Food and livelihoods in park-adjacent communities: The case of the Odzala Kokoua National Park

Germain A. Mavah[a,b], Stephan M. Funk[c], Brian Child[a], Marilyn E. Swisher[a], Robert Nasi[d], John E. Fa[d,e,*]

[a] Center for African Studies, 3141 Turlington Hall, PO Box 117315, University of Florida, Gainesville, FL 32611-7315, USA
[b] Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460, USA
[c] Centro de Excelencia en Medicina Traslacional CEMT, Av. Alemania 0458, Universidad de la Frontera, Temuco, Chile
[d] Center for International Forestry Research, CIFOR Headquarters, Bogor 16115, Indonesia
[e] Division of Biology and Conservation Ecology, School of Science and the Environment, Manchester Metropolitan University, Manchester M1 5GD, UK

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ABSTRACT

Protected areas (PAs) in Central Africa provide unprecedented opportunities to maintain ecosystem integrity and safeguard the unique wildlife of one of the most biodiverse regions in the world. However, conflicts exist between wildlife protection, and the needs of human populations adjacent to PAs. Although the use of wildlife resources within PAs is nominally regulated, wildlife exploitation in the areas surrounding parks benefit human nutrition and livelihoods of adjacent populations. In 2013–2014, we interviewed 28% of all known households in 37 villages surrounding the Odzala Kokoua National Park (OKNP), Republic of Congo. We gathered information on bushmeat consumption, income, material assets, and hunter perception of the state of wildlife. We show that bushmeat species (mostly duikers, small monkeys and porcupine) were consumed in 38–48% of meals, and 20–30% of households earned cash from hunting wildlife in most villages; more than any other single source of revenue, except cocoa. Although it remains unknown whether the park was a reservoir for wildlife for areas around the studied villages, we showed that more bushmeat was consumed closer to OKNP. By contrast, income from bushmeat sales in villages closer to markets was greater, and as a corollary, market access and household wealth were positively correlated. Overall, total household income, income from bushmeat sales, travel time, and distance to the OKNP were good predictors of household wealth. Wildlife, although considered more abundant around villages closest to the park, was perceived as generally declining around all village groups. Our results highlight the possible importance of PAs and adjacent areas as reservoirs of wildlife and in maintaining wild meat resources used by the surrounding human populations.

1. Introduction

Carefully managed protected areas (PAs) remain the cornerstone for the conservation of dwindling natural resources (Coad et al., 2015). PAs also play a significant role in providing ecosystem services for adjacent human communities, by benefiting these directly, for example through the consumption of food produced or obtained in or around PAs (Taylor, 2009; Stolton and Dudley, 2010; Ferraro et al., 2011; Turner et al., 2012). Indirect benefits are manifold and include income and employment (Angelsen and Wunder, 2003). However, park-adjacent communities experience costs e.g. no entry into nearby PAs, and their lack of acceptance of these rules can influence support for PAs and subsequent conservation related behaviours (Acquah et al., 2017). If not properly managed and included in management plans, these

communities can generate negative impacts on biodiversity, human livelihoods, and human well-being (Ghimire and Pimbert, 1997; West et al., 2006; McElwee, 2010; Barrett et al., 2011; Redpath et al., 2013).

Satisfying basic needs of people living near PAs puts enormous pressure on the environment. One of the key challenges facing such communities in tropical forest areas is how to meet the need for sufficient, safe and nutritious food without exhausting the resources available. Often park-adjacent peoples rely on wild meat as the main source of sustenance and even livelihoods. However, unsustainable hunting of wild animals even within PAs is the most commonly reported threat (Schulze et al., 2018), due to mounting human population pressures, technological advances and the emergence of a booming commercial wild meat trade. Overexploitation of wild meat has direct impacts on the survival of some targeted species, especially large mammals (Dirzo

et al., 2014; Ripple et al., 2016), and will affect the availability of sufficient foods to meet the dietary needs of those peoples reliant on this resource. Ultimately, rural communities have the option of managing existing wild meat resources more sustainably, turning to alternatives (including the production of cash crops to generate income to buy food), or hunting wildlife to local extinction and then moving to other source areas.

In the Republic of Congo (ROC), tropical moist forests cover over 200,000 km² or around 66% of the country (Mayaux et al., 2013). Significant populations of species of high conservation concern (e.g. elephants, gorillas, chimpanzees, etc.) are found within the 200 PAs (11.7% of the country's area) as well as within unprotected forests. The latter include stretches of forest managed by logging companies that exploit the important economic timber resources within these (Doumenge et al., 2015). Logging operations allow access to remote areas and encourage more people to settle within concessions in search of jobs, thus increasing hunting pressure for bushmeat (Clark et al., 2009; Poulsen et al., 2009, 2011; Nasi et al., 2012). Increased hunting pressure can be reduced or prevented through partnerships between timber companies and conservation organisations, which can be successful in promoting the sustainable management of wildlife resources within logging areas (Clark et al., 2009).

Understanding the role that PAs and logging concessions play in supplying wild meat to the adjacent communities is essential to resolve or even prevent conflict between policy-makers, local people, and managers (Oldekop et al., 2016). Ensuring that wild meat is sustainably managed in areas peripheral to PAs will positively contribute to the protection of biodiversity. To determine the level of dependence on wild meat versus other foods and income sources it is crucial to obtain data from which to establish a causal connection between people's livelihoods and protected area management (Pullin et al., 2014). Foerster et al. (2011) contrasted resource use and livelihoods in communities less influenced by a newly established PA (i.e. further away from the park) and those closest to it. The influence of proximity to the PA was significant. However, similar investigations in which the use of resources and livelihoods in communities at different distances away from a PA are scarce. In this paper, we study the contribution that park resources (wild meat) and cultivation make to the livelihoods and well-being of communities located at different distances from the Odzala-Kokoua National Park (OKNP) and the Ngombé Forest Management Unit (NFMU), in the northern ROC. Thus, by comparing communities that traditionally rely on park resources with those that do not, we can develop future management strategies that balance human welfare and conservation of biodiversity. We employ a cross-sectional design (De Vaus, 2001) to examine how livelihoods and use of wildlife resources vary according to the distance to the park and markets as predictor variables (Salafsky and Wollenberg, 2000; Foerster et al., 2011). We test two main hypotheses: (1) greater market access increases income from bushmeat sales and agriculture (mainly cocoa in this region) and both are linked to higher household wealth, and (2) shorter distances to the park increase the volume of bushmeat consumed and sold, and hence household income.

2. Methods

2.1. Study area

The study area is located in northern Congo, Central Africa, 1.61361°N, 16.05167°E (Fig. 1). Human population density is around 0.8 inhabitants km⁻² (unpublished data). The two main ethnic groups found in the area include several Bantu sub-ethnicities (70%) and indigenous Pygmies (30%). The two groups have co-existed for centuries. The main human settlement in the region is the town of Ouesso, with about 30,000 residents. It is rapidly growing because new roads connect it to Brazzaville and logging activities draw immigrants. There is also a logging town, Ngombé, as well as several villages.

The OKNP is a protected area officially proclaimed a national park in 1935, making it one of the oldest national parks in Africa. With 13,546 km² it is part of the TRIDOM Transfrontier Park, which extends from the Congo into Gabon and Cameroon (Kamdem-Toham et al., 2003). A secondary road from Ouesso to Sembé (hereafter the OS road) in the west borders the northern perimeter of the park. The Ouesso to Brazzaville road (N2) is found to the east of the park (Fig. 1).

The OKNP is situated within the catchment area of the Mambili River, which drains the area towards the south. The park is within the savanna-forest boundary of north-central Congo, allowing for a high biodiversity of flora and fauna, with species from forest and savanna. The area is densely wooded in the northwest; towards the south and east the forest becomes more open. In the south of the park an extensive forest-savanna mosaic is found, including gallery forests and dry and swamp savannas. Climate is typically equatorial with two dry and two wet seasons, 1500 mm annual rainfall and a mean annual humidity of around 80%. Temperatures are moderately high (23–25 °C), with a low annual temperature range of 1–2 °C (Hecketsweiler et al., 1991).

2.2. Village selection

Our study was conducted in villages located on the Ouesso-Sembé, Ouesso-Liouesso, and Ouesso-Pikounda road axes (Fig. 1). Study villages were classified into four comparison groups based primarily on their distance to Ouesso (one group close, two distant groups and one quasi inaccessible), their proximity to OKNP, and their most important economic activity; cocoa cultivation differentiates the two distant groups (Table A1).

2.3. Household data collection

From July 2013 until June 2014 we gathered information from a total of 386 households (28% of the 1382 known households), within 37 study villages in the four village groups. Table A1 details main characteristics of the four village groups as well as the number of villages and households sampled. Households were selected at random within each study village where we conducted semi-structured questionnaires with each household head (Table A2). Each questionnaire took about 45 min to administer. They were applied by the principle investigator (PI), a Master's student from Congo's National School of Agricultural and Forestry Sciences and a hired local guide. The PI trained the student and the guide. All three interviewers conducted questionnaires in all villages in order to avoid biased results, which might be introduced by subtle impacts of interview style on interviewees.

We documented household composition (number, age, and sex of all household members), education, income, wealth and food consumption. To determine the overall health status of all household members aged > 1 year old, we estimated the average of all household members' individual body mass index (BMI). Individual household wealth was determined, first, by establishing an inventory of cash reserves, household possessions and stocks of food items for own consumption or sale. We then assigned monetary values to all possessions and food items as declared by the respondents using current trading values in the local currency, FCFA, as a baseline. The total estimated wealth was transformed into $US using the exchange rate 1 $US = 500 FCFA. From these we partitioned the distribution of wealth of all households into five quintiles, "poorest", "poor", "middle income", "rich", and "richest". Each Individual household was then assigned to its corresponding category or wealth index relative to all surveyed households. A household's total income and its income from bushmeat was valued as absolute estimates in $US. Analyses of income from specific items (including bushmeat and cocoa, Table A3) considered absolute values and percentage of the total income (i.e. relative bushmeat income). Community coherence was estimated by the community trust index and the perception of wildlife abundance by the interviewee's assessment