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The People of the Forest: Indigenous Voices for Agency, Sustainability, and Health in Forest Conservation

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The People of the Forest: Indigenous Voices for Agency, Sustainability, and Health in Forest Conservation

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy in Environmental Health Sciences

by

Savanna Louise Carson

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ABSTRACT OF THE DISSERTATION

The People of the Forest: Indigenous Voices for Agency, Sustainability, and Health in Forest Conservation

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Savanna Louise Carson

Doctor of Philosophy in Environmental Health Sciences

University of California Los Angeles, 2018

Professor Hilary Godwin, Chair

Forest conservation is a global strategy for sequestering carbon and mitigating climate change, but the protection and management of forests can have unintended negative impacts on local populations, particularly on indigenous and other highly forest-dependent populations. Historically, a lack of inclusion of local populations in conservation planning and policy has impacted the cultural integrity and community well-being of local forest-dependent populations. To understand how forest conservation programs and policies have impacted local forest-dependent populations, we conducted first-person interviews with four communities living near the Dja Faunal Reserve in Cameroon, a UN World Heritage Site. Two of these communities were primarily individuals from the local indigenous population (Baka), and the other two communities were individuals from the majority ethnic group

(Bantu). Both groups are highly forest-dependent, but the Baka have traditionally been hunter-gatherers, whereas the Bantu in this region are experienced farmers. Study findings include insights into both group's concern about lack of inclusion in forest management, decreased forest resources, desire for sustainable livelihood-based opportunities to promote conservation outcomes, and knowledge of and attitudes towards health challenges and assets. The results of these interviews illustrated distinct concerns of the local indigenous population (Baka) for loss of traditional knowledge and culture revealed how forest management has affected their livelihood and identified health determinants related to migration, loss of traditional lands, and institutional marginalization. Comparison of their responses to those of the majority population in the region highlighted local challenges within forest conservation projects and demonstrated a need for rights-based inclusion of local populations in forest management going forward. These studies emphasize that dialogue with local forest-dependent communities can promote an understanding of culture, livelihood, forest-human relationships, environmental health, and self-determinism and can help identify opportunities to improve the health and sustainability of these populations through improved forest management.

The dissertation of Savanna Louise Carson is approved.

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2018

DEDICATION

In memory of my mother. I love you and miss you. Thank you for a lifetime of memories, the gift of creativity, and for sending me off to Cameroon with toy frogs for the children.

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Chapter 2 is a version of a manuscript that was in press in *Conservation and Society* at the time that this thesis was deposited. My co-authors include Fabrice

Kentatchime, Eric Djomo Nana, Kevin Njabo, Brian Cole, and Hilary Godwin. I would like to thank the co-authors for their contributions. Specifically, I would like to thank Fabrice Kentatchime for conducting the research interviews. Dr. Nana for transcribing and translating the research interviews, and Dr. Njabo for his contributions towards editing the manuscript, his critical research assistance, and introducing us local study populations in Southern Cameroon that we interviewed. I would like to thank Dr. Cole and Godwin for their guidance in research analysis and stewardship in writing the manuscript.

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- **S.L. Carson**, B.L. Cole, H. Godwin. *Healthy Forests, Healthy People? REDD+ Social Safeguards & Human Health*. Yale Global Health & Innovation Conference, New Haven, CT. April 11, 2014

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- **S.L. Carson**, K. Perkins, M.R. Reilly, M. Sim, S.T. Li. *The Residency Leadership's Role in Resident Support and Well-Being*. Poster, Association of Pediatric Program Directors, New Orleans, LA, April 29-March 2, 2016
- C. Lewis, **S.L. Carson**, J. Lee, A. Chin. *Harnessing Individualized Learning Plans for Program Evaluation: An Untapped Resource in the Age of APE's and Self-study*. Poster, Association of Pediatric Program Directors, New Orleans, LA, April 29-March 2, 2016
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CHAPTER 1

Introduction and Overview of the Organization of the Thesis

INTRODUCTION

Forest conservation practices that aim to mitigate global climate change can inadvertently threaten the health and well-being of indigenous forest-dependent populations. Historically, conservation activities have often excluded local indigenous communities, resulting in loss of traditional lands, livelihood impacts, and increased resource and food insecurity. These impacts, in turn, have threatened the health and cultural integrity of indigenous communities. The purpose of this research is not to question the global need and utility of forest conservation but to identify pathways forward for active participation of local populations by providing a venue for dialogue. Specifically, the goal of this research is to elucidate how using inclusionary processes can illuminate community needs and priorities.

DEFINITIONS OF LOCAL, FOREST-DEPENDANT, AND INDIGENOUS POPULATIONS

In this thesis, I use the terms local, forest-dependent, and indigenous populations to distinguish between populations that potentially may be affected by natural resource policies but whom may have unequal, different, or overlapping stakeholder interests.

The term “local populations” is used to refer to all people who reside full-time in the study area and are potential stakeholders in natural resource management.

“Forest-dependent populations” is used to refer to the subset of individuals that

reside full-time in the study area and are dependent on the non-commercial use of forest resources for their livelihood. According to the definition presented in the "Asia-Pacific Forestry Sector Outlook Study: People and Forests in Asia and the Pacific: Situation and Prospects" there are two groups of non-commercial forest-dependent people:

1. "People who live inside forests, often living as hunter-gatherers or shifting cultivators, and who are heavily dependent on forests for their livelihood primarily on a subsistence basis. People in this category are often indigenous peoples or people from minority ethnic groups. They are, thus, usually outside both the political and economic mainstream.
2. People who live near forests, usually involved in agriculture outside the forest, who regularly use forest products (timber, fuelwood, bush foods, medicinal plants, etc) partly for their own subsistence purposes and partly for income generation. For those involved in agriculture, nutrient supplements from forests are often of critical importance to productivity. Such supplements can be in the form of mulch from leaves gathered in the forest. Another source of nutrient supplement is forest grazing by livestock which converts nutrients from forest biomass into manure." [1]

The Baka who were interviewed for the studies reported herein fall into the first of these two categories; the Bantu who were interviewed for the studies reported herein fall into the latter category.

To distinguish between these two groups, we refer in the text to the Baka as an "indigenous population." This is based on the working definition of indigenous

populations promulgated by the United Nations International Labor Organization (ILO Convention 169), namely:

> "Tribal people in independent countries whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations; People in independent countries who are regarded as indigenous on account of their descent from the populations which inhabited the country, or geographical region to which the country belongs, at the time of conquest or colonization or the establishment of present state boundaries and who irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions." [2]

Based on this definition, we use "indigenous population" to refer specifically the Baka and to distinguish them from the majority (Bantu) population in the region, even though the majority Bantu groups likely descend from individuals who migrated to the region thousands of years ago. This is because the Baka, like other peoples that meet the UN ILO definition of "indigenous," have historically been marginalized in this region [3-7]. The anthropological and ethnographic literature provide extensive documentation of the subjugation of the Baka by neighboring groups in Southern Cameroon [4, 8, 9] and a recent meta-analysis reported that, out of all the indigenous populations worldwide, the Baka experience particularly great health disparities compared to the overall populations of the countries in which they reside. More information about the history of both the Baka in this region and their relationship to the majority (Bantu) group are provided later in this chapter [10].

INCREASED RECOGNITION OF THE IMPORTANCE OF INCLUDING INDIGENOUS POPULATIONS IN CONSERVATION PROGRAMS

Forest conservation researchers have endorsed both the ethical and utilitarian value of taking into account the needs of forest-dependent people [11-15]. The ethical rationale for inclusion of local populations in forest management stems from international laws on indigenous rights. International laws from the UN International Labor Organization [2], the United Nations Declaration on Indigenous Rights [16, 17] and the Convention on Biological Diversity [18, 19] mandate indigenous rights to cultural integrity, self-determinism, and traditional lands and resources. The practical rationale for inclusion of local populations emanates from the need to optimize local community buy-in of local conservation programs to increase the likelihood of sustainability. Practical sustainable benefits include the incorporating traditional ecological knowledge in conservation decisions [14, 20-22], increasing transparency in management, enhancing equilateral investment in local populations [23], and improving long-term sustainability of conservation activities by avoiding delays from liabilities, loss or prevention of investments, human rights complaints, or downstream non-compliance issues from local populations [11, 24].

Past injustices have occurred in conservation projects worldwide when inclusionary processes were absent or insufficient. Conservation programs that have resulted in the isolation of native peoples typically result from ‘protectionist’ paradigms which argue that pristine conservation requires strategic and authoritative preservation of lands without the social and human use of protected natural resources

[25-27]. Protectionist models were archetypal of most protected areas until the 1980's [28]. The term "conservation refugees" was coined to refer to displaced indigenous populations excluded from conservation planning of native lands [29, 30]. The rising critique of exclusionary processes and the human costs of protectionist conservation have resulted in the promotion of community integrated conservation programming [28].

BEYOND INCLUSION: CONSIDERING THE WELL-BEING OF LOCAL POPULATIONS IN FOREST CONSERVATION

For forest-dwelling communities the ecosystem services provided by forests are central to human well-being [31]. Losses of traditional culture, community, and livelihood have resulted from conservation programs that have limited access to native land and resources [30, 32-36]. However, resource depletion due to deforestation and forest degradation can also have a negative impact on the health and social fabric of forest-dependent communities [37, 38]. Hence, local forest-dependent populations have the potential to benefit from conservation efforts as long as they continue to have rights to customary forest resources. In turn, by protecting these resources from exploitation, conservation projects are in a unique position to promote innovative co-beneficial strategies that maximize protection of biodiversity as well as human well-being [39].

Evidence-based investments in the livelihood and health of local populations can contribute to the ultimate success of conservation projects by stabilizing local communities and decreasing the drivers for unsustainable utilization of forest

resources [40-42]. Engagement of local stakeholders in substantive ways from the outset of conservation programs is a critical mechanism for supporting the rights, well-being, and agency of individuals within indigenous populations.

INCORPORATING THE NEEDS AND PRIORITIES OF LOCAL POPULATIONS NECESSITATES INCLUSION ALONG THE CONTINUUM OF FOREST MANAGEMENT

Including local populations in the design and implementation of forestry management programs and projects would help to reduce harm to local populations [43-47]. Recent calls to improve indigenous inclusion in forest conservation encourage collaboration with local stakeholders using adaptive management and place-based decision-making [48-51]. Inclusion along the continuum of forest conservation from planning to management requires logistical facilitation, respect for indigenous knowledge, transparent-decision making, trusting relationships between stakeholders and managers, identification of value-systems, and consensus-building education for managers and indigenous populations [52, 53].

One of the challenges for inclusionary forest conservation is the act of hearing from local populations about their priorities and preferences for inclusion strategies. In work presented herein, I obtained first-person perspectives of local indigenous and majority populations surrounding a wildlife reserve in Cameroon to understand how forest conservation programs and policies impact the health and well-being of local these populations. This case study can help to inform conservation policies, not only for indigenous and local populations in Central Africa but also for other marginalized forest-dependent populations worldwide.

HISTORY OF FOREST CONSERVATION IN CAMEROON

Cameroon is one of six countries that encompass the ecologically-rich Congo Basin. The Congo Basin is the second largest tropical rainforest to the Amazon and constitutes 300 million hectares of forest and holds about 25% of the world's forest carbon stock [54]. However, deforestation and degradation, exacerbated by climate change, is predicted to severely affect the African continent [55] and the Congo Basin in particular [56, 57]. Within the Congo Basin, an estimated 86 million people are highly dependent upon the forest for their livelihood [58]. Protecting biodiversity is of critical importance to the livelihood of local populations as they depend on these vulnerable forest resources [59-63]. However, conservation programs in the Congo Basin will not be successful unless there is the co-beneficial promotion of sustainable livelihoods for local populations in conservation programs [64].

Historically, forestry policies in Cameroon have more often prioritized profitable trade and industry gain and focused less on effective and sustainable outcomes of interest to conservation stakeholders, local communities, and indigenous populations [65, 66]. For example, studies to date suggest community forestry programs, which were initiated in 1994 and comprised about 1.5 million hectares of forested land in Cameroon, have done little to improve local livelihoods, achieve equitable distribution of resources, or promote the sustainability of forest conservation [67-73]. Some programs have also led to adverse impacts on conservation. For example, the line between commercial logging and community forestry programs is blurred in some instances, resulting in the significant potential for further forest degradation [74, 75].

Although 45% of the total land mass in Cameroon is forested, about 75% of these forests have shown increasing biodiversity loss, deforestation, and degradation since 1990 [76, 77]. This is an opportune time to reevaluate and improve outcomes to forest conservation in Cameroon due to the rising population, increase in migration to biodiversity hotspots, high-dependence of local populations on natural resources, and need for biodiversity protection in the face of climate change [15, 64, 78-81].

LOCAL POPULATIONS NEAR THE DJA RESERVE IN CAMEROON

To explore the impacts of forest conservation on local populations in the Congo Basin, I have chosen to focus on the communities that surround the Dja Biosphere Reserve, a 526,000 ha UNESCO World Heritage Site located in Southern Cameroon. (See **Figure 1.1.**) The Dja Wildlife and Hunting Reserve was founded by decree No. 319 on June 26, 1950, under rule by the French High Commissioner for Cameroon. The reserve was incorporated into UNESCO's "Man and Biosphere programme" in 1981 and later founded a UNESCO World Heritage Site in 1987. While no recent census is available, an estimated five thousand people lived near the Dja Biosphere Reserve in 1987, and an estimated 30,000 people depended on resources within the reserve as of 1997 [82, 83].

The two major ethnic groups in the region studied, are Bantu and Baka. Bantu-speakers, referred to herein as "Bantu," are part of a heterogeneous mix of ethnic groups, including Badjoue, Nzime, Mbulu, and Fang-Nzaman. The Bantu serve as our reference majority population for our study. The Bantu have practiced subsistence agriculture within this region for ~2,500-3,000 years [84].

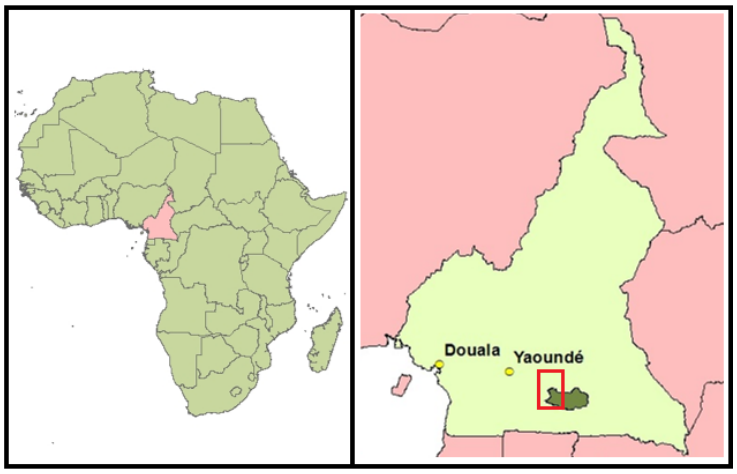

Figure 1.1. Location of the Study: Cameroon, Africa (pink in the left panel). The Dja Biosphere Reserve (dark green in the right panel) in South-Central Cameroon. The study area is inside the red box on the right panel.

The Baka are an indigenous population as defined by the African Commission on Human and Peoples' Rights and the International Working Group for Indigenous peoples. Indigenous populations make up less about 0.4% total population in Cameroon, (total population of 22 million people). The Baka are the largest of these indigenous groups in Cameroon, with an estimated population of 30,000-70,000 nationwide [7, 85]. The Baka have traditionally survived as forest-dwelling hunter-gatherers and are known as the "The Forest People," as the forest is the center of Baka culture, religion, and livelihood. Anthropologists have previously studied and documented the Baka's rich ecological knowledge, intimate connection with the forest, singing and music rituals, egalitarianism, and traditional medical knowledge [4, 86-98].

The Baka are particularly vulnerable to changes in forest policy due to the high level of their dependence on the forest, a history of institutional discrimination against indigenous populations, and a social history resulting in a lack of knowledge and understanding of their local livelihoods by decision-makers. Institutional marginalization and discrimination of minority indigenous populations in Cameroon

have prevented the Baka from obtaining equal rights [3, 99-101]. Baka can rarely obtain birth certificates or government identification which are essential to obtain citizenship and associated citizenship rights such as voting [100]. Cameroon law does not formally recognize land rights for indigenous forest-dwelling Cameroonians because protected forest areas belong to the state [3, 102, 103]. Discrimination has limited the Baka's ability to obtain public benefits such as access to health services and free primary school education [6, 7, 9, 104, 105]. Logistical, linguistic, and geographical barriers to inclusion also have limited the Baka's ability to advocate for self-determinism in government policies. Over the last century, Baka in this region have not only been relocated from their traditional lands but have also been excluded from decision-making in forestry policy and benefits [3, 6, 95].

The Baka were pressured and encouraged to be relocated to the periphery of any reserves due to "sedentarization" policies initiated in the late 1950's under French colonization and continued after independence [88, 106, 107]. The purported goal of these relocation policies was two-fold; to improve the Baka's access to resources such as health clinics and to encourage the Baka to participate in the local economy by encouraging them to produce cash crops [108]. Subsequent "sedentarization" policies implemented by government development programs, non-governmental organizations, and other pressures to modernize the Baka have dramatically influenced the cultural norms and development of the Baka in this area over the last 50 years [3, 97]. A general outline of sedentarization pressures and land policy affecting Baka is outlined in **Figure 1.2**.

Baka in this region had previously been nomadic hunter-gathers, and these

policies and programs caused many Baka to shift to a semi-sedentary lifestyle with many practicing a mixed agricultural and hunter-gatherer lifestyle [4, 8]. As a result of these policies and programs, many Baka were forced to relocate to unwanted roadside land (public land) or to land that is owned by neighboring Bantu who were granted land rights under the 1974 land law [8]. The Baka were ineligible for land rights under the 1974 land law as they lived in protected forest areas belonging to the state. Some Baka populations now live under conditions of subordination to neighboring Bantu populations [3, 102].

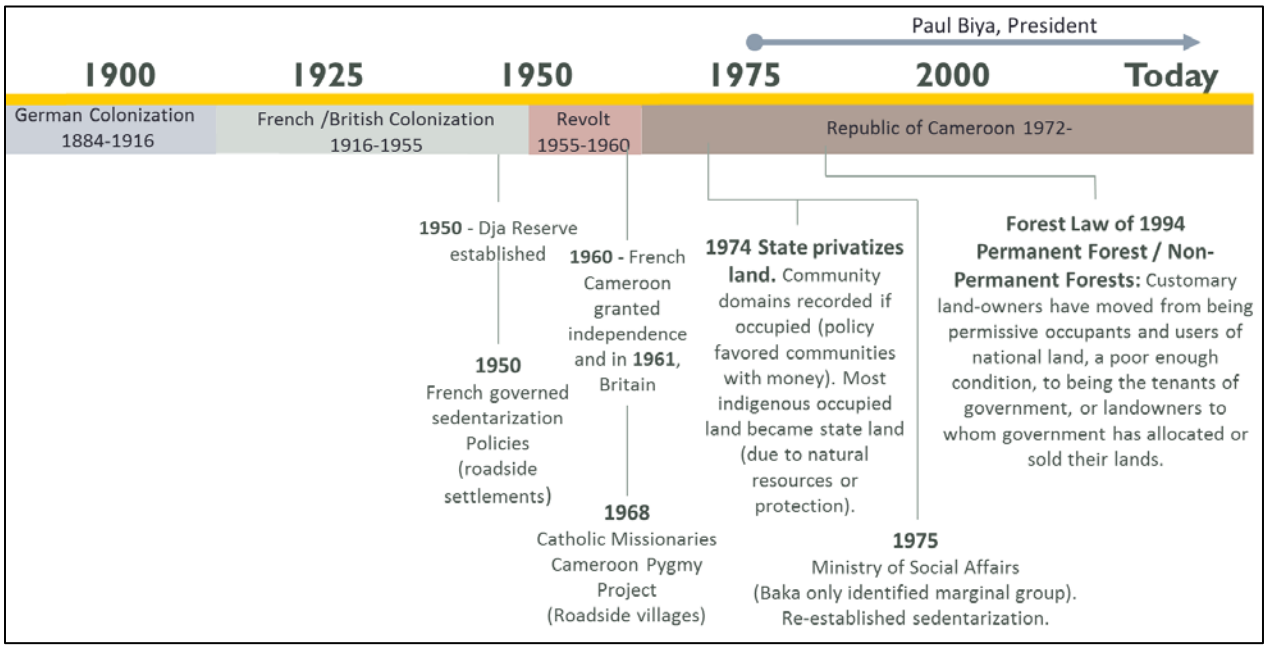

Figure 1.2. Timeline of land policies affecting indigenous populations in Cameroon with particular reference to the Baka.

GENERAL METHODS

Through the work described herein, I aimed to gain local perspectives near the Dja Reserve in Cameroon. As qualitative data derived from interviews can be a particularly useful source of information about the multifaceted interactions between nature and society in a particular context [109, 110]. Qualitative interviews not only

support the value of understanding the diversity of perspectives within local populations but provide insights into how to construct ongoing and substantive engagement strategies in this region to support indigenous and local agency within forest management.

Key informant interviews, which form the core of this work, were conducted in July 2014 with Baka and Bantu resident populations in the Northern Dja region (See **Figure 1.1.**). We conducted in-depth first-person interviews in July 2014 in four communities (two Baka communities, villages #2 and #3, two Bantu communities, villages #1 and #4, and with local clinicians at regional clinics) adjacent to the Dja Biosphere Reserve in Southern Cameroon, see **Table 1.1**.

We interviewed 15 Baka (7 females and 8 males), 20 Bantu (9 women and 11 men). We also conducted informal interviews with local clinicians from three local public and one private health center. Interviews ranged in time from 30-90 minutes. Interview participants were recruited by first obtaining permission from the village chiefs to conduct interviews in each village. Following chief approval, we held community meetings in each village to explain the study's purpose, logistics, confidentiality, the importance of the communities' perspectives, to answer questions, and to introduce the research team. We recruited interview participants using purposive sampling [34], inclusive of equal gender representation, from among residents identified by four village chiefs. To achieve female participants in equal number to male participants, our research team had to explain the purpose of equity in the interview process multiple times to village leaders and repeatedly ask for additional women participants. Inclusion criteria included: being over 18 years of

age, availability, and fluency in French or Baka. Tote bags were given to participants for their involvement in the study. Participants were invited to choose the location for the interview as long as was secluded. No participants declined to participate, but the translator decided to end an interview after one participant was unable to complete the interview after being interrupted and disengaged. Interviews were conducted with the assistance of local translators who were familiar with the local French dialect using interview guides written in both English and French (See **Appendix 1**). Some Baka interviews were conducted in Baka with the help of a local Baka-French translator.

Table 1.1. **Study Demographics**

Village	Ethnic Group	Distance to Public District Health Center	Population 2013	Participants Interviewed
1	Bantu	~40km	~400	10
2 (referred to as "Settlement 1" in Chapter 2)	Baka	~40km	~200	9
3 (referred to as "Settlement 2" in Chapter 2)	Baka	~60km	>100	6
4	Bantu	~60km	~1000	10

The research team developed a semi-structured interview guide for residents which aimed to explore local population's perceptions of regional health factors, their use of forest resources, daily menus, community management, their relationship with forestry management, and their impressions of whether or not their livelihood factors have changed during their lifetimes, see **Figure 1.3** and **Appendix A**. The guide was developed based upon a literature review of previous anthropogenic studies on local Dja populations and consultation with local scholars who had previously conducted biodiversity research in the area. Questions were framed to elicit participants' insights into community traditions, to provide insights beyond the individual's environment, to offer participants the experience of speaking as experts on their communities, and to minimize disclosure of any personal use of banned forest resources (i.e., poaching). Additionally, questions were framed using a community asset-mapping framework to establish relationships, empower participants, and focus on positive aspects of their communities [111, 112]. A separate interview guide was developed for clinician interviews regarding the clinician's perspective of local health

practices within nearby communities (see **Appendix B)**.

Figure 1.3. Interview content areas: participant views of livelihood, community practices, forest management and community health practices.

Interview transcriptions were coded via six-step thematic content analysis [113] using ATLAS.ti. I coded central themes and worked with two other research team members to analyze emerging themes, develop coding structure, and verify code appropriateness, see **Figure 1.4**. We performed iterative analysis until achievement of saturation and all interview themes were identified. Authors performed comparative analysis among consistencies, inconsistencies, and frequency between ethnic group, the four villages, each clinician, and on an individual level to determine areas of significance. We extracted themes of interest that reflected the focus of each chapter.

Figure 1.4. Example of coding for a representative quote: To the left is the resulting quote from a participant and to the right are example codes, color-coded to match relevant sections of the quote.

This community-partnered study was conducted with approvals from the University of California, Los Angeles Institutional Review Board, Cameroon National Ethics Committee, the local Cameroon Ministry of Public Health in the area studied, and the Cameroon Ministry of Science and Innovation.

ORGANIZATION OF THE THESIS

Chapter 2 examines Baka perspectives towards forest conservation policies and how they have influenced the traditional lifestyles and livelihoods of the Baka in and around the Dja Reserve in Southern Cameroon that were revealed during these interviews. To date, no systematic study has been conducted on the impacts of forest conservation programs and policies in Southern Cameroon on the agency, traditional knowledge, and livelihood of the Baka. Evaluation of barriers to inclusion of

indigenous Baka perspectives in previous programs provides a foundation for improving community partnership and knowledge sharing in future conservation programs. The results of the interviews formulate evidence-based recommendations, for how future forest conservation programs and policies could be constructed to ensure the inclusion of the voices, perspectives, knowledge, and priorities of local indigenous populations.

Chapter 3 identifies sustenance and dietary patterns in the indigenous Baka population and majority Bantu population, how they have been affected by the forest management in the region, and opportunities for sustainable livelihoods in conservation programs. Local forestry policies have limited foraging and hunting for these populations. The Bantu, as traditional agrarians, provide a reference to the pressures faced in the region as a whole. Their views provide context for the views of the Baka, an indigenous population who face specific sustenance issues as a result of their migration from traditional forestlands. Based on first-person interviews, we identified sustenance and dietary patterns in Baka and Bantu populations near the Dja Biosphere Reserve including how forestry management has affected sustenance patterns. Although previous work illustrates the importance of forests in mediating food insecurity in Cameroon [23], the literature suggests there are still significant gaps that need to be addressed to ensure sustainability of future conservation projects Southern Cameroon, including a need for sustainable resource management strategies [11, 24, 26]. Co-beneficial forest conservation programs, which consider sustainable livelihoods for local communities, can help avoid issues that result when the needs of local populations needs are unmet, including regional instability that can

threaten conservation goals. The chapter outlines recommendations for active participation of local populations in the development of sustainable livelihood options to improve sustainability in conservation.

Chapter 4 explores Baka and Bantu knowledge of and attitudes toward assets and challenges to health. Indigenous health is not only often worse than majority benchmark populations but is intricately connected to ecological health [10]. In general, the health of indigenous populations is known to be negatively impacted by environmental degradation and displacement from traditional lands. However, limited data exists on the connection between environmental health and the health of the indigenous Baka of Cameroon. The interviews reported herein engaged the Baka and Bantu in conversations regarding their health assets and challenges to health. Local clinician interviews and clinic data was obtained to provide context to health information from the Baka and Bantu. Recommendations are outlined for health promotion, protection of the Baka's rich medicinal knowledge (a critical health resource for the region), and improvement of social determinants of health.

Chapter 5 synthesizes the work herein and expands upon future applications for systematic inclusion in forest conservation based on the local voices of the Dja Reserve in Cameroon. First, an argument is presented for the protection of indigenous knowledge, culture, and self-determinism through active engagement in forest conservation. Second, I advocate for strategies to especially include women stakeholders in forest conservation based on our difficulties in obtaining women interviews. Finally, an overarching conclusion from this work is that health is a useful metric for well-being when considering the impact of forest conservation on local

populations.

REFERENCES FOR CHAPTER 1

1. Fisher, R.J., S. Srimongkontip, and C. Veer. *Asia-pacific forestry sector outlook study: People and forests in Asia and the Pacific: Situation and prospects*. Asia-Pacific Forestry Sector Outlook Study Working Paper Series 1997 [cited 2018 May 12, 2018].
2. ILO, *Indigenous and tribal peoples convention*, in *169*. 1989, International Labour Organization: Geneva.
3. Pemunta, N., *The governance of nature as development and the erasure of the pygmies of Cameroon.* GeoJournal, 2013. **78**(2): p. 353-371.
4. Lueong, G.M., *The forest people without a forest: Development paradoxes, belonging and participation of the Baka in east Cameroon*. 2016, New York: Berghahn Books.
5. Awuh, H.E., *Adaptive livelihood strategies in conservation-induced displacement: The case of the Baka of east Cameroon.* African Studies Review, 2015. **58**(2): p. 135-156.
6. Assembe Mvondo, S., *Decentralized forest resources and access of minorities to environmental justice: An analysis of the case of the Baka in southern Cameroon.* International Journal of Environmental Studies, 2006. **63**(5): p. 681-689.
7. Pyhala, A., *What future for the Baka? Indigenous peoples' rights and livelihood opportunities in south-east Cameroon*, M.W. Jensen, Editor. 2012, IWGIA.
8. Hattori, S., *Current issues facing the first people in southeastern Cameroon: The dynamics of the Baka life and their ethnic relationship with farmers.*

African study monographs. Supplementary issue., 2014. **47**: p. 97-119.

9. Egbe, E., *Social exclusión and indigenous peoples' health; an example of Cameroon Baka 'pygmies' people of the rainforest region of the south.* Journal of Sustainable Regional Health Systems, 2012. **1**: p. 16-21.
10. Anderson, I., B. Robson, M. Connolly, F. Al-Yaman, E. Bjertness, A. King, M. Tynan, R. Madden, A. Bang, C.E.A. Coimbra, Jr., M.A. Pesantes, H. Amigo, S. Andronov, B. Armien, D.A. Obando, P. Axelsson, Z.S. Bhatti, Z.A. Bhutta, P. Bjerregaard, M.B. Bjertness, R. Briceno-Leon, A.R. Broderstad, P. Bustos, V. Chongsuvivatwong, J. Chu, J. Gouda, R. Harikumar, T.T. Htay, A.S. Htet, C. Izugbara, M. Kamaka, M. King, M.R. Kodavanti, M. Lara, A. Laxmaiah, C. Lema, A.M.L. Taborda, T. Liabsuetrakul, A. Lobanov, M. Melhus, I. Meshram, J.J. Miranda, T.T. Mu, B. Nagalla, A. Nimmathota, A.I. Popov, A.M.P. Poveda, F. Ram, H. Reich, R.V. Santos, A.A. Sein, C. Shekhar, L.Y. Sherpa, P. Skold, S. Tano, A. Tanywe, C. Ugwu, F. Ugwu, P. Vapattanawong, X. Wan, J.R. Welch, G. Yang, Z. Yang, and L. Yap, *Indigenous and tribal peoples' health (the Lancet–Lowitja institute global collaboration): A population study.* The Lancet, 2016. **388**(10040): p. 131-157.
11. Andrade, G. and J. Rhodes, *Protected areas and local communities: An inevitable partnership toward successful conservation strategies?* Ecology and Society, 2012. **17**(4).
12. Berkes, F., *Rethinking community-based conservation.* Conservation Biology, 2004. **18**(3): p. 621-630.
13. Cetas, E.R. and M. Yasué, *A systematic review of motivational values and*

conservation success in and around protected areas. Conservation Biology, 2017. **31**(1): p. 203-212.

14. Fraser, E.D.G., A.J. Dougill, W.E. Mabee, M. Reed, and P. McAlpine, *Bottom-up and top-down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management.* Journal of Environmental Management, 2006. **78**(2): p. 114-127.
15. Carodenuto, S. and K. Fobissie, *Operationalizing free, prior and informed consent (FPIC) for redd+: Insights from the national fpic guidelines of Cameroon.* Carbon and Climate Law Review, 2015. **9**(2): p. 156-167.
16. Wiessner, S., *The united nations declaration on the rights of indigenous peoples*, in *The diversity of international law*. 2009, Brill. p. 343-362.
17. UNDRIP, *United Nations declaration on the rights of indigenous peoples*. 2007, United Nations Department of Public Information.
18. UNEP, *Convention on biological diversity*, in *VNEP No. 92-8314.* 2015: United Nations Environment Programme, Nairobi, Kenya.
19. Boyle, A.E., *The convention on biological diversity*, in *The environment after Rio—international law and economics*, L. Campiglio, Pineschi, L, Siniscalco, D, Treves, T Editor. 1994, Graham and Trotman: London. p. 111-127.
20. Krech, S., *Reflections on conservation, sustainability, and environmentalism in indigenous North America.* American Anthropologist, 2005. **107**(1): p. 78-86.
21. Adams, W. and J. Hutton, *People, parks and poverty: Political ecology and biodiversity conservation.* Conservation and Society, 2007. **5**(2): p. 147-183.

22. Popova, U., *Conservation, traditional knowledge, and indigenous peoples.* American Behavioral Scientist, 2013: p. 0002764213495043.

23. Smith, J. and S.J. Scherr, *Forest carbon and local livelihoods.* Assessment of opportunities and policy recommendations. CIFOR, Bogor, Indonesia, 2002.

24. Oldekop, J., G. Holmes, W. Harris, and K. Evans, *A global assessment of the social and conservation outcomes of protected areas.* Conservation Biology, 2016. **30**(1): p. 133-141.

25. Terborgh, J. and C.A. Peres, *The problem of people in parks.* Making parks work: Strategies for preserving tropical nature, 2002: p. 307-319.

26. Terborgh, J., *Requiem for nature*. 2004, Washington, DC: Island Press.

27. Oates, J.F., *Myth and reality in the rain forest: How conservation strategies are failing in West africa*. 1999: Univ of California Press.

28. Hutton, J., W.M. Adams, and J.C. Murombedzi, *Back to the barriers? Changing narratives in biodiversity conservation.* Forum for Development Studies, 2005. **32**(2): p. 341-370.

29. Westing, A.H., *Environmental refugees: A growing category of displaced persons.* Environmental Conservation, 1992. **19**(3): p. 201-207.

30. Awuh, H.E., *A critique of the global literature on the conservation refugee problem*, in *School of Geography, Environment and Earth Sciences*. 2011, Te Kura Tatāi Aro Whenua Victoria University of Wellington: New Zealand.

31. Ritter, E. and D. Dauksta, *Human–forest relationships: Ancient values in modern perspectives.* Environment, Development and Sustainability, 2013. **15**(3): p. 645-662.

32. Waylen, K.A., A. Fischer, P.J.K. McGowan, S.J. Thirgood, and E.J. Milner-Gulland, *Effect of local cultural context on the success of community-based conservation interventions.* Conservation Biology, 2010. **24**(4): p. 1119-1129.

33. Agrawal, A. and K. Redford, *Conservation and displacement: An overview.* Conservation and Society, 2009. **7**(1): p. 1.

34. Brockington, D. and J. Igoe, *Eviction for conservation: A global overview.* Conservation and Society, 2006. **4**(3): p. 424-470.

35. *Operational policy 4.12: Involuntary resettlement*, in *4.12*. 2001, World Bank: Washington, DC.

36. West, P., J. Igoe, and D. Brockington, *Parks and peoples: The social impact of protected areas.* Annual Review of Anthropology, 2006. **35**: p. 251-277.

37. Myers, S.S., L. Gaffikin, C.D. Golden, R.S. Ostfeld, K. H. Redford, T. H. Ricketts, W.R. Turner, and S.A. Osofsky, *Human health impacts of ecosystem alteration.* Proceedings of the National Academy of Sciences, 2013. **110**(47): p. 18753-18760.

38. Agarwala, M., G. Atkinson, B.P. Fry, K. Homewood, S. Mourato, J.M. Rowcliffe, G. Wallace, and E. Milner-Gulland, *Assessing the relationship between human well-being and ecosystem services: A review of frameworks.* Conservation and Society, 2014. **12**(4): p. 437-449.

39. Kareiva, P. and M. Marvier, *What is conservation science?* BioScience, 2012. **62**(11): p. 962-969.

40. Oldekop, J.A., G. Holmes, W.E. Harris, and K.L. Evans, *A global assessment of the social and conservation outcomes of protected areas.* Conservation Biology,

2015: p. n/a-n/a.

41. Andrade, G.S. and J.R. Rhodes, *Protected areas and local communities: An inevitable partnership toward successful conservation strategies?* Ecology and Society, 2012. **17**(4): p. 14.

42. Woodhouse, E., K.M. Homewood, E. Beauchamp, T. Clements, J.T. McCabe, D. Wilkie, and E. Milner-Gulland, *Guiding principles for evaluating the impacts of conservation interventions on human well-being.* Philosophical Transactions of the Royal Society B: Biological Sciences, 2015. **370**(1681).

43. Karsenty, A. and S. Ongolo, *Can "fragile states" decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the redd mechanism.* Forest Policy and Economics, 2012. **18**: p. 38-45.

44. Molua, E.L., *Discourse on climate-smart agriculture for redd+ strategy in the congo basin.* Journal of Sustainable Development, 2012. **5**(10): p. p77.

45. Mertz, O., D. Müller, T. Sikor, C. Hett, A. Heinimann, J.-C. Castella, G. Lestrelin, C.M. Ryan, D.S. Reay, and D. Schmidt-Vogt, *The forgotten d: Challenges of addressing forest degradation in complex mosaic landscapes under redd+.* Geografisk Tidsskrift-Danish Journal of Geography, 2012. **112**(1): p. 63-76.

46. Olander, L.P., C.S. Galik, and G.A. Kissinger, *Operationalizing redd+: Scope of reduced emissions from deforestation and forest degradation.* Current Opinion in Environmental Sustainability, 2012. **4**(6): p. 661-669.

47. Mlambo, M.C., *The urgent need for human well-being elements in biodiversity research.* Biodiversity and Conservation, 2012. **21**(4): p. 1149-1151.

48. Rist, L., C. Shackleton, L. Gadamus, F.S. Chapin III, C.M. Gowda, S. Setty, R. Kannan, and R.U. Shaanker, *Ecological knowledge among communities, managers and scientists: Bridging divergent perspectives to improve forest management outcomes.* Environmental Management, 2016. **57**(4): p. 798-813.

49. Adams, M.S., J. Carpenter, J.A. Housty, D. Neasloss, P.C. Paquet, C. Service, J. Walkus, and C.T. Darimont, *Toward increased engagement between academic and indigenous community partners in ecological research.* Ecology and Society, 2014. **19**(3).

50. van Kerkhoff, L. and V. Pilbeam, *Understanding socio-cultural dimensions of environmental decision-making: A knowledge governance approach.* Environmental Science & Policy, 2017. **73**: p. 29-37.

51. Martin, A., B. Coolsaet, E. Corbera, N.M. Dawson, J.A. Fraser, I. Lehmann, and I. Rodriguez, *Justice and conservation: The need to incorporate recognition.* Biological Conservation, 2016. **197**: p. 254-261.

52. Nicholas, J.R., P.W. Kyle, M. Deborah, M.A. Smith, and F.J. James, *Factors that support indigenous involvement in multi-actor environmental stewardship.* AlterNative: An International Journal of Indigenous Peoples, 2017. **13**(2): p. 58-68.

53. Sterling, E.J., E. Betley, A. Sigouin, A. Gomez, A. Toomey, G. Cullman, C. Malone, A. Pekor, F. Arengo, M. Blair, C. Filardi, K. Landrigan, and A.L. Porzecanski, *Assessing the evidence for stakeholder engagement in biodiversity conservation.* Biological Conservation, 2017. **209**: p. 159-171.

54. Saatchi, S.S., N.L. Harris, S. Brown, M. Lefsky, E.T.A. Mitchard, W. Salas, B.R.

Zutta, W. Buermann, S.L. Lewis, S. Hagen, S. Petrova, L. White, M. Silman, and A. Morel, *Benchmark map of forest carbon stocks in tropical regions across three continents.* Proceedings of the National Academy of Sciences, 2011. **108**(24): p. 9899-9904.

55. Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo, and P. Yanda, *Africa*, in *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. 2007, Cambridge University Press, Cambridge UK, 433-467.

56. Penlap, E.K., C. Matulla, H. von Storch, and F.M. Kamga, *Downscaling of gcm scenarios to assess precipitation changes in the little rainy season (march-june) in Cameroon.* Climate Research, 2004. **26**(2): p. 85-96.

57. Beaumont, L.J., A. Pitman, S. Perkins, N.E. Zimmermann, N.G. Yoccoz, and W. Thuiller, *Impacts of climate change on the world's most exceptional ecoregions.* Proceedings of the National Academy of Sciences, 2011. **108**(6): p. 2306-2311.

58. Brown, H.C.P., B. Smit, D.J. Sonwa, O.A. Somorin, and J. Nkem, *Institutional perceptions of opportunities and challenges of redd+ in the congo basin.* The Journal of Environment & Development, 2011. **20**(4): p. 381-404.

59. Sonwa, D., J. Nkem, M. Idinoba, M. Bele, and C. Jum, *Building regional priorities in forests for development and adaptation to climate change in the congo basin.* Mitigation and Adaptation Strategies For Global Change, 2012. **17**(4): p. 441-450.

60. Nkem, J.N., O.A. Somorin, C. Jum, M.E. Idinoba, Y.M. Bele, and D.J. Sonwa, *Profiling climate change vulnerability of forest indigenous communities in the congo basin.* Mitigation and Adaptation Strategies for Global Change, 2013: p. 1-21.

61. Sassen, M. and C. Jum, *Assessing local perspectives in a forested landscape of central Cameroon.* Forests, Trees and Livelihoods, 2007. **17**(1): p. 23-42.

62. Sonwa, D.J., O.A. Somorin, C. Jum, M.Y. Bele, and J.N. Nkem, *Vulnerability, forest-related sectors and climate change adaptation: The case of Cameroon.* Forest Policy and Economics, 2012.

63. Bele, M., A. Tiani, O. Somorin, and D. Sonwa, *Exploring vulnerability and adaptation to climate change of communities in the forest zone of Cameroon.* Climatic Change, 2013. **119**(3-4): p. 875-889.

64. Somorin, O.A., H.C.P. Brown, I.J. Visseren-Hamakers, D.J. Sonwa, B. Arts, and J. Nkem, *The congo basin forests in a changing climate: Policy discourses on adaptation and mitigation (redd+).* Global Environmental Change, 2012. **22**(1): p. 288-298.

65. Assembe Mvondo, S., *Local communities' and indigenous peoples' rights to forests in central africa.* Africa Spectrum, 2013. **48**(1).

66. Lescuyer, G., *Livelihoods and the adaptive application of the law in the forests of Cameroon.* Illegal logging: law enforcement, livelihoods and the timber trade, 2007: p. 167-190.

67. Beauchamp, E. and V. Ingram, *Impacts of community forests on livelihoods in Cameroon: Lessons from two case studies.* International Forestry Review, 2011.

13(4): p. 389-403.

68. Ezzine de Blas, D., M. Ruiz Pérez, J.A. Sayer, G. Lescuyer, R. Nasi, and A. Karsenty, *External influences on and conditions for community logging management in Cameroon.* World Development, 2009. **37**(2): p. 445-456.

69. Lescuyer, G., *Sustainable forest management at the local scale: A comparative analysis of community forests and domestic forests in Cameroon.* Small-scale Forestry, 2013. **12**(1): p. 51-66.

70. Biyong, M., P. Oyono, and S. Samba, *Beyond the decade of policy and community euphoria: The state of livelihoods under new local rights to forest in rural Cameroon.* Conservation and Society, 2012. **10**(2): p. 173-181.

71. Cuny, P., A.A. Ango, and Z.A. Ondoa. *Local and decentralized forest management in Cameroon: The case of the kongo community forest*. in *Proceedings of the International Conference on Managing Forests for Poverty Reduction: Capturing Opportunities in Forest Harvesting and Wood Processing for the Benefit of the Poor*. 2007. Ho Chi Minh City, Viet Nam.

72. Cerutti, P.O., G. Lescuyer, S. Assembe-Mvondo, and L. Tacconi, *The challenges of redistributing forest-related monetary benefits to local governments: A decade of logging area fees in Cameroon.* International Forestry Review, 2010. **12**(2): p. 130-138.

73. Assembe-Mvondo, S., M. Brockhaus, and G. Lescuyer, *Assessment of the effectiveness, efficiency and equity of benefit-sharing schemes under large-scale agriculture: Lessons from land fees in Cameroon.* European Journal of Development Research, 2013. **25**(4): p. 641-656.

74. Robiglio, V., G. Lescuyer, and P.O. Cerutti, *From farmers to loggers: The role of shifting cultivation landscapes in timber production in Cameroon.* Small-Scale Forestry, 2013: p. 1-19.

75. Cerutti, P.O. and L. Tacconi, *Forests, illegality, and livelihoods: The case of Cameroon.* Society and Natural Resources, 2008. **21**(9): p. 845-853.

76. Dkamela, G.P., *The context of redd+ in Cameroon: Drivers, agents and institutions*. Vol. 57. 2011: CIFOR.

77. Ernst, C., P. Mayaux, A. Verhegghen, C. Bodart, M. Christophe, and P. Defourny, *National forest cover change in congo basin: Deforestation, reforestation, degradation and regeneration for the years 1990, 2000 and 2005.* Global change biology, 2013. **19**(4): p. 1173-1187.

78. Sunderlin, W.D., O. Ndoye, H. Bikie, N. Laporte, B. Mertens, and J. Pokam, *Economic crisis, small-scale agriculture, and forest cover change in southern Cameroon.* Environmental conservation, 2000. **27**(3): p. 284-290.

79. Peach Brown, H.C. and D.J. Sonwa, *Rural local institutions and climate change adaptation in forest communities in Cameroon.* Ecology and Society, 2015. **20**(2).

80. Mbatu, R.S., *Domestic and international forest regime nexus in Cameroon: An assessment of the effectiveness of redd+ policy design strategy in the context of the climate change regime.* Forest Policy and Economics, 2015. **52**: p. 46-56.

81. Mberu, B.U. and R. Pongou, *Crossing boundaries: Internal, regional and international migration in Cameroon.* International Migration, 2016. **54**(1): p. 100-118.

82. Bedel, J., Bousquet, B., Gourlet, S. , *Réserve biosphère du Dja. Report to the government of cameroun & unesco/mab by l'école nationale du génie rural des eaux et des forêts (montpellier)*. 1987. p. 96.

83. Mouncharou, G., *Projet Dja lomié: Rapport d'avancement d'activités (october 1995-may 1997), projet uicn-Dja, lomié, cameroun.* 1997.

84. Russell, T., F. Silva, and J. Steele, *Modelling the spread of farming in the bantu-speaking regions of africa: An archaeology-based phylogeography.* PLoS ONE, 2014. **9**(1): p. e87854.

85. Ichikawa, M., *Forest conservation and indigenous peoples in the congo basin: New trends towards reconciliation between global issues and local interest in hunter gatherers of the congo basin*, ed. B.S. Hewlett. 2014, New Brunswick, New Jersey: Transaction Publishers.

86. Betti, J.L., *An ethnobotanical study of medicinal plants among the Baka pygmies in the Dja biosphere reserve, Cameroon.* African Study Monographs 2004. **25**(1).

87. Brisson, R., *Utilisation des plantes par les pygmées Baka*. 2011, Paris: L'Harmattan.

88. Joiris, V., P. de Maret, and S. Bahuchet, *La chasse, la chance, le chant: Aspects du système rituel des Baka du cameroun*, in *Faculté des sciences sociales, politiques et économiques.* 1998, Université libre de Bruxelles: Bruxelles.

89. Althabe, G., *Changements sociaux chez les pygmées Baka de l'est-cameroun.* Cahiers D'études Africaines, 1965: p. 561-592.

90. Brisson, R., *Mythologie des pygmées Baka (sud-cameroun): Mythologie et*

contes. Vol. 13. 1999: Peeters Publishers.

91. Bundo, D., *Social relationship embodied in singing and dancing performances among the Baka.* 2001.

92. Tsuru, D., *Diversity of ritual spirit performances among the Baka pygmies in southeastern Cameroon.* African Study Monographs. Supplementary issue., 1998. **25**: p. 47-84.

93. Pyhälä, A., *What future for the Baka? Indigenous peoples' rights and livelihood opportunities in south-east Cameroon*, M.W. Jensen, Editor. 2012, International Work Group for Indigeonous Affairs: Copenhagen, Denmark.

94. Hattori, S., *Current issues facing the forest people in Southeastern Cameroon: The dynamics of Baka life and their ethnic relationship with farmers.* African Study Monographs. Supplimentry Issue 2014. **47**: p. 97–119.

95. Ngefor, S., *Indigenous peoples and conservation of forest resources: The case of the Baka people of the eastern region of Cameroon.* International Journal of Green Economics, 2013. **7**(3): p. 299-313.

96. Leonhardt, A., *Baka and the magic of the state: Between autochthony and citizenship.* African Studies Review, 2006. **49**(02): p. 69-94.

97. Hewlett, B.S., *Central african government's and international ngos' perceptions of Baka pygmy development*, in *Hunter-gatherers in the modern world*, R.K.H. Megan Biesele, Peter P. Schweitzer, Editor. 2000, Berghahn: New York. p. 381-390.

98. Köhler, A. and J. Lewis, *Putting hunter-gatherer and farmer relations in perspective*. Ethnicity, hunter-gatherers, and the "other": Association or

assimilation in africa, ed. S. Kent. 2002, Washington D.C.: Smithsonian Institution Press.

99. Oyono, P.R., *From diversity to exclusion for forest minorities in Cameroon*, in *The equitable forest: Diversity, community, and resource management*, C.J.P. Colfer, Editor. 2004, Routledge: New York. p. 113-130.

100. Tchoumba, B., *Indigenous and tribal peoples and poverty reduction strategies in Cameroon*, I.L. Organization, Editor. 2005.

101. Tucker, S., *Human rights violations and indigenous 4b 2013 upr stakeholder report Cameroon*. 2013, The Center for Environment and Development: Yaoundé Cameroon.

102. Pemunta, N.V., *When 'property cannot own property': Women's lack of property rights in Cameroon.* African Journal of Economic and Sustainable Development, 2017. **6**(1): p. 67-85.

103. Tetinwe, N.A., *Translating policies on the rights of indigenous communities into concrete practice to mitigate conflicts over natural resource exploitation in central africa: Case study of the Baka people in eastern Cameroon.* Studies in Sociology of Science, 2017. **7**(6): p. 13-24.

104. Pelican, M., *Insights from Cameroon: Five years after the declaration on the rights of indigenous peoples (respond to this article at http://www. Therai. Org. Uk/at/debate).* Anthropology Today, 2013. **29**(3): p. 13-16.

105. Lewis, I., *Discrimination and access to health care: The case of nomadic forest hunter-gatherers in africa*. 1999, MSc Dissertation: University of. London: London.

106. Hewlett, B.S., *Central african government's and international ngos' perceptions of Baka pygmy development.* Hunters and gatherers in the modern world: Conflict, resistance, and self-determination, 2000: p. 380-390.

107. Bailey, R.C., S. Bahuchet, and B. Hewlett, *Development in the central african rainforest: Concern for forest peoples.* Conservation of West and Central African Rainforests, 1992: p. 202-211.

108. Dowie, M., *Forest people*, in *Conservation refugees: The hundred-year conflict between global conservation and native peoples*. 2011, MIT Press: Cambridge, Massachusetts. p. 65-78.

109. Rust, N.A., A. Abrams, D.W. Challender, G. Chapron, A. Ghoddousi, J.A. Glikman, C.H. Gowan, C. Hughes, A. Rastogi, and A. Said, *Quantity does not always mean quality: The importance of qualitative social science in conservation research.* Society & Natural Resources, 2017: p. 1-7.

110. Bennett, N.J., R. Roth, S.C. Klain, K. Chan, P. Christie, D.A. Clark, G. Cullman, D. Curran, T.J. Durbin, and G. Epstein, *Conservation social science: Understanding and integrating human dimensions to improve conservation.* Biological Conservation, 2017. **205**: p. 93-108.

111. Goldman, K.D. and K.J. Schmalz, *"Accentuate the positive!" using an asset-mapping tool as part of a community-health needs assessment.* Health Promotion Practice, 2005. **6**(2): p. 125-128.

112. Sharpe, P.A., M.L. Greaney, P.R. Lee, and S.W. Royce, *Assets-oriented community assessment.* Public Health Reports, 2000. **115**(2-3): p. 205.

113. Brannen, J., *Mixing methods: Qualitative and quantitative research*. 1992,

Aldershot: Avebury.

CHAPTER 2

Indigenous Peoples' Concerns About Loss of Forest Knowledge: Implications for Forest Management

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ABSTRACT

Although indigenous populations' participatory rights are recognized as a worldwide priority in forest management, local practices vary in interpretation, scope, and efficacy. The next generation of sustainable forest policies will require a higher degree of self-determination from indigenous groups (i.e., the ability for use, ownership, management, and control of their traditional lands and resources). Our case study provides insights into how an indigenous population, the Baka in Cameroon, face barriers to policy participation, hindering rights recognition to traditional forestland. The Baka interviewed herein expressed concern for how forest management impacts their livelihoods, threatens traditional ecological knowledge, and limits self-determination. Educational opportunities may provide co-benefits to the inclusion of indigenous stakeholders in forest management. To motivate indigenous inclusion specifically in forest management, we recommend educating forest managers in cultural competency and the importance of indigenous inclusion and knowledge. We recommend development of Baka educational programs that are focused on promoting greater self-determination and enrich understanding of the

forest management processes. These findings would help develop better relationships between indigenous peoples and forest management worldwide.

INTRODUCTION

Indigenous participation is argued to be a best practice in forest management and biodiversity conservation for utilitarian, rights-based, and moral reasons.[1] From a utilitarian perspective, the inclusion of indigenous priorities, and knowledge provides critical information. [1-7]. For instance, indigenous populations are sources of local ecological knowledge about environmental dynamics that influence forest sustainability (e.g., that have resulted from climate change) [8-13]. Past studies have also demonstrated that securing indigenous rights, and inclusion (e.g., by providing indigenous populations with land rights) can result in higher levels of biodiversity at a lower overall cost [14, 15]. From a rights-based perspective, greater indigenous self-determination in the management of their traditional lands is a matter of respecting international laws on indigenous rights (i.e., the ability for use, ownership, management, and control of their traditional lands and resources) described by the Free Prior and Informed Consent (FPIC) principle recognized as a fundamental international right of indigenous populations [16-19])[16, 20]. Finally, supporting the capacity of local communities to determine their affairs is also an issue of moral rights [21-24]. Despite international agreement on the importance of including

[1] We refer to forest management herein as the planning, decision-making, social and economic impacts, and resulting practices of forest policy, regulation, protection, conservation and/or restoration.

indigenous groups in forest management, inclusion practices vary in interpretation, scope, decision-making, and efficacy [25-28]. Recent calls to improve indigenous inclusion in forest management encourage adaptive management, dialogue with local communities, stakeholder equality, identification of community priorities, and place-based decision making [29-32]. However, many studies lack recognition of the indigenous voices and cultural competency affecting effective participation.

The indigenous Baka in Cameroon provide a case study for exploring how exclusion, cultural misunderstanding, and systematic political marginalization have affected indigenous culture, well-being, knowledge, and degree of self-determination. As a result, the Baka capacity for effective participation in sustainable forest management policy is reduced, dismissed, and ignored [33-37]. Even though the Baka, traditionally nomadic hunter-gatherers, possess intimate knowledge of the forest, biodiversity, and sustainable uses of forest resources [38-43] the incorporation and translation of their forest knowledge are rare in forest governance. Democratic Baka participation in forest policy has been limited due to discriminatory cultural practices, a complex social history, pressure to assimilate, and a lack of knowledge or understanding about Baka local livelihoods from decision makers [34, 44-46]. Baka face logistical, linguistic, and geographical barriers to participation in governance [34, 39]. Due to the lack of respect, rights, and the inclusion of Baka populations in forest management — which affect traditional culture, knowledge, and livelihood — Baka face increasing obstacles for inclusion, education, and self-determination. Considering how prior forest management in the region has impacted the Baka would provide critical insights leading to policy recommendations into how to improve

inclusion and benefit indigenous populations in future conservation planning.

Baka culture has been impacted as a result of forest management pressure to push Baka from nomadic forest camps to roadside settlements, the culmination of a series of *sedentarization* policies implemented over the last 80 years in Cameroon. A nationwide sedentarization policy was implemented in the late 1950s under French colonization, which continued after independence [47-49]. The policy encouraged relocation of indigenous populations living in protected areas, inclusive of the Baka, relocating them to the periphery of any reserves. The policy is reflective of other national sedentarization policies that have occurred internationally and similar pressures worldwide influencing indigenous populations' livelihood and rights to native lands [50-53]. The stated goal of Cameroon's relocation policy was twofold: to improve indigenous access to resources such as health clinics and promote indigenous people's participation in the local economy (including paying taxes) through the production of cash crops [54]. The relocation dramatically influenced the cultural norms of the Baka from 1950 to today. The Baka have suffered negative social and cultural consequences due to relocation resulting in a lack of land rights or land tenure to either current or traditional lands [34, 36, 48, 55-61]. Despite sedentarization, Baka still maintain a deep multi-faceted relationship with the forest. However, as sedentarization pressures continue to grow, traditional Baka knowledge continues to erode [62]. Dialogue with Baka can provide insights into the state of, exchange of, and continued use of the Baka's traditional ecological knowledge.

The purpose of this study was to engage local Baka communities in community-based action research to assess local Baka communities' evolution of the human-

forest relationship as well as to illustrate current barriers to inclusion within forest governance. Community-based action research works to combine the skills and knowledge of academic researchers with the local expertise and experiences of community participants in order to solve a problem, empower communities, build capacity, influence change, and guide policymakers [6, 63, 64]. Herein, we obtained first-hand perspectives to illustrate resulting regional effects of forest management on Baka populations regarding livelihood, the degree of self-determination, and traditional knowledge preservation. Using the Baka interviews as a case study for indigenous inclusion in forest management, we provide recommendations for both regional and international forest management practices that incorporate indigenous participation, priorities, cultural competency, and education for effective indigenous inclusion.

Despite extensive ethnographic studies on the Baka forest-relationship [33, 39, 47, 48, 58, 60, 65-67], studies on Baka perspectives regarding the impacts of forest policy on the extent of self-determination and their livelihood are still needed to inform sustainable forest management design. Community-based Baka priorities need to be developed to inform evidence-based decisions about future forest management. Evaluation of barriers to inclusion of Baka perspectives in previous forest management regimes would guide increased community partnership and improved knowledge-sharing in future programs. Local community-based research will be necessary for developing engagement approaches to reach sustained inclusion between communities with forest management because colonization, regional development

(logging, hunting tourism, roads), neighboring community relationships[2], and varying degrees of local pressure to assimilate have resulted in differences between Baka communities and their livelihood as it relates to the forest [48, 65, 68]. For instance, it has been reported in the literature that some Baka populations are aware of indigenous marginalization and their lack of indigenous rights, whereas others have reported indigenous titles only reinforce historical primitive pygmy stereotypes and marginalization [65].

METHODS

Key informant in-depth interviews were conducted in July 2014 with Baka resident populations in the Northern Dja region near the 526,000 hectares Dja Biosphere Reserve, the largest reserve in Cameroon. The reserve has been protected since 1950 and UNESCO dedicated the reserve as a World Heritage Site in 1987. This community-partnered study was conducted with approvals from the University of California, Los Angeles Institutional Review Board, the Cameroon National Ethics Committee, the Cameroon Ministry of Science and Innovation, and the regional delegation of Cameroon Ministry of Public Health in the area studied.

Study participants were recruited based on purposive sampling [69] with collaboration and approval of the two settlement chiefs. Upon arrival in each settlement, community meetings were organized to explain the research aims, the

[2] Regional government may not recognize all Baka villages and chiefs. Some villages are considered Baka camps with camp leaders subordinate to Bantu villages; discouraging official Baka engagement and political inclusion (see Lueong 2016).

importance of their community's thoughts and opinions, the collaborative purpose of the research, to explain confidentiality measures (no personal identifiers would be collected or used), and to introduce the research team. A community activity was then organized after the community meeting to familiarize the research team with community members, such as bracelet making, a tour of the village, or initiating games with children. Settlement chiefs were then asked to assist with facilitating participant lists using inclusion criteria. An inclusion criterion was: (1) over 18 years of age, (2) availability (i.e., the interview would not be a burden to daily activities), and (3) reasonable fluency in French or Baka language. Individuals were solicited to ensure equal gender representation in each settlement.

We interviewed a total of 15 study participants (eight males and seven females) from two Baka settlements. Nine participant interviews were obtained from a 300-person settlement designated as "Settlement 1," and six participant interviews were obtained from a 60-person settlement designated "Settlement 2." Settlement chiefs and interview contacts were given gifts (tote bags) regardless of agreement to participate in the study. Private interviews were conducted for 30-90 minutes each in the residents' homes, churches, or location of choice. Interviews were conducted with the assistance of local translators who were familiar with the local French or Baka dialect. Verbal informed consent was received from each study participant. Before verbal consent was obtained, interviewers individually reiterated the confidentially of the study (no personal identifiers would be collected), the voluntary nature of the interview and the ability to stop the interview process at any time, and the importance of participant thoughts and opinions to each interview contact. No

individuals declined to participate in the study. No participants declined to participate, but the translator decided to end an interview after one participant was unable to complete the interview after being interrupted and becoming disengaged.

The semi-structured interview guide was developed as part of a more extensive study aimed to explore local population's perceptions near the Dja Faunal Reserve regarding local relationships with forest management, use of forest resources, livelihood, community traditions, and health practices. The guide was developed based upon a literature review of previous anthropogenic studies on local Dja populations and consultation with local scholars who had previously conducted biodiversity research in the area. Questions were framed to elicit participants' insights into community traditions, to provide insights beyond the individual's environment, to offer participants the experience of speaking as experts on their communities, and to minimize disclosure of any personal use of banned forest resources (i.e., poaching). Additionally, questions were framed using a community asset-mapping framework to establish relationships, empower participants, and focus on positive aspects of their communities [70, 71].

A six-step thematic content analysis [72] was used to identify themes representative of participants' perspectives resulting from interview questions asked about food security, livelihood, health, community traditions, and forest management. Interviews were audio recorded and subsequently transcribed verbatim by a native speaker. One coder reviewed transcripts using ATLAS.ti software and discussed emerging themes with two other researchers. Iterative analyses continued with all three coders until saturation of significant themes was achieved. We looked

for consistencies, inconsistencies, and frequency of themes to determine areas of significance.

RESULTS

Emerging themes coded from interviews include Baka insights regarding the current Baka-forest relationship, recent changes in livelihood due to forestry resources, portrayals of community self-determination (i.e., the extent to which Baka to be agents in their development, forestry policy, or benefits), and changes in livelihood due to living on the roadside versus the forest, see **Figure 2.1**.

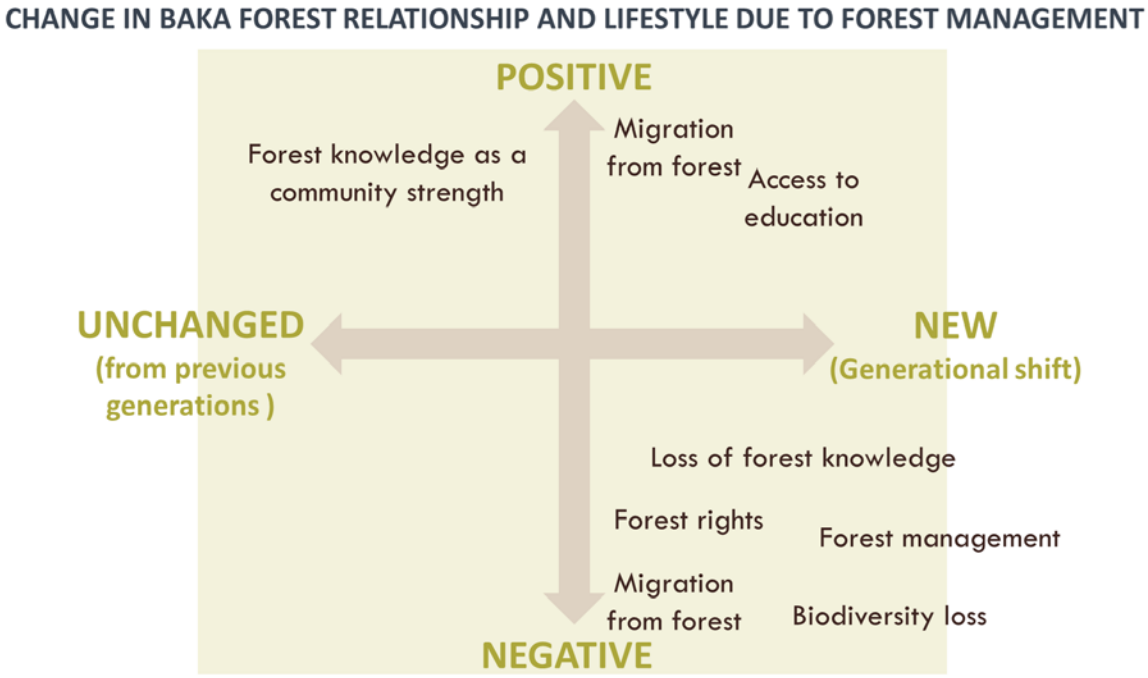

Figure 2.1. **An overview of resulting themes from Baka interviews**. The theme map places overarching themes described either positively or negatively in interviews in reference to how these themes are perceived as recent or unchanged in comparison to previous Baka generations.

Forest knowledge and knowledge of medicinal plants are community strengths

The majority of the Baka interviewed described the knowledge of the forest and traditional medicines as community strengths (10/15 participants with at least one mention). Baka individuals were proud of their unique traditional knowledge of the forest and spoke to the advantage of traditional forest knowledge in comparison to neighboring communities; "Our strength here is based on knowledge of the forest because many people know nothing of the forest" (Male, Baka Settlement 2) and, "We get our medicinal plants from the forest which makes us stronger than the Bantu[3] who do not know" (Female, Settlement 1). Knowledge of traditional medicines and plants is seen as unique to the Baka in comparison to neighboring communities. Every Baka participant mentioned using traditional medicine as a strength when discussing community health practices (15/15 participants with at least one mention), and many asserted that traditional medicine is in demand. For example, one participant noted, "My old man back home is one of the few who possesses the know-how and is still alive. Many people come from Yaoundé to get treatment from him" (Male, Settlement 1).

Expression of both positive and negative impacts of relocation to outside the forest

The Baka we interviewed were acutely aware of the impacts—both positive and negative—caused by forest-roadside migration. Although no interview questions

[3] Bantu is the colloquial name given to Bantu-speaking neighboring communities to the Baka and are estimated to have migrated to the area about ~2,500 years ago. Bantu should not be seen as a homogenous ethnic group and may represent larger Bantu speaking groups regionally, including the Badjoue, Nzime, Mbulu, and Fang-Nzaman. These groups have traditionally participated in both agriculture and hunting. When the Baka were relocated from the forest, many of them settled adjacent to existing Bantu villages.

addressed relocation as a topic directly, most participants spontaneously reflected upon the changes between forest camps and roadside settlements when asked about any community cultural changes (13/15 participants with at least one mention). Baka described the history of relocation and differences in access to resources because of migration. For example, one participant recalled,

> "Things are different these days compared to the past. In the past, our forefathers didn't know about many of the things we know today such as a school for our kids. Also, in the past, we the Baka lived only in the forest, but today we have been forced out by the government. We now live in towns." (Male, Settlement 1)

Although participants were able to highlight positive results of the relocation such as access to education, for instance, "we build our houses in the villages…we work farms, wear clothes, speak French and even send our kids to school… [and] life is much better today compared to the past" (Female, Settlement 2), not all participants agreed with the lifestyle changes and several expressed concern about how relocation may affect future generations. One man commented, "Life is much worse for the youngsters of today. That is why I am against the white man who wants to remove the Baka from the forest to take him to the village" (Male, Settlement 2).

Despite the differences in perspective regarding how relocation has affected Baka livelihood, a common theme emerged among the individuals we interviewed that moving "back" to the forest was not realistic with the current state of forest degradation. For instance, although Baka often still spend certain times of the year in the forest during hunting season—one participant noted that "when resources such as

honey are abundant, we usually spend up to 4 months in the forest, but when resources are scarce, we spend just 2 months" (Female, Settlement 2). Participants were unsure of how their communities would survive in the forest year-round as past generations did because of the current state of the forest resources, as one explained, "Because we want to have plenty of food, we can't go back to the forest" (Male, Settlement 1).

Worries about future generations retaining traditional forest knowledge due to loss of biodiversity

Baka participants expressed concern for future generations and how future generations may never know of the biodiversity of certain animals due to forest degradation. For example, a participant asserted, "If everyone thought like me then the forest would be conserved for our children because the rates at which the game is disappearing, our children will no longer know these animals" (Female, Settlement 2). Many Baka interviewed described how the loss of animals due to forest degradation had affected the Baka community (9/15 participants with at least one mention). For instance, one interviewee stated, "species of animals such as the giant pangolins and bush pigs, and big antelopes we are no longer able to find today" (Female, Settlement 1). Interviewees reported that the loss of animals had affected the Baka's ability to hunt game, which has in turn affected historical sustenance patterns. One participant stated,

> "Finding the game isn't easy today like in the past where you could set up a trap behind your house. Today you have to journey for close to 15 to 20

kilometers in the forest to kill the game. There are too many guns and poachers today". (Female, Settlement 1)

Baka interviewee's highly regarded education as important for community improvement, but some worry about the loss of traditional ecological education due to generational livelihood changes

The Baka we interviewed were enthusiastic about the benefits of education in roadside communities and described benefits to community advancement as a result of education but worry about the loss of traditional culture and ecological forest knowledge. As most of the children in the villages are of the first generation of Baka who attend school, or "formal education," there is tension between the loss of traditional and ecological forest knowledge which is formed by longitudinal practice [73]. We found education was highly regarded within the community, regardless of the context (14/15 participants with at least one mention). If Baka mentioned formal education, the Baka often subsequentially expressed the importance of literacy in advancing self-determination within the community. For instance, one participant shared,

> "Life is much better today because I do not need a Bantu to speak for me today or to write a letter for me. For example, in the past when the government sent a letter…my grandfather had to send for a Bantu, about 2 kilometers away, to come read the letter and translate to the Baka what the letter was all about". (Male, Settlement 1)

Traditional cultural and ecological education places emphasis on tradition, as a

Female from Settlement #2 states, "there is a rhythm of life in the forest we are not prepared to forget. Women teach young girls fishing techniques and how to look for wild yams. Men teach young boys how to harvest honey, climb trees, cut trees, and hunt." Another participant shared, "We the Baka have traditions that we transmit from generation to generation, and no matter what we do in life, we can never forget. Once a child is born, the child is taught these cultural values which he will carry all through his life." (Male, Settlement 2).

Many interviewees reflected on the requisite passing down of traditional knowledge to maintain Baka tradition. Baka explained the importance of youth learning from Baka elders and making sure younger generations are given a chance to learn traditional knowledge. For instance, one participant stated, "If I know something, I make sure I teach the young ones so that when they grow up, they can also do it" (Male, Settlement 2). Although the reverence for formal education is seemingly strong, some participants expressed concern about the loss of traditional education and cultural traditions:

> "Many of our customs are disappearing like in the past, our ancestors practiced circumcision, but nowadays, maybe just one member of the community knows how to do that. In the past, everybody knew how to make spears and machetes, but today only two or three people know how to do that per village." (Female, Settlement 2)

A concern for the loss of traditions and skills from migration from the forest is also described due to generational differences in livelihood. As a Female, Settlement 1, states,

> "Our grandparents lived only in the forest and did many things in the forest, but for us today who live in the village, there are things that we no longer know. [For instance] things like harvesting honey. Our fathers used lianas to climb tall trees and harvest honey for us today; we cut down the branch."

Uncertainty regarding current approaches to forest conservation and management

Many of the Baka interviewed expressed a lack of inclusion in, or a feeling of exclusion from, forest management and a paucity of benefits (11/15 participants with at least one mention). Several participants expressed frustration and potentially a lack of understanding of forest management; due to an inability see the direct benefits of forest governance. To this effect, one participant asserted:

> "The government does nothing here to protect that forest. In my opinion, they rather try to destroy the forest because they authorize timber companies to come here and cut down our big trees. We the local people gain nothing from this exploitation of our forest". (Male, Settlement 1)

Participants provided specific examples of times when Baka were excluded or marginalized from forest management projects, such as the following:

> "When the ECOFAC project [a Dutch-funded ecological development project that assisted the Dja Reserve management from 2003- 2006] was here, they were supposed to recruit the Baka as well as forest guards. But they practiced a kind of tribalism in which they recruited only Bantu men despite the fact that we could very well protect the forest". (Male, Settlement 1)

Several of the individuals we interviewed expressed skepticism about the current model of forest management in the region and questioned why Baka communities had been excluded from access to decision-making and participation. For example, one participant stated, "I believe it is not important to protect the forest from someone like me because I live in the forest and have neither job in government nor any project" (Male, Settlement 2). Another asserted, "The government doesn't even ask our opinion" (Male, Settlement 1).

Awareness of the lack of Baka rights to traditional land tenure in forestry management

The Baka may feel marginalized in forest management, not only due to exclusion from participation but also because of the lack of Baka rights to land tenure, or land rights. A few of the individuals we interviewed stressed community unhappiness about the lack of rights to land tenure in the areas they now reside (3/15 participants with at least one mention). For example, one participant said:

> "I can't tell you what the government does to protect the forest here because I don't know. We do our best to conserve the forest except that in this area where we live the Bantu are a real nuisance. They tell us that we don't have any rights here because the place belongs to them. We own no land, and we usually tell the timber companies who come here that we are forest people who once lived in the forest, but the government forced us out and settled us here. Where then are our rights in the forest?" (Male, Settlement 1)

Land tenure also affects the way Baka can participate in selling food in local markets,

as they are unable to farm or have limited farming land. One participant noted:

> "Our main worry here is that of farmland. Because of this problem we don't know how to live here due to no food security. If a solution could be found for that, then things would be much better for us". (Female, Settlement 2)

The lack of land rights also induces further dependence on local Bantu communities. For example, a participant expressed:

> "I would first like to talk about a big problem we face here. It is about land. Now is the season for sowing crops, and the Bantu who own all the land usually make us work very hard on their farms before they can authorize us to sow crops for ourselves". (Female, Settlement 2)

DISCUSSION

Baka study participants noted the importance of the Baka-forest relationship and modern influences on the Baka-forest relationship due to forest management, such as restricted access to forest resources and inhabitance. Biodiversity degradation, including declines in animal species, was a concern for the Baka because of the difficulty of imparting traditional forest knowledge to the next generation. Baka have struggled with traditional cultural hunting practices because of the noted loss of animal populations [42, 43]. Baka participants explained how relocation and migration from forest camps to roadside settlements had affected their communities' cultural identity and livelihood; all exacerbated by a lack of land tenure rights. Relocation has restricted the traditional and customary lifestyle to a new semi-sedentary lifestyle near roads and other communities [66]. Consistent with the

literature, positive impacts of relocation, such as access to education, were recognized by study participants [55].

Baka study participants noted issues with the current approaches to forest management in the region due to a lack of benefits to traditional lands and resources, and a lack of inclusion in forest management decision-making. Other Baka communities in the region are reporting forest management conflicts, explicitly because of a lack of forest rights, have been documented in populations near the Western areas of the Dja Reserve [74] and the Eastern Area of the Reserve [75]. Tchoumba and Nelson (2006) mapped the extensive, customary, and sustainable use of forest resources by Baka, in addition to describing discriminatory conflicts between forest guards and Baka. Samndong and Vatn (2012) documented forest resource conflicts with logging companies as a direct result of current forest policy preferentially granting rights to logging companies without consultation of local Baka indigenous populations. Notably, Samndong and Vatn found that participating Baka communities preferred solutions focused on sustainable regulation of rights to forest resources in comparison to financial benefits or other proposed resolutions to forest management conflicts [75].

Listening to the Baka: Implications for forestry management

Forest management practices reflecting today's voices, perspectives, and priorities of local indigenous populations are necessary to rectify the ongoing adverse impacts of forest management practices with Baka communities. Interview results regarding the degradation of the Baka-forest relationship, along with published

literature [33, 35-37, 39, 55, 60, 61, 65, 74] suggest that robust participatory action is needed to ensure the inclusion of Baka in forest management. Recommendations provided should be evaluated as essential guidance for improving Baka self-determination in future forest management exchanges. Implications for participatory best practices for Baka inclusion in forest management include the following:

1. **Baka want to be included in forest management; however, reform is needed to promote engagement and inclusion of Baka in planning, policy, and management of customary lands**. This study is not the first to illustrate the lack of inclusion of Baka in forest management, nor is it the first to recommend policy reform to improve inclusion of Baka in forest management [34, 37, 39, 60, 76, 77]. However, this is the first study that we were able to identify which gives voice to the Baka's concerns about the loss of traditional ecological knowledge and the importance of being involved in forest management to protect such knowledge. Baka are underrepresented in forest governance; thus, strategic efforts should be made to increase Baka self-determination and to recognize indigenous rights for the Baka in the management of traditional lands. Baka interviewed herein described disadvantages of the current approaches to forest management, and desire positive change for the forest and its resources. The Baka we interviewed were unable to describe direct benefits of forest conservation and therefore may not understand current strategies and resulting outcomes in regional forest management. Baka empowerment and education through participatory processes are needed to

ensure integration, buy-in, and the active inclusion of Baka within forest management decisions.

2. **Strategic efforts that include cultural competency and building capacity for engagement are necessary to improve forest management approaches to relationships with the Baka.** The Baka referred to strained forest management relationships due to a lack of recognition, inclusion, and respect for traditional lifestyles. As forest management holds current legal authority, capacity building for promoting change and inclusion must be considered in initiating, motivating, and sustaining participatory processes. The process of Baka inclusion in forest management must recognize Baka desire to maintain cultural traditions and relationships with the forest. As the inclusion of Baka indigenous populations will be new to forest management, training on recognition of bias, cultural competency, and the education of indigenous rights and value of indigenous forest knowledge in protecting forests will be critical for effective collaboration. One way to accomplish this in Southern Cameroon would be to encourage greater inclusion of Baka in Ecoguard programs and also to promote opportunities for Baka to teach both neighboring groups and forest managers about native plants traditional medicines. Learning from other collaborative co-management forestry programmes will assist in improving strategic participatory change such as capacity building that reduces power differentials, increases self-determination of indigenous populations, improves equilateral beneficial outcomes, and involves continuous feedback, reflection, and quality improvement in forest management [78-82]. Lessons learned from recent

integrative indigenous participation systems in natural resource management programmes specifically include recommendations for focus on indigenous reconciliation and equity [83], relationship building between governors and indigenous populations [84, 85], embracement of humility, transparency and openness, and elasticity in the process of inclusion [11, 81], the inclusion of well-being in outcome metrics [86], and the wholesome recognition of the critical value of indigenous knowledge to environmental management [87, 88].

3. **Facilitating inclusion by the Baka in forestry management will be critical for sustained engagement**. Logistical barriers to inclusion should be considered for facilitation of Baka communities in forest management planning and decision-making (i.e., adequately informing Baka about dates for meetings, providing translators, providing transportation to meetings, and so forth). Structuring future discussions with Baka will require a recognition of traditional Baka egalitarian cultural [65, 89]. True egalitarian engagement in forest management affairs may require longitudinal participatory timelines that allow for community-based consultation, community meetings, and the potential desire for community discussions versus one-on-one or small-group interviews. Baka traditional ecological knowledge should be obtained with respect for how systematic forest knowledge recollection transpires (i.e., traditional semantic knowledge recognition) and longitudinal knowledge acquisition [40, 62, 90]. The extent to which Baka socialize and network between neighboring Baka communities and travel within the forest should be valued as social capital. As Baka communities can exchange ideas and knowledge, as well as

communication between villages and regions with ease, collaborative and beneficial participatory forest management could present positive impacts both for remediating negative historical forest management impacts and in implementing new initiatives or ideas in improving forest management capacity.

4. **Education of Baka regarding forest governance and participatory processes will be critical to the efficacy of technocratic participation and may help to create buy-in.** The Baka hold high regard for education for advancing their communities and the skills of younger generations. While significant differences in philosophy, culture, education, and raison d'être may exist between forest managers and Baka indigenous populations, the Baka show willingness to gain advancement and would seemingly be open to education regarding current models of participatory forest governance and brainstorming for effective change. Recognition of differences in learning and memory will be important for forest managers to understand, such as respect for ways in which Baka recall knowledge within their own experiences and livelihoods [40, 90] or the potential opportunities for Baka knowledge crowdsourcing, as differences exist between Baka generations' ecological knowledge [62, 73].
5. **Baka forest knowledge is at risk and of critical value to inform sustainable approaches to forest management.** The Baka we interviewed expressed concerns about how changes in the world around them have put their traditional knowledge at risk. The risk of knowledge loss is particularly unfortunate because the Baka's traditional forest knowledge could be used to

improve and educate other stakeholders on sustainable sustenance practices and strategies for forest management [77, 82, 91]. For instance, the sustainable harvesting of bush mangoes, wild yams, honey, mushrooms, and palm grubs from the forest employed by the Baka for generations, could serve as a model for developing policies that allow residents to continue to benefit from forest resources without hampering conservation activities. In this way, recognizing the value of Baka forest knowledge can enhance conservation efforts by linking sustainable food sources for local populations to good forest stewardship. The Baka also have detailed knowledge about a wide range of forest species that forest managers can leverage when monitoring biodiversity goals. As Gupta explained, "Conserving biodiversity without conserving associated knowledge systems is like building and maintaining a library without a catalogue" [92]. Bantu and neighboring groups recognize Baka traditional forest knowledge through soliciting of Baka's knowledge of traditional medicines [58, 93, 94]. Bantu recognition of Baka forest knowledge of traditional medicines could be leveraged to convince forest managers of the importance of sustaining such knowledge.

Strengths of our study design were the exploration of Baka one-on-one interviews regarding their livelihood and perspectives on forest management. Our study included a limited geographical range, as we interviewed only two settlements near the northern buffer around the Dja Reserve. Although saturation of themes was reached in the interviews obtained, differences in perspectives between participants

and Baka from other regions or other forest-dependent populations near the Dja would need to be explored more fully before generalizing the results reported herein. Also, further study would be informative to explore how evolving Baka lifestyles influence views, for instance by comparing the opinions of Baka settled in villages near Bantu villages versus Baka maintaining a more traditional and customary lifestyle. We also did not reciprocally interview forest manager's perceived obstacles for indigenous inclusion.

CONCLUSION

Despite the Baka's in-depth knowledge about the forest and how indigenous ecological knowledge may be utilized for forest management, Baka inclusion and self-determination are unrepresented in local governance, forestry policy, and forest management. The Baka hold a complex, intimate relationship with the forest that is changing due to the management of protected areas, the pressure to assimilate, forest degradation, and the migration to roadside settlements from forest camps. The lack of rights and inclusion degrades critical Baka indigenous forest knowledge, well-being, and self-determination. The Baka serve as a case study for how reduced capacity of indigenous populations deteriorates indigenous knowledge and thus the advancement of science in forest management sustainability.

The threat of the loss of indigenous ecological knowledge must be a driving force in recognizing the value of immediate strategies to foster the inclusion of indigenous populations in forest management. Inclusion and recognition are imperative to preserve the culture, rights, and forest relationship that sustain

indigenous ecological knowledge. Legal frameworks protecting indigenous rights, livelihood practices and traditions that sustain indigenous knowledge, and institutionalizing inclusive decision making will enable evidence-based policy decisions, recognition of indigenous rights, indigenous knowledge streams critical for sustainable forest management, and effective indigenous participation within forest management.

To promote inclusion and self-determination of indigenous populations, community-based action research may be used to illuminate indigenous populations' concerns and barriers related to inclusion in policy issues that may affect indigenous well-being. Community-based action research works to inform policymakers of the traditional indigenous customs, knowledge, and livelihood practices to help them understand, prioritize, and make decisions that reduce harm created by future forest policy. Capacity building in engagement will be critical to maximizing understanding of the knowledge exchange among indigenous populations, policy experts, and conservation scientists. Capacity building and education are imperative for indigenous populations to understand the goals of forest management, acknowledge the purpose of engagement, build appreciation for the participatory process, and help increase self-determination of indigenous populations. Education is central to sustaining indigenous culture and knowledge and thus presents an opportunity for investing in indigenous stakeholders and effective inclusion.

To facilitate collaboration between indigenous populations and forest management, innovative education is needed for forest managers to develop the skills and motivation to promote change for the inclusion of indigenous populations.

Education for forest managers in cultural competency, indigenous rights, cognitive bias, the value of indigenous knowledge, and ethical decision-making is essential for resolution of past exclusion. As the pursuit of global conservation science aims to improve human capacity and indigenous rights through inclusion, we must not forget to also educate regional forest managers in the practice of resolution, bilateral exchange, the importance of cultural diverse knowledge streams in conserving biodiversity, and the importance of increased self-determination of indigenous populations in forest sustainability.

REFERENCES FOR CHAPTER 2

1. Ives, C.D. and D. Kendal, *The role of social values in the management of ecological systems.* Journal of Environmental Management, 2014. **144**: p. 67-72.
2. Bennett, N.J., R. Roth, S.C. Klain, K. Chan, P. Christie, D.A. Clark, G. Cullman, D. Curran, T.J. Durbin, G. Epstein, A. Greenberg, M.P. Nelson, J. Sandlos, R. Stedman, T.L. Teel, R. Thomas, D. Veríssimo, and C. Wyborn, *Conservation social science: Understanding and integrating human dimensions to improve conservation.* Biological Conservation, 2017. **205**: p. 93-108.
3. Naughton-Treves, L., M.B. Holland, and K. Brandon, *The role of protected areas in conserving biodiversity and sustaining local livelihoods.* Annu. Rev. Environ. Resour., 2005. **30**: p. 219-252.
4. Agarwala, M., G. Atkinson, B.P. Fry, K. Homewood, S. Mourato, J.M. Rowcliffe, G. Wallace, and E. Milner-Gulland, *Assessing the relationship between human well-being and ecosystem services: A review of frameworks.* Conservation and Society, 2014. **12**(4): p. 437-449.
5. Mantyka-Pringle, C.S., T.D. Jardine, L. Bradford, L. Bharadwaj, A.P. Kythreotis, J. Fresque-Baxter, E. Kelly, G. Somers, L.E. Doig, and P.D. Jones, *Bridging science and traditional knowledge to assess cumulative impacts of stressors on ecosystem health.* Environment International, 2017. **102**: p. 125-137.
6. Johnson, J.T., R. Howitt, G. Cajete, F. Berkes, R.P. Louis, and A. Kliskey, *Weaving indigenous and sustainability sciences to diversify our methods.*

Sustainability Science, 2016. **11**(1): p. 1-11.

7. Gómez-Baggethun, E., E. Corbera, and V. Reyes-García, *Traditional ecological knowledge and global environmental change: Research findings and policy implications.* Ecology and society, 2013. **18**(4).
8. Nyong, A., F. Adesina, and B.O. Elasha, *The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African sahel.* Mitigation and Adaptation strategies for global change, 2007. **12**(5): p. 787-797.
9. Green, D. and G. Raygorodetsky, *Indigenous knowledge of a changing climate.* Climatic Change, 2010. **100**(2): p. 239-242.
10. Alexander, C., N. Bynum, E. Johnson, U. King, T. Mustonen, P. Neofotis, N. Oettlé, C. Rosenzweig, C. Sakakibara, V. Shadrin, M. Vicarelli, J. Waterhouse, and B. Weeks, *Linking indigenous and scientific knowledge of climate change.* BioScience, 2011. **61**(6): p. 477-484.
11. Berkes, F., *Indigenous ways of knowing and the study of environmental change.* Journal of the Royal Society of New Zealand, 2009. **39**(4): p. 151-156.
12. Brugnach, M., M. Craps, and A. Dewulf, *Including indigenous peoples in climate change mitigation: Addressing issues of scale, knowledge and power.* Climatic Change, 2017. **140**(1): p. 19-32.
13. Abbott, D. and G. Wilson, *The lived experience of climate change: Knowledge, science and public action*. 2015, Switzerland: Springer International Publishing.
14. Ding, H., P. Veit, A. Blackman, E. Gray, K. Reytar, J. Altamirano, and B. Hodgdon, *Climate benefits, tenure costs: The economic case for securing*

indigenous land rights in the Amazon. World Resources Institute: Washington, DC. Available at http://www.wri.org/publication/climate-benefits-tenurecosts, 2016.

15. Robinson, B.E., M.B. Holland, and L. Naughton-Treves, *Does secure land tenure save forests? A meta-analysis of the relationship between land tenure and tropical deforestation.* Global Environmental Change, 2014. **29**(Supplement C): p. 281-293.
16. UNDRIP, *United Nations declaration on the rights of indigenous peoples*. 2007, United Nations Department of Public Information.
17. ILO, *Indigenous and tribal peoples convention*, in *169*. 1989, International Labour Organization: Geneva.
18. UNEP, *Convention on biological diversity*, in *VNEP No. 92-8314.* 2015: United Nations Environment Programme, Nairobi, Kenya.
19. Colchester, M., *Self-determination or environmental determinism for indigenous peoples in tropical forest conservation.* Conservation Biology, 2000. **14**(5): p. 1365-1367.
20. Murphy, M., *Self-determination as a collective capability: The case of indigenous peoples.* Journal of Human Development and Capabilities, 2014. **15**(4): p. 320-334.
21. Sen, A., *Human rights and capabilities.* Journal of human development, 2005. **6**(2): p. 151-166.
22. Holland, B., *Recognition, participation, and power in the global struggle for environmental justice: The emerging politics of environmental rights and*

opportunities. Politics, Groups, and Identities, 2015. **3**(4): p. 692-696.

23. Bockstael, E. and K. Watene, *Indigenous peoples and the capability approach: Taking stock.* Oxford Development Studies, 2016. **44**(3): p. 265-270.
24. Binder, C. and C. Binder, *A capability perspective on indigenous autonomy.* Oxford Development Studies, 2016. **44**(3): p. 297-314.
25. Lund, J.F., *Paradoxes of participation: The logic of professionalization in participatory forestry.* Forest Policy and Economics, 2015. **60**: p. 1-6.
26. Sterling, E.J., E. Betley, A. Sigouin, A. Gomez, A. Toomey, G. Cullman, C. Malone, A. Pekor, F. Arengo, and M. Blair, *Assessing the evidence for stakeholder engagement in biodiversity conservation.* Biological Conservation, 2017. **209**: p. 159-171.
27. Mistry, J. and A. Berardi, *Bridging indigenous and scientific knowledge.* Science, 2016. **352**(6291): p. 1274-1275.
28. Maldonado, J., T.B. Bennett, K. Chief, P. Cochran, K. Cozzetto, B. Gough, M.H. Redsteer, K. Lynn, N. Maynard, and G. Voggesser, *Engagement with indigenous peoples and honoring traditional knowledge systems.* Climatic Change, 2016. **135**(1): p. 111-126.
29. Rist, L., C. Shackleton, L. Gadamus, F.S. Chapin III, C.M. Gowda, S. Setty, R. Kannan, and R.U. Shaanker, *Ecological knowledge among communities, managers and scientists: Bridging divergent perspectives to improve forest management outcomes.* Environmental Management, 2016. **57**(4): p. 798-813.
30. Adams, M.S., J. Carpenter, J.A. Housty, D. Neasloss, P.C. Paquet, C. Service, J. Walkus, and C.T. Darimont, *Toward increased engagement between academic*

and indigenous community partners in ecological research. Ecology and Society, 2014. **19**(3).

31. van Kerkhoff, L. and V. Pilbeam, *Understanding socio-cultural dimensions of environmental decision-making: A knowledge governance approach.* Environmental Science & Policy, 2017. **73**: p. 29-37.
32. Martin, A., B. Coolsaet, E. Corbera, N.M. Dawson, J.A. Fraser, I. Lehmann, and I. Rodriguez, *Justice and conservation: The need to incorporate recognition.* Biological Conservation, 2016. **197**: p. 254-261.
33. Ngefor, S., *Indigenous peoples and conservation of forest resources: The case of the Baka people of the eastern region of Cameroon.* International Journal of Green Economics, 2013. **7**(3): p. 299-313.
34. Pemunta, N.V., *The governance of nature as development and the erasure of the pygmies of Cameroon.* GeoJournal, 2013. **78**(2): p. 353-371.
35. Assembe Mvondo, S., *Decentralized forest resources and access of minorities to environmental justice: An analysis of the case of the Baka in southern Cameroon.* International Journal of Environmental Studies, 2006. **63**(5): p. 681-689.
36. Nguiffo, S., *One forest and two dreams: The constraints imposed on the Baka in miatta by the Dja wildlife reserve.* Indigenous People and Protected Areas in Africa, 2003: p. 195-214.
37. Awuh, H.E., *Access to discourse, marginalisation and exclusion in conservation-induced resettlement: The case of the displaced Baka of east Cameroon.* International Journal of Environmental Studies, 2016. **73**(2): p. 294-312.

38. Brisson, R., *Utilisation des plantes par les pygmées Baka*. 2011, Paris: L'Harmattan.

39. Pyhälä, A., *What future for the Baka? Indigenous peoples' rights and livelihood opportunities in south-east Cameroon*, M.W. Jensen, Editor. 2012, International Work Group for Indigeonous Affairs: Copenhagen, Denmark.

40. Reyes-García, V., M. Guèze, I. Díaz-Reviriego, R. Duda, Á. Fernández-Llamazares, S. Gallois, L. Napitupulu, M. Orta-Martínez, A. Pyhälä, and E. Dounias, *The adaptive nature of culture: A cross-cultural analysis of the returns of local environmental knowledge in three indigenous societies.* Current Anthropology, 2016. **57**(6): p. 000-000.

41. Gadgil, M., F. Berkes, and C. Folke, *Indigenous knowledge for biodiversity conservation.* Ambio, 1993. **22**(2-3): p. 151-156.

42. Yasuoka, H., *The sustainability of duiker (cephalophus spp.) hunting for the Baka hunter-gatherers in southeastern Cameroon.* African Study Monographs, 2006. **33**.

43. Yasuoka, H., *Snare hunting among Baka hunter-gatherers: Implications for sustainable wildlife management.* African Study Monographs. Supplementary issue., 2014. **49**: p. 115-136.

44. Sharpe, B., *'First the forest': Conservation,'community'and 'participation'in south-west Cameroon.* Africa: Journal of the International African Institute, 1998. **68**(01): p. 25-45.

45. Jackson, D. *Implementation of international commitments on traditional forest-related knowledge: Indigenous peoples' experiences in central africa*. in

Expert Meeting on Traditional Forest-Related Knowledge (TFRK). 2004. San Jose, Costa Rica: International Alliance of Indigenous and Tribal Peoples of the Tropical Forests.

46. Graziani, M. and P. Burnham, *Legal pluralism in the rain forests of south-eastern Cameroon*, in *Rural resources & local livelihoods in africa*. 2005, Springer. p. 177-197.
47. Joiris, V., P. de Maret, and S. Bahuchet, *La chasse, la chance, le chant: Aspects du système rituel des Baka du cameroun*, in *Faculté des sciences sociales, politiques et économiques.* 1998, Université libre de Bruxelles: Bruxelles.
48. Hewlett, B.S., *Central african government's and international ngos' perceptions of Baka pygmy development*, in *Hunter-gatherers in the modern world*, R.K.H. Megan Biesele, Peter P. Schweitzer, Editor. 2000, Berghahn: New York. p. 381-390.
49. Bailey, R.C., S. Bahuchet, and B. Hewlett, *Development in the central african rainforest: Concern for forest peoples.* Conservation of West and Central African Rainforests, 1992: p. 202-211.
50. Ikeya, K., *Sedentarization among nomadic peoples in asia and africa*. 2017, National Museum of Ethnology: Osaka, Japan.
51. Kent, S., *Does sedentarization promote gender inequality? A case study from the kalahari.* Journal of the Royal Anthropological Institute, 1995: p. 513-536.
52. Maruyama, J., *The impacts of resettlement on livelihood and social relationships among the Central Kalahari San.* African Study Monographs, 2003. **24**(4): p. 223-245.

53. Awuh, H.E., *A critique of the global literature on the conservation refugee problem*, in *School of Geography, Environment and Earth Sciences*. 2011, Te Kura Tatāi Aro Whenua Victoria University of Wellington: New Zealand.

54. Dowie, M., *Forest people*, in *Conservation refugees: The hundred-year conflict between global conservation and native peoples*. 2011, MIT Press: Cambridge, Massachusetts. p. 65-78.

55. Awuh, H.E., *Adaptive livelihood strategies in conservation-induced displacement: The case of the Baka of east Cameroon.* African Studies Review, 2015. **58**(2): p. 135-156.

56. Colchester, M. and F. MacKay. *Forest peoples, customary use and state forests: The case for reform*. in *Paper to 11th Biennial Congress of the International Association for the Study of Common Property. Bali, Indonesia*. 2006.

57. Njounan Tegomo, O., L. Defo, and L. Usongo, *Mapping of resource use area by the Baka pygmies inside and around boumba-bek national park in southeast Cameroon, with special reference to baka's customary rights.* African Study Monographs. Supplementary Issue., 2012. **43**: p. 45-59.

58. Betti, J.L., *An ethnobotanical study of medicinal plants among the Baka pygmies in the Dja biosphere reserve, Cameroon.* African Study Monographs 2004. **25**(1).

59. Althabe, G., *Changements sociaux chez les pygmées Baka de l'est-cameroun.* Cahiers D'études Africaines, 1965: p. 561-592.

60. Leonhardt, A., *Baka and the magic of the state: Between autochthony and citizenship.* African Studies Review, 2006. **49**(02): p. 69-94.

61. Tetinwe, N.A., *Translating policies on the rights of indigenous communities into concrete practice to mitigate conflicts over natural resource exploitation in central africa: Case study of the Baka people in eastern Cameroon.* Studies in Sociology of Science, 2017. **7**(6): p. 13-24.

62. Gallois, S., R. Duda, and V. Reyes-García, *'Like father, like son'? Baka children's local ecological knowledge learning in a context of cultural change*, in *Hunter-gatherers in a changing world*. 2017, Springer. p. 195-211.

63. Minkler, M. and N. Wallerstein, *Community-based participatory research for health: From process to outcomes*. 2011, San Francisco: John Wiley & Sons.

64. Israel, B.A., A.J. Schulz, E.A. Parker, and A.B. Becker, *Review of community-based research: Assessing partnership approaches to improve public health.* Annual Review of Public Health, 1998. **19**(1): p. 173-202.

65. Lueong, G.M., *The forest people without a forest: Development paradoxes, belonging and participation of the Baka in east Cameroon*. 2016, New York: Berghahn Books.

66. Hattori, S., *Current issues facing the forest people in Southeastern Cameroon: The dynamics of Baka life and their ethnic relationship with farmers.* African Study Monographs. Supplimentry Issue 2014. **47**: p. 97–119.

67. Köhler, A. and J. Lewis, *Putting hunter-gatherer and farmer relations in perspective*. Ethnicity, hunter-gatherers, and the "other": Association or assimilation in africa, ed. S. Kent. 2002, Washington D.C.: Smithsonian Institution Press.

68. Shikongo, S.T. *Report on threats to the practice and transmission of*

traditional knowledge: Regional report–africa. in *United Nations Environment Programme/Convention on Biological Diversity (UNEP/CBD)*. 2005.

69. Palys, T., *Purposive sampling.* The Sage Encyclopedia of Qualitative Research Methods, 2008. **2**: p. 697-698.

70. Goldman, K.D. and K.J. Schmalz, *"Accentuate the positive!" using an asset-mapping tool as part of a community-health needs assessment.* Health Promotion Practice, 2005. **6**(2): p. 125-128.

71. Sharpe, P.A., M.L. Greaney, P.R. Lee, and S.W. Royce, *Assets-oriented community assessment.* Public Health Reports, 2000. **115**(2-3): p. 205.

72. Braun, V. and V. Clarke, *Using thematic analysis in psychology.* Qualitative Research in Psychology, 2006. **3**(2): p. 77-101.

73. Gallois, S., *Dynamics of local ecological knowledge. A case study among Baka children from Southeastern Cameroon*, in *Doctorat en Ciència i Tecnologia Ambientals*. 2015, Universitat Autònoma de Barcelona: Barcelona.

74. Tchoumba, B. and J. Nelson, *Protecting and encouraging customary use of biological resources by the Baka in the west of the Dja biosphere reserve*, in *Cameroon Article*. 2006, Forest Peoples Programme

75. Samndong, R.A. and A. Vatn, *Forest related conflicts in south-east Cameroon: Causes and policy options.* International Forestry Review, 2012. **14**(2): p. 213-226.

76. Assembe-Mvondo, S., *Local communities' and indigenous peoples' rights to forests in Central Africa: From hope to challenges.* Africa Spectrum, 2013. **48**(1): p. 25-47.

77. Ichikawa, M., *Forest conservation and indigenous peoples in the Congo basin: New trends toward reconciliation between global issues and local interest*, in *Hunter-gatherers of the Congo basin: Cultures, histories, and biology of African pygmies*, B.S. Hewlett, Editor. 2014, Transaction Publishers: New Brunswick, New Jersey. p. 321-338.

78. Castro, A.P. and E. Nielsen, *Indigenous people and co-management: Implications for conflict management.* Environmental Science & Policy, 2001. **4**(4): p. 229-239.

79. Kellert, S.R., J.N. Mehta, S.A. Ebbin, and L.L. Lichtenfeld, *Community natural resource management: Promise, rhetoric, and reality.* Society & Natural Resources, 2000. **13**(8): p. 705-715.

80. Brechin, S.R., P.R. Wilshusen, C.L. Fortwangler, and P.C. West, *Beyond the square wheel: Toward a more comprehensive understanding of biodiversity conservation as social and political process.* Society & Natural Resources, 2002. **15**(1): p. 41-64.

81. Berkes, F., *Evolution of co-management: Role of knowledge generation, bridging organizations and social learning.* Journal of Environmental Management, 2009. **90**(5): p. 1692-1702.

82. Tengö, M., E.S. Brondizio, T. Elmqvist, P. Malmer, and M. Spierenburg, *Connecting diverse knowledge systems for enhanced ecosystem governance: The multiple evidence base approach.* Ambio, 2014. **43**(5): p. 579-591.

83. Stefanelli, R.D., H. Castleden, S.L. Harper, D. Martin, A. Cunsolo, and C. Hart, *Experiences with integrative indigenous and Western knowledge in water*

research and management: A systematic realist review of literature from Canada, Australia, New Zealand, and the United States. Environmental Reviews, 2017. **25**(3): p. 323-333.

84. McLeod, F., L. Viswanathan, G.S. Whitelaw, J. Macbeth, C. King, D.D. McCarthy, and E. Alexiuk, *Finding common ground: A critical review of land use and resource management policies in Ontario, Canada and their intersection with first nations.* International Indigenous Policy Journal, 2015. **6**(1).

85. Natcher, D.C., S. Davis, and C.G. Hickey, *Co-management: Managing relationships, not resources.* Human Organization, 2005. **64**(3): p. 240-250.

86. Milner-Gulland, E.J., J.A. McGregor, M. Agarwala, G. Atkinson, P. Bevan, T. Clements, T. Daw, K. Homewood, N. Kumpel, J. Lewis, S. Mourato, B. Palmer Fry, M. Redshaw, J.M. Rowcliffe, S. Suon, G. Wallace, H. Washington, and D. Wilkie, *Accounting for the impact of conservation on human well-being.* Conservation Biology, 2014. **28**(5): p. 1160-1166.

87. Ens, E.J., P. Pert, P.A. Clarke, M. Budden, L. Clubb, B. Doran, C. Douras, J. Gaikwad, B. Gott, S. Leonard, J. Locke, J. Packer, G. Turpin, and S. Wason, *Indigenous biocultural knowledge in ecosystem science and management: Review and insight from Australia.* Biological Conservation, 2015. **181**(Supplement C): p. 133-149.

88. Ens, E., M.L. Scott, Y.M. Rangers, C. Moritz, and R. Pirzl, *Putting indigenous conservation policy into practice delivers biodiversity and cultural benefits.* Biodiversity and Conservation, 2016. **25**(14): p. 2889-2906.

89. Hewlett, B.S., *Hunter-gatherers of the Congo basin: Cultures, histories, and biology of African pygmies*. 2014, New Brunswick, New Jersey: Transaction Publishers.

90. Reyes-García, V., A. Pyhälä, I. Díaz-Reviriego, R. Duda, Á. Fernández-Llamazares, S. Gallois, M. Guèze, and L. Napitupulu, *Schooling, local knowledge and working memory: A study among three contemporary hunter-gatherer societies.* PloS one, 2016. **11**(1): p. e0145265.

91. Berkes, F., J. Colding, and C. Folke, *Rediscovery of traditional ecological knowledge as adaptive management.* Ecological Applications, 2000. **10**(5): p. 1251-1262.

92. Gupta, A.K., *WIPO-UNEP study on the role of intellectual property rights in the sharing of benefits arising from the use of biological resources and associated traditional knowledge*. 2004: World Intellectual Property Organization.

93. Betti, J.L. and S.R.Y. Mebere, *An ethnobotanical study of medicinal plants used in the Kalamaloué national park, Cameroon.* Journal of Medicinal Plants Research, 2011. **5**.

94. Betti, J.L., O.D. Yongo, D.O. Mbomio, D.M. Iponga, and A. Ngoye, *An ethnobotanical and floristical study of medicinal plants among the Baka pygmies in the periphery of the Ipassa-Biosphere reserve, Gabon.* European Journal of Medicinal Plants, 2013. **3**(2): p. 174-205.

CHAPTER 3

Visions from Local Populations for Livelihood-based Solutions to Promote Forest Conservation Sustainability in the Congo Basin

This chapter is adapted from a manuscript that was under review by Human Ecology as of May 24, 2018. Authors: Savanna Carson, Fabrice Kentatchime, Eric Djomo Nana, Brian Cole, Hilary Godwin.

ABSTRACT

Forest management practices that aim to mitigate the threats of deforestation and forest degradation can inadvertently threaten the ability of forest-dependent local populations to meet basic daily sustenance needs. Stakeholder engagement can help find common ground between environmental goals and the livelihood needs of local populations. A starting point for local stakeholder engagement is to gather insights into how forest management differentially impacts the livelihood and well-being of these populations, which may be quite heterogeneous in their perspectives and livelihood needs. Towards this end, we conducted semi-structured first-person interviews in forest-dependent communities in Cameroon about perspectives on and suggestions about forest resources and management. This study provides insights into commonalities and differences of perspectives within a population and supports the use of stakeholder engagement strategies that facilitate bidirectional communication and take into consideration diverse perspectives and priorities.

INTRODUCTION

Active engagement strategies can help to increase the likelihood that conservation activities will benefit location populations. Even well-meaning natural resource protection efforts can negatively impact local population's well-being, livelihood, and culture [1-3]. Severe impacts are especially likely for indigenous populations reliant on natural resources and traditional lands [4-6]. Active participation of local stakeholders in management decisions can increase awareness and prevent unintentional negative impacts on local populations and lead to more robust, sustainable resource management [7-9]. Active participation goes beyond efforts to inform or secure active consent and includes knowledge-sharing, meaningful involvement of local stakeholders in decision-making, and consensus building in resource management decisions [10]. Identifying and implementing culturally-appropriate strategies for facilitating active participation of local stakeholders in resource management decisions requires informed understanding and dialogue with these populations.

Consideration of impacts on local livelihoods can also enhance the sustainability of forest conservation efforts. Forest management researchers have long recognized the ethical imperative and utilitarian value of taking into account the needs of forest-dependent populations [10-12]. Understanding sustenance constraints, self-determination, and visions for the future are especially valuable to understanding local perspectives on forest management policies [13-15]. The daily needs of forest-dependent populations are still commonly not prioritized in forest management [1, 3]. Self-determination is "not only a basic human right but is also a basic human need

that has real developmental consequences" [16]. Considering the diversity of needs and perspectives of local populations helps to guide forest management decisions that prevent harm and promote the well-being of local populations [13, 17, 18].

To date, engagement of local populations in the management of Southern Cameroon's forests has been limited [19-23] but would be particularly beneficial. Southern Cameroonian rainforests contain some of the world's richest and most vulnerable ecosystems and are home to a large number of forest-dependent agrarian and indigenous populations that traditionally utilize natural resources for livelihood [24, 25]. Forest-proximal groups in Southern Cameroon include distinct ethnic groups with different social structures, traditional livelihoods, and relations with the forest. Understanding the needs and perspectives of each of these groups in forest management is important for local livelihood as Cameroonian forests help to mediate food insecurity [26, 27].

To provide a foundation for engaging stakeholders in Southern Cameroon, we conducted first-person interviews to identify perspectives on current and historical sustenance patterns, livelihood factors, and forest resource relationships. Qualitative data derived from interviews can be a particularly useful source of information about the complex interactions between nature and society ("conservation social science") in a particular context [28, 29]. These interviews support the value of understanding the diversity of perspectives within local populations and provide insights into how to construct ongoing and substantive engagement strategies in this region to support forest management.

We focused on elucidating the perspectives of individuals from two ethnic

groups (Baka and Bantu) who live adjacent to each other in communities surrounding the Dja Faunal Reserve in Southern Cameroon. Bantu-speakers in this region are part of a heterogeneous mix of ethnic groups, including Badjoue, Nzime, Mbulu, and Fang-Nzaman. These groups (hereto referred to as "Bantu") live in agrarian communities and are descended from individuals who migrated to the area about 2,500 years ago [30]. In contrast, the Baka are indigenous traditionally hunter-gatherer populations. Baka who traditionally lived within the area encompassed by the Dja Faunal Reserve were forced to migrate near roads surrounding the reserve due to sedentarization policies starting in the 1950's [31, 32]. As a result, the Baka communities surrounding the reserve have undergone significant lifestyle changes over the last 50-70 years during which they have partially shifted toward a partially agrarian lifestyle [33]. Our interviews and analysis focused on elucidating how prior forestry management decisions in the region have impacted food and livelihood security for these two distinct but entwined populations.

METHODS

The study area consisted of four communities: two Baka communities (villages #2 and #3) and two Bantu communities (villages #1 and #4), in the northern region in the Dja Biosphere Reserve Cameroon. In-depth first-person interviews were conducted in July 2014 with approvals obtained from the Institutional Review Board of the University of California, Los Angeles, the Cameroon National Ethics Committee, the Cameroon Ministry of Science and Innovation, and the regional delegation of Cameroon Ministry of Public Health in the area studied.

Semi-structured interview question guides were developed based on themes related to relationships with forest management, livelihood, and natural resource utilization by forest-dependent communities in Southern Cameroon. The interview structure and questions were informed by prior informal conversations by the researchers with villagers in this region about challenges they face concerning sustenance and livelihood. Questions were posed to elicit participants' perceptions of local sustenance patterns, forest resources, livelihood factors, and regional forest management schemes. Participants were also asked to reflect on if and how sustenance, livelihood, or forest management changed in their lifetimes. Interview guides were framed to allow the participant to serve as community experts, reflecting beyond individual practice, to alleviate concerns they might have that they could be subject to retaliation from their individual use of restricted forest resources.

We first approached community village chiefs to request permission to talk with residents. Community meetings were then organized to explain study purpose and logistics, to answer questions, to explain confidentiality, to explain the importance of the communities' thoughts and opinions, and to introduce the research team. A community activity was then organized after the community meeting to familiarize the research team with community members, such as bracelet making, a tour of the village, or initiating games with children. Recruitment of interview participants occurred using purposive sampling in collaboration with the four village chiefs [34]. Specifically, the research team asked village chiefs to select participants in a way that ensured equal gender representation within each community. Additional inclusion criteria included: being over 18 years of age, having time to talk with the

research team, and fluency in French or Baka. Most participants were fluent in French. However, a few Baka participants required a local Baka translator (from Baka into French). Tote bags were given to community chiefs and interview participants for their involvement in the study.

We interviewed 35 participants: 15 Baka (7 females and 8 males) and 20 Bantu (10 females and 10 males). Interviews were conducted individually and ranged in time from 30-90 minutes. Participants were allowed to choose the location for the interview as long as it was a private area. Locations for the interviews included areas inside or just outside homes, churches, or otherwise empty community centers. Interviews were conducted, recorded, transcribed and translated by the research team and local translators familiar with the local French dialect or Baka language. Participant consent was conducted verbally and recorded. No participants declined to participate, but the translator decided to end an interview after one participant was unable to complete the interview after being interrupted and becoming disengaged.

Interview transcriptions were coded using six-step thematic content analysis [35] using ATLAS.ti. A research team member coded main themes and worked with two other members of the researcher team to analyze emerging themes, develop coding structure and verify code appropriateness. Iterative analysis was performed until saturation was achieved.

RESULTS

The results presented herein focus on the commonalities and differences in perspectives on forest management, livelihood, and natural resource utilization found

between interviewees from Baka and Bantu ethnic groups. By contrast, we did not find a significant correlation between the responses of interviewees based on gender or community proximity to the forest. Despite some commonalities, there are overarching differences between how members of the two ethnic groups described their diet, food sources, food insecurity, as well as coping strategies, factors and policies affecting community livelihoods (see **Figure 3.1**.). Likewise, interviewees from the two ethnic groups provided different types of insights into their livelihoods and their perspectives on how forest management policies impact local livelihoods. Both Baka and Bantu interviewees presented suggestions (without being prompted) on how to improve forest management outcomes by providing sustainable alternatives to game and bushmeat hunting.

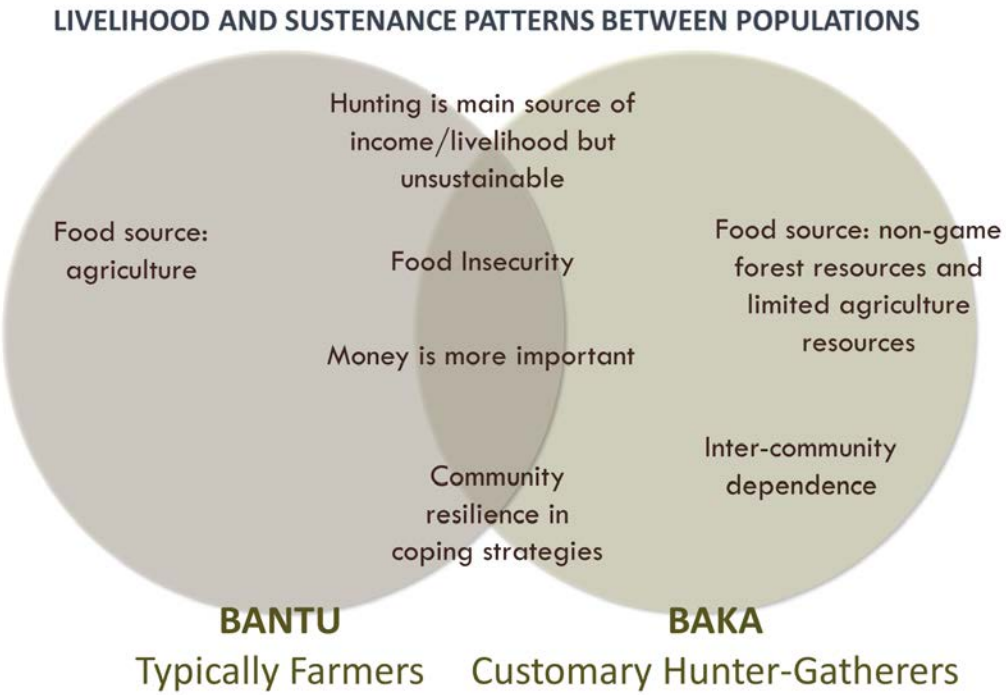

Figure 3.1. An overview of resulting themes from Baka and Bantu interviews. Themes described in interviews are categorized by whether they were raised Bantu participants, Baka participants or both participant populations.

Non-game food products, food sources, and food insecurity

Because the Baka have traditionally been considered to be primarily hunter-gatherers and the Bantu communities surrounding the Dja Reserve are considered to be agrarian, one might expect significant differences in their perspectives on the relationship between the forest and sustenance [30, 36, 37]. However, many of the Baka communities surrounding the Dja Reserve have increasingly become dependent upon agriculture for sustenance, and the Bantu in this region have traditionally depended on the forest for game [31, 37]. Thus, it is not surprising that both Baka and Bantu interviewees reported sustaining their families and communities on a diet of fruits, vegetables, roots, seeds, and meats sourced from agriculture or hunting and gathering of forest resources. Food sources are important to forest management in that making decisions about restricting forest resources may impact local populations.

When asked about daily menus, a majority of participants (over half of individuals in both ethnic groups) mentioned cassava, fish, vegetables, cocoyam, plantains, and mangos. Typical food products consistently mentioned by both groups included tubers, rats or moles, Moabi fruit (*Baillonella toxisperma*), duikers (antelope), mushrooms, and insect larvae or beetles. Food products frequently mentioned by Bantu interviewees but not by Baka participants, such as peanuts and maize, probably reflect greater agriculture proficiency of the Bantu in this region. A majority of the Baka we interviewed mentioned non-game forest products such as honey and wild yams as well as (to a lesser degree) tubers, sweet potatoes, and tortoises. Bantu interviewees did not name any of these specific non-game forest products with any frequency. Baka were more likely that the Bantu to mention the

forest as a primary food source: all 15 Baka participants but only 5 out of 20 Bantu participants mentioned the forest as a resource for non-game foods. By contrast, all participants in both groups mentioned agriculture as a food source.

Nearly all participants, regardless of ethnicity, described routine food insecurity. However, the reported contributing factors to food insecurity were different for Baka and Bantu participants. Bantu interviewees typically described food insecurity as a result of agricultural difficulties (e.g., pest infestations, soil degradation, and intense sun). As a Bantu interviewee from Village #1 explained, "*there are seasons here when insects become a pest for our crops, and that usually leads to famine in the village.*" A majority of Baka interviewees ascribed food insecurity to the seasonality of food resources, including the impacts of seasonal availability of fish, game, and foraged food products. For instance, one Baka male in village #2 stated:

> "*This season is the difficult one and getting food is not easy, so we mostly eat cassava and cocoyam leaves. If you are lucky enough to find the hole of a mole rat, you dig for it and get it, and you obtain a delicious meal.*"

Sociocultural differences and community resilience in food insecurity coping strategies

Baka and Bantu interviewees described distinct strategies for coping with food insecurity. These coping strategies help to provide insights into the daily struggle for food in these populations and their reliance on direct food sourcing options (such as hunting versus agriculture) available to local communities. Half of the Bantu

mentioned farming as the most secure source of food. For instance, one male Bantu participant from village #4 stated: "*The problem of famine depends on the amount of effort you put on your farm. If you often work on your farm, you will not know famine.*" By contrast, Baka interviewees were more likely to mention the forest as a key source of food security "*we have all we need in the forest*" (Baka male, village #2). Other strategies for coping with food insecurity mentioned by a few participants in each group included fishing or food preservation techniques at times when there is excess food. A few individuals in both groups mentioned purchasing food as a coping strategy, but purchasing food was typically described in a theoretical manner, due to the expressed lack of means for earning money (described further below).

Participants described social capital (i.e., community networking) as a way to mitigate impacts of food insecurity. Community-wide food collaboration was widespread in both groups. Food collaboration occurs through communally clearing land and sowing seeds in farms and assisting other community members in times of need. "*We have to work together to get enough to eat*," explained a Baka Male from Village #2. A Baka female from village #4 also described helping individuals within communities: "*when food becomes scarce in the village, we put food in dishes to give to those who do not have. All men eat together."*

Baka also expressed how *inter*-community reliance helped them cope with food security. A majority of Baka interviewees described relying on neighbor groups, including working on farms in neighboring Bantu communities, as a way to help cope with seasonal food insecurity. One Baka male from village #3 explained "*You can walk for a long time in the forest and find nothing. During such seasons, we go and work*

for the Bantu in their farms, and they give us tubers of cassava." By contrast, no Bantus mentioned working for neighboring groups.

The struggle between money-based livelihoods, hunting, protein sources, and game sustainability in forest management

Both Baka and Bantu groups expressed the increasing importance of earning money to be able to afford basic needs. Both ethnic groups described the need for cash to purchase fuel, oil, shoes, clothes, educational materials (uniforms or supplies), and to pay for healthcare. A Bantu female from village 4 reflected on the increased importance of money over her lifetime as she explains, "*ever since this place becomes more developed, life gets more difficult. …* [but in the past,] *even those without money could eat."* Bantu participants also mentioned inflation as a concern. For instance, one Bantu male from village #4 described inflation in the context of dowry practices:

> *"Dowry in the past was quite different from the way it is practiced today. The dowry of our mothers was about 250 francs, but today that of a single girl is close to millions of francs. In the past, when a young man was interested in a girl, he had to bring some local goods as a dowry. Some parents did not even ask for a dowry for their daughters, but nowadays, things have changed."*

Baka and Bantu interviewees cited concerns about not having sufficient options for livelihood other than poaching and selling the game in and around the forest, both of which are restricted by the government and enforced by government conservators. Both groups reported relying on hunting to support their families and described a

reduction in the availability of game, consistent with studies showing species decline in the region [38-41]. The majority of the participants mentioned that game is harder to obtain than it was previously and said that they eat meat less often as a result. One Bantu male from village #1 stated:

> "*Our diet here is based mainly on vegetables because the state forbids bushmeat. The funny thing about it is that they stop us from hunting the game but do not provide any alternatives. Thus, our diet, which is made of vegetables only, is of low nutritional value. … Our diet here is really poor. Only God keeps us safe."*

Many of the interviewees identified contradictions between valuing forest sustainability and their ongoing struggle for money, resources, sustenance, and livelihood resilience. A Baka male from village #2 explained:

> *"Life was much easier for our forefathers as they had the forest only for themselves. They hunted and ate the game at will but we are no longer authorized to live that way, and there are no alternatives that have been presented to us. How then do they expect us to live? How do they expect us to purchase soap or fuel when we are not authorized to hunt in this area in which we were born?"*

Participants from both ethnic groups described declines in animal populations and explained how the current level of game hunting and forest exploitation is unsustainable. Poaching is a known and a recognized issue in these communities. Interviewees also described difficulties in motivating residents to stop hunting game:

> *"How can you sensitize someone who has nothing to do? Such a person will*

never understand [the reasons to stop hunting for sustenance and income]*. He would tell you that you have a job and earn money, but he has nothing. Would you personally feed his family every month end when you take your pay? Fortunately, some people understand, and they have abandoned poaching in exchange for farming… That is good, but I believe it is a little late because almost all the game is gone*." (Bantu Male, village 4)

Forest Management and local communities: known implications and prospects for improved forest management

Both Baka and Bantu interviewees expressed concerns regarding the current state of forest management in the region and a desire to be included in decision-making and to have access to alternative livelihoods. Participants were not able to identify how current management practices benefit local populations, stating, for instance:

The government does nothing here to protect that forest. To me, they rather try to destroy the forest because they authorize timber companies to come here and put down our big trees. We the local people gain nothing from this exploitation of our forest. (Baka Male, village #2)

Interviewees expressed a desire to be included in forest management: "*It is everyone's wish here that the local people be part of the management of the forest because they know the forest best*" (Bantu male, village 4). Participants described the importance of conservation despite the perspective that current forest management may be unsustainable or exclude local populations. However, Bantu

interviewees were more likely to describe conservation as important than the Baka we interviewed (11 out of 20 Bantu versus 1 out of 15 Baka individuals).

Both groups were keen to describe modern difficulties in forest management and mention how guns, logging machines, and the timber trade have increased forest degradation. One Bantu man in village #1 explained: "*Our parents practiced much better forest protection because they did not have any machinery to cut down the big trees, but today with these big machines, we completely destroy the forest."*

Participants suggested numerous potential adaptive solutions that could facilitate conservation, while at the same time promoting community sustainability. Interviewees stressed livelihood-based methods as a way to sustain the needs of local communities in the face of restrictions created by conservation policies. The most prominent livelihood-based solutions mentioned include:

1. Fostering employment or income-generating activities to replace poaching. For instance, one Bantu male from village #4 articulated that: "*income activities have to be created for these youths to empower them*."
2. Developing protein alternatives to replace game. For instance, one Baka male from village #2 suggested that: "*if alternative livelihood activities could be found for poachers such as poultry farms, pig farms or even fish ponds, then poaching would definitely stop.*"
3. Implementing culturally-appropriate livelihood-based solutions that create local buy-in for conservation. For example: "*All we ask are alternative livelihood means such as animal rearing like pig and chicken farms to replace the game we hunt.*" (Bantu male, village #1).

4. Promoting community autonomy through sustainable livelihood-based solutions. For instance, a Baka male explained the need for livelihood solutions but described a previous project that was unsustainable: "*Agriculture and animal rearing would also work very well here. For example, in the past, we had a fish pond … That project no longer exists because there was no feed left as the white man who started the project later left*" (Baka male, village #2).

DISCUSSION AND RECOMMENDATIONS

Finding common ground between forest protection and local livelihoods can improve the long-term success and sustainability of forest management efforts and protect the well-being of local populations. Efforts to understand perspectives of forest-dependent populations can also provide local knowledge critical to successful forest management. However, to be able to leverage those perspectives and knowledge, forest managers need to have ongoing, substantive, and bidirectional interactions with local populations. The multifaceted nature of local perspectives provides insight into how to structure more effective engagement strategies to benefit both local populations and forest management. Although these results are specific to the communities in which the interviews were conducted, many of the insights gained from them have relevance to best-practices for engaging local populations in promoting sustainable forest management in other regions.

Food insecurity compromises ecological sustainability and impacts community well-being

Individuals we interviewed from both Baka and Bantu communities identified food insecurity pressures within their communities and described how increasing food security would improve regional sustainability. Food insecurity affects the well-being, cultural identity, and community resilience of local forest-proximal communities worldwide. In the case of the communities bordering the Dja Faunal Reserve, drivers of local food insecurity mentioned by participants included agricultural food insecurity, seasonal availability of foods, and restrictions on the use of forest resources. Agriculturally-related food insecurity, specifically due to soil degradation and pests, has also been reported by other researchers in the region [42, 43]. Recent reductions in annual crop yields have declined due to climate change and factor into social determinants such as education, further affecting community well-being [19, 44]. Seasonal food insecurity, prevalent in the region [26], affects mental and physical health. Seasonal food insecurity mainly affects vulnerable populations such as populations undergoing sociocultural sustenance transitions, impoverished populations, women, and children [45-48].

Increased use of sustainable food products from the forest and adoption of agroforestry practices could be used to improve food security and stabilize the natural ecosystems in this region [49-53]. Participants in this study recognized the ecologic signs of unsustainable hunting pressures on forest resources but felt as if other options do not exist to pay for life-supporting supplies such as fuel, soap, education, or healthcare. Current livelihood strategies include the selling and trade of goods, though formal marketplace structures are limited in the area. The Baka, as described in results above, work for neighboring groups for trade or money in

exchange. Eating and selling game as a source of food and income has also been reported by others in the region [54, 55].

A call to include and invest in local population's livelihood to invest in conservation

Programs that provide and promote culturally-appropriate sustainable livelihoods and skill-building may improve stability and self-sufficiency in forest-dependent populations [56]. Consistent with prior studies [24, 57], participants in our study recognized that development of alternative livelihoods could improve their food security. In this study, both Baka and Bantu interviewees expressed a desire to be included in identifying livelihood-based solutions to bolster forest management efforts. Several study participants spontaneously offered proposals reflecting the local population's desire for broad sustainable change. Some of their livelihood proposals, such as poultry farming, would require new skills, resources, or outside assistance to implement. However, other possible livelihood-focused solutions draw directly from local traditions. Beekeeping, for example, would draw directly on the Baka's considerable expertise with local bee species and in gathering honey in the forest.

Inclusive dialogue with forest-dependent populations increases the likelihood that tractable, sustainable policies and practices will be developed and implemented. Inclusion provides added value and helps to create a shared a vision for protecting forest resources. An integrated and collaborative approach to developing alternative livelihoods would also help secure community buy-in and to identify livelihood-based

solutions that reflect local priorities, needs, and culture [2, 58, 59]. A diverse set of sustainable livelihood options would help to increase community resilience. Likewise, existing social capital within local populations could be leveraged to diversify options and enhance community reliance [60-63]. In Southern Cameroon, the development of alternative and sustainable livelihoods for local populations will be particularly important going forward, as climate change and further resource extraction is likely to have considerable impacts on this region [61, 63-65].

Unique inequities for local indigenous populations in forest management

Engaging Baka in forest management will require recognizing past injustices and focus going forward on equitable benefits to reduce further harm to indigenous culture, livelihood, and ecological knowledge. Baka interviewees in this study described a reliance on neighboring (Bantu) groups for trading, working, or obtaining income. This dependence on neighboring Bantu communities has been described extensively in the anthropological literature as well [33, 37]. Other studies have also documented inequalities between Baka and other forest-dependent populations within land rights, democracy and a lack of cultural competency in forest governance and management [31, 32, 66]. As Baka acculturate from living in the forest to living in roadside encampments, the effects of these inequalities are exacerbated as they struggle with inadequate farming expertise, land tenure/ownership, and multiple pressures on hunting [33, 66].

The Baka are a critical source of ecological knowledge that should particularly be leveraged to promote sustainable forest management. Indigenous forest knowledge

can help reduce disaster risk [67], identify environmental changes (e.g., climate change) [68], and inform sustainable livelihood strategies [69]. For instance, non-game forest products, such as wild yams and insects, are standard in the Baka diet and are of high nutritional value; these may offer sustainable options to non-sustainable game or agriculture products [70, 71]. However, the Baka's forest knowledge is potentially at risk as their ties and access to the forest are weakened [72].

CONCLUSIONS

Engagement of local populations in forest management provides an opportunity to enable self-determination and facilitates sustainability in forest management by understanding local perspectives in forest-adjacent communities' livelihood. It is also consistent with human rights reasoning. Evidence-based investments in the livelihood and health of local populations can contribute to the ultimate success of conservation projects by stabilizing local communities and decreasing the drivers for unsustainable utilization of forest resources [10, 73]. Other benefits also derive from an inclusive forest management process including community buy-in, conservation co-benefits, trust, and the capability to learn from local ecological intelligence. Inclusive dialogue with forest-dependent populations provides critical information for how local livelihoods may be more sustainable, support forest conservation efforts, and provides an information exchange that increases the sense of agency, trust, and shared responsibility in protecting forest resources.

In this study, both Baka and Bantu participants recognized the unsustainability

of current forest management practices and suggested possible ways to promote more sustainable livelihoods for local populations. Local populations, as experts of their communities, culture, motivations, values, histories, and livelihoods, can recommend and provide input for the design of sustainable livelihoods. Ongoing participatory engagement with forest conservation specialists can help resource-dependent populations, such as the Baka and Bantu, develop sustainable livelihoods that benefit and address their unique vulnerability to environmental, social, climate, and policy change. Forest conservation that focuses on balancing local population's priorities, well-being, and knowledge, will help to secure sustainable conservation goals [65, 74, 75] and improve forest ecosystem sustainability and functionality [76]. Conservation policies that focus on ongoing engagement and investments in programs and practices that promote sustainable local livelihoods are critical tools for promoting sustainable conservation.

REFERENCES FOR CHAPTER 3

1. Robinson, E.J.Z., *Resource-dependent livelihoods and the natural resource base.* Annual Review of Resource Economics, 2016. **8**(1): p. 281-301.
2. Bele, M.Y., D.J. Sonwa, and A.-M. Tiani, *Adapting the Congo basin forests management to climate change: Linkages among biodiversity, forest loss, and human well-being.* Forest Policy and Economics, 2015. **50**: p. 1-10.
3. Persha, L., A. Agrawal, and A. Chhatre, *Social and ecological synergy: Local rulemaking, forest livelihoods, and biodiversity conservation.* Science, 2011. **331**(6024): p. 1606-1608.
4. Ichikawa, M., *Forest conservation and indigenous peoples in the Congo basin: New trends toward reconciliation between global issues and local interest*, in *Hunter-gatherers of the Congo basin: Cultures, histories, and biology of African pygmies*, B.S. Hewlett, Editor. 2014, Transaction Publishers: New Brunswick, New Jersey. p. 321-338.
5. Lewis, J., *Where goods are free but knowledge costs.* Hunter-Gatherer Research, 2015. **1**(1): p. 1-27.
6. Awuh, H.E., *A critique of the global literature on the conservation refugee problem*, in *School of Geography, Environment and Earth Sciences*. 2011, Te Kura Tatāi Aro Whenua Victoria University of Wellington: New Zealand.
7. Ens, E., M.L. Scott, Y.M. Rangers, C. Moritz, and R. Pirzl, *Putting indigenous conservation policy into practice delivers biodiversity and cultural benefits.* Biodiversity and Conservation, 2016. **25**(14): p. 2889-2906.
8. Johnson, J.T., R. Howitt, G. Cajete, F. Berkes, R.P. Louis, and A. Kliskey,

Weaving indigenous and sustainability sciences to diversify our methods. Sustainability Science, 2016. **11**(1): p. 1-11.

9. Maldonado, J., T.B. Bennett, K. Chief, P. Cochran, K. Cozzetto, B. Gough, M.H. Redsteer, K. Lynn, N. Maynard, and G. Voggesser, *Engagement with indigenous peoples and honoring traditional knowledge systems.* Climatic Change, 2016. **135**(1): p. 111-126.
10. Andrade, G.S. and J.R. Rhodes, *Protected areas and local communities: An inevitable partnership toward successful conservation strategies?* Ecology and Society, 2012. **17**(4): p. 14.
11. Berkes, F., *Rethinking community-based conservation.* Conservation Biology, 2004. **18**(3): p. 621-630.
12. Cetas, E.R. and M. Yasué, *A systematic review of motivational values and conservation success in and around protected areas.* Conservation Biology, 2017. **31**(1): p. 203-212.
13. Martin, A., B. Coolsaet, E. Corbera, N.M. Dawson, J.A. Fraser, I. Lehmann, and I. Rodriguez, *Justice and conservation: The need to incorporate recognition.* Biological Conservation, 2016. **197**: p. 254-261.
14. Sonwa, D.J., J.N. Nkem, M.E. Idinoba, M.Y. Bele, and C. Jum, *Building regional priorities in forests for development and adaptation to climate change in the Congo basin.* Mitigation and Adaptation Strategies for Global Change, 2012. **17**(4): p. 441-450.
15. Colchester, M., *Self-determination or environmental determinism for indigenous peoples in tropical forest conservation.* Conservation Biology, 2000.

14(5): p. 1365-1367.

16. Murphy, M., *Self-determination as a collective capability: The case of indigenous peoples.* Journal of Human Development and Capabilities, 2014. **15**(4): p. 320-334.
17. Fraser, E.D.G., A.J. Dougill, W.E. Mabee, M. Reed, and P. McAlpine, *Bottom up and top-down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management.* Journal of Environmental Management, 2006. **78**(2): p. 114-127.
18. Woodhouse, E., K.M. Homewood, E. Beauchamp, T. Clements, J.T. McCabe, D. Wilkie, and E. Milner-Gulland, *Guiding principles for evaluating the impacts of conservation interventions on human well-being.* Philosophical Transactions of the Royal Society B: Biological Sciences, 2015. **370**(1681).
19. Donn, P., J.L. Ngondi, J.C. Tieguhong, D.M. Iponga, O. Tchingsabe, R. Fungo, M. Tchatat, and J.M. Kahindo, *Poverty and poor education are key determinants of high household food insecurity among populations adjoining forest concessions in the Congo basin.* BMC Nutrition, 2016. **2**(1): p. 1-12.
20. Gbetnkom, D., *Forest depletion and food security of poor rural populations in Africa: Evidence from Cameroon.* Journal of African Economies, 2009. **18**(2): p. 261-286.
21. Sanchez, P.A., *Linking climate change research with food security and poverty reduction in the tropics.* Agriculture, Ecosystems & Environment, 2000. **82**(1–3): p. 371-383.

22. Fa, J.E., D. Currie, and J. Meeuwig, *Bushmeat and food security in the Congo basin: Linkages between wildlife and people's future.* Environmental Conservation, 2003. **30**(1): p. 71-78.

23. Carodenuto, S. and K. Fobissie, *Operationalizing free, prior and informed consent (FPIC) for redd+: Insights from the national fpic guidelines of Cameroon.* Carbon and Climate Law Review, 2015. **9**(2): p. 156-167.

24. Ambrose-Oji, B., *The contribution of ntfps to the livelihoods of the 'forest poor': Evidence from the tropical forest zone of south-west Cameroon.* International Forestry Review, 2003. **5**(2): p. 106-117.

25. Ingram, V. and J. Schure, *Review of non timber forest products (NTFPS) in central Africa, Cameroon*. 2010, CIFOR: Cameroon.

26. Fungo, R., J. Muyonga, M. Kabahenda, A. Kaaya, C.A. Okia, P. Donn, T. Mathurin, O. Tchingsabe, J.C. Tiegehungo, J. Loo, and L. Snook, *Contribution of forest foods to dietary intake and their association with household food insecurity: A cross-sectional study in women from rural Cameroon.* Public Health Nutrition, 2016. **19**(17): p. 1-12.

27. Ingram, V.J., *Win-wins in forest product value chains?: How governance impacts the sustainability of livelihoods based on non-timber forest products from Cameroon*, in *Social and Behavioural Sciences*. 2014, Universiteit van Amsterdam: Amsterdam Institute for Social Science Research.

28. Rust, N.A., A. Abrams, D.W. Challender, G. Chapron, A. Ghoddousi, J.A. Glikman, C.H. Gowan, C. Hughes, A. Rastogi, and A. Said, *Quantity does not always mean quality: The importance of qualitative social science in*

conservation research. Society & Natural Resources, 2017: p. 1-7.

29. Bennett, N.J., R. Roth, S.C. Klain, K. Chan, P. Christie, D.A. Clark, G. Cullman, D. Curran, T.J. Durbin, and G. Epstein, *Conservation social science: Understanding and integrating human dimensions to improve conservation.* Biological Conservation, 2017. **205**: p. 93-108.
30. Russell, T., F. Silva, and J. Steele, *Modelling the spread of farming in the bantu-speaking regions of africa: An archaeology-based phylogeography.* PLoS ONE, 2014. **9**(1): p. e87854.
31. Awuh, H.E., *Adaptive livelihood strategies in conservation-induced displacement: The case of the Baka of east Cameroon.* African Studies Review, 2015. **58**(2): p. 135-156.
32. Awuh, H.E., *Access to discourse, marginalisation and exclusion in conservation-induced resettlement: The case of the displaced Baka of east Cameroon.* International Journal of Environmental Studies, 2016. **73**(2): p. 294-312.
33. Lueong, G.M., *The forest people without a forest: Development paradoxes, belonging and participation of the Baka in east Cameroon*. 2016, New York: Berghahn Books.
34. Palys, T., *Purposive sampling.* The Sage Encyclopedia of Qualitative Research Methods, 2008. **2**: p. 697-698.
35. Braun, V. and V. Clarke, *Using thematic analysis in psychology.* Qualitative Research in Psychology, 2006. **3**(2): p. 77-101.
36. Ngima Mawoung, G., *Bantu and bakola/bagyelli of southwestern Cameroon: A permanent conflictual cohabitation.* African Study Monographs, 2016. **37**(1): p.

45-54.

37. Hattori, S., *Current issues facing the forest people in Southeastern Cameroon: The dynamics of Baka life and their ethnic relationship with farmers.* African Study Monographs. Supplimentry Issue 2014. **47**: p. 97–119.

38. Yasuoka, H., *The sustainability of duiker (cephalophus spp.) hunting for the Baka hunter-gatherers in southeastern Cameroon.* African Study Monographs, 2006. **33**.

39. Maisels, F., E. Keming, M. Kemei, and C. Toh, *The extirpation of large mammals and implications for montane forest conservation: The case of the kilum-ijim forest, north-West province, Cameroon.* Oryx, 2001. **35**(4): p. 322-331.

40. Visconti, P., R.L. Pressey, D. Giorgini, L. Maiorano, M. Bakkenes, L. Boitani, R. Alkemade, A. Falcucci, F. Chiozza, and C. Rondinini, *Future hotspots of terrestrial mammal loss.* Philosophical Transactions of the Royal Society of London B: Biological Sciences, 2011. **366**(1578): p. 2693-2702.

41. Linder, J.M. and J.F. Oates, *Differential impact of bushmeat hunting on monkey species and implications for primate conservation in korup national park, Cameroon.* Biological Conservation, 2011. **144**(2): p. 738-745.

42. Arlet, M.E. and F. Molleman, *Rodents damage crops more than wildlife in subsistence agriculture on the northern periphery of Dja reserve, Cameroon.* International Journal of Pest Management, 2007. **53**(3): p. 237-243.

43. Sanchez, P.A. and R.R.B. Leakey, *Land use transformation in africa: Three determinants for balancing food security with natural resource utilization.*

Developments in Crop Science, 1997. **25**(1-3): p. 19-27.

44. Fuller, T.L., P.R. Sesink Clee, K.Y. Njabo, A. Tróchez, K. Morgan, D.B. Meñe, N.M. Anthony, M.K. Gonder, W.R. Allen, R. Hanna, and T.B. Smith, *Climate warming causes declines in crop yields and lowers school attendance rates in central africa.* Science of The Total Environment, 2018. **610**(Supplement C): p. 503-510.

45. Dounias, E. and M. Ichikawa, *Seasonal bushmeat hunger in the congo basin.* EcoHealth, 2017. **14**(3): p. 1-16.

46. Jost Robinson, C.A. and M.J. Remis, *Baaka women's health and subsistence practices in transitional conservation economies: Variation with age, household size, and food security.* American Journal of Human Biology, 2016. **28**(4): p. 453-460.

47. Chambers, R., *Health, agriculture, and rural poverty - why seasons matter.* Journal of Development Studies, 1982. **18**(2): p. 217-238.

48. Remis, M.J. and C.A. Jost Robinson, *Examining short-term nutritional status among baaka foragers in transitional economies.* American Journal of Physical Anthropology, 2014. **154**(3): p. 365-375.

49. McNeely, J.A. and G. Schroth, *Agroforestry and biodiversity conservation – traditional practices, present dynamics, and lessons for the future.* Biodiversity & Conservation, 2006. **15**(2): p. 549-554.

50. Hurni, H., M. Giger, H. Liniger, R. Mekdaschi Studer, P. Messerli, B. Portner, G. Schwilch, B. Wolfgramm, and T. Breu, *Soils, agriculture and food security: The interplay between ecosystem functioning and human well-being.* Current

Opinion in Environmental Sustainability, 2015. **15**(Supplement C): p. 25-34.

51. Mbow, C., P. Smith, D. Skole, L. Duguma, and M. Bustamante, *Achieving mitigation and adaptation to climate change through sustainable agroforestry practices in africa.* Current Opinion in Environmental Sustainability, 2014. **6**(Supplement C): p. 8-14.
52. Carsan, S., A. Stroebel, I. Dawson, R. Kindt, C. Mbow, J. Mowo, and R. Jamnadass, *Can agroforestry option values improve the functioning of drivers of agricultural intensification in africa?* Current Opinion in Environmental Sustainability, 2014. **6**(Supplement C): p. 35-40.
53. Lasco, R.D., R.J.P. Delfino, D.C. Catacutan, E.S. Simelton, and D.M. Wilson, *Climate risk adaptation by smallholder farmers: The roles of trees and agroforestry.* Current Opinion in Environmental Sustainability, 2014. **6**(Supplement C): p. 83-88.
54. Fa, J.E., D. Currie, and J. Meeuwig, *Bushmeat and food security in the congo basin: Linkages between wildlife and people's future.* Environmental Conservation, 2003. **30**(01): p. 71-78.
55. Cawthorn, D.-M. and L.C. Hoffman, *The bushmeat and food security nexus: A global account of the contributions, conundrums and ethical collisions.* Food Research International, 2015. **76**(Part 4): p. 906-925.
56. Russell, D., P. Mbile, and N. Tchamou, *Farm and forest in central africa: Toward an integrated rural development strategy.* Journal of Sustainable Forestry, 2011. **30**(1-2): p. 111-132.
57. Wright, J.H., N.A.O. Hill, D. Roe, J.M. Rowcliffe, N.F. Kümpel, M. Day, F.

Booker, and E.J. Milner-Gulland, *Reframing the concept of alternative livelihoods.* Conservation Biology, 2016. **30**(1): p. 7-13.

58. Brown, H.C.P., J.N. Nkem, D.J. Sonwa, and Y. Bele, *Institutional adaptive capacity and climate change response in the congo basin forests of Cameroon.* Mitigation and Adaptation Strategies for Global Change, 2010. **15**(3): p. 263-282.

59. Vinceti, B., C. Termote, A. Ickowitz, B. Powell, K. Kehlenbeck, and D. Hunter, *The contribution of forests and trees to sustainable diets.* Sustainability, 2013. **5**(11): p. 4797.

60. Chia, E.L., O.A. Somorin, D.J. Sonwa, and A.M. Tiani, *Local vulnerability, forest communities and forest-carbon conservation: Case of southern Cameroon.* International Journal of Biodiversity and Conservation, 2013. **5**(8): p. 498-507.

61. Chia, E.L., A.M. Tiani, D.J. Sonwa, A.S. Perez-Teran, and B. Tchatchou, *Securing well-being with the advent of climate hazards: Case of forest-dependent communities in a landscape in the congo basin.* International Journal of Climate Change Strategies and Management, 2016. **8**(2): p. 175-193.

62. Wilkie, D., G. Morelli, F. Rotberg, and E. Shaw, *Wetter isn't better: Global warming and food security in the congo basin.* Global Environmental Change, 1999. **9**(4): p. 323-328.

63. Nkem, J.N., O.A. Somorin, C. Jum, M.E. Idinoba, Y.M. Bele, and D.J. Sonwa, *Profiling climate change vulnerability of forest indigenous communities in the congo basin.* Mitigation and Adaptation Strategies for Global Change, 2013.

18(5): p. 513-533.

64. Molua, E.L., *Climate variability, vulnerability and effectiveness of farm-level adaptation options: The challenges and implications for food security in southwestern Cameroon.* Environment and Development Economics, 2002. **7**(3): p. 529-545.

65. Bele, M., A. Tiani, O. Somorin, and D. Sonwa, *Exploring vulnerability and adaptation to climate change of communities in the forest zone of Cameroon.* Climatic Change, 2013. **119**(3-4): p. 875-889.

66. Pyhälä, A., *What future for the Baka? Indigenous peoples' rights and livelihood opportunities in south-east Cameroon*, M.W. Jensen, Editor. 2012, International Work Group for Indigeonous Affairs: Copenhagen, Denmark.

67. Baumwoll, J., *The value of indigenous knowledge for disaster risk reduction: A unique assessment tool for reducing community vulnerability to natural disasters*. 2008, Vienna, Austria: Webster University.

68. Abbott, D. and G. Wilson, *The lived experience of climate change: Knowledge, science and public action*. 2015, Switzerland: Springer International Publishing.

69. Pandey, D.N., *Ethnoforestry: Local knowledge for sustainable forestry and livelihood security*. 1998, New Delhi: Himanshu Publications.

70. Cruz-Garcia, G.S., E. Sachet, M. Vanegas, and K. Piispanen, *Are the major imperatives of food security missing in ecosystem services research*? Ecosystem Services, 2016. **19**(Supplement C): p. 19-31.

71. Tata Ngome, P.I., C. Shackleton, A. Degrande, and J.C. Tieguhong, *Addressing constraints in promoting wild edible plants' utilization in household nutrition:*

Case of the congo basin forest area. Agriculture & Food Security, 2017. **6**(1): p. 20.

72. Colfer, C.J.P., *Human health and forests: A global overview of issues, practice and policy*. People and plants international conservation. 2012, London, UK: Routledge.

73. Oldekop, J., G. Holmes, W. Harris, and K. Evans, *A global assessment of the social and conservation outcomes of protected areas.* Conservation Biology, 2016. **30**(1): p. 133-141.

74. Nielsen, M.R., M. Pouliot, H. Meilby, C. Smith-Hall, and A. Angelsen, *Global patterns and determinants of the economic importance of bushmeat.* Biological Conservation, 2017. **215**(Supplement C): p. 277-287.

75. Bennett, N.J., R. Roth, S.C. Klain, K.M.A. Chan, D.A. Clark, G. Cullman, G. Epstein, M.P. Nelson, R. Stedman, T.L. Teel, R.E.W. Thomas, C. Wyborn, D. Curran, A. Greenberg, J. Sandlos, and D. Veríssimo, *Mainstreaming the social sciences in conservation.* Conservation Biology, 2017. **31**(1): p. 56-66.

76. Vimal, R., *Monitoring for conservation in african tropical national parks: An agenda towards policy-relevant science.* Biological Conservation, 2017. **214**(Supplement C): p. 127-135.

CHAPTER 4

Perspectives of health challenges and assets of Indigenous and local forest-dependent populations in Southern Cameroon

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ABSTRACT:

In general, indigenous populations have poorer health outcomes than reference populations. Marginalization, colonization, and migration from traditional lands have all affected traditional medicine usage, indigenous populations health access and indigenous health overall. An in-depth understanding of health for specific populations is essential to developing actionable insights into contributing factors to poor indigenous health. To develop a more complete, nuanced understanding of indigenous health status, we conducted first-person interviews with both the indigenous Baka and neighboring Bantu villagers (the reference population in the region), as well as local clinicians in Southern Cameroon. These interviews elucidated perspectives on the most pressing challenges to health and assets to health for both groups, including access to health services, causes of illness, the uses and values of traditional versus modern medicine, and community resilience during severe health events. Baka interviewees, in particular, reported facing health challenges due to affordability and discrimination in public health centers, health effects due to

migration from their traditional lands, and a lack of culturally-appropriate public health services.

INTRODUCTION:

The purpose of this study is to explore differences and commonalities in how two neighboring ethnic groups in Southern Cameroon, the indigenous minority Baka population and the majority Bantu-speaking[4] population in Southern Cameroon, view health challenges and assets. Both groups are poor and rural, but their traditional livelihoods and land tenure rights vary greatly. The Baka, who traditionally subsisted on hunting and gathering, [1, 2] were only recently sedentarized, and are still highly dependent on forest resources. The Bantu-speaking majority population have traditionally depended on agriculture for sustenance [3, 4].

Indigenous peoples around the world are known to experience poorer health outcomes than benchmark populations [5]. Global colonization, indigenous marginalization, and resulting migration from traditional lands have generally been detrimental to the health of indigenous peoples [6-10]. Additionally, language, remoteness, discrimination, and other logistical barriers reduce indigenous access to modern healthcare systems [11-14]. Surveillance data of indigenous health and health practices is lacking, constraining efforts to improve health conditions for indigenous populations, such as the Baka in Cameroon [15]. We chose qualitative interviews to gain insights into how the indigenous populations view their health, their health determinants, and how their perspectives compare to surrounding majority populations [16].

The Baka population in Cameroon is estimated to be about 40,000, comprising less than one percent of the total population (23 million) [17]. Bantu are estimated to

[4] Bantu-speakers, referred to, as "Bantu," are a heterogeneous mix of ethnic groups in this region, including Badjoue, Nzime, Mbulu, and Fang-Nzaman.

make up about 19% of Cameroon's total population [18]. Baka and Bantu populations are both more prevalent in southern Cameroon, and one survey found the local population was 25% Baka and 60% Bantu [19]. Ethnographic studies in the last 50 years have documented the complex nature of Baka interactions with neighboring Bantu groups in Southern Cameroon including Baka subordination and discrimination [2, 3, 20].

In recent decades, the Baka have lost much of their traditional lands due to forest protection measures and have been pressured to migrate outside forests boundaries to roadside encampments [2, 21]. Their increasingly sedentary lifestyle outside the forest and interaction with neighboring communities has increased the prevalence of diseases tied to poor sanitation and increased exposure to infectious diseases [22]. The Baka typically lack legal rights to their traditional lands and face discrimination in public benefits such as voting, education, and healthcare [13, 23-26].

However, relatively few studies have focused on how these changes affect Baka health and well-being, particularly from their perspective. To address this gap and place the Baka's expressions of their health in a local context we conducted interviews with Baka and Bantu participants about their perceptions of common illnesses, changes in common illnesses over time, causes of illness, traditional medicine[5] usage, factors affecting access to modern[6] healthcare, and community

[5] Traditional medicine is a broad term used to define non-western medicine including "health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being." (Fokunang, 2011).

health traditions. Insights from this research can serve as a foundation for mutually beneficial health knowledge, methods, approaches, and treatments to improve the health of culturally and ethnically diverse populations [27-29].

METHODS:

We conducted in-depth first-person interviews in July 2014 in four communities (two Bantu communities, villages #1 and #4, and two Baka communities, villages #2 and #3,) adjacent to the Dja Biosphere Reserve in Southern Cameroon and with local clinicians at regional clinics. The location was chosen because it is ultra-rural and thus prime for studying remote health access in Cameroon. Also the area is known to neighbor traditional Baka lands where forced migration occurred [30-33]. We interviewed 15 Baka (7 women and 8 men), and 20 Bantu (10 women and 10 men) and four local nurse clinicians from three local public and one private health center. Interviews ranged in time from 30–90 minutes. No participants declined to participate, but the translator decided to end an interview after one participant was unable to complete the interview.

The interview guide comprised of open-ended questions to elicit participant comments on pressing challenges to health, causes of disease, and assets available to support health. The scope of the interview questions aimed to take into account social determinants of health including livelihood, welfare, and perspectives on what constitutes one's health. Topics included common illness over time, health factors,

[6] We refer to public and private healthcare systems (as opposed to traditional medicine practices) in Cameroon herein as "modern medicine" [interviewee's described modern medicine as the "clinic" (clinique) or "hospital" (hôpital) because this term was used dominantly in the region including by both the researchers and participants in the interviews.

health access, common health burdens, and health practices. Clinician interviews consisted of informal conversations regarding the clinicians' perspectives of local health practices within nearby communities. Health data were collected from the four clinics in the study area and the provincial Ministry of Public Health statistician. We obtained study approvals from the Institutional Review Board of the University of California Los Angeles, the Cameroon Ministry of Public Health National Ethics Committee, the Cameroon Ministry of Science and Innovation, and the regional, provincial Ministry of Public Health of Cameroon.

Interview participant recruitment was initiated by first obtaining permission from the four the village chiefs. Following chief approval, we held community meetings in each village to explain the study's purpose, logistics, confidentiality, the importance of the communities' perspectives, to answer questions, and to introduce the research team. We recruited interview participants using purposive sampling [34], inclusive of equal gender representation, from among residents identified by four village chiefs. Inclusion criteria included: being over 18 years of age, availability, and fluency in French or Baka. Tote bags were given to participants for their involvement in the study.

The research team conducted, recorded, transcribed, and translated the interviews. We interviewed one clinician in English; otherwise, all interviews were conducted in French or Baka with the assistance from a francophone Cameroonian researcher and a hired bilingual Baka-French community member. Before the interview, individual participant consent was conducted verbally and recorded. A Cameroon researcher, fluent in French and English including local dialect used locally,

transcribed and translated all recordings to English off-site.

Interview transcriptions were coded using six-step thematic content analysis using ATLAS.ti. A research team member coded central themes and worked with two other research team members to analyze emerging themes, develop coding structure, and verify code appropriateness. We performed iterative analysis until achievement of saturation and all interview themes were identified. Authors performed comparative analysis among consistencies, inconsistencies, and frequency between ethnic group, the four villages, and on an individual level to determine areas of significance.

RESULTS AND DISCUSSION:

Despite some commonalities, Baka and Bantu interviewees revealed differences in their perspectives on pressing health challenges and health assets in their communities (see **Figure 4.1**.). Participant perspectives are described below in the following thematic areas: common illness, social and environmental impacts on health, barriers to modern healthcare access, traditional medicine usage, and community health resilience.

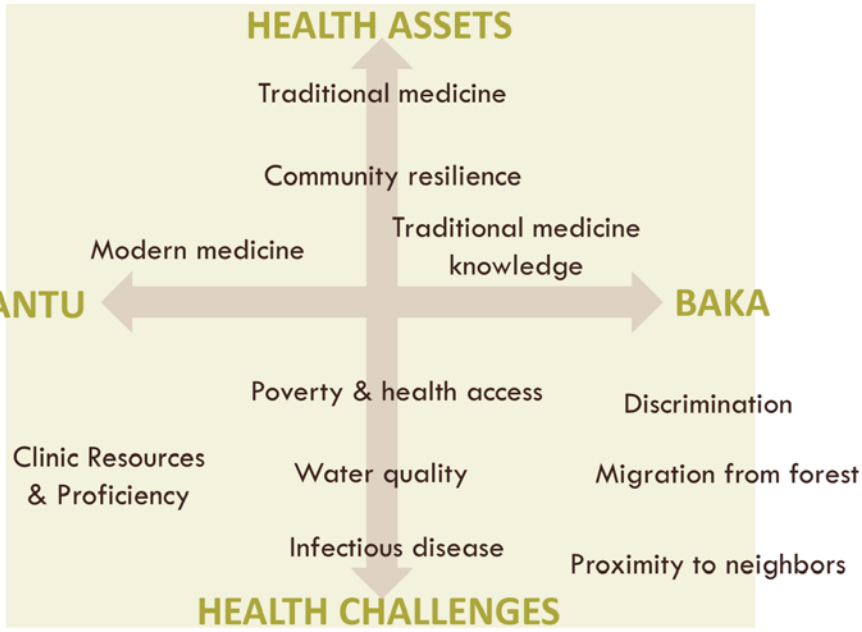

Figure 4.1. An overview of resulting themes from Baka and Bantu interviews. Themes are categorized by whether they were described either more significantly by Baka or Bantu in interviews and also by whether these themes were perceived health assets or health challenges by interviewees.

Changes in illness over time and local health statistics

Baka and Bantu interviewees described infectious disease burdens as a significant challenge to their community's health. Both Baka and Bantu interviewees described the top common illness in their communities as malaria, cold/flu, diarrhea, backache, headache, hernia, rheumatism, HIV/AIDS, gastrointestinal helminths, tuberculosis (TB), and typhoid. Bantu interviewees were more likely than Baka participants to mention HIV/AIDS, malaria, stomach ache, syphilis, and tuberculosis as common diseases. Baka interviewees were more likely than Bantu participants to cite diarrhea, headache, and toothache as common illnesses. Baka and Bantu mentioned HIV/AIDS as the most prevalent illness previously non-existent in prior generations. Both groups noted the decreased prevalence of leprosy, sleeping sickness, and

smallpox compared to previous generations. The leading nationwide causes of death in Cameroon at the time of the study were HIV/AIDS, malaria, maternal/neonatal death, and TB [35].

Although the Cameroon Ministry of Health does not collect or report race/ethnicity data for disease prevalence, past studies in the literature have reported different rates of specific diseases between Baka and Bantu populations in this region. Specifically, some studies have shown Baka have a higher vulnerability to TB, malaria, yaws, ulcers, parasites, malnutrition, hepatitis C, and oral health but lower rates of HIV/AIDS and hepatitis B than neighboring Bantu populations [14, 15, 36-39]. One explanation for the Baka's lower rates of HIV/AIDS put forward in the literature is the historical sexual isolation from neighboring Bantu [40]. However, a recent study in the region found Baka HIV seroprevalence had increased from previous studies decades prior due to increased sexual contact with Bantu [41].

Illness prevalence perspectives were triangulated with a patient data set obtained from a local private clinic serving communities surveyed herein. All other health data obtained from local clinics and district statisticians were found to be incomplete and thus not reportable herein. The private clinic dataset included more than 5,000 patient visits during the three years before this study (2011-2013) and contained annual summaries of patient visits, the reason for visit, visit cost, and final diagnoses. Thirty percent of patients from 2011-2013 were diagnosed with malaria, and 4% were diagnosed with typhoid. While the HIV/AIDS infection rate and prevalence were unavailable for the region, about 6% of all pregnant mothers tested positive for HIV at the clinic during this period. When defining underweight births as

<2.5 kg, 15% of clinic births were considered underweight. The clinic reported a 6% rate of fetal death similar to country-wide rates of fetal death rates [35, 42]. The local clinic statistics are likely a vast underrepresentation of health issues for local populations, and may overly represent populations able to afford and access local health care, as many of those interviewed face obstacles for health care access (discussed further below).

Perceived causes of poor health reflect the social history of the Baka

Baka and Bantu interviewees also described perceived causes of poor health within their communities. Both Baka and Bantu described poor water quality as a cause of poor health. A Baka female, village #2, explained, "Illness from which we suffer the most here in the village is stomach ache and diarrhea because of the water." Water quality is a significant health challenge documented in many indigenous communities worldwide [10, 43].

Baka interviewees provided perspectives regarding causes of increasing illnesses including traditional land loss and migration from forested areas to rural roadsides. One Baka female respondent village #2, explained that "now that we live in the village, there are many illnesses from which we suffer from…life for our ancestors was much better because many illnesses that we have today did not exist." Baka perceptions of newfound illnesses due to migration from the forest may be due to the potential for forest ecological disease mitigation [44-46]. For example, the malaria vector, *Anopheles*, does not favor deep forest environments [15, 44]. In fact, many Baka participants described malaria as a newfound disease. Additionally, Baka

interviewees perceive that their recent migratory proximity to neighboring Bantu groups is another source of newfound illness. A Baka female, village #2, explains, "When we lived in the forest, we did not know these illnesses. I believe they all are a result of our proximity to the Bantu." Migration from the forest and increased contact with nearby ethnic groups have been shown previously to contribute to poor Baka health and increased disease prevalence [38, 47, 48].

Poverty and discrimination are challenges to modern healthcare access

Baka and Bantu interviewees both described barriers to accessing modern healthcare as a challenge to health. Health access barriers included health center proximity and cost. A male Bantu, village #4, explained different factors impact healthcare access, "We have a health center here with no staff and no drugs. We are therefore forced to journey over 25 km to the [private] hospital, but then there is the problem of transport."

Although both groups cited cost as the most common barrier to modern healthcare; however, the Baka reported distinct issues with financing health care. Baka are also often excluded from the cash system as the Bantu often pay for Baka labor with materials such as clothing, food, or alcohol instead of cash. While Baka were more likely to mention not using modern healthcare at all due to cost, Bantu interviewees also described cash deficits for health costs. A Baka female, village #2, explained the need for cash to afford modern health care:

> "We use our local plants and herbs to fight illness because when we are confronted with a serious case and have no money, the patient may die. The

> staff at the hospital told us to bring any serious case, but we know quite well that without money or any other form of payment, the patient will be left to suffer and die."

Clinicians noted prenatal care and vaccines as the only free health services funded by the government at the time of the study. In cases where healthcare services were unaffordable, patients reported returning home to try traditional medicine treatments instead. A Baka male, village #3, explained:

> "When someone falls sick, we look for particular trees in the forest from which we get a piece of the bark and either boil or put into our nostrils depending on the illness. If that cannot cure the illness, then the person is taken to the hospital, but if they require a lot of money, we come back to the village to continue with our traditional medicine."

Clinicians also described how Baka, in relation to Bantu groups, would typically only seek modern healthcare for severe health events, and when alternative, less costly traditional medicines had failed.

While public clinics may lack funding to cover non-paying customers, the nurses from the private clinic reported that staff at times undercut their pay to cover costs for patient care. One clinician described sometimes allowing alternative payment schemes, especially for the Baka who do not have traditional currency streams. The Baka also explained how in severe health situations, when it was feasible for the private clinic, Baka were allowed to offer a trade of chickens, palm wine, or physical labor on clinic property for health services in lieu of money.

Systematic financial and indigenous discrimination in modern healthcare is also

a barrier to modern healthcare access for the Baka. A clinician from the private clinic explained how the Baka often do not have money (typically taking jobs for trade or slave labor) and are often seen as second-class citizens, leading to treatment refusal at public fee-for-service clinics. This clinician cited previous discriminatory treatment refusal from the public health center and reported needing to routinely escort severely ill Baka patients to the public regional health center to ensure treatment. The clinician also described needing to send extremely detailed referrals for Baka to ensure that they would receive proper treatment (e.g., anesthesia and bandages for surgeries) when the clinician is unable to escort severely ill Baka patients to the regional hospital. These reports are consistent with discrimination against the Baka and other indigenous populations at healthcare centers in the Congo Basin that have been previously reported in the literature [13, 23, 49].

Dissatisfaction with healthcare varied between the two populations. Bantu interviewees mentioned dissatisfaction with modern healthcare due to the limited proficiency, equipment, unreliable availability of pharmaceuticals, and the limited range of services offered at local health centers. Baka did not indicate dissatisfaction with health centers; however, their usage rates were seemingly much less or non-existent when discussed with clinic staff, potentially resulting in an inability to distinguish the service quality and range at local health centers. A male Bantu, village #1, explained, “the medical personnel lack instruments for appropriate diagnosis, [and] they simply provide symptomatic treatment.” Another Bantu male, village #4, explained the limited aptitude at local clinics, “There are frequent cases of child deaths here because these nurses are not very skilled. They do all they can, but when

the situation is too complicated for them, the children die." These perspectives may also be reflective of resource-poor settings where care is delayed due to limited resources, leading to progressed illnesses. Local clinicians supported villager observations describing limited staffing and resources. Rural government clinics are often run by one nurse requiring closing the clinic routinely for staffing absences even those that pertain to regular business such as field vaccination campaigns, to order and obtain prescriptions, and when attending district health meetings. Clinicians also cited the high cost of pharmaceuticals, an inability to order pharmaceuticals more frequently than once a month, and limited budgets with no room for error or outbreaks as contributing factors to poor healthcare.

Baka and Bantu interviewees perceive traditional medicine as an economically-friendly healthcare asset

Interviewees from both ethnic groups described using a mixture of modern and traditional health practices. For the Baka, indigenous medicine is not only economical but also the most favored and culturally appropriate health care option. Baka interviewees were significantly more likely to describe using traditional medicine as a first line defense of illness. A Baka female, village #2, explained, "When someone falls sick in the village, we search for barks, fetch water and medicinal plants, and make an infusion to give the sick person." The Baka are known for their traditional knowledge in medicinal plants and ecological forest systems [30, 50, 51]. However, as the Baka have migrated from the forest to roadside communities, their access to medicinal plants and their traditional knowledge sustainment have been increasingly

threatened [26, 52]. Traditional medicines used by the Baka have been independently demonstrated to be effective or to contain active compounds against a variety of ailments including intestinal helminthiasis, jaundice, malaria, diarrhea, parasites, gonorrhea, toothache and cough [30]. In comparison, the Bantu we interviewed also reported using traditional medicine primarily during times of personal economic insecurity or as a second line of defense if modern medicine was unsuccessful. Bantu interviewees were more likely to report using modern medicine (i.e., going to the clinic) as the first-line response to illness. Bantu also described reasons for preferring modern healthcare over traditional medicine as a Bantu male, village #3, explains, "we do not trust traditional medicine because it is risky."

Both Bantu and Baka interviewees explained traditional medicine is the first line defense when modern healthcare is unaffordable. As a Bantu male from village #4 stated, "if there is money, you take the person to the hospital but if there isn't money you try medicinal plants. If you are lucky, it will work, but if you are not, you would be forced to go borrow money [to get modern medical treatment sequentially]." As Bantu female, village #4, stated traditional medicine is an important safety net option for those without money, "We know plants that cure. Even those who are jobless can benefit from this."

Both groups described the primary uses for traditional medicine as being for aches (including stomach, head, and back aches), sorcery/witchcraft, and malaria. Bantu described using modern medicine for malaria treatment whereas Baka only described traditional medicine for malaria treatment. As a result, local clinics and Baka may underestimate Baka malaria prevalence due to lack of reported clinical

diagnosis. Both ethnic groups reported exclusively using modern medicine for severe childhood illnesses, HIV/AIDS, and tuberculosis. A Baka male, village #3, explained the traditional medicines ineffectiveness towards certain diseases as, "diseases for which names were given to us by the whites. Diseases like tuberculosis and cough are the diseases that we do not understand the cause."

Regardless of the motivational reasons for the use of traditional medicine in the region, be it due to access, affordability, efficacy, and belief-system, these interviews illustrate how traditional medicine is a critical source of primary and secondary healthcare access for both the Baka and Bantu populations interviewed. However, the wealth of the Baka's traditional medical knowledge has not been subject to systematic research and utilization further threatening the value and irremediable loss of traditional medicinal expertise [15].

In addition, modern clinic staff may try to discourage traditional medicine use, and as a result, further marginalize traditional health practices. A Baka female, village #2, describes questions of patient safety in traditional medicine; "we did not have the habit of giving birth in the hospital but in the village but today, we are told that is not safe." The inclusion of traditional medicine in modern healthcare would help to reduce stigmas associated with traditional medicine usage and prevent further marginalization of the Baka. Cameroon launched a strategic plan for traditional medicine integration in the last decade. However financial, and logistical complexities exist in practice, and it is not clear how ethical inclusion of indigenous populations will occur in planning, research, and in addressing intellectual rights [53].

Both groups describe community resilience as a health asset, particularly in cases of severe illness or death

Baka and Bantu groups described depending on community-driven aid in times of severe illness or death. Community members describe donations when modern healthcare visits are vital. A Bantu male, village #4, explained how communities, in general, come together to help each other when facing serious illness or death:

> "If someone falls sick or is seriously injured, we call for a meeting in which we discuss ways of generating money to take the person to the hospital if needed. Same thing when it concerns death in the village. We gather around the bereaved, contribute money, food that women prepare, and other things."

However, not all interviewees described community cohesion in times of suffering. Some Bantu presented negative attitudes about community resilience. For instance, a Bantu male, village #1, explains the increasingly present individualistic mindset between villagers of today, "If anyone in the community was hurt, all came to his aid, but today if you have a problem but don't have money, no one bothers to help you."

RECOMMENDATIONS

Achieving health for all marginalized populations, especially traditionally hunter-gatherers without access to their traditional needs livelihood needs, requires active engagement, inclusion, and research concerning upstream determinants of health. Based on our discussions with local populations and clinicians, we advocate the following ways to improve modern health access, engage local communities in health promotion, and build capacity for community health assets in the region.

1. **Incorporate a component of community resilience in development of health interventions and policies.** Community resilience, factors that Lorentz describes as supporting the "the immune system of social systems" [54], can be especially useful in ecological change and during adverse shocks to community well-being [55, 56]. Harnessing community resilience is valuable for health promotion when used to build adaptive capacity with local communities. Examples of community collaboration beneficial to institutional public health include enhancing health surveillance, improving disaster response and recovery, and strengthening local health system's ability to respond quickly to disease outbreaks. Public health programs should aim to build adaptive capacity between communities to protect and increase benefits of social resilience in the face of constant socio-environmental change to promote indigenous and local population's health.
2. **Engage local populations in the planning and delivery of modern health care to reduce barriers to access and to promote health equity**. Lowering barriers to modern healthcare will require active inclusion to provide an evidence-based foundation for advancing equity. As indigenous populations use traditional medicine and have historically been isolated and marginalized in modern healthcare, facilitating health interventions for the Baka requires inclusive decision-making, culturally-sensitive integrative medicine, and indigenous language translation or healthcare provider indigenous language-proficiency.

3. **Extend efforts to research and recognize upstream determinants of health in forest-dependent populations.** Large-scale top-down management of land and environmental resources increases the likelihood of poor health, especially in indigenous people [46]. Also, environmental change and forest deforestation affect disease regulation due to factors such as vector distribution, water quality, and loss of ecosystem resilience and resources [57-59]. As a result of these upstream determinants of health, environmental health is dynamic for forest-dependent populations. While the Baka face significant environmental, cultural, and socioeconomic changes likely to affect health and well-being, holistic approaches to health for both the Baka and Bantu populations will require further research, attention, and policy modification to improve upstream determinants of health.
4. **Protect indigenous rights to forest access, traditional lands, and self-determination.** Traditional knowledge of medicinal plants is a vital source of healthcare within the region. However, this valuable resource is at-risk due to anticipated biodiversity loss from climate change and migration away from traditional forested lands. These factors threaten both the health of indigenous populations and traditional medical knowledge. Integrating the Baka's rich traditional knowledge of medicinal plants with modern resources could provide other communities with more sustainable, accessible, and affordable public health solutions. Protection of forest access protection is critical to sustaining current and potential benefits of indigenous medicine to the region.

5. **Develop and institutionalize mechanisms for preserving, utilizing, and disseminating traditional ecological knowledge**. Traditional medicinal knowledge provides valuable local and regional benefits and services including availability, proximity to forest proximal populations, economic advantages, the encouragement of pro-ecologic resource management, promotion of the cultural sustainment of traditional medicine, and the potential discovery of new therapies [60-62]. Health and educational systems should be designed to encourage usage, proliferation, education, integration, and protection of traditional medical knowledge. Medical training that includes components of indigenous health can improve the reach of public health impacts to improve sensitivity, uses, and practices of traditional medicines [63]. Medicinal plant repositories or seed banks could assist in cataloging medicinal plants [53]. Relevant to all aspects of integrative medicine is the recognition of indigenous intellectual rights in the future development of traditional medicines and delivery [38].
6. **Implement programs to develop health literacy and community-based collaborative education to improve local capacity for health promotion.** Improving health literacy, by building upon community cohesion and resilience, represents an economic opportunity for improving health promotion in the region. Training programs in maternal and child health interventions, midwifery, sanitation (such as latrine construction), and water purification strategies would engage and empower local experts, or volunteer community health workers, to improve local capacity in health promotion. These

interviews suggest programs designed to decrease the incidence of malaria, and diarrheal disease would be particularly beneficial. Education with local communities allows for ownership of health literacy improving effectiveness, efficiency, and equity in health promotion [64, 65].

CONCLUSION

Baka and Bantu interviewees in this study portrayed challenges and assets in health management in their communities differently, but there are some overarching commonalities. While environmental changes affect health and well-being, local populations combat adversity with common assets: longstanding medical traditional knowledge and community resilience. The economic and socio-cultural benefits of these assets present opportunities for protection and further health promotion. Deficits in health in the region include a preventable disease burden and the relatively high cost of modern healthcare for local populations. The Baka indigenous population specifically portrayed disadvantages in health including disparities in modern healthcare treatment due to prohibitive health care costs and discrimination. The Baka also identified specific health determinants related to migration, traditional lands loss, and institutional marginalization.

The recommendations laid out herein are essential in improving health for the Baka, a marginalized indigenous population who have lost access to their traditional lands, but also provide insights for indigenous health promotion worldwide. Indigenous health is a global agenda as these populations are commonly isolated from their traditional lands, culture, and livelihood [5, 6, 10, 66-68]. Pathways forward for

active engagement, inclusion, education, and improvement upon upstream determinants of health will improve indigenous capacity and self-determinism in health.

REFERENCES FOR CHAPTER 4

1. Hewlett, B.S., *Hunter-gatherers of the Congo basin: Cultures, histories, and biology of African pygmies*. 2014, New Brunswick, New Jersey: Transaction Publishers.
2. Lueong, G.M., *The forest people without a forest: Development paradoxes, belonging and participation of the Baka in east Cameroon*. 2016, New York: Berghahn Books.
3. Hattori, S., *Current issues facing the forest people in Southeastern Cameroon: The dynamics of Baka life and their ethnic relationship with farmers.* African Study Monographs. Supplementary Issue 2014. **47**: p. 97–119.
4. Neumann, K., K. Bostoen, A. Höhn, S. Kahlheber, A. Ngomanda, and B. Tchiengué, *First farmers in the central African rainforest: A view from southern Cameroon.* Quaternary International, 2012. **249**: p. 53-62.
5. Anderson, I., B. Robson, M. Connolly, F. Al-Yaman, E. Bjertness, A. King, M. Tynan, R. Madden, A. Bang, C.E.A. Coimbra, Jr., M.A. Pesantes, H. Amigo, S. Andronov, B. Armien, D.A. Obando, P. Axelsson, Z.S. Bhatti, Z.A. Bhutta, P. Bjerregaard, M.B. Bjertness, R. Briceno-Leon, A.R. Broderstad, P. Bustos, V. Chongsuvivatwong, J. Chu, J. Gouda, R. Harikumar, T.T. Htay, A.S. Htet, C. Izugbara, M. Kamaka, M. King, M.R. Kodavanti, M. Lara, A. Laxmaiah, C. Lema, A.M.L. Taborda, T. Liabsuetrakul, A. Lobanov, M. Melhus, I. Meshram, J.J. Miranda, T.T. Mu, B. Nagalla, A. Nimmathota, A.I. Popov, A.M.P. Poveda, F. Ram, H. Reich, R.V. Santos, A.A. Sein, C. Shekhar, L.Y. Sherpa, P. Skold, S. Tano, A. Tanywe, C. Ugwu, F. Ugwu, P. Vapattanawong, X. Wan, J.R. Welch,

G. Yang, Z. Yang, and L. Yap, *Indigenous and tribal peoples' health (the Lancet–Lowitja institute global collaboration): A population study.* The Lancet, 2016. **388**(10040): p. 131-157.

6. Ohenjo, N.o., R. Willis, D. Jackson, C. Nettleton, K. Good, and B. Mugarura, *Health of indigenous people in Africa.* The Lancet, 2006. **367**(9526): p. 1937-1946.
7. Axelsson, P., T. Kukutai, and R. Kippen, *The field of indigenous health and the role of colonisation and history.* Journal of Population Research, 2016. **33**(1): p. 1-7.
8. Griffiths, K., C. Coleman, V. Lee, and R. Madden, *How colonisation determines social justice and indigenous health—a review of the literature.* Journal of Population Research, 2016. **33**(1): p. 9-30.
9. Paradies, Y., *Colonisation, racism and indigenous health.* Journal of Population Research, 2016. **33**(1): p. 83-96.
10. Gracey, M. and M. King, *Indigenous health part 1: Determinants and disease patterns.* The Lancet, 2009. **374**(9683): p. 65-75.
11. Flood, D. and P. Rohloff, *Indigenous languages and global health.* The Lancet Global Health, 2018. **6**(2): p. e134-e135.
12. Wilkinson, D., P. Ryan, and J. Hiller, *Variation in mortality rates in Australia: Correlation with indigenous status, remoteness and socio-economic deprivation.* Journal of Public Health, 2001. **23**(1): p. 74-77.
13. Lewis, I., *Discrimination and access to health care: The case of nomadic forest hunter-gatherers in Africa*. 1999, MSc Dissertation: University of. London:

London.

14. Tchoumba, B., *Indigenous and tribal peoples and poverty reduction strategies in Cameroon*, I.L. Organization, Editor. 2005.
15. Abéga, S.C., *Pygmées Baka: Le Droit à La Différence*. 1998, Yaoundé, Cameroon: INADES-formation Cameroun.
16. Valeggia, C.R. and J.J. Snodgrass, *Health of indigenous peoples.* Annual Review of Anthropology, 2015. **44**(1): p. 117-135.
17. Pyhälä, A., *What future for the Baka? Indigenous peoples' rights and livelihood opportunities in south-east Cameroon*, M.W. Jensen, Editor. 2012, International Work Group for Indigenous Affairs: Copenhagen, Denmark.
18. Agency, C.I., *The world factbook 2018*. 2018, Central Intelligence Agency: Washington, DC.
19. Njounan Tegomo, O., L. Defo, and L. Usongo, *Mapping of resource use area by the Baka pygmies inside and around Boumba-Bek national park in Southeast Cameroon, with special reference to baka's customary rights.* African Study Monographs. Supplementary Issue., 2012. **43**: p. 45-59.
20. Ngefor, S., *Indigenous peoples and conservation of forest resources: The case of the Baka people of the eastern region of Cameroon.* International Journal of Green Economics, 2013. **7**(3): p. 299-313.
21. Awuh, H.E., *Access to discourse, marginalisation and exclusion in conservation-induced resettlement: The case of the displaced Baka of east Cameroon.* International Journal of Environmental Studies, 2016. **73**(2): p. 294-312.
22. Froment, A., *Evolutionary biology and health of hunter-gatherer populations*,

in *Hunter-gatherers: An interdisciplinary perspective*, C. Panter-Brick, R.H. Layton, and P. Rowley-Conwy, Editors. 2001, Cambridge University Press. p. 239-266.

23. Egbe, E., *Social exclusión and indigenous peoples' health; an example of Cameroon Baka 'pygmies' people of the rainforest region of the south.* Journal of Sustainable Regional Health Systems, 2012. **1**: p. 16-21.
24. Oyono, P.R., *From diversity to exclusion for forest minorities in Cameroon*, in *The equitable forest: Diversity, community, and resource management*, C.J.P. Colfer, Editor. 2004, Routledge: New York. p. 113-130.
25. Tucker, S., *Human rights violations and indigenous 4b 2013 UPR stakeholder report Cameroon*. 2013, The Center for Environment and Development: Yaoundé Cameroon.
26. Pemunta, N.V., *The governance of nature as development and the erasure of the pygmies of Cameroon.* GeoJournal, 2013. **78**(2): p. 353-371.
27. Martin, D.H., *Two-eyed seeing: A framework for understanding indigenous and non-indigenous approaches to indigenous health research.* Canadian Journal of Nursing Research Archive, 2012. **44**(2): p. 20-42.
28. Janes, C.R., *The health transition, global modernity and the crisis of traditional medicine: The tibetan case.* Social Science & Medicine, 1999. **48**(12): p. 1803-1820.
29. Durie, M., *Understanding health and illness: Research at the interface between science and indigenous knowledge.* International Journal of Epidemiology, 2004. **33**(5): p. 1138-1143.

30. Betti, J.L., *An ethnobotanical study of medicinal plants among the Baka pygmies in the Dja biosphere reserve, Cameroon.* African Study Monographs 2004. **25**(1).

31. Nguiffo, S., *One forest and two dreams: The constraints imposed on the Baka in miatta by the Dja wildlife reserve.* Indigenous People and Protected Areas in Africa, 2003: p. 195-214.

32. Tchoumba, B. and J. Nelson, *Protecting and encouraging customary use of biological resources by the Baka in the west of the Dja biosphere reserve*, in *Cameroon Article*. 2006, Forest Peoples Programme

33. Awuh, H.E., *Adaptive livelihood strategies in conservation-induced displacement: The case of the Baka of east Cameroon.* African Studies Review, 2015. **58**(2): p. 135-156.

34. Palys, T., *Purposive sampling.* The Sage Encyclopedia of Qualitative Research Methods, 2008. **2**: p. 697-698.

35. WHO. *Cameroon statistics summary (2002 - present)*. Global Health Observatory 2012-Present [cited 2018 3/7/2018]; Available from: apps.who.int/gho/data/node.country.country-CMR.

36. Ndumbe, P.M., G. Atchou, M. Biwole, V. Lobe, and J. Ayuk-Takem, *Infections among pygmies in the eastern province of Cameroon.* Medical Microbiology and Immunology, 1993. **182**(6): p. 281-284.

37. Walker, P.L. and B.S. Hewlett, *Dental health diet and social status among central African foragers and farmers.* American Anthropologist, 1990. **92**(2): p. 383-398.

38. Kowo, M.P., P. Goubau, E.-C.N. Ndam, O. Njoya, S. Sasaki, V. Seghers, and H. Kesteloot, *Prevalence of hepatitis c virus and other blood-borne viruses in pygmies and neighbouring Bantus in southern Cameroon.* Transactions of the Royal Society of Tropical Medicine and Hygiene, 1995. **89**(5): p. 484-486.

39. Pampiglione, S. and A.E. Wilkinson, *A study of yaws among pygmies in Cameroon and Zaire.* British Journal of Venereal Diseases, 1975. **51**(3): p. 165-169.

40. Froment, A., *Human biology and health of African rainforest inhabitants*, in *Hunter-gatherers of the Congo basin: Cultures, histories and biology of African pygmies*, B.S. Hewlett, Editor. 2014, Transaction Publishers: New Brunswick, New Jersey. p. 117-164.

41. Essomba, N.E., D. Adiogo, D.K. Koum, C. Ndonnang, M.I.N. Ngwe, L.N. Ayuck, L. Lehman, and Y. Coppieters, *Seroprevalence, attitudes and practices of the Baka pygmies of eastern Cameroon towards HIV and aids.* The Journal of Infection in Developing Countries, 2015. **9**(08): p. 849-856.

42. Bove, A.P.B., P.J. Robyn, and R.J. Singh, *Towards greater equity: A special focus on health (English)*, in *Cameroon Economic Update*. 2013, World Bank: Washington, DC.

43. Jiménez, A., M. Cortobius, and M. Kjellén, *Water, sanitation and hygiene and indigenous peoples: A review of the literature.* Water International, 2014. **39**(3): p. 277-293.

44. Pattanayak, S.K. and J. Yasuoka, *Deforestation and malaria: Revisiting the human ecology perspective.* Human health and forests: a global overview of

issues, practice and policy, 2008: p. 197-217.

45. Colfer, C.J.P., *Human health and forests: A global overview of issues, practice and policy*. People and plants international conservation. 2012, London, UK: Routledge.

46. Butler, C.D., *Human health and forests: An overview.* Human Health and Forests: A Global Overview of Issues, Practice and Policy; Colfer, CJP, Ed, 2008: p. 13-33.

47. Ndembi, N., H. Yumo, J. Takehisa, T. Takemura, E. Kobayashi, C. Ngansop, E. Songok, T. Miura, E. Ido, and M. Hayami, *Hiv type 1 infection in pygmy hunter-gatherers is from contact with Bantu rather than from nonhuman primates.* AIDS research and human retroviruses, 2003. **19**(5): p. 435-439.

48. Froment, A., *"Human biology and health of African rainforest inhabitants" in hunter-gatherers of the Congo basin* ed. e. Harry S. Hewlett. 2014, New Brunswick, New Jersey: Transaction Publishers.

49. Jackson, D. and K. Payne, *Twa women, twa rights in the great lakes region of Africa*. 2003: Minority Rights Group International London.

50. Betti, J.L., O.D. Yongo, D.O. Mbomio, D.M. Iponga, and A. Ngoye, *An ethnobotanical and floristical study of medicinal plants among the Baka pygmies in the periphery of the Ipassa-Biosphere reserve, Gabon.* European Journal of Medicinal Plants, 2013. **3**(2): p. 174-205.

51. Brisson, R., *Utilisation des plantes par les pygmées Baka*. 2011, Paris: L'Harmattan.

52. Gallois, S., R. Duda, and V. Reyes-García, *'Like father, like son'? Baka*

children's local ecological knowledge learning in a context of cultural change, in *Hunter-gatherers in a changing world*. 2017, Springer. p. 195-211.

53. Fokunang, C.N., V. Ndikum, O.Y. Tabi, R.B. Jiofack, B. Ngameni, N.M. Guedje, E.A. Tembe-Fokunang, P. Tomkins, S. Barkwan, F. Kechia, E. Asongalem, J. Ngoupayou, N.J. Torimiro, K.H. Gonsu, V. Sielinou, B.T. Ngadjui, F. Angwafor, A. Nkongmeneck, O.M. Abena, J. Ngogang, T. Asonganyi, V. Colizzi, J. Lohoue, and K. Kamsu, *Traditional medicine: Past, present and future research and development prospects and integration in the national health system of Cameroon.* African Journal of Traditional, Complementary, and Alternative Medicines, 2011. **8**(3): p. 284-295.

54. Lorenz, D.F., *The diversity of resilience: Contributions from a social science perspective.* Natural Hazards, 2013. **67**(1): p. 7-24.

55. Berkes, F., J. Colding, and C. Folke, *Navigating social-ecological systems: Building resilience for complexity and change*. 2008, Navigating Social-Ecological Systems: Building Resilience for Complexity and Change: Cambridge University Press.

56. Mekou, Y.B., J.S. Denis, and T.A. Marie, *Supporting local adaptive capacity to climate change in the Congo basin forest of Cameroon: A participatory action research approach.* International Journal of Climate Change Strategies and Management, 2013. **5**(2): p. 181-197.

57. Patz, J.A., U. Confalonieri, F. Amerasinghe, K. Chua, P. Daszak, A. Hyatt, D. Molyneux, M. Thomson, L. Yameogo, and M. Lazaro. *Human health: Ecosystem regulation of infectious diseases*. in *Ecosystems and Human Well-Being:*

Current State and Trends: Findings of the Condition and Trends Working Group of the Millennium Ecosystem Assessment. 2005.

58. Foley, J.A., R. DeFries, G.P. Asner, C. Barford, G. Bonan, S.R. Carpenter, F.S. Chapin, M.T. Coe, G.C. Daily, and H.K. Gibbs, *Global consequences of land use.* Science, 2005. **309**(5734): p. 570-574.
59. McMichael, A.J. and R.E. Woodruff, *Detecting the health effects of environmental change: Scientific and political challenge.* EcoHealth, 2005. **2**.
60. Alves, R.R. and I.M. Rosa, *Biodiversity, traditional medicine and public health: Where do they meet?* Journal of Ethnobiology and Ethnomedicine, 2007. **3**(1): p. 14.
61. Anyinam, C., *Availability, accessibility, acceptability, and adaptibility: Four attributes of african ethno-medicine.* Social Science & Medicine, 1987. **25**(7): p. 803-811.
62. Waldron, I., *The marginalization of african indigenous healing traditions within western medicine: Reconciling ideological tensions & contradictions along the epistemological terrain.* Women's Health and Urban Life, 2010. **9**(1): p. 50-68.
63. Tambo, E., E.C. Ugwu, G. Madjou, E.M. Tekwu, A.H. Gilani, and J.Y. Ngogang, *Afrian traditional and alternative medicine implementation into primary healthcare systems in africa: Bottlenecks and prospects.* Holistic Healthcare: Possibilities and Challenges, 2017: p. 31.
64. Marmot, M., S. Friel, R. Bell, T.A.J. Houweling, and S. Taylor, *Closing the gap in a generation: Health equity through action on the social determinants of*

health. The Lancet, 2008. **372**(9650): p. 1661-1669.

65. Marmot, M., *Achieving health equity: From root causes to fair outcomes.* The Lancet, 2007. **370**(9593): p. 1153-1163.

66. Stephens, C., J. Porter, C. Nettleton, and R. Willis, *Disappearing, displaced, and undervalued: A call to action for indigenous health worldwide.* The Lancet, 2006. **367**(9527): p. 2019-2028.

67. King, M., A. Smith, and M. Gracey, *Indigenous health part 2: The underlying causes of the health gap.* The Lancet, 2009. **374**(9683): p. 76-85.

68. Walker, J., R. Lovett, T. Kukutai, C. Jones, and D. Henry, *Indigenous health data and the path to healing.* The Lancet, 2017. **390**(10107): p. 2022-2023.

CHAPTER 5

Future Directions and Applications of This Work

The indigenous voices heard through our research identified a concern for the loss of traditional knowledge and culture, recognition of how forest management has affected their livelihood, and identification of health determinants related to migration and loss of traditional lands. These conversations suggest that active participation and representation of indigenous populations are essential throughout the continuum of forest management to promote traditional knowledge, agency, and resilience. Additionally, the voices of local women emphasize the importance of women stakeholders in conservation projects, primarily due to the difficulty our team experienced in obtaining equilateral participation from women in this research. These studies also point to the value of using health as a metric for community well-being in conservation programming to provide a measurable, cross-cultural, and equity-based co-benefit strategy for local populations.

PROTECTION OF INDIGENOUS KNOWLEDGE, SELF-DETERMINISM, AND CULTURE IN CONSERVATION PROGRAMMING

Future work in this field, and for the Baka, should focus on the development of translation of the recommendations outlined in each chapter, into practice. These include protecting of access to traditional lands, facilitating inclusion in the management of traditional lands, promoting strategies to sustain traditional knowledge, and promotion of indigenous self-determinism. Areas of opportunity exist

for national legal protection strategies, equilateral benefit mechanisms in conservation programs, indigenous management and protected use of native lands, and social, educational, research, and health promotion programs, which integrate and promote sustainment of indigenous knowledge.

Active participation of indigenous populations is a dynamic process, with no "end date," requiring the ongoing evolution of knowledge sharing, communication strategies, education, experimentation, and adaption throughout the continuum of forest management. Participation should include a diversity of local, but especially indigenous populations, and consults with national and international indigenous representation groups. For instance, local and regional indigenous interest groups have made it a mission statement to improve political participation, natural resources, health, education, economic development, and gender representation. "Gbabandi" (founded in 2016) is the first representative platform of indigenous forest peoples both in Cameroon and in Central Africa. Permanent solutions for respect for indigenous rights, inclusion, empowerment, and protection of traditional knowledge require permanent participation. Policies in conservation that prevent harm and promote health to indigenous populations (i.e., direct access to sustainable forest resources, health promotion, and preservation of cultural identity and lifestyle) will be critical to aligning conservation goals with the needs, agency and community priorities of local populations.

EMPOWERING WOMEN IN CONSERVATION PROGRAMS

Here, we have focused on exploring the differences of the perspectives of the Baka compared to their Bantu neighbors, but there is also a need in future studies to look at women in particular. Women have been cited as essential advocates for forest conservation due to their reliance on ecosystem services and strength in community organizing [1]. Past conservation efforts have been criticized for not involving women more substantively [2]. As women play critical roles in promoting and maintaining family well-being, our research team sought to include them in equal representation to men in our first-person interviews. To include women in equal amounts to men, our research team had to explain the purpose of equity in the interview process multiple times to village leaders as well as be careful to approach women at a time when their daily work would not be interrupted. Although it was challenging to obtain interviews with women in each community, the results were extremely informative. Women brought up different well-being concerns as a vulnerable subgroup, for instance, lack of access to education and women's healthcare. This is of particular concern because the promotion of women's health and economic opportunities has been demonstrated in a number of contexts to be crucial to the health and well-being of communities [3, 4]. Outreach efforts are recommended to prioritize engagement of women to increase equitable outcomes in forestry policy [5]. Engaging women in active participatory processes is essential to identifying solutions to broader health issues related to optimizing co-benefits in conservation goals.

LOOKING FORWARD: HEALTH AS A METRIC IN CONSERVATION PROGRAMS

A more significant implication of this work is the concept that health and well-

being of local populations can be used as a metric for sustainability success in conservation and forest management programs. Co-beneficial health programming provides a holistic measure of human impacts of conservation, is an essential step in climate justice, and will help ensure the long-term sustainability of conservation programs [6-10]. Reducing the potential for conservation impacts on local forest-dependent populations is limited by the lack of a comprehensive framework prospectively identifying potential health and well-being impacts.

One potential framework to help reduce potential harm to local populations in conservation planning and programming is the Health Impact Assessment. The Health Impact Assessment is an important tool that can be used to inform decision-makers about the potential health consequences of proposed policies and programs [11, 12]. The HIA process provides a detailed framework for assessing both intentional and unintentional impacts of proposed activities on health, evaluating region-specific priorities, and including input from a broad range of stakeholders (include indigenous populations) and hence provides a standardized methodology for addressing determinants of social, health, and livelihood impacts in conservation programs.

Human health has been proposed previously as an integrative approach to measuring holistic sustainability in conservation [10, 13, 14]. However, the idea of applying the HIA framework as an assessment tool for conservation projects is new. By assessing impacts on the health of local populations, HIA facilitates inclusion of other developmental values including happiness, health, justice and the preservation of the human-forest relationship [15-17]. To date, no standardized tools or processes have been deployed to evaluate potential conservation projects and resulting impacts on

health. There has been widespread recognition of the need for HIA's in developing countries, particularly for proposed policies related to climate change mitigation strategies [18, 19]. Similar process frameworks, such as environmental or social impact assessments (EIAs and SIAs) have been used to synergize local priorities with conservation goals to maximize aggregate benefits [20, 21]. The scope of EIAs and SIAs do not systematically include health considerations [22]. While both the SIA and the HIA are diverse evidence-based approaches to priority building and decision-making, the value of the HIA approach is that it focuses on health outcomes, which methodically promotes equality [23]. The HIA framework promotes the development of quantitative measures that can be used to assess outcomes [24], account for environmental health and justice considerations [25], and promote assessing impacts on human rights and stakeholder engagement [26, 27].

Appendix A

Resident Interview Question Guide

UCLA FIELDING SCHOOL OF PUBLIC HEALTH

IRB Approved Interview Questions & Format for Residents near the Dja Reserve

Interview Format: Non-scheduled non-standardized narrative interviews

TOPIC 1: Daily Life and Livelihood

1. Question: Do you mind telling me about your daily life, where you live, and your community resources?

Prompts given participant response	a. What does your family eat on a typical day, yesterday or the day before, for example? b. Is this food you grow or find yourself, or do you buy it? Prompts: Hunting, fishing, gathering, planting c. Are there resources you and your community obtain from the forest? d. For getting food (or earning money for food), are there certain things that are the job of one person? e. For getting food (or earning money for food), are certain activities that are shared among members of your family? f. For getting food (or earning money for food), are there ways different families in your village help each other? g. What are plentiful resources within your location? Are there times when it is difficult to get the food you want? What are the problems your family faces in getting food or money for food? Are there certain times or seasons when it is more difficult? h. Besides food, are there other ways that families help each other out? i. How about other things your family needs? How do you: a. Collect water for drinking and cooking, build huts, sell products (what do you sell), work for money, etc. b. What are the things that are the job of one person and not another? c. Which of these things are shared jobs that family members work together on? j. In what ways do you think your lives are different than the lives of your parents? In what ways do you think the lives of your

	children will be different from your own? Are there ways of your parents that are important for each generation to learn? How are these taught? How have these traditions changed? k. Over the last several years do you think the lives of people in your village have been getting easier or more difficult? l. Are there other ways you work together as a community? How you do you support each other? How do you learn from each other? m. What is your favorite part of your day?

TOPIC 2: Community Health Practices

1. Question: We are curious about human health in your community. Do you mind telling me about health practices in your community?

Prompts given participant response	1. How do you support your family or community when there is sickness? 2. What are the common illnesses in this area? 3. What are the illnesses that worry people the most around here? What causes these illnesses? 4. Over the past several years are there certain illnesses that are becoming more common? Are there illnesses that are becoming less common? 5. How far away is the nearest health clinic? 6. For what kinds of illnesses do people go to the health clinic? 7. For what kinds of illnesses can you buy medicines in the market or in a store? 8. Do you use medicines? Are there certain illnesses that people prefer to treat with medicines from the forest? Are these medicines preferred? 9. How is knowledge passed down about providing care to others in the event of illness? 10. How does your community provide for others in health practices (such as giving birth, etc.)? 11. What do you consider strengths in your community for health practices? *12. If Death or chronic illness is brought up:* How do death/chronic illness affect the community? How does it affect families? What happens when someone dies/gets very sick?

TOPIC 3

2a. Question: Strengths of the community.

Prompts given participant response	a. Did you grow up here? b. How is this village different from how it used to be? c. What do you consider strengths in your community in your location? d. What do you consider strengths in your community in community leadership? e. What do you consider strengths in your community for knowledge? f. What do you consider strengths in your community for culture/tradition? g. What do you consider strengths in your community for forest knowledge? h. Are the ceremonies, like the coming-of-age ceremonies for boys and girls, hunting ceremonies, healing ceremonies and funeral ceremonies like they used to be? What has changed? i. Do people have more money than they used to? Is money more important than it used to be?

Follow-up questions, second visit as needed (if finish above):

TOPIC 4 Organizational Engagements

2a. Question: How have previous NGO's, organizations or groups come to work with your community?

Prompts given participant response	a. Have you ever worked with outside organizations? a. If yes: i. What did the projects entail? What was the goal of the project? What did the project do? ii. How did they contact you? iii. How long did they stay? iv. What did you learn? v. How was this project or how were these projects viewed by the community? vi. How have you liked or disliked these projects? vii. How have they improved or not improved the goals they set out to achieve? b. If no: i. Have you ever been contacted by outside groups who have wanted to work with you? ii. Do you refrain from talking to outside groups?

TOPIC 4 Forest Management Practices

2a. Question: Forest Management and Organizational Engagement

Prompts given participant response	a. Is there anything the government is doing to protect the Dja Forest? b. Do you think this is helping people in your village? c. Do people from your village talk to people from the government about the rules for the Dja? d. Do you think there are differences in how the forest is managed now than from when you grew up? e. What do you consider strengths in your community for forest knowledge? f. How do you think your community would want to be included on changing in taking care of the forest? g. How do you think your community would want to be included on aspects of forest and government policy?

Appendix B

Clinician Interview Question Guide

UCLA FIELDING SCHOOL OF PUBLIC HEALTH

Interview Questions for the Health Ministry and related personnel

Interview Format: Scheduled non-standardized narrative interviews

TOPIC 1: Community Health Practices

1. Question: How is health data is collected for the Ministry of Health?

Prompts given participant response	1. How is health data collected in Cameroon? What health data is collected routinely? How are different illnesses or vaccines tracked? 2. What are the common illnesses in Cameroon? 3. What are the illnesses that are priorities of the health ministry? 4. Over the past several years are there certain illnesses that are becoming more common? Are there illnesses that are becoming less common? 5. Are there certain illnesses that people prefer to treat with traditional medicines? Why are these medicines preferred? How important is the forest for supplying what's needed for these medicines?

REFERENCES FOR CHAPTER 5

1. Brown, H.C.P., B. Smit, D.J. Sonwa, O.A. Somorin, and J. Nkem, *Institutional perceptions of opportunities and challenges of redd+ in the Congo basin.* The Journal of Environment & Development, 2011. **20**(4): p. 381-404.
2. Peach Brown, H., *Gender, climate change and redd+ in the Congo basin forests of central Africa.* International Forestry Review, 2011. **13**(2): p. 163-176.
3. Kar, S.B., C.A. Pascual, and K.L. Chickering, *Empowerment of women for health promotion: A meta-analysis.* Social Science & Medicine, 1999. **49**(11): p. 1431-1460.
4. Mehra, R., *Women, empowerment, and economic development.* Annals of the American Academy of Political and Social Science, 1997. **554**: p. 136-149.
5. Pierce Colfer, C.J. and R.D. Minarchek, *Forest research and gender: A review of available methods for promoting equity.* Forests, Trees and Livelihoods, 2013(ahead-of-print): p. 1-20.
6. Karsenty, A. and S. Ongolo, *Can "fragile states" decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the redd mechanism.* Forest Policy and Economics, 2012. **18**: p. 38-45.
7. Molua, E.L., *Discourse on climate-smart agriculture for redd+ strategy in the Congo basin.* Journal of Sustainable Development, 2012. **5**(10): p. p77.
8. Mertz, O., D. Müller, T. Sikor, C. Hett, A. Heinimann, J.-C. Castella, G. Lestrelin, C.M. Ryan, D.S. Reay, and D. Schmidt-Vogt, *The forgotten d: Challenges of addressing forest degradation in complex mosaic landscapes under redd+.* Geografisk Tidsskrift-Danish Journal of Geography, 2012. **112**(1):

p. 63-76.

9. Nicholson, S. and D. Chong, *Jumping on the human rights bandwagon: How rights-based linkages can refocus climate politics.* Global Environmental Politics, 2011. **11**(3): p. 121-136.

10. Olander, L.P., C.S. Galik, and G.A. Kissinger, *Operationalizing redd+: Scope of reduced emissions from deforestation and forest degradation.* Current Opinion in Environmental Sustainability, 2012. **4**(6): p. 661-669.

11. Cole, B.L., R. Shimkhada, J.E. Fielding, G. Kominski, and H. Morgenstern, *Methodologies for realizing the potential of health impact assessment.* American journal of preventive medicine, 2005. **28**(4): p. 382-389.

12. Tyrrell, T.D. and J.B. Alcorn. *Analysis of possible indicators to measure impacts of redd+ on biodiversity and on indigenous and local communities*. in *Subsidiary Body on Scientific, Technical, and Technological Advice, Sixteenth Meeting*. 2011. Montreal, Canada: Convention on Biological Diversity.

13. Hahn, S., N. Anandaraja, and L. D'Agnes, *Linking population, health, and the environment: An overview of integrated programs and a case study in Nepal.* Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine, 2011. **78**(3): p. 394-405.

14. Chapman, C.A., B. van Bavel, C. Boodman, R.R. Ghai, J.F. Gogarten, J. Hartter, L.E. Mechak, P.A. Omeja, S. Poonawala, D. Tuli, and T.L. Goldberg, *Providing health care to improve community perceptions of protected areas.* Oryx, 2015. **49**: p. 636-642.

15. Easterlin, R.A., L.A. McVey, M. Switek, O. Sawangfa, and J.S. Zweig, *The*

happiness-income paradox revisited. Proceedings of the National Academy of Sciences, 2010. **107**(52): p. 22463-22468.

16. Ritter, E. and D. Dauksta, *Human–forest relationships: Ancient values in modern perspectives.* Environment, Development and Sustainability, 2013. **15**(3): p. 645-662.
17. Okereke, C. and K. Dooley, *Principles of justice in proposals and policy approaches to avoided deforestation: Towards a post-Kyoto climate agreement.* Global Environmental Change, 2010. **20**(1): p. 82-95.
18. Erlanger, T.E., G.R. Krieger, B.H. Singer, and J. Utzinger, *The 6/94 gap in health impact assessment.* Environmental Impact Assessment Review, 2008. **28**(4-5): p. 349-358.
19. Wernham, A., *Health impact assessments are needed in decision making about environmental and land-use policy.* Health Affairs, 2011. **30**(5): p. 947-956.
20. Pasgaard, M., *The challenge of assessing social dimensions of avoided deforestation: Examples from Cambodia.* Environmental Impact Assessment Review, 2013. **38**(0): p. 64-72.
21. Patz, J., D. Campbell-Lendrum, H. Gibbs, and R. Woodruff, *Health impact assessment of global climate change: Expanding on comparative risk assessment approaches for policy making.* Annual Review of Public Health, 2008. **29**: p. 27-39.
22. Fischer, T.B., M. Matuzzi, and J. Nowacki, *The consideration of health in strategic environmental assessment (sea).* Environmental Impact Assessment Review, 2010. **30**(3): p. 200-210.

23. Harris-Roxas, B., F. Viliani, A. Bond, B. Cave, M. Divall, P. Furu, P. Harris, M. Soeberg, A. Wernham, and M. Winkler, *Health impact assessment: The state of the art.* Impact Assessment and Project Appraisal, 2012. **30**(1): p. 43-52.

24. Bhatia, R. and E. Seto, *Quantitative estimation in health impact assessment: Opportunities and challenges.* Environmental Impact Assessment Review, 2011. **31**(3): p. 301-309.

25. Bhatia, R. and A. Wernham, *Integrating human health into environmental impact assessment: An unrealized opportunity for environmental health and justice.* Ciência & Saúde Coletiva, 2009. **14**: p. 1159-1175.

26. MacNaughton, G. and P. Hunt, *Health impact assessment: The contribution of the right to the highest attainable standard of health.* Public Health, 2009. **123**(4): p. 302-305.

27. Salcito, K., J. Utzinger, G.R. Krieger, M. Wielga, B.H. Singer, M.S. Winkler, and M.G. Weiss, *Experience and lessons from health impact assessment for human rights impact assessment.* BMC International Health and Human Rights, 2015. **15**(1): p. 24.