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Original Research Article

New Homes, New Challenges: The Experience of Resettled Maasai Pastoralists of RAPland Village, Olkaria Kenya

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Abstract: Grand development projects sometimes result in the forced relocation of people. The relocation is usually stressful in terms of marginalization and social disarticulation, and more so for pastoral communities. The RAPland village at Olkaria, Kenya, was created to accommodate 155 households that were displaced by the development of a geothermal electricity generation plant. The study aimed to explain how relocation constrained resources for extensive pastoralism and how pastoralists cope through adaptation of old pastoralists' knowledge, attitudes, and perceptions and the creation of new strategies for resilient livelihoods using the case of the RAPland Community. Household surveys, key informant interviews, focus group discussions, and field observation were used to gather required information. It documented information on land, pasture, and water availability and access. It also assessed livestock production challenges before and after the resettlement and adopted coping strategies. Statistical package for social scientists (version 21) software was used in analysing the data after the screening and cleaning were done using Microsoft Excel (2019). There was a general perception that pastures and water availability were significantly ($P<0.05$) affected by the relocation. Besides, herders and their herds travelled longer distances, from a mean of 3.2 ±0.29 to 8.1 ±0.41 kilometres to access pastures. Before the relocation, the highest-ranking constraints were drought, livestock diseases, pasture inadequacy, and wildlife predation. After the relocation, access to water, poor pastures, grazing terrain (gulleys), wildlife predation, drought, and livestock diseases became the significant constraints affecting livestock productivity. In conclusion, the reduction in pastures and water access affected livestock productivity in spite of attempts at coping with encountered livestock challenges, the community's dependence on pastoral livestock is threatened, thus, their food and nutritional security.

Keywords: adaptation mechanisms, livestock production, pastoralism, pasturage, performance, relocation and water.

INTRODUCTION

In the quest to accelerate economic growth and development in the country, the Kenyan government, through a parastatal called the Kenya Electricity Generation Company (KenGen), expanded its existing geothermal energy production plants in the Olkaria area (Olkaria I – IV). This expansion caused displacement and relocation of the Maasai pastoral communities occupying and utilising these areas earmarked with geothermal developments in 2014. In effect, the project-affected persons (PAPs) were resettled in the RAPland village, which was created to host the affected populations. Being pastoralists, they started to complain about the unsuitability of the RAPland area to their way of life – that is, pastoralism, thus their livelihoods. De Wet (2006), in the African context, compensation for lost land and resources has been inadequate, resulting in hunger, starvation, and poverty among the displaced and resettled people.

Presently, the development-induced displacement and resettlement (DIDR) of the people is a significant force migration problem globally (Pankhurst & Piguet, 2009). Resettlement is an essential developmental discourse among developing nations (Belay *et al*., 2005; Asrat, 2006). As such, some 15 million people are affected yearly by public and private developmental projects (Cernea, 2008). Development-induced displacement involves ousting people from their lands or disrupting their access to land-based

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resources to create space for a project; thus, it could have physical and economic attributes and implications. Development-induced displacement is thus the uprooting of the inhabitants from their lands by the government/developer and using it for project up-bring (Wakessa, 2017). Most of these developmental projects (mines, dams, industrial estates, irrigation schemes, urban expansion, conservancies, and tourism development) require a large tract of land and would displace many people (Vanclay, 2017). Development of such projects is necessary, especially in poverty reduction and services delivery for the people. However, the affected people are only sometimes well resettled and compensated. For instance, some 250 – 300 million people estimated to have been displaced in the last 20 years have not been fully resettled. They are left without proper livelihood strategies and are marginalized (Cernea, 2008).

Owing to inadequate planning of resettlement action plans (RAPs) and other shortcomings, resettlement causes impoverishment among the PAPs. Cernea (2007) developed the Impoverishment Risks and Reconstruction model (IRR) that identified interlinked risks of food insecurity, high prevalence of diseases, loss of homes, loss of jobs, loss of land, and property, loss of jobs and social disintegration that are associated with displacement and resettlement. Tan and Yao (2006) stated that forced or involuntary resettlement results in population dislocation, human misery, and disasters in Africa, destroying indigenous production systems and social fabric and creating risks of impoverishment among the communities. Displacement does not only lead to the loss of physical capital (productive lands, homes, and jobs) but also non-physical capital that includes relatives, neighbors, and social affiliations and ties (Tesfa, 2014). Vanclay (2017) highlighted inadequate baseline data, budgets, unrealistic timeframes, and poor understanding of local social contexts as planning failures of resettlement programs.

Although the PAPs are compensated with cash or land, it is always inadequate, and they fail to re-establish their livelihoods as their assets are undervalued (Cernea, 2008). In the land compensation, the land for resettlement could be either smaller or low-quality. For instant, a post-resettlement assessment done among the evictees of Ruaha National Park expansion in Tanzania recorded a loss of grazing land, water points, fishing grounds, and livelihood sources (Sirima, 2016). Most compensation do not consider relocation's social and emotional cost but instead focus on the physical assets (Bennett & McDowell, 2012; Vanclay, 2017). Wakessa (2017) acknowledged the inevitability of socio- cultural and the difficulty of measuring the impacts of relocations and the valuation of the assets considered for compensation.

Pastoralism is the only suitable food production system on Earth's terrestrial dry lands (deserts, grasslands, rangelands) that covers about 41% and hosts and supports some 2 billion people (MEA, 2005). Its gross domestic product (GDP) contribution stands between 10 and 44% among African countries, supporting people (1.3 billion) as the primary livelihood based (Karaimu, 2013). In Kenya, some 80% of land fall under arid and semi-arid lands (ASAL), and communities inhabiting these areas graze livestock (pastoralism) for their living (Amwata *et al.,* 2015). To gauge and assess the impacts of relocation among the pastoralists of the RAPland village, the study was grounded on two objectives: (i) To assess pasture and water availability in the RAPland area; and (ii) to evaluate constraints hindering livestock production and performance, coping mechanisms adopted by the pastoralists before and after being resettled.

MATERIALS AND METHODS

The Study Area

RAPland village was created in 2014 to accommodate the project-affected persons (PAPs) displaced by the expansion of the geothermal energy production plant (Olkaria I – IV) in the Olkaria area. The Greater Olkaria Area Bloc, which is approximately 80 square kilometres in size, was gazetted in 1971 as Geothermal Resource Area by the government of Kenya. Prominent features bordering or nearing the RAPland village are Hell's Gate National Park and Lake Naivasha. Agro-ecologically, the Olkaria area is categorised as a semi-arid climate or zone V. According to Wamalwa (2014), the RAPland area has a long rainy season between March and May and a shorter one in October and November, with an annual average of 634 mm.

Before they were displaced and resettled, the Maasai pastoralists lived in their traditional houses called Manyatta (plural Manyattas). This changed when they were relocated into the RAPland village, which comprised two – bedroom units for each household.

The grazing of pastoral herds is the primary livelihood activity of the Maasai pastoralists. These include cattle, sheep, goats, and donkeys, although some households have adopted keeping indigenous chicken for immediate family use. Households primarily depend on livestock for survival, in that small ruminants (sheep and goats) are sold to meet immediate household needs like buying cereals and grains. In contrast, large ruminants like cattle are marketed to solve heavier issues like clearance of bills (school fees, hospital bills), among others. Some of the RAPland residents managed to get employment with companies operating within or around the geothermal area.

Data Collection and Analysis

Primary data was gathered with household interviews with 105 heads. Some six (6) key

informants' interviews, three (3) focus group discussions, and field observations were carried out between May and June 2019. Information was collected on pastures and water adequacy, distances, sources, constraints hindering livestock productivity, and coping mechanisms employed by the pastoralists before and after the resettlement. With a relatively smaller displaced population of 155 households, the study targeted the whole population, but only 105 household heads participated. With some lacking livestock, others had moved out of RAPland, while the rest were not willing to participate.

Three focus group discussions were held for each category of older adults, women, and youths (young men and women), and six key informant interviews. These focused on rangeland resources-availability and quality (pastures & water), constraints affecting livestock, and coping mechanisms used in the old and new areas. At the same time, the field observations look at topography, vegetation cover, pastures, water sources, and conditions.

Analytical software – Statistical Package for Social Scientists (SPSS, version 21) was used to analyze the questionnaire data after summarising it with Microsoft Excel, 2019. The results were obtained and presented in the form of tables, percentages, and frequencies. These results were validated/triangulated by the field observations, key informant interviews, and focus group discussions that gave more insight into the plights facing resettled pastoral communities of the RAPland village.

RESULTS AND DISCUSSIONS

Characteristics of Interviewees

Most interviewees were women; they constituted (68%) with 32% men. This was so as most men had gone out for daily chores, including grazing of herds, some works at geothermal stations and others in livestock markets. However, they were still responsible for livestock decisions, including assessing potential grazing areas. Most respondents were married at 87%, with only 13% unmarried. Those aged 18 – 45 constituted 72% of the households' interviewees, and the remainder (28%) had over 46 years. Being pastoralists with no access to education facilities then, illiteracy was still high at 54%, with 19% and 22% that had graduated from primary and secondary levels, respectively.

Rangeland Resources-Availability in RAPland Village

Pastures

Our results showed that resettlement significantly (P<0.05) affected pasture sufficiency and distance. About 65.7% of the households in RAPland village reported pasture inadequacy. As such, the herders had to cover longer distances to access pastures, marked by an increase from a mean of 3.2 ±0.29 to 8.1 ±0.41 kilometres, unlike before relocation (Manyatta villages), where 88.3% reported adequate pasturage. In terms of pasture sources, nearly all households relied on natural pasturage/grazing fields before and after the relocation, as indicated by 99% and 97%, respectively. A small proportion of households reported using purchased feeds in the RAPland village, which was only to support and supplement 'the vulnerable stock' that includes the sick, young, or milking stock that remains near the homestead. At the same time, the other herds are taken to distanced grazing fields.

According to FGD discussants, pasturage inadequacy was majorly caused by the reduction of rangelands, bushy vegetation cover, erratic rainfall patterns, and numerous valleys that caused pasture insufficiency in RAPland village. Before the relocation, they had a larger area of about 4200 acres compared to the RAPland area, which is only 1700 acres and was only suitable for residential housing units. The reduction in grazing fields was also compounded by restriction to access nearby rangelands, thus impairing livestock mobility - essential management tools and strategy for pastoral systems. Tolera & Abebe, (2007) studies in the Dirre and Moyale districts of Southern Ethiopia revealed pasture shortages due to rangeland shrinkage and impaired livestock mobility. This is consistent with other studies by Desta and Coppock (2004), Elias and Abdi (2010), and Kimiti *et al*., (2018), which observed pasturage shortages because of a reduction in grazing fields and lack of access to surrounding pastureland after the resettlement. Elias and Abdi (2010) reported pasture inadequacy due to a reduction in grazing land among the pastoralists of Southern Ethiopia. Kahsay (2020) and Adnew -Degefu *et al.,* (2020) also noted the difficulties resettlers faced in rearing their herds due to the loss of grazing land and watering points in the Tigray regions and Awash Valley, respectively of Ethiopia. Recurrent droughts, overgrazing-due to impaired livestock mobility, and bush encroachment, collectively grouped as environmental drivers, could have contributed to pasture shortages in RAPland villages (Admasu *et al*., 2010 Kimiti *et al*., 2018).

The Maasai pastoralists acknowledged that pastures and water insufficiency reduced livestock's nutritional status, affecting animals' health, reproduction, and production – milk yield (Cordova-Izquierdo, 2016). The reproductive and productive characteristics are critical determinants of profitable livestock rearing and herds continuity (Lobago *et al.*, 2007). Although pastoralism has been a self-sustaining food production system for many households and communities, it has been impacted by several exogenous factors like developmental projects that take away communal lands, thus altering the spatial and temporal variability of rangeland resources (pastures and watering points), threatening pastoral livelihoods

and the attainment of several United Nations (UN) Sustainable Development Goals (SDGs).

Water Resources

Water availability was significantly (*P <0.05)* affected by the resettlement. Water was adequate in old/Manyatta villages for 86.4% of households compared to when they moved into the RAPland village, where 75% had no sufficient water, as indicated in table 2. Lake Naivasha is the lifeline of RAPland communities. Water is pumped (two to three times a week) into a big collection tank and distributed to four (4) water kiosks around the village. This needed to be adequate and sustainable, according to FGD discussants who reported frequent breakdowns of pumping systems, leaving residents and their herds in dire conditions, especially during dry seasons when there are few alternative surface water sources. This observation agrees with Adnew -Degefu *et al.*, (2020) study that acknowledged insufficient water infrastructure among the resettled communities of Awash Valley in Ethiopia. In addition, in Ethiopia's Tigray region, the resettled pastoralists needed more points after losing their rangelands; this made it difficult to rear livestock (Kahsay, 2020).

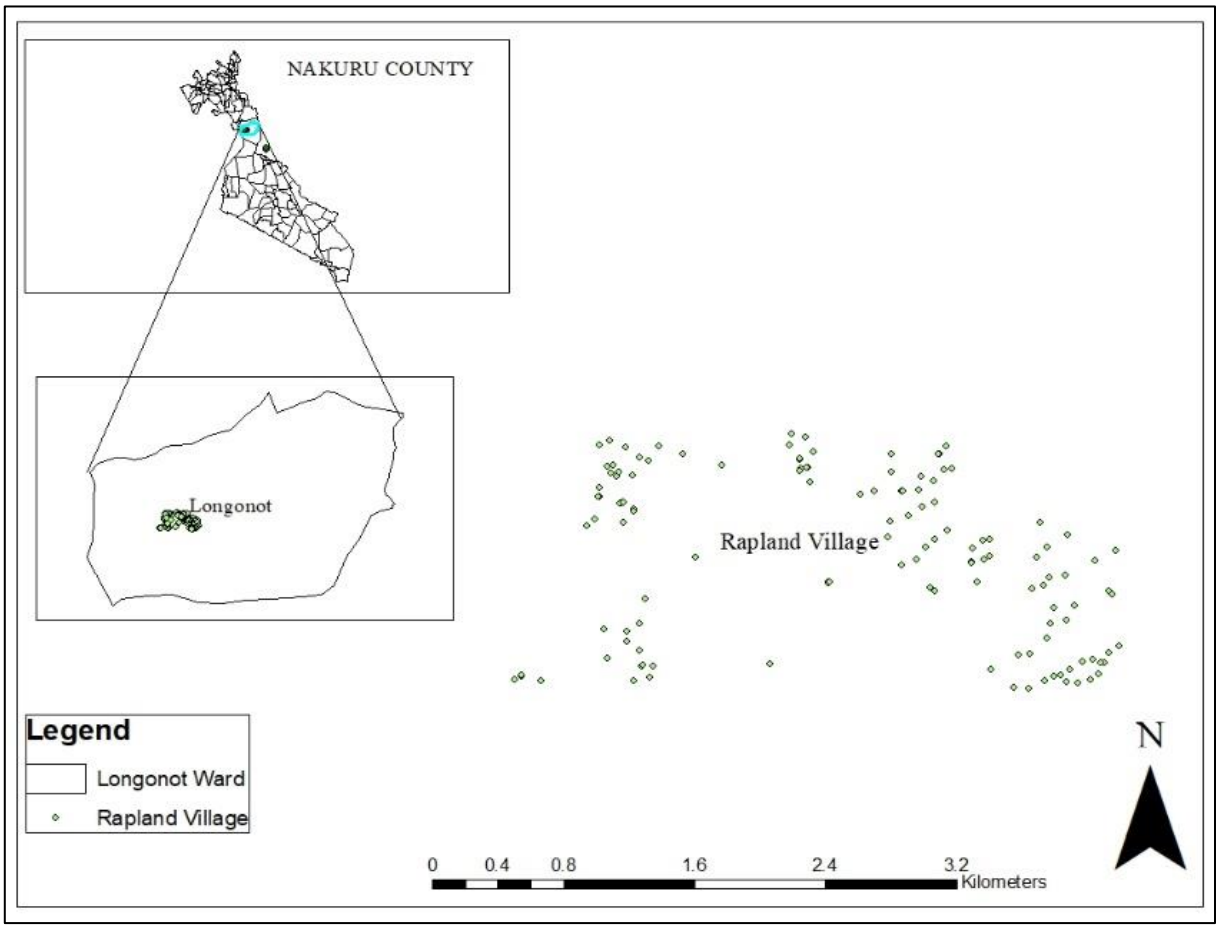

Figure 1: RAPland village's map
Source: Authors photo gallery

Table 1: Pasture sources, availability, and distances in Old and RAPland villages

Pasture		Before Resettlement(N= 104)		After Resettlement (N = 105)		Chi-Square	P Value
		n	%	n	%		
Sources	Natural	103	99	102	97.1	3.015	0.083
	Purchased	1	1	3	2.9		
Availability	Sufficient	92	88.3	36	34.3	63.917	0
	Insufficient	12	11.7	69	65.7		
Distance in (km)*		3.154 ±0.288		8.114 ±0.411			0

Table 2: Water source, availability, and distances in Old and RAPland villages

Pasture		Before Resettlement (N = 104)		After Resettlement (N = 105)		Chi-Square	P Value
		n	%	n	%		
Sources	Pipe	96	92.3	97	92.4	3.015	0.083
	Truck	5	4.8	5	4.8		
	Rainwater	3	2.9	3	2.9		
Availability	Sufficient	90	86.4	26	25	79.032	0
	Insufficient	14	13.6	79	75		
Distance in (km)		3.56 ±0.34		3.46 ±0.36			0.841

The other aspect, which caused water shortages among the RAPland communities, was the lack of access to Hell's Gate National Park and neighboring ranches around the RAPland area. Kimiti *et al*., (2018) and Elias and Abdi (2010); both acknowledged water inadequacy encountered by the pastoralists due to the shrinkage of rangelands, loss of water points, and being denied access to water points. Wakchaure & Praveen (2015), livestock's body is 60 – 70% water, and the lack of it means poor performance and health as it is essential for digestion, body temperature control, metabolism, eyesight, growth, and reproduction. The type of diet, activity, gestation, feed intake, environmental conditions, and lactation influences livestock water requirement. Much research conducted in African pastoral systems has highlighted the scarcity of pastures and watering points due to rangelands' shrinkage as a significant factor hindering livestock productivity and performance.

Figure 2: Water trough at the Water yard for watering livestock in RAPland Village
Authors' photo gallery

Constraints Affecting Livestock and Mitigation Adopted by the Pastoralists before and after the Relocation

Production Constraints affecting Livestock in old and RAPland Villages

Before the relocation, drought (27%), diseases (27%), pasture insufficiency (23%), predation from wild animals (11%), conflict (7%), and water inadequacy (5%) were the significant challenges affecting pastoralists. This, however, changed in the RAPland village in that lack of water (21%), pasture inadequacy (19%), lousy gullies (15%), predation from wild animals (13%), frequent droughts (12%), diseases (11%), conflict (6%), market access (2%) become the significant constraints as indicated in table 3. RAPland communities rely on Lake Naivasha for the provision of water, and as such, it is pumped two – three times weekly. According to the FGD discussants, this was unreliable as it was frequently breakdown. This is worsened by the lack of surface water sources (rivers, streams, ponds) in RAPland and not watering within Hell Gate's National Park.

The pastoralists blamed pasture shortages on the shrinkage of rangeland; massive gullies, poor vegetation cover, and frequent droughts. Tashi and

Foggin's (2012) study of the resident of the Tibetan region acknowledged that pasture and watering points became inadequate for the relocatees because of the reduction in rangeland. This is consistent with Worku's (2011) research among the residents of Gambella Regional State of Ethiopia.

In the Awash Valley of Ethiopia, severe water and pasture shortages were recorded due to the loss of rangeland to a developmental project and poor development of water infrastructures (Adnew -Degefu *et al.,* 2020; Elias & Abdi, 2010). The loss of grazing land to developmental project causes' poor quality of grazing for the herds; as such, RAPland residents had limited areas to move their livestock to – which impaired livestock mobility. This degraded rangelands, thus aggravating pasture conditions in the area. Lkhagvadorj *et al.*, (2013) observed pasture insufficiency due to rangeland degradation, as equally discussed by Van Dijk and Bose (2016). In East Africa, one of the significant causes of pasture inadequacy is the dispossession of rangelands (Brockington, 1999).

Table 3: Ranking of livestock production constraints and adaption mechanisms deployed by pastoralists before and after relocation

Constraint	Rank before relocation	Rank after relocation	Adaptation mechanisms	
			Before relocation	After relocation
Droughts	1	6	Migration	Herds diversification
			Herds splitting	Migration
			Selling part of herds	Splitting of herds
				Selling part of herds
Livestock diseases	2	5	Migration	Use of herbs
			Use of herbs	Vaccination
			Deworming	Treatment/deworming
				Migration
Pasturage	3	2	Migration	Herds Diversification
				Purchase of pasture/feeds
				Herds migration
				Splitting of herds
Water Acess	4	1	Ponds' water	Buying of water
			Migration	Herds migration
			Buying	Harvesting of rain water
Wildlife Predation	5	4	Reporting/authorities	Poisoning
			Poisoning/herbs	Trapping
			Trapping	Migration
				Fencing
				Reports to Wildlife Service
				Tight herding
Conflicts (Humans)	6	7	Mediation by elders	Mediation
			Reporting to Elders	Reporting to the police
				Reporting to Elders
Gulleys	0	3		Migration
				Separation of the herds
Market distances Access	0	8		People walked longer
				Hike hiring fees for herders

Table 4: Causes of livestock production constraints in old and new villages

Constraint	Causes in old village	Causes in RAPland village
Watering points	Droughts Erratic rain patterns	Frequent breakdown of a water pumping system
		RAPland village dependence on pumped water
		RAPland lacking surface water/streams, rivers
		Aridity and semi-arid nature of RAPland
		Loose soil with the poor water-holding ability
		Unreliable rainfall and droughts
Pastures	Drought	Aridity of the RAPland area and surroundings
	Rainfall insufficiency	Reduced rangelands
	Competitions for grazing fields	Reduced rangelands
		Pastoralists denied to graze in Hell Gate's park
Wildlife Predation	Availability of predators	Presence of many predators

	Inadequate herding practices	Bushy area with numerous valleys/hills
	Restricted killings of wildlife	Proximity to the Hell's Gate National Park
		Inadequate fencing around the homestead
Droughts	Climatic changes	Climate changes
	Rainfall variability	Unreliable rainfalls
Diseases	Inadequate animal health care	Inadequate veterinary care
	Inadequate extension services	Inadequate animal care services
	Inadequate personnel	Absent of livestock diseases surveillance
Conflicts	Livestock thefts	Pastures and water points inadequacy
		Pasture/water control
		Livestock's stealing
		Inadequate security personnel in RAPland
Gulleys		Poor soils that are easily carried away by runoff
		Hilly nature of the area
		Heavy runoff during rainy seasons

Figure 3: Gulley in RAPland village
Source: Authors' photo gallery

Besides causing injuries and death to herders and livestock, the poor terrain of the RAPland village was supposed to be pasture growth areas, which contributed to inadequate grazing and quality of grazing. Predation from wild animals was rampant in the RAPland village in the first two years of resettlement. This was because of inadequate fences, bushy cover, and numerous gullies and hills near the Hell Gate's National Park. Gitunu (1999); Karanth (2007); and Hogan, 2010) acknowledged that predation from wild animals is a limiting factor in the growth of pastoral herds. These include leopards, cheetahs, and hyenas that preyed on cattle, goats, sheep, and baboons against the kids and lambs.

Regarding animal health, some reported diseases in the RAPland area included foot and mouth disease, trypanosomiasis, contagious bovine pleuropneumonia, East coast fever, and Endo/ectoparasites for the cattle; for sheep and goats were the Peste des petit ruminants, and contagious caprine pleuropneumonia. Their occurrence was due to inadequate veterinary services, despite being promised a cattle dip by the project developers.

Concerning the conflicts, the causes in the Manyattas/old village and RAPland villages were similar. However, they were more intense in the RAPland village due to competition over grazing land that has reduced after the relocation. The competition was worsened by the denial of access to grazing and watering points in Hell Gate National Park, as equally acknowledged by Adnew -Degefu *et al.,* (2020), Himmelfarb (2006), and Tashi and Foggin (2012).

Wildlife – Pastoralists' conflict in RAPland village is common during dry seasons and droughts when pastures and watering points are inadequate. Domestic stocks and wild animals have to compete over the few resources around Hell's Gate National Park. Koenig & Diarra (1998) reported livestock–wildlife conflicts when pastoral communities stay in proximity to forests, game parks, and reserves. This

acknowledgment is consistent with Hogan, 2010 and Karanth, 2007 findings.

The coping Mechanisms adopted by pastoralists of RAPland village

Coping strategy could be defined as processes and actions employed by the displaced to adapt and mitigate against the consequences imposed on them by the resettlement; as such, these coping mechanisms could be implemented at the level of individuals, clan/community, and households. In this regard, some of the coping mechanisms deployed by the Maasai herders included herds' splitting; donation to relatives; destocking; herds' diversification, and herds' migration, thus minimising livestock loss due to production constraints (Hassan *et al*., 2018; Zigale, 2021). Livestock-rearing techniques and practices have been embedded as part of the pastoral communities' socio-cultural, saving them during catastrophes like droughts, floods, disease outbreaks, and raids.

Pastures and water shortages were met by a few households through purchasing, especially for the milking and sick stocks that could not be taken for far grazing zones. This, however, was only applicable to the few individuals with financial means. Destocking, especially that of donating some livestock to relatives living in separate areas, was practiced most by many households, especially when severe and prolonged droughts were anticipated. Commercial destocking was rarely used as it was constrained by several factors, including severity and duration of the drought, availability of functional livestock markets, and its safety and access, as forwarded by Speranza (2010).

As there were no numerous gullies in the old villages/Manyattas, its effects were severe in RAPland through injuries or deaths to pastoralists and their stock. As such, the herders could only move their herds, especially cattle affected the most due to their large size, into areas with few gullies. This practise contributed to the pasture-insufficiency experienced by pastoral communities of the RAPland village.

According to FGD discussions, ethno – veterinary methods were used by individuals with traditional knowledge of herbs against livestock diseases in the RAPland village. This depends significantly on individuals' ability to identify the herbs and their application methods, although their effectiveness could not be ascertained during the study. Others used modern approaches like deworming, spraying, injection, and vaccination. These were, however, constrained by a lack of para-vets and extension workers/Community – based Animal Health Workers (CBAHW), veterinary drugs, vaccines, and livestock infrastructures like dips – for controlling external parasites.

Herrero *et al*., (2016), pastoral communities have immense knowledge of their environments and, as such, have high adaption modalities that enable them to live in harsh and drier rangelands. RAPland residents adopted practices that included local poisons, traps, and scarecrows to control and minimize wild predation. There were no compensations from the wildlife authority – that is, Kenya Wildlife Services (KWS) for herds' loss to predators; FGD discussants revealed this, and as such, those who reported their loss of livestock remained frustrated.

Figure 4: A Maasai pastoralist with ABG during data collection near RAPland village Authors' photo gallery

CONCLUSION AND RECOMMENDATIONS

From this study, we deduced that the resettled pastoralists of RAPland village experienced more severe livestock production challenges; these include mainly inadequate water, inadequate pastures/feed shortages, poor quality of grazing, lousy terrains, predation from wild animals, and frequent droughts. These affected livestock production and performance and, as such, affected poverty, food, and nutrition security among the relocatees. Pastoralists' livelihoods depend significantly on the environment/rangelands where they graze their livestock. The pastoralists used their ancient knowledge and skills to cope with the relocation challenges encountered in RAPland village; however, the adjustments and the learning have taken time. The suffering endured by the pastoralists could have been avoided by better preparation for the relocation through adequate Resettlement Action Plans (RAPs) planning. Although the documented livestock production constraints encountered by the Maasai pastoralists in RAPland resembled the ones they faced before being relocated, the severity and importance had changed. As such, the impacts on livestock productivity and performance became more profound, jeopardising people's livelihoods and well-being.

Abbreviations

ANOVA – analysis of variance, ASAL – arid and semi-arid lands, CBAHWs – Community-Based Animal Health Workers, FGD – focus group discussion, IRR - impoverishment risks and reconstruction model, KenGen – Kenya Electricity Generation Company, KWS – Kenya Wildlife Services, MEA – Millennium Ecosystem Assessment, PAPs – project affected persons, RAP – resettlement actions plan, and RAPland – resettlement action plan land.

DECLARATIONS

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Consent for publication: Not applicable

Availability of data and material: The datasets used in this study are available from the corresponding author and upon reasonable request.

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REFERENCES

- Admasu, T., Abule, E., & Tessema, Z. (2010). Livestock-rangeland management practices and community perceptions towards rangeland degradation in South Omo zone of Southern Ethiopia. *Livestock Research for Rural Development*, 22(5). http://www.lrrd.org/lrrd22/1/tere22005.htm
- Adnew Degefu, M., Assen, M., Satyal, P., & Budds, J. (2020). Villagization and access to water resources in the Middle Awash Valley of Ethiopia: implications for climate change adaptation. *Climate and Development*, 12(10), 899-910. https://doi.org/10.1080/17565529.2019.1701973
- Amwata, D. A., Nyariki, D. M., & Musimba, N. R. (2015). Factors influencing pastoral and agropastoral household vulnerability to food insecurity in the drylands of Kenya: a case study of Kajiado and Makueni Counties. *Journal of International Development*, 28(5), 771-787.
- Asrat, T. (2006). Resettlement and food security with reference to the Ethiopian experience: The Boreda case. Catholic Church Community Based Integrated Development Program. *Southern region of Ethiopia*, 9-13.
- Belay, K., Beyene, F., & Manig, W. (2005). Coping with drought among pastoral and agro-pastoral communities in eastern Ethiopia. *Journal of Rural Development/Nongchon-Gyeongje*, 28(1071-2019-1825), 185-210.
- Bennett, O., & McDowell, C. (2012). The human cost of development and resettlement. Washing D. C: Palgrave Macmillan.
- Brockington, D. (1999). Conservation, displacement, and livelihoods. The consequences of the eviction for pastoralists moved from the Mkomazi Game Reserve, Tanzania. *Nomadic Peoples*, 74-96.
- Cernea, M. M. (2007). IRR: An operational risks reduction model for population resettlement. *Hydro Nepal: Journal of Water, Energy and Environment*, 1, 35-39.

- Cernea, M. M. (2008). Compensation and benefit sharing: Why resettlement policies and practices must be reformed. *Water Science and Engineering*, 1(1), 89-120.
- Cordova-Izquierdo, A. (2016). Best Practices in animal reproduction: impact of nutrition on reproductive performance livestock. *J Adv Dairy Res*, 4, 152.
- De Wet, C. J. (Ed.). (2006). Development-induced displacement: Problems, policies and people (Vol. 18). Berghahn Books.
- Elias, E., & Abdi, F. (2010). Putting pastoralists on the policy agenda: Land alienation in Southern Ethiopia. London: IIED.
- Gitunu, A. M. M. (1999). Livestock production and food security in a changing socio-cultural environment due to involuntary relocation of agro-pastoralists into semi-arid areas of Makueni District, Kenya.
- Hassan, M., Ahmed, M., Abadir, M., Aw-Muse, A., & Apparao, T. (2018). Assessment of Rangeland Resource Utilization and Management Practice on Pastoralist in Afdem District of Sitti Zone, Somali State, Ethiopia. *GSJ*, 6(11), Online: ISSN 2320-918
- Herrero, M., Addison, J., Bedelian, C., Carabine, E., Havlik, P., Henderson, B., & Thornton, P. K. (2016). Climate change and pastoralism: impacts, consequences and adaptation. *Rev Sci Tech*, 35, 417-33.
- Himmelfarb, D. (2006). Moving people, moving boundaries: the socio-economic effects of protectionist conservation, involuntary resettlement, and tenure insecurity on the edge of Mt. Elgon National Park, Uganda. Agroforestry in Landscape Mosaics Working Paper Series. World Agroforestry Centre, Tropical Resources Institute of Yale University, and the University of Georgia, 7.
- Hogan, C. (2010). Pastoralism, nature conservation, and development. Convention on Biological Diversity, Montreal, Canada.
- Kahsay, B. G. (2020). Socio-cultural and economic impacts of development induced displacement on resettled people: The case of Welkayt Sugar Factory in Tigray Region, Ethiopia. *International Journal of Sociology and Anthropology*, 12(4), 94-103.
- Karaimu, P. (2013). Making visible the 'invisible benefits' of African pastoralism will spur national and pastoral economies both.
- Karanth, K. K. (2007). Making resettlement work: the case of India's Bhadra Wildlife Sanctuary. *Biological Conservation*, 139(3-4), 315-324.
- Kimiti, K. S., Western, D., Mbau, J. S., & Wasonga, O. V. (2018). Impacts of long-term land-use changes on herd size and mobility among pastoral households in the Amboseli ecosystem, Kenya. *Ecological processes*, 7(1), 4.
- Koenig, D., & Diarra, T. (1998). The environmental effects of policy change in the West African savanna: resettlement, structural adjustment, and conservation in western Mali. *Journal of Political Ecology*, 5(1), 23-52.
- Lkhagvadorj, D., Hauck, M., Dulamsuren, C., & Tsogtbaatar, J. (2013). Twenty years after decollectivization: mobile livestock husbandry and its ecological impact in the Mongolian forest-steppe. *Human Ecology*, *41*, 725-735.
- Lobago, F., Bekana, M., Gustafsson, H., & Kindahl, H. (2007). Longitudinal observation on reproductive and lactation performances of smallholder crossbred dairy cattle in Fitche, Oromia region, central Ethiopia. *Tropical Animal Health and Production*, 39(6), 395-403.
- Millennium Ecosystem Assessment, M. E. A. (2005). Ecosystems and human well-being (Vol. 5, pp. 563-563). Washington, DC: Island press.
- Pankhurst, A., & Piguet, F. (2009). Moving people in Ethiopia. Development, Displacement and the State. Eastern Africa Series. Rochester, USA.
- Sirima, A. (2016). The social and economic impacts of Ruaha National Park expansion.
- Speranza, C. I. (2010). Drought coping and adaptation strategies: Understanding adaptations to climate change in agro-pastoral livestock production in Makueni District, Kenya. *The European Journal of Development Research*, 22(5), 623-642.
- Tan, Y., & Yao, F. (2006). Three Gorges Project: Effects of resettlement on the environment in the reservoir area and countermeasures. *Population and Environment*, 27(4), 351-371.
- Tashi, G., & Foggin, M. (2012). Resettlement as development and progress? Eight years on Review of emerging social and development impacts of an ecological resettlement' project in Tibet Autonomous Region, China. *Nomadic Peoples*, 16(1), 134-151.
- Tolera, A., & Abebe, A. (2007). Livestock production in pastoral and agro-pastoral production systems of southern Ethiopia. *Livestock research for rural development*, 19(12), 4-7.
- Van Dijk, H., & Bose, P. (2016). Dryland landscapes: Forest management, gender and social diversity in Asia and Africa. *Dryland Forests: Management and Social Diversity in Africa and Asia*, 3-21.
- Vanclay, F. (2017). Project-induced displacement and resettlement: from impoverishment risks to an opportunity for development. *Impact Assessment and Project Appraisal*, 35(1), 3-21.
- Wakchaure, R., Ganguly, S., & Praveen, P. K. (2015). Role of water in livestock. *Rec. Adv. Acad. Sc. Jour*, 1, 53-56.
- Wakessa, T. K. (2017). Challenges and Opportunities of Development Induced-Displaced

Households: The Impact of Adama II Wind Power Project in Focus. Adiss Ababa University.

- Wamalwa, R. N. (2017). Evaluation of the Geothermal Energy Potential of the Olkaria Field Kenya, Based on Geochemical Data-A Numerical Model (Doctoral dissertation, University of Nairobi).
- Worku, B. (2011). Impact of resettlement on the livelihood of the settler population in Abobo woreda, Gambella People's Regional State (Doctoral dissertation, unpublished, Addis Ababa, Ethiopia).
- Zigale, T. T. (2021). Climate change, pastoral livelihood vulnerability and adaptation strategies: a case study of Sitti zone, Somali Regional state in eastern Ethiopia (Doctoral dissertation, University of South Africa).