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DEMYSTIFYING AGRICULTURAL POPULISM IN MAASAI RANGELANDS IN THE SOUTHWESTERN KENYA

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Abstract:
Agricultural expansion in Kenya's Amboseli region has resulted in proven negative effects both on native megafauna that use the ecosystem as a dispersal area, as well as on grazing and water resources utilized by local livestock herds. While community conservancy programs supported by non-governmental organizations (NGOs) provide an ecologically sustainable alternative to farming's increasing popularity, the claim that agriculture is the most profitable land-use option for the region remains dominant — even as increasingly frequent droughts interrupt agricultural processes. This study presents a comparative analysis of the overall benefit of land-use– agriculture and conservancies– in the Amboseli region. We draw on fieldwork conducted between March - May 2023, in the former Kimana Group Ranch in the Amboseli region of southwestern Kenya. Data was collected through household surveys with 150 landowners, and key informant interviews with leaders and officers of various conservancies and NGOs in the area. We conducted approximate analyses of the annual cash flow reported by each household to compare the profitability of different land-use options. The results of the study show that, while agriculture is by far the most popular land-use option in Amboseli, the region's traditional pastoralist practices remain the most financially stable and lucrative land-use option. Leasing land for conservation through community conservancies was the second most profitable. Irrigated agriculture, mostly practiced by non-Maasai people, showed relatively short-lived financial returns. We argue that increased farming in Maasai rangelands is fueled primarily by land privatization and the promise of immediate profits — promises whose benefits are far outweighed by long-term economic and socio-ecological consequences. Considering that indigenous Maasai

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pastoralism is most sustainable for the semiarid rangeland and that our research indicated agriculture is practiced most by non-Maasai, we argue for an examination of how traditional ecological knowledge (TEK) competes with non-indigenous practices, especially considering that rangelands in East Africa are increasingly becoming fragile due to climate change.

Keywords: Amboseli ecosystem, agriculture expansion, Maasai pastoralism, livelihoods, income, conservancies

1. Introduction

The Amboseli ecosystem in Kajiado County is one of the most critical wildlife conservation areas in Kenya. The ecosystem, which includes Amboseli National Park and its environs, has long been the focus of studies regarding the influence of agriculture encroachment in wildlife habitats (Okello and D'Amour, 2008) and community-based conservation (Kipkeu et al., 2014). Historically, the region has been primarily occupied by the pastoral Maasai people, whose livestock herds shared communal rangelands with wildlife. However, as the area has seen rapid population growth over the past 50 years, the Amboseli ecosystem has faced several challenges related to urbanization and land privatization (Groom and Western, 2023; Mbane et al. 2019). Fences surrounding privatized land sever wildlife corridors and fragment habitats (Groom & Western, 2013), emerging irrigated agriculture in the landscape depletes natural freshwater sources (Njuguna & Mburu, 2021), and boxed-in livestock herds compete with endangered wild animals for land resources and space (Kimiti et al., 2016). All these changes relate to land subdivision, with the most impactful socio-ecological change being a shift towards agricultural land-use among a historically pastoralist population (Hemingway et al. 2022).

Before the introduction of commercial agriculture into the region, the land around Amboseli NP was organized into group ranches that forwent private land-use practices in favor of a communal ownership model. Though the group ranch model offered Maasai pastoralists significantly larger chunks of communal grazing land than recently privatized plots, it represented the first major attempt to carve the "*previously open Maasai range into a series of smaller units of variable size held under corporate title*" (Mwangi, 2007, p. 889). Maasais from different *bomas* (homesteads) shared the resources of the group ranch and grazed their cattle alongside wildlife in unfenced pastures. Since the beginning of land privatization in the mid-1990s, the region has seen an influx of settlers from outside of Kajiado — many of whom are either non-Maasai or non-pastoralists (Kimani & Pickard, 1998) — who have purchased plots of land for cultivation. Over the last few decades, land has been subdivided so much that the (now "former") Kimana Group Ranch (KGR) has become a checkerboard of crop fields and truncated rangelands (Stettler, 2002).

New settlers in the region are not the sole reason for the spread of farming. Previously-pastoralist Maasai households have started to lease their newly privatized

land to farmers or have started to farm crops themselves. Hemingway and colleagues, in their recent study, observe that "*the stereotype of the one-dimensional Maasai herdsman as an obligate pastoralist is unraveling fast*" (Hemingway et al., 2022, p. 3). Recurrent droughts – – including the 2022-2023 drought, dubbed the "*worst drought in 40 years*" (UNFPA, 2023) — have only worsened the competition for resources and fueled the change from pastoralism to irrigated agriculture. Farmers with the financial means turn towards borehole-fed irrigation systems, resourced with underground water from Mt. Kilimanjaro. Okello et al. (2011) made a similar observation that, faced with the options of herding livestock in ever-shrinking pastures or switching to crop farming, many pastoralists who witness the success of wealthy non-Maasai farmers choose the latter.

Crop farming has proven to have negative effects on both native wildlife and the surrounding environment. Farms have begun to encroach on preexisting wildlife sanctuaries, both small (like the Kimana Wildlife Sanctuary in the former KGR) and large (the Amboseli NP itself). This has led to an increase in human-wildlife conflicts, both in terms of livestock predation and herbivore crop-raiding (Okello et al., 2011); carnivores target fenced-in sheep and goats when they are the closest food source, and elephants break into onion and tomato farms when their rangelands are blocked. In addition, farms are severely resource intensive: considering much of the Amboseli ecosystem is geologically and climatologically unfit for rain-fed cultivation (IPC, 2022), the need for stream or borehole-pumped water, pesticides, and fertilizers makes agriculture one of the largest threats to conservation in the region.

Regional conservation stakeholders have made attempts to mitigate the effects of subdivision and agricultural expansion through the introduction of community conservancies. Conservancies were first launched in the former KGR to offer an alternative land-use option to increasingly popular crop farming. Today, the KGR comprises six conservancies — communal pastures leased by land-owning members to non-governmental organizations like the Big Life Foundation and the International Fund for Animal Welfare (IFAW). Though legally subdivided into 60-acre plots, each plot is unfenced and allows for movement and grazing across the entirety of the conservancy land. Participating members are paid lease fees semiannually, benefit from NGO-constructed social amenities (i.e. schools, hospitals, etc.), and are allowed to graze their cattle on common-use plots far larger than neighboring private spaces. In exchange, they aid conservation organizations in keeping wildlife dispersal areas open by hindering further sales and subdivision in the region. Despite the work of conservancies, the underlying economic narrative among area landowners is that agricultural land-use options are more profitable and financially stable compared to pastoralism and conservancy land leases. We refer to this persistent belief as agriculture *populism*.

As is common with many discursive regimes, agriculture *populism* can sometimes obscure embedded falsehoods. The objective of this paper is to provide an empirical analysis of this pro-agriculture narrative vis a vis other land-uses – pastoralism and conservation, and to methodically gauge its ubiquity in the KGR community. To do so, we will begin by assessing the KGR community's perception of agricultural, pastoral, and conservation-based land-use options. Next, we will quantify the monetary contributions

attributed to each land-use option in order to effectively compare their benefits. While numerous studies have been conducted on the rate at which pastoral lands have been converted to farms (Campbell et al., 2000), few (if any) have ascertained the actual cash flows of various land-use options in the region. Next, this paper will determine the ontological and socioeconomic justifications for land-use switches in the region, as well as the implications of such changes.

In particular, this paper will answer three central research questions: What are the real comparative advantages of agricultural and pastoral land-use options? What factors prompt land-use and livelihood switches in the former Kimana Group Ranch? How do these changes affect the conservancy projects of the Amboseli ecosystem? The inversely proportional relationship between decreasing pastoral land and increasing agricultural land is a consequential phenomenon in Kenya and, therefore, makes these questions central to ongoing conservation efforts (Kamiti et al., 2016). Commercial farming has negative, tangible effects on areas ill-suited to water-intensive land-use (Boone et al., 2005; Njuguna & Mburu, 2021). Similarly, the land subdivision inherent in cultivation has dire consequences for native wildlife, which already face threats when sharing land with pastoralists (Karuiki et al., 2021). Understanding the realities around the pro-agriculture narrative is instrumental in developing sustainable land-use practices that uphold the level of biodiversity in regions of East Africa with natural resource conflicts.

2. Methodology

2.1 Research Setting

The overall research site for this study is the Amboseli ecosystem, which covers more than 1.3 million acres of land in Kajiado County, southern Kenya (Amboseli Ecosystem Trust, 2023). Located in the Rift Valley region of Kenya, the ecosystem is mainly made up of ASAL (Arid and Semi-Arid Land) areas (also called "Sahel savannahs"), the Chyulu Hills mountain range and lower slopes of Mt. Kilimanjaro being exceptions. The region experiences two alternating seasons (dry and rainy), which repeat twice a year (short-dry, long-rainy, long-dry, and short-rainy) (Nicholson, 2017). However, the effects of climate change in the area over recent decades have made it difficult to delineate between these seasons (IPC, 2022). The area receives low and increasingly stochastic rainfall each year (Hemingway et al., 2022), which has had major effects on the region's two crop-growing seasons. Field research took place during the 2023 long rainy season, which affects crop production, water-leasing costs, and market prices of livestock and food. For the purposes of our research, all survey questions concerned the 2022 calendar year (see: Research Methods), which was characterized by the severe 2022-2023 drought.

The topography of the region is mainly bushland savannah, sporadically populated with volcanic hills. The soil composition consists of "red" and "black" soil; both soil types are compact, fine-grained, and have high moisture retention. However, only 7% of the land in Kajiado County has the potential for rain-fed crops (Sitters et al., 2009), making crop farming without irrigation difficult (IPC, 2022). The other 93% of land has historically been used as open-range land for local Maasai pastoralists. Vegetation in

the region is sparse, with most non-irrigated, non-riparian areas consisting of shrubland. What few woodland areas exist are primarily riverine, or found in marshlands supplied with fresh water by Kilimanjaro-fed springs. In these areas, common flora include *Acacia tortilis*, *Solanum incanum*, *Euphoria calabara*, *Cyphostemma*, *Cordia monoica*, *Grewia bicolor*, and *Commiphora africana*.

The specific research site is the former KGR, one of six group ranches in the Amboseli ecosystem. With an area of 251km², the KGR contains six conservancies run by the BigLife Foundation (BigLife, 2023): Kilitome, Nailepu, Osupuko, Nalarami, Olteyiani, and Ole Polos. The group ranch's most notable community-leased protected area is the Kimana Wildlife Sanctuary (which has been acquired by the Angama Amboseli safari lodge as of 2024), which sits along the Kimana river, near the Isinet springs. The study this paper draws from was conducted in four villages within the KGR: Namelok, Oloile, Kwa Kuku, and Oltepesi. Given the placement of these villages, some of this project's respondents are part of conservancies, and some are not. Similarly, some villagers are Maasai, and some are not. The diversity of respondents' backgrounds is helpful in analyzing the following critical demographic questions: How does the average community member benefit from joining a conservancy? What are the perceptions of different ethnicities on agricultural and pastoral land-use? And, what are the advantages and disadvantages of living in proximity to protected wildlife areas?

The former KGR is the most subdivided group ranch in the Amboseli ecosystem, making it an ideal region for studying the effects of land privatization and fencing on land-use and the surrounding environs (Hemingway et al., 2022). The area was once under an open tenure land agreement, communally occupied almost entirely by Maasai pastoralists. In 1968, with the creation of group ranches in Kenya, the open rangelands were divided into large, (theoretically) easily-manageable, communally-owned parcels of land. In 1996, group ranches began subdividing into individual, private land tenures (Mwangi, 2007). In the early 2000s, KGR became the first group ranch in Kenya to completely subdivide into individually-owned plots of land. The increased sedentarization of the local population has resulted in the fencing off of wildlife corridors and natural resource areas, heightening human-wildlife conflicts and depleting flora biomass in overgrazed land (Groom & Western, 2013). These effects have been mitigated somewhat by the creation of conservancies, which in the past 15 years have allowed individual landowners to amalgamate their individual parcels of land into communal areas again. The landowners who participated (and continue to participate) in this land "recommoning" are mainly Maasai (Kiaka et al., 2024).

Two-thirds of Kenya's wildlife lives outside of state-managed protected areas – – meaning they share the same land as people (KWCA, 2020; MTW, 2018). Common megafauna include African elephants (*Loxidonta africana*) and Maasai giraffes (*Giraffa camelopardalis tippelskirchi*). Plains zebras (Equus quagga) and various antelope species are ubiquitous. Predators like black-backed jackals (*Lupulella mesomelas*), spotted hyenas (*Crocuta crocuta*), and African lions (*Panthera leo*) are also ordinarily sighted in the region. Elephants pose the greatest threat to landowners in southern Kenya due to their vast home ranges and voracious crop-raiding capabilities (Tiller et al., 2021). Predation of

livestock by carnivores is also a source of conflict in the region, though mitigation strategies against predation (i.e. predator-proof bomas) are more effective than those against elephants (Manoa, 2016; Okello, 2005). The encroachment of urban areas into wildlife habitats is a significant driver of human-wildlife conflicts, often fueled by agricultural expansion that displaces animals from their natural habitats. While legislation has been introduced to respond to human-wildlife conflicts — like the *Wildlife Conservation and Management Act* (GOK, 2013) — attitudes towards wildlife are fairly cautious in the Amboseli ecosystem.

2.2 Research methods and approach

2.2.1 Data collection

The data this paper analyzes was collected through field surveys, a method piloted with brief human-wildlife conflict-related questionnaires in February 2023. The questionnaire for this project covered six topics: demographics, agricultural earnings, livestock earnings, conservation earnings, land-use preferences, and incentivizing conservation. We used KoboCollect to digitize the questionnaire and record data forms in the field. The questionnaire consisted of 84 questions and sub-questions; roughly 50% of the questions were conditional, meaning that the shortest interviews answered only about 42 questions. Considering a large portion of our project involved (approximate, rather than exact) income analysis, we spent ample time designing an ethically-sound method for collecting financial data. For all financial inquiries, we utilized local units of measurement. These units, such as a standard 90kg bag of maize, or a single goat, maintain a consistent weight or size. However, they are subject to seasonal price fluctuations, particularly noticeable in livestock costs. To address potential inconsistencies, all financial questions were framed in relation to the prevailing prices of these units during the first week of fieldwork. Additionally, the survey respondents were briefed on these unit prices through the translators. For example, one finance question aimed to determine the expenses associated with farm upkeep in the previous year: "With all the money you spent on your farm in 2022 (i.e. seeds, water, labor, etc.), how many bags of maize could you buy today?"

The questionnaire was initially expected to take 30-45 minutes but took 20-30 minutes in practice. The process became faster after the first two days of fieldwork once our translators became fully acquainted with the language and delivery of the survey questions. The questionnaire was digital, written in English, and modified after the first fieldwork day to include and exclude certain questions; the fourth version of our questionnaire was the final one. In total, 150 landowners were surveyed at the household level. Households were selected randomly and spread across four villages (Namelok, Kwa Kuku, Oloile and Oltepesi) in the former Kimana Group Ranch (Figure 2). The distribution was such that 22 surveys were done in Kwa Kuku, 40 in Namelok, 46 in Oloile, and 42 in Oltepesi.

We also conducted 10 key informant interviews with conservation officers from NGOs working in the areas such as Big Life Foundation, Amboseli Land Owners Conservancies Association (ALOCA), International Fund for Animal Welfare (IFAW),

Kilitome Conservancy, Nature Kenya, and with an honorary warden, as well as a researcher from Amboseli National Park. The complementary nature of the landowner responses and the key informant interview provided us with a well-rounded view of the conservancy system, the effects of land subdivision on wildlife dispersal corridors, and the challenges facing both residents and conservation officials in the Amboseli ecosystem.

2.2.2 Data analysis

We used a mixed methods approach to analyze the data. All of the survey data from KoboCollect was transferred to Google Sheets. For our quantitative financial data, we first converted all local units into prevailing prices for the week of April 16th, 2023 (*Table 1*). These prevailing prices were determined both through an analysis of Kimana's weekly market and by the median response from four local people who are knowledgeable about market prices. For qualitative data from our questionnaires and key informant interviews, we used thematic analysis to categorize responses into themes and sub-themes. For example, for responses to the survey question "What makes pastoralism a difficult land-use option?" we essentialized respondents' free-form verbal responses into major themes: "lion attacks" and "wildlife killing livestock" became "Wildlife Predation"; "lack of rainfall" and "no more water for cows" became "Drought," and so on.

Table 1: Price key for determining financial data

Price Key (Averages for Week of 4/16/23)		
Unit	**Price (KES)**	**Price (USD)**
1 Bag of Maize	Ksh6400	$49.92
1 Bag of Beans	Ksh18000	$140.4
1 Bag of Spinach	Ksh1300	$10.14
1 Mature Cow	Ksh56000	$436.8
1 Calf	Ksh20000	$156
1 Mature Shoat	Ksh14000	$109.2
1 kg of Peppers	Ksh70	$0.546
1 Box of Tomatoes (120Kg)	Ksh9000	$70.2
1kg Melons	Ksh40	$0.312
1kg French Beans	Ksh30	$0.234

After standardizing all of the financial data from the survey, we analyzed the cash flow of each interviewed household and its total liquidity based on earnings from agriculture, pastoralism, conservancy payments, and any other aspects of household income. We also determined the approximate amount of money spent by each household per land-use option. The values presented during the results section have been converted from Kenyan shillings (KES) to US dollars (USD) at a fixed exchange rate.[ii] The discrete monetary outcomes each household sustains from the upkeep of its land have not been

[ii] USD amounts shown were converted from Kenyan shillings at a fixed exchange rate of 1 KES = .0078 USD (as of 24 Aug. 2024).

thoroughly explored in this region of Kenya before; consequently, most land-use comparisons have been made on speculative rather than quantitative pecuniary grounds. Land-use comparisons that allow the ability to quantitatively analyze the data should ideally provide a stronger evaluation of the socioeconomic motivations behind agriculture proliferation in the Amboseli Ecosystem as a whole — a valuable asset to future researchers in the area.

Many of the statistics in this paper stem from simple percentage, proportion, mean, and median calculations. If a trend was observed, we examined the statistical significance of each trend.

Chi-square tests were employed to assess whether the observed frequencies in two sample categories differed from the expected frequencies (assuming no association between the variables). The test assumes that the sample observations must be independent of each other, that each expected frequency should be at least 5 for reliability, and that the sample size should be sufficiently large. In this paper, Chi-square tests are listed with the format "χ^2 (*degrees of freedom*, *sample size*) = *Chi-square value, p-value.* The critical values are not listed, under the assumption that all Chi-square tests included in the paper have Chi-square values large enough to reject null hypotheses.

One-way analysis of variance (ANOVA) tests were used to compare sample means. They are listed using the format (*F-value* (*degrees of freedom between*, *degrees of freedom within*) = *F-statistic*, *p-value*). Scheffé's Test was used as a post-hoc analysis for ANOVA tests to control for Type 1 error and is listed using the format (*F-value* (*degrees of freedom between*, *degrees of freedom within*) = *F-statistic*, *p-value*). Contextual 95% confidence intervals (CIs) were included as necessary.

2.2.3 Study limitations

The biggest potential limitation for this study was the language barrier. Though each translator had gone through and studied the survey (and had access to it prior to fieldwork), there is a possibility that aspects of our questions and respondents' answers were lost in translation. We were also aware that locals in the KGR sometimes harbor negative perceptions of conservation groups. Even though our research team was not part of any conservation organization, we understand that due to the content of our questionnaire, certain mistaken correlations might have been made. These presumed affiliations between us and area conservation institutions might have had an effect on respondents' answers. To mitigate that, we left our conservation land-use questions to the end of our survey and repeatedly assured the respondents that we were impartial researchers.

This study was about earnings and land-use practices in 2022, which was a drought year. Our financial data has been adjusted for this year, as explained above, to maintain a level of consistency. In addition, while 2022 was a particularly dry year – where people might have sold more livestock than usual — the findings of this study are still very much relevant to this region: being an ASAL area, the Amboseli ecosystem experiences frequent droughts that have huge impacts on the local land-use practices (agricultural, pastoral, or otherwise). Studies undertaken during drought years will only

become increasingly relevant as the frequency of droughts in sub-Saharan Africa has nearly tripled since the 1970s (Zeufac et al., 2021).

2.3 Ethics considerations

This research complies with the guidelines of the Institutional Review Board (IRB) for the School for Field Studies on the ethical responsibilities and guidelines of research being conducted in Kenya involving human subjects. The ethics approval no. is 2023-04-KY-02.

3. Results

One of the most significant findings of the study is that there are major discrepancies in the pro-agriculture narrative in the study area. The clearest sign of this is the difference between perceptions of agriculture's profitability and the actual cash flow contributing to agricultural households' average liquidity. In terms of livelihood, households primarily practicing agriculture made up the majority of our samples. Concurrently, agricultural livelihoods edged out other livelihoods in our study of preferred livelihood options and were the clear majority when we measured what respondents perceived other landowners' land-use preferences to be. There is discordance between these preferences and the actual profitability of agriculture or pastoral land-uses. Our research found that households that reported receiving agriculture income in 2022 averaged the least amount of earnings, and overall, agriculture contributed the least to the average household in 2022. Previous studies on primary livelihood options in the Amboseli Ecosystem — even those as recent as 2020 (Njuguna & Mburu, 2021) — found livestock keeping to be the most important source of income in the region, which correlates with this study's cash flow analysis. Though past studies such as Hemingway et al. (2022) have made assertions regarding agriculture's comparative profitability in the Amboseli ecosystem, our findings indicate this is not always true for those in the KGR. Below is a detailed analysis of our survey data.

3.1 Primary versus preferred livelihood and land-use options

Our findings indicated that agriculture-based work ("crop farming" + "farm laborer") constitutes the primary source of livelihood for 45.33% of the 150 respondents (Figure 3); pastoralism was a close second, at 36% (n=150) of respondents. These statistics roughly aligned with respondents' preferred livelihood option: when asked for their livelihood preferences, the margin between agriculture and pastoralism was smaller — agriculture amounted to 43.33% (MOE = 7.93%),[iii] and pastoralism amounted to 40.7% (MOE=7.86%) of the 150 respondents (Figure 4). This margin becomes even smaller if looking exclusively at land-use options (i.e. removing "farm laborer" from the total agriculture percentage): 41.33% (n = 150) of respondents preferred to use their land solely for crop farming (the same percentage as those actually using their land for crop farming, compared to those 40.7% (n = 150) who preferred pastoralism. When respondents were

[iii] Margin of Error (MOE) calculated assuming a 95% confidence level; Z-value=1.96.

asked to indicate what they saw as the most preferred land-use option in the Kimana area, a majority of 69.3% (n = 150) responded with agriculture (Figure 5). 26.57% (n = 150) of landowners had leased their land for crop farming in 2022. Overall, agricultural land-use was a more prominent choice in terms of actual land-use, occupation, and preference among landowners surveyed. However, more respondents wanted to practice pastoralism than actually did.

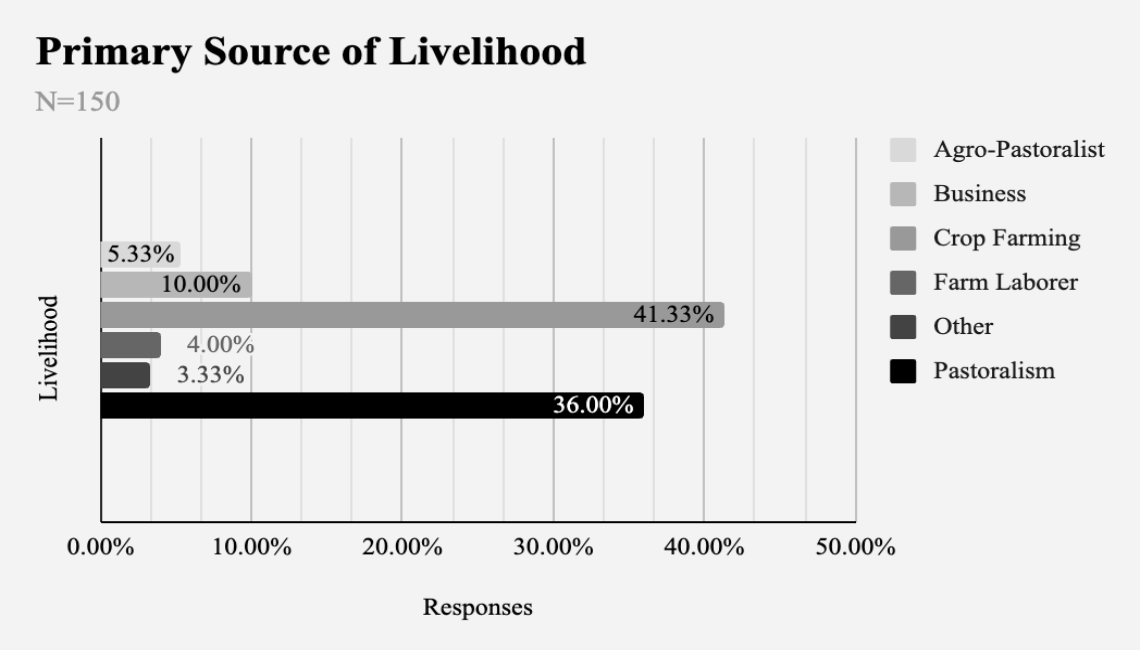

Figure 3: Primary source of livelihood in the former KGR (N=150)

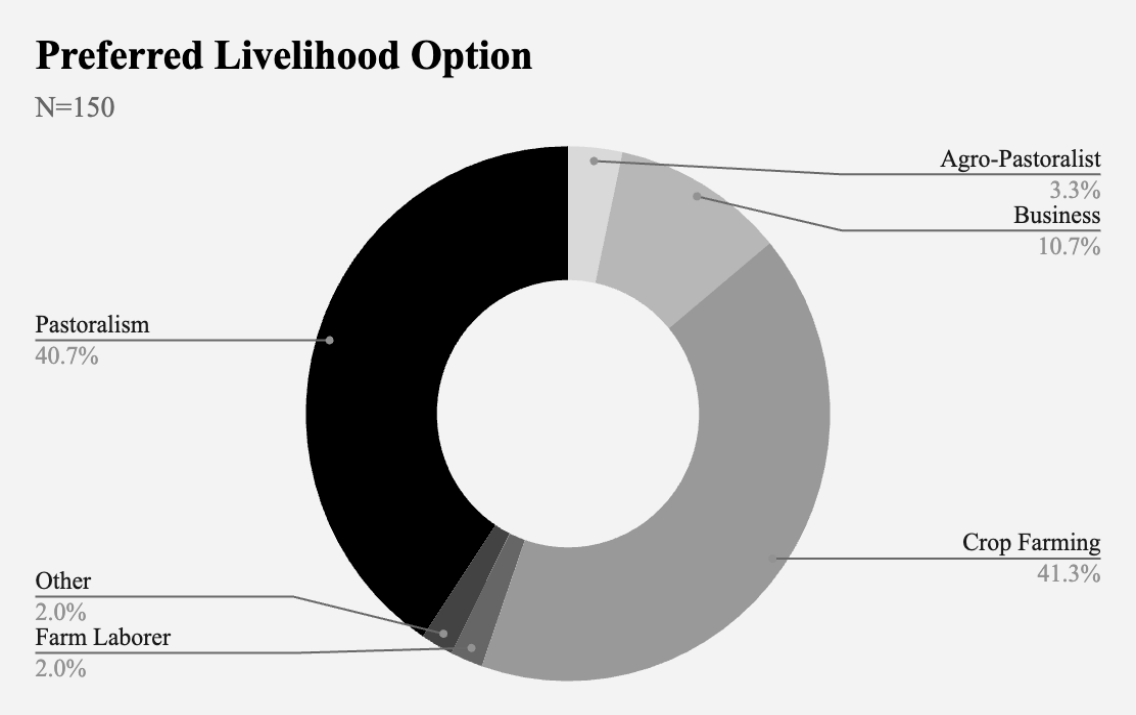

Figure 4: Respondents (N = 150) were asked which livelihood option they would prefer to practice "in an ideal world." Responses differed slightly from their primary source of livelihood

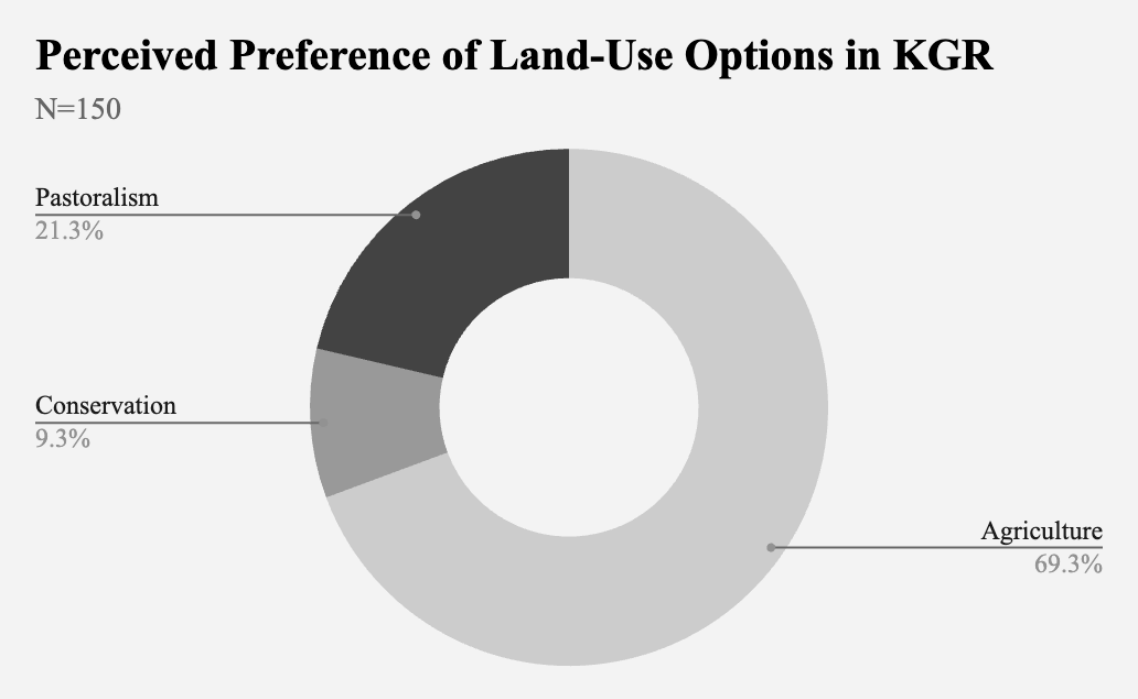

Figure 5: Respondents (N = 150) were asked which land-use option they thought was most preferred by their neighbors: pastoral, agricultural, or conservation-based (i.e. conservancy)

3.2 Ethnicity, livelihood preferences and land-use change

Of the 34.6% of respondents (N=150) who reported switching their primary source of livelihood within the last five years, 71.16% of them (n = 52) switched from "no agriculture" to "agriculture" or "agro-pastoralism" (Table 4a). Our data also illuminated significant differences between the livelihood preferences of the Maasai respondents (71.33%, n = 107) and non-Maasai respondents (28.67%, n = 43). For example, Maasai respondents were less likely to use their land for agriculture than non-Maasai respondents (74.42%), even though agriculture was the most ubiquitous choice of livelihood across all respondents (N = 150) (Table 2). A Chi-squared test determined that this ethnically-conditional preference was statistically significant: χ^2 (1, N = 150) = 13.61, $p < .05$. The primary source of livelihood also differed by ethnicity (Figure 6). Non-Maasai respondents were almost twice as likely to have agricultural livelihoods. As expected, Maasai respondents were chiefly pastoralists.

Table 2: Relationship between ethnicity (Maasai/non-Maasai) and using land for agriculture

Relationship Between Ethnicity and Agriculture Land-Use				
***N* = 150**	Practice Agriculture:	Yes	No	Total
Maasai	Responses:	44	63	107
	Percentage of Maasai:	41.12%	58.88%	100.00%
Not Maasai	Responses:	32	11	43
	Percentage of non-Maasai:	74.42%	25.58%	100.00%

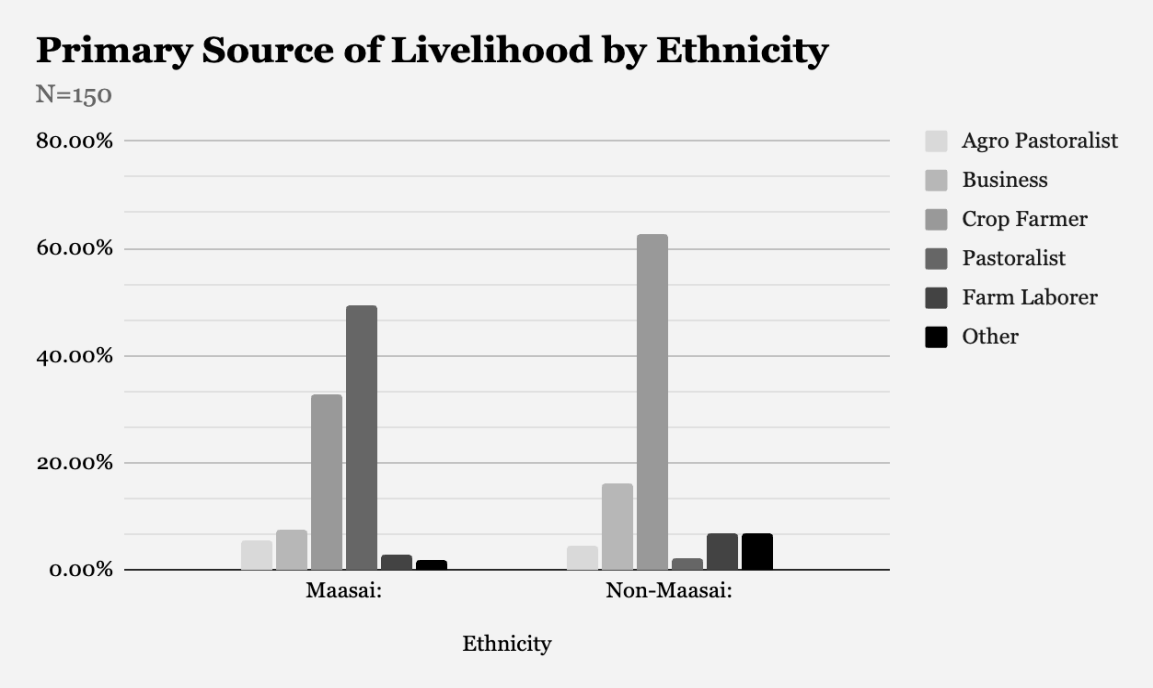

Figure 6: Relationship between ethnicity (Maasai/non-Maasai) and using land for agriculture (N = 150)

A Chi-squared contingency test (df = 1, N = 150, χ^2=8.99, p < .05) revealed a statistically significant difference in the occurrence of livelihood changes between Maasai and non-Maasai respondents. Maasai respondents (42.06%, n = 107) were more likely to have switched livelihoods in the last five years compared to non-Maasai respondents (16.28%, n = 43) (Table 3). Of the 52 respondents who changed livelihoods, pastoralists (61.54%, n = 29) were particularly likely to have switched (Table 4a, Figure 7). Most of those who changed livelihoods transitioned to agriculture (36.54%, n = 19) (Table 4b).

A further Chi-squared contingency test (df = 2, n = 45), χ^2 = 7.93, p < .05) demonstrated a statistically significant difference in the types of livelihoods that were switched to agriculture. The majority of those who shifted to agriculture-based livelihoods came from pastoralist backgrounds (57.89%) (Table 4b). This finding indicates that the rate of switching to agriculture among non-agriculturalists was significantly higher among pastoralists (Figure 7). Overall, these results suggest that while the Amboseli Ecosystem is indeed experiencing a shift towards agriculturalism, Maasai landowners are disproportionately undergoing this shift (Table 3).

All 18 respondents who switched to agro-pastoralism came from exclusively pastoralist backgrounds. More pastoralists switched to agro-pastoralism than to agriculture and business combined. This finding implies a reluctance within pastoralist communities to completely abandon pastoralism as part of their income stream.

Table 3: Likelihood of changing livelihood over the past five years

Likelihood of Changing Livelihood over Past Five Years by Ethnicity		
Ethnicity	Maasai (n = 107)	Non-Maasai (n = 43)
No. of respondents likely to change livelihood	45	7
Percent of n	42.06%	16.28%

Table 4a: Livelihood switches over the last five years: where respondents changed from

Livelihood changes (*n* = 52)				
Original Livelihood:	**Agriculture**	**Agro-Pastoralism**	**Pastoralism**	**Business**
# of Respondents:	7	5	32	8
% of *n*:	13.46%	9.62%	61.54%	15.38%

Table 4b: Livelihood changes over the last five years: where respondents changed to

Breakdown of Livelihood Switch (Destination) (*n* = 52)				
Destination:	**To Agriculture**	**To Agro-Pastoralism**	**To Business**	**To Pastoralism**
# of Respondents:	19	18	4	11
% of Respondents who Switched	36.54%	34.62%	7.69%	21.15%
Origin:	**Agro-Pastoralism**	**Agriculture**	**Agriculture**	**Agriculture**
% of Respondents at Destination:	10.53%	0.00%	0.00%	63.64%
Origin:	**Business**	**Business**	**Agro-Pastoralism**	**Agro-Pastoralism**
% of Respondents at Destination:	31.58%	0.00%	25.00%	18.18%
Origin:	**Pastoralism**	**Pastoralism**	**Pastoralism**	**Business**
% of Respondents at Destination:	57.89%	100.00%	75.00%	18.18%

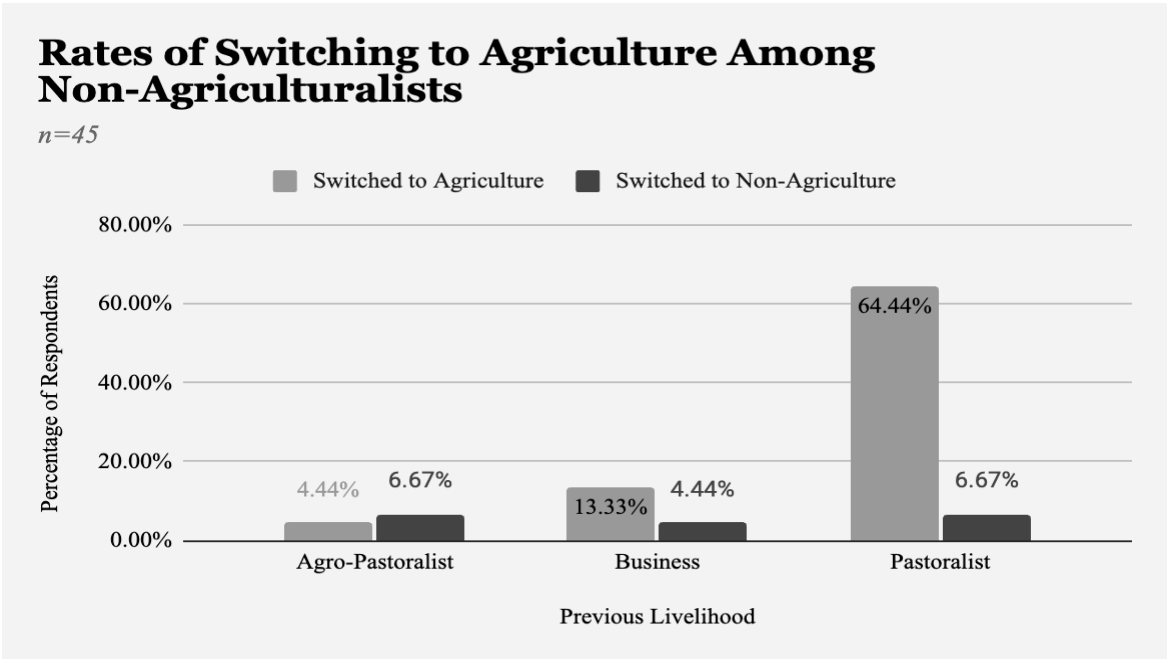

Figure 7: Rates of switching livelihood to agriculture among non-agriculturalists (n = 45)

3.3 Local perceptions on conservation as a viable land-use option

Conservation-related land-use options were, on the whole, not preferred by respondents. However, whether a respondent ranked land-use practices first or not (out of conservation, agriculture, and pastoralism) was somewhat dependent on ethnicity. Whereas 14.02% (n = 15) of Maasai landowners were more likely to rank conservation — read: leasing their land to conservancies — first, none of the non-Maasai respondents indicated any conservation preference (Figure 8).

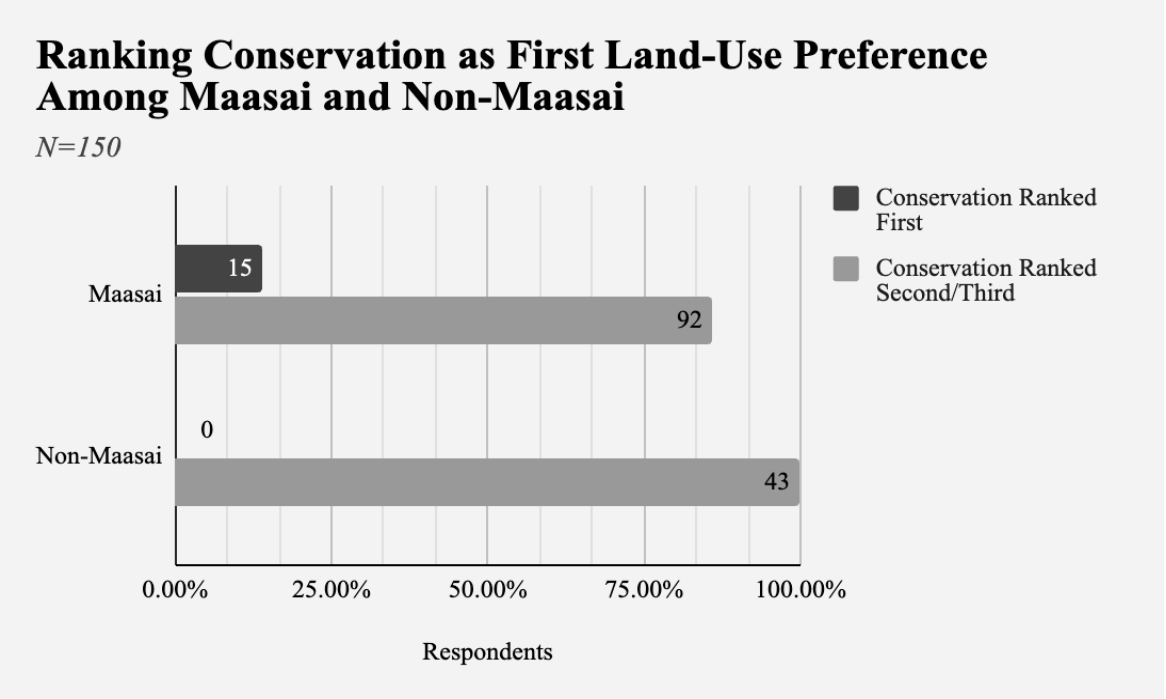

Figure 8: Ranking conservation as the first land-use preference by ethnicity

A Chi-squared contingency test (df = 1, N = 150), χ^2 = 5.07, p < .05) showed a statistically significant difference between respondents' likelihood of using land for agriculture and whether or not they ranked conservation first (out of pastoralism, agriculture, and conservation land-use options). Respondents who did not use their land for agriculture were far more likely to rank conservation first (Figure 9).

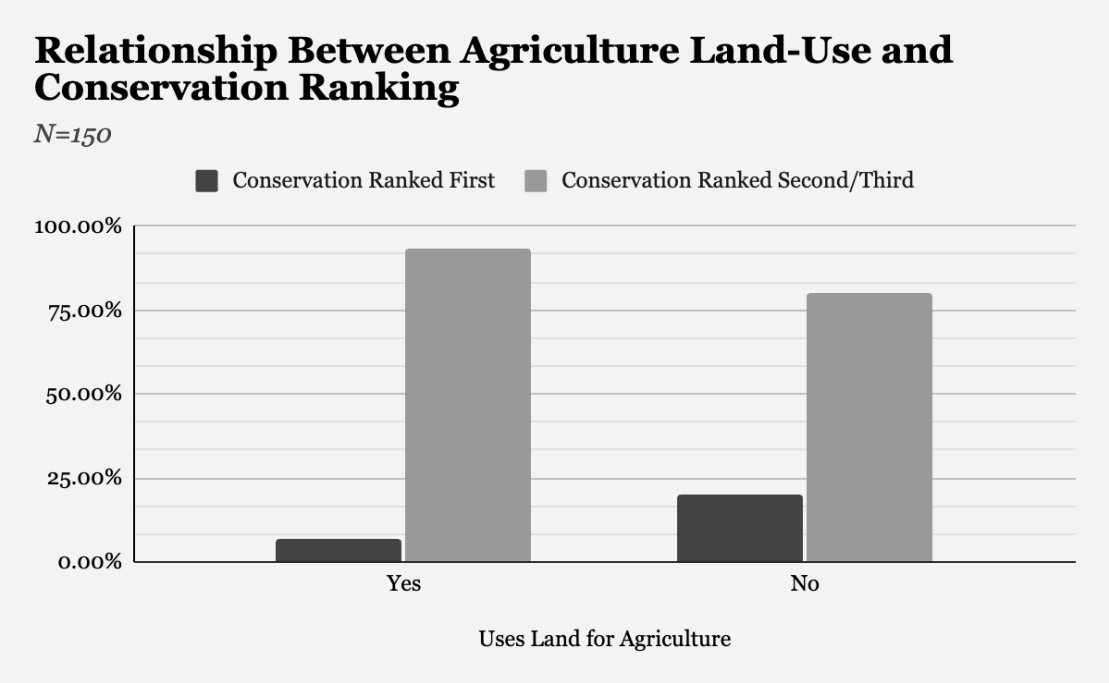

Figure 9: Relationship between using land for agriculture and ranking conservation first (N = 150)

Respondents were also asked what incentives would make conservancy land-use more appealing to them. Of those who answered (n = 126) (Table 5), 25.20% cited increased lease-fee payments, 23.62% cited stronger separation between humans and wildlife, and 11.02% cited increased transparency between conservancy higher-ups and conservancy members. Overall, 39.37% of those who responded cited increases in payments ("Increasing Lease-Fee Payments" + "Increasing Financial Aid"), and 9.45% of responses cited better employment opportunities.

Table 5: Respondents listed incentives that would increase conservancy membership appeal

What Would Make Conservation Land-Use More Appealing to You? (*n* = 126)				
Increasing Conservation Education	**Allowing Members to Cultivate Land**	**Creating Employment**	**Increasing Financial Aid**	**Expanding Grazing Rights**
4.72%	0.79%	9.45%	14.17%	2.36%
Addressing Human-Wildlife Conflicts	**Increasing Lease-Fee Payments**	**Creating of Institutions and Social Amenities**	**Creating Transparency**	
23.62%	25.20%	8.66%	11.02%	

3.4 Cash flow across the three land-uses

There were large discrepancies between livelihood, land-use and profit over 2022 (Figure 10). Farm laborer households — in this case, households where working members were contracted weekly or monthly by area farms — had the highest profits, though they only made up 4% (n = 6) of respondents. Several factors may have contributed to this, the primary one being that laborers who work on other landowners' farms have relatively

stable incomes regardless of the farm's crop yield. Like those whose primary livelihood choice was business, farm laborers often have several income streams and cycle through different farm contracts multiple times a year. Farm laborers are also usually employed by larger corporate farms, whose access to boreholes and electric fences makes them more financially successful.

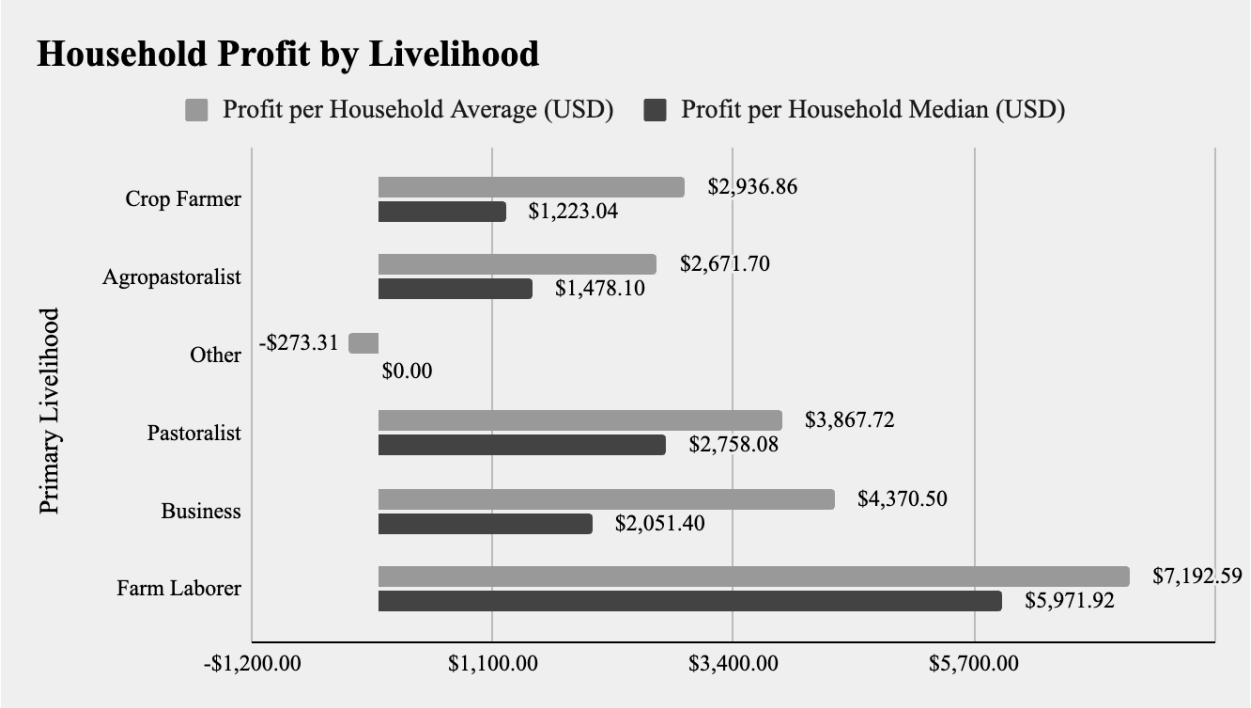

Figure 10: Household profit (net earnings – net expenditures) by livelihood choice over 2022 (N = 150). Values converted from Kenyan shillings at a fixed exchange rate

Comparing pastoralists and crop farmers, who made up 36% (n = 54) and 41.33% (n = 62) of our respondents, respectively, pastoralists had a higher annual average and median profit margin. While crop farmers' average household profit hovered around $1000 less than pastoralist households, the median for crop farming household annual profit averages was over $1,500 less than pastoralist households. The profit mean and standard error for each livelihood option allowed us to calculate the signal-to-noise ratio (SNR) of each mean to determine its reliability (higher SNR numbers indicate more reliable estimates). The pastoralism mean estimate had the highest reliability with a SNR of 6.428, followed by crop farming's SNR of 4.336. Crop farming households were also twice as likely as pastoralist households to have net-negative profits over 2022. However, pastoralist households had higher expenditures on average.

It is worth noting that the 95% confidence intervals (CI) for the profit means were relatively wide: the pastoralism CI was ($2,660.79 – $5,074.67), and the interval for crop farming was ($1,582.53 – $4,291.20); these CIs indicate risks of multicollinearity with the mean estimate. Additionally, the differences between the median and mean profits demonstrate significant skewness, mostly positive. Because the individual profits are not

symmetrically distributed, the median profit numbers may, therefore, be a better indicator of the data's central tendency.

Liquefiable assets for households also differed based on their stated primary land-use option (Figure 11).[iv] Considering "Conservation" households receive semi-annual lease fee payments from their conservancies in addition to the income from their livestock, it is notable that they actually have lower average liquidities than pastoralist households. There are multiple possible explanations for this phenomenon — the most significant being that conservancy members may suffer more from resource degradation while sharing their land with other pastoralists and native wildlife. Additionally, some of our "Conservation" respondents cited that non-conservancy-member pastoralists often graze livestock on their land.

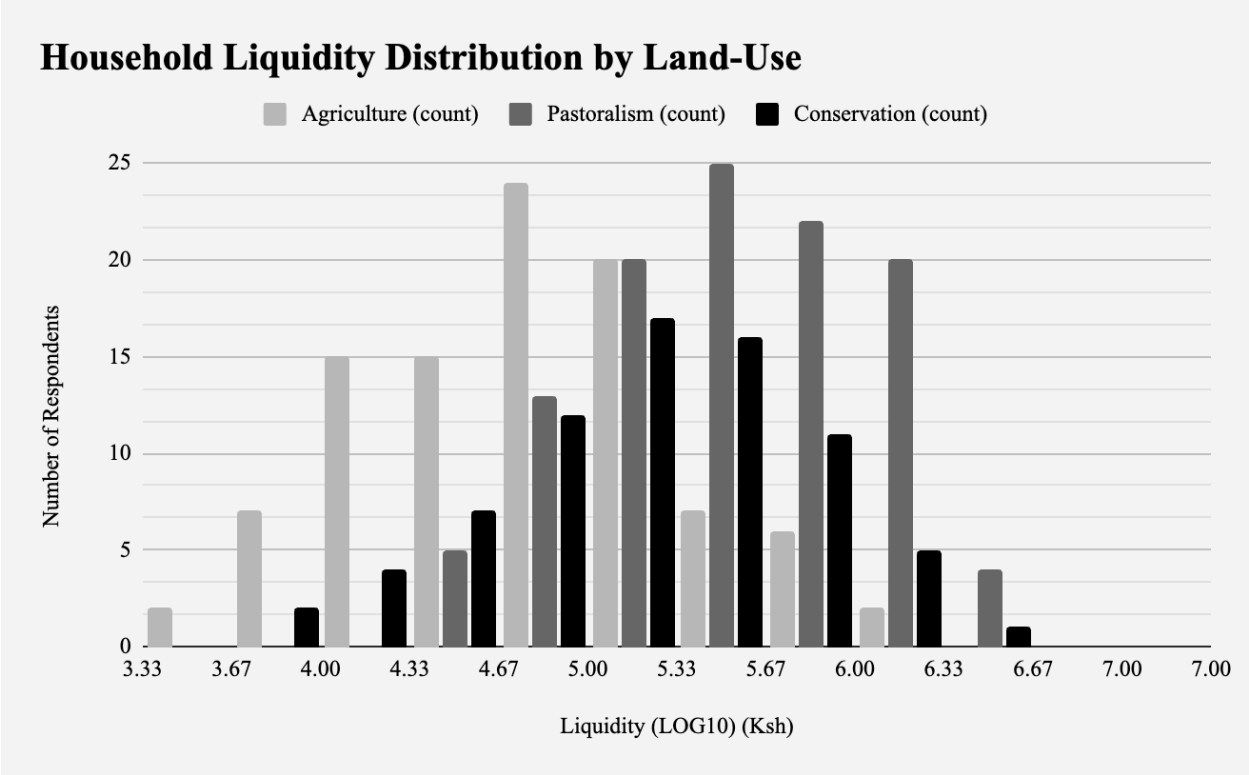

Figure 11. Logarithmic histogram showing the spread of liquidity among households who made earnings from agriculture, pastoralism, or conservation

Liquidity was calculated in different ways for each land-use group. For livestock owners (pastoralist and conservancy households), cattle, goats and sheep function as frozen financial assets, and the valuation of a household's livestock is added to their other assets. Crop farmers do not have a comparable set of assets — if a crop yield is low or even zero, there are few other assets on the farm that can be liquified to make ends meet (aside from selling/leasing cropland itself).

[iv] Because conservation-related land-use options indicate a landowner practices pastoralism on conservancy land, the three major livelihood options can be thought of as practicing "Agriculture" versus "Pastoralism" versus "Pastoralism on Conservancy Land."

The difference in earnings between conservancy members and non-members was also significant. The scatter plot below (Figure 12) shows the spread for net earnings (total income minus total expenditures) made per household in 2022. Conservancy members (n = 65) had a wider spread than non-members (n = 85), who often made less than $1,950 over the course of 2022. Additionally, the overall earnings average per household between members and non-members was significantly different: member households averaged $5,609 in profit, while non-members averaged only $1,824. The median profit per household between members and non-members was $4,368 to $287, respectively, or a ratio of 15.22:1.

Figure 12: Total earnings between conservancy members and non-members over 2022 (N = 150). Values converted from Kenyan shillings at a fixed exchange rate

The yearly profit variations between conservancy members and non-members were considerable when matched against ethnicity (Figure 13). Maasai member households had significantly higher profits than other groups in 2022, averaging $5,797. A one-way analysis of variance (ANOVA) test, performed to compare the effects of ethnicity and conservancy membership on the average yearly household earnings, revealed there was a statistically significant difference in earnings between at least two groups: Maasai members and non-members ($F(3, 146) = 10.16$, $p = .00000404$). Post-hoc tests using Scheffé's method determined that the mean earnings were significantly different between the following groups: Maasai members and non-members ($F(3, 146) = 8.20$, $p < .05$), Maasai members and Non-Maasai members ($F(3, 146) = 30.05$, $p < .001$), and Maasai non-members and Non-Maasai non-members ($F(3, 146) = 7.04$, $p < .05$). There was

no statistically significant difference between non-Maasai members and non-Maasai non-members.

When the contribution each household's primary livelihood preference made to its overall total earnings was measured, crop farming's cash contribution was far lower than pastoralism's contribution. For households that indicated crop farming as their primary land-use option, crop farming composed an average of 25.16% of their earnings in 2022. The median contribution per household was lower, with farming constituting roughly 20.41% of median crop farmer earnings. For households that indicated pastoralism as their primary land-use option, livestock contributed an overwhelming average of 134.53% of their earnings. The median contribution per household was lower, with livestock constituting 104.92% of median pastoralist earnings. These findings suggest that crop farming landowners have a highly diversified income source (other possible income streams may include leasing cropland or working for other farms) but a low overall yield for their preferred livelihood option. Crop farmers may often need other income streams during drought years. On the contrary, pastoralists seem to rely solely on pastoralism for their income. Their profit yield is higher, suggesting that they double down on livestock trade even during drought years, with relatively high success.

Figure 13: Household profit (net income – net expenditures) averages and medians by membership and ethnicity combination (N = 150). Values converted from Kenyan shillings at a fixed exchange rate

4. Discussion

The aim of this paper was to determine the validity of pro-agriculture land-use assumptions in the Amboseli ecosystem. We also attempted to quantify the average earnings of households depending on specific land-use options. Our subsequent goals were to determine the ontological and socioeconomic justifications for these land-use changes in order to better understand what benefits landowners see in certain land-use practices.

The data shows that communities in the Amboseli ecosystem see agriculture as the most financially viable land-use option in this region, pastoralism as a close second, and leasing land to conservancies as a distant third. This confirms an existing agriculture *populism*. Multiple competing variables affect these assumptions: recurrent droughts can drastically change the microclimate in southern Kajiado, which is a fragile arid/semi-arid land (ASAL) zone (IPC, 2022); erratic rainfall patterns have negative effects on pastoral and agricultural incomes (Amwata, 2016); there are increased perceptions of traditional pastoralism as being less profitable on average than more-profitable crop farming (Hemingway et al., 2022); conservancies, being relatively nascent, may not have earned the complete trust of the community as an adequate contributor of income, especially as starting lease fee rates are as low as Ksh600 ($4.68) per acre per year.[v] The ecosystem is in flux, and the instability has given rise to the idea that agriculture is a profitable alternative to preexisting lifestyles. However, as mentioned in the introduction, widespread narratives often eclipse inconsistencies — the data analyzed in this paper demonstrates this.

4.1 Agriculture *populism* versus agriculture earnings

Differences between past studies and this study may be attributed to the timing of the field research: our study was concerned with the income of a drought year when rainfall levels were hardly enough to yield crop results without the use of boreholes or stream-pumped irrigation. However, considering Kajiado County's 36.9% poverty rate (CSA, 2016), it is probable that a significant portion of those who attempt agriculture have neither the funds for drilling boreholes nor for irrigation infrastructure (and even those wealthy enough to do so risk depleting natural resources). There is a need for further research to determine what percentage of those who farm successfully in the Amboseli ecosystem actually live in this region.

The ethnicity statistics also bring light to the disparities between pastoralist and agricultural households. The data shows that Maasai respondents were far more likely to switch primary livelihoods to agriculture over the last five years; the majority of those who switched to agriculture land-use cited drought-related problems when rearing cattle, which doesn't bode well for practicing agriculture in a drought-prone ecosystem. A majority of non-Maasai respondents practiced crop farming on their land, compared to only a minority of Maasai respondents. Southern Kajiado has seen a phenomenon of

[v] Officer, Big Life Foundation; Key informant interview; Imbirikani, 18 April 2023.

non-Maasai people moving to the region specifically to practice agriculture over the past several decades. This has reduced the percentage of Maasai in Kajiado county from 78% in 1968 to an estimated 40% today (Ntiati, 2002). The influx of non-Maasai agriculturalists into the former KGR has spurred the growth of the agriculture industry in the Amboseli ecosystem as a whole. Many who come to the Kimana area are already wealthy and have either a) enough land to make a profit, even during drought years, or b) streams of income in other parts of Kenya that are not as vulnerable to climate change (Kimani & Pickard, 1998). It would seem that local Maasai landowners who have been struggling financially see wealthy farms and subsequently decide to take up farming, only to be dragged further down the economic ladder when they cannot afford the high costs inherent in tilling non-arable land (IPC, 2022). In this semiarid area, successful farming is heavily dependent on irrigation and fertilizer/pesticide use, which, as noted by several respondents practicing agriculture, is quite costly. It is also likely that not all of the money generated by successful non-Maasai, non-resident farmers in 2022 was recirculated back into Kajiado County's economy (though further research is needed on this point). We therefore observe that, for most people in the KGR, the economic risks of making agriculture their primary land-use option far outweigh the benefits — especially during drought years.

4.2 Pastoralism as a conservation-compatible land-use option

Pastoralism has been the most prominent land-use and livelihood option in the Amboseli ecosystem for centuries, even though that prominence is declining. The data shows that most of the respondents who switched from pastoralist livelihoods switched to agricultural livelihoods, signaling that there is a growing perception of crop farming as more profitable than pastoralist or conservation-based land-use options. However, our study shows that pastoralism consistently brings in the most amount of cash to the average household in former KGR; households that reported receiving income from pastoralism also had the highest cash flow in 2022 on average. Considering livestock markets comprise 17% of Kenya's economy (World Bank, 2022), the benefits of keeping and selling livestock are apparent: pastoralism has been and continues to be the most lucrative land-use option for the average KGR resident.

The caveat of this specific finding is that during drought years such as 2022, people tend to sell livestock to make up for economic losses or to ensure enough financial stability to pay for school fees and increasingly expensive food. However, as we showed by the average liquidity for pastoralist households in 2022, those primarily practicing pastoralism have far more cash to use. This finding aligns with past studies examining how pastoralists use livestock herds as collateral from which to access credit, which is especially helpful during recurrent droughts (Njuguna & Mburu, 2021). During the worst droughts, the lack of rainfall has harsher consequences for those practicing agriculture (save for those few who can afford irrigation, fertilizer, and other costly forms of farm maintenance) than for those practicing pastoralism. While pastoralists with large herds often see large portions of their livestock die, they still have options to sell what cattle or sheep and goats they do have and to liquify their assets (Njuguna & Mburu, 2021).

Farmers often end drought years by barely breaking even; someone with an agricultural livelihood may need to do casual farm jobs to get needed liquid cash during dry years. During the best of times, farming can be just as lucrative as pastoralism — though in a climate with increasingly sporadic rainfall, it remains a difficult and unpredictable land-use option for many in the former KGR. Pastoralism is, for many reasons, finely tuned to be an accessible land-use option in the Amboseli ecosystem. Furthermore, as shown in the extant literature, it has been the source of livelihood for the majority of the Maasai Amboseli ecosystem for years (Hemingway et al., 2022). Evidently, the Maasai who have switched livelihoods recently have made efforts to retain pastoralist practices.

4.3 Implications for conservation

The question remains: what are the impacts of these trends on conservation in the region? As the data shows, conservation was consistently ranked the least-preferred land-use option during our study — even though, as our interview with a conservation officer from IFAW illuminates, conservancy leases entail "minimum investment for maximum output." [vi] While more qualitative data justify this position— namely low lease-fee payments, human-wildlife conflicts, and prohibition of agricultural production on conservancy-leased land — leasing land to conservancies still represents the most stable source of income in the former KGR. The lease-fee payments from Big Life Foundation[vii], currently, stand at roughly Ksh1,200 ($9.36) per acre per year, [viii] where most conservancies lease land in 60-acre plots. Our analysis shows that conservation-based land-use consistently brought in the second-largest earnings after pastoralism.

Despite the unpopularity of conservation land-use options, there was a notable difference between pastoralists and non-pastoralists' rankings of conservation, in that households that used land for agriculture were less likely to rank conservation first. Maasai were also far more likely to rank conservation first, signaling a greater familiarity with conservation projects among their community. Maasai openness to conservation manifests itself mainly through leasing land to conservancies — A majority of the Maasai respondents indicated they were members of conservancies in the former KGR, compared to a minority non-Maasai respondents. However, that openness also manifests itself through Maasai's preference for pastoralist lifestyles. The implication here is that should more locals turn to agriculture, negative attitudes towards conservation might increase.

[vi] Officer, International Fund for Animal Welfare (IFAW); Key informant interview; Kimana, 24 April 2023.
[vii] Big Life Foundation is a local conservation NGO that leases land from Maasai landowners in Amboseli area for conservation. These are usually done through community conservancies and wildlife corridors.
[viii] Chairperson, Amboseli Land Owners Conservation Association (ALOCA); Key informant interview; Imbirikani, 18 April 2023.

5. Conclusion

When making the choice between pastoralism and agriculture, the former is far more compatible with conservation than the latter. The benefit of traditional land-use practices is that they are integrated into the ecological cycles of the surrounding environs. Thus, pastoralism — which thrives in unfenced, communal land shared with wildlife and other livestock herds — has always integrated successfully with conservationism (Groom & Western, 2013); this belief was one of the motivations behind the creation of group ranches in the 1960s (Mwangi, 2007). Agriculture represents a detrimental shift from conservation projects in the Amboseli ecosystem due to its resource-intensive nature: high water usage drains swamps, streams, and in parts of this region, has tripled the depth to the water table; pesticides and fertilizers deplete the ground of natural mineral resources to the extent that plots of land used for agriculture become barren and fallow after a few seasons (Stettler, 2002). Agriculture also leads to land subdivision, which threatens not only wildlife conservation, but also pastoralism as a lifestyle (Kiaka et al. 2024). When livestock herding is not confined to small, privatized rangelands that can be easily overgrazed, it is complementary to the behavior of native wildlife in the dispersal areas around Amboseli National Park. There is a future for conservation in the Amboseli region — however, it depends less on altering an already-balanced ecosystem than on reverting to a pre-privatized land tenure system.

5.1 Recommendations

Considering that agriculture is no more beneficial than pastoralism, or in fact, is *less* beneficial for the average Kimana landowner, we reach a dilemma: in an ecosystem where droughts are increasingly common, it is difficult to keep large livestock herds; however, it is also too expensive to run a profitable farm. If landowners are still unwilling to lease land to conservancies, how might landowners in the former KGR avoid this lose-lose scenario? We therefore make the following recommendations.

1) Government institutions (i.e. the Kenya Wildlife Service) and NGOs (i.e. Big Life Foundation, IFAW, Amboseli Ecosystem Trust, etc.) that support landowners in this region should invest in non-resource intensive, non-agricultural land-use options that make it easier to keep livestock. As shown in our study, the preference among the dominant group in this region is pastoralism. Those who do not practice it practice agriculture as a sort of last resort brought on by drought or economic downturns. By catering to the specific needs of pastoralists in the region, conservation entities can both decrease detrimental land-use and strengthen goodwill towards conservation. These investments should aim to restore some of the natural resources pastoralists rely on. Conservancies could be re-seeded with drought-tolerant, but nutritious grass varieties during rainy seasons, in order to provide herders with grazing areas during dry seasons. NGO education initiatives could encourage pastoralists to reduce herd sizes so as to minimize livestock deaths and maximize the sales price of each cow or goat. By making it easier for

the local population to keep livestock, we indirectly divest from agricultural expansion in the Amboseli ecosystem.

2) Conservation NGOs and committees running neighboring group ranches could avoid unplanned subdivisions that have carved up the former KGR. The soil and grass biomass degradation in the KGR is a reason not to overuse small plots of land — which arrive with agricultural privatization. Conservancies should also be wary of the negative perceptions of conservation in the Amboseli ecosystem, so as to better market themselves to prospective landowners. The other group ranches in the Amboseli ecosystem are in varying stages of subdivision, and are still open to land-use reversions.
3) Landowners who are thinking about switching land-use to cultivation should understand the cost-benefit risk of beginning to crop farm. Many of the successful farms in this ecosystem rely on heavy water and biochemical usage — it is important to know whether switching to agricultural land-use will actually be more profitable than pastoralism, conservation, or business options.
4) Pastoralists could continue to practice pastoralism; those who have the option should join conservancies without fear of having to stop grazing. The conservancy model's efficacy increases with the addition of each member — more members mean there is more space to graze, and the toll of grazing on rangelands is distributed more widely.
5) Future researchers could focus on the impacts of agriculture in Kajiado County to determine the percentage of successful farmers in the Amboseli ecosystem reside here. Understanding the breakdown of ethnicity, wealth, and location will give a better insight into why people come to Kajiado to farm, how they make profits, and where those profits go. This will further help to demistify the agricultural pupulism.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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