology of Bahuchet and Guillaume (1982) and Kitanishi (1995). The term ‘Pygmy’ is often used to describe Central African hunter-gatherers, but it is strongly disliked by the Aka, and is a derogatory term, so is not used here. The Aka speak a C-10 Bantu language (Bahuchet and Guillaume, 1982), they are an egalitarian society with a predominantly immediate-return system of production based on hunting and gathering, although increasingly they practice some delayed-return activities such as agriculture (Woodburn 1982; Lewis 2002).

The Aka and farmer-fishers are culturally and historically distinct. The inter-ethnic relationship and inter-dependency between the two groups was often mistaken for slavery during the colonial era (Bahuchet and Guillaume 1982). The Aka were present in the forest prior to the penetration of the farmer-fishers, and initial exchanges between the two groups were based on silent exchanges of goods. Farmer-fishers brought metallurgy, and inter-group relations—ritual, symbolic and material—have evolved over the generations (Lewis 2002).

On the Upper Motaba River, Aka and farmer-fishers have extensive social and exchange relations. The Aka provide farmer-fishers with forest products, such as bushmeat and honey, plus their labour in fields, in exchange for agricultural products and desirable goods, such as alcohol, tobacco, clothing, salt, and iron. Relations between Aka and farmer-fisher families are hereditary between particular families, and as a mark of this relationship the Aka call their farmer-fisher family *nkumu*, translating loosely as ‘my owner or patron’ (Bahuchet and Guillaume 1982). Farmer-fishers call the Aka *bambenga*, which has no literal translation, and Aka often call farmer-fishers *milo* (sing. *milo*, pl. *bilo*), which refers to all the non-Pygmy Africans they encounter (Bahuchet and Guillaume 1982).

Research strategy and methodology

As primary researcher, I spent 14 months in northern Congo between May 2007 and July 2008, living in the village of Makao-Linganga, in Aka forest camps (*lango*), and other communities on the Upper Motaba River. I worked in French and basic Lingala with a Congolese assistant and two local assistants: a Kaka-Ikenga man and an Aka-Mbendjelé man.

Study villages were chosen to allow the examination of the joint impacts of conservation and forestry on livelihoods (Table 1). The first criterion was the presence or absence of a conservation project or enforced conservation regulations; second, the presence or absence of a forestry road or site; and third, the ethnic composition of the farmer-fisher group in the village. This last criterion aimed to account for the fact that different ethnicities are reported to practice different livelihood activities in the region (Bahuchet and Guillaume 1982). This sampling structure generated treatment villages, villages with conservation and forestry, and control villages, villages without conservation or forestry (Table 1).

To understand how peoples’ livelihood activities, strategies and capitals have changed over time, a combination of quantitative methods, including a household survey, and qualitative methods, including ethnographic methods (observation and interviewing) and Participatory Rural Appraisal (PRA) techniques (mapping and wealth assessment) were used. The combination of methods aimed to account for the acknowledged limitations of household questionnaires, which can be poor in eliciting reliable information on sensitive issues, but can be important for comparative analysis (Adams and Megaw 1997). The use of mixed methods in this instance also ensured that detailed comparative information on households’ activities and changes in their assets and access to these assets was complemented by qualitative observations and interviews to explain observed trends.

The research was structured based on the Sustainable Livelihoods Approach, which emerged, in part, from work on entitlements by Amartya Sen (1981). The approach is

Table 1
Characteristics of the study villages

Village	Makao-Linganga	Sombo	Likombo-Zingo	Ndjubé
Category	Treatment: Conservation and forestry	Treatment: Forestry, weak conservation influence	Control: Neither conservation nor forestry	Control: Neither conservation nor forestry
Population	670	2500	283	565
Proportion of farmer-fishers: Aka	71:29	95:5	31:69	40:60
Criteria				
Conservation	Yes: NNNP Park Outreach project base	Some: NNNP has little jurisdiction, MEFE is regulation enforcement	No	No
Forestry	Yes	Yes	No	No
Ethnic groups	Farmer-fishers: Kaka-Ikenga Aka: Mbendjelé	Congolese in-migrants, immigrants from Central African Republic, Cameroon, Democratic Republic of Congo Aka: Mbendjelé	Farmer-fishers: Kaka-Mbakolo Aka: Mbendjelé	Farmer-fishers: Bondongo Aka: Mbendjelé

NNNP=Nouabalé-Ndoki national park; MEFE=Ministry of forest economy and the environment

useful for conservation-livelihood research as: (1) it addresses differential impacts of a range of structures and processes on households; (2) focuses on the root causes of poverty (Igoe 2006); (3) suggests that economic interests are not necessarily of primary importance (De Haan and Zoomers 2005); (4) avoids oversimplified outsider prescriptions of poverty (Chambers 1997); and (5) allows for the consideration of factors arising from and affecting different scales. This structural approach to poverty recognizes that people adapt to changing institutional contexts and are dependent upon access to a variety of ‘capitals’ which together form the ‘livelihood platform’ (Ellis 2000).

The research used the household as a unit of analysis. Although the household as a unit of analysis is problematic, defining a unit of production and consumption is important for comparative work (Guyer 1981). The household is commonly used in livelihood studies due to its ability to bridge individual-level microeconomics to the broader political economy (De Haan and Zoomers 2005). The livelihood indicators assessed included household livelihood activities and strategies, and household ‘capitals’. The sustainable livelihood approach divides capitals into five general categories: natural, human, social, physical and financial (Chambers and Conway 1991). The use of these categories here is not intended to reduce these often complex and interacting assets to a quantifiable unit, but instead to organise the types of assets and relationships which people draw upon to make their livelihood for the purpose of analysis. This permits comparisons between social groups and affected and non-affected households. Within each category there are a series of locally relevant indicators that were chosen during an extensive period of participant observation and iterative survey design prior to the household survey. Table 2 highlights the key indicators used, and the results section explains the local meanings of these indicators further.

The research used structured household questionnaire surveys. During the first two months locally relevant definitions for both Aka and farmer-fisher households were formulated based on local social structures and definitions (Hampshire and Randall 2005).

Stratified random sampling was used to select households using a village map with coded households for each village (Kitchin and Tate 2000). Each questionnaire was translated by local research assistants (Aka with Aka and farmer-fishers with farmer-fishers) and delivered to the head of household, and partner (if applicable) together. The sample was stratified for Aka and farmer-fisher households in each village. In total the survey was completed for 69% of the 359 households (159 farmer-fisher households; 200 Aka households) in the study sites (63% of farmer-fisher households, N=101; 74% of Aka households; N=147).

The household survey asked respondents to state current livelihood activities and then respond to questions regarding the suite of indicators (Table 2) that were later condensed into household ‘capitals’.

Household heads and their partners were each asked to report three livelihood activities in terms of time spent on those

Table 2
Livelihood indicators chosen for analysis

Livelihood indicators	Research methods used
Reported change in livelihood activities	Household questionnaire Informal interviewing Participant observation
Reported change in livelihood strategy Reported time spent on forest-based activities Reported and mapped spatial use of forest	Household questionnaire Participatory mapping Participant observation
Natural capital Access to the forest space Hunting access Sustainability of resource use	Participatory mapping Informal interviewing Informal interviewing
Human capital Skills and employment Level of education Household labour	Household questionnaire Informal interviewing Participant observation
Social capital Social and power relations Customary social positions Size and dynamics of Aka camps	Informal interviewing Participant observation Participant observation
Physical capital Market value of assets chosen during participatory wealth assessments (Table 3)/household Market value of ‘modern’ assets/household	Participatory wealth assessment Household questionnaire
Financial capital Cash in household Debt of household	Household questionnaire

activities during the course of the last 12 months, including the dry and rainy season. They were then asked to cite three activities they carried out before the NNNP conservation project was established in 1993. In villages with conservation and forestry all respondents could easily recall the arrival of the conservation project. In villages without conservation and forestry, local indicators of the 1992–1993 time period was used. These indicators were generated with a local research assistant, and included for example the chief and village elders who were in power at that time. This comparison of livelihood activities allowed the proportion of households engaged in particular livelihood activities to be calculated prior to conservation and forestry, and during the time of the questionnaire (September–November 2007). Households were also asked about their livelihood strategies in terms of the amount of time they spend a year based in the forest for livelihood activities compared to the year prior to the establishment of the conservation project.

Physical capital was assessed within the questionnaire using an asset list based on assets generated using Participatory Wealth Assessment (PWA) explained below. Households’ financial capital was determined by asking the household head and partner the amount of cash and debt they had at the time of the interview. This indicator was not designed to be a proxy for income, but was used to understand households’ access to cash at the time of the questionnaire. Interviews were all held within a period of 3 months (September–November) to assure that cash and debt

were not overly affected by seasonal variations in livelihood activities. Lastly, information on a household's level of education, employment, and labour available were also asked to assess human capital. The existence of a previous study by Kitanishi (1995) in 1991–1992 meant that some livelihood indicators could be compared directly. These included ownership of hunting weapons (physical capital), and number of individuals and dynamics in the Aka forest camp (social capital).

A PWA was used at the household level to generate lists of locally important capitals prior to the questionnaire. During a PWA individuals are asked to discuss local meanings of wealth, and to generate lists of local indicators (Grandin 1988). The PWA was carried out separately with Kaka men and women, and Aka men and women, once in Makao-Linganga (a treatment site) and once in Ndjube (a control site). Participating individuals were those who knew the community well and had a good relationship with the primary researcher. The lists generated were different for Aka and farmer-fishers, with 34 assets measured for Aka households, and 29 items measured for farmer-fishers (Table 3). Assets were assigned a market value based on their local sale value, or a value calculated based on their exchange with other products.

Participatory sketch mapping was used to understand how people's spatial use of the forest, an indicator of livelihood strategy, had changed over time. Sketch mapping is one of a family of PRA techniques which are designed to allow people to generate, analyse and share knowledge themselves (Chambers 1994). Mapping sessions were carried out throughout the study period. Mapping was conducted with Aka and farmer-fisher groups separately in each study village, and focused on macro-level (community and Upper Motaba-level) changes in the spatial use of the forest space. Participants, usually between five and ten in number, were selected based on their relationship with the primary researcher and local recognition as individuals who know the forest well.

Ethnographic methods used included informal interviewing and participant observation. These methods were used to explore causal relationships between the impacts of conservation and forestry on livelihoods. Informal interviews were an effective way to explore qualitative changes in social relations, labour relations and access to natural resources that were not identified in the household survey, and were carried out during extensive visits to each site and Aka forest camps (lango). Participant observation was used throughout the study period, as the researcher lived in the study communities and spent 3 months living in Aka forest camps to observe interactions between the Aka and farmer-fishers. Observations helped verify peoples' reported livelihood activities, particularly illegal activities such as snare hunting, and gave a better understanding of how individuals had adapted their livelihoods to contemporary change.

Household livelihood data was entered into Microsoft Office Excel in the field, and analysed in SPSS version 16.0 (Carver and Nash 2009). Parametric tests were used for normally distributed data, and non-parametric tests (Chi-squared, Mann-Whitney

Table 3
Asset list for Aka and farmer-fishers generated through participatory wealth assessment

Aka assets	Market price (USD)	Farmer-fisher assets	Market price (USD)
Plastic cup	0.7	Machete	11.1
Plate	1.8	Radio	11.1
Pot/pan	11.1	Large women's basket	3.3
Wooden pestle and mortar	1.1	Canoe	66.7
Knife	1.1	Axe	11.1
Soap	0.6	Shotgun	333.3
Salt	0.2	Hunting net	4.4
Women's basket	2.2	Hunting spear	4.4
5l plastic water container	2.2	Fishing net	2.7
25l plastic water container	5.6	Fishing basket	3.3
Plastic bucket	3.3	Fish trap	4.4
Mattress	22.2	Fish hook	0.1
Sleeping mat	1.1	Fishing harpoon	3.3
Calabash	1.1	Mobile telephone	33.3
Skin oil	0.6	Torch	4.4
Mosquito net	11.1	Bicycle	44.4
Sharpening file	3.3	Television	88.9
Iron anvil	6.7	Chair	4.4
Axe head	4.4	Table	4.4
Machete	11.1	DVD/video cassette player	44.4
Torch	4.4	Refrigerator	177.8
Crossbow	3.3	Motorcycle	555.6
Spear head (ngongo)	2.2	Chainsaw	111.1
Spear head (ndaba)	2.2	Wheelbarrow	66.7
Nylon snare	0.1	Maize/cassava grinder	444.4
Wire snare	0.2	Mattress	22.2
Traditional snare	0.1	Mosquito net	11.1
Porcupine net	1.1	Generator	88.9
Canoe	22.2	Outboard motor	666.7
Fishing net	2.7		
Fishing hook	0.1		
Hunting net	1.1/metre		
Fishing spear	2.2		
Radio	11.1		

USD=450.5 FCFA

and KruskalWallis) were used otherwise. Chi-squared goodness of fit was used to compare between livelihood activities prior to conservation and forestry (expected) and activities reported in 2007–2008 (observed). ArcView version 3.2 was used to create a map of forest use from the participatory map (Ormsby et al. 2010). Notes from ethnographic methods were written up in Microsoft Office Word on a daily basis. After the research period these results were then coded and analysed using thematic analysis (Aronson 1994).

RESULTS

Changes in livelihood activities, strategies and capital

Livelihood activities and strategies

The principal changes in farmer-fisher livelihood activities were the substantial increase in households' engaged in formal employment, and the reduction in the number of households reporting engagement in the relatively unprofitable activity of palm wine (*piké*) harvesting (Table 4). There was also a reduction in reported snare hunting in Makao-Linganga. Agriculture followed by fishing remain the key livelihood activities among farmer-fishers, and the number of farmer-fisher households reporting that gun hunting was one of their principal livelihood activities did not change significantly over time.

The livelihood portfolios of the farmer-fishers in the villages without conservation and forestry appear to remain the same prior to and post-conservation and forestry (Table 4). The only significant change was an increase in the proportion of households engaged in craft activities in Likombo-Zingo compared to prior to conservation and forestry.

Aka livelihood activities showed more of a shift than the Kaka activities. Specifically, Aka men's livelihood activities showed more significant changes than women's.

Aka women's key activity, the gathering of non-timber forest products (NTFPs), such as wild yam (particularly *Dioscorea* spp.) and other wild plant gathering (for example *coco Gnetum bucholzianum*, *G.africanum*, and *mo.payo*, *Irvingia excelsa*), has remained unchanged in both sites with and without conservation and forestry. However, in villages with conservation and forestry, Aka women informally reported spending more time *coco* gathering than previously, due to its commercialization by farmer-fisher women in Sombo forestry town and Makao-Linganga (50–100 CFA/bundle, USD 0.11–0.22).

Changes in Aka men's livelihood activities in the villages with conservation and forestry included the reduction in hunting with traditional techniques, particularly spear (*ngongo/ndaba*) and net (*bokia*) hunting, and a reduction in time spent collecting honey (Figure 2). This is illustrative of the increased amount of time the Aka spend in the village involved in piece-work (for farmer-fishers), formal employment, gun-hunting for villagers, or working in farmer-fishers' fields. This was observed to a lesser degree in villages without conservation and forestry.

Interestingly, Aka men and women in villages with and without conservation and forestry spend more time on their own fields than prior to conservation and forestry. Although Aka activities have become more orientated around the village economy, particularly in villages with conservation and

Table 4
Change in household engagement in livelihood activities for farmer-fishers and Aka

	Makao, pre-NNP	Makao, 2007–2008	Sombo, pre-NNNP	Sombo, 2007–2008	Likombo-Zingo, pre-NNNP	Likombo-Zingo, 2007–2008	Ndjube, pre-NNNP	Ndjube, 2007–2008
Farmer-fisher livelihood activities								
Agriculture	100.0	96.4	-	-	100.0	100.0	100.0	96.7
Fishing	67.9	62.5	-	-	80.0	73.3	90.0	90.0
Shotgun hunting	28.6	26.8	-	-	6.7	6.7	6.7	10.0
Snare hunting	10.7	1.8*	-	-	13.3	13.3	6.7	0.0
Palm wine production	32.1	16.1**	-	-	60.0	53.3	50.0	46.7
Formal employment	5.4	51.8***	-	-	0.0	0.0	6.7	0.0
Commerce	25.0	33.9	-	-	0.0	13.3	20.0	13.3
Livestock	5.4	1.8	-	-	0.0	0.0	3.3	3.3
Artisan activities	16.1	30.4*	-	-	6.7	26.7***	33.3	40.0
Alcohol production	16.1	10.7	-	-	40.0	46.7	3.3	3.3
Aka livelihood activities								
Agriculture for themselves	26.2	54.8***	33.3	63.0***	21.4	42.9**	86.0	96.0*
Agriculture for villagers	61.9	90.5***	48.1	63.0	57.1	53.6	28.0	4.0***
Fishing	28.6	14.3*	40.7	25.9***	39.3	50.0	54.0	50.0
Shotgun hunting for villagers	26.2	50.0***	14.8	55.6***	10.7	17.9	16.0	20.0
Hunting with traditional tech	50.0	7.1***	74.1	14.8***	60.7	50.0	32.0	30.0
Formal employment	0.0	19.0***	3.7	14.8	0.0	0.0	0.0	0.0
Honey collecting	69.0	33.3***	55.6	48.1	32.1	42.9	40.0	42.0
Wild yams and other NTFPs	83.3	81.0	77.8	92.6	78.6	82.1	86.0	82.0
Other work for villagers	19.0	54.8***	22.2	44.4***	25.0	35.7	14.0	22.0

Note: Significance levels determined using Chi-squared goodness of fit: $p < 0.001$ ***; $p = 0.001-0.01$ **; $p = 0.01-0.05$ *; NNNP=Nouabalé-Ndoki national park; NTFP=Non timber forest products

forestry, and are more dependent on work for farmer-fishers, they still use forest resources. However, the 3 months of observations and informal interviews illustrated that forest trips are now shorter, more commercially-orientated trips for honey (500–1000 CFA/l, USD 1.11–2.22) or bushmeat for farmer-fishers. In villages without conservation and forestry there were very few significant changes in livelihood activities. However, in Ndjubé, the Aka reported working less for the Bondongo farmer-fishers, and more for themselves.

In terms of livelihood strategies, significantly more farmer-fisher and Aka households from villages with conservation and forestry reported spending less time in the forest over the course of the year compared to villages without conservation and forestry (72% of Kaka and 69% of Aka in Makao-Linganga; 36% of Kaka and 30% Likombo-Zingo; 21% of Bondongo and 2% of Aka in Ndjubé; Kaka/Bondongo: $\chi^2=10.88$, P value=0.004; Aka $\chi^2=32.663$, P value<0.001). The actual forest space used by the population of the village with conservation and forestry, Makao-Linganga, also reduced (Figure 3)—a change not apparent in villages without conservation and forestry.

Natural capital

A conservative calculation from the participatory mapping exercise shows that NNNP now occupies 580 sq. km of forest

previously used itinerantly by the Kaka and Aka for this and other livelihood activities (Figure 3). The enforcement of Congolese hunting regulations by the conservation project in villages with conservation and forestry has led to reduced access to a number of mammal species, described by an elderly Aka man in Sombo as ‘all the succulent meats’. These include forest elephants (*Loxodonta africana cyclotis*) and other large game (forest buffalo *Syncerus caffer nanus*, western lowland gorillas *Gorilla gorilla*, and sitatunga *Tragelaphus spekei*). The enforcement of Congolese hunting regulations by the conservation project also prevented the use of wire and nylon snares. “Meat has become rare”, was a common complaint of the Aka. Observations in forest camps revealed that while some snare hunting continued, it was practiced less than in forests around the villages without conservation and forestry.

The arrival of Sombo forestry town, in 2001, 6 km north of Makao-Linganga, and now with a population of 2500, has led to increased use of non-timber forest products (NTFPs) in the forest surrounding Makao-Linganga. These NTFPs include bushmeat, fish, caterpillars, coco, traditional medicines, *payo* (*Irvingia excelsa*), and *ngongo* (*Marantaceae* leaves). Conflicts over the use of these NTFPs between the Makao-Linganga and Sombo population are escalating. Complaints of these NTFPs becoming rare were common

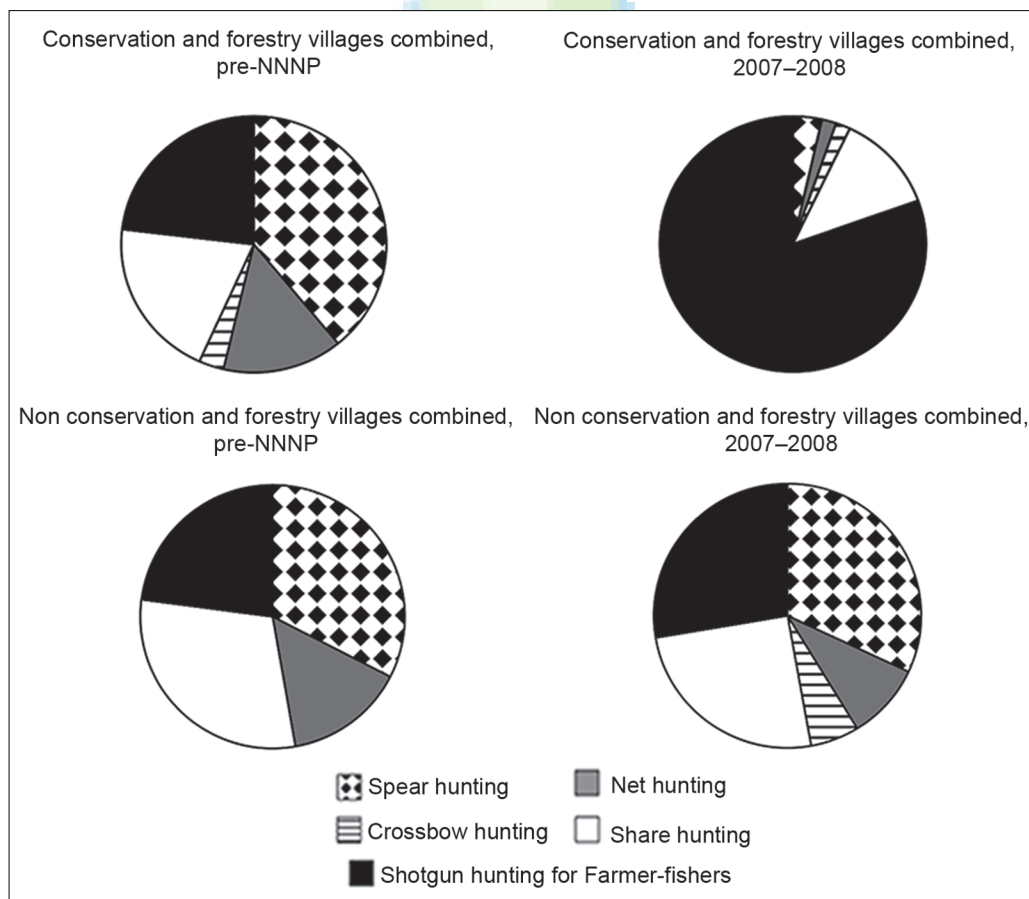


Figure 2
Comparison of Aka's reported hunting techniques prior to conservation (pre-NNNP), and in 2007–2008.

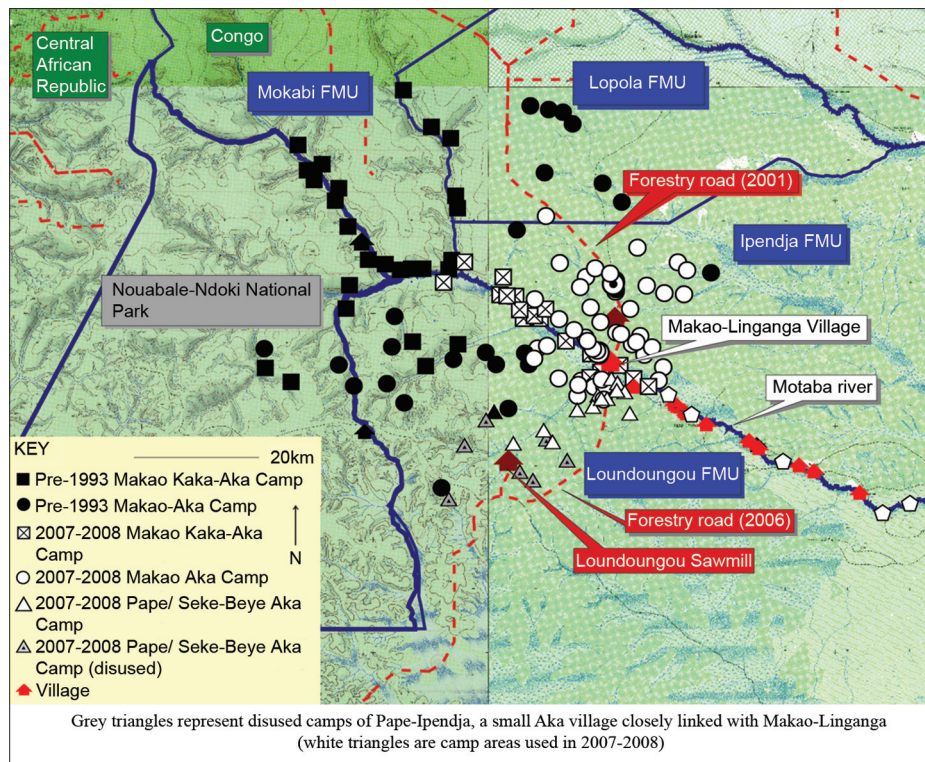


Figure 3
Distribution of disused (pre-conservation-forestry, black squares for farmer-fisher camps and black circles for Aka camp areas) and used forest camps (2007-2008) by farmer-fishers and Aka of Makao (white squares for farmer-fishers and white circles for Aka).

during the household survey. These conflicts and sustainability issues were not evident in villages without conservation and forestry.

Human capital

Human assets, or capital, refers to the education, skills and health of the household and thus the households' ability to mobilize labour (Carney 1998). Directly, human capital in villages with conservation and forestry has been affected by training and employment opportunities offered by conservation and forestry. For example, conservation has influenced the skills of both the Kaka and Aka through employment as rangers and guides for the ICDP and for NNNP. Approximately 20% of Aka household heads in Makao-Linganga were engaged in conservation employment of some form. In terms of education in the Kaka village with conservation and forestry, Makao-Linganga, farmer-fishers' education level was higher than other villages (KW $\chi^2=17.3$, P value < 0.001). However, among the Aka, education was highest in one of the villages without conservation and forestry, Ndjubé (KW $\chi^2=27.97$, P value ≤ 0.001).

In villages with conservation and forestry there had been a transformation of the character and extent of labour relations between the Aka and farmer-fishers, which was less evident in villages without conservation and forestry. In villages with conservation and forestry, cash has entered the labour exchange. However, payments rarely surpass 500 CFA (USD 1.1). Kaka's use of alcohol (both *piké*—palm wine—and *lotoko*—a spirit made from cassava) as a payment to Aka for

work is also increasing in villages with conservation and forestry, resulting in addiction. Many Aka now form new social relations in Sombo with in-migrants and forestry employees, which is more profitable financially than working for their *nkumus* in Makao-Linganga. New labour relations in villages with conservation and forestry also come with discrimination and conflict; forestry employees in Sombo refer to the Aka as 'our Hebrews', because the extremely strenuous work and low remuneration of Aka work is slave-like, and physical conflicts are common.

Social capital

In villages with conservation and forestry there had been substantial change in social capital. In Makao-Linganga, a school teacher noted, "In Bangui Motaba [a village to the south, just north of Likombo] the villagers [farmer-fishers] themselves control the village and make the decisions. In Makao-Linganga it's the outsiders who rule the village". The presence of conservation rangers has served to reinforce existing power relations, to the detriment of Aka livelihoods. For example, in Makao-Linganga, Kaka men continued illegal hunting activities such as night hunting and took multiple cartridges into the forest unhindered by rangers. However, regulations regarding snare hunting, principally practiced by the Aka, are still heavily enforced. Snare regulations were enforced through meetings with Akas' *nkumus* and Aka rather than directly with Aka men themselves. In one instance, the *nkumus* of Aka from a Motaba-based village who had been in the forest west of Makao-Linganga for over six months, spread

rumours in Makao-Linganga that their Aka were poaching gorillas and elephants, in order that the rangers would visit the *lango* (forest camp) and pressure them to return to the village.

Aka cited their distrust for conservation project staff. An Aka man from Pape Ipendja stated, “Rangers just want to catch Aka with bushmeat, even if it is not gorilla. They will get more things [referring to shoulder stars] on their shoulders if they say it is gorilla meat”. As a precaution, Aka hide and sometimes bury the bones of animals they have hunted both by legal registered shotguns and by legal traditional methods to avoid trouble from rangers if bones are found in Aka fireplaces. Aka often reported that the banning of elephant hunting led to the abandonment of the importance of the ‘*tuma*’—the ‘great elephant hunters’. Hunting regulations also affected the power drawn by Kaka men from the sacred forest, *Ginaro*. The forest, next to the village, was a source of power for Kaka men, which has declined substantially since the arrival of conservation and forestry. *Ginaro* still plays an important role in villages without conservation and forestry.

Lastly, in villages with conservation and forestry, according to observations and Aka informants, Aka *molongo* forest camps have reduced in size. In 2007–2008², Aka *molongo* camps averaged 11 individuals per forest camp compared to 46 during 1991–1992 (Kitanishi 1995). This reduction in the size of Aka forest camp reportedly started with the arrival of wire snares among the Aka. In Makao-Linganga, for example, the mean group size for one-day *e.sondo* spear hunting dropped from 5.8 (N=24) in 1991–1992 (Kitanishi 1995) to 1.3 (N=6) in 2007–2008, reducing hunt efficiency and, like net-hunting, leading to disuse. As a result hunting social positions such as *mo.pondi* (young men who have participated in spear hunting) and *bayanji* (skilled spear hunters who have killed many bushpigs) are redundant. These activities and positions continue to exist in the villages without conservation and forestry.

Physical and financial capital

Physical capital was measured using average market value of assets chosen during the participatory wealth assessment (Table 3) per household as an indicator. Among farmer-fisher

households there was evidence of overall accumulation of physical assets in the Kaka village with conservation and forestry, Makao-Linganga, as the market value of all possessions varied between the three villages (ANOVA: $F_{2, 100}=3.558$, P value=0.032), and was significantly higher in Makao-Linganga than in Ndjubé (Tukey: P value=0.45). There were no other significant differences between villages (Table 5). The value of modern goods (see Table for list of modern goods) per Kaka household was also significantly different between villages (ANOVA: $F_{2, 100}=6.008$, P value=0.003), higher in the Kaka village with conservation and forestry, Makao-Linganga than the villages without conservation and forestry, although not significantly different between villages without conservation and forestry (Tukey: P value=0.990) (Table 5).

In contrast to farmer-fisher households, there was no evidence for a significant difference in the market value of all possessions per Aka household between villages (ANOVA: $F_{3, 177}=0.920$, P value=0.433). Only when the value of modern equipment per household in the two villages with conservation and forestry were combined and compared to the villages without conservation and forestry it was evident that the value of modern equipment (mattress, torch and radio) per Aka household was higher in the villages with conservation and forestry than the villages without conservation and forestry (MW: $\chi^2=17.61$, P value=0.001) (Table 5). It was also apparent in villages with conservation and forestry that traditional household assets, such as water containers made from seeds (*tombo*) and hunting nets (*bokia*) had been abandoned.

When Aka hunting equipment per household was compared to data collected prior to the conservation project (Kitanishi 1995), it was evident that the percentage of Aka men owning spears, crossbows, snares and hunting nets has decreased in villages with conservation and forestry but remains high for villages without conservation and forestry (Table 5). In particular, net hunting reduced substantially more than other hunting techniques in villages with conservation and forestry, while wire snares reduced in Makao-Linganga.

Table 5
Quantified results for household material assets between villages, major ethnic groups and, where possible, gender

Indicator		Treatment villages			Control villages			
		Makao-Linganga		Sombo	Likombo-Zingo		Ndjubé	
		Kaka	Aka	Aka	Kaka	Aka	Bondongo	Aka
Physical capital	Mean market value of measured household goods/household ^a	USD 538.6	USD 97.4	USD 101.5	USD 359.0	USD 93.5	USD 363.6	USD 108.9
	Mean market value of modern goods/household ^b	USD 100.0	USD 8.3	USD 10.8	USD 24.9	USD 3.1	USD 29.9	USD 2.7
Physical capital – Aka hunting weapons	Net	1991/1992 30	2007/2008 6	2007/2008 14	1991/1992 39	2007/2008 54	2007/2008 54	
	Spear	94	62	64	90	97	97	
	Crossbow	85	24	14	16	14	14	
	Nylon snare	NA	44	41	29	51	51	
	Wire snare	50	3	14	48	54	54	
Financial capital	Mean cash per household	USD 65.9	USD 1.3	USD 2.8	USD 60.7	USD 0.3	USD 26.6	USD 0.7
	Percentage of indebted households	73.0	45.2	72.1	27.0	17.9	27.0	48.0
	Mean debt of indebted households	USD 75.8	USD 8.7	USD 3.6	USD 10.0	USD 1.3	USD 20.8	USD 2.8

As well as greater physical capital, households within villages with conservation and forestry were hypothesised to have greater financial capital (hypothesis 6). This hypothesis was based on the increased availability of salaried employment and increased access to markets due to roads in villages with conservation and forestry. However, when analysed in terms of cash-in-household, there was no significant difference between the average finances of farmer-fisher households between villages (KW: $\chi^2=0.779$, P value=0.677) (Table 5). Nevertheless, when only households with cash were analyzed, the Kaka village with conservation and forestry (Makao-Linganga) and one village without conservation and forestry (Likombo-Zingo) had significantly higher cash per cash-holding households than the Bondongo households of Ndjubé (KW: $\chi^2=6.370$, P value=0.041). Mean household debt was significantly higher in the Kaka villages with conservation and forestry than the villages without conservation and forestry (KW: $\chi^2=28.649$, P value<0.001). Debt was greater in both extent and depth in the Kaka village with conservation and forestry, with over 70% of farmer-fisher households holding debt.

Farmer-fishers also use livestock as a financial capital store. While there were no significant differences in poultry ownership between villages (KW: $\chi^2=1.223$, P value=0.542), farmer-fishers households in the village with conservation and forestry owned fewer goats and sheep than other villages (KW: $\chi^2=28.537$, P value<0.001).

Aka households in the villages with conservation and forestry appeared to have more cash in their households at the time of the questionnaire than in 1993, although this was not significantly different (KW: $\chi^2=4.203$, P value=0.240). However, debt (*yungo*) relations between Aka and farmer-fishers in the villages with conservation and forestry are more extensive, with a higher proportion of indebted households ($\chi^2=9.441$, P value=0.024), and deeper, with a higher level of debt than in 1993 (KW: $\chi^2=19.896$, P value<0.001).

Reasons for changes in livelihood activities, strategies and capitals

Livelihood activities and strategies

The results highlight significant shifts in livelihood activities and strategies by both the Kaka and Aka in villages with conservation and forestry. This shift was less evident in villages without conservation and forestry, supporting hypothesis 1, that there would be a greater reported change in livelihood activities in villages with conservation and forestry compared to villages without conservation and forestry. Overall these results support hypothesis 2, that there would be a shift away from forest-based subsistence livelihood strategies towards a stronger engagement in the village economy, in villages with conservation and forestry, but not control villages. This was the case for both farmer-fishers and Aka. Both groups now spend less time practicing livelihood activities in the forest, and both groups reported extracting higher harvests of bushmeat and other NTFPs from the forest on a more frequent commercial basis.

During the questionnaire, Kaka households attributed this change in livelihood strategy to the availability of village-based employment (over 50% of responses), village modernization, and increased commercialisation of forest products. The Kaka effectively reoriented their livelihoods to more profitable village-based economic activities and formal employment. However, conservation regulations did play a role in this change, for example, the reduction in wire snare hunting among Kaka of Makao-Linganga. Although there was a lack of change in gun hunting among the Kaka, this is because farmer-fishers themselves do not spend much time hunting, preferring to send the Aka hunting with their shotgun.

In villages without conservation and forestry, although there wasn't a significant shift in livelihood activities, villagers reported a re-orientation in their livelihood activities towards sales rather than purely subsistence. For women, this included an increase in the market for mats and baskets, which they related to the more frequent river traffic. According to villagers the Motaba River traffic has gradually increased since the mid-1990s, due to a rise in the number of traders (small commerce) and, more recently, the establishment of Sombo forestry town. Other respondents noted a significant increase in demand for agricultural and forest products from this river traffic. One farmer-fisher respondent explained, "Today we would rather work hard and go hungry in order to sell all of our produce to passers-by on the Motaba [River]. Before [early 1990s] we would fish and make a field just to eat".

Changes in Aka livelihood activities and strategies were more evident than changes in Kaka livelihoods (Table 4), supporting hypothesis 7, that livelihood changes will be expressed differently between these two groups. These shifts were most evident in men's livelihood activities. This is due to the effect of conservation regulations on hunting, a male dominated activity, and the increase in village-based activities which men orientated themselves towards. Although not evident in Table 4, Aka men also reported filling the gap in supply of palm by tapping palm wine trees around the village and selling palm wine to Kaka men in Makao-Linganga (100 CFA/l³, USD 0.022).

The shift in livelihood activities is indicative of the increasingly sedentary nature of Aka in villages with conservation and forestry. In the questionnaire, Aka in Makao-Linganga and Sombo cited the availability of employment and development of the village most as reasons for this change (76% of responses), while reduction in forest resources and conservation regulations were only mentioned by 8% and 4% of households respectively. Informally, opinions among the Aka for the reasons behind this shift were divided along the axes of gender and age. Aka women complained that their husbands wanted to spend more time in the village in order to carry out 'jobs' (cash-for-labour) for farmer-fishers so that they could drink. Many Aka men (and some women) were addicted to *lotoko* (cassava-based local liquor). Aka women argued that they preferred life in the forest compared to men, and women often initiated longer forest trips. This is potentially linked to the fact that Aka women contribute

the most to household production (up to 80%) in forestry towns compared to in the forest where contributions are more equal (Bienvenue Kimbembe pers. comm. 2008).

In the forest campfire discussions invariably led to complaints among Aka men about conservation regulations and how the increased use of gun-hunting for farmer-fishers means less meat is available for members of the *lango*. Older Aka men argued that the shift was because ‘the forest doesn’t give like it used to’, referring to the lack of wildlife and other resources close to the villages. Younger Aka men on the other hand often teased their parents, saying, “would you ever see a young Aka man spear-hunting today!” However, these same young and middle-aged men reiterated that employment was a critical reason for this change. An Aka man explained:

“We saw that it was better to stay close to the village. When there was work we would know, and some of us decided just to stay in the village for work. The project told us to leave our hunting and the forest and to work for them. To modernize.”

Although changes in livelihood activities were not as apparent in villages without conservation and forestry, the shift in Ndjubé towards independent agricultural activities is interesting. Aka explained that this was a result of the different, reportedly less repressive, farmer-fisher-Aka relations in Ndjubé compared to those in Kaka-Ikenga villages. These relations had been influenced by the politics of the Ndjubé village chief who ensured that everyone in the village worked for themselves.

Among both the Kaka and Aka there was an underreporting of the role of conservation in livelihood change, particularly during the household survey. This is most likely related to response bias. Although the primary researcher lived in the village and was disassociated with the conservation project, *mondelés* (white people) were often locally-associated with the conservation project. Results obtained informally show that for the most part the Kaka did not see conservation regulations as a major driver in this change, as they had come to the village through choice due to employment and commercial opportunities. However, this was not the case for the Aka who informally reported conservation activities to be a major force driving changes in their livelihoods.

Natural capital

The results offer strong support for hypothesis 3 that households in villages with conservation and forestry had reduced access to natural resources compared to villages without conservation and forestry. The research showed that the creation of NNNP in 1993, which prohibited elephant hunting practiced previously by the population of Makao-Linganga in the *bais* (forest clearings), partly explains the reduction in the use of space highlighted in Figure 3. Villages without conservation or forestry were affected by this change.

In addition, enforcement of regulations of snare hunting, have led to a perceived lack of meat among the Aka. Snare hunting provided 75% of meat to the Aka in 1991–1992 (Kitanishi 1995). The Aka informally blamed the prohibition of large mammals and snare hunting for increased Aka engagement

in village-based gun hunting that is occurring with increasing frequency. As ecoguards are not present in villages without conservation or forestry, members of these villages do not bear these opportunity costs.

In villages with conservation and forestry the sustainability of the use of NTFPs, including wildlife, is increasingly questionable. The Makao-Linganga population use less forest (Figure 3), and in Congolese formal law local populations and immigrants have equal rights to NTFPs (Poulsen et al. 2007). The ICDP’s primary focus on preserving the integrity of NNNP and the key conservation species in the buffer zone meant it was poorly placed to establish sustainable resource management practices for common species of livelihood value.

Human capital

There was some evidence that there had been an improvement in human capital in the villages with conservation and forestry, supporting hypothesis 4. However, the most significant change was the change in labour relations, substantially altering households’ labour availability. The elevated education level of Kaka in Makao-Linganga was due to the inclusion of ranger and forestry worker families in the survey, who were chiefly educated outside of the village, rather than any improvements in the education system in Makao-Linganga *per se*. Among the Aka, a village without conservation and forestry, Ndjubé, had the highest level of education as the village chief assures that Aka children attend the primary school for the whole term. Although the ICDP built a school building in Makao-Linganga, and there are regular environmental education (Club Ebobo) classes, no Aka children attended the school for a full term in 2007–2008. However, in the other village with conservation and forestry, Sombo, two new schools have recently been built by THANRY-Congo, one that is purely for the Aka of Sombo.

Perhaps the most interesting contemporary change in human capital in villages with conservation and forestry was the transformation in labour relations. Prior to conservation and forestry Aka labour was remunerated by farmer-fishers with alcohol, food and marijuana. Aka worked for their *nkumu* for 4–6 months a year particularly during field-clearance and planting between December and March. Today, the results show that Aka have become more accustomed to fee-for-service work, and cash payments are preferred over exchange goods. This shift is due to the introduction of the cash economy in villages with conservation and forestry. This was catalysed by the introduction of salaries by the conservation project in 1993, and dramatically exacerbated by commercial forestry economy in 2001. Farmer-fishers’ low remuneration of Aka labour in this contemporary context is an effort to control Aka labour, to prevent access to market goods, and to establish debt relations. They know that small notes and coins (100–500 CFA) paid to the Aka are often spent on alcohol and cigarettes, whereas larger notes, only really accessible through formal employment (1500 CFA and more) are used for market goods that contribute to household wellbeing. One farmer-fisher explained, “If we pay them with money like 2000 CFA (USD 4.4) they can buy what they want and won’t

need us. We prefer they come to us when they need things like machetes and mosquito nets, and they work for us”.

It is worthwhile noting that Aka’s new social relations in forestry towns, though more financially rewarding, do not provide the same security function if Aka are ill or in need. For this reason, many Aka acted to maintain their village *nkumu* relationship. These changes in labour relations are not as apparent in villages without conservation and forestry. They are the result of two opposing forces at play: the emancipation of the Aka due to their access to cash through formal employment, versus the increasing needs and desires of farmer-fishers for Aka labour and NTFPs to meet market opportunities. A Kaka man summarized the change, “Often now you see farmer-fishers telling the Aka to work in the middle of the day when the sun is hot on their backs. In the past you would never see this in the village, we were one family”.

Social capital

There was evidence that conservation and forestry had a direct impact on social capital in villages with conservation and forestry. This appeared to occur to the detriment of the Aka, who were more vulnerable to contemporary change, supporting hypothesis 5 that changes would be to the detriment of more vulnerable groups. Changes in social capital were predominantly due to the formation of a new power block composed of rangers and families of forestry workers in villages with conservation and forestry. In effect, rangers, using the conservation rationale, have replaced the customary power held previously by Kaka and Aka hunters. Customary power in this case was represented among the Aka by the specialist position ‘*tuma*’—great elephant hunter. This position was highly respected in Aka society (Lewis 2002). It has largely been abandoned in villages with conservation and forestry. In the case of Kaka men, the decline in the practice of the *Ginaro* sacred forest, which was directly linked to men’s hunting activities, is representative of the break-down of this customary institution. In villages with conservation and forestry, hunting has been conceptualized by the conservation project in terms of rational science. This new discourse emphasises ‘sustainability’, and effectively de-legitimizes local belief systems. In villages without conservation and forestry the sacred *Ginaro* forest is still intricate to the Kaka’s belief system, and the position *tuma* still exists among adult Aka men. The message received by the populations of conservation and forestry villages is that all hunting, even with traditional techniques, is poaching.

In Makao-Linganga, the conservation project has also reinforced pre-existing relations between Aka and Kaka, largely in favour of Kaka livelihood activities. This has influenced the relationship between the Aka and Kaka. This occurred because the rangers, who are all Bantu, were constrained in their actions towards other villagers by their social obligations and their integration within the Makao-Linganga community. Both the Kaka and Aka constantly re-positioned themselves to best benefit from this evolving dynamic. The Aka’s relationship with the Kaka is a constant discussion point among the Aka.

Conversations focused on the unfair behaviour of certain farmer-fishers and immigrants in forestry towns. Aka did not show an inherent preference for being ‘independent’ from their traditional *nkumu* relation with farmer-fishers, but rather were constantly concerned with how best to take advantage of the changing circumstances in order to gain access to cash, materials, or favourable social relations.

In addition to the direct impacts of conservation, more fundamental changes in social capital in villages with conservation and forestry, not apparent in villages without conservation and forestry, have occurred due to indirect knock-on effects of joint conservation and forestry. In villages with conservation and forestry, the size and dynamics of Aka forest camps has been completely transformed, which has not occurred in villages without conservation and forestry. The process of reduction in the size of the camp is linked to reduction in activities such as net hunting and spear hunting which Guillaume (2001) and Kitanishi (1995) suggest are synergistic due to the need for large hunter group size if the activity is to be successful. These changes are related to the orientation of Aka livelihoods towards village-based activities combined with the prohibition of hunting of large mammals that requires large mobile Aka groups.

Physical and financial capital

In villages with conservation and forestry, farmer-fishers were better able to accumulate both physical and financial capital. This is due to their ability to access formal employment and commercial opportunities, and their delayed-return system of production mean that they accumulate physical capital. However, farmer-fishers in villages with conservation and forestry also had increased levels of debt. This was linked to the proliferation of moneylenders and availability of modern goods in villages with conservation and forestry. Moneylenders were mostly salaried employees of conservation and commercial forestry, and businessmen in Sombo forestry town.

The low sheep and goat ownership in conservation and forestry villages was blamed locally on a leopard (*Panthera pardus*) that had attacked and killed over twenty-five goats and sheep in Makao-Linganga between 2006 and 2008. The fact that they could not hunt the leopard due to the conservation project discouraged people from continuing with raising livestock.

While the accumulation of physical and financial capital lends some support to hypothesis 6, that villages with conservation and forestry would have great physical and financial capital, this was not the case among the Aka. The Aka did not accumulate more capital when measured in terms of the market value. Bahuchet (1990) argues that Aka do not customarily accumulate financial and physical capital. There was a lower proportion of wire snares in villages with conservation and forestry due to the strict enforcement of conservation regulations. However, Aka in villages with conservation and forestry did accumulate more modern goods than Aka households in villages without conservation and forestry. Interestingly, mean household debt was highest in Makao-Linganga where Aka-*nkumu* relations continue, and

debt is entrenched, compared to Sombo where Aka form new relations with non-*nkumu* forestry workers.

DISCUSSION

This paper has analysed the livelihood impacts of biodiversity conservation activities and commercial forestry on several communities in northern Congo. The aim was to better understand the nature of these impacts, and demonstrate the importance of analysing conservation-related livelihood change in relation to the suite of factors that influence rural livelihoods in the region. While the case study demonstrates some clear links between conservation activities and the resulting livelihood impacts, the suite of direct and indirect impacts of commercial forestry appeared to be the key driver of livelihood change in these communities.

The article highlights that the enforcement of conservation rules and regulations is only one of several changes to the structures and processes in which peoples' livelihoods are situated. The effects of new market forces due to roads and forestry sites, and increasing pressure on natural resources, act together to structure peoples' livelihood activities, strategies, and mediate access to various capitals. It is unwise to assign simple causal links in these contexts, as people are constantly adapting to these changes and to the knock on transformations in the socioeconomic context. However, there were clear differences in the livelihood impacts of the two main social groups—the Aka and the farmer-fishers and these impacts have implications not only for peoples' livelihood security and their use of the forest, but for the manner in which conservation practitioners might support peoples' livelihood activities and encourage the sustainable use of forest resources.

Impacts of conservation and commercial forestry on livelihood activities and strategies

The livelihood activities and strategies of those households in villages with conservation and forestry had changed substantially more than villages without conservation and forestry. Shifts in Aka livelihood activities, in particular Aka men's livelihoods, were particularly evident. Changes in livelihood activities were predominantly due to the injection of cash into the local economy from conservation employment and commercial forestry operations. While the enforcement of conservation regulations limited livelihood options in villages with conservation and forestry, this was of secondary importance compared to the effect of these economic transformations.

The result of these changes is that both the Kaka and the Aka have become more sedentary in conservation-forestry towns. However, although changes in the local economy appeared to be the primary force driving livelihood change, conservation regulations also acted to structure peoples' livelihoods. In particular, both the Kaka and Aka previously used the area within NNNP for itinerant hunting and fishing (Figure 3), and particularly elephant hunting, but were prevented from

this use due to the park creation. This reduced the mobility of the Makao-Linganga Aka as they were prohibited from crossing the Upper Motaba watershed, a historical route through NNNP to Bayanga in which they have extensive kinship relations (Kretsinger and Hardin 2003). The debate as to whether or not this equates to physical displacement is constrained by the emphasis on the displacement of permanent dwellings. For example, Curran et al. (2009: 37) explain that "there are no signs of recent permanent habitation within the area of the park". However, if we apply Redford and Fearn's (2007: 5) definition of physical displacement—"the involuntary physical removal of peoples from their historical or existing home areas as a result of actions by governments or other organizational actors"—a case for physical displacement could be made, as both the Aka and Kaka identify the area of NNNP as part of their historical and existing home area. Furthermore, the case for economic displacement, which the World Bank defines as a 'loss of income sources or means of livelihood, whether or not the affected persons must move to another location' (Cernea 2006: 14), is clear. This has occurred both for past users of the national park area, and for the users of the area around NNNP.

This paper therefore provides some evidence for physical displacement, which is conditional upon using a more appropriate definition for semi-nomadic peoples' livelihood systems and customary land use. The results present strong evidence for economic displacement. However, although conservation acted as a push from the forest through the creation of high opportunity costs, these opportunity costs were offset to some degree by the availability of economic opportunities in the village space created by conservation and commercial forestry. This means that the question as to whether shifts in livelihood strategy and forest use highlighted in this paper were out of choice or necessity is crucial. The increasing sedentism of Aka elsewhere in northern Congo, such as in Ouesso forestry town, has been attributed to reductions in forest resources available to Aka, and the devastating livelihood impact of conservationists' activities (Lewis 2001). However, Kretsinger and Hardin (2003: 140) have shown that historically the Aka have followed and settled near available employment and other economic opportunities, a phenomenon the authors refer to as 'to vote with one's feet'. In comparable contexts in the region where biodiversity conservation is absent, increasing sedentism, individualization, the creation of debt relations, and increased alcohol consumption in Aka communities have all been linked to heightened Aka engagement in growing farmer-fishers economies rather than conservation *per se* (Bahuchet and Guillaume 1982; Kitanishi 2006). In this case study it was clear that young Aka men chose to spend more time in forestry towns and villages, as the attractions of forestry towns and affected villages act as a pull towards village-based life. The divisiveness of debt relations and alcohol tie them to village life, and generate conflicts between Aka men and women, the latter of whom often prefer forest-based life. However, many Aka men actually felt they were forced to the village due to the enforcement of Congolese hunting regulations. While this

was also true of Kaka elephant hunters, overall changes in Kaka livelihood strategy were mostly a voluntary shift in order to benefit from new economic opportunities.

Therefore, as Curran et al. (2009) argue, the impacts of conservation-related displacement need to be understood in the context of the other major land-use changes occurring in the region. Specifically in this case study, the socioeconomic transformations related to commercial forestry, Aka's relationship with their Bantu neighbours, and shifts in the institutional setting, all act to influence peoples' livelihood strategies and decision-making. Nevertheless, while it is important to understand whether displacement has occurred or not, it is more important to thoroughly understand the subtle socioeconomic impacts of conservation and other land-use changes. These include some of the resulting feedback effects illustrated in this article, which can be extremely damaging to rural lives and livelihoods, and that are rarely documented in the conservation literature. While other studies from neighbouring Central African Republic and Cameroon already illustrate the high opportunity costs associated with conservation, and the enclosure effect of conservation regulations combined with commercial forestry (Nguiffo 1998; Hodgkinson 2009), few assess the local level outcomes in detail. Although Cernea (2006) recognises that economic displacement, or the 'second debate', can be as damaging as forced expulsion, our lack of longitudinal livelihood data associated with conservation projects is still a major barrier to improving the design and implementation of a conservation approach that supports rural peoples' livelihoods.

Impacts of conservation and commercial forestry on peoples' capital and the implications for livelihood security

Previous studies have analysed commercial forestry as an industry, focusing on levels of employment generated, provision of community-level services, and the division of forestry revenue (Logo 2010). In this paper, the use of the sustainable livelihoods approach, which conceptualises assets as the basis of a livelihood platform, permitted an in-depth analysis of socioeconomic changes on the household-level beyond those individuals directly involved in the industry. The use of this approach illustrated that commercial forestry is representative of a variety of forces from a local perspective. These forces extend beyond the visual impacts such as roads, in-migration and immigration, and employment, and include commoditization of forest resources, and substantial changes in social and labour relations linked to changes in the economy.

In villages with conservation and forestry, farmer-fishers appear better positioned to benefit from these changes through their accumulation of physical and financial capital, and their relatively better access to formal employment and commercial opportunities. Aka, on the other hand, appear to be less well positioned to benefit from the economic changes linked to commercial forestry. In turn, the negative impacts of conservation were clustered within households' natural

and social capital. These capitals are important to both Aka and farmer-fishers, but access to natural capital is of central importance to livelihood strategies of the Aka. Their exchanges with outside groups, and their identity first as peoples of the forest is based on access to these capitals (Guillaume 2001; Lewis 2002). Therefore although the replacement of natural capital for financial capital appears more feasible for the Kaka, it has a damaging effect on Aka livelihood security.

This case study highlights that there are significant and previously underreported socioeconomic transformations resulting from the combination of commercial forestry and conservation-related economic displacement that extend beyond Cernea's (2006) second debate. These include, for example, the reduction in the size of the Aka forest camp, changes in hunting techniques and hunting patterns, altered labour relations, poor health, low school attendance, addiction to alcohol and marijuana, and marginalisation of customary institutions. These indirect changes are significant because they are subtle, pass easily unnoticed to the outsider, but, in effect, structure how resource divisions and decision-making occur among individuals, households and communities. West et al. (2006: 265) refer to these complex, livelihood-moderating factors as the "subtle but profound local social effects of the creation of nature and environment."

An example was the observed changes in the dynamics of Aka forest camps. The camp, or *lango*, is a particularly important unit of sharing, consumption and production (Woodburn 1982). Bahuchet and Guillaume (1982) show that the reduction in camp size (number of members) is related to a process of individualization that involves the disintegration of former associations between lineages, usually caused by integration of Aka into village economies. This process leads to a reduction in collective activities and the accumulation of modern goods by individual exchange and means (Bahuchet and Guillaume 1982). In southern Cameroon, for example, Aka now sell bushmeat to one another rather than sharing among members of the forest camp (Kitanishi 2006). As mid-age adults in Aka camp supply the majority of food to dependents such as the elderly and children (Bahuchet 1990), camp break-down has serious implications for the food security of the most vulnerable individuals.

Broader implications and recommendations

This article depicts some of the impacts of the rapid introduction of the monetary economy into previously isolated forest communities. While one social group, the Kaka, are able to adapt their livelihoods, the development opportunities for the other, the Aka, do not appear to be sustainable. The results illustrate that although the immediate impacts of conservation-related livelihood change may be slight, the actual livelihood impacts will depend on the context and livelihood space into which people are economically displaced, or move into. Conservation efforts in sub-Saharan Africa increasingly operate within landscapes with large-scale extractive industries and developments—mining, commercial forestry, biofuel

development and commercial agriculture—activities that will increasingly influence peoples' livelihood space.

As large-scale extractive industries continually transform the economic context of rural communities in sub-Saharan Africa, conservation projects themselves are becoming increasingly influenced by neo-liberalism (Adams and Hutton 2007). In many cases biodiversity conservation projects now aim to de-link resource dependent livelihoods from natural resource use, through payment schemes (direct payments for conservation, and Payments for Ecosystem Services projects) which potentially introduce large amounts of cash into subsistence rural economies. Without generating a thorough understanding of local livelihood systems, and integrating local people into the design of the project, it is difficult to see how the outcomes of these projects will differ from the results presented in this paper in context of northern Congo. However, O'Neill and Muir (2010) illustrate that conservation projects rarely invest sufficiently in monitoring project performance. The authors show that for every dollar spent on conservation, Results-Based Management (RBM) guides only 10-30 cents, and only approximately 5% of projects go through the full project design-implement-adapt cycle. With this in mind, contemporary conservation projects operating in similar contexts would benefit from: 1) placing more emphasis on understanding local livelihood systems prior to project intervention, and frequently monitoring their livelihood impacts; 2) recognising those capitals that are not always of a replaceable or exchangeable form, and that mechanisms mediating access to these capitals are constantly changing; and 3) involving community members in the design of suitable livelihood interventions and natural resource management plans.

Putting these recommendations into practice in northern Congo would require undertaking a similar assessment of the local value of natural capital and how this value differs between households and social groups. This could be achieved using the results here as a baseline, and using a similar combination of methods. The goal should be to generate a monitoring protocol for the systematic collection of long-term longitudinal livelihood data to generate the information required to understand how to support rural livelihoods in these contexts, and to influence policy makers. Conservation efforts in northern Congo would also benefit from adopting participatory approach to development and local conservation policy, which would involve gaining local consent, and participation in project design and monitoring. There is a wealth of participatory techniques that can be used for this purpose (Pretty et al. 1995). The approach should be disaggregated for farmer-fishers and Aka, and for gender and age, in order to understand diverse local needs. Initiating this process would require accepting that trade-offs will be required. For example, it is likely that this would include ensuring and maintaining Akas' access to the forest space, inclusive of the space within NNNP. However, as Aka will increasingly settle in forestry towns, it will be essential that their access to education and health services be improved. Without formal education, Aka will struggle

to participate in formalised contemporary natural resource management schemes in the region.

CONCLUSION

Conservation efforts in sub-Saharan Africa often occur in rapidly changing contexts due to the rise in large-scale extractive industries, infrastructure projects and other land use changes. The resulting socioeconomic transformations rapidly alter the local economy, affecting peoples' access to the capitals that are critical to their livelihoods. When conservation efforts occur within these contexts, the impacts of conservation-related economic displacement can be exacerbated due to changes in peoples' livelihood space. These subtle livelihood changes should be at the centre of conservation-development policy debates. This requires sound initial understandings of affected communities, the establishment of long-term livelihood monitoring systems, and the meaningful involvement of affected communities in monitoring and project design.

ACKNOWLEDGEMENTS

Acknowledgements are due to ESRC-NERC who funded this research. I would like to thank all those who commented on a final draft of the paper, including John Poulsen, Simon Batterbury, Patricia Daley, Fiona Maisels, Julie Baker, Lindsay Stringer, and Rob Harley. I am also grateful to the four anonymous reviewers for their comments and additions which I hope have improved the paper.

Thanks also go to the communities in which I worked—for their support of the research, and to the Congolese research assistants: Henri Obondo, Kambeolo Frank Herve, Dangay Larcon and Massongue. In addition, thanks to all the WCS and MEFE staff who supported the research.

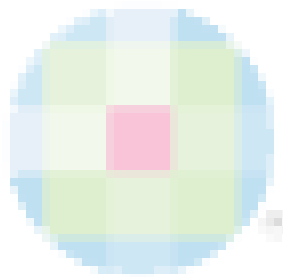
REFERENCES

- Adams, W.M. 2004. *Against extinction: the story of conservation*. London: Earthscan.
- Adams, W.M. and J. Hutton. 2007. People, parks and poverty: political ecology and biodiversity conservation. *Conservation and Society* 5: 147–183.
- Adams, W.M. and C.C. Megaw. 1997. Researchers and the rural poor: asking questions in the third world. *Journal of Geography in Higher Education* 21: 215–119.
- Agrawal, A. and K. Redford. 2006. Poverty, development, and biodiversity conservation: shooting in the dark? In: *Wildlife Conservation Society working paper No. 26* (eds. Agrawal, A. and K. Redford). 1st edition. New York, NY: Wildlife Conservation Society.
- Aronson, J. 1994. A pragmatic view of thematic analysis. *The Qualitative Report* 2: 1–3.
- Ashley, C., J. Elliott, G. Sikoyo, and K. Hanlon. 1999. *Handbook for assessing the economic and livelihood impacts of wildlife enterprises*. Nairobi: African Wildlife Foundation.
- Bahuchet, S. 1990. Food sharing among the pygmies of Central Africa. *African Study Monographs* 11: 27–53.
- Bahuchet, S. and H. Guillaume. 1982. Aka-farmer relations in the northwest Congo Basin. In: *Politics and history in band societies* (eds. Leacock, E. and R. Lee). 1st edition. Pp. 189–211. Cambridge: Cambridge University Press.
- Brockington, D. 2002. *Fortress conservation: the preservation of Mkomazi Game Reserve, Tanzania*. Oxford: Indiana University Press.

- Brockington, D., J. Igoe, and K. Schmidt-Soltau. 2006. Conservation, human rights and poverty reduction. *Conservation Biology* 20: 250–252.
- Carney, D. 1998. Implementing the sustainable rural livelihoods approach. In: *Sustainable rural livelihoods: what contribution can we make?* (ed. Carney, D). 1st edition. London: Department for International Development.
- Carver, R.H. and J.G. Nash. 2009. *Doing data analysis with SPSS®: Version 16.0: Version 16*. Belmont, USA: Brooks/Cole.
- (CBFP) Congo Basin Forest Partnership. 2006. *The forests of the Congo Basin: the state of the forest 2006*. Washington, DC.: The Congo Basin Forest Partnership.
- Cernea, M. 2006. Re-examining “displacement”: a redefinition of concepts in development and conservation policies. *Social Change* 36: 8–35.
- Cernea, M.M. and K. Schmidt-Soltau. 2006. Poverty risks and national parks: policy issues in conservation and resettlement. *World Development* 34: 1808–1830.
- Chambers, R. 1994. Participatory rural appraisal (PRA): challenges, potentials and paradigm. *World Development* 22: 1437–1454.
- Chambers, R. 1997. *Whose reality counts? Putting the first last*. London: Intermediate Technology Publications.
- Chambers, R. and G. R. Conway. 1991. Sustainable rural livelihoods: practical concepts for the 21st century. *IDS Discussion Paper* 296: 1–29.
- Coad, L., A. Campbell, L. Miles, and K. Humphries. 2008. The costs and benefits of forest protected areas for local livelihoods: a review of current literature. In: *UNEP Working Paper*. Cambridge: UNEP World Conservation Monitoring Centre.
- Cotula, L., S. Vermeulen, R. Leonard, and J. Keeley. 2009. *Land grab or development opportunity? Agricultural investment and international land deals in Africa*. London: International Institute for Environment and Development (with FAO) and International Fund for Agricultural Development.
- Curran, B., T. Sunderland, F. Maisels, J. Oates, S. Asaha, M. Balinga, L. Defo, et al. 2009. Are Central Africa’s protected areas displacing hundreds of thousands of rural poor? *Conservation and Society* 7: 30–45.
- De Haan, L. and A. Zoomers. 2005. Exploring the frontiers of livelihoods research. *Development and Change* 36: 27–47.
- Devereux, S. B. Vaitla, and S.H. Swan. 2008. *Seasons of hunger*. London: Pluto Press.
- Ellis, F. 2000. *Rural livelihoods and diversity in developing countries*. Oxford: Oxford University Press.
- Foerster, S. D.S. Wilkie, G.A. Morelli, J. Demmer, M. Starkey, P. Telfer, and M. Steil. 2011. Human livelihoods and protected areas in Gabon: a cross-sectional comparison of welfare and consumption patterns. *Oryx* 45(3): 347–356.
- Grandin, B. 1988. *Wealth ranking in smallholder communities: a field manual*. London: Intermediate Technology Publications.
- Guillaume, H. 2001. *Du miel au café, de l’ivoire à l’acajou: La colonisation de l’interfluve Sangha-Oubangui et l’évolution des rapports entre chasseurs-collecteurs pygmées Aka et agriculteurs (Centrafrique, Congo) 1880-1980*. Paris: Peeters Press.
- Guyer, J.I. 1981. Household and community in African Studies. *African Studies Review* 24: 87–137.
- Hampshire, K. and S. Randall. 2005. People are a resource: demography and livelihoods in Sahelian FulBe of Burkina Faso. In: *Rural resources and local livelihoods in Africa* (ed. Homewood, K.). 1st edition. Pp. 123–136. Oxford: James Currey.
- Harvey, D. 2010. *The enigma of capital and the crises of capitalism*. New York, NY: Oxford University Press.
- Hodgkinson, C. 2009. *Tourists, gorillas and guns: integrating conservation and development in the Central African Republic*. Ph.D. thesis. University College, London, UK.
- Igoe, J. 2006. Measuring the costs and benefits of conservation to local communities. *Journal of Ecological Anthropology* 10: 72–77.
- Kitanishi, K. 1995. Seasonal changes in the subsistence activities and food intake of the Aka hunter-gatherers in northeastern Congo. *African Studies Monographs* 16: 73–115.
- Kitanishi, K. 2006. The impact of cash and commoditization on the Baka hunter-gatherer society in southeastern Cameroon. *African study monographs* 33: 121–142.
- Kitchin, R. and N.J. Tate. 2000. *Conducting research in human geography*. Essex: Pearson Education Limited.
- Kretsinger, A.L. and R. Hardin. 2003. Watershed, weddings and workforces: migration, sedentarization, and social change among the Baaka of southwestern Central African Republic. *African Study Monographs* 28: 123–141.
- Laporte, N.T. J.A. Stabach, R. Grosch, T.S. Lin, and S.J. Goetz. 2007. Expansion of industrial logging in Central Africa. *Science* 316: 1451.
- Lewis, J. 2001. Forest people or village people: whose voice will be heard? In: *Africa’s indigenous peoples: ‘first peoples’ or ‘marginalized minorities’?* (eds. Barnard, A. and J. Kenrick). 1st edition. Edinburgh: Centre of African Studies.
- Lewis, J. 2002. *Forest hunter-gatherers and their world: a study of the Mbendjele Yaka Pygmies of Congo-Brazzaville and their secular and religious activities and representations*. Ph.D. thesis. London School of Economics, London, UK.
- Logo, P.B. 2010. Governance of decentralized forest revenue in Central Africa: for better or for worse? In: *Governing Africa’s forests in a globalized world* (eds. German, L.A., A. Karsenty, and A.M. Tiana). 1st edition. Pp. 174–186. London: Earthscan.
- Madzou, Y.C. and V. Yako. 2000. *Caracteristiques Socioeconomiques de Makao-Linganga*. GTZ Report. Brazzaville: GTZ.
- Maisels, F. and B. Djoni-Djimbi. 2001. Nouabalé-Ndoki National Park, Republique du Congo. Management Plan. Brazzaville, Wildlife Conservation Society.
- Maisels, F., T. Sunderland, B. Curran, K. Loebenstein, J. Oates, L. Usongo, A. Dunn, et al. 2007. Central Africa’s protected areas and the purported displacement of people: a first critical review of existing data. In: *Protected areas and human displacement: a conservation perspective* (eds. Redford, K.H. and E. Fearn). New York: Wildlife Conservation Society Working Paper No. 29.
- (MEF) Ministère des Eaux et Forêts. 1983. *Définissant les conditions de la conservation et de l’exploitation de la faune sauvage*. Government report. Brazzaville: Ministère des Eaux et Forêts.
- Nguiffo, S.A. 1998. In defense of the commons: forest battles in southern Cameroon. In: *Privatising nature: political struggles for the global commons* (ed. Goldman, M.) 1st edition. Pp. 102–119. London: Pluto Press.
- O’Neill, E. and M. Muir. 2010. Performance measurement in the conservation community. In: *Measuring conservation effectiveness summit*. Organised by the Conservation Measures Partnership. Palo Alto. May 5th–6th, 2010.
- Ormsby, T, E.J. Napoleon, R. Burke, C. Groessler, L. Bowden. 2010. *Getting to know ArcGIS Desktop*. New York Street, CA: ESRI Press.
- Poulsen, J.R. C.J. Clark, and G.A. Mavah. 2007. Wildlife management in a logging concession in northern Congo: can livelihoods be maintained through sustainable hunting? In: *Bushmeat and livelihoods* (eds. Davies, G. and D. Brown). 1st edition. Pp. 140–157. Oxford: Blackwell Publishing.
- Redford, K. and E. Fearn. 2007. Protected areas and human displacement: A conservation perspective. New York, NY: Wildlife Conservation Society Working Paper No. 29.
- Riddell, M. 2005. Community attitudes around Nouabalé-Ndoki National Park. M.Sc. Thesis. Oxford University, Oxford, UK.
- Roe, D., F. Nelson, and C.E. Sandbrook. 2009. Community management of natural resources in Africa: impacts, experiences and future directions. IIED Report. London: International Institute for Environment and Development.
- Schmidt-Soltau, K. 2003. Conservation-related resettlement risks in Central

- Africa: environmental and social risks. *Development and Change* 34: 525–551.
- Schmidt-Soltau, K. 2009. Is the displacement of people from parks only ‘purported’ or is it real? *Conservation and Society* 7(1): 46–55.
- Sen, A. 1981. *Poverty and famines: an essay on entitlement and deprivation*. Oxford: Oxford University Press.
- Vorlaufer, K. 2002. CAMPFIRE-The political ecology of poverty alleviation, wildlife utilisation and biodiversity conservation in Zimbabwe. *Erdkunde* 56: 184–206.
- West, P. and D. Brockington. 2006. An anthropological perspective on some unexpected consequences of protected areas. *Conservation Biology* 20: 609–616.
- West, P. J. Igoe and D. Brockington. 2006. Parks and peoples: the social impact of protected areas. *Annual Review of Anthropology* 35: 251–277.
- Wilkie, D. E. Shaw, F. Rotberg, G. Morelli, and P. Auzel. 2000. Roads, development, and conservation in the Congo Basin. *Conservation Biology* 14: 1614–1622.
- Woodburn, J. 1982. Egalitarian societies. *Man* 17: 431–451.

Received: March 2012; Accepted: July 2012



Announcement

“QUICK RESPONSE CODE” LINK FOR FULL TEXT ARTICLES

The journal issue has a unique new feature for reaching to the journal’s website without typing a single letter. Each article on its first page has a “Quick Response Code”. Using any mobile or other hand-held device with camera and GPRS/other internet source, one can reach to the full text of that particular article on the journal’s website. Start a QR-code reading software (see list of free applications from <http://tinyurl.com/yzlh2tc>) and point the camera to the QR-code printed in the journal. It will automatically take you to the HTML full text of that article. One can also use a desktop or laptop with web camera for similar functionality. See <http://tinyurl.com/2bw7fn3> or <http://tinyurl.com/3ysr3me> for the free applications.