






Security in flexibility: accessing land and water for irrigation in Kenya's changing rural environment

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Abstract – In the semi-arid lands of southern Kenya, a dynamic process of farmer-led irrigation has developed over the past two decades. It is characterised by short-term agreements to access land and water. Resident and migrant farmers, capital providers and local landowners have engaged in diverse partnerships to benefit from water and land along the Olkeriai sand river. This study aims to unravel which actors and motives drive the resulting highly dynamic forms of irrigation. Surveys, in-depth interviews and mapping exercises with farmers, capital providers and landowners were conducted over a period of 1.5 years. The results show that involved actors favour short-term lease and partnership arrangements and farmers frequently change fields along the river or leave the area and return. It is primarily the migrant farmers and capital providers who take decisions on when and where to move. They are informed by their experience with production factors, financial gains and losses, partner relations, or the ability to expand. We conclude that individualisation of land rights, migration, abundance of water, proximate markets, and rural-urban networks are instrumental to the emergence of this dynamic form of agriculture. Farmers have found a degree of security in flexibility, to access land and water in shifting fields and partners, rather than in property rights for specific plots. Yet, the short-term scope of these operations for monetary gains raises concerns about the sustainable use of land and water resources in the region.

Keywords: access to land and water / flexible agreements / farmer-led irrigation / sand river aquifers / Kenya

Résumé – La sécurité dans la flexibilité: accès à la terre et à l'eau pour l'irrigation dans l'environnement rural changeant du Kenya. Dans les terres semi-arides du sud du Kenya, un processus dynamique d'irrigation initié par les agriculteurs a pu être observé au cours des deux dernières décennies. Il est caractérisé par des accords à court terme pour accéder à la terre et à l'eau. Des agriculteurs résidents et migrants, des fournisseurs de capitaux et des propriétaires fonciers locaux se sont engagés dans divers partenariats pour tirer parti de l'eau et des terres le long de la rivière de sable Olkeriai. Cette étude a pour but de déterminer quels acteurs et quels motifs sont à l'origine de ces formes d'irrigation très dynamiques. Des enquêtes, des entretiens approfondis et des exercices de cartographie avec des agriculteurs, des fournisseurs de capitaux et des propriétaires fonciers ont été menés sur une période d'un an et demi. Les résultats montrent que les acteurs impliqués privilégient les baux à court terme et les accords de partenariat et que les agriculteurs changent fréquemment de champs le long de la rivière ou quittent la région pour y revenir. Ce sont principalement les agriculteurs migrants et les fournisseurs de capitaux qui décident quand et où déménager. Ils utilisent leur expérience des facteurs de production, des gains financiers et des pertes, des relations de partenariat, ou de la capacité d'agrandissement. Nous concluons que l'individualisation des droits fonciers, la migration, l'abondance de l'eau, la proximité des marchés et les réseaux ruraux-urbains sont déterminants pour l'émergence de cette forme dynamique d'agriculture. Les agriculteurs ont trouvé un certain degré de sécurité dans la flexibilité, changeant continuellement de terre, de

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source d'eau et de partenaires, plutôt que dans des droits de propriété pour des parcelles spécifiques. Pourtant, la vue à court terme de ces opérations visant des gains monétaires soulève des inquiétudes quant à l'utilisation durable des ressources en terre et en eau de la région.

Mots clés : accès à la terre et à l'eau / accords flexibles / irrigation dirigée par les agriculteurs / aquifères des rivières de sable / Kenya

1 Introduction

Various formal and informal types of farmer-led irrigation are practiced in Sub-Saharan Africa, where land and water tenure do not appear to be a prerequisite for development (Woodhouse *et al.*, 2017). Farmer-led irrigation (FLI) is hereby defined as a “process whereby farmers drive the establishment, improvement and/or expansion of irrigated agriculture, often in interaction with other actors” (Veldwisch *et al.*, 2019). These farmers have diverse approaches to access land, such as renting plots, acquiring non-formally registered lands, or using unauthorised patches in (peri-)urban areas (De Fraiture *et al.*, 2014; Woodhouse *et al.*, 2017; de Bont *et al.*, 2019). These vibrant ventures find themselves on various points along axes of formality and legality. The spread of such, often unregulated, forms of irrigation raises legitimate concerns regarding over-abstraction, water conflicts, pollution, equity and sustainability of natural resources (Giordano and de Fraiture, 2014; Woodhouse *et al.*, 2017; Lefore *et al.*, 2019). Many such endeavours have a short-term and flexible character, which triggers calls for an understanding of the spatial dynamics of irrigation. Although dynamics in the sense of land use changes are often analysed at a landscape level, the spatial trajectories of individual farmers are rarely empirically described in the literature (Campbell *et al.*, 2005; Jampani *et al.*, 2020). Understanding the spatial movements of individual farmers, and identifying who and what drives these movements shed new light on how to perceive and address sustainability concerns.

Along the Olkeriai sand river in southern Kenya, different forms of market-oriented irrigation have emerged and expanded over the past two decades. The prevalent arrangement is a partnership between a capital provider, known as *tajiri*, and two or three migrant farmers (Karimba *et al.*, 2022). In this semi-arid area, these partnerships shape access to land and water through short-term leases from local Maasai landowners. We aim to unravel those strategies to access land and water, understand how spatial dynamics of farmers and their use of natural resources manifest in this setting, and explain which actors and motives drive the short-term agreements and spatial movement of individual farmers. Consequently, we challenge the notion of secured access to land and water if narrowly understood from a fixed delineated piece of land. Hence, rather than engaging with the extensively debated definition and merits of tenure security in relation to land policy reform in Sub-Saharan Africa (Platteau, 1996; Lund, 2000; Chimhowu and Woodhouse, 2006; Rutten, 2008), this study invites us to reconsider our perception of security in accessing resources.

Section 2 covers an introduction to the area, followed by the research approach and methods in Section 3. In Section 4, we present the results and start with the multiple strategies of

different types of farmers to access land and water resources. We then explore the spatial dynamics and explain the underlying motives. Finally, in Section 5, we come to the discussion and conclusions.

2 Area description

The Olkeriai sand river is situated in Kajiado county in the central south of Kenya, approximately 100 km south of Nairobi (Fig. 1). The Olkeriai, which forms part of the Athi basin, is an ephemeral river that holds water in its sandy river deposits, even in the dry season. The region experiences a bimodal rainfall pattern with an average annual precipitation of 675 mm/yr (Bobadoye *et al.*, 2016). The resulting flood events replenish the sand river, which forms an important nature-based water storage for multiple uses like livestock, irrigation and domestic use. Sand in the river is also harvested for construction development in urban areas. The area is traditionally home to Maasai people, whose living has depended primarily on livestock rearing with recent diversification in trade, local business and crop production as observed in many parts of Maasailand in Kenya (Southgate and Hulme, 2000; Government of the Republic of Kenya, 2013a, 2013b; Achambault *et al.*, 2014). There are three rural business centres along the river stretch; Ngatu, Mashuuru and Selengei. Kajiado county as a whole is home to over 1,1 million people (Republic of Kenya, 2019).

Over the past two decades, irrigation activities have sprouted, conducted by a blend of actors among which resident and migrant farmers, landowners and capital providers. Farmers use motorised diesel and petrol pumps to access water from scoop holes or shallow wells in the sandy river bed or in their fields. With hoses/pipes, they irrigate staple and cash crops like maize, water melon, tomato and French beans. They are connected to local and regional (export) markets, mostly through brokers. Besides land and water availability, another trigger to irrigation expansion has been the tarmacking of the road connecting the area to Nairobi in 2018–2019 (Karimba *et al.*, 2022).

3 Research approach and methods

The research approach is threefold (Tab. 1). The first step consists of a baseline survey conducted in 2019 that identified 104 plots with irrigating farmers along the river and the types of farming arrangements and land access they employed. It distinguishes between resident and migrant farmers, whereby a resident is regarded as someone who used to belong to one of the (former) Maasai group ranches. A migrant is considered as someone who originates from other regions within Kenya or Tanzania and comes to the area, mostly temporarily, for the

Table 1. Three components of the research with number of actors interviewed and mapped.**Tableau 1.** Trois composantes de la recherche avec le nombre d'acteurs interrogés et cartographiés.

Approach	Number
<i>1. Baseline survey</i>	
Total	104
Resident farmers	15
Migrant farmers individual	14
Migrant farmers in partnership with <i>tajiri</i>	75
<i>2. In-depth interviews</i>	
Migrant farmers	
– Total*	32
– Individual	8
– Partnership with <i>tajiri</i>	24
<i>Tajiris</i>	4
Land owners	11
<i>3. Migrant farmers movements mapped</i>	
Total	13
Individual	3
Partnership with <i>tajiri</i>	10

* 32 migrant farmers of whom two left the area.

purpose of engagement in irrigated farming (International Organisation for Migration, 2019). The second component of the study focuses on identifying the strategies and dynamics to access land and water, the interests of different actors, and the motives underpinning the observed dynamics. It is based on semi-structured interviews with farmers, *tajiris* and landowners, who are purposively sampled from the baseline survey in order to grasp the diversity in farming constellations and dynamic in terms of farm arrangement, cultivated area, location, and gender and age of the farmer. A specific semi-structured questionnaire for migrant farmers who left the area was developed to understand their motives and subsequent actions. The third part of the study illustrates and explains the movements of farmers by (a) assessing whether farmers had moved plots within the study period, and (b) mapping all the movements of a smaller number of farmers, since they started irrigating along the sand river. Field data were collected with Google Earth printouts and GPS points, and maps were produced with QGIS. The time span covering the different field visits was 1.5 year (November 2019–May 2021). Quantitative data from the semi-structured interviews was used to analyse land access, presence, movements and characteristics of farmers, and map out their spatial trajectories. Qualitative data was used to analyse drivers for developments and movements, and challenges faced by the different actors involved.

4 Results

4.1 Flexible strategies to access land

Land along the sand river is predominantly owned by Maasai people who previously managed the lands communally as part of four different group ranches: Imaroro-Mashuuru and Osilalei in the upstream section, and Nkama and Selengei in

the downstream part (BurnSilver and Mwangi, 2007). In recent years, the land has been subdivided and former group ranch members can acquire individual title deeds. In Imaroro-Mashuuru, Osilalei and Nkama group ranches, which include Mashuuru and Nkatu (Fig. 1), subdivision has been completed, and landowners can lease out or sell parts of their land. In the downstream group ranch Selengei, this process is ongoing, and individuals have made claims to certain portions of the land that they have used before. Until formalisation, they may lease out these lands for irrigated farming, yet within certain limitations of the Group Ranch rules. Although it is documented that Maasai have been leasing land for irrigation in other areas of Kenya since the 1950s, it is not exactly known when this phenomenon emerged along the Olkeriai (Southgate and Hulme, 2000). Sparse irrigated crop production started at least in the early 2000's with a growing number of individual leases to local and migrant farmers. Over the last five to ten years, irrigated farming has intensified when actors with complementary interests devised new institutional arrangements to access land and water in the area.

An array of flexible farming arrangements has developed along the Olkeriai, by resident and migrant farmers, land owners and capital providers, locally known as *tajiris*. Migrant farmers are the largest group of irrigators as they work on 86% of the plots studied (Tab. 2). The other 14% are cultivated by resident farmers. The majority of migrant farmers (84%) works in a partnership, while a smaller group of the migrant farmers (16%) farms individually. Most farmers remain in the same arrangement over time, although few switched from an individual to a partnership farm or vice versa. A partnership consists of two or three migrant farmers, one *tajiri* and a land owner. The migrant farmers provide labour, agricultural skills and knowledge to the partnership. The *tajiri*, meaning 'rich person' in Kiswahili, finances the land lease including water abstraction, irrigation equipment and farming inputs. Most *tajiris* have limited agricultural skills and combine irrigation with other business. They originate from within in the region or other counties within Kenya and Tanzania. Those from outside usually do not stay in the area, but manage the farms remotely and are present in the area during the establishment of the farm and harvest. The farmers and *tajiris* find each other through local contacts, based on experiences by other actors and sometimes *tajiris* visit farms to observe farmers performance in the field. Some *tajiris* come to the area together with farmers whom they have worked with before. The relations are mostly purely business and in some cases family members collaborate in partnerships. Profits are shared among the *tajiri* and the farmers at the end of the season, mostly at a 50–50% basis. Landowners regard the financial gains as the main benefit from leasing land, for most forming an additional income source to livestock, other businesses and subsistence farming. Few landowners combine land lease with their own irrigated crop production for the market, in which cases irrigated farming constitute the main income source.

All migrant farmers work on land leased from local land owners, with one exceptional case where a Kenyan migrant farmer bought land with title deeds. In the partnership construction, the *tajiri* is the one who settles the lease. These oral or written agreements are short-term, usually for one season or a maximum of one year. The lease fee averages €233/ha/yr, with a range from €190–380/ha/yr ($n=7$). The

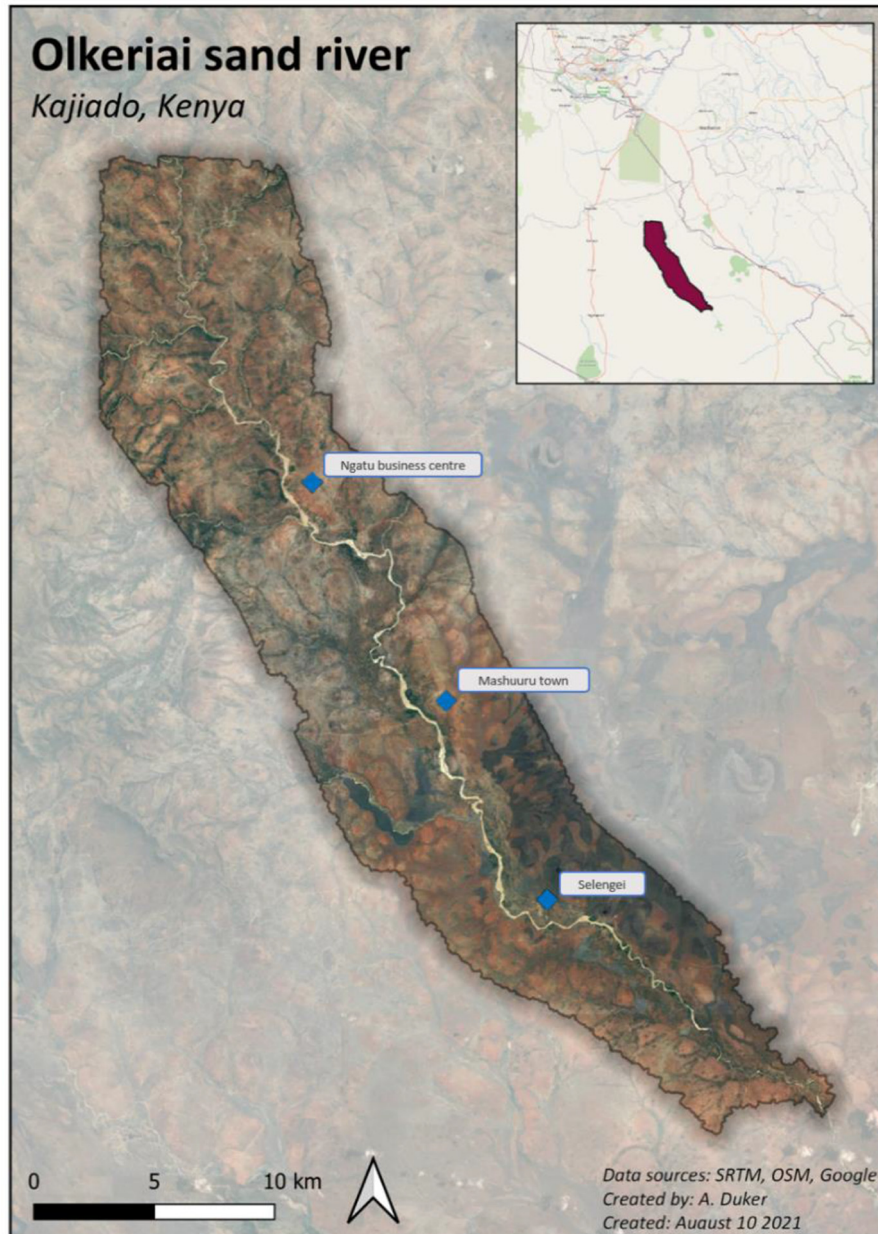


Fig. 1. Map of the Olkeriai sand river in Kajiado, Kenya.

Fig. 1. Carte de la rivière de sable Olkeriai à Kajiado, Kenya.

majority of leased lands (76%) is between 0.4 to 2.0 ha, with the largest plots just over 6 ha. A land owner may lease to multiple farmers or *tajiris*, and a *tajiri* often simultaneously leases lands from several land owners.

Water is accessed through scoop holes in the river bed or shallow wells on the river banks. In most cases, the land lease includes access to water from the adjacent shallow groundwater in the sand river, as land owners retain *de facto* water rights for their lands bordering the river. In few cases, when the land owner does not have a well, farmers or *tajiris* pay for abstracting water from a well of a neighbouring landowner. Farmers with shared wells have informal sharing arrangements if the well capacity

does not allow them to pump simultaneously. There is no governmental water authority actively regulating water abstraction from the sand river aquifer.

The influx of these new land users prompted residents, mostly originally pastoralists, to diversify their livelihood sources by leasing land and water to migrant farmers, establishing their own farms, becoming a *tajiri*, or a combination of these. 14% of the visited plots are cultivated by resident farmers who mostly work individually and on their own land (87%, [Tab. 2](#)). Few residents lease land as they do not own land close to the sand river, and a few farm in partnership with a *tajiri* and a land owner.

Table 2. Farm arrangements and land access.**Tableau 2.** Arrangements agricoles et accès aux terres.

	Migrant farmers	Resident farmers	All combined
<i>Total plots</i>	89 (86%)	15 (14%)	104 (100%)
<i>Partnership farm</i>	75 (84%)	2 (13%)	77 (74%)
Lease land	75	2	77
Own land	0	0	0
<i>Individual farm</i>	14 (16%)	13 (87%)	27 (26%)
Lease land	13	1	14
Own land	1	12	13

Table 3. Time of migrant farmers present in the area and number of plots accessed over time.**Tableau 3.** Temps de présence des agriculteurs migrants dans la zone et nombre de parcelles cultivées au fil du temps.

	Individual lease farmers (<i>n</i> = 8)	Partnership lease farmers (<i>n</i> = 24)	Total (<i>n</i> = 32)
Average presence in area (yrs)*	5.0	4.0	4.3
Range of presence in area (yrs)	1–11	1–13	1–13
Average number of plots accessed	2.6	3.0	2.9
Multiple plots simultaneously (no. farmers)	1	0	1

* Measured in 2019.

4.2 Mapping the spatial dynamics of farmers

This study zooms in on the migrant farmers who cultivate leased lands. They constitute the large majority of irrigators in the area and display specific spatial patterns. Migrants farmers originate from various counties within Kenya and from northern Tanzania. Among migrant farmers, we distinguish between ‘individual farmers’ who lease and farm without a *tajiri*, and ‘partnership farmers’ who collaborate with a *tajiri*. Individual farmers usually have relatives or friends in the region who introduce them to the opportunities the area provides. Partnership farmers may arrive with a *tajiri* they have worked with in other regions, but most come and search for a new partnership. At the time of first fieldwork (2019), migrant farmers had spent on average 4.3 years in the study area. Among those, individual farmers stayed slightly longer in the region than partnership farmers (5 and 4 years, respectively) (Tab. 3). In this timeframe, they changed the plots they cultivated 2.9 times on average. This is about once every two years for individual farmers and once every 16 months for partnership farmers. One individual farmer leased multiple fields simultaneously.

In May 2021, only 28% of the sampled farmers were still producing crops on the same plot they had been cultivating in November 2019 (Tab. 4). Half of the individual farmers (50%) and a large majority of the partnership farmers (79%) had left the parcel they cultivated at the start of our research. Of those who left, most of the individual farmers left the area, while the majority of partnership farmers remained farming on other fields along the sand river. In the same timeframe, a minority (25%) of the partnership farmers had left the area and returned to the Olkeriai to irrigate.

Figure 2 illustrates the movements of two individual and 10 partnership farmers between different plots along the Olkeriai sand river. The movements vary in terms of frequency

and distance. Several partnership farmers change plots almost every year, while others cultivated the same fields for several years in a row. Some shift within short distances, but most move along the full river stretch. There are four main motives to move: production factors, financial gains and losses, disagreements between partners, and opportunities for expansion. In the case of partnerships, it may be the *tajiri* or the farmer who decides to move. Either they agree to move together or they part ways. Decisions of the *tajiris* mostly relate to production factors such as lease conditions (price, duration), soil quality, water access, market access, flood risk, and pest occurrence. Despite being located in a semi-arid area, water availability is not a reason for actors to shift, as the sand river aquifer provides sufficient water. In the downstream part, water levels are deeper, but still sufficient and well accessible. In rare occasions disagreement between the *tajiri* and the land owner is the motivation to move. When partnership farmers decide to change location, without the *tajiri*, it is often the result of disagreement or conflict with the *tajiri* (timely supply of inputs, sharing profits). Another major reason to move, for both individual and partnership farmers, are consecutive financial losses, either due to failed harvest (pests, floods) or low market prices, in 2020 often due to the pandemic. They may move to smaller plots, or seek opportunities outside the region. *Tajiris* and partnership farmers usually part ways in case they experience financial losses or when the *tajiri* is not satisfied with the farmers’ performance. In a few occasions, *tajiris* or individual farmers move because they want to expand by leasing an additional or larger plot.

In the upstream part of the Olkeriai river, irrigation has existed for a longer time than downstream. It is easier to access larger plots of land downstream as farmers plough on average 2.1 ha downstream in contrast to 1.4 ha upstream. Although Figure 2 does not indicate a general trend of farmers moving downstream, frequent tomato pests and decreasing soil fertility

Table 4. Moves of migrant farmers over study period.**Tableau 4.** Déplacements des agriculteurs migrants au cours de la période étudiée.

	Individual lease (n = 8)	Partnership lease (n = 24)	Total (n = 32)
Present at same plot after 1.5 year (%) [*]	50	21	28
No more present at same plot after 1.5 years (%)	50	79	72
Of those no more present at the same plot			
– Remained farming on a different plot along the sand river (%)	25	68	61
– Moved outside of the area (%)	75	32	39
Ever moved out of area and returned (%)	0	25	19

^{*} Between November 2019 and May 2021.

are reasons for several farmers to leave the upper part and restart further south. They thus accept the burden and costs of clearing land and accessing deeper water levels to increase productivity and reduce fertiliser needs.

Figure 2 also shows that seven partnership farmers have left the area (years underlined), and five of them returned to the Olkeriai. Of all partnership farmers 25% left the area temporarily, to come back after a season or after a few years (Tab. 4). They left because they experienced losses and decided to search for employment elsewhere, started farming in other regions with presumed lower input costs (like gravity irrigation), or they had made enough profit to return home or invest in other business. Some returned to the Olkeriai after failure to find alternative income, or disappointing production in other regions.

Hence, the migrant farmers and *tajiris* are the prime drivers behind the shifts. Yet, in some cases land owners have terminated collaboration after the harvest season when conflicts arose. These were triggered by untimely lease payments, extension of the growing season beyond the lease period, and unapproved expansion of the area. Nevertheless, the majority of land owners surveyed did not experience conflicts with farmers or *tajiris* leasing land. The majority of land owners has no interest to lease land for longer periods as they want to remain flexible on how and with whom to use the land. Two land owners stopped leasing land to limit soil degradation and one experienced the demand for land to drop due to the pandemic.

4.3 Diverse motives of individual and partnership farmers

Individual and partnership migrant farmers show different dynamics. Individuals tend to stay longer in the region and move fields less frequently. This is explained by differences in farming motives and modes of operation. Individual farmers mostly come from neighbouring counties and have an average age of 50 years. They invest their own capital in acquiring irrigation equipment, improving the land and sometimes in digging a well or scoop hole. Many have developed off-farm income in the vicinity of their plot or in nearby settlements, such as keeping livestock, running a shop or restaurant, or trading in agricultural produce. They often live in semi-permanent houses close to the farm or rent lodging in one of the rural business centres, and travel home regularly. Few live close to family members who also established a farm or are

otherwise involved in the agricultural production or supply chain. Partnership farmers have a different social profile than those who farm individually. They are mostly men with an average age of 36 years, and come from neighbouring counties and also from regions further away in Kenya or Tanzania. Most of them have farmed in different ‘irrigation hotspots’ in southern Kenya and northern Tanzania. With a few exceptions, they have not made significant investments in other local business and they live in temporary sheds on the farm plots, ready to move on once they or the *tajiri* decide to do so. Hence, they employ another strategy in benefitting from short-term business opportunities with less strongly developed ties within the local social fabric. Yet, some remain engaged in longer-term partnerships with *tajiris* if they prove to be successful. These different motives of farming also explain why, in case of failed harvests, most partnership farmers tend to move to another plot or leave the area to explore other opportunities, while individual migrant farmers tend to stay in the area to focus on alternative income to be able to start farming in the following season. Despite many migrant farmers working in the area for several years, hardly ever do they have the ambition of settling down.

5 Discussion and conclusions

This study illustrates how a dynamic form of farmer-led irrigation evolves along the Olkeriai sand river. Farmers have developed diverse strategies to access land and water resources for staple and cash crop production, either individually or in partnership – an institutional arrangement that developed over the last five to ten years. *Tajiris* with financial capital, and farmers with knowledge and skills, meet in complementary and strategic partnerships, along with land owners. Migrant farmers and *tajiris* introduced the partnership arrangement that has spread rapidly. Although migrant farmers may own land elsewhere, the combination of land, water, capital and markets provides an opportunity they do not find in their home region. In many other parts of Sub-Saharan Africa, migration is also observed to fuel so-called vernacular land markets for agricultural production (Chimhowu and Woodhouse, 2006). Along the Olkeriai, this phenomenon is supported by the shift in land ownership from communal Maasai group ranches to individual ownership. Although land ownership does not prove to be a necessity for migrant farmers, individual title deeds made leasing land easier and resulted in a vivid land lease market. The farming partnerships offered an opportunity for

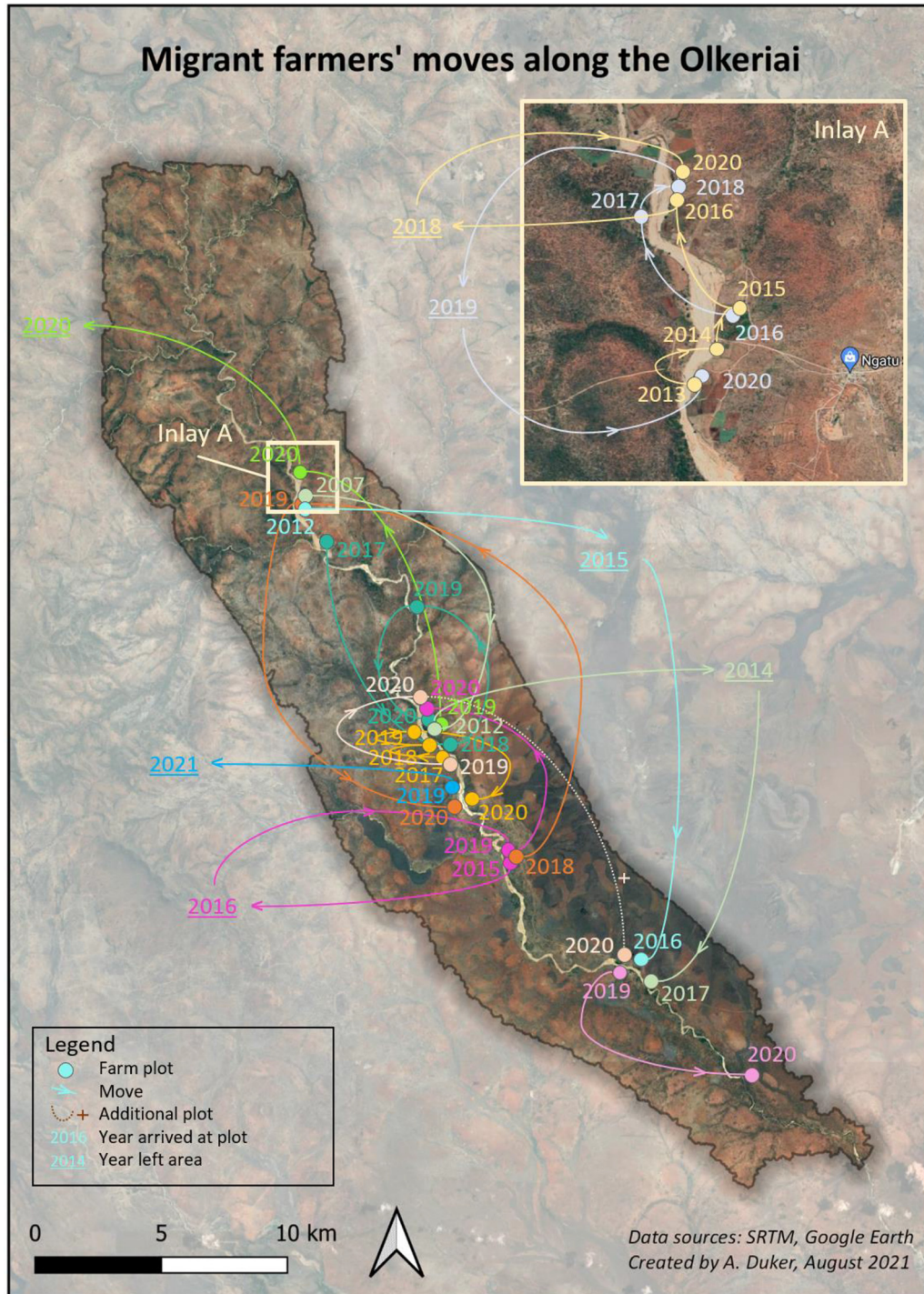


Fig. 2. Map with the moves of migrant farmers along the Olkeriai over time. Each colour represents the trajectory of one farmer with the years corresponding to the year of first cultivation at that plot. Underlined years outside the catchment delineation refer to years when the farmers left the area. A field without continuing arrow implies that the farmer was still present at that plot in 2021. The inlay shows two farmers who moved around in a small area.

Fig. 2. Carte représentant les déplacements des agriculteurs migrants le long de l'Olkeriai au fil du temps. Chaque couleur représente la trajectoire d'un agriculteur; les années correspondant à l'année de la première culture sur cette parcelle. Les années soulignées en dehors de la délimitation du bassin versant correspondent aux années où les agriculteurs ont quitté la zone. Un champ sans flèche continue implique que l'agriculteur était toujours présent sur cette parcelle en 2021. L'incrustation montre deux agriculteurs qui se sont déplacés dans une petite zone.

supplementary income for land owners, resembling a trend observed in several parts of Kenya, where land tenure changes influence livelihood diversification (Sundstrom *et al.*, 2012; Achambault *et al.*, 2014). In addition, the reliable water availability of the sand river is a magnet for irrigation activities, as it is replenished after major flood events. It removes a barrier for irrigation technology and fertiliser adoption as observed in other areas in Eastern Africa where smallholder irrigation frequently faces water scarcity (Nakawuka *et al.*, 2018). Finally, market-proximity, infrastructure and networks enable farmers to access financial capital and inputs, and sell produce for regional and international markets.

This farming system that includes land, water, technology, partnerships and markets is highly dynamic in space and time. These findings resonate with farmer-led irrigation literature that deviates from conceptualising irrigation as schemes, co-managed by farmers and (non-)governmental agencies (Woodhouse *et al.*, 2017; Harrison, 2018). This case also clearly positions farmers, *tajiris* and land owners as agents of irrigation development, rather than ‘beneficiaries’ (Woodhouse *et al.*, 2017). The system components promote flexibility, which is for example reflected in water abstraction technology. Pumps and hosepipes are movable and the non-movable abstraction points are either part of the land lease agreement or a low-cost investment.

These short-term and dynamic ‘blended arrangements’ have thus evolved based on location-specific norms and possibilities to fit the combined interests of a group of actors (Cleaver, 2015). The flexibility of temporary lease, partnership and marketing agreements serves the mutual interests of partners involved as described in similar cases of FLI (De Fraiture *et al.*, 2014). First, it is an entrepreneurial opportunity for quick cash generation in a search of optimal production conditions and, at the same time, an escape route to recover from shocks such as financial losses and conflicts. Second, these ventures are part of diversified livelihood strategies and the pragmatic and flexible character allows to experiment, fail, change, and redirect available resources. Actors involved thus appreciate the possibility to shift plots and terminate collaboration, which is manifested in a spatial dynamic of farmers and *tajiris* moving through the area. The extent of dynamics varies as some plots and partnerships last for several years whereas others are rearranged seasonally.

These findings imply a different approach towards security in accessing land and water than commonly understood. Four elements emerge when reviewing the concept of security: continuity/duration, delineation of a locality, recognition by others, and robustness to cope with challenges (Lund, 2000; Meinzen-Dick, 2014; Higgins *et al.*, 2018). In our case, the duration of a single contract may be short, yet continuity is found in the opportunity to substitute land and partners, as long as land and water resources are ample. Farmers and *tajiris* experience a sense of certainty in the notion that they can continue business even if the current location or partner proves unsuccessful and challenges occur, as there are alternatives available both in terms of natural resources and partners. The delineation of the locality is thus not confined to a single plot, but a stretch of the river, and sometimes beyond, where actors move around, which concurs with findings on crop cultivation in other parts of Kajiado county (Southgate and Hulme, 2000). Recognition is manifested in the contracts among the different

partners involved, and the ability of land owners to transfer access to land and water to others. In conclusion, security to access land and water is found in flexibility, rather than in a specific plot or lasting agreements. This has implications for current agricultural and irrigation development policies that are hardly ever beneficial to FLID. They hinge on land and water tenure security, for example in obtaining agricultural loans. Also, most governments in SSA, with Kenya being no exception, still primarily target rehabilitation, expansion and modernization of irrigation schemes without considering possible needs of farmer-led irrigators (Government of the Republic of Kenya, 2013a, Government of the Republic of Kenya, 2013b).

However, when moving beyond the individual actor, we see that the irrigation developments show drawbacks. Current and potential future risks include land degradation, reduction of riparian vegetation, and over-abstraction of water, which may lead to scarcity and conflicts on benefit- and risk-sharing. The short-term scope of the partnerships for monetary gains is likely to elicit these vulnerabilities. Therefore, we conclude that security and short-term profitability for individual actors of irrigation ventures evoke an adverse impact on the sustainability of natural resources use at catchment level. The diversity and short-term presence of irrigation actors will affect the eagerness and possibilities for any future strategies to address these challenges. Future research is therefore recommended to address these concerns of equity and sustainability.

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