The Impact of Agricultural Intensification on Civil Conflict in Africa

Münch, Marie

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Marie Münch

Faculty of Social and Behavioral Sciences, Leiden University

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Supervisor: Dr Babak RezaeeDaryakenari

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Student Number: 2068702

Universiteit Leiden

Abstract

This research investigates the link between agricultural intensification and civil conflict. Agricultural intensification is a widely promoted solution for food insecurity. However, this research theorizes that agricultural intensification creates disadvantages for the smallholder sector and thus might trigger civil conflict. An OLS, negative binomial, and logistic regression analysis correlate fertilizer-use in 37 African countries to the incidence and count of civil conflicts between 2004 and 2016. The empirical results are mixed and only partly significant. Yet, they indicate agricultural intensification to have a conflict-reducing effect. Surprisingly, the outcome of intensification, that is higher agricultural productivity, is significantly associated with an increased risk of conflict. Also, as a mediator agricultural productivity creates a significant and positive indirect link between intensification and civil conflict. Hence, the conflict-enhancing capacity of agricultural intensification might be contingent on whether intensification leads to an increase in agricultural productivity. This opens pathways for future research, where the impact of agricultural productivity on conflict as well as the relation between intensification and productivity should be scrutinized.

Keywords: agricultural intensification, horizontal inequality, grievances, civil conflict, green revolution

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The Impact of Agricultural Intensification on Civil Conflict in Africa

This research addresses the question: *What is the impact of agricultural intensification on civil conflict in Africa?* The importance of such an investigation derives from the interplay of food insecurity, population growth, and climate change. Food insecurity impairs human wellbeing and multiplies conflict risks (Hendrix & Brinkman, 2013; Weinberg & Bakker, 2015). At the same time, the world's population is predicted to reach 9 billion in 2050, which is 2 billion people more than today who will need sufficient amounts of food (Food and Agriculture Organization of the United Nations [FAO], 2009). On top of this, climate change is predicted to impact agricultural production and thus complicate adequate food supply even further (Mbow et al., 2019).

International organizations, donor agencies, and scholars are, therefore, calling for an intensification of agriculture to increase productivity (Collier & Dercon, 2014; Gates Foundation, n.d.; World Bank [WB], 2009). However, productivity-enhancing practices, for instance the use of fertilizer and high-yielding seeds, have been shown to have negative side-effects. Examples are environmental degradation, increased land inequality, and private sector influence on governments (Freebairn, 1995; Huggins, 2009; Nally, 2016; Pingali, 1995). These side-effects might lead to grievances, which can trigger civil conflict. This implies that the attempt to reduce one determinant of conflict, namely food insecurity, might create another one, namely intensive agriculture.

Extensive research has been conducted on the 'Green Revolution' in Asia and Latin America and the rise of corporate farms in America in the 1960s/70s. The 'Green Revolution' is characterized by high inputs, such as fertilizer, pesticides, and modern seed varieties, which significantly increase productivity (Evenson & Gollin, 2003; Pingali, 2012). Both negative and positive effects have been assessed (Evenson & Gollin, 2003; Pingali, 1995) as well as the link between agricultural transformation and rural conflict (Popkin, 1980). Research in the US has

focused on the effect of corporate farming on rural communities, showing that it significantly decreases socio-economic well-being and erodes community structures (Goldschmidt, 1978; Labao & Stofferahn, 2007).

The impact of agriculture in the 21st century has only been investigated through case studies, which are insufficient for establishing a general link between agricultural intensification and conflict (Huggins, 2009; Koopman, 2012; Peters & Richards, 2011). Therefore, there is a need for quantitative research.

This especially applies to Africa, as it is the continent with the greatest prevalence and increase of undernourishment (FAO, 2019; Toenniessen et al., 2008). It is also the continent where 5 of the 9 countries with the greatest population growth are situated (UN News, 2017, June 21). Additionally, climate change is predicted to reduce African agricultural output by 15% to 30% until 2080-2100 (FAO, 2009). Meanwhile, agricultural productivity in Africa is low, so that an 'African Green Revolution' is called for (Annan, 2003; Sanchez et al., 2009). However, if this has the potential to fuel conflict, a re-evaluation of this approach is required.

Importantly, agricultural intensification fosters inequalities between the smallholder and large-scale, corporate agricultural sector (Collier & Dercon, 2014). A growing body of literature suggests that 'horizontal inequality' between social groups creates multidimensional group grievances, which can trigger conflict (Østby, 2013; Stewart, 2008). Based on this, I argue that agricultural intensification increases the risk of civil conflict. This hypothesis is tested through an OLS, negative binomial, and logistic regression analysis, which correlate the fertilizer use of 37 African countries from 2004 to 2016 to civil conflict incidence and count.

The results show that *agricultural intensification* has no significant impact on the *incidence* of civil conflict. Results for its impact on conflict *intensity* are mixed but indicate agricultural intensification to be associated with a decrease of conflict intensity. Yet, the outcome of intensification, that is increased *agricultural productivity*, is significantly associated with an

increase in civil conflict *incidence* and *intensity*. Also, as a mediator *agricultural productivity* creates a significant and positive indirect link between intensification and civil conflict.

The next section reviews existing literature on the causes of intra-state civil conflicts and the impacts of agricultural intensification. Thereafter, the theoretical framework is presented building upon literature on 'horizontal inequality' and civil conflict. This is followed by an explanation of the methods used and the empirical results. The paper closes with concluding remarks and recommendations for future research.

Literature Review

Research on the causes of intra-state civil conflict has identified several potential and often symbiotic predictors of conflict. These range from economic (Buhaug et al., 2011; Collier & Hoeffler, 2004; Nafziger & Auvinen, 2002), to political (Cornell & Grimes, 2015; Dalton et al., 2010), and social ones (Cederman et al., 2011; Østby et al., 2009; Stewart, 2008). Since the late 1970s, scholars pay increasing attention to environmental causes of conflict (e.g., Durham, 1979; Homer-Dixon, 1991; Ross, 2004). The advent of climate change has contributed to this interest. However, the impact of environmental variables remains controversial for two main reasons. First, environmental factors are broad and can be measured in a variety of ways. This impairs comparability of studies and complicates generalizations (Salehyan, 2014). Second, climate-related variables often only indirectly affect conflict by running through other determinants of conflict (Mach et al., 2019).

One widely accepted factor within the research-field of environmental causes of conflict is food insecurity, specifically rising food prices. Rising food prices have been shown to be associated with protests and riots (Hendrix & Brinkman, 2013; Hendrix & Haggard, 2015; Weinberg & Bakker, 2015) and to increase the likelihood of violence against civilians by rebel groups (RezaeeDaryakenari et al., 2020). These findings, alongside concerns about human

suffering, have led to calls by scientists (Collier & Dercon, 2014; Sanchez et al., 2009) and policymakers for agricultural intensification in order to "boost agricultural productivity" (Annan, 2003, p. 1485).

Arguments for agricultural intensification as the solution to food insecurity are largely based on the success of the 'Green Revolution' in Asia and Latin America in the 1960s. Several authors stress the potential of high-yielding seeds in conjunction with increased inputs (fertilizer, pesticides, irrigation) and supporting institutions to increase productivity and thus reduce food insecurity (Evenson & Gollin, 2003; Pingali, 2012; Toenniessen et al., 2008).

Therefore, many scholars regard a similar 'Green Revolution' to be necessary for Africa, where agricultural productivity is low and undernourishment high (Breisinger et al., 2009; Hunt, 2011; Pingali, 2012; Toenniessen et al., 2008). Additionally, Breisinger et al. (2009), Hunt (2011), and Reardon et al. (1999) highlight that intensification must counteract the unsustainable expansion of arable land, which has led to deforestation. Others focus on persisting high levels of poverty and argue that growth in the agricultural sector leads to greater poverty reduction than growth in other economic sectors (Pingali, 2012; Toenniessen et al., 2008). This is also relevant for the reduction of conflict, as poverty is one of the most widely recognized predictors of civil conflict (Hegre & Sambanis, 2006; Sambanis, 2005; Ward et al., 2010).

Some scholars assume that because of lower labor costs, smallholders can achieve greater yields than large farmers. This is known as the 'inverse productivity relationship,' first noticed by Chayanov in 1926 (Hunt, 2011; Nally, 2016; Reardon et al., 1999; Ruttan, 2002). For this reason, modernizing the practices of smallholders has become the focus of agricultural development in Africa (Collier & Dercon, 2014). However, Collier and Dercon (2014) argue for concentrating on larger commercial farms, which face economies of scale with regard to "skills and technology, finance and access to capital and the organization and logistics of

trading marketing and storage" (p. 94). They, therefore, expect larger farms to be better able to drive agricultural development in Africa and thus to reduce poverty.

Overall, these scholars regard an 'African Green Revolution' as the right path ahead. Evenson and Gollin (2003) contend that this is also feasible, as research into the diverse climatic conditions has been conducted, so that suitable high-yielding staple crops are now available.

However, there is also extensive research on negative externalities of agricultural intensification. Research on corporate farms in the US shows that these negatively affect socioeconomic, social, and environmental indicators (Goldschmidt, 1978; Labao & Stofferahn, 2007; Lee, 2008). Research on the 'Green Revolution' in Asia and Latin America also reports a range of negative impacts. Economically, Fischer (2015) and Freebairn (1995) find that it increased inequalities and created debts for smallholders. Widely detected environmental consequences are soil salinity and erosion, waterlogging, soil toxicity and nutrient deficiencies, reduced air and water quality, eutrophication as well as increased death rates among vertebrates and algae (Pimentel & Pimentel, 1990; Pingali, 1995; Pingali & Rosegrant, 1994). Social side-effects have been observed as well. Pimentel and Pimentel (1990) and Pingali (1995) identify significant health impacts of pesticides. Satyavathi et al. (2010) find increased workloads for women.

One strand of research studies the potential of agricultural intensification to fuel rural conflict (Lichbach, 1987; Popkin, 1980). In his seminal work, 'The Rational Peasant,' Popkin (1980) argues that peasants do not oppose new technologies and prefer traditional practices per se but revolt when modern techniques create disadvantages. Even though Popkin's work is rooted in the context of decolonization, so that its applicability to today's agriculture can be questioned, this insight continues to be relevant. Dzuverović and Milošević (2013) reason that violence can erupt when individuals feel left out of or do not profit from new developments.

These arguments are consistent with the reasoning that inequalities can generate conflict (Cramer, 2003; Gurr, 1968; Nafziger & Auvinen, 2002). According to Dzuverović and Miloševič (2013), land inequality is one of the most salient forms of inequality in less developed countries. Both qualitative and quantitative research reveal land inequality to be associated with civil conflict. Thomson (2016) finds that high landholding inequality significantly increases the risk of conflict. Koopman (2012) documents "large and peaceful protest march[es] as a response to large-scale land acquisitions by international corporations in the Senegal River Valley" (p. 659). Meanwhile, Peters and Richards (2011) report the destruction of property of a company in Sierra Leone, which failed to compensate farmers for their loss of land. While there is a wider range of negative externalities resulting from agricultural intensification, research on their impact on conflict is lacking.

Nevertheless, suggestions for modifying the 'Green Revolution' have been made and applied to Africa, focusing on institutional changes and local research (Fischer, 2015; Hunt, 2011; Pingali, 2012; Toenniessen et al., 2008). These modifications aim at mitigating the negative consequences of intensification, while still obtaining productivity enhancements.

However, Gegenbach et al. (2018) and Nally (2016) show that many detrimental side-effects of intensive agriculture persist. The case studies from Africa indicate that these can fuel conflict (Huggins, 2009; Koopman, 2012; Peters & Richards, 2011). This research aims to address the tentative link between modern agricultural intensification and conflict. The hope is to clarify whether a link exists and thus help to discern a socially acceptable approach to agricultural development.

Theoretical Framework

Among the explanations for civil conflict one of the most prominent, and at the same time most intensely debated, theories is Gurr's (1968) 'relative deprivation.' According to Gurr

(1968), (income) inequality triggers feelings of 'relative deprivation,' where individuals perceive to obtain less than they are entitled to. This can result in grievances, that can trigger aggression, which in turn may motivate individuals to become active and engage in conflict. Empirical support for this theory is, however, mixed. Some studies find inequality and grievances to be significant for conflict onset (Bartusevičius, 2014; Besançon, 2005; Dzuverović, 2013; Nafziger & Auvinen, 2002). Others find no empirical support and theorize opportunity structures to be more important (Collier & Hoeffler, 2004; Fearon & Laitin, 2003; Tilly, 1978).

More recently, a body of literature has emerged that explains these disparate findings with a central methodological 'flaw' (Buhaug et al., 2011; Cederman et al., 2011; Østby, 2013; Stewart, 2008). Instead of looking at inequality between individuals ('vertical inequality'), these scholars argue that 'horizontal inequality' between social groups triggers group grievances, which in turn can lead to civil conflict. As Østby (2013) fittingly puts it, "conflict […] is a group phenomenon" (p. 213). When individuals are part of a group, and grievances shared among group members, organization for conflict should be easier than where grievances are felt individually (Østby, 2013). Using Stewart's (2008) words, this paper assumes that "group identities are […] powerful as sources of action" (p. 417).

Thus far, 'horizontal inequalities' between groups and resulting group grievances have mostly been understood to exist between ethnic, religious, and regional groups (Bartusevičius, 2014; Nafziger & Auvinen, 2002; Sambanis, 2005). However, other social groups might develop group grievances as well (Koubi & Böhmelt, 2014; Østby et al., 2009; Siroky & Hechter, 2016). Thomson (2016), for instance, explicitly recognizes that "rural inequality has a horizontal aspect" (p. 512). The question is, therefore, how a social group can develop a group identity strong enough for the generation of group grievances?

Siroky and Hechter (2016) stress that each individual belongs to several social groups and that the salience of each group identity depends on two factors: Solidarity among group members ('segmentation') and between-group inequality ('hierarchy') (p. 92). For an individual to identify with one particular group, both solidarity among group members and between-group inequality must be high. Siroky and Hechter (2016) expect groups that are "comprised of individuals sharing income levels, occupational niches, residential neighborhood, and socioeconomic status," to face greater levels of equality and thus solidarity (p. 94).

Agricultural intensification in Africa especially targets smallholders, that is family farmers cultivating small patches of land (Collier & Dercon, 2014; Deininger & Byerlee, 2012; Staatz & Dembélé, 2008). Hence, for agricultural intensification to trigger conflict, smallholders must identify as a social group and develop group grievances based on this group identity. African smallholders share several commonalities, such as their occupational niche, small farms (<1-10 hectares), the dominance of family labor, the use of traditional practices, and oftentimes self-sufficiency (FAO, 2013; Gollin, 2014). These commonalities can be assumed to create a sense of shared identity and solidarity, as similarity has been shown to be central for group identification and formation (McPherson et al., 2001; Peski, 2008). This is known as the principle of homophily, which centers on the insight that "[s]imilarity breeds connection" (McPherson et al., 2001, p. 415).

Since African smallholders, however, have heterogenous income levels (Gollin, 2014; Staatz & Dembélé, 2008) the arising group identity is not class-based (where income levels are more or less equal) but sectoral (Brawley, 1997; Garst, 1999; Mamalakis, 1969). That the occupational sector can be an important similarity and source for identity as well as group formation is widely accepted (Christiansen, 1999; Gini, 1998; Unruh, 2004). Lazarsfeld and Merton (1954) distinguish between status- and value-based homophily. Status-based

homophily includes such dimensions as race, ethnicity, religion, and occupation. While the former three have been the focus of the study of social groups and 'horizontal inequalities' (Stewart, 2008), this study looks at the occupational sector as the basis for group formation, inequalities, and grievances.

Mamalakis (1969) already recognized the ability of economic sectors to organize for conflict, especially when inequality between two sectors increases. While Mamalakis (1969) regards the agricultural sector as one unit, this research perceives the smallholder agricultural sector to be distinct from the commercial, large-scale agricultural sector. The latter is defined by Deininger and Byerlee (2012) to entail large farms, which are often vertically and horizontally integrated and owned by corporations. Many of these enterprises, therefore, qualify as agri-businesses, which control all processes from agricultural production to retail.

As Østby (2013) elaborates, horizontal inequalities are not always obvious. They might only "become evident, […] when traditional peoples on the periphery of modernizing societies are drawn into closer contact with the more powerful and technologically proficient groups" (p. 215). Arguably, this is the case in Africa, where agricultural intensification brings smallholders into contact with large agri-businesses and modern techniques (Huggins, 2009; Hunt, 2011). Smallholders might, therefore, increasingly become aware of their group identity as they are confronted with the 'other,' that is agribusinesses and large industrial farmers, more often.

Moreover, economies of scale advantage the large-scale, corporate agricultural sector with regard to the adoption of intensive agricultural practices (Collier & Dercon, 2014). This contributes to between-group inequalities ('hierarchy') between the smallholder and large-scale, corporate sector. Such inequalities might lead to the development of group grievances among African smallholders, which can trigger conflict.

However, solidarity within the smallholder sector is expected to be weaker than within other identity groups such as ethnic groups. This assumption is based on research by McPherson et al. (2001) and Smith (1991), who show that ethnic, racial, and religious identities are more salient than socio-economic ones. Stewart (2008), more generally, argues that identities which cannot be altered can be presumed to be more pertinent.

Therefore, given lower solidarity levels, the smallholder sector might only be able to organize for low-intensity civil conflict. This can imply violence but does not involve organized military groups (Hendrix & Salehyan, 2012). According to Hendrix and Salehyan (2012), low-intensity civil conflict requires less organization, planning, and funding than armed rebellion. Hence, groups with lower levels of solidarity but shared grievances can be expected to be able to mobilize for demonstrations, strikes or riots. For these types of action, a common cause and shared grievances are required. However, participants do not need to make large financial commitments or engage in extensive planning. Solidarity levels, as found within for instance ethnic groups, might be necessary for high-intensity conflict such as ethnic civil wars. There, both risks and costs are considerably higher (Hendrix & Salehyan, 2012).

In the case of smallholders, inequalities created by agricultural intensification serve as a common cause. Yet, solidarity levels are unlikely to be great enough to elicit large financial contributions or the willingness to spend much time on planning an armed rebellion. Therefore, while smallholders might under some circumstances be able to engage in high-intensity conflict, this research expects low-intensity civil conflict to be more common. This argumentation is in line with research by Regan and Norton (2005), who reason that grievances are sufficient for initiating low-intensity conflict. They propose that high-intensity conflict, on the other hand, might require ‘selective incentives’ such as financial compensation.

This answers to research on the collective action problem by Olson (1965). He suggests that outcomes of collective action are public goods, from which everyone profits, irrespective

of whether he/she contributed to their provision or not. Therefore, Olson (1965) maintains that 'selective incentives,' in form of additional rewards for participants, are required. This research acknowledges the relevance of the collective action problem and assumes that it applies universally. However, conflict still occurs. Therefore, the view of Regan and Norton (2005) is adopted, and grievances are regarded as sufficient incentives for low-intensity civil conflicts. It is beyond the scope of this research to investigate in more detail how the collective action problem can be overcome in individual conflicts. Nonetheless, its presence is controlled for by including a variable on ethnic fractionalization in the empirical part of this research. Highly fractionalized societies will find it more difficult to organize for conflict (Alesina et al., 1999; Collier et al., 2001; Easterly & Levine, 1997).

So far, the argument is, therefore, that agricultural intensification leads to grievances among smallholders. These grievances can motivate the smallholder sector to engage in low-intensity civil conflict. To gain a better understanding of the nature of such conflict, it is important to consider which type of grievances agricultural intensification creates for the smallholder sector. As Stewart (2008) demonstrates, it is not sensible to think of grievances in merely economic terms. Her argument that grievances are multidimensional (economic, social, political, and cultural) and strongest when several dimensions overlap is adopted here.

Firstly, agricultural intensification can create economic disadvantages for smallholders, both in comparison to their previous economic situation and to larger, industrial farmers. These economic disadvantages are generated through a multitude of pathways. Increasing land concentration and grabs, especially by agribusinesses, lead to intraregional inequality, that deprives some smallholders of their basis of existence (Huggins, 2009; Koopman, 2012; Peters & Richards, 2011; Thomson, 2016). The bias of agricultural investment towards more fertile regions additionally forges interregional inequality (Freebairn, 1995; Pingali, 2012). Intensification is often accompanied by dependence on private companies for the provision of

inputs. This has been shown to create depts for many smallholders (GRAIN, 2007; Hunt, 2011; Nally, 2016). Additionally, inputs, particularly pesticides, impact the health of farmers and thus indirectly increase health-care costs of smallholders (Pimentel & Pimentel, 1990; Pingali, 1995). Many smallholders rely on food sources beyond their farms. Environmental degradation resulting from intensive farming can harm or eliminate these additional sources, requiring farmers to buy food (Freebairn, 1995; Pingali, 1995). Lastly, the gendered accessibility of many technologies disadvantages women working in agriculture (Gegenbach et al., 2018; Satyavathi et al., 2010). These mechanisms can foster economic grievances among smallholders.

Secondly, agricultural intensification is usually superimposed on smallholders (Gegenbach et al., 2018; GRAIN, 2014; Huggins, 2009). These are not participants in the change but only recipients of new technologies. Oftentimes, new technologies replace traditional practices, which can be perceived as a loss of autonomy and identity (Huggins, 2009; Nally, 2016; Rohrer, 1986). Particularly female farmers see their rights undermined by technologies that are predominantly adapted to the needs of male farmers (Gegenbach et al., 2018; Pingali, 2012; Satyavathi et al., 2010). Together, these disadvantages are likely to create social grievances among smallholders.

Thirdly, agricultural intensification affects and engages actors beyond those employed in the agricultural sector. Specifically, private companies and agribusinesses have been shown to increasingly lobby government officials. This can result in unequal laws (Fischer, 2015; GRAIN, 2019; Koopman, 2012; Nally, 2016) and mistreatment of smallholders (GRAIN, 2015; Huggins, 2009; Hunt, 2011; Nally, 2016). Governments have also been shown to resort to coercive measures, both against property and individuals. These measures seek to ensure compliance with new agricultural policies (Huggins, 2009; Koopman, 2012; Peters & Richards, 2011). Such developments are likely to generate political grievances among smallholders.

Lastly, agricultural intensification contributes to environmental degradation (GRAIN, 2007; Pimentel & Pimentel, 1990; Pingali & Rosegrant, 1994; WB, 2009). At the same time, research suggests that smallholders do not only value the productivity but also the quality of their farmland and immediate surroundings (GRAIN, 2018; Satyavathi et al., 2010). Therefore, environmental grievances are a further category of grievances beyond those established by Stewart (2008).

Due to a lack of data, it is currently not possible to determine which of these micro-mechanisms is more important for the outbreak of conflict. Therefore, this paper focuses on establishing a macro-level link between agricultural intensification and civil conflict. In doing so, it is, however, important to keep in mind that this research does not assume agricultural intensification and conflict to be connected by a single causal mechanism. Rather, agricultural intensification is believed to unleash a variety of micro-mechanisms that lead to economic, social, political, and environmental grievances. In agreement with research on 'horizontal inequalities,' these grievances are felt by African smallholders as a group. Especially, when several grievances coincide, smallholders are expected to mobilize and engage in low-intensity civil conflict.

The target of such conflict can either be the large-scale, corporate agricultural sector, which promotes and profits from agricultural intensification, or the government. Micro-mechanisms contributing to political grievances reveal the extensive involvement of government actors in the transformation of (African) agriculture. As Salehyan and Stewart (2017) argue, "[w]hen the state is highly central in generating particular grievances, dissidents will be more likely to target the state" (p. 963). Together, these deliberations lead to the formulation of the following hypothesis:

H1) Agricultural intensification in Africa increases the risk of low-intensity civil conflict.

Research Design

Dependent Variables: Low-Intensity Conflict Count & Low-Intensity Conflict Incidence

To test for the relationship between agricultural intensification and low-intensity civil conflict, two dependent variables are used. One is *low-intensity conflict incidence,* the other is *low-intensity conflict count*. The data for both comes from the Social Conflict in Africa Database (SCAD), compiled by Salehyan et al. (2012). This dataset is specialised into the recording of social conflict and is, therefore, widely used by researchers interested into conflict short of armed rebellions and (civil) wars (e.g., Buhaug et al., 2015; Hendrix & Salehyan, 2012; Smith, 2014). It differs from databases on organized armed conflict, such as the Uppsala University Armed Conflicts Database (ACD), in that it does not have a minimum number of deaths for an event to be recorded. Conflict events are divided into ten types, including organized and spontaneous demonstrations, organized and spontaneous riots, general and limited strikes, pro-government violence, anti-government violence, extra-government-violence, and intra-government violence. Events are recorded for countries with a minimum population of 1 million in Africa, Mexico, Central America, and the Caribbean from 1990 to 2017 (Salehyan et al., 2012).

This research focuses on organized and spontaneous demonstrations, organized and spontaneous riots as well as general and limited strikes. The inclusion of riots implies that agricultural intensification might lead to violent conflict. However, the exclusion of other event types intends to preclude forms of conflict that require the involvement of militias and thus higher levels of organization and planning.

The variable *low-intensity conflict incidence* is coded as a dummy variable, which takes the value of 1 if at least one conflict occurred in a given country-year, and the value of 0 otherwise. The variable *low-intensity conflict count* measures the intensity of conflict in a country-year. This helps to distinguish between years that are coded as 1 but saw different amounts of

conflict. Only countries from Africa are examined, since Africa has become the focus area of agricultural development and intensification (Annan, 2003; Hunt, 2011; Sanchez et al., 2009).

Independent Variable: Agricultural Intensification

The independent variable is *agricultural intensification*. Agricultural intensification is "characterised by the significant use of capital and inputs relative to land" (Eurostat, 2014, para. 1). Green Revolution practices, in particular, entail the "use of mineral fertilizers, pesticides and irrigation" as well as high-yielding seeds (FAO, n.d., Achievements of the Green Revolution section, para. 2). However, data on these characteristics is scarce. Especially data on the use of high-yielding seeds and irrigation is only available for a limited number of countries and years (see, e.g., FAO, 2016; International Seed Federation, n.d.; Siebert et al., 2013). It is, therefore, unsuitable for large N-studies.

The most widely recorded characteristic across time and space is fertilizer consumption in kilogram per hectare of arable land from the World Bank Development Indicators (2020a). This measurement is not optimal, as it entails only one, albeit important, aspect of intensification. Agricultural intensification is not one single process but a combination of several interventions, which together result in higher productivity (Pingali, 2012; Sanchez et al., 2009; Toenniessen et al., 2008). Yet, due to the centrality of fertilizer for agricultural intensification and the renewed attention to it in policymaking, especially in form of fertilizer subsidies (African Development Bank Group, n.d.; Jayne & Rashid, 2013), fertilizer consumption is believed to be an appropriate compromise indicator for the purpose of this research.

The variable is lagged by one year to control for potential theoretical and statistical issues. As the collective action problem illustrates, organisation for conflict is difficult. Therefore, it might take some time for smallholders to mobilize so that conflict only occurs in the year after

intensive agriculture has been implemented or augmented. Statistically, lagging the independent variable controls for simultaneity and omitted variables and, therefore, endogeneity. This is important, as a reduction in conflict has been shown to contribute to agricultural growth (Staatz & Dembélé, 2008). This could manifest itself in the adoption of more intensive practices such as higher fertilizer use. The lag ensures that reverse causality is ruled out, as conflict in a given year cannot influence the intensity of agriculture in the year before.

Controls

Several control variables are included to account for alternative explanations of civil conflict. This intends to reduce potential confounding effects. *Agricultural productivity*, measured by dividing the World Bank (2020b) crop production index by the percentage of agricultural land (WB, 2020c), controls for whether intensification has increased production (Gizelis & Wooden, 2010). This ensures that conflict is not attributed to intensification when it is, in fact, caused by persisting food insecurity.

Population is a widely accepted determinant of conflict (e.g., Böhmelt et al., 2014; Brückner, 2010; Fearon & Laitin, 2003). The reasoning is that larger populations strain scarce resources and thus increase the risk of conflict (Andre & Platteau, 1998; Homer-Dixon, 1994). This possibility is accounted for by using data from the World Bank (2020d).

GDP per capita, measured in current US$ by the World Bank (2020e), serves as a proxy for economic development, which has been shown to decrease the risk of conflict (Fearon & Laitin, 2003; Hegre & Sambanis, 2006; Hendrix & Salehyan, 2012). Fearon and Laitin (2003) explain this effect by relating economic development to increased state capacities and decreased incentives for rebels. Research on the causes of protests, that is low-intensity civil conflict, however, suggests that higher income levels increase the occurrence of unrest, as the

more well-off are more politically engaged (Dalton et al., 2010; Norris, 2006). Either way, economic development, and specifically GDP per capita, appears to be relevant for civil conflict, and is, therefore, included in this research.

Regime type is controlled for by including the polity2 variable from the Polity IV dataset (Marshall et al., 2017). This variable measures a country's regime type on a scale between -10 (full autocracy) and +10 (full democracy). Böhmelt et al. (2014) argue that democracies are more accommodative to, and thus face higher levels of, low-intensity civil conflict. More democratic regimes are less repressive towards actions such as demonstrations, which increases the likelihood of citizens to participate in these.

Ethnolinguistic fractionalization attempts to control for the 'collective action problem.' Research shows that more fragmented societies have lower levels of conflict, as collective organisation is more difficult (Alesina et al., 1999; Collier et al., 2001; Easterly & Levine, 1997). The data is taken from Fearon and Laitin (2003) and is based on the ELF index (Atlas Narodov Mira, 1964). The index "gives the probability that two randomly drawn individuals in a country are from different ethnolinguistic groups" (Fearon & Laitin, 2003, p. 78).

This list of controls is not exhaustive but contains several of the most commonly used predictors for civil conflict (e.g., Fearon & Laitin, 2003). Importantly, only such variables are included that can be assumed to be relevant for *low-intensity* civil conflict (compare, e.g., with Hendrix & Salehyan, 2012) so that more parsimonious models could be estimated. C*ountry fixed-effects* are included as a robustness check to control for whether any unobserved, time-invariant factors have an impact on low-intensity civil conflict.

Empirical Analysis

The relation between *agricultural intensification* and the categorical dependent variable *low-intensity civil conflict incidence* is tested by estimating a binominal logistic regression

model. The relation between *agricultural intensification* and the continuous dependent variable *low-intensity conflict count* is tested through an OLS regression model. Since the linear model violates the assumption of normality, a negative binomial regression is run as well. All regressions are rerun including the dependent variable lagged by one year as a predictor to check for robustness.

Data for both the dependent and independent variables is at the country-level. Therefore, this analysis is based on the country-year level and includes 37 African countries between 2004 and 2016. While some researchers argue for studying civil conflict at the sub-national level (e.g., Buhaug & Lujala, 2005; Raleigh & Urdal, 2007), agricultural intensification is usually pursued at the national level, for example through input subsidy programmes (Jayne & Rashid, 2013; Staatz & Dembélé, 2008). Hence, the national level seems to be the appropriate level of analysis.

Results

Table 1 shows the main results from the OLS, negative binomial, and logistic regressions. All three models are significant and have moderate explanatory power. The OLS model explains 28.7% of the variance in low-intensity conflict count, while the explanatory power of the logit model varies between 22.4% and 35.3%, depending on which pseudo R^2 (Cox and Snell's or Nagelkerke's) is looked at.

The hypothesis of this research postulates that agricultural intensification increases the risk of low-intensity civil conflict. When assessing the coefficients of *agricultural intensification* in the different models, mixed results are obtained. The OLS regression (model I) indicates *agricultural intensification* to have a positive and significant impact on the intensity of conflict (b= 0.067; p= 0.003). A one-unit increase in *agricultural intensification*, that is fertilizer use increasing by 1kg per hectare of arable land, is associated with a 0.067-unit increase in the

Table 1

Main Regression Results

	(I)	(II)	(III)
	OLS	**Negative Binomial**	**Logit**
Variables			
(Constant)	-103.425***	-11.108***	-15.459***
	(30.018)	(1.236)	(3.484)
Agricultural Intensification (lag)[a]	0.067**	-0.002*	-0.001
	(0.023)	(0.001)	(0.003)
Agricultural Productivity	1.339**	0.092***	0.249*
	(0.507)	(0.021)	(0.098)
Regime Type	-0.027	0.021	0.031
	(0.342)	(0.016)	(0.033)
GDP/capita (log)	4.192	0.459**	-0.140
	(3.847)	(0.157)	(0.484)
Population (log)	13.266***	1.590***	2.290***
	(3.474)	(0.147)	(0.399)
Ethnic Fractionalization	-4.137	-0.419	0.733
	(6.941)	(0.281)	(0.686)
Number of Observations	342	342	342
R^2	0.287		
-2LL			257.124
Cox & Snell R^2			0.224
Nagelkerke R^2			0.353
AIC		2,009.706	

Note: Standard Errors in Parentheses. ***p < 0.001, **p< 0.01, *p< 0.05

[a] Lagged by one year.

intensity of civil conflict (holding all other predictors constant). This result is in line with the hypothesis of this research.

However, checks of the model assumptions reveal that the OLS model violates the assumption of normality (see Online Appendices A to C for further checks of assumptions for

all models). This is problematic, as it can affect parameter estimates and their significance values. Therefore, one needs to be cautious about drawing strong conclusions from this model.

An alternative way to model count data is to run a Poisson or negative binomial regression. Negative binomial models are preferable when the count data is over-dispersed, as is the case for low-intensity conflict count (see Online Appendix A). The negative binomial regression is run including a dispersion parameter of 1.173 to correct for this. In the negative binomial regression (model II), *agricultural intensification* is significant again. However, in the opposite direction than expected by this research (b= -0.002; p= 0.039). Here, agricultural intensification is associated with a reduction in the intensity of civil conflict.

In the logistic regression (model III), *agricultural intensification* is not a significant predictor of low-intensity civil conflict incidence (b= -0.001, p= 0.685). However, similar to the negative binomial model, the result indicates that agricultural intensification is associated with a reduction in the risk of low-intensity civil conflict.

These results do not offer support for the hypothesis of this research. Yet, it is noticeable that *agricultural productivity* is a positive and significant predictor across all models. This is surprising, as increases in agricultural productivity are the intended outcome of agricultural intensification. These two predictors were thus expected to affect low-intensity civil conflict in a similar direction.

To investigate further into this finding, a mediation analysis was conducted (see Appendix D). Using Hayes' (2018) PROCESS version 3.5, *agricultural productivity* was added as a mediator between *agricultural intensification* and low-intensity civil conflict *count* and *incidence*. This aimed at clarifying the relation between agricultural intensification and productivity, as well as the role of productivity in the relationship between intensification and low-intensity civil conflict.

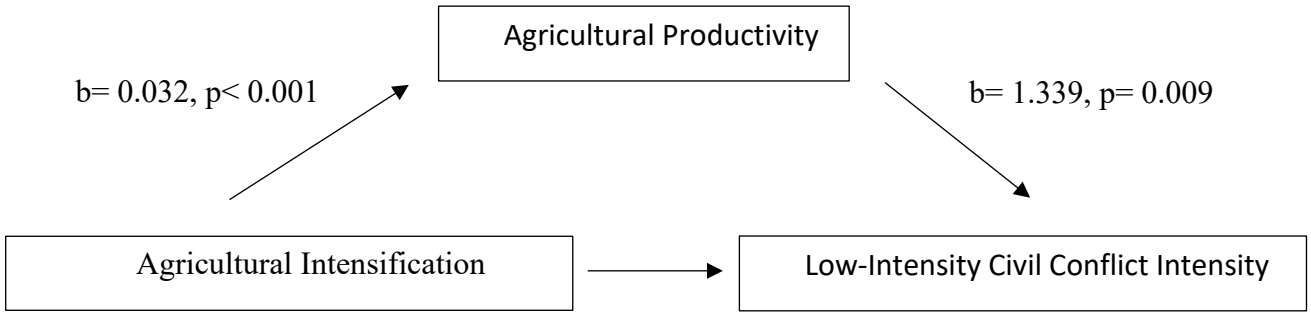
As Figure 1 and 2 illustrate, *agricultural intensification* is indeed associated with a significant increase in *agricultural productivity* (b= 0.032, p< 0.001). And, *agricultural productivity* is significantly correlated with an increase in low-intensity civil conflict *count* (b= 1.339, p= 0.009) and *incidence* (b= 0.249, p= 0.011). Adding *agricultural productivity* as a mediator into the OLS model (model I) does not cause substantial changes, as the indirect link between *agricultural intensification* and low-intensity civil conflict *count* is positive and significant (b= 0.043, 95% BCI [0.008, 0.081]). This is close to the results of the direct link (b= 0.067, p= 0.004). More interesting is the relation between *agricultural intensification* and low-intensity civil conflict *incidence.* Whereas the direct effect of *intensification* on low-intensity conflict *incidence* is negative and insignificant (model III: b= -0.001, p= 0.685), the indirect effect is positive and significant, as the bootstrapped confidence interval does not cross zero (b= 0.008, 95% BCI [0.003, 0.020]).

There are several potential explanations for this finding. One is that unless agricultural intensification increases productivity, it is not associated with an increase in low-intensity civil conflict. This would mean that only micro-mechanisms which are connected to increased productivity create group grievances, which can affect low-intensity civil conflict.

Another explanation derives from agricultural intensification being proxied by fertilizer use in this research. However, intensification consists of several interacting processes, including, also, higher levels of irrigation and the adoption of high-yielding seeds (Pingali, 2012; Sanchez et al., 2009). Accordingly, it is possible that agricultural intensification is not captured in its entirety. Fertilizer use might not adequately proxy the process of intensification and, thus, have no significant direct effect on low-intensity civil conflict *incidence*. Being the outcome of intensification, agricultural productivity bundles the diverse processes of intensification not individually accounted for in this research. This might explain why adding it as a mediator creates a significant and positive indirect effect of *agricultural intensification* on low-intensity

Figure 1

OLS Regression with Mediation Effect

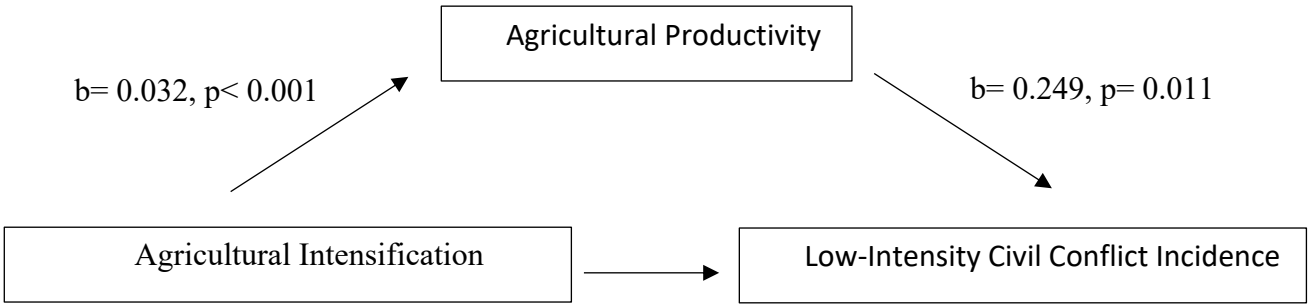


Direct effect: b= 0.067, p= 0.004

Indirect effect: b= 0.043, 95% BCI [0.008, 0.081]

Figure 2

Logistic Regression with Mediation Effect



Direct effect: b= -0.001, p= 0.685

Indirect effect: b= 0.008, 95% BCI [0.003, 0.020]

civil conflict *incidence*.

At this point, such inferences have to be regarded as assumptions. It is equally possible that agricultural productivity is positively correlated with an increased risk of conflict independent from the process through which it has been obtained. Therefore, more in-depth research on the role of agricultural productivity in the relation between agricultural intensification and low-intensity civil conflict is needed.

When looking at the other control variables, *population* is highly significant across all models. As expected, increases in population are associated with an increased risk of low-intensity civil conflict.

GDP per capita is only significant in the negative binomial regression (model II) (b= 0.459; p= 0.003). Every one-unit increase of the logged *GDP per capita* variable increases the incidence rate of low-intensity civil conflict by 58.2% (see Online Appendix A). This lends some support to findings in the literature that people with higher incomes are more likely to protest (Dalton et al., 2010; Norris, 2006). However, this does not necessarily question findings by Collier and Hoeffler (2004) and Fearon and Laitin (2003), where GDP per capita has a conflict-reducing effect. Rather, it supports the insight that different kinds of conflict, especially low-intensity versus high-intensity, are associated with different mechanisms (Böhmelt et al., 2014; Regan & Norton, 2005). Yet, no strong conclusions about the impact of GDP per capita can be drawn, as it is insignificant in all other models and has a negative coefficient in the logit model (b= -0.140).

Lastly, *regime type* and *ethnic fractionalization* have inconsistent and insignificant results across all models.

Robustness Checks

Further regressions were run to check for the robustness of these findings. Table 2 displays the results. When *lagged conflict count* or *incidence* is included as a predictor, *agricultural intensification* is only significant in the negative binomial model (model V). There, it continues to have a conflict-reducing effect (b= -0.003, p= 0.008). Meanwhile, *agricultural productivity* is associated with an increased risk of conflict across all models, but not significantly in the OLS model (model IV: b= 0.825, p= 0.067). The significance of *GDP per capita* is reduced to the 0.05 level in the negative binomial model (model V) (b= 0.358).

In the OLS and logit models it remains insignificant. *Population* continues to be (highly) significant and positive across models, whereas *regime type* and *ethnic fractionalization* remain insignificant. Overall, there are no substantial changes in any of the models when the lagged conflict variable is included.

However, *lagged conflict count* and *incidence* are significant and positive predictors of conflict *count* and *incidence* respectively in all three models. This is in line with research that has shown a country's recent history of conflict to impact its proneness to conflict (Collier & Hoeffler, 2004; Hegre et al., 2001; Hegre & Sambanis, 2006). There are two, not necessarily mutually exclusive, explanations for why this is the case. The shorter the time since the last conflict, the more conflict-related resources are still available (Collier & Hoeffler, 2004). This might, however, be more relevant for armed than for low-intensity civil conflict, where material requirements and opportunity costs are lower. The second explanation is that grievances from previous conflict might fuel renewed conflict (Collier & Hoeffler, 2004).

When *lagged conflict count* and *incidence* are included as predictors, the R^2 of the OLS model increases to 0.448, the pseudo R^2 of the logit model increases to 0.261 (Cox and Snell's) and 0.412 (Nagelkerke's), and the AIC of the negative binomial model decreases to 1,992.352. This illustrates the importance of these predictors for the overall model-fit.

Additionally, all models were rerun including *country-fixed effects*. Note that the number of observations consequently changes from 342 to 426. The Seychelles could not be included due to zero variance in the dependent variable. Standard errors in the OLS regression are adjusted by using Hayes and Cai's (2007) HCREG macro. When country-fixed effects are included, no predictor is significant in the OLS or logit model. In the negative binomial model, only *population* remains a positive and significant predictor of low-intensity civil conflict (b= 5.178, p= 0.003). Hence, the inclusion of country-fixed effects might, indeed, account for previously unobserved factors. Therefore, these results should caution against drawing

Table 2

Robustness Checks

Variables	(IV) OLS Robust[ab]	(V) Negative Binomial Robust[ab]	(VI) Logit Robust[ab]	(VII) Fixed[c] OLS[d]	(VIII) Fixed[c] Negative Binomial	(IX) Fixed[c] Logit
(Constant)	-57.599*	-9.626***	-13.662***	-314.915	-36.970**	-75.459
	(26.862)	(1.275)	(3.707)	(374.659)	(11.753)	(11343.483)
Agricultural Intensification (lag)[a]	0.026	-0.003**	-0.001	-0.128	-0.004	0.022
	(0.020)	(0.001)	(0.003)	(0.214)	(0.004)	(0.017)
Agricultural Productivity	0.825	0.075***	0.192*	-2.013	-0.045	0.207
	(0.450)	(0.020)	(0.095)	(5.053)	(0.099)	(0.648)
Regime Type	0.005	0.018	0.017	0.545	-0.014	0.153
	(0.301)	(0.015)	(0.035)	(0.684)	(0.025)	(0.154)
GDP/capita (log)	2.498	0.358*	-0.050	26.500	0.147	-2.470
	(3.395)	(0.154)	(0.506)	(19.096)	(0.542)	(0.2.204)
Population (log)	7.331*	1.406***	1.874***	32.384	5.178**	13.694
	(3.121)	(0.152)	(0.430)	(53.077)	(1.729)	(7.469)
Ethnic Fractionalization	-2.599	-0.280	0.641			
	(6.120)	(0.273)	(0.721)			
Conflict Count (lag)[a]	0.480***	0.013**				
	(0.049)	(0.004)				
Conflict Incidence (lag)[a]			1.492***			
			(0.360)			
Number of Observations	342	342	342	426	426	426
R^2	0.448			0.347		
-2LL			240.345			192.303
Cox & Snell R^2			0.261			0.376
Nagelkerke R^2			0.412			0.624
AIC		1,992.352			2,436.468	

Note: Standard Errors in Parentheses. ***p < 0.001, **p< 0.01, *p< 0.05

[a] Lagged by one year. [b] Lagged dependent variable as predictor. [c] Country-fixed effect with Algeria as reference category. [d] With adjusted standard errors.

causal inferences from the models above and substantiate the call for continued research on the relation between agricultural intensification, productivity, and civil conflict.

Conclusion

This research started with the puzzle of whether agricultural intensification, which aims at reducing hunger and conflict, could in fact increase conflict. Based upon theories on 'horizontal inequalities,' the agricultural smallholder sector was expected to develop multidimensional group grievances, which can lead to low-intensity civil conflict. Therefore, this research hypothesized that agricultural intensification increases the risk of low-intensity civil conflict.

Empirical results on the direct impact of *agricultural intensification* on low-intensity civil conflict are inconsistent. When correcting for normality and over-dispersion, *agricultural intensification* is associated with a significant reduction in the *intensity* of conflict. With regard to the *incidence* of low-intensity civil conflict, results are insignificant but also hint at a conflict-reducing effect. Meanwhile, *agricultural productivity* is associated with a significant increase of both low-intensity civil conflict *incidence* and *intensity*. Moreover, when *agricultural productivity* is added as a mediator, there is a significant and positive indirect effect of *intensification* on low-intensity civil conflict.

Hence, agricultural intensification might only increase the risk of low-intensity civil conflict by way of increasing productivity. This has several scientific implications. First, it seems that only such micro-mechanisms proposed in the theoretical framework of this research might facilitate conflict that are connected to a growth in productivity. Secondly, these findings suggest that the occupational sector might indeed be a source of group identity, as smallholders appear to be able to organize for low-intensity civil conflict when productivity increases.

From a practical perspective these findings are problematic. Given population growth forecasts, it is evident that agricultural output has to increase in order to meet future demands

for food (FAO, 2009; WB, 2008). As Hunt (2011), among others, outlines, it is not desirable that increases in output are achieved through an expansion of agricultural land, as this causes deforestation. However, the conflict-enhancing potential of heightened productivity questions the social desirability of increasing the output of existing agricultural land. This creates an impasse for agricultural development policies.

Before expanding into pathways for future research, it is important to consider the limitations of the present study. Due to a lack of available data, agricultural intensification has been proxied by fertilizer use in kilogram per hectare of arable land (WB, 2020a). However, this indicator is imperfect, as agricultural intensification entails a number of interacting processes (Pingali, 2012). Therefore, it is likely that fertilizer use does not capture agricultural intensification and its consequences in their entirety. This could, *inter alia*, explain the mismatch between the direct impact of *agricultural intensification* and *agricultural productivity* on low-intensity civil conflict.

Moreover, low-intensity civil conflict is conceptualized as demonstrations, strikes, and riots. However, Staatz and Dembélé (2008) observe a "rise of independent farmer and trader organizations that are giving voice to rural people to lobby for policies more favorable to agriculture and rural development" (p. 10). Such regular forms of opposition are, however, not included in the SCAD database. Hence, a potentially important part of the story has been excluded from this research.

Together with the implications of the present results, these limitations create interesting possibilities for future research. Firstly, it needs to be determined, whether agricultural productivity is associated with an increase in the risk of conflict independent from the process through which it is obtained. A prominent alternative to agricultural intensification using 'Green Revolution' practices (agro-industrial approach) is sustainable agriculture (agro-ecological approach) (Horlings & Marsden, 2011). The agro-ecological approach entails a

variety of methods, such as zero tillage, multi-cropping, and organic production (Altieri, 2018). Horlings and Marsden (2011) demonstrate the productivity-enhancing potential of these practices. Comparative case studies of regions that either employ agro-industrial or agro-ecological methods could help to determine whether these regions face different levels of civil conflict.

If such an investigation finds the conflict-enhancing potential of agricultural productivity to be contingent on agro-industrial practices, a more thorough collection of data on the diverse aspects of this form of intensification should be encouraged. Subsequently, regression models including an aggregate intensification indicator or indicators of individual aspects of it could be estimated. This would help to discern whether it is the sum of practices that has a conflict-enhancing effect, or if only one specific aspect is associated with conflict.

In all of this, regular forms of opposition should be included to gain a complete picture of the repercussions of enhanced agricultural productivity. Special attention should be paid to the role of farmer organizations, which are of growing importance at the local to national level (Heemskerk & Wennink, 2004; Staatz & Dembélé, 2008). Quantitatively, agricultural productivity enhancements could be correlated to the number of court cases. Qualitatively, the role of farmer organizations and lobby activities could be assessed through an inquiry of policy documents.

The FAO predicts that “food production must increase by 70 percent” in order for us to be able to feed 9 billion people in 2050 (FAO, 2009, p. 2). This will inevitably require changes in how agricultural production is organized. Policymakers need scientific evidence on the economic, political, social, and environmental implications of different production scenarios, in order to be able to make informed decisions. Clarifying the impact of intensive agriculture and increased productivity on conflict would constitute an important step into this direction.

References

African Development Bank Group. (n.d.). *Abuja Declaration.* https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/africa-fertilizer-financing-mechanism/about-affm/abuja-declaration.

Alesina, A., Baqir, R., & Easterly, W. (1999). Public goods and ethnic divisions. *Quarterly Journal of Economics*, *114*(4), 1243-1284. https://doi.org/10.1162/003355399556269.

Altieri, M. A. (2018). *Agroecology: The science of sustainable agriculture*. Boca Raton, FL: CRC Press.

Andre, C., & Platteau, J. (1998). Land relations under unbearable stress: Rwanda caught in the Malthusian trap. *Journal of Economic Behavior & Organisation, 34*(1), 1-47. https://doi.org/10.1016/S0167-2681(97)00045-0.

Annan, K. (2003). A challenge to the world's scientists. *Science, 299*(5612), 1485. Retrieved from https://science.sciencemag.org/content/299/5612/1485.

Atlas Narodov Mira (1964). Miklukho-Maklai Ethnological Institute at the Department of Geodesy and Cartography of the State Geological Committee of the Soviet Union: Moscow.

Bartusevičius, H. (2014). The inequality-conflict nexus re-examined: Income, education and popular rebellion. *Journal of Peace Research, 51*(1), 35-50. https://doi.org/10.1177%2F0022343313503179.

Besançon, M. L. (2005). Relative resources: Inequality in ethnic wars, revolutions, and genocides. *Journal of Peace Research, 42*(4), 393-415. https://doi.org/10.1177%2F0022343305054086.

Brawley, M. R. (1997). Factoral or sectoral conflict? Partially mobile factors and the politics of trade in imperial Germany. *International Studies Quarterly, 41*, 633-654. Retrieved from www.jstor.org/stable/2600856.

Breisinger, C., Diao, X., Thurlow, J., & Al Hassan, R. (2009). Potential impacts of a green revolution in Africa - The case of Ghana. *Journal of International Development, 23*, 82-102. https://doi.org/10.1002/jid.1641.

Brückner, M. (2010). Population size and civil conflict risk: Is there a causal link? *The Economic Journal, 120*(544), 535-550. https://doi.org/10.1111/j.1468-0297.2010.02352.x.

Böhmelt, T., Bernauer, T., Buhaug, H., Gleditsch, N. P., Tribaldos, T., & Wischnath, G. (2014). Demand, supply, and restraint: Determinants of domestic water conflict and cooperation. *Global Environmental Change, 29*, 337-348. http://dx.doi.org/10.1016/j.gloenvcha.2013.11.018.

Buhaug, H., Benjaminsen, T. A., Sjaastad, E., & Theisen, O. M. (2015). Climate variability, food production shocks, and violent conflict in Sub-Saharan Africa. *Environmental Research Letters, 10*(12), 1-11. Retrieved from https://iopscience.iop.org/article/10.1088/1748-9326/10/12/125015.

Buhaug, H., Gleditsch, K. S., Holtermann, H., Østby, G., & Tollefsen, A. F. (2011). It's the local economy, stupid! Geographic wealth dispersion and conflict outbreak location. *Journal of Conflict Resolution, 55*(5), 814-840. https://doi.org/10.1177%2F0022002711408011.

Buhaug, H., & Lujala, P. (2005). Accounting for scale: Measuring geography in quantitative studies of civil war. *Political Geography, 24*, 399-418. https://doi.org/10.1016/j.polgeo.2005.01.006.

Cederman, L., Weidmann, N. B., & Gleditsch, K. S. (2011). Horizontal inequalities and ethnonationalist civil war: A global comparison. *American Political Science Association, 105*(3), 478-495. Retrieved from https://www.jstor.org/stable/41480853.

Chayanov, A. V. (1926). *The theory of the peasant economy* (D. Torner, B. Kernblay, & R. E. F. Smith, Eds.). Homewood, IL: Richard D. Irwin, Inc.

Christiansen, C. H. (1999). Defining lives: Occupation as identity: An essay on competence, coherence and the creation of meaning. *American Journal of Occupational Therapy, 53*, 547-558. https://doi.org/10.5014/ajot.53.6.547.

Collier, P., & Dercon, S. (2014). African agriculture in 50 years: Smallholders in a rapidly changing world? *World Development, 63*, 92-101. http://dx.doi.org/10.1016/j.worlddev.2013.10.001 .

Collier, P., & Hoeffler, A. (2004). Greed and grievance in civil war. *Oxford Economic Papers, 56*, 563-595. https://doi.org/10.1093/oep/gpf064.

Collier, P., Honohan, P., & Moene, K. (2001). Implications of ethnic diversity. *Economic Policy, 16*(32), 129-166. Retrieved from www.jstor.org/stable/3601036.

Cornell, A., & Grimes, M. (2015). Institutions as incentives for civic action: Bureaucratic structures, civil society, and disruptive protests. *The Journal of Politics, 77*(3), 664-678. Retrieved from https://www.jstor.org/stable/10.1086/681058.

Cramer, C. (2003). Does inequality cause conflict? *Journal of International Development, 15*(4), 397-412. https://doi.org/10.1002/jid.992.

Dalton, R., Van Sickle, A., & Weldon, S. (2010). The individual-institutional nexus of protest behavior. *British Journal of Political Science, 40*(1), 51-73. Retrieved from https://www.jstor.org/stable/40649423.

Deininger, K., & Byerlee, D. (2012). The rise of large farms in land abundant countries: Do they have a future? *World Development, 40*(4), 701-714. https://doi.org/10.1016/j.worlddev.2011.04.030.

Durham, W. H. (1979). *Scarcity and survival in Central America: Ecological origins of the soccer war.* Stanford, CA: Stanford University Press.

Dzuverović, N. (2013). Does more (or less) lead to violence? Application of the relative deprivation hypothesis on economic inequality-induced conflicts. *Croatian International Relations Review, 19*(68). https://doi.org/10.2478/cirr-2013-0003.

Dzuverović, N., & Milošević, A. (2013). In search for more: The importance of income inequality in conflict formation and its policy implications. *Croatian Political Science Review, 50(*5), 173-186. Retrieved from https://www.academia.edu/6257512/In_Search_for_More_The_Importance_of_Income_Inequality_in_Conflict_Formation_and_Its_Policy_Implications.

Eurostat. (2014). *Glossary: Intensive farming*. https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Intensive_farming.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy: Policies and ethnic divisions. *Quarterly Journal of Economics, 112*(4), 1203-1250. https://doi.org/10.1162/003355300555466.

Evenson, R. E., & Gollin, D. (2003). Assessing the impact of the green revolution: 1960-2000. *Science, 300*(5620), 758-762. https://doi.org/10.1126/science.1078710.

FAO. (2009). *How to feed the world in 2050*. http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf.

FAO. (2013). *Smallholders and family farmers*. http://www.fao.org/family-farming/detail/en/c/273864/.

FAO. (2016). *AQUASTAT* [Main Database]. Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en.

FAO. (2019). *The state of food security and nutrition in the world*. http://www.fao.org/state-of-food-security-nutrition .

FAO. (n.d.). *Towards a new green revolution*. http://www.fao.org/3/x0262e/x0262e06.htm.

Fearon, J. D., & Laitin, D. D. (2003). Ethnicity, insurgency, and civil war. *American Political Science Review, 97*(1), 75-90. Retrieved from www.jstor.org/stable/3118222.

Fischer, K. (2015). Why new crop technology is not scale-neutral- A critique of the expectations for a crop based African green revolution. *Research Policy, 45*, 1185-1194. http://dx.doi.org/10.1016/j.respol.2016.03.007.

Freebairn, D. K. (1995). Did the green revolution concentrate incomes? A quantitative study of research reports. *World Development, 23*(2), 265-279. https://doi.org/10.1016/0305-750X(94)00116-G.

Garst, W. D. (1999). From sectoral linkages to class conflict: Trade and coalition formation in Britain prior to and after world war I. *Comparative Political Studies, 32*(7), 788-809. https://doi.org/10.1177%2F0010414099032007002.

Gates Foundation. (n.d.). *Alliance for a green revolution in Africa (AGRA).* https://www.gatesfoundation.org/Where-We-Work/Africa-Office/AGRA.

Gegenbach, H., Schurman, R. A., Bassett, T. J., Munro, W. A., & Moseley, W. G. (2018). Limits of the new green revolution for Africa: Reconceptualizing gendered agricultural value chains. *The Geographical Journal, 184,* 208-214. https://doi.org/10.1111/geoj.12233.

Gini, A. (1998). Work, identity and self: How we are formed by the work we do. *Journal of Business Ethics, 17*, 707-714. Retrieved from https://www.jstor.org/stable/25073117.

Gizelis, T., & Wooden, A. E. (2010). Water resources, institutions, & intrastate conflict. *Political Geography, 29*(8), 444-453. https://doi.org/10.1016/j.polgeo.2010.10.005.

Gollin, D. (2014). *Smallholder agriculture in Africa: An overview and implications for policy* [Working Paper]. International Institute for Environment and Development: London. Retrieved from http://pubs.iied.org/16574IIED.

GRAIN. (2007). *A new green revolution for Africa?* https://www.grain.org/article/entries/74-a-new-green-revolution-for-africa.

GRAIN. (2014). *How does the Gates Foundation spend its money to feed the world?* https://www.grain.org/article/entries/5064-how-does-the-gates-foundation-spend-its-money-to-feed-the-world.

GRAIN. (2015). *Land and seed laws under attack: Who is pushing changes in Africa?* https://www.grain.org/article/entries/5121-land-and-seed-laws-under-attack-who-is-pushing-changes-in-africa.

GRAIN. (2018). *The real seed producers: Small-scale farmers save, use, share and enhance the seed diversity of the crops that feed Africa.* https://www.grain.org/en/article/6035-the-real-seeds-producers-small-scale-farmers-save-use-share-and-enhance-the-seed-diversity-of-the-crops-that-feed-africa.

GRAIN. (2019). *Food sovereignty is Africa's only solution to climate chaos.* https://www.grain.org/en/article/6293-food-sovereignty-is-africa-s-only-solution-to-climate-chaos.

Goldschmidt, W. (1978). *As you sow: Three studies on the social consequences of agribusiness.* Montclair, NJ: Allanheld, Osmun and Company.

Gurr, T. (1968). A causal model of civil strife: A comparative analysis using new indices. *The American Political Science Review, 62*(4), 1104-1124. Retrieved from www.jstor.org/stable/1953907.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). New York, NY: Guilford Press.

Hayes, A. F., & Cai, L. (2007). Using heteroscedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation. *Behavior Research Methods, 39*, 709-722.

Hegre, H., Ellingsen, T., Gates, S., & Gleditsch, N. P. (2001). Toward a democratic peace? Democracy, political change and civil war, 1816-1992. *The American Political Science Review, 95*(1), 33-48. https://doi.org/10.1017/S0003055401000119.

Hegre, H., & Sambanis, N. (2006). Sensitivity analysis of empirical results on civil war onset. *Journal of Conflict Resolution, 50*(4), 508–535. https://doi.org/10.1177/0022002706289303.

Heemskerk, W., & Wennink, B. (2004). *Building social capital for agricultural innovation: Experiences with farmer groups in Sub-Saharan Africa.* Royal Tropical Institute (KIT), Amsterdam. https://www.kit.nl/wp-content/uploads/2018/08/761_Bull368-Building-web.pdf.

Hendrix, C. S., & Brinkman, H. (2013). Food insecurity and conflict dynamics: Causal linkages and complex feedbacks. *Stability: International Journal of Security & Development, 2*(2), 1-18. http://dx.doi.org/10.5334/sta.bm.

Hendrix, C. S., & Haggard, S. (2015). Global food prices, regime type, and urban unrest in the developing world. *Journal of Peace Research, 52*(2), 143-157. https://doi.org/10.1177%2F0022343314561599.

Hendrix, C. S., & Salehyan, I. (2012). Climate change, rainfall, and social conflict in Africa. *Journal of Peace Research, 49*(1), 35-50. https://doi.org/10.1177%2F0022343311426165.

Homer-Dixon, T. F. (1991). On the threshold: Environmental changes as causes of acute conflict. *International Security, 16*(2), 76-116. Retrieved from https://www.jstor.org/stable/2539061.

Homer-Dixon, T. F. (1994). Environmental scarcities and violence conflict: Evidence from cases. *International Security, 19*(1), 5-40. Retrieved from https://www.jstor.org/stable/2539147.

Horlings, L. G., & Marsden, T. K. (2011). Towards the real green revolution? Exploring the conceptual dimensions of modernization of agriculture that could 'feed the world.' *Global Environmental Change, 21*, 441-452. https://doi.org/10.1016/j.gloenvcha.2011.01.004.

Huggins, C. (2009). Agricultural policies and local grievances in rural Rwanda. *Peace Review, 21*(3), 296-303. https://doi.org/10.1080/10402650903099351.

Hunt, D. (2011). *Green revolutions for Africa.* Chatham House. https://www.chathamhouse.org/publications/papers/view/109570.

International Seed Federation. (n.d). *Seed statistics* [Data set]. International Seed Federation. https://www.worldseed.org/resources/seed-statistics/.

Jayne, T. S., & Rashid, S. (2013). Input subsidy programs in sub-Saharan Africa: A synthesis of recent evidence. *Agricultural Economics, 44*(6), 547-562. https://doi.org/10.1111/agec.12073

Koopman, J. (2012). Land grabs, government, peasant and civil society activism in the Senegal River Valley. *Review of African Political Economy, 39*(134), 655-664. https://doi.org/10.1080/03056244.2012.738797.

Koubi, V., & Böhmelt, T. (2014). Grievances, economic wealth and civil conflict. *Journal of Peace Research, 51*(1), 19-33. https://doi.org/10.1177%2F0022343313500501.

Labao, L., & Stofferahn, C. W. (2007). The community effects of industrialized farming: Social science research and challenges to corporate farming laws. *Agriculture and Human Values, 25*(2), 219-240. https://doi.org/10.1007/s10460-007-9107-8.

Lazarsfeld, P. F., & Merton, R. K. (1954). Friendship as a social process: A substantive and methodological analysis. In M. Berger (Ed.), *Freedom and control in modern society* (pp. 18-66). New York, NY: Van Nostrand.

Lee, M. R. (2008). Civic community in the hinterland: Toward a theory of rural social structure and violence. *Criminology, 46*(2), 447-478. https://doi.org/10.1111/j.1745-9125.2008.00115.x.

Lichbach, M. I. (1987). Deterrence or escalation? The puzzle of aggregate studies of repression and dissent. *The Journal of Conflict Resolution, 31*(2), 266-297. Retrieved from www.jstor.org/stable/174013.

Mach, K. J., Kraan, C. M., Adger, W. N., Buhaug, H., Burke, M., Fearon, J. D., Field, C. B., Hendrix, C. S., Maystadt, J., O'Loughlin, J., Roessler, P., Scheffran, J., Schultz, K. A., & von Uexkull, N. (2019). Climate as a risk factor for armed conflict. *Nature, 57*(1), 193-197. https://doi.org/10.1038/s41586-019-1300-6.

Mamalakis, M. J. (1969). The theory of sectoral clashes. *Latin American Research Review, 4*(3), 9-46. Retrieved from https://www.jstor.org/stable/2502284.

Marshall, M. G., Gurr, T. R., & Jaggers, K. (2017). *Polity IV project: Political regime characteristics and transitions, 1800-2016 (p4v2016 & p4v2016d)* [Dataset Users' Manual]. Center for Systemic Peace. https://www.systemicpeace.org/inscr/p4manualv2016.pdf.

Mbow, C., Rosenzweig, C., Barioni, L.G., Benton, T.G., Herrero, M., Krishnapillai, M., Liwenga, E., Pradhan, P., Rivera-Ferre, M. G., Sapkota, T., Tubiello, F.N., Xu, Y. (2019). Food Security. In P.R. Shukla, J. Skea, E. Calco Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, & J. Malley [Eds.], *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems* (pp. 437-550). The Intergovernmental Panel on Climate Change. https://www.ipcc.ch/srccl/chapter/chapter-5/.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology, 27*, 415-444. https://doi.org/10.1146/annurev.soc.27.1.415.

Nafziger, E. W., & Auvinen, J. (2002). Economic development, inequality, war, and state violence. *World Development, 30*(2), 153-163. https://doi.org/10.1016/S0305-750X(01)00108-5.

Nally, D. (2016). Against food security: On forms of care and fields of violence. *Global Society, 30*(4), 558-582. https://doi.org/10.1080/13600826.2016.1158700 .

Norris, P. (2006). *Political protest in fragile states* [Paper for the plenary panel PS01 Political Action and Beyond at the International Political Science Association World Congress in Fukuoka, Japan, July 2006]. John F. Kennedy School of Government, Harvard University. Retrieved from https://www.academia.edu/2748760/Political_protest_in_fragile_states.

Olson, M. (1965). *The logic of collective action: Public goods and the theory of groups*. Boston, MA: Harvard University Press.

Østby, G. (2013). Inequality and political violence: A review of the literature. *International Area Studies Review, 16*(2), 206-213. https://doi.org/10.1177%2F2233865913490937.

Østby, G., Nordas, R., & Rød, J. K. (2009). Regional inequalities and civil conflict in Sub-Saharan Africa. *International Studies Quarterly, 53*(2), 301-324. https://doi.org/10.1111/j.1468-2478.2009.00535.x.

Peski, M. (2008). *Complementarities, group formation and preferences for similarity* [Working Paper]. Department of Economics, University of Toronto. Retrieved from http://individual.utoronto.ca/mpeski/papers/similarity.pdf.

Peters, K., & Richards, P. (2011). Rebellion and agrarian tensions in Sierra Leone. *Journal of Agrarian Change, 11*(3), 377-395. https://doi.org/10.1111/j.1471-0366.2011.00316.x .

Pimentel, D., & Pimentel, M. (1990). Comment: Adverse environmental consequences of the green revolution. *Population and Development Review, 16*, 329-332. Retrieved from https://www.jstor.org/stable/2808081.

Pingali, P. L. (1995). Impact of pesticides on farmer health and the rice environment: An overview of results from a multidisciplinary study in the Philippines. In P. L. Pingali, & P. A. Roger (Eds.), *Impact of pesticides on farmer health and the rice environment* (pp. 3-21). Kluwer Academic Publishers.

Pingali, P. L. (2012). Green revolution: Impacts, limits, and the path ahead. *Proceedings of the National Academy of Sciences of the United States of America, 109*(31), 12302-12308. http://www.pnas.org/cgi/doi/10.1073/pnas.0912953109.

Pingali, P. L., & Rosegrant, M. W. (1994). *Confronting the environmental consequences of the green revolution in Asia* [Manuscript in Preparation]. Environment and Production Technology Division, International Food Policy Research Institute. Retrieved from

https://www.researchgate.net/publication/5056026_Confronting_the_environmental_consequences_of_the_Green_Revolution_in_Asia.

Popkin, S. (1980). The rational peasant: The political economy of peasant society. *Theory and Society, 9*(3), 411-471. Retrieved from www.jstor.org/stable/656877.

Raleigh, C., & Urdal, H. (2007). Climate change, environmental degradation and armed conflict. *Political Geography, 26*(6), 674-694. https://doi.org/10.1016/j.polgeo.2007.06.005.

Reardon, T., Barrett, C., Kelly, V., & Savadogo, K. (1999). Policy reforms and sustainable agricultural intensification in Africa. *Development Policy Review, 17*, 375-395. https://doi.org/10.1111/1467-7679.00093.

Regan, P. M., & Norton, D. (2005). Greed, grievance, and mobilization in civil wars. *Journal of Conflict Resolution, 49*(3), 319-336. https://doi.org/10.1177%2F0022002704273441.

RezaeeDaryakenari, B., Landis, S. T., & Thies, C. G. (2020). Food price volatilities and civilian victimization in Africa. *Conflict Management and Peace Science, 37*(2), 193-214. https://doi.org/10.1177%2F0738894217729527.

Rohrer, W. C. (1986). Developing third world farming: Conflict between modern imperatives and traditional ways. *Economic Development and Cultural Change, 34*(2), 299-314. Retrieved from www.jstor.org/stable/1153852.

Ross, M. L. (2004). How do natural resources influence civil war? Evidence from thirteen cases. *International Organization, 58*(1), 35-67. Retrieved from http://www.jstor.org/stable/3877888?origin=JSTOR-pdf.

Ruttan, V. W. (2002). *Controversy about agricultural technology: Lessons from the green revolution* [Manuscript in Preparation]. Department of Applied Economics, University of Minnesota. http://dx.doi.org/10.22004/ag.econ.13885.

Salehyan, I. (2014). Climate change and conflict: Making sense of disparate findings. *Political Geography, 43*, 1-5. https://doi.org/10.1016/j.polgeo.2014.10.004.

Salehyan, I., Hendrix, C. S., Hamner, J., Case, C., Linebarger, C., Stull, E., & Williams, J. (2012). Social conflict in Africa: A new database. *International Interactions, 38*(4), 503-511. https://doi.org/10.1080/03050629.2012.697426.

Salehyan, I., & Stewart, B. (2017). Political mobilization and government targeting: When do dissidents challenge the state? *Comparative Political Studies, 50*(7), 963-991. https://doi.org/10.1177%2F0010414016655541.

Sambanis, N. (2005). Using case studies to refine and expand the theory of civil war. In: P. Collier & N. Sambanis (Eds.), *Understanding civil war: Evidence and Analysis* (Vol. 1: Africa, pp. 303-334). The World Bank.

Sanchez, P. A., Denning, G. L., & Nziguheba, G. (2009). The African green revolution moves forward. *Food Security, 1*, 37-44. https://doi.org/10.1007/s12571-009-0011-5.

Satyavathi, C. T., Bharadwaj, Ch., & Brahmanand, P. S. (2010). Role of farm women in agriculture. *Gender, Technology and Development, 14*(3), 441-449. https://doi.org/10.1177/097185241001400308.

Siebert, S.; Henrich, V., Frenken, K., & Burke, J. (2013). *Global map of irrigation areas* [version 5] [Map]. Rheinische Friedrich-Wilhelms-University/ Food and Agricultural Organisation of the United Nations. http://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/latest-version/.

Siroky, D., & Hechter, M. (2016). Ethnicity, class, and civil war: The role of hierarchy, segmentation, and cross-cutting cleavages. *Civil Wars, 18*(1), 91-107. https://doi.org/10.1080/13698249.2016.1145178.

Smith, A. D. (1991). *National Identity*. Reno, NV: University of Nevada Press.

Smith, T. G. (2014). Feeding unrest: Disentangling the causal relationship between food price shocks and sociopolitical conflict in urban Africa. *Journal of Peace Research, 51*(6), 679-695. https://doi.org/10.1177%2F0022343314543722.

Staatz, J. M., & Dembélé, N. N. (2008). *Agriculture for development in Sub-Saharan Africa*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/9043.

Stewart, F. (2008). Horizontal inequalities and conflict: An introduction and some hypotheses. In F. Stewart (Ed.), *Horizontal inequalities and conflict. Understanding group violence in multiethnic societies* (pp. 3-24). London: Palgrave Macmillan.

Tilly, C. (1978). *From mobilization to revolution*. New York, NY: McGraw Hill.

Thomson, H. (2016). Rural grievances, landholding inequality, and civil conflict. *International Studies Quarterly, 60*, 511-519. https://doi.org/10.1093/isq/sqw023.

Toenniessen, G., Adesina, A., & DeVries, J. (2008). Building an alliance for a green revolution in Africa. *Annals of the New York Academy of Sciences, 1136*, 233-242. https://doi.org/10.1196/annals.1425.028.

UN News (2017, June 21). *World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100.* https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html.

Unruh, A. M. (2004). Reflections on: "So…what do you do?" Occupation and the construction of identity. *Canadian Journal of Occupational Therapy, 71*, 290-295. https://doi.org/10.1177%2F000841740407100508.

Ward, M. D., Greenhill, B. D., & Bakke, K. M. (2010). The perils of policy by p-value: Predicting civil conflicts. *Journal of Peace Research, 47*, 363-375. https://doi.org/10.1177%2F0022343309356491.

Weinberg, J., & Bakker, R. (2015). Let them eat cake: Food prices, domestic policy and social unrest. *Conflict Management and Peace Science, 32*(3), 309-326. https://doi.org/10.1177%2F0738894214532411.

World Bank. (2008). *World development report 2008: Agriculture for development.* The World Bank. https://doi.org/10.1596/978-0-8213-6807-7.

World Bank. (2009). *Awakening Africa's sleeping giant: Prospects for commercial agriculture in the Guinea Savannah Zone and beyond.* The World Bank. https://openknowledge.worldbank.org/handle/10986/2640.

World Bank. (2020a). *World Development Indicators. Fertilizer consumption (kilograms per hectare of arable land* [Data file]. The World Bank https://data.worldbank.org/indicator/AG.CON.FERT.ZS.

World Bank. (2020b). *World Development Indicators. Crop production index (2004-2006=100)* [Data file]. The World Bank. https://data.worldbank.org/indicator/AG.PRD.CROP.XD.

World Bank. (2020c). *World Development Indicators. Agricultural land (% of land area)* [Data file]. The World Bank. https://databank.worldbank.org/reports.aspx?source=2&series=AG.LND.AGRI.ZS&country=.

World Bank. (2020d). *World Development Indicators. Population, total* [Data file]. The World Bank. https://data.worldbank.org/indicator/SP.POP.TOTL.

World Bank. (2020e). *World Development Indicators. GDP per capita (current US$)* [Data file]. The World Bank. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD.

Appendix A

Replication Data

Data for the replication of all models can be found in the Online Appendices. These contain the SPSS Syntax and Output of models I to IX, further checks of assumptions and the mediation effect.

Online Appendix A contains the Syntax and Output of the OLS, negative binomial, and logistic regression (models I, II and III). It also contains tests for multicollinearity, independence of errors, normality, homoscedasticity, outliers, and leverage values, as well as a one-sample Kolmogorov-Smirnov test to test for a Poisson distribution of the data.

Online Appendix B contains the Output of the mediation analysis using Hayes' (2018) PROCESS version 3.5.

Online Appendix C contains the Syntax and Output of the robustness checks (models IV to IX). It also entails checks for model assumptions, that is multicollinearity, independence of errors, normality, homoscedasticity, outliers, and leverage values. Section C5.1 contains the Output for the fixed OLS regression (model VII) with adjusted standard errors, which was generated using Hayes and Cai's (2007) HCREG macro in SPSS.

The online appendices can be accessed through the following link:
https://www.dropbox.com/sh/1ka5ur1qa1ae5px/AAC-i_L_zT6kJm9qeX8CCMl7a?dl=0.

Appendix B

List of Countries Included in the Analysis

Table B1

Countries Included in the Analysis and Their Conflict Count

Country	*Conflicts, 2004-2016*	*Country*	*Conflicts, 2004-2016*
Algeria	128	Malawi	59
Angola	33	Mali	87
Benin	23	Mauritius	4
Burkina Faso	51	Morocco	176
Burundi	102	Mozambique	41
Cameroon	56	Namibia	6
Congo, DR	169	Niger	81
Congo	13	Nigeria	506
Cote d'Ivoire	109	Rwanda	6
Egypt	1276	Senegal	102
Eritrea	2	Seychelles	0
Ethiopia	84	South Africa	391
Gabon	61	Tanzania	49
Gambia	13	Togo	61
Ghana	19	Tunisia	255
Guinea	143	Uganda	69
Kenya	270	Zambia	75
Libya	150	Zimbabwe	175
Madagascar	54		

Appendix C

Descriptive Statistics

Table C1

Descriptive Statistics of the Variables Included in the Analysis

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Agricultural Intensification	443	43,93	115,24	0,00	816,93
Agricultural Productivity	481	4,45	5,79	0,79	33,22
Regime Type	468	1,77	4,97	-7	10
GDP/ capita (log)	476	3,10	0,48	2,11	4,18
Population (log)	476	7,12	0,61	4,92	8,27
Ethnic Fractionalization	377	0,60	0,25	0,04	0,90
Conflict Count	481	10,39	29,67	0	471
Conflict Incidence	481	0,80	0,39	0	1

Appendix D

Mediation Analysis

Table D1

OLS Regression with Agricultural Productivity as Outcome Variable

	(I)
	OLS[a]
Variables	
(Constant)	-16.958*** (3.095)
Agricultural Intensification (lag)[b]	0.032*** (0.002)
Regime Type	-0.213*** (0.035)
GDP/capita (log)	1.414*** (0.407)
Population (log)	2.425*** (0.349)
Ethnic Fractionalization	-1.938** (0.739)
Number of Observations	342
R^2	0.700

Note: Standard Errors in Parentheses. ***p < 0.001, **p< 0.01, *p< 0.05

[a] Agricultural productivity as outcome variable. [b] Lagged by one year.

Table D2

Full Models Including Indirect Effects

	(II)	(III)
	OLS	**Logit**
Variables		
(Constant)	-103.425***	-15.459***
	(30.018)	(3.484)
Agricultural Intensification (lag)[a]	0.067**	-0.001
	(0.023)	(0.003)
Agricultural Productivity	1.339**	0.249*
	(0.507)	(0.098)
Indirect Effect of Agricultural Intensification (lag)[ab]	0.043[c]	0.008[d]
	(0.019)	(0.004)
Regime Type	-0.027	0.031
	(0.342)	(0.033)
GDP/capita (log)	4.192	-0.140
	(3.847)	(0.484)
Population (log)	13.266***	2.290***
	(3.474)	(0.399)
Ethnic Fractionalization	-4.137	0.733
	(6.941)	(0.686)
Number of Observations	342	342
R^2	0.287	
-2LL		257.124
Cox & Snell R^2		0.224
Nagelkerke R^2		0.353

Note: Standard Errors in Parentheses. ***p < 0.001, **p< 0.01, *p< 0.05

[a] Lagged by one year. [b] Mediated by agricultural productivity. [c] 95% BCI [0.008, 0.081].

[d] 95% BCI [0.003, 0.02].