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The Politics of Land Use in the Korup National Park

Siewe Siewe [1,*], Jacqueline M. Vadjunec [1] and Beth Caniglia [2]

[1] Department of Geography, College of Arts & Sciences, Oklahoma State University, 337 Murray Hall, Stillwater, OK 74078, USA; jacqueline.vadjunec@okstate.edu

[2] Sustainable Economic & Enterprise Development Institute, Regis University College of Business & Economics, 3333 Regis Blvd. K-24, Denver, CO 80221, USA; ecaniglia@regis.edu

* Correspondence: siewes@okstate.edu; Tel.: +1-405-744-6250

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Abstract: Recently, the call to combine land change science (LCS) and political ecology (PE) in the study of human-environment interactions has been widely discussed by scientists from both subfields of geography. In this paper, we use a hybrid ecology framework to examine the effects of conservation policies on the environment and the livelihood of the people of the Korup National Park (KNP). Using techniques in both PE and LCS, our results show that conservation policies, politics, and population are the primary drivers of environmental change in the KNP. We conclude by arguing that a deeper understanding can be garnered by combining LCS and PE approaches to analyze and contribute to the people and parks debate.

Keywords: political ecology; land change science; hybrid ecologies; conservation; Korup National Park

1. Introduction

Tropical forests cover about 11 percent of the Earth's surface and provide habitation for a large number of plants and animals [1]. These forests also provide ecosystem services, which can be broadly grouped into; provisioning, regulating, cultural, and supporting services to more than 110 million people who depend on them for their daily livelihood [2–5]. Human activities such as deforestation affect the physical state of these forests, and thus their ability to provide these services.

Over the years, conservation groups have adopted several approaches; from the development of "hard-park" (parks with strict policies to prevent human encroachment) conservation policies ([6]; p. 783) to people-oriented park designs, to curb the adverse effects of humans on the environment. Currently, there are more than 100,000 protected areas in the world, covering about 14.6% of the Earth's total land surface ([7]; p. 220). The increase in the number of parks around the world has also witnessed an increase in the number of conflicts between park management and traditional people seeking to make a livelihood. Local people around parks have been known to trespass park boundaries to hunt, fish, harvest non-timber forests products, and, in some cases, harvest timber for their livelihood [8].

Land change science (LCS) and political ecology (PE) are subfields in geography that attempt to explain the interactions between humans and their immediate environments. Although the definitions of both fields have changed over time [9], LCS has been defined as involving the type, location, and intensity of human-environmental change [10]. PE on the other hand, "is the study of the constantly shifting dialectic between society and land based resources, and also within classes and groups within society itself" ([11]; p. 17).

Land change scientists and political ecologists both focus on human-environment relationships, but differ in the way they structure their research questions and the methods they use in answering these questions [12]. Turner and Robbins [12], however, argue that land change scientists and political ecologists arrive at similar conclusions on land use issues such as vulnerability and forest transitions.

They also argue that LCS and PE can benefit from each other on topics in which they individually fall short. For example, ecological issues in PE can be addressed through LCS, while PE can strengthen LCS by explaining power dynamics inherent in social relationships [13].

Zimmerer [14] first used the term "hybrid ecologies", but it was in response to Turner II and Robbins' challenge that Brannstrom and Vadjunec [9] put together the first edited volume on hybrid ecologies. Hybrid ecologies illustrate the importance of LCS and PE in the understanding of human environment interactions. Hybrid ecologies emphasize similarities (areas of "convergence") between LCS and PE, while acknowledging their differences in "problem framing" ([12]; pp. 295, 299) and methods of analysis.

Political ecologists and land change scientists seek answers to problems relating to human environment interactions [12]. Although the methods employed by land change scientists and political ecologists have been described as "parallel" ([12]; p. 295), some practitioners from both fields believe that we can enhance our understanding of the interaction between humans and their environment if both approaches were combined into "hybrid ecologies" ([12]; p. 308).

Arguments in favor of a combined LCS-PE approach go beyond the fact that their intellectual history overlaps [12], to aspects of their methodology. In their explanation of some of the challenges in LCS, Rindfuss and colleagues [15] highlighted shortcomings in LCS's ability to provide feedback regarding the different factors that affect land-cover change. For example, LCS techniques such as remote sensing and Geographic Information Systems (GIS) can only provide a snap shot of the landscape or the environment. Furthermore, these snap shots only provide limited explanations for different land-use changes. If we combine LCS methods and results with PE discourse and interpretive analyses that question choices and decisions that affect the landscape, we acquire a better and a more complete understanding of environmental change [12]. Brannstrom and Vadjunec's [9] text on "hybrid ecology" advances the need for the combined approach, calling "it a pragmatic and problem-driven enterprise", important in achieving a balance in sustainability science ([9]; p. 11).

In this paper, we use a hybrid ecology approach to examine the effects of conservation policies on the environment and livelihood of the people of the Korup National park (KNP). We examine the politics of conservation in the KNP, and combine/compare our findings to the findings of other studies in the KNP. We combine the results from LCS analysis (Landsat imagery, GIS data, and remote sensing analysis), with data from household surveys, key informant interviews, participant observation, historical narrative, and coding techniques. Our goal is to provide a comprehensive explanation to the changing environment in the KNP; to contribute/support hybrid ecologies, and to improve our understanding of the factors that drive the land-use change in the KNP.

This paper is divided into three parts. Part one examines LCS and PE as individual fields of study, as well as a combined approach to understanding human environment interactions. Part two reviews the origins of parks, and examines the evolution of parks in Cameroon. The methods used in data collection, remote sensing and data analysis are discussed in part two. Part three examines the policies that promoted the creation of parks in Cameroon, and the KNP in particular. In part three, we also discuss the effects of these policies on the land-use and land-cover change (LULCC) in the park and then summarize our findings in a conclusion that highlights the importance of hybrid ecologies.

1.1. Land Change Science and Environmental Change

Land cover generally refers to the physical attributes of land (e.g., desert, forest, etc.), while land use refers to the conversion of land cover for and by humans ([10]; p. 2). Land change science (LCS) research seeks to understand how humans and biophysical forces affect the environment. According to Turner II and Robbins ([12]; p. 299), LCS "*devotes attention to human environment dynamics on the surface of the earth, seeking to uncover attributes about land-uses and covers and the processes of their change to inform global environmental change and sustainability*". LCS investigates how individuals and societies contribute to land-use and land-cover change (LULCC), and how they are in turn influenced by and

respond to these changes [16]. Simply put, LCS involves the type, location, and intensity of human environmental change, asking questions such as what factors lead to changes in the environment [10].

LCS has distant ties to environmental anthropology, human and cultural ecology, and risk hazard studies [12]. LCS developed in the late 1980s, when natural and remote sensing scientists in the International Geosphere-Biosphere Programme (IGBP) recognized the importance of a coupled natural and social science approach to understanding land-use and land-cover dynamics [9,10]. The reason for this appeal to merge both sciences was to help natural and remote sensing scientists improve their understanding of land-use patterns and dynamics. LCS was therefore born as a research project [9,10,16,17] to improve understanding of the different land-use and land-cover patterns affecting Earth systems and to promote research at various spatial and temporal scales. According to Rindfuss and colleagues [15], three main reasons account for these variations in temporal and spatial scales in LCS. First, to monitor the different changes in land cover; second, to explain the coupled human and environment interactions that bring about these changes; and third, to use the understanding of these changes to develop and improve on spatially explicit models ([15]; p. 13977). LCS therefore seeks to improve our understanding of the environment by modeling/combining the different variables (actors) involved in this relationship.

Like LCS, political ecology (PE) has roots in geography, anthropology, environmental sociology, environmental history, and cultural landscape studies, as well as human and cultural ecology [12,18]. Political ecology, like LCS, is also multi-scalar in its analysis, ranging from local to global scales, crossing international boundaries and social structures. Political ecologists often answer conservation questions related to natural resource management [19,20], land-use and land-cover changes [11,21], revealing its close similarities with land change science [9,12]. PE explores these themes by exposing the relationship between societies and the biologically, culturally, and politically complex worlds, filling gaps in LCS analysis [9].

Political Ecology of Environmental Change

The increase in the number of parks and protected areas around the world has gained the attention of scholars who are interested in a deeper understanding of conservation policies, and the tools of conservation (e.g., parks) [22–24]. This growing literature examines the origins of global environmental discourses such as conservation, deforestation, desertification, etc., and their link to poverty and other social implications via tools of implementation like parks [25,26]. Political ecology often uses a bottom-top approach to understanding the relationship between politics, the political economy, and ecology [11,27]. Over the years however, political ecology has morphed into different things to different people, thus making it difficult to agree on one specific definition. In this paper, political ecology evaluates environmental issues, by analyzing the:

> *political dimensions of the interaction between the state, and other actors, and the places where they live. It sees politics as the competition between humans over the division of resources, and looks at the means by which different actors deploy whatever power they have to achieve their ends.* ([28]; p. 359)

In their different approaches to understanding human-environment relationships, political ecologists [18,29–31] and other social scientists [32] deviate from deterministic/common explanations to environmental change. They show that our comprehension of environmental issues requires an understanding of the politics of resource use, and the role of power in influencing environmental discourses, access, and the relationship between actors [25,29].

For example, political ecologists who study conservation often combine politics, history, and discourse analysis to show that nature (parks and wildernesses) results from the interaction of actors with unequal power relation that leads to the marginalization of the weaker actor(s) [18,29,33–35]. It is with this understanding that Robbins ([18]; p. 147) discusses his "conservation and control thesis", in which he argues that conservation has often served as a tool for powerful groups to control

indigenous people and their resources. Over the years, political ecologists have documented several examples of this unequal power relation and their effect on the environment and traditional people.

Power does not only determine who makes the rules and who gains access to resources, it also determines/affects the reaction of other environmental stakeholders to these policies [29]. In Madagascar for example, after the state ban of the use of fire for subsistence agriculture, the Malagasy people responded by occasionally setting the forests on fire [36], exacerbating the environmental situation. McGregor [37] illustrates these same power dynamics and their negative outcomes in her examination of colonial conservation policies in Zimbabwe and their effect on ecological change. She explains that discrimination, coercion, and punitive restrictions on indigenous people's use of resources accompanied the implementation of colonial ideologies of conservation in Zimbabwe ([37]; p. 257), and led to the loss of top soil and the creation of new gullies. Otutei's [29] work on the political ecology of forest management in the Assin North Municipality in Ghana shows that forest policies have led to unequal power distribution and the marginalization of some indigenous people. The result of this marginalization has been indigenous resistance in the form of the destruction of trees and arson, which has retarded forest management efforts ([29]; p. 108). Extreme indigenous responses to hardline conservation policies are also discussed by Tchamie [38], who describes the gruesome destruction (uncontrolled felling, illicit clearing, illegal returns to vacated villages, and massive destruction of wildlife) ([38]; p. 58) of protected areas by indigenous people in Togo who believed that parks were the source of all their problems. Robbins [18] describes these after-and-unpredicted effects of conservation policies as "unintended consequences" of conservation policies ([18]; p. 170). To understand the KNP management policies and its accompanying effects on the environment and people in the KNP, we start by examining the evolution of parks in Cameroon.

1.2. Evolution of Parks in Cameroon

In 2000, the government of Cameroon (GoC) and its conservation partners successfully and "completely" removed the village of Ikondo-Kondo 1 from the Korup National Park (KNP), to another location outside the park's boundary [39,40]. This "voluntary" resettlement was orchestrated by the GoC, with the support of donor organizations such as the World Wide Fund for Nature (WWF), the UK Department of International Development (DFID), Wildlife Conservation International (now WCS), the US Agency for International Development (USAID), the German Society for International Cooperation (GIZ), the European Commission, the US Department of Defense, and the German Development Service (DED) [41]. The resettlement project was the first step towards making the KNP a park free from humans, and a smaller step towards curbing the destructive activities of the indigenous people that lived within and around the park boundaries. This displacement of the people of Ikondo-Kondo 1 from their ancestral homeland is one of many resettlement cases in Africa [42]. The native Mursi, Suri, Nyangatom, Dizi, and Me'en people, who live around the Omo National Park in Ethiopia, and the Bushmen of the Central Kalahari game reserve in Botswana are other examples [33]. The proffered reason for the resettlement of these people is the same: to protect biodiversity from humans [3].

Western concepts, which separated nature from human societies, led to the creation of parks such as Yellowstone and Yosemite National Parks, which directly influenced the creation of parks in Cameroon and other African countries [33,40,43,44]. Political ecologists have argued that creating and understanding nature has deep political significance because in the creation of these areas, the organization in charge generally also has the power to determine who can use nature, when, where and how [11,14,18,29]. In Cameroon, the process of creating parks started in 1896, when the German colonial administrators declared all "unoccupied" land to be crown land ([44]; p. 15). The British and French colonial administrations subsequently copied this land tenure tradition, which has survived until the present day [44,45].

Through colonial conservation policies, large tracts of unoccupied lands were set aside for logging, agricultural, and watershed protection purposes [46]. However, as the practice of conservation spread

throughout the country and continent, indigenous lands were quickly converted and designated as protected areas, free from human interference. This strategy of creating parks did not consider indigenous livelihoods, nor did it compensate them for the expropriation of their lands [47]. The establishment of parks in the colonial era therefore had a negative impact on the local population, whose reaction to the creation of these parks ranged from indifference to hostility [43].

After Cameroon gained independence in 1960, it continued to follow the colonial framework for protected areas. The GoC created new protected areas and changed the status of others from national reserves to national parks. Decree No. 81-13 in 1981 stated that not less than 20% of the country should be put under the total protection of national parks and/or reserves. Chapter 1 article 3 of Decree 83/170 defined national parks and prohibited livelihood activities in these parks. Nevertheless, the decree did not prohibit human settlements within these parks [43,48]. An economic crisis that started in 1985, coupled with the World Bank's structural adjustment plans and growing international concern over environmental degradation and loss of biodiversity led the GoC to develop a tropical forest action plan. This plan supported the sustainable management of forests in 1988 (with the support of the World Bank) [43].

Changes in the economic and political atmosphere (products of the structural adjustments plan) forced the government to create more national parks (e.g., KNP), and institute stringent laws through different ministries to govern them [43,44,49]. In addition to the national forestry laws, the country became a signatory to several international, regional, and sub-regional conventions and conservation organizations. These commitments further opened the country to the ideas of environmental protectionists who encouraged the government to set aside more land for the purpose of conservation.

Protected areas in Cameroon today cover 18.75% of the national territory (an area of about 8,900,000 ha) and can be broken down into several categories: national parks (16), wildlife sanctuaries (4), wildlife reserves (6), zoological gardens (3), hunting zones (46), and community hunting zones (22) ([45]; p. 19). Creating parks for generating income was the first sign of neoliberal conservation tactics in Cameroon. The commercialization of nature became prevalent and over the years, the revenue generated from safari hunting and park entrance fees increased (in 2007 alone, park entry and hunting fees generated about $415 (USD) [45].

Scientific literature has documented the role of European conservationists in the creation of parks in Africa and around the world [43,50,51]. In the case of Cameroon, Steve Gartlan, who was the WWF country director, drafted the country's first forest laws in the early 1990s [51]. Gartlan, who lobbied the government for the creation of the KNP, saw his role in the development of national conservation policies as well justified. He argued, "It is unrealistic and irresponsible to hand over the duty of protecting these unique ecosystems to the local communities who have neither the resources nor the biological education necessary to manage them" ([52]; p. 223).

Gartlan is not unique in his view of local indigenous people as incapable of effectively managing their resources. Similar perspectives have been the driving force behind the creation of national parks, and shed light on two important issues about the conservation of natural resources in Cameroon and other African countries. First, Africa's people are often referenced in a negative light (destroyers of nature), while much of their environment is framed positively (rich in biodiversity). Africa's nature is "nature as it should be," "un-spoilt," and "pure," while its people are "warring," poverty stricken, and the main cause for the dwindling biodiversity on the continent ([42]; p. 84).

Second, since the 1980s, conservation in Cameroon (and Africa in general) has focused on different ways in which wildlife and nature can pay for themselves, so that the world can benefit from their conservation [42]. This has led to the framing of Africa's natural resources as "inverted commons," a special type of resource that belongs to the whole world, but for which only Africans pay the real price ([42]; p. 87). The idea of the "inverted commons" can be used to explain power dynamics between stakeholders in conservation negotiations. Power dynamics that determine the system of rule/control over resources are usually dependent on market structure and purchasing power [42,53,54]. This

idea raises questions such as; who really owns and controls Africa's resources? Conservationists like Gartlan along with conservation Non-Governmental Organization (NGOs) have framed Africa's natural resources as some global commons, which must be jointly protected for the benefit of all, though often at the expense of the local indigenous people. This reflects inequalities in resource use and access that can be easily recognized (and reproduced) in conservation policies. These inequalities are evident in the creation of the KNP.

Creation of the Korup National Park: Background and History

The Korup National Park is located in the Southwest region of Cameroon (Figure 1). Five villages (Erat, Bera, Esukutan, Ikenge, Bareka Batanga) reside within the park boundaries and depend completely on the resources in the park for their livelihood. Livelihood activities in the park include subsistence agriculture, fishing, hunting, cash cropping, and the harvesting of non-timber forest products [41,43,55,56].

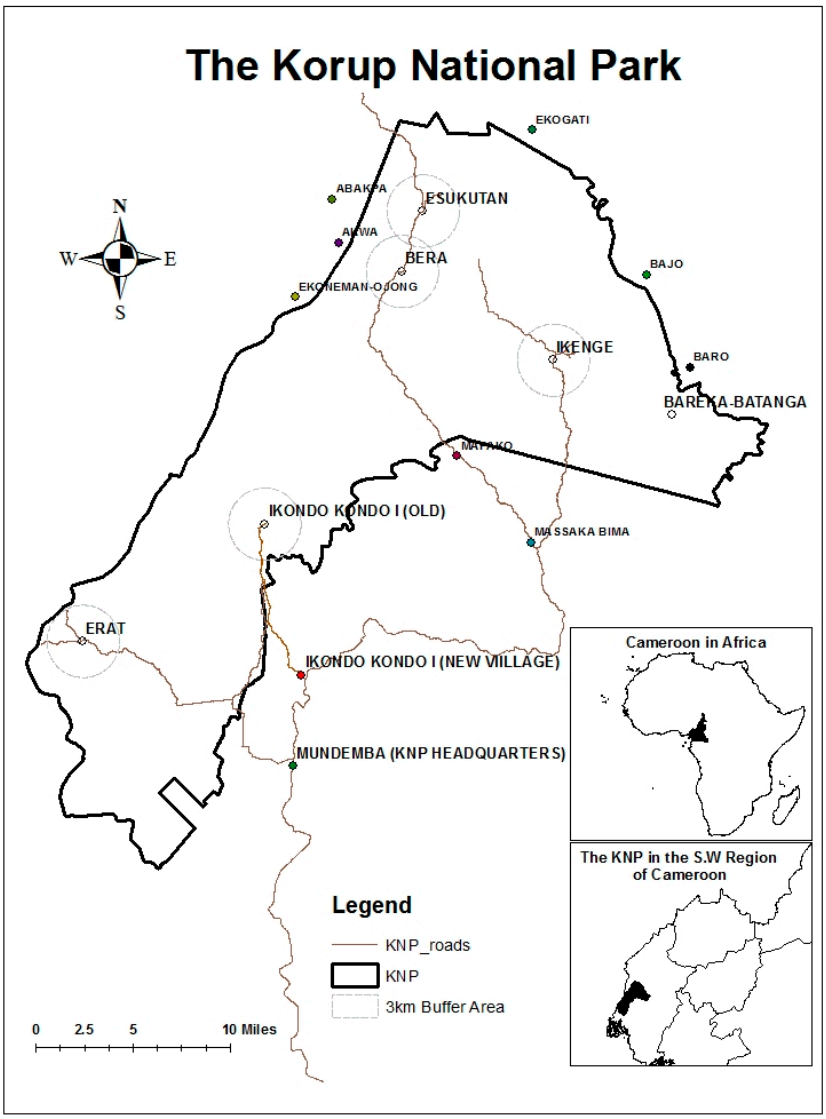

Figure 1. The Korup National Park in Cameroon. Created by Siewe Siewe. Source: Shapefiles for Cameroon and Africa (ArcGIS database).

Discussions on the creation of the Korup National Park started in the 1970s, when the rare Preuss' Red Colobus Monkey attracted conservationists Gartlan and T. Truthsaker to the Korup area [41].

As a result of their visit to the area the two wrote a letter to the GoC informing them of Korup's uniqueness and ecological importance [43]. The letter resulted in no immediate reaction, but in the years that followed, the Korup area witnessed rapid exposure and interest from the conservation world [41]. They portrayed the Korup area as an "Eden," untouched and void of human interference in a film produced by Phil Agland to raise funds for its protection, perpetuating the wilderness myth of the area. At the turn of the century, the KNP became the only protected area in the humid forest region of Central Africa with an active resettlement compensation program [40,43].

Some of the early research done in the Korup region identified hunting as the main source of income for the local people. This led conservation officials to conclude that relocating the people of the region was the only way to protect the biodiversity of the region [40,43,45]. Indigenous people were forced to surrender their lands to the GoC and its partners in exchange for housing, financial support, material support, and the appeal of being close to civilization (other roadside communities) [40,41,43].

In the late 1980s and early 1990s, the GoC and its partners (WWF, GIZ, etc.) sponsored three main socio-economic studies in the KNP region to collect data needed to inform the resettlement plans. Infield [57], whose report identified hunting as the most important activity in the park area and noted an increasing level of negative attitudes from hunters, warned the government against making inflexible hunting laws, and admonished them to make treaties with local hunters [41,58]. In his cost benefit analysis, Ruitenbeek [59] argued that forced removal of the people was not optimal and that voluntary compensated migration would be necessary, but only if conservationists found the effect of the indigenous activities to be irreversible. Because there was no significant data to support the latter condition, he concluded that the best option was for the GoC and its counterparts to wait for the people to migrate voluntarily to another part of the forest, without any form of compensation [27,41,59].

Devitt's 1988 report had the most in-depth recommendations about the resettlement of the Korup area [41]. Devitt made recommendations on the location of roads, development, conservation, and resettlement of the Korup area. He suggested that resettlement efforts start in the northeast corner of the park, with the smallest and almost deserted village of the park, and then progressively move southwards, resettling the rest of the villages based on tribal groups. He also suggested that the GoC should redraw the boundary of the park to avoid the relocation/resettlement of the largest village in the park (Erat).

Despite these recommendations, the master plan of 1989 identified resettlement as a very important step toward preserving the biodiversity of the KNP. In 2000, against all the recommendations from socio-economic and environmental impact studies, the GoC and its partners resettled the village of Ikondo-Kondo 1 to a new location outside the park boundary. Plans to resettle the other villages in the region failed because of the "stubborn nature" of the people ([41]; p. 45); see also [43]. These plans also failed because contrary to Devitt's recommendations, the park authorities were more concerned with relocating the large villages of the park area than they were of the small villages such as Bareka Batanga [41].

The creation of the park in 1986 meant that indigenous communities inside the KNP had lost their rights to use the resources within the park boundary for their livelihoods [40,41]. The failure to resettle the villages left within the park boundary made the situation worse, as the park management was determined to reduce the impact of indigenous land-use activities on the environment. The number of game control posts and game guards were increased and the people were continuously discouraged from cultivating permanent crops. The following section discusses the methods used to collect and analyze the data for this study.

2. Methods

2.1. Ethnographic Methods

This study is based on data collected during nine months (December 2011 to August 2012) of fieldwork in the KNP. Fieldwork was conducted in four of the five villages (Esukutan, Bera,

Ikenge, and Erat) within the park, and involved the use of archival and ethnographic methods of data collection. Sixty-five questionnaires were used to obtain data from households in the different villages. The questionnaires comprised of both structured and semi-structured questions relating to household structures and land-use systems. Household structured questions were summed, tallied in spreadsheets, and were then used to run statistical analysis for each household, village, and the KNP as a whole. Semi-structured questions were coded for recurring themes in subject's responses. Every compound[1] in the study villages was visited, but only the willing heads of household were interviewed for the project.

Archival research was conducted in Mundemba and the nation's capital of Yaoundé over the course of three weeks during the same field period. Archival research provided data which served as the basis for understanding the data collected on current park policies and their land use systems. For example, in this study, data from previous studies on the number of people involved in hunting activities and cocoa production is compared to data collected from the field (see Figures 2 and 3). Twelve semi-structured key informant interviews, primarily of village leaders and elders, game guards, and NGO and KNP park officials provided environmental and historical context to the data collected through participant observation of farm practices and other village activities. Pidgin English was used in conducting all household surveys (usually 3 hours long) and village key informant interviews. Whenever possible, both male and female heads of households were interviewed to provide data on household demographics, histories, and assets. The reason for interviewing both male and female heads was three fold. First, to ensure accurate information and understand differing perspectives on household livelihood and production systems—the park offers different experiences for men and women and hence differing histories. Secondly, to understand the land-use systems of local indigenous people in light of their history and current park policies. The third goal was to analyze the dependence of the people on their immediate environment, livelihood production systems, as well as their perspective on conservation and other institutional interventions.

Data from key informant interviews and open-ended questions were coded for recurring themes. Coded themes were used in two different ways; first, some themes were tallied to provide a percentage number of the respondents that supported, rejected, or were indifferent about the question asked. Coded themes were also used to better understand household land use trends and respondent's perception on households. This data was also used to corroborate other data obtained from household interviews and archival research [59]. The goal was to develop a better understanding of land-use, livelihood, and the indigenous people's perception of park management issues.

2.2. Quantitative Methods

Quantitative data from a land-use change study was also used [60]. Satellite image analysis was performed on two LANDSAT TM and ETM+ scenes that cover the total area of the park. Raw images for two periods; 2000 and 2013 for Path/Row 187/56 and 187/57 were downloaded from the United States Geological Survey (USGS) website (Image Source: USGS Glovis). The year 2000 is significant to the history of the park because it was the year when the first and only village of the park was successfully resettled to some other location outside the park's boundaries. It therefore provides a good point of reference from which to measure the LULCC in the park. To avoid cloud and haze problems common with LANDSAT images in the tropics, the images were chosen to match the dry season period between November and February [61,62] in the park. Potential gap issues in the data caused by the Scan Line Corrector (SLC) problem were resolved by using the LANDSAT 7 ETM+ DESTRIPE tool in ENVI 4.5. The raw images were georeferenced using a linear first-order polynomial

[1] For this study, a compound is defined as a multi-family household, where a group of people live together in the same house, but have different families, own separate properties, and are engaged in different land use activities. These different families can be polygamous, or monogamous. In each case, households stay separated from each other.

fit, based on ground control Geographic Information System (GIS) points collected during the field study. Images were also corrected for atmospheric and radiometric errors in ENVI 4.5. A root mean square error less than 3 meters in each case ensured that changes between the two dates resulted from actual land-use change, and not from uneven image registration [61,63,64].

Data was classified using the Iterative Self-Organizing Data (ISODATA) module in Erdas Imagine. The ISODATA algorithm is an iterative procedure that first assigns an initial arbitrary cluster to a pixel, and then in a second step classifies each pixel into a closer cluster ([65]; p. 215). Using this algorithm, 150 classes were generated from 10 maximum iterations and then compressed (grouped) into pixels representing 3 main cover types; forest, deforested, and water [66]. Class assignment was based on visual interpretation of the image using expert knowledge of the field. The signatures from the ISODATA algorithm were compared to ground truth data from known places in the field. The hybrid image classification was performed to reduce the spectral complexities that are common with the classification of tropical imagery. The process, though tedious, provides for a detailed classification of the land-use types in the park area. Using 50 separate ground control points, an accuracy assessment was performed on all the classified images. In all instances, and for all the land–use classes, a minimum accuracy level of 95% was achieved (see [61,62]).

After assessing the accuracy of the classification, the classified images were mosaicked and clipped to the boundary of the park for a change detection analysis. In order to cover the whole area of the park, two LANDSAT footprints (row 56 and 57) were classified separately before being mosaicked together. The footprints were independently classified because of spectral differences between them. Using the cross tabulation matrix in Idrisi Andes, land-cover transitions between the two periods were determined, with the image year 2000 as the base image, comparing it against the 2013 image. This process combined information from the individually classified images, to provide a single image that identified how each individual pixel changed from 2000 to 2013. The "transition image" includes pixels with land-cover information from both dates (2000 and 2013) [61].

A reclassification process followed, and the resulting change image had five main LULCC categories: Forest 2013, Water, Non-Forest 2000, Non-Forest 2013, and Forest-regrowth (See Table 1 below).

Table 1. Land use Classification Schema.

ID	Class	Description
0	Background	Unclassified area outside the area of study
1	Forest 2013	Dense, closed tropical forest common to the KNP park
2	Water	Rivers, creek, ponds, and other water bodies
3	Non-forest 2000	Areas lacking green vegetation cover and/or bare soil (2000).
4	Non-forest 2013	Areas lacking green vegetation cover and/or bare soil (2013).
5	Forest regrowth 2013	Areas that changed from being bare of vegetation in 2000 to being forest (regrowth) in 2013.

Combined, the data provides a narrative of the factors that influence household decisions and historical patterns of land-use systems and changes in the KNP. The results below discuss findings from fieldwork, presented in sections that reveal the impact that conservation policies have had on the livelihood systems, and the environment of the KNP.

3. Consequences of Conservation Policies in the KNP

Studies have shown that before the creation of the KNP, the people depended on hunting, fishing, subsistence agriculture, the harvesting of non-timber forest products (NTFPs) and small scale cash cropping [41,45,56,67]. Since the designation of this area as a national park and the resettlement of the village of Ikondo-Kondo 1 in 2000 there have been several changes in the land use and livelihood systems of the villages that remained in the park. Household data showed that more than 95% of the household heads interviewed were involved in subsistence agriculture, making subsistence farming

the main livelihood activity in the park [60]. Using data gathered from household surveys and the results from coding, this section shows the effects of conservation policies on the environment and indigenous livelihood by examining the results from LCS analysis, the population of the KNP, and two livelihood activities (hunting and cash cropping).

3.1. Land-Use and Land-Cover Change at the Community Scale

Between the year 2000 and 2013, the rate of deforestation in the KNP varied widely from one village to another, as shown in Figure 2 and Table 2 below.

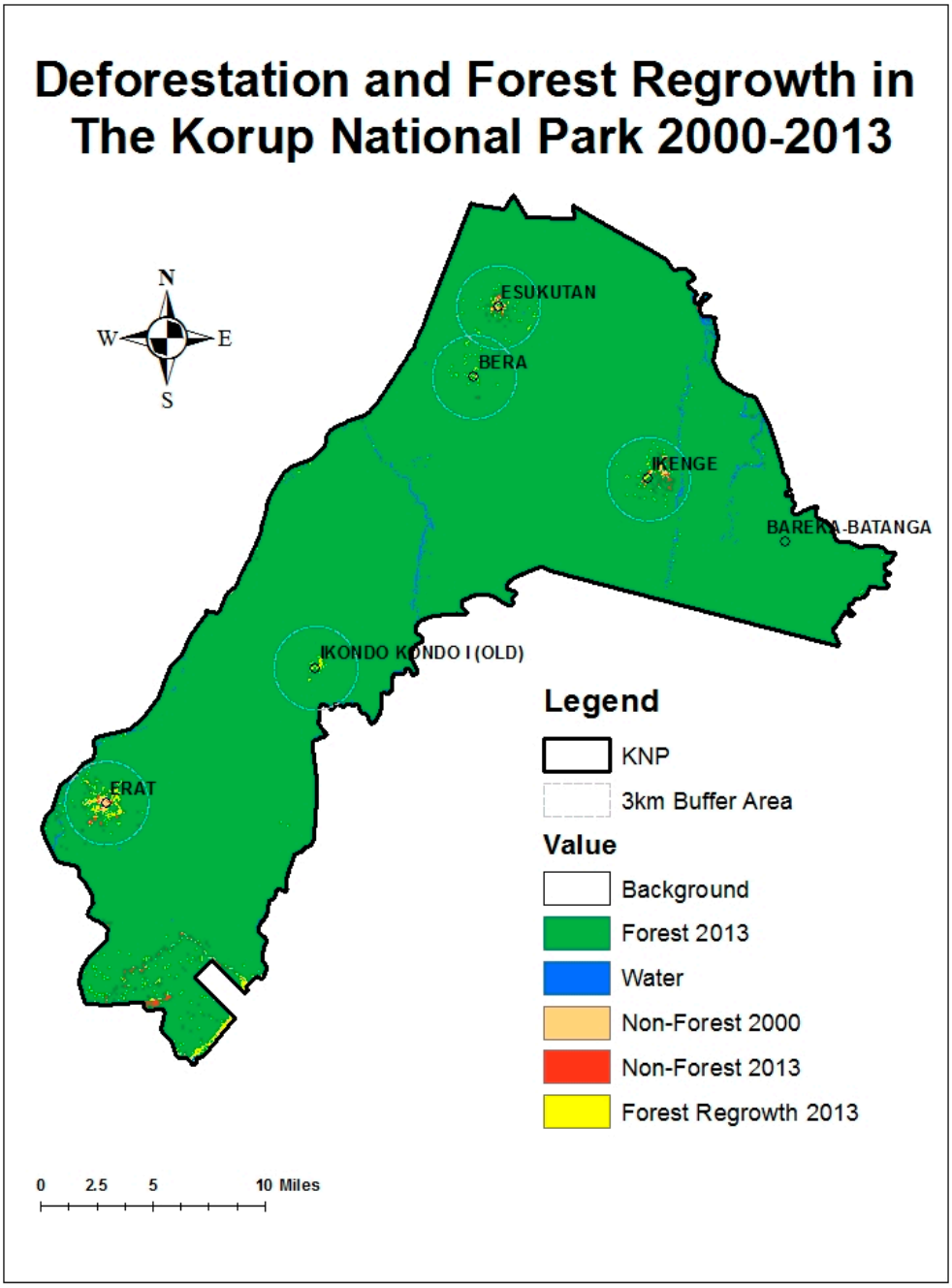

Figure 2. Deforestation and Forest Regrowth in the Korup National Park in Cameroon. Classification by Siewe Siewe. Source: LANDSAT Imagery (USGS Glovis).

Table 2. Area (Ha) and Percent (%) Deforested and Regrowth in the Korup National Park between 2000 and 2013.

	Bera	Esukutan	Ikenge	Erat	KNP
Deforested in 2000	43.1 (1.51%)	85.1 (3.15%)	38.5 (3.01%)	247.8 (8.68%)	994.7 (7.12%)
Deforested in 2013	10.4 (0.37%)	70.1 (2.46%)	115 (4.03%)	168.6 (5.91%)	760.9 (5.16%)
Total Deforestation (2000–2013)	53.5 (1.88%)	155.2 (5.61%)	153.5 (7.04%)	416.5 (14.59%)	1755.7 (12.28%)
Forest Regrowth (2000–2013)	39.6 (1.38%)	57 (2%)	51.1 (1.79%)	164.2 (5.75%)	687.4 (4.6%)

In 2000, the total area deforested in the KNP was 994.77 ha (7.12%). Overall, the village of Erat experienced the greatest amount of deforestation, 247.86 ha (8.68%). In the same year, the village of Ikenge had the smallest deforested area (38.52 ha) (3.01%). The village of Erat had the largest population in the KNP in 2000, and the village of Ikenge while not the smallest in terms of population, had its people largely involved in hunting activities instead of agricultural activities [38,41], hence the smallest area deforested in 2000. The villages of Esukutan and Bera had 85.11 (3.15%) and 43.11 (1.51%) hectares of deforested land in 2000, respectively. Both villages were modestly involved in agricultural practices at the time.

From a preservation and biodiversity protection standpoint, biologists argue that an area of forest once altered, stays significantly altered, often requiring many years to return to its climax vegetation [50], thus not fulfilling part of a park's directive. From this conservationist standpoint, therefore, the total area deforested in the KNP increased from 994.77 hectares in 2000 to 1,755.73 hectares in 2013 (12.28% of the total area) (Figure 2). Although the park experienced an increase in the total area deforested (areas deforested in 2000 plus areas deforested between 2000 and 2013), there was actually a 1.96% drop in the rate of deforestation in the park from 2000. The main reason for this drop in the total area deforested was the relocation of the village of Ikondo-Kondo 1 to a site outside the park boundaries. In 2013, the total area deforested dropped in all but one of the villages in the park; Ikenge, which almost doubled its total deforested area in 2013 (4.03%). The main reason for the increase in the total area deforested in Ikenge between 2000 and 2013 was and still is the gradual change in the predominant activities of the people; from hunting to commercial agriculture. In the other three villages, the rate of deforestation dropped.

Although the total area deforested increased between 2000 and 2013, there was a significant regrowth of forest in the villages and in the park in general, between 2000 and 2013. Forest regrowth around the villages may be attributed to the swidden cycle practiced by the local people, and also to the resettlement of the village of Ikondo-Kondo 1 to a new area outside the park. This area of the park, which has been abandoned since the year 2000, is now mostly in the intermediate stages of secondary succession. Of all the surveyed villages, the village of Erat had the largest area covered by forest regrowth (164.2 ha), making up to 5.75% of its total area. There was regrowth in all of the other three villages, but to varying degrees: Bera (39.6 ha, 1.38%); Ikenge (51.12 ha, 1.21%); and Esukutan (57.06 ha, 2%).

Remote sensing analysis also shows that deforestation in all the villages mainly follows footpaths. The results show that deforestation in and around the villages increased in areas where the forest had been previously cleared or fragmented. This means that farmers tend to extend their farms from areas that have already been cleared, or start new farms only in areas where other farmers had previously cultivated farms (un-isolated areas). We now explore the drivers of LULCC in the KNP.

3.2. Population

One of the main impacts of conservation policies in the KNP is its effect on the population and migration pattern of the region. Before the presidential decree that created the KNP, the population of the region fluctuated. Between 1925 and 1999, the population changed for reasons such as; wars, witchcraft, trade, and the search for arable land [41,68]. The largest change in the population of the region happened between 1999 and 2000 when the government and its conservation partners resettled

the village of Ikondo-Kondo 1 (~110 people) to an area outside of the park boundary [67]. After the resettlement of the village of Ikondo-Kondo 1, the population of the KNP continued to drop as people in other park villages migrated from their villages for fear of park authorities. This movement of people had serious consequences on the environment and the people. Today, the estimated population of the KNP is 776 people [61].

On the eve of the resettlement of the KNP (Ikondo-Kondo 1), the GoC and its conservation partners advised the indigenous people of the park not to expand or develop their farms. Such investments would have been considered useless considering the eminent relocation of the people to some place outside the park boundaries [39,41]. As a result, heads of households stopped the cultivation of their farms and in some cases even the repair of their houses. This period of little or no farming broke down the balanced agricultural structure/system of these villages, and almost led to the starvation of some households. Shortly after the year 2000, it had become clear to some park villagers that relocation/resettlement as promised by the government and its partners was not going to happen. This realization fueled anger and mistrust between the indigenous people and the government and forced heads of households to returning to farming. It also led to the opening of many new farms in primary forests, as heads of households tried to "compensate" for the lost time. It is because of this resurgence into farming that our analysis showed a strong correlation ($r = 0.995$, $\rho \leq 0.05$) between total population and total area deforested in the park between 2000 and 2013. This is supported by the fact that most of the deforestation (around 2000) was concentrated around the villages that remained in the park.

From our analysis, the residents of the KNP impacted their environment in two different and opposite ways: as agents of deforestation and as agents of forest regrowth. As agents of deforestation, the people cut down the forests around them for subsistence agriculture. As agents of forest regrowth (see Figure 2 and Table 2), out migration of the people from certain parts of the park encouraged the regrowth of forests. Our argument supports conservationist ideas [51] that encourage the resettlement of people in biodiversity hot spots because their presence (absolute numbers) in such areas negatively affects the flora and fauna of the area. As explained earlier, some political ecologists (e.g., [18,69,70] etc.) have expressed a divergence with the ideas that support the creation of parks such as the KNP and promote the resettlement/disenfranchisement of indigenous people (e.g., resettlement of the village of Ikondo-Kondo 1).

Other case studies of deforestation and environmental change [69,71,72] have shown that population (in numbers alone) is not the main cause of the deforestation. In these studies, conservation policies were identified as the main drivers of change. Hecht [69] (see also [73]) argued that shifting cultivation is ecologically sound in areas with low population densities, and only becomes destructive when an increase in population reduces the available land (land/person ratio), shortening the fallow period (p. 679). With a population density of 0.61 persons/km^2, a minimum crop rotation cycle of 6 years and an average farm size of 0.98 ha per household, the population of the KNP only offers an overly simplified explanation of the deforestation in the KNP, and cannot be seen as the primary driver responsible for the environmental changes in the park. This fact emphasizes the difference between the visible proximate (LCS) and underlying factors of environmental change. This is corroborated by previous studies in the KNP that have described the vegetation as lush and its indigenous livelihood as predominantly dependent on hunting [38,43,57,68,74,75].

Apart from the mass out migration in 2000, conservation policies in the KNP have also indirectly affected the population that remained within the park boundaries, by encouraging out migration from the park. In the village of Erat for example, policies that favor the protection of the African forest buffalo (*Syncerus caffer nanus*) (hence forth "buffalo"), have forced some families to migrate to other villages bordering the KNP. This small subspecies of the African buffalo in the KNP grazes on indigenous subsistence farms, where the forest is thin and gives way for grass and other food crops. This is particularly significant because of the hunting culture of the indigenous people.

3.3. Hunting

Past socio-economic studies [39,76,77] in the KNP have argued that hunting is the main subsistence activity in the KNP. Bush meat in the KNP serves both as a source of income and also as a source of protein for the indigenous people. However, the results from these studies vary as to the number of people involved in this activity (Figure 2). While some studies [68,76] show that the number of people involved in hunting in the KNP has significantly decreased over the years, others like Linder and Oates [78] show from field studies that the practice of hunting is on the rise. This discrepancy stems from the confusion in heads of households' definition of a hunter. Heads of households define a hunter as someone whose subsistence depends completely on hunting. As a result, many residents do not consider themselves hunters, but as farmers who occasionally hunt to sustain their families. In this study, we define a hunter as anyone involved in any form of hunting, using guns, box traps, and or snares.

The data from fieldwork and archival research shows that the number of people involved in hunting increased between 1925 and 1988 (Figure 3). The number of hunters in the KNP only started dropping on the eve of the resettlement of the village of Ikondo-Kondo 1 in 2000. Roschenthaler's study showed that 53.3% of the population surveyed in 1999 was also involved in hunting. Between 1999 and 2012 when this study was conducted, that number decreased to 29% of the total population surveyed. From the coded responses of semi-structured questions and key informant interviews, two primary reasons were identified for this decline in hunting activities: the strenuous nature of the job (54%) and the fear of being caught (38%).

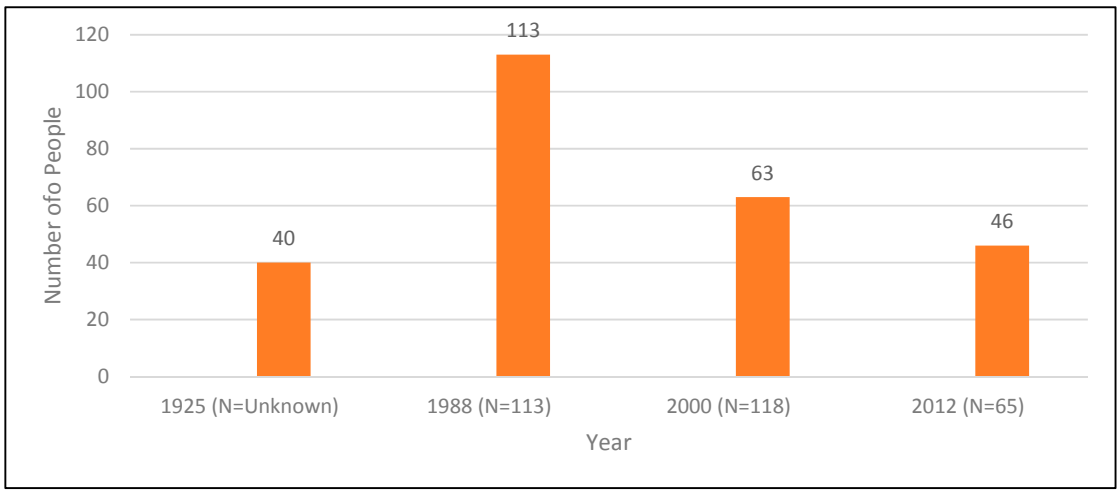

Figure 3. Number of people involved in hunting activities in the KNP between 1925 and 2012 (N = total study population). Sources: [60,68,75,76].

From our results, the main reason for the drop in hunting activities in the KNP is that heads of households find hunting to be strenuous, time consuming, and less rewarding than other livelihood activities such as subsistence and cash crop farming. A former hunter in the village of Erat had this to say about his hunting activities.

> *I used to hunt when I was young and had the strength to walk long distances for bush meat. Today, I am no longer as strong as I used to be and the animals have reduced in number. Hunters now have to trek longer distances and sleep many more days in the forest to get half of what we used to get, in*

half the time. I no longer have that kind of strength left, and I would rather use the little I have on my cocoa farm[2].

Hunting in the KNP usually entails spending several days and nights in the forest to hunt and smoke the meat. The bush meat is brought back to the village twice every week in preparation for market days in Nigeria. This is a difficult and risky routine for most villagers to maintain on a regular basis.

Qualitative coding of the results also shows fear (38%) as a reason why heads of households in the KNP do not hunt; the fear of game guards, of being locked up, or charged a penalty for hunting. In 2003, a clash between hunters and game guards led to the hospitalization of a hunter from the village of Erat and the destruction of park properties by villagers in retaliation for their injured comrade. There have been other cases of clashes between villagers and game guards, which have led to the imprisonment of many indigenes and the loss of property and sometimes life. A farmer from the village of Esukutan expressed this fear in his response to the question; do you hunt?

"No I don't. Who will take care of my wife and children if I go to prison?"

As mentioned earlier, the decrease in the number of people involved in hunting activities does not support recent studies and field observations that show that hunting activities are actually increasing within the park area. Results from qualitative coding also show that hunting activities have increased because it was and still is a quick way for most farmers to make a living. Heads of households acknowledge that they would hunt to meet dietary needs. These results also show that hunting activities also increased because resettlement plans and the resettlement of the village of Ikondo-Kondo 1 left some parts of the park open to hunters from neighboring villages in Nigeria and Cameroon. To understand this discrepancy between heads of households' responses and field data, it is important that we further examine data collected using household surveys.

Household data showed that of the 65 households that participated in this study, 29.2% (19) of them did not own guns. Four heads of households (6.1%) did not answer the question, and 42 (64.6%) owned at least one gun. The survey showed that households in the KNP own an average of 1.06 guns. Because the KNP is not on the war front (although some head of households would like to see themselves as defenders/protectors of the boundary with Nigeria), it is fair to say that with an average of 1.06 guns in the park, the majority of household heads may be involved in some form of (even occasional) hunting in the KNP.

Linder and Oates' [78] study further supports these data, showing that there is an increase in the hunting activities in the KNP. Although many household heads may not consider themselves hunters (because they are not completely dependent on the activity), results from qualitative coding showed that 75% of them believed that the animal population in the KNP has dropped from what it used to be five to ten years ago. Eighty percent of them attributed this drop in animal population to excessive hunting activities of people living within the park and others from nearby villages. This drop in animal population would explain why hunting activities have become strenuous and difficult for some villagers.

The management of the KNP has strict laws (contrary to Infield's recommendation) that prohibit (especially of class "A" animals such as the African forest buffalo (*Syncerus caffer nanus*)) hunting in the KNP. Killing a class "A" animal carries a fine of about 500.000 FCFA ($250 USD) and or up to a year in prison. The result of these laws is the criminalization of traditional hunting activities that have sustained the livelihood of the indigenous people for many years and that have maintained a balanced ecosystem (wilderness). These laws have eliminated any form of compromise concerning hunting between the people and the park's management, evident from the constant clashes between villagers and game guards. Hunting still takes place, but usually at night. Bush meat seldom leaves the KNP

[2] Interviewees identities are confidential and anonymous. Names of participants are, therefore, withheld.

villages for Cameroonian markets because those who hunt fear game guards. Instead, hunters have redirected the bush meat sales to towns and markets in Nigeria that offer better prices, and pose no risks of them running into game guards.

Another effect albeit indirect that the policies against hunting in the KNP have had on the environment is that they have led to the explosion in buffalo population [60]. Two main reasons can be advanced for this; Firstly, buffalo meat is not as popular as other meat (e.g., deer meat) in the diet of the indigenous people. Secondly, being a class "A" animal, killing a buffalo comes with a steep fine and possible jail time. In the village of Erat, coding reveals that all heads of households (100%) interviewed have had their farms destroyed in some way by buffalos. Because of these animals, farmers have been forced to limit their farming activities to plots around their houses and in some extreme cases, indigenes have been forced to move out of the park area to villages in Nigeria. In such communities, hunting becomes a more productive enterprise in making a living since the prospects of having good farm harvests are usually in the balance. Small family farms around the houses are not adequate to sustain the family through the year and hunting provides a complementary platform to earn a living. Apart from hunting activities, another rapidly changing livelihood activity in the KNP is cash cropping.

3.4. Cocoa Farming

Conservation policies in the KNP have also affected the amount cash crop farming taking place in the park. Park management policies have increased the cultivation of cash crops (Cocoa), and consequently, the rate of deforestation in the KNP. Results from the coding analysis shows that 85% of all heads of households involved in cash cropping believed that cultivating cocoa and other permanent crops was the logical thing to do after the government failed to relocate them to another site outside the park boundary. Furthermore, our imagery analysis showed that a total area of ~1,755.7 hectares was deforested between 2000 and 2013. Increase in the cultivation of cocoa is one of the factors that caused this increase in total area deforested. In the cultivation of cocoa, it is customary for farmers in the KNP to cut down or burn trees that shade the young cocoa plants from growing. They do this to provide "light" for the young cocoa plants.

Cocoa production in the KNP has significantly increased since 1925 (Figure 4). In 1925, the indigenous people of the KNP considered cash crop production to be a part time livelihood activity [48]. Since then, the total cocoa output from the KNP has consistently increased over the years. Villages like Erat (62 bags) and Ikenge (173 bags (50 kg bags)) produced a lot more cocoa in 1999 than they did in 2012 (0 and 164 bags respectively). This is because most of the farmers in these villages abandoned the cultivation of their cocoa farms, while waiting for the government and its partners to resettle them [39,41]. Today, many farmers have returned to the cultivation of cocoa and have encouraged their children to do the same. This return to the cultivation of cocoa has been the main reason for the increase in total area deforested in the KNP. When asked why everybody in the village was cultivating cocoa, a farmer said:

> *"Cocoa is now our way of life. That is where the money is and I have to open up more cocoa farms so that I can leave an inheritance for my children. Here in the park I do not have money to give to them or a house to leave for them. What I have are these farms and I must cultivate them because this land is ours, given to us by our forefathers."*

Another farmer explained his involvement in cocoa farming as thus:

> *"Only a foolish person will not develop a cocoa farm today. Almost everybody has a small cocoa farm, even those that are in school in Mamfe (neighboring town to the KNP). We are not leaving this land anymore, so why not plant something that will benefit you and your family in the future."*

In answering the same question, two cocoa farmers compared their cash crop activities to hunting activities in the park. The first farmer said:

"Hunting provides quick money, which is good when you have an emergency, but it is also very dangerous. Cocoa farming takes time but once you have it planted and matured, you are set and assured of money year in and year out."

Farmer two in the same light said:

"Cocoa is good because it cannot be seized or taken from us. Game guards can seize guns and bush meat, but they cannot seize our cocoa. I will plant as much as I can."

The issue of increasing cocoa cultivation in the KNP can also be linked to better cocoa prices in the world market, and to the development issues in the park. Although cocoa production in the park has increased, farmers believe they can plant more if they have a means of evacuating their cocoa products. Another farmer addressed this issue as he discussed cocoa farming in the KNP.

"Cocoa is now the most profitable farming activity for us here in the park. I would plant more cocoa if I had the means of transporting the produce to the market. We have to pay young people today to transport our cocoa (head transport) to the next village from where it is picked up by the buyer. The costs are high, and there have been cases where cocoa rots in the village because there was no one to transport it to the next village."

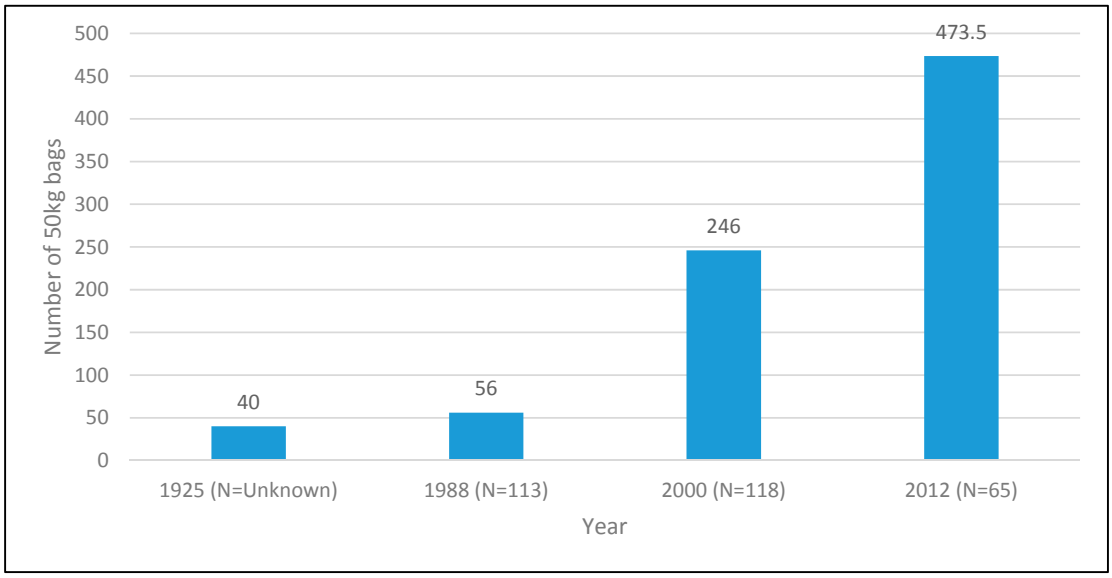

Figure 4. Cocoa output in the KNP between 1925 and 2012 (N=total study population). Sources: [68,75,76].

The above statements express a shared feeling among farmers in the KNP who see their cultivation of cash crops and expansion of farms as a way to expressing their opposition to park policies. Other farmers describe it as a way to take back what is rightfully theirs (their ancestral land). Although subsistence farming is the main livelihood activity in the KNP [61], household data shows that 92.3% of subsistence farmers also have cash crop farms. About two percent (1.5%) of respondents are involved only in subsistence agriculture, while 6.1% of them are involved in cash cropping only. The increase in subsistence and cash cropping activities in the KNP is also evident in the average number of farms owned by household residents (2.7). Each households owns at least a cash crop farm (1.7), producing an average of 8.2 kilograms of cocoa per household [61].

3.5. Indigenous Satisfaction with the KNP Management

Failed resettlement plans forced the management of the KNP to adopt innovative management techniques to contain the livelihood activities of the villages still living within the park boundaries. One

such method was the adoption of zoning techniques, which divided the park into six different zones: peripheral, agro-forestry, use (areas for village livelihood activities (NTFPs and food cultivation)), core (areas important in maintaining the ecological integrity of the park), tourism, and research zones. As an Integrated Conservation and Development Project (ICDP) project, the KNP had the dual objective of socioeconomically developing the park edge residents while conserving the biodiversity within the park [72]. In the KNP, a three kilometers peripheral zone, occupied by 25 different villages [45], represents the zone of socioeconomic development. It is in this region that most development projects sponsored by the, Government of Cameroon (GoC) and its partners have been located. The GoC together with its partners have built schools, churches, town halls, roads, and developed water projects for the villages in this peripheral zone, "neglecting" (according to one of the interviewees) the villages located within the park boundary. Results from coding analysis show that virtually every household head interviewed (100%) is displeased with the park's management for this "neglect." Residents believe it is their right (as original owners of the land) to the benefits that come with the conservation of their land. This adds to the reason many families in the KNP do not like or support the current management efforts of the KNP. Their disgruntlement has been shown in ways such as increasing their hunting activities, cash crop farming, and other subtle ways such as boycotts of park summoned meetings and refusal to participate in park sponsored exercises. Some villages in the KNP have gone as far as prohibiting game guards from setting foot in their villages. This dissatisfaction was further proven when heads of households were asked to rate their satisfaction with the role of Non-Governmental Organizations (NGOs), GoC, and the management of the KNP in developing the KNP (Figure 5).

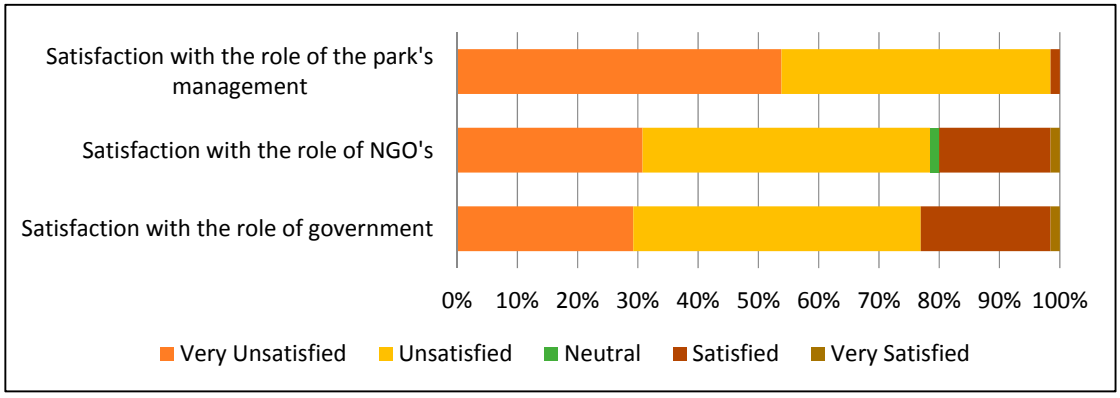

Figure 5. Household satisfaction ratings for Non-Governmental Organizations (NGOs), the Government of Cameroon (GoC), and the management of the KNP in developing the KNP (n = 65).

Of the sixty-five heads of households surveyed, 94% were either very unsatisfied or unsatisfied with the role of the park's management with the development of the park. Only 1 household head was satisfied with the actions of park management, compared to the 14 (21%) and 12 (18%) who were satisfied with the role of the government and NGOs, respectively. Although services are provided for villages living within the 3 km buffer, the behaviors of the people and their land-use activities are increasingly being controlled and monitored. This is a classical form of control that is associated with conservation policies [79]. The residents of the KNP and those who occupy the buffer areas of the park are expected to live lives with minimal impacts on the environment; expectations that undermine the connections these societies have with the outside world.

Past conservation policies like those in the KNP have failed in their goals to protect the environment and as a result, new ways of conserving the environment while enhancing the livelihood of indigenous people are currently being discussed and experimented in different parts of Cameroon and the world in general. The most popular of these tactics are the commercialization of park management, ecotourism, and Payments for Environmental services (PES) [80]. Of these three, PES initiatives are the most widely discussed in conservation circles.

4. Discussions and Conclusions

This study shows the effects of conservation policies on the environment and the livelihood of the indigenous people in the KNP. The results show that past conservation policies influence current conservation and management structures in Cameroon and in the KNP in particular. In the case of the KNP, past conservation policies provided the framework for the policies that have promoted an unbalanced development and unequal access to resources. As shown above, these policies are part of the reason behind the deforestation, degradation, forest regrowth, and the changing land uses and livelihood systems in the KNP, not primarily the population. This study also shows the influential role of conservationists and scientists such as Gartlan in defining and creating nature as "wilderness". Conservation setting agendas defined the region of the KNP as ecologically significant, and gave the government a reason for resettling its inhabitants and zoning of the area. These power struggles also contributed in the disintegration of the relationship between the people, the park management, and the national government administration.

The power dynamics in the region also changed the local livelihood and production systems. In the KNP, the indigenous people's dependence on hunting has increased, threatening some animal populations. The cultivation of cocoa has also increased, leading to increased levels of deforestation in some park villages [60]. It should, however, be noted that the cultivation of cocoa has also increased the vegetation cover in some areas in the park, especially in the areas where the cocoa trees have grown to maturity (e.g., Esukutan). This is confirmed by our remote sensing analysis which showed that total area deforested in 2013 (760.9 ha) was less than the total area deforested in 2000 (994.7 ha). The analysis also showed that there was a total of about 687.4 ha in forest regrowth. In these areas, matured cocoa farms and traditional fruit trees like bitter mango have contributed to the forest cover. This shows that household heads in the KNP do not only contribute to the deforestation of the park, but also take part in some form of reforestation (agroforestry) in the park. Conservationist ideas which see people of the KNP as destructors of the environment are incomplete, as locals are also re-foresters of their environment. Siewe and Vadjunec's [81] study on the impact of deforestation in the KNP showed that biodiversity was higher in reforested (formerly deforested) regions of the park than it was in areas that had not been touched or cultivated. This further supports indigenous people's contribution to the forests and diversity in the KNP.

Remote sensing and GIS analysis of the land-use changes in the KNP explain the "what" (deforestation), "where" (spatial distribution of deforestation in the KNP), and part of the "why" (primary/immediate factors that cause deforestation). They do not identify the latent drivers (policies) of the immediate drivers (population) of change. Although increasingly LCS analyses do acknowledge the potential influence of park policies on some of the proximate factors of environmental change, most of them like Kusimi [67] do not explain these underlying factors and their intricate links in enough detail to the rest of the world. This is where political ecology fits in, to complement LCS explanations, and to offer a better explanation and understanding of human-environment dynamics, and of the intricate influence of underlying factors [9,12]. In this paper, we have used a hybrid ecology framework to explain how the population of the KNP is affected by the conservation policies, which were drafted based on western (colonial) ideas of wilderness areas. If population (absolute numbers) is not the problem, then relocating/resettling the population without reforming the policies will therefore not solve the problem in the KNP.

The significance of the above result is far reaching, affecting not only our perception of the indigenous people of the KNP, but also our appreciation of hybrid ecologies. LCS exposes the factors that affect environmental change in the KNP, while PE identifies the subtle power dynamics (colonial policy and power) behind the drivers of change, and their effects on indigenous livelihood. This breakdown of the results shows both the differences and the similarities between LCS and PE. While they both seek an understanding of the human-environment relation, LCS principally seeks to inform science [9,12] while PE seeks to improve the livelihood of human groups. Such research synergy is also exemplified in studies by Walker and Richards [13], Radel et al. [82], King [80],

Lestrelin et al. [25], etc., that offer better and more meaningful explanations to the observable patterns in; livestock distribution (Mexico), pasture lands, forest transitions (South east Asia), and livelihood strategies. These researchers all used hybrid ecologies to accentuate the "ecology" in political ecology, and to reveal the inherent power dynamics that drive land use systems. The combination of PE and LCS in the form of hybrid ecologies is therefore beneficial to themes in resource management and sustainability science.

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