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Large-scale land investments and land-use conflicts in the agro-pastoral areas of Ethiopia

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ABSTRACT

We examined the determinants of conflict among agro-pastoral households in areas affected by large-scale land investments in Ethiopia. We combined household and community surveys to collect data and used descriptive statistics and a binary logit model to analyze them. The results indicated that, in the last decade, land conflicts were prevalent in more than a quarter of the studied communities and that they increased since the establishment of large-scale land investments. The scarcity of pastureland and tenure insecurity are the key drivers of land conflict. We conclude that the state appropriation of traditional pastures for industrial plantations and a lack of property rights for the commons exacerbate land conflicts.

1. Introduction

Land is the main source of livelihood for most people in developing countries. In many of these countries, secure access to land has always been a challenge (George et al., 2021). In Africa, land is the cornerstone of economic, social, and political life and is subject to conflict, conquest, expropriation, and exploitation (Bob, 2010). Land conflict arises when two or more groups believe that their interests and perceptions regarding a piece of land are incompatible (Magsi, 2013; Sinthumule et al., 2020; Wehrmann, 2008, 2017). This creates disputes, disagreements, and contestations over property rights and interests (Kalabamu, 2019; Ochieng, 2011). Land-use conflicts result from the dissatisfaction of people with actions undertaken or planned by their neighbors, private institutions, or public authorities (Torre et al., 2014) and from peoples' resistance to the dispossession of their land without their consent (Upreti, 2004; Wehrmann, 2017). Jiang et al. (2021) describe land-use conflict as the situation that occurs when stakeholders pursue their incompatible interests for scarce land resources. According to Wehrmann (2017), land conflict involves conflict over ownership, access, decision making, and the right to compensation for land. Large-scale land investments (LSLIs)[1] are key drivers of contemporary land conflicts in developing countries (Bruce and Boudreaux, 2011; Hufe and Heuermann, 2017; Jiali et al., 2021; Ndi and Batterbury, 2017). Conflicts can occur over land and water in the context of rangelands. LSLIs restrict access to both land and water. For simplicity, we refer to land-use conflict to capture both.

Land conflicts can be driven by the acquisitions of land for LSLIs as they marginalized local communities (Ndi, and Batterbury, 2017). LSLIs are mainly driven by globalization and liberalization of trade in developing countries (Cochrane and Legault, 2020; Wayessa, 2020). Since 2008, the global demand for land has increased due to the growing demand for foods, biofuels, financial crises, and conservation (Bruce and Boudreaux, 2011; Margulis et al., 2013; Scoones et al., 2013). Consequently, multinational companies from developed countries have been investing in land in developing countries to secure future food supply (Abbink, 2011) and accumulate land resources (Basu, 2007; Scoones et al., 2013). The potential for economic development, foreign earnings, transfer of skills and technologies, and infrastructure development motivate the acceptance of LSLIs in developing countries (Jiali et al., 2021; Magsi, 2013; Sinthumule et al., 2020). Not only have corporations from developed countries acquired large-scale land areas in developing countries (Scoones et al., 2013), but nation-states and local elites with profit motives are also involved in land grabbing (Baglioni and Gibbon, 2013; Cotula, 2009). LSLIs, those run by both foreign investors and

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[1] Different terminologies, such as land acquisitions, large-scale land transfers, land grabs, and land deals, have been used to explain the compulsory transfer of land rights. We broadly refer to them as large-scale land investments. The core idea is the forceful control of relatively large tracts of land and other natural resources (Margulis et al., 2013).

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nation-states, widely exclude and displace local people (Abbink, 2011; Deininger and Byerlee, 2011; Ndi and Batterbury, 2017; Scoones et al., 2013) and have been conducted with low levels of transparency, consultation, or respect for the rights of local communities (Ariti et al., 2018; Cotula, 2009; Margulis et al., 2013; Wehrmann, 2017). Consequently, LSLIs face strong opposition from local communities (Basu, 2007; Scoones et al., 2013; Yang and He, 2021), and national governments have used force to break local resistance (Basu, 2007; Wehrmann, 2017). As a result, land conflicts have become more frequent and severe over time (Deininger and Byerlee, 2011; Dong et al., 2021; Margulis et al., 2013; UNEP, 2015).

The accurate identification of land-use conflicts and their drivers and effects is a prerequisite for resolving them and for optimizing the sustainable use of land (Dong et al., 2021). However, past studies have been one-sided, focusing largely on foreign-run LSLIs rather than on public land acquisitions (Cochrane and Legault, 2020; Cotula, 2009; Hufe and Heuermann, 2017). Moreover, globally, insufficient attention has been given to understanding land conflicts from LSLIs (Yang and He, 2021). Therefore, this study focuses on state-run LSLIs and their consequences for local communities. There are various stakeholders in land-use conflict in rural areas (Bob, 2010; UNEP, 2015), including states, local communities, ethnic groups, and private companies. In this paper, although we highlight land-use conflicts between pastoralists and other actors, the focus is on land-use conflicts between LSLIs and local pastoral households in Ethiopia.

This study aims to assess the nature of land conflict in pastoral areas in general and between pastoralists and LSLIs in particular and to identify the determinants of land conflict between pastoral households and LSLIs in Ethiopia. It has three contributions. First, it fills the knowledge gap about the existing land conflict and its determinants in LSLI-dominated pastoral areas. Second, it focuses on public investments in LSLIs, unlike most studies that have examined foreign investments. Third, it develops a comprehensive theoretical framework that combines insights from resource scarcity and property rights to analyze the complexity of land conflicts.

2. Background to the study

Pastoralism predominates on 43% of Africa's land (FAO, 2018), which includes 268 million pastoralists; the Horn of Africa has the largest population of pastoralists in the world (De Haan et al., 2016; Mkutu, 2001). Pastoral ethnicities are a minority in Africa and suffer from political marginalization (Rettberg et al., 2017). For example, less than 1% of the national budget, on average, is allocated to pastoralists in Africa (FAO, 2018).

Africa has a history of land dispossession, contestation, and inequitable land distribution (Bob, 2010; Kariuki and Ng'etich, 2016). In many African countries, land policies allow the appropriation of pastoral rangelands for LSLIs, with associated displacement and increasing poverty (De Haan et al., 2016). This has led to widespread conflict over land in pastoral areas (FAO, 2018; Hufe and Heuermann, 2017), such as those in Tanzania (Bergius et al., 2020), Kenya (Kariuki and Ng'etich, 2016), Ethiopia (Korf et al., 2015; Müller-Mahn et al., 2010), Ghana (Bukari and Kuusaana, 2018), Nigeria, Liberia, Sierra Leone, and Sudan (Bruce and Boudreaux, 2011).

An estimated 15% of Ethiopia's population is made up of pastoralists who reside in more than 60% of the country's drylands (PFE, 2010). Similar to many African countries, pastoralists in Ethiopia suffer from political marginalization. All land in Ethiopia is owned by the state, which limits the property rights of pastoralists (Lavers, 2018), and the Growth and Transformation Plan favors LSLIs in agro-pastoral areas. LSLIs have taken the best rangelands by denying pastoralists access to them (Müller-Mahn et al., 2010). As a result, the loss of key dry-season grazing areas to LSLIs is the main source of conflict in agro-pastoral areas (Little and McPeak, 2014; Ola-Adams and Okali, 2008; Rettberg et al., 2017). Pastoralists manifest strong resistance to formal land appropriations (Hundie, 2010; Rettberg et al., 2017). In severe scenarios, such resistance involves armed confrontation. Consequently, conflict over grazing and watering resources and boundary claims has become a major livelihood challenge for pastoral communities (Beyene, 2009; Bogale, 2006; Rettberg et al., 2017).

Land conflict has increased in Ethiopia in recent years. Since 2016, the government's plan to extend the capital, Addis Ababa, into the Oromia region has triggered major protests. Moreover, the land dispute between the Oromia and Somalia pastoral regions caused the internal displacement of around three million people in 2017–2018. Similarly, the land disputes between Guji and Gedeo internally displaced about one million agro-pastoralists in 2018–2019. Land-related disputes also exist in non-pastoral regions, such as the Amhara and Tigray regions (Lavers, 2018). Currently, the political unrest in Ethiopia can also be related to land resources, as land is a highly politicized resource linked to structural inequality.

Land conflicts have negative effects on households and the economy as a whole. They slow down investment and can result in property loss for the conflicting parties (Wehrmann, 2008). In Africa, land conflicts have continuously weakened and reduced countries' capacity to achieve their development goals (Beyene, 2009). Land conflicts are linked to security and livelihood issues in fragile pastoral areas, such as the loss of human life, displacement, and disruption in education and mobility (Beyene, 2009). Micro-conflicts can severely affect economic development and escalate into a community-wide conflict.

Conflicts in the pastoral areas of Ethiopia have received widespread attention, but an in-depth analysis remains missing. The available literature has mainly focused on general conflicts and is based on reports in the media or from activists and rights groups but not on robust investigations. Some studies have investigated the link between insecure property rights and land disputes at the household level in non-pastoral highland areas of Ethiopia (Di Falco et al., 2019; Lucchetti, 2015). Another strand of literature has focused on the macro-level conflict between Ethiopia and other countries (e.g., the conflict between Eritrea and Ethiopia) (Uchehara, 2014). Other studies investigating conflict in pastoral areas have focused on the conflict between different ethnic groups (Beyene, 2009; McPeak and Little, 2018; Tadesse et al., 2015) or between neighboring pastoralists (Hundie, 2010; McPeak and Little, 2018). These studies either used a case study approach, a narrative synthesis, or a restrictive theoretical framework, all of which provide little insight into the determinants of land conflict. Therefore, this study develops a comprehensive theoretical framework combining insights into resource scarcity and property rights to uncover the complexities of land conflict. The land conflict between pastoralists and LSLIs is most common in pastoral Ethiopia. However, it lacks sufficient attention at the household level in previous research.

The study area for this research is the Ethiopian Awash Valley. This region is home to different indigenous agro-pastoralists, such as Karrayyu, Ittu, Afar, and Issa. The Awash River basin has attracted significant LSLIs in the country. The Awash Valley was used by pastoralists until the 1960 s (Said, 1994). In 1974, the Ethiopian government encroached on more than 45% of the rangelands in the Awash Valley for LSLIs (Hundie, 2010; Ola-Adams and Okali, 2008; Said, 1994), undermining pastoralists' access to productive rangelands. After 1991, many state-owned large-scale farms were returned to Afar pastoralists (Ibrahim, 2016). However, since 2010, the government has reclaimed the land to expand sugar plantations to meet the Growth and Transformation Plan targets (ESC, 2017; Müller-Mahn et al., 2010). In 2014, the Kesem and Tendaho plantations grabbed more than 2000 ha and 75000 ha, respectively, of rangelands in the Awash Valley. Tendaho dispossessed 75% of the Afar pastoralists' access to dry-season grazing (Ibrahim, 2016). The expansion of sugar plantations into pastoral areas has deepened an old problem and increased the intensity of land conflict in recent years. However, most studies on the Awash Valley have given insufficient attention to land conflicts. The literature on conflict has emphasized the conflict among pastoralists, between pastoralists and

farmers, or among ethnic groups, but it has largely ignored the conflict between pastoralists and LSLIs (Hundie, 2010; Menbere, 2013; Reda, 2014).

Therefore, the Awash Valley is a good example of an area of land conflict in agro-pastoral Ethiopia. It is also a key area for the national economy, as a major road that links the country to international trade through Djibouti crosses this area. A better understanding of the complexities of conflict and its specific determinants is needed to design peacebuilding strategies in contested areas like the Awash valley.

3. A conceptual model of land conflict

The major theories explaining land-use conflicts in agrarian economies are property rights and environmental scarcity (Beyene, 2017; Di Falco et al., 2019; Homer-Dixon, 1994). Property rights theory argues that poorly defined property rights are sources of conflict (Beyene, 2017). Property rights are the institutions (rules) that specify a bundle of rights over the property (land). Schlager and Ostrom (1992) categorize these rights as use rights, control rights, and authoritative rights (definition and allocation). Disagreements, contradictions, and overlapping rights over resource use are often the sources of conflict (Ochieng, 2011; UN, 2012). The contradictions emanate from the deterioration of the traditional authorities' role in commons management and the dominance of government authorities. Contradictions also intensify when land users and the state claim the same land. Thus, a lack of land tenure security (e.g., dispossession of commons rights, evictions) exacerbates mistrust and grievances, leading to conflict (Bruce and Boudreaux, 2011; Di Falco et al., 2019). The lack of relevant laws to protect land rights is at the center of land conflicts (Nara et al., 2021). In the context of this paper, LSLIs claim pastoralists' traditional land and hamper their rights to use, control, and allocate it, causing conflict between pastoralists and LSLIs (Lode and Kassa, 2001; Tadesse et al., 2015).

The United Nations defines environmental scarcity as a situation in which the supply of renewable resources (e.g., water, forests, rangelands, and croplands) is insufficient to meet demand (UN, 2010, 2012). Environmental scarcity also indicates an inequitable distribution of resources (*ibid.*). Three concepts of scarcity are explained in classical economics: absolute scarcity, relative scarcity, and political scarcity. The absolute scarcity is based on Malthus's theory of population (Malthus, 1798) that argues resources are finite and subject to depletion as the population grows, while Ricardo (1955) sees land scarcity as relative to demand rather than absolute. Marx's political scarcity emphasizes how political contests over resources and historical inequalities due to elite capture have affected resource access (Scoones et al., 2019). Scoones et al. (2019) revisited the absolute, relative, and political scarcity within the global land crisis and demonstrated that the greater source of scarcity is political inequality. They further categorized scarcity as exogenous (environmentally given) and endogenous (users behaviour). In the context of LSLIs, it is the exogenous scarcity that plays a significant role in land conflicts, while a lack of cooperation between land users may exacerbate conflict within or between groups (Hoenow and Kirk, 2021; Scoones et al., 2019). Scarcity is contingent, contextual, relational, and above all, political (Scoones et al., 2019). Despite this, their conceptualization of scarcity is limited to a qualitative analysis.

Homer-Dixon (1994) describes environmental scarcity as the declining availability of natural resources and broadly classified the concept into three dimensions: supply-induced scarcity, demand-induced scarcity, and structural scarcity (Homer-Dixon, 1994; Ochieng, 2011). Supply-induced scarcity occurs when land degrades in quality and depletes in quantity (UN, 2010). Supply-induced scarcity in pastoral areas is caused by environmental degradation, climate change, and recurrent drought (Hundie, 2010; Jiang et al., 2021; Safarzynska, 2018, 2012). As the supply of land is reduced, claims over land by different land users increase the likelihood of conflict (Feldt et al., 2020; Jiang et al., 2021; UN, 2012).

Demand-induced scarcity arises when the demand for land cannot be met by an existing supply (Homer-Dixon, 1994; UN, 2012). Capitalist motives to accumulate land by LSLIs are the major cause of demand-induced scarcity and, thus, conflict (Jiali et al., 2021; Kariuki and Ng'etich, 2016). When powerful groups (e.g., LSLIs) control access to scarce lands, conflict occurs with the host community. This further increases resource scarcity for an ethnic minority such as pastoralists and violence. In addition, population growth (human and livestock) increases demand for land and affects land rights (Abdulahi, 2005, 2010), thus increasing land scarcity (Feldt et al., 2020). For example, the Ethiopian population has grown 2.7-fold over the last five decades (Hailu, 2016). An increased demand for land increases tensions over claims to the scarce land between land users and can lead to violence, as disadvantaged groups (e.g., pastoralists) seek equitable access to scarce resources (UN, 2010). Thus, land scarcity, from the perspectives of demand and supply, can increase the likelihood of land-use conflict (Bruce and Boudreaux, 2011; Hilhorst and Zomers, 2011). Structural scarcity arises from the unequal social distribution of a resource (UN, 2012), which could be caused by tenure insecurity and unequal power relations. Therefore, it is interrelated with the notions of property rights and security. The lack of equal access to land is an important source of conflict (Menbere, 2013).

The imbalance of power among land users and the lack of equitable access to natural resources have contributed to the recurrence of conflicts in Ethiopia (Beyene, 2007; Lode and Kassa, 2001; Tadesse et al., 2015). Loss of access to key resources and eviction without compensation are drivers of conflict between affected communities, the government, and the private sector (Ochieng, 2011). Moreover, Ethiopian pastoralists are sidelined from making decisions that affect their livelihoods, which makes it more likely that they will oppose decisions made by the government (Ariti et al., 2018; Ochieng, 2011; UN, 2012). Furthermore, a lack of good governance and related grievances are major political factors underlying conflicts (Rahmato, 2014; Regassa et al., 2019).

In addition to the above theoretical perspectives, land-use policy affects land conflicts. Before 1974, in the imperial era, land policy in Ethiopia favored landlords who exploited peasant labor. From 1974–1991, during the socialist era, the government abolished the landlord–tenant relationship and declared usufruct rights over land (Di Falco et al., 2019) under the motto of *land to the tiller* (farmers). Since 1991, according to Article 40 of the constitution, the state owns all land and can allocate it to investment at any time, which promotes insecurity of landholding.

In all eras, land transfer rights, such as sale, lease, and mortgage, are prohibited by the rule of the state (Di Falco et al., 2019). For pastoralists, land use was governed by customary clan leaders until 1991, but this role has diminished in recent years (Mulugeta, 2014). The exclusion of local people from decision making concerning land allocations drives conflict. In Ethiopia, land policies have favored the non-pastoral uses of the land (Little and McPeak, 2014; Regassa et al., 2019). The Growth and Transformation Plan of Ethiopia aspires to make the country a middle-income nation by 2025 through the commercialization and industrialization of agriculture. This includes the development of the sugar industry, which is targeted mainly in the lowland areas of the country where agro-pastoralists reside. The communal grazing rights of pastoralists are not protected by law (Mkutu, 2001; Regassa et al., 2019). As a result, the government has allocated communal land to sugar production, and pastoralists have lost entitlement to dry-season grazing. This has led to structural scarcity (Menbere, 2013) and violent conflict (FAO, 2018). Fig. 1 presents the conceptual framework of our research. The framework is based on two theoretical perspectives and the relevant literature (Homer-Dixon, 1994; Ochieng, 2011).

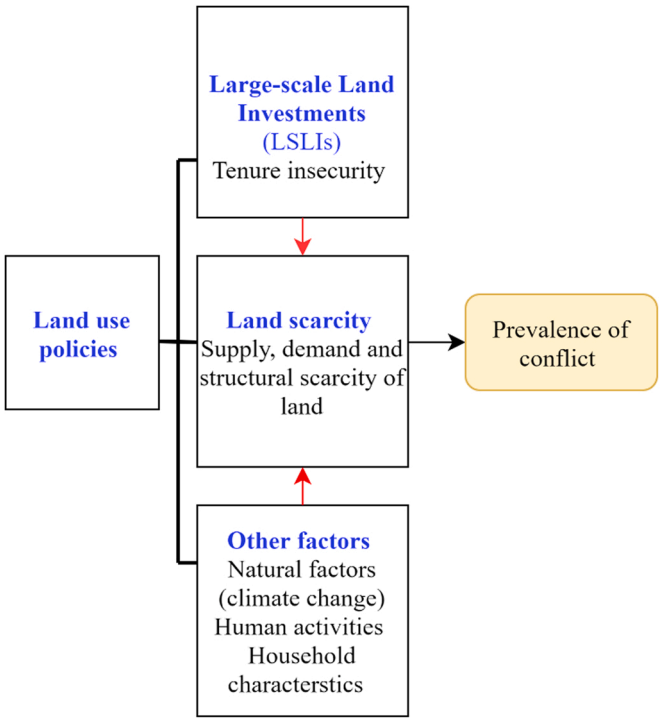

Fig. 1. Conceptual framework of the land-use conflict in Ethiopia.
Source: Authors' design based on a literature review.

4. Methodology

4.1. Sampling

This study combines information from household and community surveys with secondary information from the literature. A cross-sectional household survey was conducted in 2019 in the agro-pastoral communities of Karrayyu and Afar. These communities have been affected by LSLIs located in the Awash Valley of Ethiopia. We selected Fentale and Dubti *woredas*[2] and eight *kebeles*.[3] The *kebeles* were stratified into nearby (5 km) and distant kebeles from LSLIs using the Yamane sampling formula (Yamane, 1973). A total of 870 households were randomly selected (440 from Fentale and 430 from Dubti).

4.2. Data

Primary data on the loss, access, use, control and management of pastureland and the exposure and frequency of conflict were collected through household interviews. We followed Wehrmann (2008) in designing and clustering the questionnaire. We asked whether the household had faced conflicts related to LSLIs on grazing or farmland in the last 10 years. At the village level, data on the history, causes, and effects of conflicts and the community perception of LSLI were collected through focus group discussions (FGDs) and key informant interviews. In total, eight FGDs involving 43 male and 16 female elders were conducted. The key informant interviews were conducted with local experts in each *kebele*.

4.3. Variables and hypotheses

4.3.1. Dependent variable

The respondents were asked retrospective questions about their households' exposure to land conflict with the LSLIs (1 yes, 0 no) in the last 10 years. We followed Kisoza (2014) and Wehrmann (2008) in defining household conflict exposure. Accordingly, conflict was interpreted as a disagreement on land use, ranging from simple disputes to occasional fighting and severe violence involving death and loss of property. Here, a conflict is a situation in which pastoralists and LSLIs claim the same scarce land at the same time. It also encompasses forced displacement, loss of access to customary lands, or their combination.

4.3.2. Explanatory variables

The concept of conflict is complex and has many causes. We used the conceptual framework developed in Section 3 to investigate the drivers of conflict between pastoralists and LSLIs (Fig. 1).

Table 1 shows the definition, descriptive statistics, and expected signs of the independent variables by households' exposure and non-exposure to LSLI conflict. We focused primarily on how the lack of property rights caused by LSLIs leads to land-use conflicts. We used household distance from LSLIs (LSLI_km), loss of farmland to LSLI (LAND_loss), household worry about losing land (LAND_worry), and lack of trust in LSLIs (LSLI_trust) as proxy indicators for the influence of LSLIs. The study households have lost access to both farm and grazing lands. Over 50%[4] of the respondents reported that they had lost farmlands to LSLIs in the past. The dispossession of property rights, measured by the loss of farmland to LSLIs, was expected to intensify land scarcity and land conflict. As a result, most households did not trust LSLIs, and 40% still worried that they would lose their land in the future. Households' proximity to LSLI was expected to increase their vulnerability to land conflict.

We used proxy indicators to measure scarcity. Land supply scarcities can be caused by drought, land degradation, and Prosopis[5] invasions, which are expected to increase the likelihood of land conflict. About 63.3% of the respondents owned farmland, and 60% had access to irrigation. These were agro-pastoralists who cultivate crops to supplement their livelihoods. The dryland owned by pastoralists, however, is less suitable for crop production unless it is irrigated. Irrigation may help households diversify their livelihoods and reduce vulnerability to water scarcity. However, the distribution and control of irrigation use are strongly connected to LSLIs. More than 50% of households suffered severe drought, and more than 30% suffered from Prosopis invasion. Prosopis is an invasive weed with an adverse effect on biodiversity and livelihood in pastoral areas. In the Afar region, Prosopis invaded over 1.2 million hectares (FDRE, 2017). It is one of the worst invasive alien species, causing severe environmental degradation in arid and semi-arid lowlands. The key informants reported that poisonous thorns from Prosopis cause physical injuries to humans and livestock.

Demand-induced scarcity is related to households' requirements for land for grazing livestock and food production. Land is a fixed asset, whereas the population increases over time. The larger the size of households and livestock owned, the greater the demand for land. In this study, the average family size was eight members, which is higher than the national average of 4.9 for rural areas. The average number of

[2] *Woreda* is the fourth lowest administrative level in Ethiopia (Federal-Regional-zonal- woreda).

[3] *Kebele* is the fifth lowest administrative unit in Ethiopia (Federal-Regional-zonal- woreda-kebele).

[4] Over 90% of the households had lost access to grazing lands. Nevertheless, the loss of access to grazing lands is not different among households exposed to conflict and those who did not. We therefore include the loss of access to farmland in the regression.

[5] Prosopis juliflora is a threat to biodiversity and livelihoods in the pastoral and agro-pastoral areas of Ethiopia. It invades pasturelands, irrigation, and crop lands, and it displaces native vegetation. The government of Ethiopia has developed a strategy to prevent its invasion and restore invaded areas (FDRE, 2017).

Table 1
Independent variables definitions, mean values and hypotheses.

				Conflict exposure (1/0)		
	Variables	Definition	Total sample	Exposed to land conflict	Not exposed to land conflict	Expected sign
				mean	mean	mean
LSLI-induced	LSLI_km	Distance from LSLI (km)	10	11	9	-
tenure insecurity and structural scarcities	LAND_loss	Lost farmland due to LSLIs in the past (1 yes, 0 no)	0.6	0.7	0.5	+
	LAND_worry	Very much worried about losing land (1 yes, 0 no)	0.4	0.4	0.4	+
	LSLI_trust	Do not trust LSLI (1 yes, 0 no)	0.9	1.0	0.9	+
Supply-induced scarcities	LAND_own	Quantity of land owned (ha)	0.9	0.9	0.9	-
	IRRIGATE	Own irrigable land (1 yes, 0 no)	0.6	0.5	0.6	-/+
	LDI	Land Degradation Index (1 none, 2 light, 3 moderate, 4 severe)	1.9	2.2	1.6	+
	DROUGHT	Household exposure to drought (1 yes, 0 no)	0.6	0.8	0.5	+
	PROSOPIS	Prosopis invasions (1 yes, 0 no)	0.5	0.7	0.3	+
Demand-induced scarcities	HH_size	Number of family members	8	8	8	+
	TLU	Livestock number owned (TLU[a])	14.5	16.4	13.3	+
	MOBILITY	If the household practices mobility (1 yes, 0 no)	0.5	0.4	0.6	-
Household characteristics	MARKET_Km	Distance to market (km)	14.6	15.7	14.0	+
	ROAD_km	Distance to roads (km)	2.5	3.5	1.9	+
	LOGINC	Total household income in USD[b]	1241.0	1600.7	1134.4	+ /-
	COOPER	Membership of cooperatives (1 yes, 0 no)	0.2	0.2	0.2	-
	LEADER	Household head leadership position (1 yes, 0 no)	0.2	0.2	0.2	-
	NONFARM	Participate in non-farm activities (1, yes, 0 no)	0.8	0.8	0.8	-
	CREDIT	Household credit use (1 yes, 0 no)	0.1	0.2	0.1	-
	EXTENSION	Access to agricultural extension (1 yes, 0 no)	0.4	0.3	0.4	-
	AGE	Age of the head in years	42.1	41.5	42.4	-
	GENDER	Gender of head (1 male, 0 female)	0.8	0.9	0.8	+
	EDU	Years of education of the head	1.3	1.6	1.2	-

[a] TLU refers to tropical livestock units using the conversion factors of Storck and Doppler (1991). TLU was calculated by multiplying the count of each species by their respective units: sheep and goat (0.1), cow (1.0), ox (1.1), donkey (0.5), horse (0.8), poultry (0.01), and camel (1.2) (Storck and Doppler, 1991).
[b] USD calculation is based on a 27.4 exchange rate for 2019.
Source Authors' survey (2019)

livestock owned was 13.3 tropical units. About 60% of the households practiced herd mobility to search for pastures and water. The restrictions on mobility weakened pastoralists' coping strategies, leading to conflict. Structural scarcity is embedded in the lack of property rights and the power imbalance in land-use decisions. We included qualitative information from the key informants in the Results section to capture it.

Household characteristics were used as control variables in the analysis. The household characteristics such as, household income, access to markets and roads, cooperatives, extension programs, and credit and non-farm activities. These factors are important in pastoralists' livelihoods and are expected to reduce the likelihood of land conflicts. To access markets and roads, households traveled 14.6 km and 2.5 km on average, respectively. Only 10% of the households participated in credit programs, 20% in cooperatives, and 39% in extension programs. About 19% of the household heads had leadership positions in their villages (as clan and village chiefs). A village chief (kebele chairman) is responsible for land administration according to government regulations. If the heads of the households are clan leaders or village chiefs, they receive social respect due to their political capital. About 82% of the respondents participated in one or more non-farm activities. The average age and education of the household head were 42.1 and 1.3 years (below grade one), respectively. In Ethiopia, 49% of females and 35% of males did not attend school. The education of pastoralists was even lower, as they had very limited access to education. Young men are mainly responsible for livestock herding and are more vulnerable to conflict than their counterparts (Flintan, 2020). Women have lower access to land and decision making in the pastoral areas of Ethiopia and elsewhere in Africa (Balehey et al., 2018; Nara et al., 2021). War, defense, and heroism are the roles of men, while women nurse children and serve the family in pastoral gender roles (Moritz, 2008). Stickler et al. (2018) show that more males than females reported conflicts in Afar.

Households with a conflict prevalence with LSLIs had higher land degradation, more livestock, and higher incomes than those who did not report conflict with LSLIs. The mean income of households without conflict was US$ 1134.4 in 2019, which is lower than the US$ 1600.7 for households with conflict. However, both groups lived below the nationally defined absolute poverty line set in 2016 (US$ 2000). Livestock is the major source of pastoralists' income, and households with more livestock earn more income. However, more livestock increases competition over land and increases the likelihood of conflict. Most drought-vulnerable households and those with access to the extension were exposed to land conflicts with LSLIs, while a smaller share of households that practiced herd mobility were exposed to conflicts with LSLIs.

5. Econometric model

Our dependent variable—conflict exposure—is a dummy variable. Logit and probit models can be specified to investigate the probabilities of an event occurring as a function of a set of non-stochastic explanatory variables. Although both logit and probit models provide similar results, the logit model is widely used to analyze conflict (Haslam and Tanimoune, 2016; Kisoza, 2014; Safarzynska, 2018). Thus, we chose a binary logit model to identify the determinants of conflict in the agro-pastoral context. Logit does not require normal distribution assumptions and is computationally less demanding (Gujarati, 2003).

Following Gujarati (2003), the functional form of the logit model is specified as follows:

$$P_i = E(Y = 1 \mid X_i = \beta_0 + \beta_i X_i .. \quad .(1)$$

The logistic model (the log-odds ratio) takes the following form:

$$P_i = E(Y = 1 \mid X_i = \beta_1 + \beta_2 X_i = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i)}} \quad (2)$$

For ease of exposition, the probability that a given household is exposed to conflict is expressed as follows:

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^Z}{1 + e^Z}. \quad (3)$$

where $Z_i = \beta_0 + \beta_i X_i$.

The probability of not encountering conflict is expressed as 1-P_i:

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \quad (4)$$

We calculate marginal effects of each independent variable on the outcome variable conflict exposure to estimate the effect of a unit change in the independent variable on the dependent variable –conflict exposure.

6. Results and Discussion

6.1. Descriptive results

6.1.1. Prevalence, causes, and trends of land-use conflict

In this section, we discuss the prevalence of land-use conflict among pastoralists and other actors. In the last 12 months before the survey, 18.2% of the agro-pastoral households were exposed to land conflict. Previous studies reported that 16% and 6% of households were exposed in Oromia and Afar, respectively (Stickler et al., 2018). Over the last 10 years, 27.4% of the respondents were exposed to conflict associated with LSLIs. The average number of conflicts encountered by households in the last decade was 3.6 (Table 2). As the Karrayyu and Afar pastoralists resisted the establishment of LSLIs, the government of Ethiopia deployed federal police forces to control the land. As a result, violent clashes occurred between plantation workers and pastoralists (Mulugeta, 2014). The LSLIs prevent herd movements, jail the herders or the livestock, and impose fines whenever livestock encroaches on the plantation areas. Physical attacks also occur between plantation guards and livestock herders when negotiations fail.

Among competing land users, agro-pastoral households faced land conflict mainly with national parks (57.6%) and LSLIs (38.6%). More than half of the vital dry-season grazing areas of the Afar and Karrayyu rangelands were appropriated by plantations, and this increased the grievances of the local community land-use conflict. Conflicts with communities in neighboring regions (other ethnic groups) and the government accounted for 10%.

The incidence of land conflicts involving LSLIs increased for 57.5% of households over the last 10 years, while 35.1% and 7.4% reported that conflicts decreased and continued, respectively (Table 3). FGDs with elders and previous studies also indicated a trend of increasing conflicts (Mulugeta and Hagmann, 2008; Said, 1994; Tadesse et al., 2015; Tafere, 2013). Trends in land conflict varied by study site. Many households in Fentale reported increasing land conflicts, whereas those in Dubti reported a declining trend. Stickler et al. (2018) find a low incidence of conflict in Afar. The FGDs in Fentale indicated that the establishment of the Metehara and Kesem sugar estates led to the loss of crucial farming and dry-season grazing areas, watering points, and burial sites. In 2016, a violent conflict occurred, leading to the death of two people from the pastoralist groups, following the expansion of the plantation into the burial areas.

Table 4 presents the distribution of respondents by their perceptions of the causes of land-related conflicts. Based on the literature, we identified 10 causes of land conflict for the study areas. Most respondents identified livestock mobility (71.3%), grazing land scarcity (59.0%), loss of tenure security (53.2%), and farmland shortages (51.9%) as the major causes of land conflict.

More than a quarter of the respondents reported border-related disputes and national park encroachment as important causes of land conflicts. For example, there were frequent conflicts between Karrayyu and neighboring Argoba, between Karrayyu and Afar, and between Issa and Afar over the bordering rangeland. According to the FGDs, the conflicts between Karrayyu and Argoba and between Issa and Afar increased in intensity and frequency,[6] whereas those between Karrayyu and Afar declined, following the peace negotiations between Karrayyu and Afar elders.

Livestock raiding is another cause of conflict, affecting 16.3% of the respondents. In the past, livestock raiding was practiced by pastoralists from different clans. Recently, urban brokers, in consultation with pastoralists, have raided livestock for commercial purposes. Two weeks before the survey, key informants and the media reported that over 400 livestock from Karrayyu were raided to unknown places using big trucks for sale in urban markets. Such illegal raids involved the killing of herders and led to the escalation of conflict between different ethnic

Table 2
Prevalence of conflict in the last 12 months and over 10 years.

Households' exposure to conflicts	
Share of households exposed to conflict, 12 months	18.2%
Share of households exposed to conflict, 10 years	27.4%
Average number of conflicts that households have been exposed to, 10 years	3.6
Conflicting parties, 10 years	
Conflicts between pastoralists and LSLIs	38.6%
Conflicts between pastoralists of neighboring regions (Karrayyu vs. Argoba, Issa vs. Afar)	10.6%
Conflicts between pastoralists and the local government	9.0%
Conflicts between pastoralists and private large-scale farms	23.9%
Conflicts between pastoralists and national parks	57.6%

Source: Authors' survey (2019)

Table 3
Share of households indicating an increasing, decreasing, or stable evolution of land conflicts over the last 10 years.

Conflict	Fentale	Dubti	Average
Increasing	72.7	39.6	57.5
Decreasing	21.8	50.9	35.1
Unchanged	5.5	9.6	7.4

Source: Authors' survey (2019)

Table 4
Households' perceptions of the causes of land conflict.

Causes of conflict	%
Livestock mobility	71.3
Expanding territory	24.2
Border dispute/unclear boundary	25.6
Farmland shortage	51.9
Grazing land scarcity	59
Livestock raiding	16.3
Lack of land tenure	53.2
Commercial investors	23.9
LSLIs	45
National parks	31.5

Source: Authors' survey (2019)

[6] During data collection, we observed the total shutdown of Metehara town and the blockage of the Addis Ababa Djibouti road because of the conflict between Karrayyu and Argoba. There were fatalities from both sides, but there were no official or independent reports to cite.

groups. Previous studies have reported that in 1976–1990, 83 Karrayyu were killed, and 1212 livestock units were raided (Mulugeta and Hagmann, 2008). In 1981–1992, 86 Afar were killed, and 848 livestock units were raided. A total of 71 LSLI workers were killed, and 47 were wounded by the Afar in 1979–1990 (Said, 1994).

When grazing and farmland are scarce, competing claims lead to conflict (Tafere, 2013). Thus, land conflicts were caused by the shrinkage of grazing land by LSLIs (45%), national parks (31.5%), and private commercial farms (23.9%). The absence of compensation for lost land is also a major driver of conflict (Menbere, 2013). In Fentale, the Metehara sugar plantation expanded into the Kesem sugar plantation, and Karrayyu pastoralists lost access to dry-season grazing in the Fentale plain. This resulted in unsolved grievances. The FGD participants in Fentale explained the structural scarcities created by the sugar plantations as follows:

> *"During the establishment of the Metehara plantations, the local government and company workers told us that they were going to benefit our community. They promised to employ a lot of local people and establish sugar out-growers, which was a total lie. They employed very few local people, such as security guards, and even those employed gained unfair positions. They neither recruited out-growers nor paid compensation for the land lost. We demonstrated resistance, but the federal and local authorities often reacted with repression rather than with negotiation. Currently, we are more desperate than ever and remain voiceless."*

Key informants from the Metehara sugar plantation did not deny these complaints from the community. Less than 1% of the company employees were from the pastoral community because, according to the plantation, they lacked skilled labor.

For example, the Tendaho sugar factory swore to create job opportunities for 50,000 people in Afar (Rettberg et al., 2017), but it failed to keep its promise. The Tendaho company established 16 out-grower cooperatives that hosted 2000 households to produce and supply sugar cane to the factory at US$2190 per hectare per year. In 2016, although some cooperatives supplied sugar cane, the company did not settle the payments, leaving unsolved grievances. Moreover, participation in sugar out-grower programs in Ethiopia has significantly reduced household income (Wendimu et al., 2016). As a consequence of unmet expectations and grievances, the community resisted LSLIs. In some instances, organized and armed attacks occurred in the sugar factories. The government of Ethiopia supported the sugar companies by suppressing local voices and resistance. At the time of this survey, we saw a permanent military station inside the LSLIs to ward off mass attacks on the sugar plantations. The FGD participants in Dubti described the level of grievances about the loss of pastureland to the Tendaho sugar plantation as follows:

> "*The land was used by our ancestors for centuries. We have lost access to the land because the sugar plantation took it forcefully. As a result, we have become impoverished. We repeatedly requested that the Ethiopian government return our land, or at least to provide us partial access during dry season. However, we did not receive a favorable response. We hope that one day, we can reclaim our land and that the plantation will be destroyed."* FGD discussion in Dubti (2019).

The Tendaho plantation representatives in Dubti agreed with the grievances of the local communities and indicated that the company was underperforming and incurring losses.

6.1.2. Land conflict resolution and coping strategies

Most of the conflicts in the study region were solved by clan leaders (86.4%) and through courts (36.3%), the police (36.4%), and political systems (11.8%) (Table 5). Clan leaders are respected for their wisdom and honesty, and they deal with conflict in a participatory, transparent, and flexible nature (Tafere, 2013). The traditional governance systems that involve conflict resolution are called the *Gadaa*[7] and *Madaa*[8] in the Karrayyu and Afar societies, respectively. However, the role of traditional leaders in land conflict resolution has declined (Beyene, 2007). For example, 54% of the conflicts in Afar were solved by the government, and only 31% were solved by the traditional elders' council (Stickler et al., 2018). There is also a weak collaboration between the formal and informal systems involved in conflict resolution. There are no mechanisms for conflict surveillance, monitoring, and controlling in the formal system, and the federal police usually intervene only after severe damage has occurred.

Table 5
Conflict resolution and coping mechanisms.

Conflict resolution	%
Clan/ elders	86.4
Court and Sharia	36.3
Police	36.4
Politics	11.8
Coping strategies	
Borrow money	38
Sell livestock	58.8
Migrate	28.4
Seek relatives' support	50.2
Relocate children/send to relatives	24.6
Sell labor	31

Source: Authors' survey (2019)

To cope with conflict, more than half of the households sold livestock and sought the help of relatives or external support. About 38% of the respondents borrowed money, and more than a quarter of the respondents migrated and sold labor.

6.1.3. The perceived effect of land conflict

Conflict exposure directly affected household welfare through the death of household members (9.1%), livestock death (29.6%), and damage to houses and assets (6.1%). The indirect effects on the well-being of households resulted from children dropping out of school (25.5%), lack of security and stability (31.7%), forced migration (17.4%), and market price shocks (32.7%). These findings are supported by studies that have reported the loss of human life and livestock raiding due to conflicts (Ola-Adams and Okali, 2008). The negative welfare effects of conflict were mainly observed among households that were exposed to conflicts. Table 6.

6.2. Econometric model results

Model fitness was checked before and after the estimations. The variance inflation factor confirmed that there was no problem of multicollinearity among the independent variables [9] (Appendix Table 3). The post-estimation classification showed that 67.3% and 86.6% of the sensitivity (households correctly predicted being exposed to conflict) and specificity (households correctly predicted being not exposed to

[7] *Gadaa* is a traditional governance institution among the Karrayyu and wider Oromo communities in Ethiopia. The *Gadaa* system uses peacekeeping and conflict resolution mechanisms.

[8] *Mad'aa* consists of guidelines and rules on how to handle conflict in the Afar community.

[9] In the regression, the regional variable district is eliminated because of its exceptionally high VIF value (5.3) and R2 of 0.81 (Appendix Tables 1 and 2). However, some variables that are included in the analysis, such as drought, degradation, and invasion by Prosopis, are expected to pick up regional variations.

Table 6
Consequences of conflict in household well-being.

Consequences of conflict	%
Direct effects	
Human death	9.6
Livestock death	29.6
Forced migration	17.4
House and asset burning	6.5
Indirect effects	
Children dropping out of school	25.5
Lack of security and stability	31.7
Market price shock	32.7

Source: Authors' survey (2019)

conflict) were correctly predicted, respectively (Table 2). Overall, the model correctly predicted 79.1% of the cases, and the likelihood ratio test showed high predictive power. This indicated that the model was a good fit for the data.

Out of the 23 independent variables expected to affect land conflict (Table 1), 13 were statistically significant (Table 7). Lack of property rights and tenure insecurity are the most common causes of land-related conflicts in Ethiopia. In the country, land rights for farmers have improved since 1974 (e.g., land for tiller proclamations, land certification, or registration programs) but have deteriorated for pastoralists. There are no specific laws that protect the land rights of pastoralists in Ethiopia, and land appropriations by the state have deprived pastoralists of their rights of accessing to land resources. The loss of access to key pasture and water resources due to LSLIs has disrupted pastoral systems and created land scarcity. This has made pastoral households more vulnerable to land conflicts. Households that have lost their land due to LSLIs are 15.6% more likely to be exposed to land conflict than those who have not. A lack of trust in LSLIs increases the likelihood of land conflict. There is a 40.4% higher risk of conflict in households that lack trust in LSLIs. These results confirm the findings of earlier reports on Ethiopia (De Haan et al., 2016; FAO, 2018; Ola-Adams and Okali, 2008). A lack of compensation and strong mistrust increase the prevalence of conflict (Wehrmann, 2008). Access to irrigation also contributes to the likelihood of conflicts between agro-pastoralists and LSLIs. Conflict is 6% more likely to occur in households with irrigation access. First, the LSLIs control the distribution of irrigation water, which may put the pastoralists at a disadvantage. Second, the allocation of pasture land for irrigation agriculture adversely affects pastoralists' access to grazing areas (Abdulahi, 2005; Said, 1994).

All supply-induced scarcity variables significantly triggered land conflict. As expected, households that faced severe land degradation and drought, as well as invasive Prosopis, were 21.7%, 13.8% and 12.7% more likely to be exposed to conflict, respectively. Pastoral areas in Ethiopia generally receive less than 500 mm of precipitation annually, and when there is a severe drought, pastoralists move to riverbanks and become vulnerable to conflict. This study confirms previous works showing drought as a driver of land-related conflict (De Haan et al., 2016; Mkutu, 2001; Mulugeta and Hagmann, 2008; Ola-Adams and Okali, 2008; Wehrmann, 2008). A discussion with elders confirmed that drought shocks were worsening because of the increasing scarcity of grazing areas. Moreover, land degradation and Prosopis invasion minimized the quality and quantity of land available to pastoralists.

Among the demand-induced scarcity variables, household size reduced the probability of land conflict. A household with an additional household member is 0.7% less likely to face conflict This is contrary to our expectations, but it can be explained as follows. The size of a household indicates households' labor endowment. Labor is a crucial asset in herd mobility and livelihood diversification, and labor-scarce households do not able to search for grazing and are forced to compete for scarce grazing grounds, which is likely to lead to more conflicts. For example, in Afar households with labor shortages are obliged to feed livestock sedentary (Botterli, 2015). Moreover, as the number of livestock the household owns increases, the demand for

Table 7
Determinants of land conflict between pastoralists and large-scale land investments.

		Logit coefficients		Marginal effects	
Category	Variables	Coef.	Std. Err	Dy/dx	Std. Err
Tenure insecurity	LSLI_km	− 0.003	0.018	-0.001	0.003
	LAND_worry	0.072	0.201	0.011	0.03
	LSLI_trust	1.091 * **	0.404	0.163 * **	0.059
Supply-induced scarcities	LAND_own	− 0.044	0.115	-0.007	0.017
	IRRIGATE	0.403 *	0.218	0.060 *	0.032
	LDI	1.448 * **	0.227	0.217 * **	0.031
	DROUGHT	0.919 * **	0.23	0.138 * **	0.033
	PROSOPIS	0.851 * **	0.241	0.127 * **	0.035
Demand-induced scarcity	HH_size	− 0.049 *	0.029	-0.007 *	0.004
	TLU	0.012 *	0.006	0.002 *	0.001
Household characteristics	MOBILITY	− 0.234	0.2	-0.035	0.029
	ROAD_km	0.064 * **	0.023	0.010 * **	0.003
	MARKET_km	0.012	0.013	0.002	0.002
	LOGINC	0.045	0.084	0.01	0.012
	COOPER	− 0.507 * *	0.251	-0.076 * *	0.037
	LEADER	− 0.217	0.237	-0.032	0.035
	NONFARM	− 0.257	0.272	-0.038	0.041
	CREDIT	1.317 * **	0.283	0.197 * **	0.041
	EXTENSION	0.299 * *	0.023	0.045 * *	0.0184
	AGE	0.005	0.009	0.001	0.001
	GENDER	− 0.029	0.263	-0.004	0.039
	EDU	− 0.020	0.036	-0.003	0.005
	Cons	− 7.262 * **	1.092		
	Sensitivity	0.673			
	Specificity	0.866			
	Correctly predicted	0.791			
	N	863			
	LR chi2(21)	351.2 * **			
	Log-likelihood	− 399.9			

* ** , * *, and * show $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.
Source: Authors' survey (2019)

grazing land and water and the likelihood of conflict also increase. The size of livestock increases the probability of land conflict by 0.2%. This result is consistent with a study conducted in Tanzania (Kisoza, 2014). Households with a larger herd size are generally the wealthier households that have the means to invest in arms, which intensifies conflict. This is in accordance with a study in Ghana that found that an increase in herd size also increases land conflicts (Abdulahi, 2005).

Among the household characteristics, contrary to expectations, credit access increased the likelihood of land conflict (19.7%). A possible explanation is that credit is used for investments and improvements to assets, which leads to a higher likelihood of defending land and assets from expropriation. Credit can also be used to access arms, which can increase the chance of conflict. A one km increase in distance from roads increases households' risk of conflict by 1%. Easier access to roads reduces transaction costs for pastoralist households to access nearby labor markets and other services, including education, health, and product markets. Therefore, households closer to roads may be less dependent on land than remote households that have limited economic opportunities. Moreover, in remote areas, the peacekeeping structure is weak, which makes it easier for conflicts to prevail.

Cooperative membership significantly reduces land conflict, whereas access to extension services intensifies land conflict. Households with cooperative membership are 7.6% less likely to face conflict, while households with access to extension services are 4.5% more likely to face conflict. Cooperatives provide marketing information and training to members on commercialization and complement the traditional collective action of pastoralists. This finding contradicts a study in Burundi that found no effect of cooperatives on the incidence of land conflicts (McDougal and Almquist, 2014). Extension access intensifies land conflicts. Ethiopian extension is generally focused on crop production and not livestock production or pastoralism (Beyene, 2009). Therefore, extension favors the cultivation of crops on pasture lands (supply of seeds and fertilizer), which increases the demand for farmland and reduces the availability of grazing and land-use conflicts between crop producers and pastoralists. Moreover, the expansion of crop farming reduces the available resources for grazing and increases conflicts (Abdulahi, 2005). The household heads age, gender and education showed no significant variation in conflict exposure.

7. Conclusion

This study investigated the factors affecting land conflict in agro-pastoral areas affected by large-scale land investments. Data collection was conducted in 2019 in the Awash Valley of Ethiopia in the Afar and Karrayyu agro-pastoral communities. We used a mixed method that combined household and community surveys with qualitative and quantitative techniques to assess the determinants of land conflict. We applied a conceptual framework that combined the theories of property rights and environmental scarcities to disentangle the complexities of the drivers of land conflict.

Land conflicts have always been part of pastoral livelihoods in Ethiopia. Specifically, conflicts over grazing land became more severe after the establishment of large-scale land investments in pastoral areas. In the last decade, more than a quarter of the agro-pastoral households in our study area were exposed to land conflicts in general and 38% to land conflicts with large-scale land investments in particular. On average, a household faced four conflicts over the last 10 years. With a growing population and demand for more land, land conflicts are likely to increase further in the future.

We argue that land conflicts in pastoral areas are the result of a myriad of resource scarcities, political marginalization, and property rights distortions. The binary logit model results show that households that lost access to land and trust in LSLIs had more probability of facing land conflicts. Supply-induced scarcities, such as land degradation, drought, and invasion of Prosopis; demand-induced scarcities, such as the number of livestock owned; and socioeconomic factors, such as access to credit and extension, were the major drivers of land conflict. Therefore, the dispossession of property rights due to large-scale land investments, which causes the loss of access to grazing areas for pastoralists, is at the center of land conflicts. Severe land degradation, drought, and invasive weeds further caused pasture supply scarcities and increased households' vulnerability to land conflict. Households that owned more livestock were more likely to face land-use conflicts. Conversely, household size, access to roads, markets, and cooperatives reduced the likelihood of land-use conflict. The empirical findings confirmed the many determinants of land-use conflicts, but the insecurity of property rights and land ownership was the main reason identified from community discussions.

The study confirms that land-use policies that favor cultivation over herding are a major driver of conflicts over land. There are no clear regulations that guarantee pastoralists' rights to the use of their ancestral lands. Land policies in Ethiopia have neglected the rights of pastoralists, with a bias toward large-scale industrial plantations. This has exacerbated the scarcities of pastures and water and has further disrupted their livelihoods. Although the pastoral community strongly resists forceful evictions from their commons, they are generally voiceless and unheard due to political marginalization. As long as pastoral people live with a long-standing grievance over the loss of land to sugar plantations, land conflicts will remain intense. Moreover, inefficient formal systems, coupled with deteriorating informal systems, fail to provide adequate solutions to existing land conflicts. The conflict between large-scale land investments and pastoralists remains a great challenge. Ignoring this problem can limit the potential to achieve sustainable development and increase pastoralists' hostility toward large-scale land investments. Therefore, designing effective institutions that monitor land conflicts and empower informal leaders in conflict handling is a necessary step in conflict resolution.

Efforts to prevent and reduce land conflicts involving pastoralists should address each of the factors that exacerbate conflicts, as identified in this study. The most important factor is the lack of clear property rights that match the pastoralists' mode of production and protect them from land grabbing by the state and other powerful groups. Therefore, legal reforms that ensure property rights for customary and communal land use and that address land grievances are needed. In particular, peacebuilding strategies should emphasize the development of a clear land-use policy for the commons in large-scale land investments -affected areas. Moreover, strategies for mitigating the underlying causes of scarcity, such as drought coping, rehabilitation of degraded rangelands, and prevention of Prosopis, should be prioritized to reduce land conflicts in the long run. Enhancing households' access to roads, markets, and cooperatives can prevent land-use conflict in the study areas.

In the absence of panel data on micro-level conflicts, the dynamic nature of land conflicts is difficult to explain. Nevertheless, we attempted to robustly assess the household-level determinants of conflicts and cross-check the validity through FGDs and the available literature. Our study contributes to the sparse literature on land conflicts in large-scale land investments areas, which builds on micro-level, robust evidence. As there is a lack of data on land-use conflict in Ethiopia, particularly in pastoral areas, we relied on cross-sectional data to identify the drivers of land conflict. Therefore, future research that uses historical or panel data on land-use conflict could be useful.

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Conflict of interest

The authors declare that there is no conflict of interest concerning this manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.landusepol.2022.106166.

References

Abbink, J., 2011. 'Land to the foreigners': economic, legal, and socio-cultural aspects of new land acquisition schemes in Ethiopia. J. Contemp. Afr. Stud. 29, 513–535. https://doi.org/10.1080/02589001.2011.603213.

Abdulahi, M., 2005. The changing nature of pastoral conflicts in South-Eastern Ethiopia. The case of the Boran and Digodi pastoralists.Africa peace forum, Nairobi, Kenya.

Ariti, A.T., van Vliet, J., Verburg, P.H., 2018. Farmers' participation in the development of land use policies for the Central Rift Valley of Ethiopia. Land Use Policy 71, 129–137. https://doi.org/10.1016/j.landusepol.2017.11.051.

Baglioni, E., Gibbon, P., 2013. Land grabbing, large- and small-scale farming: what can evidence and policy from 20th century Africa contribute to the debate? Third World Q. 34, 1558–1581. https://doi.org/10.1186/s13570-018-0129-1.

Balehey, S., Tesfay, G., Balehegn, M., 2018. Traditional gender inequalities limit pastoral women's opportunities for adaptation to climate change: evidence from the Afar pastoralists of Ethiopia. Pastoralism 8, 23. https://doi.org/10.1186/s13570-018-0129-1.

Basu, P.K., 2007. Political Economy of Land Grab. Economic and Political Weekly 42, 1281–1287. ⟨https://www.jstor.org/stable/4419447⟩.

Beyene, F., 2007. The role of customary institutions in managing conflict on grazing land: a case study from Mieso District, Eastern Ethiopia. Institutional Change in Agriculture and Natural Resources (ICAR), Discussion Papers 17, Humboldt University, Berlin. ⟨https://nbn-resolving.org/urn:nbn:de:0168-ssoar-125921⟩.

Beyene, F., 2009. Property rights conflict, customary institutions and the state: the case of agro-pastoralists in Mieso district, eastern Ethiopia. J. Mod. Afr. Stud. 47, 213–239. https://doi.org/10.1017/S0022278×09003814.

Beyene, F., 2017. Natural resource conflict analysis among pastoralists in Southern Ethiopia. J. Peace Dev. 12, 19–33. https://doi.org/10.1080/15423166.2017.1284605.

Bob, U., 2010. Land-related conflicts in sub-Saharan Africa. Afr. J. Confl. Resolut. 10, 49–64. https://doi.org/10.4314/ajcr.v10i2.63310.

Botterli, A., 2015. Adapting to climate change through villagization?: the context of sedentary vulnerability in Afar region, Ethiopia. Norwegian University of Life Sciences, ⟨http://hdl.handle.net/11250/293843⟩.

Bruce, J., Boudreaux, K., 2011. Land and conflict, land disputes, and land conflicts. Property Rights and Resource Governance. USAID Issue Briefing Paper No.12. Washington, DC.

Bogale, A, 2006. Resource scarcity induced conflict and its management: Implication for sustainable rural livelihoods in Eastern Ethiopia. Households in Conflict Network (HiCN). Working Paper 17.

Bukari, K.N., Kuusaana, E.D., 2018. Impacts of large-scale landholdings on Fulani pastoralists' in the Agogo traditional area of Ghana. Land Use Policy 79, 748–758. https://doi.org/10.1016/j.landusepol.2018.09.018.

Cochrane, L., Legault, D.D., 2020. The rush for land and agricultural investment in Ethiopia: what we know and what we are missing. Land 9, 167. https://doi.org/10.3390/land9050167.

Cotula, L., 2009. Land grab or development opportunity?: agricultural investment and international land deals in Africa. IIED/FAO/IFAD, London/Rome.

De Haan, C., Dubern, E., Garancher, B., Quintero, C., 2016. Pastoralism Development in the Sahel: A Road to Stability? World Bank, Washington, DC.

Deininger, K., Byerlee, D., 2011. Rising Global Interest in Farmland: Can it Yield Sustainable and Equitable Benefits? The World Bank Publications, Washington, D.C. ⟨http://hdl.handle.net/10986/2263⟩.

Di Falco, S., Laurent-Lucchetti, J., Veronesi, M., Kohlin, G., 2019. Property rights, land disputes and water scarcity: empirical evidence from Ethiopia. Am. J. Agric. Econ. 102, 54–71. https://doi.org/10.1093/ajae/aaz036.

Dong, G., Ge, Y., Jia, H., Sun, C., Pan, S., 2021. Land use multi-suitability, land resource scarcity and diversity of human needs: a new framework for land use conflict identification. Land 10, 1–14. https://doi.org/10.3390/land10101003.

ESC, 2017. Ethiopian Sugar Corporation Factories Profile. ⟨http://ethiopiansugar.com/index.php/en/factories/omo-kuraz-sugar-factory-ii⟩.

FAO, 2018. Pastoralism in Africa's drylands Reducing risks, addressing vulnerability and enhancing resilience. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FDRE, 2017. National Strategy on Prosopis juliflora Management. Federal Democratic Republic of Ethiopia (FDRE) Ministry of Livestock & Fisheries, Addis Ababa, Ethiopia.

Feldt, T., Karg, H., Kadaouré, I., Bessert, L., Schlecht, E., 2020. Growing struggle over rising demand: how land-use change and complex farmer-grazier conflicts impact grazing management in the Western Highlands of Cameroon, 1-14 104579 Land Use Policy 95. https://doi.org/10.1016/j.landusepol.2020.104579.

Flintan, F.E., 2020. How to prevent land-use conflicts in pastoral areas. International Fund for Agricultural Development (IFAD), Rome, Italy.

George, J., Adelaja, A., Awokuse, T., Vaughan, O., 2021. Terrorist attacks, land resource competition and violent farmer-herder conflicts. Land Use Policy 102, 105241. https://doi.org/10.1016/j.landusepol.2020.105241.

Gujarati, D.N., 2003. Basic Econometrics, fourth ed. Tata McGraw-Hill Companies, Inc, New York, USA.

Hailu, R., 2016. Population dynamism and agrarian transformation in Ethiopia. Afr. J. Agric. Res. 11, 3863–3879. https://doi.org/10.5897/ajar2014.8959.

Haslam, P.A., Tanimoune, N.A., 2016. The determinants of social conflict in the Latin American mining sector: New evidence with quantitative data. World Dev. 78, 401–419. https://doi.org/10.1016/j.worlddev.2015.10.020.

Hilhorst, T., Zomers, A., 2011. How can large scale transnational land acquisition contribute to inclusive and sustainable growth. Tropical Institute KIT Univ. Utrecht, p. 35.

Homer-Dixon, T.F., 1994. Environmental scarcities and violent conflict: evidence from cases. Int. Secur. 19, 5–40. https://doi.org/10.2307/2539147.

Hoenow, N.C., Kirk, M., 2021. Does competitive scarcity affect the speed of resource extraction? A common-pool resource lab-in-the-field experiment on land use in northern Namibia. World Dev. 147, 105623 https://doi.org/10.1016/j.worlddev.2021.105623.

Hufe, P., Heuermann, D.F., 2017. The local impacts of large-scale land acquisitions: a review of case study evidence from Sub-Saharan Africa. J. Contemp. Afr. Stud. 35, 168–189. https://doi.org/10.1080/02589001.2017.1307505.

Hundie, B., 2010. Conflicts between Afar pastoralists and their neighbors: triggers and motivations. Int. J. Confl. Violence 4, 134–148. https://doi.org/10.4119/ijcv-2820.

Ibrahim, J., 2016. Socio-Economic Effect of Tendaho Sugar cane Plantation on the Pastoral Livelihood of Afar National Regional State. St. Mary's University.

Jiali, W., yanfang, L., xiaoling, Z., 2021. Conflict in informal rural construction land transfer practices in China: a case of Hubei. Land Use Policy 109, 105573. https://doi.org/10.1016/j.landusepol.2021.105573.

Jiang, S., Meng, J., Zhu, L., Cheng, H., 2021. Spatial-temporal pattern of land use conflict in China and its multilevel driving mechanisms. Sci. Total Environ. 801, 149697 https://doi.org/10.1016/j.scitotenv.2021.149697.

Kalabamu, F.T., 2019. Land tenure reforms and persistence of land conflicts in Sub-Saharan Africa – the case of Botswana. Land Use Policy 81, 337–345. https://doi.org/10.1016/j.landusepol.2018.11.002.

Kariuki, F., Ng'etich, R., 2016. Land grabbing, tenure security and livelihoods in Kenya. Afr. J. Leg. Stud. 9, 79–99. https://doi.org/10.1163/17087384-12340004.

Kisoza, L., 2014. Empirical analysis of resource-use conflicts between smallholder farmers and pastoralists in semi-arid areas: a case of Mkata plains. East. Tanzan. Huria: J. Open Univ. Tanzan. 16, 104–116.

Korf, B., Hagmann, T., Emmenegger, R., 2015. Re-spacing African drylands: territorialization, sedentarization and indigenous commodification in the Ethiopian pastoral frontier. J. Peasant Stud. 42, 881–901. https://doi.org/10.1080/03066150.2015.1006628.

Lavers, T., 2018. Responding to land-based conflict in Ethiopia: the land rights of ethnic minorities under federalism. Afr. Aff. 117, 462–484. https://doi.org/10.1093/afraf/ady010.

Little, P.D., McPeak, J.G., 2014. Resilience and pastoralism in Africa south of the Sahara, with a particular focus on the horn of Africa and the Sahel, West Africa, In 2020 Conference Paper (Vol 9).

Lode, K., Kassa, G., 2001. Proceedings from a workshop on conflict resolution organized by the Drylands Coordination Group (DCG), November 8–10, 2000, Nazareth, Ethiopia. Report-Drylands Coordination Group (Norway).

Lucchetti, J., 2015. Property rights and land disputes: theory and evidence from the Highland of Ethiopia, Energy and Climate conference Toulouse, France.

Magsi, H., 2013. Land-use conflicts in developing countries: framing conflict resolution and prevention strategies to ensure economic growth and human welfare. The case of Chotiari water reservoir from Pakistan. Doctoral Dessertation, AgroParisTech.

Malthus, T.R., 1798. An Essay on the Principle of Population. Electronic Scholarly Publishing Project, London, UK.

Margulis, M.E., McKeon, N., Borras, S.M., 2013. Land grabbing and global governance: critical perspectives. Globalizations 10, 1–23. https://doi.org/10.1080/14747731.2013.764151.

McDougal, T.L., Almquist, L., 2014. The effects of agricultural cooperatives on land conflicts, violence, and community trust: Household-level evidence from rural Burundi. Econ. Peace Secur. J. 9 https://doi.org/10.15355/epsj.9.2.5.

McPeak, J.G., Little, P.D., 2018. Mobile peoples, contested borders: land-use conflicts and resolution mechanisms among Borana and Guji Communities, Southern Ethiopia. World Dev. 103, 119–132. https://doi.org/10.1016/j.worlddev.2017.10.001.

Menbere, A., 2013. Dynamics of pastoralist relations at change: an exploration into the causes of Afar-Karrayu conflict in the Awash Valley. Ethiop. J. Soc. Sci. Humanit. 9, 1–28.

Mkutu, K., 2001. Pastoralism and conflict in the Horn of Africa. Africa Peace Forum Saferworld. Organisation, University of Bradford.

Moritz, M., 2008. A critical examination of honor cultures and herding societies in Africa. Afr. Stud. Rev. 51, 99–117. ⟨https://www.jstor.org/stable/27667342⟩.

Müller-Mahn, D., Rettberg, S., Getachew, G., 2010. Pathways and dead ends of pastoral development among the Afar and Karrayu in Ethiopia. Eur. J. Dev. Res. 22, 660–677. https://doi.org/10.1057/ejdr.2010.37.

Mulugeta, A., 2014. " Development Facilitators", Land Acquisition and Governance in Pastoralist Areas of Ethiopia. The University of Basel, Institute of Social Anthropology.

Mulugeta, A., Hagmann, T., 2008. Governing violence in the pastoralist space: Karrayu and state notions of cattle raiding in the Ethiopian Awash Valley. Afr. Focus 21, 71–87. https://doi.org/10.21825/af.v21i2.5048.
Nara, B.B., Lengoiboni, M., Zevenbergen, J., 2021. Assessing customary land rights and tenure security variations of smallholder farmers in northwest Ghana. Land Use Policy 104, 105352. https://doi.org/10.1016/j.landusepol.2021.105352.
Ndi, F.A., Batterbury, S., 2017. Land grabbing and the axis of political conflicts: insights from Southwest Cameroon. Afr. Spectr. 52, 33–63. https://doi.org/10.1177/000203971705200102.
Ochieng, C., 2011. Toolkit and guidance for preventing and managing land and natural resources conflict: Conflict prevention in resource-rich economies.
Ola-Adams, B.A., Okali, D.U., 2008. Impact of Land Use Conflict on Livelihood and Range Condition in the Awash Valley of Ethiopia, The Future of Drylands. Springer, pp. 457–469. https://doi.org/10.1007/978-1-4020-6970-3_42.
PFE, 2010. Proceeding Climate Change and pastoralism: The Implication on Sustainable Pastoral Development in Ethiopia. of 5th National Conference on Pastoral Development in Ethiopia. August 25th -26th,2010. Addis Ababa. Ethiopia.
Rahmato, D., 2014. The perils of development from above: land deals in Ethiopia. Afr. Identit. 12, 26–44. https://doi.org/10.1080/14725843.2014.886431.
Reda, K.T., 2014. Formal and informal land tenure systems in Afar region, Ethiopia: perceptions, attitudes and implications for land use disputes. Afr. J. Confl. Resolut. 14, 41–62.
Regassa, A., Hizekiel, Y., Korf, B., 2019. 'Civilizing' the pastoral frontier: land grabbing, dispossession and coercive agrarian development in Ethiopia. J. Peasant Stud. 46, 935–955. https://doi.org/10.1080/03066150.2017.1420060.
Ricardo, D., 1955. The Works and Correspondence of David Ricardo: Volume 10, Biographical Miscellany. Cambridge University Press.
Rettberg, S., Beckmann, G., Minah, M., Schelchen, A. 2017. Ethiopia's Arid and Semi-Arid Lowlands: Towards Inclusive and Sustainable Rural Transformation. Centre for Rural Development (SLE), SLE discussion paper 03/2017, Berlin.
Safarzynska, K., 2018. The impact of resource uncertainty and intergroup conflict on harvesting in the common-pool resource experiment. Environ. Resour. Econ. 71, 1001–1025. https://doi.org/10.1007/s10640-017-0193-9.
Said, A., 1994. Pastoralism and the state policies in Mid-Awash valley: the case of the Afar, Ethiopia. Nordiska Afrikainstitutet.
Schlager, E., Ostrom, E., 1992. Property-rights regimes and natural resources: a conceptual analysis. Land Econ. 249–262. https://doi.org/10.2307/3146375.
Scoones, I., Hall, R., Borras, S.M., White, B., Wolford, W., 2013. The politics of evidence: methodologies for understanding the global land rush. J. Peasant Stud. 40, 469–483. https://doi.org/10.1080/03066150.2013.801341.
Scoones, I., Smalley, R., Hall, R., Tsikata, D., 2019. Narratives of scarcity: framing the global land rush. Geoforum 101, 231–241. https://doi.org/10.1016/j.geoforum.2018.06.006.
Sinthumule, N.I., Ratshivhadelo, T., Nelwamondo, T., 2020. Stakeholder perspectives on land-use conflicts in the South African section of the Greater Mapungubwe Transfrontier Conservation Area. J. Land Use Sci. 15, 11–24. https://doi.org/10.1080/1747423X.2020.1739767.
Stickler, M., Huntington, H., Ewing, B., 2018. Measuring community perceptions of tenure security: Evidence from four African countries, Land governance in an interconnected world The World Bank, Washington DC.
Storck, H., Doppler, W., 1991. Farming systems and farm management practices of smallholders in the Hararghe Highlands. Wissenschaftsverlag Vauk Kiel.
Tadesse, B., Beyene, F., Kassa, W., Wentzell, R., 2015. The dynamics of (Agro) pastoral conflicts in Eastern Ethiopia. Ethiop. J. Soc. Sci. Humanit. 11, 29–60.
Tafere, K., 2013. Peace-making from within the tradition of conflict resolution in Northern Afar, Ethiopia. Ethiop. J. Soc. Sci. Humanit. 9, 57–78.
Torre, A., Melot, R., Magsi, H., Bossuet, L., Cadoret, A., Caron, A., Darly, S., Jeanneaux, P., Kirat, T., Pham, H.V., Kolokouris, O., 2014. Identifying and Measuring Land-use and Proximity Conflicts: Methods and Identification, 3. SpringerPlus, p. 85. https://doi.org/10.1186/2193-1801-3-85.
Uchehara, K.E., 2014. Understanding African relationships: the case of Eritrean-Ethiopian border dispute. Int. J. Soc. Inq. 7, 63–78.
UN, 2010. Environmental scarcity and conflict: Guidance note for practitioners. The United Nations Interagency Framework Team for Preventive Action. New York, USA. ⟨https://postconflict.unep.ch/publications/ECP/GN_Scarcity_FINAL.pdf⟩.
UN, 2012. Toolkit and guidance for preventing and managing land and natural resources conflict. Renewable Resources and Conflict. New York, USA.
UNEP, 2015. Natural Resources and Conflict A Guide for Mediation Practitioners. United Nations Department of Political Affairs and United Nations Environment Programme (UNEP). New York, USA.
Wayessa, G.O., 2020. Impacts of land leases in Oromia, Ethiopia: changes in access to livelihood resources for local people. Land Use Policy 97, 104713. https://doi.org/10.1016/j.landusepol.2020.104713.
Wehrmann, B., 2008. Land conflicts: A practical guide to dealing with land disputes. GTZ Eschborn.
Wehrmann, B., 2017. Understanding, preventing, and solving land conflicts. A practical guide and toolbox. Printing and distribution: Schleunungdruck GmbH Eltertstr, 27, 2017, p. 97828.
Wendimu, M.A., Henningsen, A., Gibbon, P., 2016. Sugarcane outgrowers in Ethiopia: "forced" to remain poor? World Dev. 83, 84–97. https://doi.org/10.1016/j.worlddev.2016.03.002.
Yamane, T., 1973. Statistics: An Introductory Analysis. Harper and Row, New York NY.
Yang, B., He, J., 2021. Global land grabbing: a critical review of case studies across the world, 1-19 Land 10, 324. https://doi.org/10.3390/land10030324.
Upreti, B.R., 2004. Resource Conflicts and Conflict Resolution in Nepal. Mountain Research and Development 24 (1), 60–66. https://doi.org/10.1659/0276-4741(2004)024[0060:RCACRI]2.0.CO;2.