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ORIGINAL PAPER

Now there is no land: a story of ethnic migration in a protected area landscape in western Uganda

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Abstract Migration is a major factor shaping protected area landscapes. Combining historical narratives with interview, census, and satellite data, we investigate the ways in which migration has transformed the landscape surrounding Kibale National Park in western Uganda. We show that the region has gone from sparsely

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populated bushland to densely settled subsistence agricultural landscape occupied by tens of thousands of small-scale farming households since the last half of the twentieth century. Population density closer to the park has grown to 1.5 times higher than places more distant from the park. Migration to areas near the park has not necessarily been driven by economic benefits from the park itself, but rather by important push and pull factors at different scales. Results indicate that understanding the social and cultural underpinnings of human migration to, and environmental change along, the borders of protected areas is fundamental to developing appropriate people–park policy as a result of neighboring land use intensification brought about by changing demographics.

Keywords Migration · Landscape transformation · Population growth · Kibale National Park · Uganda · Protected areas

"All this here was once for the Toro Kingdom, but now there are many Bakiga here. We are brothers and welcomed them, but now the land is too little and we do not know what the future will be like in this place" (Toro Kingdom regent).

Introduction

Tropical deforestation and land degradation constitute major facets of global and regional environmental change, with substantial impacts on biodiversity and climate (Turner and Corlett 1996; Matson et al. 1997; Geist and Lambin 2002; Chambers et al. 2007; Frolking et al. 2012). Much deforested land has already been converted to agriculture; cropland in tropical countries is estimated to have expanded by 48,000 km^2 per year between 1999 and 2008 (Phalan et al. 2013), driven in part by increasing population growth and the need to develop and improve livelihoods. The greatest proportion of forecasted global human population growth in this century will occur in Africa, whose population is projected to increase 114 % by the year 2050 (Roberts 2011). Many biodiverse regions in the tropics, and particularly in

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Africa, are, or soon will be, dominated by agricultural landscapes surrounding remaining protected areas (DeFries et al. 2004, 2007; Wittemyer et al. 2008).

Conserving tropical forest biodiversity most often requires some form of protected status, particularly in regions with high human population density where such status is often the main or only factor that keeps those areas from being converted to agriculture or other transformative human use (Chapman and Peres 2001; Bruner et al. 2001; Terborgh et al. 2002; Chapman et al. 2006). Increased population density usually involves increased land conversion to agriculture and land use intensification surrounding protected areas, which while necessary for maintaining or improving the livelihoods of the growing population, also further insularizes the protected habitat (Hansen and DeFries 2007; Goldman et al. 2008; Hartter and Southworth 2009). Insularized protected areas can significantly affect the biota both within and outside the protected area and may also lead to increased pressure on remaining undomesticated areas outside the park and possibly for access to resources inside the protected area (DeFries et al. 2005; MacKenzie et al. 2012).

Rural to rural migrations and their patterns and dynamics of change are imperfectly understood in sub-Saharan Africa (Hoffman et al. 2011) particularly around protected areas, but human migration and population growth does play an important role in influencing environmental outcomes (Carr et al. 2005; Carr 2009). Recent research and debates also examine the question of whether population densities have grown more rapidly in areas near protected areas than elsewhere, arguing that increased opportunities near protected areas draw disproportionate numbers of migrants (Newmark and Hough 2000; Wittemyer et al. 2008). Others counter that these areas are subject to population increase at regional "rural" density rates (Joppa et al. 2008), while others yet assert that areas nearer protected areas do not have elevated in-migration patterns (Salerno et al. 2014), or that if people are drawn to these places, it is because of available land or family ties rather than the presence of the protected area itself (Zommers and MacDonald 2012). This continuing debate illustrates the importance of understanding the underlying social, cultural, economic, and political factors that drive migration to protected area boundaries, which in turn can provide a context for the development of appropriate management strategies for parks and their surrounding human populations (Ryan et al. in review).

Although conservation literature often assumes that human population growth will have predominantly negative impacts on forests and protected areas in general, some studies from West Africa and elsewhere suggest a counter-narrative and alternate perspective on the relationship between population change and forested areas. Fairhead and Leach (1995, 1998), Leach and Fairhead (2000), Bassett and Zuéli (2000) among others have found that estimates of historic deforestation are exaggerated or are not based on reliable baseline evidence at various sites in West African savanna and forest regions. Moreover, evidence from ethnographic accounts as well as aerial or satellite imagery and other data sources has shown that in many cases, tree or forest cover is greater at present or in recent periods than it was several decades ago or further in the past. They also suggest that in at least some instances, agricultural activities (and "intensive agriculture") have stimulated tree planting and net increases in tree cover and forested habitat. As Leach and Fairhead (2000)

say, "neo-Malthusian deforestation narratives…obscure wide-spread processes by which people have enriched landscapes with trees, and in which the peopling of a landscape has sometimes meant an expansion of tree and forest cover" (p. 18).

A mixed methods approach can provide a fuller understanding the push and pull factors for migration and the interconnection to environmental change (e.g., Bilsborrow 1992; Henry et al. 2004; Gray 2011; Gray and Bilsborrow 2013). Using historical narrative, demographic, and remotely sensed data, we examine migration as a factor that has shaped land use and land cover change in the human landscapes surrounding a protected area in western Uganda. We do this with the aim of exploring the complex set of factors that conservation authorities may need to understand in order to successfully manage protected areas in rapidly changing, densely populated, anthropogenic landscapes.

Study area

High rural population densities and very rapid rates of population growth are important contextual features of land use trends in Uganda (UBOS 2009), including the landscapes near Uganda's protected areas. The country's population is estimated to be growing at 3.3 % annually, which ranks second in Africa behind Niger, and is one of the highest rates of natural population growth in the world (PRB 2012). More than 80 % of the land is used for small-scale farming and nearly 80 % of households are farmers (UBOS 2009). National population density averages 120 people per square kilometer, but population density in some rural areas in the west and east of the country is at least double the national average, and is sometimes as much as four to five times higher (UBOS 2006; MacKenzie and Hartter 2013; Wambi 2012).

The Toro Kingdom (approximately 13,500 km^2) in western Uganda (Fig. 1) was established in the 1800s after splitting from the Bunyoro Kingdom to the north. Kingdoms were officially abolished in 1967 by Uganda's first president Milton Obote, but were reinstated in 1993, though largely with only cultural and ceremonial authority. The Batoro (the people of the Kingdom of Toro) represent about 2.6 % of the population of Uganda and 8.6 % of population in the western region (UBOS 2006). As with most of Uganda's population, they are mainly agriculturalists with a tradition of cattle husbandry as well as crop agriculture.

The Kigezi region in southwest Uganda (approximately 5,200 people/km^2) is a densely populated rural area settled mainly by the Bakiga, who represent about 7.2 % of the national population and 24.1 % of western region population (UBOS 2006).[1] Land use in Kigezi is characterized by much more densely settled and intensively cultivated landscapes than in most of Toro, including conversion of wet bottomlands and often steep hillsides to intensive cultivation (Carswell 2002,

[1] Prior to Kigezi being administered as a district by the colonial government, this area was comprised of Bakiga and also known as Bushengyera, Kayoza, Mpororo, and Bufumbira. The Bakiga were a highly decentralized society where power was diffused through various family units. The region acquired the name "Kigezi" from a misinterpretation of the word *ikigezi* (meaning small lake in Rufumbira/Kinyarwanda) (Denoon 1972). Although Kigezi does not formally exist in name, it continues to represent the cultural home of the Bakiga. Thus, we refer to it in the present tense.

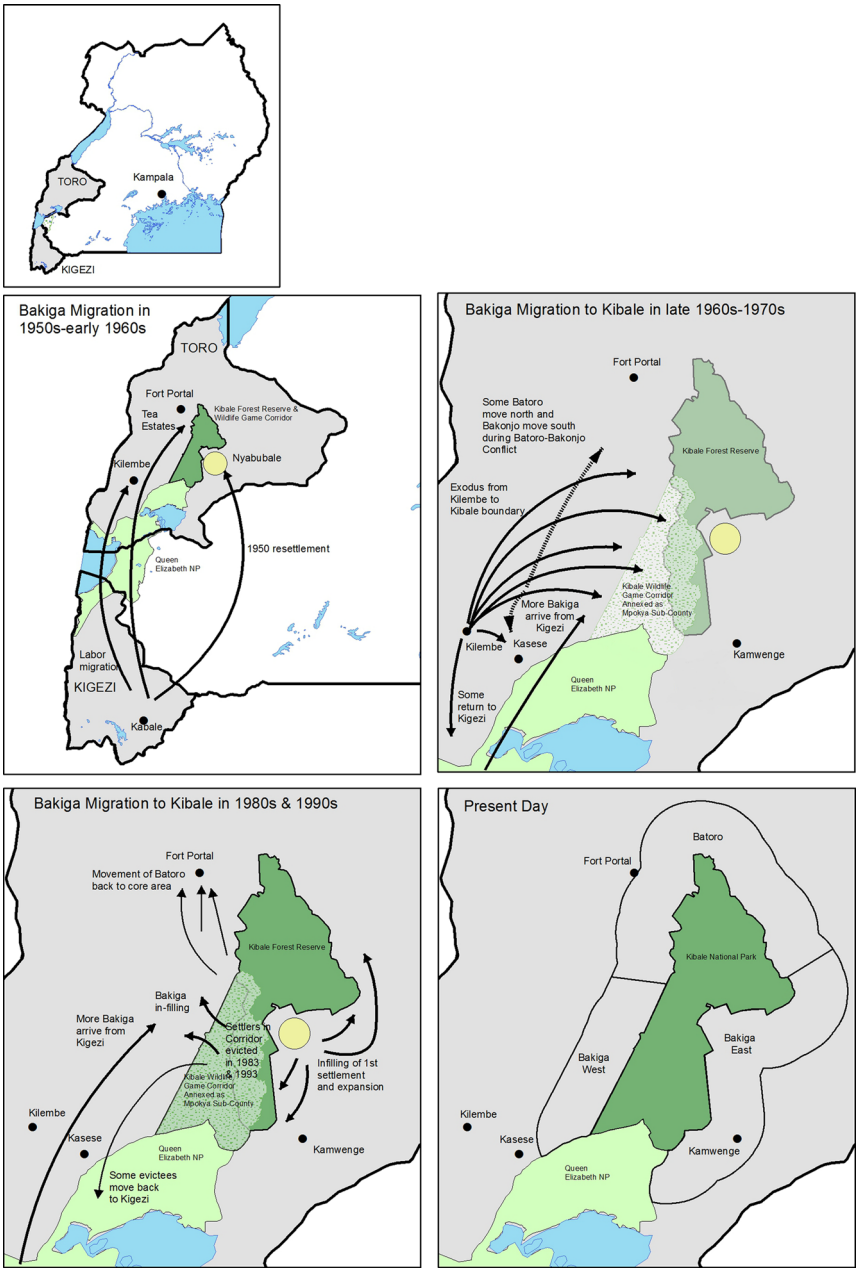

Fig. 1 Census data and interviews were used to map three major waves of Bakiga migration in western Uganda from Kigezi to areas near Kibale National Park between the 1950s and 1990s. The Bakiga first moved to the east side of Kibale near Bigodi (*yellow circle*). There were three major waves of Bakiga migration to the KNP landscape leading to present-day settlement patterns. Presently, Batoro and Bakiga ethnic dominance varies around Kibale. "Bakiga East," "Bakiga West," "Batoro" show approximate boundaries of population dominance by either Bakiga or Batoro (Color figure online)

2003b, 2007; Farley 1996; Olson 1996; Puhalla 2009). With relatively small areas of available arable land and a system of separable inheritance that divides plots among family members, land ownership in much of Kigezi is highly fragmented with extremely small landholdings. Noting soil degradation and erosion, cultivation on steep slopes and marginal areas, and fragmented and small farming lands, the perception that Kigezi was on the brink of disaster has been common since the 1920s (Purseglove 1946, 1950; but see Farley 1996; Lindblade et al. 1998; Bolwig 2002; Carswell 2003a). In an attempt to avert purported impending agricultural collapse, the colonial government began resettling people to reduce population and land pressures. In 1955, an agreement was reached between the Secretary General of Kigezi, Paulo Ngorogoza, and King Rukidi of Toro to move people to the Toro area mainly east of what is now Kibale National Park (hereafter KNP) (Ngabirano 2008). A series of waves of migration to KNP continued in succeeding years and decades, as shown in Fig. 1.

Mid-altitude tropical moist forest covers most of KNP, with savannah grasslands and woodland dominating in the southwest. KNP was created by combining the Kibale Forest Reserve (455 km^2) and the Kibale Corridor Game Reserve (340 km^2) in 1993. The corridor was created in 1926 and, although occupied by small numbers of people, its use was mainly limited to hunting camps (Ryan and Hartter 2012). The forest and game reserves were managed separately by colonial and subsequently by Uganda government agencies, though the 134 km^2 overlap had dual status and lay within the Forest Reserve and Game Reserve (van Orsdol 1986; Aluma et al. 1989; Howard et al. 2000; Struhsaker 1997), until these two entities were combined in 1993 creating the National Park.

In the early 1930s, the population of local people inside what became KNP (the vast majority of whom were settled in the corridor) was very low. In 1971, people (mainly Bakiga, but some Batoro) began to settle in the corridor on a much larger scale (Marquardt 1994; Ryan and Hartter 2012). Little opposition to settlement was raised by the Game Department, and people seeking land were allocated parcels by local chiefs to clear and settle (Marquardt 1994). With the opportunity to acquire land and the collapse of local industries, including the Kilembe Mines and the Hima Cement Factory near Kasese town in the mid-1970s, and the formal annexation of the corridor as Mpokya sub-county in 1976 (retracted in the early 1980s), settlement in the corridor accelerated (Aluma et al. 1989; Drennon 1997). The Game Department's official survey estimate in 1977 of 4,000 people grew to about 8,000 living in the corridor in 1982, with an average of 17 homesteads/km^2 (van Orsdol 1986). When the national park was created, all these people were expelled from the corridor. Most were resettled in Bugangaizi, 250 km north of KNP, though a few remained and settled next to the park (Feeney 1998). Since 1993, there has been no human settlement within the park's official boundaries.

By the 1930s, the area around KNP was only sparsely settled. The landscape was a mixture of forest in the north and tall grasses and woodlands in the drier south with papyrus wetlands interspersed throughout. Presently, the landscape surrounding KNP is a mosaic of intensive smallholder agriculture (with most farms <5 ha), large tea estates (>200 ha), large prison lands almost exclusively planted with maize, and interspersed isolated forest fragments (Hartter and Southworth 2009).

Most people near the park are non-mobile subsistence farmers and belong primarily to two ethnic groups: the Batoro and the Bakiga. Both ethnic groups plant a mixture of subsistence crops (bananas, maize, beans, and cassava as the main staple foods) and cash crops (tobacco, coffee, tea) during the two farming seasons.

The climate is warm throughout the year, with an average range of 15–23 °C. Elevation and rainfall decrease from north to south in KNP: The far northern part of the region near Fort Portal is approximately 1,500 m a.s.l. and receives approximately 1,450 mm of rainfall annually, while the far southern portion near Kasese is less than 1,000 m a.s.l. and receives less than 850 mm of rainfall annually (T.T. Struhsaker and C.A. Chapman unpublished data; Diem et al. 2014). The 45 % difference in rainfall has been confirmed by a recent evaluation of rainfall totals from rain gauges and satellite products (Diem et al. 2014). Rainy seasons are mainly controlled by movements of the Intertropical Convergence Zone and typically occur during boreal spring and boreal autumn (Basalirwa 1995; Nicholson 1996; Hartter et al. 2012).

Materials and methods

Demographic change

Tracking historical changes in population and migrations in Africa is typically complicated by a lack of relevant data, changing spatial extents of administrative units, and circulatory migration (Gould 1995). This is especially true in Uganda, where continuous splitting and merging of administrative units makes year to year comparisons of population densities and ethnic distributions tied to administrative units extremely difficult. To track spatiotemporal changes in population, we created a temporal series of population density maps. Population data were obtained from the Uganda Bureau of Statistics (UBOS), the Population Secretariat, and the National Archives, for census dates 1921, 1932, 1948, 1959, 1969, 1980, 1991, and 2002 (no additional national censuses have been completed as of January 2014, but UBOS published population estimates for 2008–2012). A complete official record of the 1948 census was never completed. The data presented are thought to be the most comprehensive available dataset for this region and time span.

Population data were extracted and digitized at as fine a scale (i.e., below district level) as available, but this was not possible in all census years. Administrative units from 1921, 1932, 1948, 1959, 1969, and 1980 were digitized from existing colonial and government maps produced for each census year, obtained from the National Archives, the Surveys and Mapping Department Headquarters, and UBOS. Map scales varied from 1:1,000,000 to 1:1,500,000. Digital copies of administrative units from 1991 and 2002 were obtained from the International Livestock Research Institute (Thornton et al. 2002), and the GADM Database of Global Administrative Areas (GLA 2012), respectively. For each year, all administrative unit polygons (down to the sub-county level) were georeferenced (WGS 84) and populated with population values obtained from census records. The polygons were then projected to Africa Alber's Equal Area Conic Projected Coordinate System to calculate the

area of the polygons (km^2), to obtain a population density for each polygon. The polygons were then reprojected back to WGS 84 Geographic Coordinate System. Population density was then adjusted in three ways: (1) Population was subtracted from water bodies, (2) we assumed that the effective population was zero in national parks following their establishment,[2] (3) since our interest was in understanding rural population growth, we did not consider major urban areas, which would skew the densities of administrative zones that contain them. Subsequently, the area and population density was recalculated for each polygon. These polygons were then converted to rasters (using maximum area, where the polygon that covered the greatest area in a particular pixel became the value of the pixel) and resampled to 1-km pixels, so that each pixel would contain a population value.

We then compared ethnic composition in the areas we are calling Toro and Kigezi. While these regions do not officially exist, we use their rough extent under the British colonial government for comparison. To create the ethnic population maps, we located the number of individuals within each census year (for census years that included ethnicity data: 1932, 1948, 1959, 2002) that were denoted as Batoro or Bakiga and divided the total for each ethnicity by the total population. Subsequently, these percentages were inserted into the previously created administrative unit polygons for each respective census year. The polygons were then converted to 1-km raster images and were annotated with percent change of Batoro and Bakiga between years. This resolution was reasonable given that ethnicity data were at the sub-county level.

We conducted household surveys in 25 villages surrounding KNP in 2009. The 25 study villages were located directly adjacent to KNP and contiguously separated by approximately 5 km around the periphery of the park to create an evenly distributed spatial sample within three of the four districts bordering the park (Kasese district was excluded since much of the land adjacent to the park in this district is used for prison and army training grounds). Based on our scouting of villages near KNP, we believe that this represents approximately 40 % of the villages bordering the park in the three districts. The number of households within the study villages ranged from 41 to 242 households (median = 84). Within each village, 23–25 households were quota sampled to ensure representative numbers of lower, medium, and higher wealth households, where wealth was stratified based on primary dwelling construction, with mud and wattle indicating a poorer household and brick a richer household (Ellis and Bahiigwa 2003; Hartter 2009). A total of 596 households, located between 15 m and 3,300 m from the park boundary, were included in the survey. Each respondent was asked which tribal affiliations were represented in the household, crops cultivated, and household demographics. Other topics were perceived benefits and losses of living next to KNP, specifics about crop raiding, accessing resources in the park, and perceptions about their relationship with Uganda Wildlife Authority. In addition, a content analysis of census reports from the Ugandan and Colonial governments from the 1910s through 2000s

[2] The general policy under the Game Management Authority, the Forestry Department and then under Uganda Wildlife Authority was, and is, to prohibit settlement within these areas (some settlements in Queen Elizabeth National Park exist, but they have a negligible effect on overall population density).

Table 1 Survey demographics by zone

Zone	Number of villages	Number of HHs	Batoro HHs	Bakiga HHs	Other tribes or mixed HHs
Batoro	10	239	155	34	50
Bakiga West	4	71	0	64	7
Bakiga East	11	286	2	221	63

acquired from Makerere University Library, the Population Secretariat, UBOS, and the National Archives was used to describe the migration of the Bakiga.

Land use history

We used ethnographic data to contextualize demographic change near KNP over the last 50 years. Forty-two opportunistic interviews with elders (50+ years old) who had historical knowledge of the place and environment near KNP were conducted between July and August 2011 and 2012. These informants were farmers, local elders, government officials, chiefs, and the King of Toro's regent.[3] We sought out Bakiga individuals who had moved from Kigezi in the 1950s and 1960s to provide information about why they moved and the destinations of their migrations. The semi-structured interviews followed a series of questions covering land use history, migration, and population change. All interviews were conducted in local languages Rutoro, Rukiga, and Rukonjo, using an interpreter, or in English when the participant was conversant. The number of interviews was considered sufficient when no new information was discovered with further interviewing.

Present-day land cover

We examined land cover between 2000 and 2010 in the present-day Bakiga and Batoro dominated areas. Assuming that the trend of forest conversion has continued over time near KNP as population increased, we hypothesized that Bakiga and Batoro settlements would differ to some extent in land cover. The areas within 10 km of KNP that are dominated by either Bakiga or Batoro ("Batoro" = 706 km^2, "Bakiga West" = 345 km^2, and "Bakiga East" = 643 km^2) were delineated using interview and survey data (Fig. 1; Table 1). Each of these regions, however, is diverse, and other ethnic groups are interspersed throughout the landscape.

To examine differences in the influence that these different groups had on forested areas, we chose to test whether there were differences in the extent of forested area among these three areas. We extracted derived data products from the Moderate Image Spectrometer (MODIS) (tile h20v09) for the Bakiga East, Bakiga

[3] The regent for Rukirabasaija Oyo Nyimba Kabamba Iguru Rukidi IV (King Oyo) was responsible for overseeing King Oyo's growth into the role of King and with handling the cultural affairs of the Kingdom during the King's youth.

West, and Batoro areas.[4] We used two measures of forested areas change: percent tree cover in 2000 and 2010 and percent tree cover change from 2000 to 2010. Annual estimates of percent tree cover in 2000 and 2010 were extracted from the Vegetation Continuous Fields (MOD44B) product at a 250-m resolution (Hansen et al. 2003, 2005; Conservation International 2011) from the pixels inside each polygon. The three areas were compared using ANOVA to test differences of means, and Tukey–Kramer honest significant difference (HSD) tests for multiple comparisons for cover in 2000 and 2010 as well as change in percent cover 2000–2010. We assumed that areas with a lower proportion of forest cover indicated more land under cultivation. Thus, areas with lower percent tree cover would be considered more intensively farmed. To support this, we also compared the types of crops grown by Batoro and Bakiga households as reported in the survey. In addition, we acknowledge that these regions may have had initial conditions that had different percent forest covers and slightly different ecotone types that may dictate forest conversion efforts. Nonetheless, this methodology provides insight into present-day forest conversion practices.

We also examined how the three regions differ in initial land cover in 2001 and land cover in 2009. We extracted land cover classes that correspond to the International Geosphere-Biosphere Program (IGBP) global vegetation classification scheme from the MODIS product MCD12Q1 V051 (Friedl et al. 2010). This product has a lower spatial resolution compared to the MOD44B analysis above, 500 meters compared to 250 meters. We utilized this land cover product as a check on agricultural differences and practices between the three regions.

Results

Demographic change

Prior to the first migration wave to Toro in the 1950s, population density in Kigezi was extremely high compared to other rural regions in Uganda. This region is consistently one of the three most heavily populated districts in Uganda. The population in Kigezi grew from 100,000 in 1911 to 642,000 by 1969; by 1980, population density in Kigezi exceeded 194 people/km^2 (Langlands 1971a, Figs. 2, 3; Table 2).

High and increasing density created land shortages throughout Kigezi. In addition, inheritance rules which dictated that family land was subdivided among all adult sons resulted in small plots and severe disaggregation of landholdings (Kabera 1983; Langlands 1971a; Carswell 2002, 2003b). This rapid population growth and severe land shortage lead to steady out-migration, and between 1959 and 1969, an estimated 100,000 left Kigezi (Langlands 1971a). They first moved within Kigezi, but over time, the radius for migration from Kigezi increased (Dak 1968; Langlands 1971a). In addition, many young men left Kigezi in search of wage labor to pay poll

[4] Due to major differences in topography and intensity of cultivation, using Kigezi as a control site was not possible, as we had hoped.

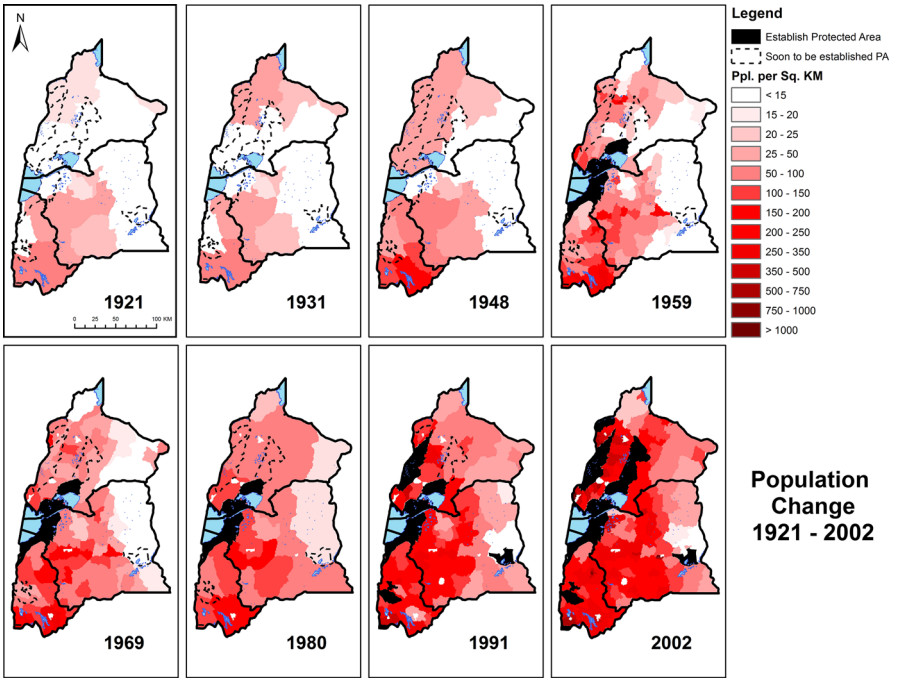

Fig. 2 Population density for administrative areas of western Uganda (Kigezi, Ankole, Toro) for census years at 1-km resolution, sub-county levels. Calculations and rendering of population density excludes water bodies, national parks (i.e., population excluded from within national park boundary after formally established), and urban areas (Color figure online)

taxes imposed by the British government (Carswell 2007). By 1959, the population was relatively young, providing a large labor class. Between the 1950s and 1969, labor migration from Kigezi was at its peak, and Bakiga settlement in the Toro region heavily expanded (Dak 1968; Langlands 1971b, c). The Bakiga went to work at tea estates, railway construction, Hima cement factory, and copper and cobalt mines at Kilembe, with about 38,000 being recruited this way between 1955 and 1960 (Baryaruha 1967; Goddard et al. 1975; Kabera 1983). By the time of the 1959 census, there was a male population of 173,212 in Toro. At that time, 83 % (4,711 individuals) of all male migrants in Toro were Bakiga (Government of Uganda 1960; Dak 1968).

During the 1950s and 1960s, Bakiga laborers visited places near KNP to which they could potentially migrate (Langlands 1971a). Land near KNP was particularly attractive because there was comparatively low human population density and plenty of available land that was a mix of forest and grassland (Baker 1958; Langlands 1974; Goddard et al. 1975; Aluma et al. 1989). An assessment of the land ownership claimed, there was "plenty of land for the domiciles in Toro District" (Dak 1968, p. 170). The first migrants from Kigezi arrived in 1955 to the east side of the Kibale Forest Reserve near the town of Bigodi. This immigration continued well into the 1960s (Kabera 1983), leading to an almost fourfold increase in population

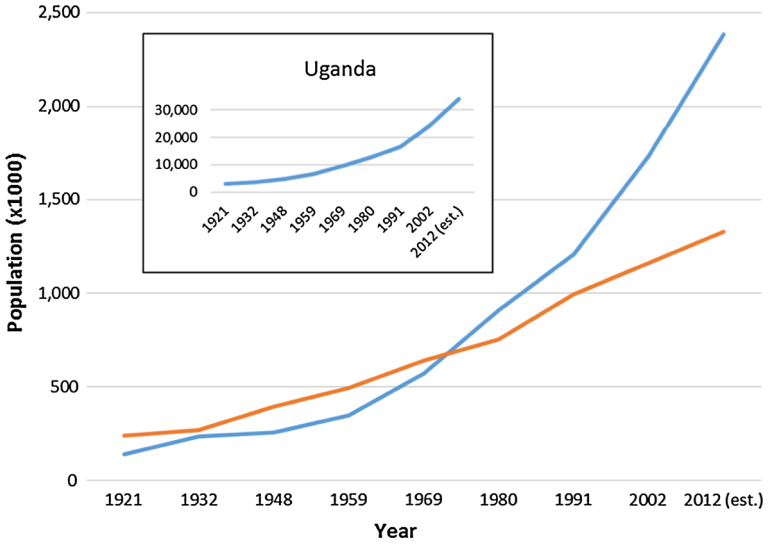

Fig. 3 Uganda census data for Toro (*blue line*) and Kigezi (*red line*) regions and Uganda. Population estimates for 2012 were developed by Uganda Bureau of Statistics based on 2002 data (Color figure online)

in Toro between 1959 and 1969. In addition, past sleeping sickness outbreaks caused national anxiety and there was a perceived urgency to resettle people in areas free of tsetse flies (Kahimbaara and Langlands 1970; Berrang-Ford et al. 2006). By the late 1960s, there was high density in the southernmost areas of Kigezi and the only relatively empty land was found in northern Kigezi which was tsetse infested up to Queen Elizabeth National Park (Dak 1968). Many of the Bakiga who wanted more land that was tsetse free migrated to KNP. Between 1946 and 1975, approximately 80,000 people migrated from Kigezi to Toro (Langlands 1971b).

The out-migration of Bakiga from Kigezi contributed to a major increase in population density across western Uganda. As a result, not only did the overall population in Toro grow, but over time, the Bakiga became a much more prominent ethnic group rather than a small minority of migrant workers in areas outside Kigezi (Fig. 4). With successive waves of Bakiga migration, the places around KNP which had been very sparsely populated became increasingly populated, rising from less than 15 people/km^2 in the 1950s to 25 in 1969, and 250 or more in many places by 2002. The Toro region, primarily populated by Batoro in the 1932 and 1948 censuses, became steadily populated (and in some parts eventually dominated) by Bakiga. During the first wave of migration to Toro, the population grew by 34 % between 1948 and 1959, while Kigezi's population increased by 25 %. As migration continued, Toro's population grew faster than the national average, and by 1980, the census indicates Toro had overtaken Kigezi in total population.

By 2002, the Bakiga were the largest ethnic group in the southern areas east and west of KNP. Presently, the areas we designate as "Bakiga East" and "Bakiga West" within 5 km from the park are dominated by Bakiga, while the Batoro area is more mixed between Batoro and Bakiga. Between the 1959 census—roughly when

Table 2 Population in Toro, Kigezi, the Western Province and Uganda for census years and the 2012 estimates extrapolated from 2002 census data by Uganda Bureau of Statistics, and year to year population change

Year	Toro		Kigezi		Western Province		Uganda	
	Population	% Change	Population	% Change	Population	% Change	Population	% Change
1921	139,856	67	238,122	13	727,004	3.2	3,071,608	16
1932	233,139	11	269,216	47	893,287	3.0	3,553,534	38
1948	258,873	34	395,529	25	1,163,706	3.1	4,917,555	31
1959	347,479	64	493,444	30	1,497,510	3.1	6,449,558	48
1969	570,606	59	642,299	17	2,423,086	40.0	9,526,237	33
1980	909,734	33	751,980	32	3,392,067	34.1	12,636,179	32
1991	1,207,100	43	994,700	16	4,547,900	38.5	16,671,700	45
2002	1,730,800	38	1,158,500	14	6,298,100		24,227,300	41
2012 (est.)	2,384,700		1,325,800		8,274,200		34,132,900	

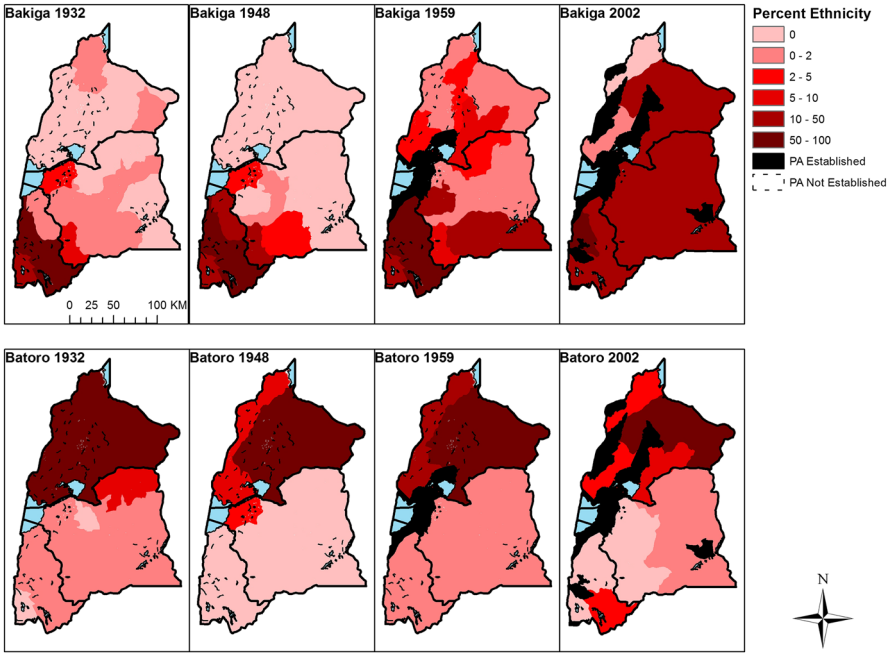

Fig. 4 Population density of the Bakiga and Batoro in western Uganda (Kigezi, Ankole, Toro) for census years when ethnicity was recorded at 1-km resolution. Calculations and rendering of population density excludes water bodies, national parks (i.e., population excluded from within national park boundary after formally established), and urban areas (Color figure online)

Bakiga had just begun movement to Toro from Kigezi—and the most current Uganda census in 2002, the Bakiga population in Toro went from 5,824 to 279,557—an increase of about 274,000 people or 4,700 %. During that same time, the Batoro population went from 183,492 to 515,439—an increase of about 332,000 people, or about 180 %; Batoro were still the majority in Toro (65 %), but Bakiga represented a large minority group (35 %). However, in our survey areas near the park, the ethnic proportions are roughly the reverse of those in the large area. The relative tribal proportions self-identified by survey respondents indicate that in these area adjacents to KNP, Bakiga comprise about 63 % of the households, Batoro 35 %, Bakiga 63 %, Bafumbiira 8 %, Bakonjo <1 %, other 7 %.[5] Figure 5 shows the distribution of percent tribal association for Bakiga and Batoro tribes, illustrating that the boundaries between Batoro and Bakiga East and West are transition zones.

Land tenure in Uganda, like most sub-Saharan countries, has been defined by successive governance regimes (Toulmin and Quan 2000). As a result, there are many forms of land tenure legally recognized in Uganda, including systems of freehold, leasehold and customary/communal. Although originally a form of clan or tribal land

[5] The total is greater than 100 % because 13 % of the survey households self-identified more than one tribal affiliation.

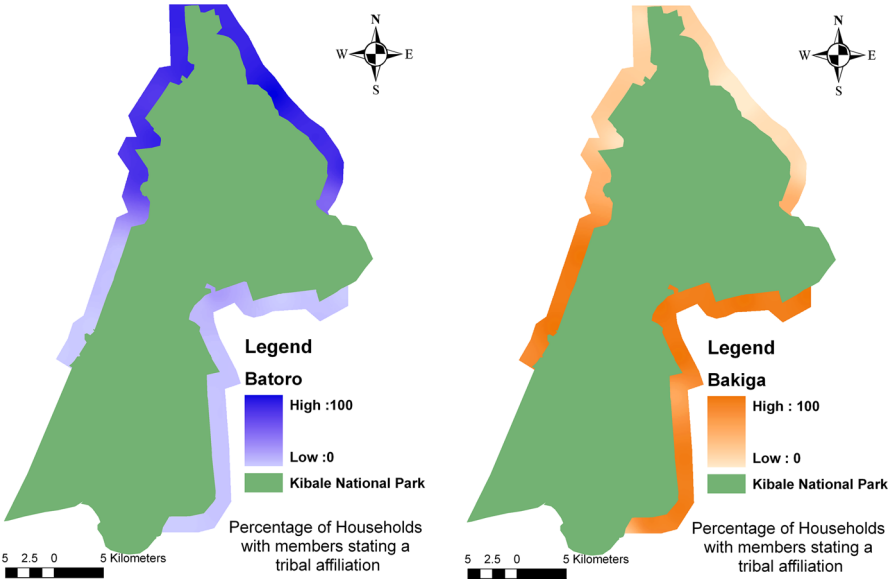

Fig. 5 Percent tribal affiliation of Batoro and Bakiga households near Kibale National Park (Color figure online)

distribution, customary land tenure is evolving into individual ownership in some areas of Uganda (Place and Otsuka 2002). Traditionally, land was allotted to members of the tribe or clan and managed by the tribal or clan leader for the benefit of the community. Following independence, civil war, settlement programs, and migration have mixed the tribal affiliations of communities in Uganda. As a result, claims of land ownership now tend to be based on occupancy rather than communal usage (Place and Otsuka 2000). There have been attempts to legitimize customary land tenure, and land owners can get a certificate of customary ownership, but the overlay of different management systems has led to confusion over jurisdictions and actual rights to land use and ownership (Toulmin and Quan 2000).

Population density near what is now KNP grew enormously. In 1959, the sub-counties that included KNP (land areas total = 3,991 km^2) had a population density of 28 people/km^2. By 2002, their population density had increased to 293 people/km^2, but in a smaller area (2,951 km^2).[6] In sub-counties not adjacent to KNP, the population density rose from 29 individuals/km^2 in 1959 to 188 people/km^2 in 2002. Over that time period in Toro, overall population density increased from 28 to 178 people/km^2, with an overall population increase of 398 %. This rate is higher than the total increase of 276 % in Uganda's population, wherein national level population density increased from 33 to 134 individuals/km^2. In Toro, there was a 4.08-fold increase in population density, as opposed to the national increase of 4.08 times.

[6] Sub-counties are subdivided over time as new sub-counties are created. When KNP was created, there were fewer, but bigger sub-counties adjacent to the park boundary, whose areas extended farther from the park, compared to the present.

Land use history

The Bakiga migration accelerated population growth near KNP, with a great deal of land conversion and increasing insularization of KNP. When the Bakiga arrived to Toro, they found comparatively unoccupied land with low-density Batoro settlements interspersed with forests and grasslands: "There was [plenty of] land. It was mainly bushland, and it was easy to get because the Batoro were spread out" (respondent 10, Bakiga). The relatively open and abundant unsettled areas outside the forest reserve and corridor were converted to productive farm land both as more Bakiga moved in and also as a function of general population increase in the area. In the process, many of the forest fragments outside the forest reserve were cleared and wetlands were drained. Maize was not traditionally a widely grown staple crop for the Bakiga in Kigezi, but those who migrated to this area adopted maize into their more intensive and market oriented agricultural systems. Much of the maize was grown for sale, and much of the earnings were invested in further land purchase and labor hire. Maize is hardy and as described by an informant, "…can resist drier conditions, grow well in the KNP soils, and can be easily intercropped with beans or other field crops. It was easy for us to grow it on our farms" (respondent 7, Bakiga). Further, Bakiga were accustomed to a cash economy in Kigezi and were skilled at developing networks to sell surplus maize and other food crops (Carswell 2003b, 2007).

As more people moved to the area, land first acquired monetary value and its value then increased rapidly, mainly beginning in the 1960s. Prior to this time, land was usually acquired through *embagwa* (Table 3), where newcomers approached local chiefs to be granted unused land and in return provided the Batoro chief a modest amount of money or agreed to provide a proportion of the harvest: "At first, we could ask the local chief for land and he would tell us to take as much land as we could clear" (respondent 8, Bakiga). However, as more Bakiga came to KNP, much of the land that had been under the control of the King of Toro and administered through local chiefs was allocated to individuals and households, and as the land market developed, local Batoro began selling their land to Bakiga migrants. By the early 1970s, acquiring land through purchase was common. Unsettled land was still relatively abundant, and many people were beginning to settle within the corridor in KNP (Ryan and Hartter 2012). Many Bakiga were buying land from Batoro and some from the newly established Bakiga: "We paid for our land, but we could buy as much as we wanted. We were only limited by money." (respondent 21, Bakiga). Many realized that they had more land than they could cultivate, and willing buyers were increasingly abundant, and thus, they subdivided parcels and sold them off. As Bakiga settlements grew, new migrants arrived, additional farms were established, and land prices steadily increased (Table 3). While the willing buyer, willing seller system was by the 1990s deeply entrenched in the local economy and further legitimized by the Uganda Land Act in 1998, land prices steadily climbed as population density increased and unsettled land became difficult to find: "Yes, land is very expensive now. But if you have the money, somebody is always willing to sell" (respondent 27, Batoro). As Bakiga acquired land, more land was converted to agriculture. In much of the Bakiga-held land, widespread cultivation of maize

Table 3 Timeline of land acquisition in the Toro Kingdom (and major push, pull, and political factors to the Kibale region from the 1930s to current. Prices in Uganda shillings/acre[1,2])

	Decade								
	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Current
Land acquisition process	Allocated by local Batoro chiefs as representatives of the King of Toro			Allocated by Batoro administrators (politically appointed "chiefs")		Purchase			
Land price	Embagwa			Embagwa or <10 Ush/ac	<10,000 Ush/ac	<50,000 Ush/ac	30,000–200,000 Ush/ac	100,000–1,000,000 Ush/ac	500,000–>10,000,000 Ush/ac (more if closer to main road)
Push/Pull/ Political Factors	Colonial rule, kingdoms existed & British administration			1962: Uganda independence 1967: Obote is first president, kingdoms abolished 1969: second wave of Bakiga migrants Batoro-Bakonjo conflict	1972: Amin seizes power 1975: Land Reform Decree Act where all land is centralized Kilembe mines close	Third wave of Bakiga migrants Land has acquired a higher value First eviction of people from Kibale (mainly Bakiga) 1986: Museveni comes to power Steady in-filling of Bakiga in places where they bought land, some Batoro emigrate back to core	1993: KNP established. Eviction of everyone–mainly Bakiga and Bakonjo, and a few Batoro 1995: Ugandan Constitution signed making provisions for acquisition of land by the government 1998: The Land Act was introduced and is the current basis for land law in Uganda and defines recognized tenure regimes including customary and private ownership		
			First wave of Bakiga migrants				Willing buyer, willing seller for land. Land is expensive and difficult to find.		

[1]It is not entirely clear if the prices are per acre or per hectare since the local word is the same. Also, most people do not measure their land in acres or hectares and only in the extreme rarest instances are lands in Uganda surveyed, let alone in rural areas. They know the boundaries based on physical landmarks (e.g., rocks, hedgerow, trees, streams)

[2] During the colonial period, the Uganda currency was linked to the British pound. Ugandan currency was introduced in 1966. Heavy inflation and devaluation under Amin and Obote 2, then inflation-control measures instituted 1987 and after have meant that historic land prices are not directly comparable to the present

Table 4 Comparison of pixel-wise mean percent forest cover and change in the three regions (shown in Fig. 1. Forest cover derived from MODIS Vegetation Continuous Fields data (MOD44B)

Region	% Forest cover[a]		% Forest cover change[b]
	2000	2010	2000–2010
Batoro	33.40	25.88	−7.51
Bakiga East	28.44	23.24	−5.20
Bakiga West	16.04	19.96	3.92

[a] All regions differed significantly from one another in both years (Tukey–Kramer HSD, $p < 0.0001$)

[b] All region changes differed significantly from one another (Tukey–Kramer HSD, $p < 0.0001$)

began, particularly in the drier areas on the southeast and southwest sides of KNP where the Bakiga tended to concentrate their settlements.

There was also a decline and constriction of Batoro managed agricultural landscapes. In the 1950s, there were large tracts of bush land which migrants could acquire. Such lands were peripheral to the settled and cultivated land, and the Bakiga were seen "in need," and so, the Batoro did not have any apprehension of Bakiga immigration. The chief and the settled people were willing to allocate land to new migrants on the periphery and near the forest reserve and corridor. In some areas, these new homesteads would provide a buffer to prevent or minimize crop raiding and livestock predation by wild animals (Kabera 1983; Aluma et al. 1989; MacKenzie and Ahabyona 2012). The traditional Bakiga land tenure system was individualistic and based on the principle that a man could hold as much land as he could cultivate and defend with the assistance of his clansmen. The first immigrants sought to create social bonds with original occupiers to protect the families from theft, witchcraft, and wild animals. Larger groups were important for defense and the building of social capital which in turn could be leveraged to acquire and gain land access. Thus, having more Bakiga around was advantageous for security and building wealth. Over time as new migrants came and second-generation migrants or larger Bakiga families established farms of their own in the area, more land was converted to agriculture. As the Batoro saw more Bakiga coming, and because they were aware of the strong family bonds existing in the Bakiga culture that would bring more family members to the area, land prices rose sharply (Table 3). Some Batoro remained, but with newfound relative wealth, many of them relocated to communities near Fort Portal, a growing urban center. The Batoro seem not to have realized until late that their patterns of land allocation to the Bakiga would eventually restrict their families' access to land (Interview, King of Toro regent, July 25, 2011). The Batoro who remained were simply outnumbered by the Bakiga who moved there (Fig. 3) and who had comparatively larger families. From the 2009 survey, the average number of adult women in Batoro households is 1.16, while in Bakiga households, this number is 1.40 (Mann–Whitney $p = 0.006$). This difference is due to a higher prevalence of polygamy in Bakiga culture (Just and Murray 1996). Accounting for all children produced by all adult women in the household, the average Bakiga family size is 7.2, while the average Batoro family size is 6.3 (t test $p = 0.033$).

Over time, the landscape had a greater imprint of Bakiga land use, and land shortage has become an important issue. In their patrilineal system of land inheritance, both the Bakiga and Batoro worry about having enough land to pass to their sons. Instead of subdividing their main plot to their sons, fathers must purchase land that is farther away, or the son is forced to procure his own small parcel of land when he is married: "Now there is no land and our sons will have no land in the future… But you can always get land if you are willing to pay a lot of money" (respondent 13, Bakiga).

Present-day land cover

Movement of the Bakiga to Toro since the 1950s has led to continual forest conversion and farmland expansion. From our analysis of MODIS data, we see evidence of this continual land cover change in the three areas of study around KNP over the last decade. We found that the Batoro area had the highest percent tree cover compared to both of the Bakiga areas in both 2000 and 2010, with Bakiga West having the lowest percent of tree cover of the three areas in both 2000 and 2010 (Table 4, t test, $p < 0.0001$). From 2000 to 2010, Bakiga West had some increase in tree cover, while the eastern Bakiga and Batoro areas had a moderate and a greater amount of forest lost, respectively (t test, $p < 0.0001$).

In addition, the type of crops cultivated differs between Bakiga and Batoro areas. Some of these differences can be accounted for by external factors such as tea being cultivated near the tea estates in the north (Batoro), Kamwenge council promoting their district as a tobacco growing area (Bakiga East), and possibly rainfall. However, Bakiga households were more likely to grow high-density crops such as maize ($\chi^2 = 21.94$, $p < 0.001$), cassava ($\chi^2 = 6.67$, $p = 0.010$), sorghum ($\chi^2 = 28.2$, $p < 0.001$), ground nuts ($\chi^2 = 12.25$, $p < 0.001$), and rice ($\chi^2 = 17.72$, $p < 0.001$), while Batoro households were more likely to cultivate banana (matoke) plantations ($\chi^2 = 4.05$, $p = 0.044$). Our analysis of land cover types and change between 2001 and 2009 indicate that Bakiga East had a decline in cropland (lands covered with temporary crops followed by harvest and a bare soil period, IGBP) of 3.3 %, and Bakiga West saw a decline of 3.5 %. The Batoro areas had an increase in cropland of 1.9 %. However, one land cover class from this analysis is a cropland/natural vegetation mosaic (lands with a mosaic of croplands, forests, shrublands, and grasslands in which no one component comprises more than 60 % of the lands). We found an increase of 7.4 and 7.5 % for the Bakiga East and West areas, while there was a decrease of 4.1 % in the Batoro area. We note that these two land cover categories comprise a majority of the area in all three regions of interest.

Discussion

Contemporary migration theories focus on a range of potential explanatory and causal factors to migration. These include the search for better economic opportunities (Todaro 1969), push and pull factors of economic and political

change at origin and destination (Lee 1966), responses to structural adjustments caused by colonial governance and capitalist development (Adepoju 2004), household livelihood strategies for risk diversification and responses to environmental stress (Stark and Levhari 1982; Gould 1995; de Haan 1999; Henry et al. 2003; Grenier and Sakdapolrak 2013). All of these perspectives are represented to a greater or lesser extent in the migration story of the Bakiga to the Toro Kingdom: initially moving at the insistence of the colonial and national governments to relieve population pressures, then migrating to employment opportunities in mines and tea estates, and finally relocating in cultural and kinship groups to areas of improved agricultural fertility. In turn, the Bakiga have influenced their destination environment bringing agricultural intensification to the borders of KNP.

The migrations of Bakiga have led to major changes in western Uganda. Shorter distance migration by the Batoro was also important; some Batoro sold land to immigrants and moved to Fort Portal, while others seeking available land pushed closer to the park boundaries. Other movements of people, including the Bakonjo from near Kasese and the Rwenzori Mountains, also affected the amount of available land and patterns of land use change. However, the long distance migration of the Bakiga to the boundaries of KNP stands out as the primary catalyst to facilitated change in some areas and accelerated it in others. Census and survey data show that Bakiga households dominate near the park, a very different ethnic makeup than the rest of Toro, where Batoro still comprise the majority. The KNP case supports the thesis that protected areas are an attractor to migrants, and therefore, population growth tends to be higher than other areas without protected areas (Wittemyer et al. 2008). However, counter to claims that people migrate to the borders of protected areas in order to benefit from park-based employment and economic opportunities generated by foreign investment in conservation (Wittemyer et al. 2008), our interview and archival data clearly suggests that the Bakiga were drawn to KNP as a result of land availability (Zommers and MacDonald 2012) and were preferentially settled closer to the park by the resident Batoro, while many Batoro moved to the urban center of Fort Portal and rural areas farther from the park. Our quantitative data indicate that the population density near the park differs from that farther away, and that the ethnic composition of many of the areas near the park differ, quite dramatically from that in the larger surrounding region. This pattern of changing population density and ethnic composition coincides with the qualitative discussion of the ethno-cultural (including agricultural) impacts that have resulted from the ethnically differentiated migrations to the areas around the park. In contrast to other studies that rely on statistical techniques (e.g., Wittemyer et al. 2008; Joppa et al. 2008), our analysis of quantitative and qualitative data provide a broader perspective on drivers and landscape impacts of population growth near KNP.

We found that population density closer to the park became 1.5 times greater than that farther from the park over the span of 43 years. In addition, by 2002, no settlements remained inside KNP. The landscape surrounding KNP has had to absorb this large population increase, both from migration and natural increase. However, we disagree with the notion that moving to the park was thought to be exceptionally lucrative. People moved to the park (forest reserve and game corridor

at the time) because KNP and other Ugandan protected areas (e.g., Murchison Falls, Queen Elizabeth) were originally gazetted in low-density areas. People would not have wanted to move near to these areas because of the wildlife, which threatened their livelihoods as agropastoralists. Over time, however, these areas became densely population for reasons mainly based on land availability rather than to take advantage of park-based employment or tourism income. Forest parks in Uganda have relatively low visitation [KNP had 7,650 visitors in 2009, UWA (2009)], but still present some opportunity for the community to benefit through revenue sharing programs, employment, and tourism (MacKenzie 2012). Residents admit that living near the park is far from perfect, but they would rather have the park continued to exist than not (Hartter 2009), though this for reasons that include generalized environmental benefits of air and climate quality rather than any direct economic benefits the park might present (Hartter and Goldman 2011; Hartter et al. 2014).

The resulting rise in population and land pressure has provided dependable markets for food and the sale of wood for fuel and construction. Since access to credit and savings is difficult, many families rely on the harvest and sale of maize and other crops as well as tree harvesting to purchase foodstuffs. Areas with more trees (Batoro, Fig. 1) and fewer trees (Bakiga West, Fig. 1) can heavily influence land use, livelihood strategies, and risk management. We show that there is greater tree cover in the Batoro area, but this is also the area of higher forest loss between 2000 and 2010 (Table 3). While our analysis only describes change over a 10-year period, it is evident that the east and west sides of the park differ in forest cover. This may be due to a host of interacting environmental, political, and cultural factors, such as agricultural expansion (Hartter and Southworth 2009) and demand for fuelwood near Fort Portal on the west side (MacKenzie and Hartter 2013). However, the areas that have fewer trees (Bakiga East and Bakiga West) also tend to be drier (Breytenbach 2013) than the Batoro area. The landscape transitions from forest (north) to more savannah woodland (south), which produces an open canopy and fewer trees. In addition, a large swath of the lands bordering the park is occupied by prison lands in the southern part of Bakiga West. These fields were planted with maize used to feed prisoners and for sale to subsidize the prison. Bakiga East has a large protected swamp forest of 420 ha (Hartter and Southworth 2009), thus Bakiga East has a higher proportion of forest. What is less clear is why there is a difference in forest change. Where Bakiga East and Batoro areas lost forest cover between 2000 and 2010, Bakiga West gained. Bakiga West is in the southern part of the Kabarole District where legislation was enacted requiring tree planting: "All land owners shall plant trees on at least 10 % of the acreage of his or her land as advised by Council." (Kabarole District 2006, p. 10), which may have contributed to increased forest cover. We note that while the three areas differ in percent tree cover, we cannot definitively say that the differences are attributed to Bakiga in-migration and land use practices. For example, initial conditions due to biogeography of forests and land cover types based on rainfall patterns, soil types, or other historical disturbances may have resulted straightforwardly in more trees initially in the Batoro region. The Bakiga settled in drier and hotter areas around KNP (Breytenbach 2013; Diem et al. 2014). Also, the Bakiga settled where land was productive and available—it had fewer trees and more grasses, and it was easier to

clear for farming. It was also less desirable by the Batoro because it was farther away from the cultural hub of the Toro Kingdom (Fort Portal) and had more wild animals.

We found little change in overall agriculture or cropland using our land cover analysis, although land cover analysis was limited to one decade while historical archive, census, and qualitative data spanned over 90 years. We note that our land cover analysis is not tuned specifically to the different land cover types in the Kibale region, but is used for regional comparison. Still, we present data because it did not require extensive field-based data for developing a classification model. We suggest that an effort to develop such a model would provide added benefit to ecological and environmental research in this region.

These results also have implications for the West African counter-narratives on "deforestation" and tree cover, based on the work of Fairhead and Leach (1995, 1998), Leach and Fairhead (2000) and others as noted earlier. First, as mentioned, population density in this area in Uganda is approximately 10–20 times as high as most of the sites referred to in the West African studies. Based on accounts of land cover by older respondents that go back 50 years or more (the 1960s and earlier) when population density in the Kibale region was probably a tenth or less than current densities, natural forest areas as well as natural grasslands and wetlands were also far more abundant in the landscape than they are today. It is possible that the kind of forest cover dynamics discussed by Leach and Fairhead and others may apply for population densities up to a certain threshold level after which there are significant declines in natural forest areas, except, as is currently the case with KNP, when there is effective externally sanctioned protection for forest reserves or parks. Second, and partly related to this, the agro-ecological conditions in the mid-altitude region of western Uganda discussed here are considerably different and far more attractive and favorable to intensive agriculture, particularly in soil quality and rainfall regimes, than those in the lowland West African sites. A third significant point is that tree cover may still persist and even expand in areas of fairly high population density and intensive agriculture, but this will primarily involve planted trees that provide economic benefits (fruit, fuelwood, charcoal, construction materials, etc.), not ecologically intact (though not to say "pristine") forests of reasonable size. As this paper has indicated, substantial and varying amounts of tree cover exist in most of our study area outside KNP despite high population densities, but these are not for the most part natural forests, and the smaller mostly bottomland natural forests that still persist outside KNP continue to decline rapidly in extent and area as well as in their capacity to maintain diverse plant and animal populations.

Much of the area around KNP now exhibits characteristics similar to Kigezi's fragmented landscape: dense settlement, intensive cultivation, small land holdings, and few natural forest fragments and wetlands remain. Land shortages and increasing population have meant that farm sizes are small and fallow times are reduced and short. Many people complain of reduced soil fertility and decreased yields (Hartter et al. 2012), and remaining forests (outside the park) are often viewed as "unclaimed" or "unutilized" and thus converted to agricultural land (Hartter 2010). While this may prove useful in curbing the problem of wildlife raiding crops, it has led to fuelwood shortages (Hartter et al. 2011) and further

isolated the park and fragmented the surrounding landscape (Hartter and Southworth 2009). Land shortage and land prices accordingly have substantially increased, making it extremely difficult for the system of inheritance to continue. Fathers do not have enough land, and land is too expensive to acquire enough to pass to their sons for them to have sufficient land to support a family. Our study shows that this intensive land use can be attributed to multiple factors: farming differences between the Bakiga and Batoro, decreasing available land for cultivation as more Bakiga and others have moved to the area, and due to the natural rate of human population increase.

Conclusion

KNP and the area surrounding it exemplify landscape transformation that is the expression of large-scale demographic change due to migration as well as natural increase. The history of migration to the area also shows the interacting cultural imprints of two ethnic groups that bring varying patterns of use of land and other resources. Contrary to a hypothesized positive relationship between population growth and forest extent or tree cover based on some studies in West Africa, this case shows that, at least once a certain threshold level of population density is reached, ecologically functional forests (as opposed to planted trees for economic purposes) are likely to decline and generally disappear except for forests that have protected status.

The Batoro and the national park in this region may face an uncertain future. A combination of forces acting at different scales and in different directions, shaped by political changes, exogenous national influences, intra-regional evolution, as well as economic opportunity, and local population growth, have led to the erosion of dominance of the Batoro near KNP. The Batoro willingly allowed the Bakiga to migrate to Toro and have generally peacefully coexisted, and even inter-married. Continued population growth, forest conversion, and expanding crop production will continue to add environmental pressures, requiring conservation policies to adapt to this changing landscape.

How can we learn from this ethnic migration, and what might continued population growth mean for the future of protected areas in this biodiverse region? Substantial in-migration and land use change outside the boundaries of the protected area have had little significant impact on the park itself as long as the park's boundaries, and protected status have been maintained and enforced by the state, but substantial impacts occurred during the period when state enforcement and attention were removed. At a larger scale, the Albertine Rift in East Africa remains one of the world's hotspots for biodiversity (Myers et al. 2000), but also has extraordinarily high rates of human population growth and land conversion (Fisher and Christopher 2007), which are exemplified in our KNP case study. Human populations throughout this region will continue to be heavily reliant on local food production and resource extraction.

As population in the region grows, and KNP becomes an even more isolated protected island of natural vegetation and uncolonized land, the future of the KNP

landscape may be uncertain. KNP's boundaries are recognized by local communities, and despite concern over lack of access to park resources and crop raiding, there still is support for the park (Hartter and Goldman 2011), particularly because of perceived ecosystem services (Hartter et al. 2014).

Land use change outside protected areas enhances the share of primary production for human consumption, but decreases the share available for other ecosystem functions (DeFries et al. 2004), and continued use and conversion of natural areas leads to further landscape fragmentation and alters ecosystem processes (Matson et al. 1997). Migrations to protected areas will continue, but as we have shown, will not necessarily be driven by economic benefits from the protected areas themselves. Instead, there are important push and pull factors at different scales that must be understood (Salerno et al. 2014). As people move in, tensions may mount in adjacent lands as they are relied on not only to maintain (or recreate) habitat connectivity, but also to sustain local livelihoods. Uganda Wildlife Authority will need to evolve outreach policies to deal with resource shortages in the domesticated landscape or face increased illegal resource extraction from within protected area boundaries. In the case of KNP and other forested parks in East Africa, as long as people around the protected area believe the boundary is fairly and equitably managed and maintained, it appears that the protected area will be locally supported.

This paper illustrates how complex, and to a certain extent, how contradictory the factors influencing human migration can be. Theorizing the movement of people to the borders of KNP cannot be neatly pigeon-holed into a single hypothesis. Rather, the evidence shows a layering of migration factors. Our analysis of the KNP system indicates that understanding the social and cultural underpinnings of human migration to, and environmental change along, the borders of protected areas is fundamental to developing appropriate people–park policy and managing human–park interaction as a result of neighboring land use intensification brought about by changing populations and changing ethnic make-up.

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