Food, State Power, and Rebellion: The Case of Maize*

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Abstract

Why do rebellions occur and persist in some countries but not in others? Evidence shows that natural resources affect the fighting capacity of rebel groups, yet by focusing on lucrative resources that are rare in most rebellion-afflicted countries, such as oil and diamonds, scholars neglected one necessary input for rebellion: staple crops. Focusing on maize, the world's most prevalent staple, this study argues that, as one of the most important resources for rebel groups, maize can have a destabilizing effect on the state's ability to thwart rebellion. These claims are corroborated statistically on a new time-varying, high-resolution global dataset of staple crop productivity, and then qualitatively through analysis of archival records on the Mau Mau rebellion. In identifying an overlooked, global linkage between agricultural abundance, state capacity, and intrastate violence, this study explains strong geographical and temporal variations in rebellions at both the subnational and global levels.

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Despite Napoleon's famous maxim that, "the army marches on its stomach," conflict scholars rarely if ever consider the imperative to secure agricultural resources for military operations in their theories. When staple crops are discussed in the context of rebellion, the emphasis is often on how decreases in agricultural output are associated with more labor flexibility, which results in cheaper labor and more recruits being available to rebels (Burke et al. 2009; Miguel et al. 2004). This scarcity-centric view, however, ignores the key fact that more potential recruits mean little if the group cannot feed them. Therefore, unsurprisingly, recent research now points to the importance of agricultural productivity to the fighting efforts of rebel groups, and thus associates conflict with abundance (Butler and Gates 2012; Koren 2018; Salehyan and Hendrix 2014). Such studies yielded important insights into how agricultural productivity affects the behaviors of armed groups, but we are still missing an analysis that looks at how rebellion activity within states is conditioned by the variability in (i) staple crops across the *entire terrestrial globe* (rather than in Africa, the focus of many studies), and (ii) its effects in areas where the state is powerful.

What impact do staple crops have on local and global rebellion patterns? Does higher access to staples destabilizes or helps to prevent the spread of rebellions into areas where the state maintains strong presence? Focusing on maize, one of the world's most important staples (FAO, 2013), this study establishes that, indeed, more access to staple crops effectively reduces the ability of the state to deter rebellions. Groups that can access more nutritious food can not only support more troops but also keep morale high, which motivates members to fight toward a common goal (Weinstein 2007: 174-175; 178-179). Sometimes food is the object of violence: groups will actively fight to gain access to locally-sourced, nutritious food. More often, however, rebels move into high-access areas and establish control over them, which allows the group to increase its size and expand its rebellion activity. The advantages gained by securing high access to staple crops are so great that rebel groups will risk attacking even areas where state forces are relatively strong to secure it, which help to explain why rebellions often arise in centers of state power (Koren and Sarbahi 2018).

Therefore, access to locally sourced nutritious, durable staples, in this case maize, explains more variation in the conduct of rebellion than is currently appreciated.

To test this interactive hypothesis, I rely on a mixed-methodology that involves high-resolution data analysis and original archival research. Drawing on a 0.5 decimal degree ($\circ$) grid of 64,818 cells for the terrestrial globe (excluding Antarctica and the Arctic) (Tollefsen et al. 2012), newly created high-resolution data on annual local maize productivity (Ray et al. 2012) are used to estimate how the effect of state capacity on rebellion varies based on access to staples at the 0.5$\circ$ grid level, accounting for salient confounders. Building on past research that draws linkages between state capacity and nighttime light emissions (Henderson et al. 2012; Weidmann and Schutte 2017), and empirically validates these linkages and their impact on conflict (Koren and Sarbahi 2018), local annual nighttime light level are used to approximate variations in state capacity at the highly localized level. Because the effect of this interaction might not be linear—for instance because variations in access to food can increase rebellion incidence both where rule-of-law institutions are weak (Butler and Gates 2012; Salehyan and Hendrix 2014) and where the state is strong—I also rely on general additive models (GAMs) to evaluate how my hypothesis' validity varies along the different dimensions of maize productivity and nighttime light (Beck and Jackman 1998; Keele 2008).

To complement these cross-sectional analysis findings and validate pertinent mechanisms at the local level, I also analyze archival evidence on the Mau Mau rebellion against British rule in 1950s Kenya, collected at the National Archives in London. Combined with historical literature, these newly available archival resources allow me to construct a comprehensive case study and explore the role nutritious staples, and specifically maize, have historically played in rebellion. These documents show that British officials deliberated specifically about the importance of nutritious staple crops to the Mau Mau fighting efforts not only as sustenance, (they knew hunting and foraging could provide similar daily nutrition), but also for enabling the Mau Mau to support its members more efficiently, contributing to the group's cohesion and improving troops' morale. These documents also show that, as a result, the gains for the Mau Mau from obtaining access to these staples often outweighed the risk of facing colonial forces where the latter had the military advantage.

This article's findings contribute significantly to our understanding of how intrastate armed conflict spreads, why it concentrates in certain regions, and when high levels of state capacity are not enough to deter rebels. Across the entire terrestrial globe, higher access to staples often has a greater destabilizing effect where the state is *strong*, a finding that diverges from the conventional wisdom that associates rebellion activity with low state capacity (Fearon and Laitin 2003). These findings are in line with research linking agricultural abundance to rebellion in some world regions (Butler and Gates 2012; Hendrix and Salehyan 2012; Salehyan and Hendrix 2014), as well as with studies that emphasize that, at the local level, rebellions often arise in centers of state power (Koren and Sarbahi 2018).

Empirically, the maize area indicator used for analysis improves on past studies that focused on the country as their unit of analysis (Fearon and Laitin 2003; Miguel et al. 2004), or employed proxies such as precipitation (Salehyan and Hendrix 2014) and temperature (Burke et al. 2009). Moreover, whereas many previous studies on the effect of agricultural productivity restricted their analysis to Africa in particular (Burke et al. 2009; Hendrix and Salehyan 2012; Koren 2018), the high resolution maize indicator used here is available globally. This helps to overcome the "streetlight effect," namely that "[s]tudies focusing on one or a few cases tend to study places where the dependent variable (violent conflict) is present and hardly relate to the independent variable" (Adams et al. 2018: 202). Finally, by highlighting the role of food as a potentially de-stabilizer of state power and facilitator of rebellion, the linkages identified here will assist policymakers in better directing intervention efforts.

Maize, State Power, and Rebellion

Staple crops can impact rebellions through multiple pathways. One such pathway relates to grievances over land possession. To this end, country-specific research associates rebellions with unfair distribution and appropriation of land by the state or groups/corporations supported by it, for instance in Ethiopia, Uganda, and Somalia (Mkutu 2001) as well as Ghana (Tonah 2006). Grievances over land appropriation were also an important cause of the Mau Mau rebellion in 1950s Kenya, as discussed in greater detail in the Supplemental Appendix (also see Branch 2007). While such motivations are undoubtedly an important explanation for why rebellions might arise, research also identifies a complementary perspective, which emphasizes the instrumental importance of securing natural resources to the fighting capacity of different groups (Butler and Gates 2012; Koren 2018; Salehyan and Hendrix 2014; Weinstein 2007), and which is also the focus of this article. Hence, the phenomenon of interest here is rebellion incidence (or "activity"), namely the onset of rebellions within or their spread into a particular region—rather than their duration or inception at the country level—as influenced by the rebels' imperative to secure food access for their fighting efforts and the ability of the state to regulate it.

This instrumentalist approach suggests two potentially conflicting perspectives on the influence agricultural productivity exerts over rebellion. On the one hand, decreases in agricultural output caused by prolonged heat waves or drought can lead to more labor flexibility, which results in cheaper labor and more recruits being available to rebels. Miguel et al. (2004), for instance, link low precipitation levels with shrinkage of primarily agricultural economies, and thus with a higher probability of civil war. Similarly, Burke et al. (2009) find that sub-Saharan African countries where temperature levels were, on average, higher, were more likely to experience rebellions.

This perspective, however, overlooks several key facts related to the nature of rebellion. A larger pool of potential recruits means little if the rebel group cannot provide food support for recruits in training. As Salehyan and Hendrix (2014: 248) succinctly explain, "[p]eriods of acute scarcity may incline individuals to focus on immediate survival rather than engage in costly, destructive fighting, while periods of relative abundance free up resources and labor, and create more advantageous tactical environments, for conflict." An alternative perspective is thus to look at staples as a crucial resource needed to satisfy the group's demand for effective and dependable troops. Therefore, a second logic emphasizes the imperative of rebel groups to secure nutritious food, a critical but under-analyzed input for rebellion.

Research has established the importance of access to natural resources in determining rebel groups' strength and strategic behavior during rebellions (Hazen 2013; Wood 2010). Previous studies linked natural resources to the conduct of rebellion through pathways such as contest over resource appropriation (Blattman and Miguel 2010: 9-11) and limitations on access (Hazen 2013), and argued that rebel capacity interacts with geographic factors to maximize these groups' ability to fight long conflicts (Buhaug et al. 2009). From this perspective, local access to staples serves as an approximation of rebel group capacity. Compared with other lucrative resources such as oil or diamonds that are absent in most rebellion-afflicted countries,[1] due to their prevalence staple crops shape conflict patterns in the vast majority of developing regions. For example, in his analysis of violent conflict in Africa, Koren (2018: 2) finds that "areas with more food resources are more valued by different actors, and as a result attract more conflict."

Regular access to nutritious food has not only physical, but also psychological effects. For instance, in his study of American troops during the Second World War, Boring (1945: 327) finds that physically, for experienced troops, "pride in the ability to keep going on little, plus realization of the military necessity of so doing, offsets in considerable degree the tendency to a lowering morale" (1945, 328). At the same time, however, "[i]f the needs of troops for water and food are not satisfied, if they are thirsty and hungry, then morale goes down. Men tend to become irritable and jittery; they are likely to be aggressive and quarrelsome, projecting their troubles on others, finding fault where no fault lies" (1945, 327). Nutritious food binds the group members together, and helps form the social contract underlying the group's very existence.

[1]Within the 1994-2008 sample analyzed in the empirical section, of the 60 countries that experienced rebellion, 23 and 34 did not have any level of, or no information was available on, oil production and gem production, respectively.

Case-based evidence supports this notion. For instance, Weinstein finds that a crucial aspect of the National Resistance Army's (NRA) success in Uganda was its ability to effectively organize food contribution from the local population (2007, 175-180). This allowed the NRA to provide credible commitment to both rebels and civilians, a system that "reduced the potential for corruption and ensured that the demand for food was not unmanageable" (2007, 179). Similarly, the Holy Spirit Movement, a precursor of the Lord's Resistance Army (LRA), emphasized the role of food as an instrument of group-building, instructing its troops that "you shall not eat food with anybody who has not been sworn in by the Holy Spirit" (Doom and Vlassenroot 1999: 18). And in Mozambique, "[i]n control areas, [the rebel group] RENAMO established bases, and the civilian population was exploited and involved more directly in the rebel activities, for example as food producers" (Hultman 2009: 833).

Therefore, higher access to more locally-sourced, nutritious staple crops enables rebel groups to support more troops and to fight longer and harder. Access to more nutritious staples also increases the group's credibility to its members, and helps to guarantee that these troops will fight together toward a common goal. While numerous crops can impact the probability of rebellion, this study focuses on maize for three reasons. First, maize is the main staple crop in Africa, Latin America, and East Asia, regions that historically were highly susceptible to rebellions (Oerke and Dehne 2004).[2] Hence, at the local (village/town) level, maize is the most accessible staple crop to many rebel groups fighting in rural areas. As such, regular access to more maize fields should allow rebel leaders to support their members more effectively and credibly show the group can fight long conflicts, thus increasing group cohesion. Indeed, maize fields were present in 58 of the 60 countries that experienced rebellion within my sample.

Second, unlike many other crops, maize can be easily retrieved, stolen, transported, and kept for relatively long periods of time without the risk of decomposition. Maize does not require special preparation or processing, and in fact can easily be consumed raw. It is also

[2]Caloric intake from maize as percent of total caloric intake for countries surveyed by the FAO are reported in Table A1, Supplemental Appendix.

rich in both starches—i.e., energy—*and* nutritious proteins, fuel to support hungry rebels and their war efforts (FAO, 2013). As a result, maize can be not only consumed by hungry troops, but also sold in local, and even international, markets with relative ease, which can increase the group's revenue flows, as is the case with other staples such as barley (Jaafar and Woertz 2016). Finally, unlike other staples that are crucial in a developing-country setting, such as rice, information on maize was available at the *annual* 0.5 decimal grid cell level resolution across the entire terrestrial globe.[3]

Importantly, the ability of rebellions to spread is conditioned not only by access to food, but also by the state's ability to fight and defeat the rebels in these locations (Butler and Gates 2012; Koren and Sarbahi 2018). In a highly-cited paper, for instance, Fearon and Laitin (2003: 88), associate rebellions with low institutional and military capacities on the part of the state, and conclude that, "while economic growth may correlate with fewer civil wars, the causal mechanism is more likely a well-financed and administratively competent government." Yet, if access to more maize fields improves the capacity of a rebel group, then rebellion activity should increase in areas where the state is relatively strong, specifically, for at least two reasons.

First, access to more maize enables a rebel group to recruit more troops, support those it has already recruited, train recruits more efficiently, and operate in larger contingents. Therefore, rebel groups operating in regions with more staples, in this case maize, can use these crops to improve operational capacity (Salehyan and Hendrix 2014; Koren 2018). This in turn allows them to overcome asymmetries in military capabilities and to defeat (typically) stronger state forces, even in locations where the state maintains relatively high presence.

Second, even if rebels do not yet control these high-access food points, the potential benefits of securing access to more maize can create incentives to take greater risks and attack locations where the state is especially strong. Indeed, considering the importance to

[3]To illustrate that this variable is a good and close proxy of other staples, Figure A1, Supplemental Appendix plots the high correlation between the averaged values of my time-varying maize indicator and a non-time-varying measure of all cropland.

its military fighting efforts, the state will invest more resources in defending these high access points, developing infrastructure, and building bases in these locations. At the same time, if taking these risks pays off, the resulting benefits can have important implications for the rebel group's ability to win the rebellion by improving its strength, and potentially even via collecting revenues by harvesting and selling the staples it now controls. The Islamic State (IS), for instance, sought to expend its capacity using agricultural production within the "breadbasket" territories it specifically targeted. As a result, IS "has considered food related infrastructure such as silos as strategic assets. Like oil refineries it has sought to take them over intact" (Jaafar and Woertz 2016: 14).

This suggests the effect of staples is often conditional: areas with more state presence should be associated with lower levels of rebellion activity unless these locations are also high maize access points. In other words, access to maize should nullify the deterring effect of relatively high state capacity levels, which means that more state presence will have a pacifying effect on rebellion where maize levels are low, but no effect where maize levels are high. Conflict over staple access in high state-capacity regions can be the result of pre-existing grievances: individuals will be more motivated to fight over high abundance areas if they feel they have a right to these regions. However, in line with the the theoretical argument advanced here, recent research also highlights the instrumentalist impact of state capacity on rebellion, especially at the local level (Butler and Gates 2012; Fearon and Laitin 2003; Koren and Sarbahi 2018).

It is important to emphasize, however, that in large part, the body of research on food resources' impact on conflict trends focuses on Africa (Burke et al. 2009; Hendrix and Salehyan 2012; Koren 2018). Empirically, this makes sense; African states have experienced the majority of rebellions in recent years (Burke et al. 2009), and states located in the tropics are expected to bear the lion share of climate change's effects (FAO, 2008). Yet, this focus can also introduce sampling bias, if the countries and regions under study do not represent the intended population. Indeed, there is evidence to suggest that some of trends observed within and across African states might not fully resemble conflict trends in other world regions (Adams et al. 2018), for instance because many Africa economies rely heavily on agriculture, or because grievances over land appropriation are more likely. Some recent research also emphasizes that the interactive effect of food and state capacity on conflict might be context dependent: local-level shocks can push different types of conflict in different directions for different actors (Koren 2018; McGuirk and Burke 2017).

Taking these issues as well as the highly-localized nature of the sample (discussed in detail below) in to consideration suggests the possibility that the functional form of the regression relationship might vary *locally* along the maize access and state capacity dimensions (Beck and Jackman 1998; Keele 2008). In other words, the relationship between staple crop abundance, state power, and rebellion might not be completely linear. In some local contexts staple crop abundance should not only obviate the effect of state capacity, but even reverse it; in other contexts these effect will resemble more closely the expectations set forth by other studies on the relationship between food and conflict in low-development regions (Koren 2018; Salehyan and Hendrix 2014). The theory about the potentially destabilizing effect of staple crop abundance thus suggests the following hypothesis:

- H: On average, more state presence will have a pacifying effect on rebellion where local maize access levels are low, which will decrease as local maize access levels rise

Cross-National Analysis

Data, Variables, and Methodology

Because my hypothesis is focused on the variation in violence *within* states, data measured at the annual country level would be inadequate for the purpose of empirical verification. I accordingly construct a high-resolution, subnational sample encompassing 16 years (1993-2008) for the entire terrestrial globe.[4] These data and the variables discussed below are first structured into a grid-year level dataset wherein the cell, my cross-sectional unit of interest,

[4] Note that information on some variables was available only starting 1994.

is measured at the 0.5 x 0.5 ∘ resolution, or approximately 55 x 55 kilometers at the equator (3025 square kilometers area) (Tollefsen et al. 2012).

Relying on this fine-grain empirical framework has two advantages. First, it allows me to carefully and accurately operationalize the level and variation in access to maize and state presence within and across different countries, which is necessary for my hypothesis to be evaluated. Thus, this framework is sensitive enough to capture variations in the prevalence of rebellion as it is reflected in the distribution of access to staple crop and state capacity within a given country (Raleigh 2012). Second, my grid cell framework allows me to identify how access to cropland in different parts of the country affects rebellion dynamics not only in cells where staple crops are grown, but also across cropland and non-cropland grid cells, which helps to overcome the aforementioned "streetlight effect" (Adams et al. 2018). This fine-grained grid is thus disaggregated enough to allow me to evaluate local variations in violence, but not overly disaggregated such that my localized indicators lose their precision levels due to different approaches of measuring a campaign's geographic location (Weidmann 2013).

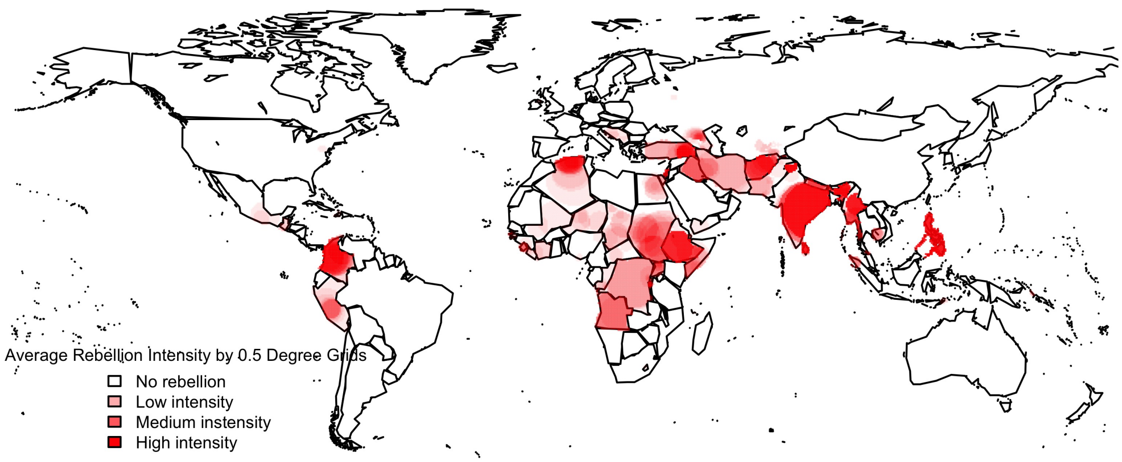
The dependent variable, $Rebellion_t$, is operationalized as the yearly (t) incidence of rebellion within a sample cell. This measure was included in the v.1.01 version of the PRIO-Grid dataset and derived from the UCDP/PRIO Armed Conflict Dataset (Themnér and Wallensteen 2012). This variable records the *by-grid-cell distribution* of all internationalized intrastate or intrastate conflicts between two parties—one of which is an official state government—that resulted in at least 25 combatant deaths. The resulting $Rebellion_t$ variable is thus a binary indicator, measuring whether a rebellion—i.e. campaigns waged by rebel groups against the official government of the state with or without the involved of external states—was recorded as ongoing/arising (coded one) or not (coded zero) within a grid cell during a given year. The variable $Rebellion_t$ has a mean of 0.064, a mode of zero and a standard deviation of 0.245. For summary purposes, averaged values for this variable are plotted for the entire 1993-2008 period in Figure 1 below.

Recall that my hypotheses expects that higher local access to maize will mitigate the deterring effect of state power on rebellion. Data for constructing my main explanatory indicator were obtained from Ray et al. (2012), who constructed what is arguably the best high-resolution indicator of maize area currently available using methods discussed in detail in the Supplemental Appendix due to space constraints. These maize area data measure the total harvested area within a 0.08 degree cell and are expressed in hectares.[5] To ensure comparability against other variables used in this study, these data on maize coded by Ray et al. (2012) were summed to the annual 0.5 $\circ$ grid cell level. The resulting $Maize\ area_t$ variable therefore measures the total maize hectares harvested within a given 0.5 $\circ$ grid cell during a given year, with a mean of 0.536, and range of 0 $\Leftrightarrow$ 24.63, and a standard deviation of 1.547 harvested hectares. For summary purposes, averaged values for this variable are plotted for the entire 1993-2008 period in Figure 2 below.

By approximating levels of maize coverage at the highly localized level, this indicator is in line with previous research (Koren and Bagozzi 2016), which similarly used the extent of 0.5 x 0.5 grid cell's that is covered in cropland to approximate food access. However, this indicator provides three major improvements over past research. First, it is *time varying*, whereas the majority of previous studies relied on static indicators at a comparable levels of geographic resolution. Second, it captures true variations in *nutritious staple crops*, whereas the measures used by past research are less successful at distinguishing grassland and other "green" areas more broadly from staple cropland, specifically. Finally, this indicator is available at the high resolution 0.5 x 0.5 grid level across the entire terrestrial globe, allowing me to evaluate my argument across all world regions.

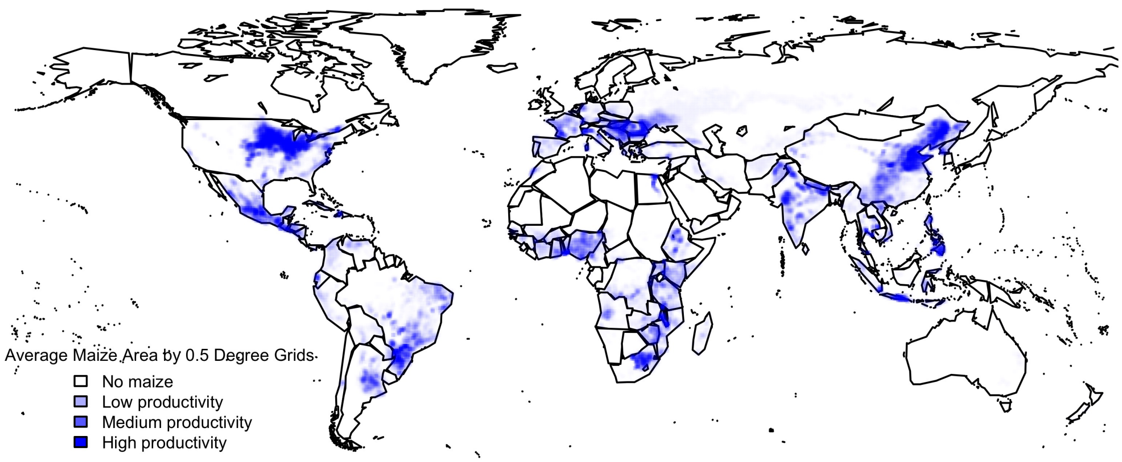
[5] Areas harvested multiple times in a given year are hence measured more than once in the data

Figure 1: Average Levels of Rebellion Activity by Grid Cell, 1993–2008



Recall that my hypothesis assumes that maize access will moderate the effect of state capacity with respect to rebellion. Testing this hypothesis thus necessitates employing a measure of state capacity that varies *within and across* states. Recent research has highlighted numerous potential measures of state capacity, such as GDP (Fearon and Laitin 2003), taxation data (Harbers 2015), and—more recently—electrification as reflected by cloud-free, nighttime light emissions (Henderson et al. 2012; Koren and Sarbahi 2018; Weidmann and Schutte 2017). Indeed, nighttime luminosity is an effective proxy of the extent of the state's territorial control, and allows to identify peripheral regions where the state exercises limited administrative control (Koren and Sarbahi 2018). This is true not only for developed

Figure 2: Total Maize Coverage by Grid Cell, 1993–2008



countries—which are, on average, the largest producers of nighttime light emissions (Weidmann and Schutte 2017)—but also for developing states where electricity is scarce and its provision is dominated by the state (Harbers 2015; Koren and Sarbahi 2018).

Importantly, unlike other measures of state capacity such as taxation, annual nighttime light levels can be easily measured at the highly localized level across the entire terrestrial globe, which means that—while it might not be a perfect measure of state power—nighttime light is a good reflection of the state's presence in a given area, and at least a prerequisite for building further capacity in that region. Research shows nighttime light emissions capture not only cities—the presence of which can be controlled for—but also centers of state power that have relatively low population levels, for instance district capitals (Koren and Sarbahi 2018), infrastructure expansions (Harbers 2015), and the presence of military bases (Lee 2014).[6]

As a result of these different advantages, recent research has tested and validated nighttime light emissions as a proxy for state capacity and control (Henderson et al. 2012; Weidmann and Schutte 2017), especially with respect to rebellions and civil conflict (Koren and Sarbahi 2018).

Building on this research, and considering the size and high resolution of my sample, I conceptualize my state capacity/power indicator as the average annual levels of total nighttime light emissions within a given 0.5 $\circ$ cell, calibrated to range between one and zero, obtained from PRIO-Grid (Tollefsen et al. 2012), in a manner used by past research (Koren and Sarbahi 2018). This variable, $\textit{Nighttime light}_t$, has a mean of 0.054 and standard deviation of 0.067. To test my interactive hypothesis, I also include in my models the interaction term of these two explanatory variables, $\textit{Maize area}_t \times \textit{Nighttime light}_t$, alongside its constitutive terms.

To ensure that the results are not driven by alternative explanations, several controls are added to my model. First, a one-year lag of my dependent variable, $\textit{Rebellion}_{t-1}$, was included to ensure that any findings pertaining to $\textit{Maize area}_t$ are robust to proximate levels of conflict at year $t-1$. I also include a spatial lag indicator, $\textit{Rebellion (spl.)}_t$, measuring whether rebellion activity was reported in a first-order neighboring cell on year t, to account for spatial conflict dependence. My models also account for population density in a given cell during a given year by including the variable $\textit{Population}_{t-1}$. To account for climatic factors that might influence food productivity, I add indicators for average annual temperature and drought levels.[7]

[6] To illustrate that nighttime does capture state capacity related factors other than urbanization within my sample, note that the correlation between urbanization levels and maize area within my sample is 0.099, whereas the correlation between nighttime light levels and maize area is 0.192.

[7] This indicator was conceptualized based on the Standardized Precipitation Index (SPI), and classifies drought severity as the number of standard deviations below average precipitation levels (0, 1, 1.5, and 2.5) in a particular grid cell during a given year.

To ensure that my *Nighttime light*$_t$ variable captures state capacity, specifically, rather than the effects of urbanization or illicit natural resources more broadly, I include controls for travel time (in minutes) to the nearest city with 50,000 or more residents (in hours), *Travel time* and whether drugs were reported as being grown in the 0.5 $\circ$ cell during year t, *Drugs*$_t$. These indicators, as well as the climatic controls, where included in the PRIO-Grid. I also account for a country's political regime via the ordinal *Polity*$_{t-1}$ indicator (Marshall et al. 2013), as political regime-type is related to both rebellion (Colaresi and Thompson 2003) and agricultural development (Bates and Block 2013). Finally, considering that new states are especially likely to experience rebellions (Fearon and Laitin 2003), I include an indicator for whether a given state was newly formed at year t. To account for time-related dependencies, fixed effects were also included for each year covered in the data (1993-2008). Summary statistics for all variables used in analysis, including robustness models, are listed in Table A2, Supplemental Appendix.[8]

Because my dependent variable is binary, I rely on logistic regression to test both hypotheses. Note, however, that this choice makes a strong assumption about the functional for of the data, especially when some of the independent variables, with vary wide ranges of values, are logged to account for potential biases within maximum likelihood estimators. Considering the highly-localized nature of my sample, however, it is quite probable that the effects of my variables of interest might vary locally, and hence that enforcing a functional form that "gets the mean right" on such a large sample might neglect potential nonlinearities occurring at the local level (Beck and Jackman 1998). Accordingly, in addition to relying on the parametric model, I also estimate a corresponding semiparametric general additive model (GAM), which relaxes the functional form with respect to my main variables of interest as well as variables with a potential power-law distribution such as *Travel time* and *Population*$_t$. For these smoothed terms, thin-plate regression smoothers are applied, as they are considered the default optimal smoother of any given basis dimension/rank (Wood 2003),

[8] All time varying variables are denoted t for convenience.

with $k - 1$ degrees of freedom.[9] Importantly, using GAMs allows to better estimate the effects of interaction terms, as these are taken more effectively into account via smoothing (Keele 2008: 109-119).

Results

Table 1 first reports a baseline logit model of rebellion, which includes only my interaction term $Maize\ area_t \times Nighttime\ light_t$ alongside its constitutive terms, the one-year lag of the dependent variable, $Rebellion_{t-1}$, and year fixed effects. This model is followed by a full logit specification that includes all controls. Across both models, the coefficient estimate of $Nighttime\ light_t$ is negative and significant (as it the case in Table 1), implying that state presence has a $Rebellion_t$ depressive effect where no maize is present, ostensibly because these conditions are unfavorable to rebel recruitment and fighting due to the state's superior power, leading to a lower probability of rebellion activity in these regions. On the other hand, the coefficient for $Maize\ area_t \times Nighttime\ light_t$ is positive and significant, suggesting that increases in state capacity (measured by nighttime light emissions) are associated with an added $Rebellion_t$ intensifying effect where more maize is grown.

To evaluate whether the interaction supports my hypothesis, I combine the individual component terms of $Maize\ area_t$ and $Nighttime\ light_t$, along with $Maize\ area_t \times Nighttime\ light_t$, to plot the marginal effect of a reasonable change in nighttime light on $Rebellion_t$ at each level of $Maize\ area_t$. Specifically, I use the full model's estimates to calculate the percentage change in the effect of $Nighttime\ light_t$ (i.e., its coefficient) given an increase in maize area from its minimum to its maximum value, while holding all other controls to their means (for continuous variables), median (for ordinal variables) or modes (for binary variables). I plot these estimated marginal effects, along with their 95% confidence intervals, in Figure 3. As Figure 3 illustrates, as more maize is grown in a given cell in year t, the conditional effect of $Nighttime\ light_t$ changes from being negative and statistically significant

[9] As shown in the Supplemental Appendix, the results are robust to using P-spline smoothers that impose a discrete penalty on the basis coefficients.

where less maize is grown to positive and (marginally) significant where maize levels are high, with an average change of approximately twice its coefficient size.

These conditional effects suggest that indeed, access to more maize nullifies, and even reverses, the deterring effect of state capacity on rebellion, as suggested by my research hypothesis. In line with past research (Jaafar and Woertz 2016; Salehyan and Hendrix 2014), and as was discussed in the previous section, these effects are likely either the result of rebels extracting more capacity from higher access to maize, or the fact that the state is more likely to establish bases in these regions, which generates increases in rebellion activity as rebels are willing to take greater risk in order in to establish control over these extremely valuable high access points. Yet, because these conditional effects where generated using a rigid functional form, they might neglect important nonlinearities in these effects, as the effect of maize access might differ across different levels of state capacity, and vice versa.

To evaluate whether this is the case, I next turn to the general additive models. To this end, the last two columns in Table 1 report two sets of GAMs with thin-plate regression smoothers corresponding to the GLMs. Smoothing is applied to my variables of interest and the interaction term $\textit{Maize area}_t \times \textit{Nighttime light}_t$, as well as the indicators that were logged in the GLMs. The effects of smoothing on the degrees of freedom within each model and whether this difference is statistically significant are additionally reported in Table 2. As shown in Table 2, smoothing indeed generates a statistically significant effect on each of these variable, suggesting that the effect of my variables of interest and their interaction does not necessarily follows a strict structural form. These results also suggest that the log transformation is problematic. However, as illustrated in Figures A2–A3, Supplemental Appendix, these effects, while statistically significant, might not be substantive, with the possible exception of the $\textit{Travel time}_t$ variable.

The same, however, is not true for the interaction effects. Indeed, one of the greatest strengths of GAMs is their ability to estimate how interactive effects operate by allowing to assess how the probability of rebellion varies along both the stale crop and state capacity dimensions. To this end, the perspective plot in Figure 4 first illustrates that in low state-capacity regions, the probability of rebellion reaches its pick along the $Maize\ area_t$ dimension where maize levels are moderate, then decreases within extremely high productivity areas. This finding is in line with studies of conflict in developing regions, and primarily Africa, which illustrate that high abundance areas within these developing states tend, on average, to attract more conflict (Butler and Gates 2012; Koren 2018; Salehyan and Hendrix 2014). However, in areas with high maize productivity, the probability of conflict increases with higher values of $nighttime\ light_t$, before decreasing in regions with very high nighttime light levels. The rest of this perspective plot shows that the probability of conflict remains relatively constant at zero within cell-years with high nighttime light emissions but low maize productivity, which is also in line with my research hypothesis.

Overall, Figure 4 allows for a much more nuanced evaluation of the effects plotted in Figure 3. It suggests that there are two "clusters" where the interaction between maize and state power increases the probability of rebellion, rather than one: (i) low state capacity, medium maize productivity cell-years, and (ii) medium-to-high state capacity, high productivity cell-years. This finding validates the notion that by focusing on specific world regions, conflict scholars might miss an important piece of the puzzle (Adams et al. 2018). It also informs our understanding of the relationship between food and conflict—which currently focuses on (i)—and highlights other potential areas of interest to both scholars and policymakers concerned with the causes and prevention of rebellions.

Table 1: Determinants of Rebellions, 1993-2008

	GLMs		GAMs	
	Baseline	**Full**	**Baseline**	**Full**
Maize area$_t$	-0.22^{***} (0.01)	-0.12^{***} (0.01)	See Table 2	
Nighttime light$_t$	-7.26^{***} (0.16)	-3.31^{***} (0.21)	See Table 2	
Maize area$_t$ × *Nighttime light*$_t$	0.62^{***} (0.06)	0.27^{***} (0.07)	See Figure 4	
Population$_t$[1]	0.40^{***} (0.01)	0.37^{***} (0.01)	See Table 2	
Travel time[1]	–	0.25^{***} (0.02)	See Table 2	
Rebellion$_{t-1}$	5.12^{***} (0.02)	1.28^{***} (0.03)	5.20^{***} (0.02)	1.29^{***} (0.03)
Rebellion (spl.)$_t$	–	4.64^{***} (0.03)	–	4.75^{***} (0.03)
Temperature$_t$	–	0.03^{***} (1e-03)	–	0.03^{***} (1e-03)
Drought$_t$	–	0.10^{***} (0.01)	–	0.11^{***} (0.01)
Drugs$_t$	–	0.37^{***} (0.03)	–	0.42^{***} (0.04)
Polity2$_t$	–	0.01^{***} (2e-03)	–	1e-04 (2e-03)
New state$_t$	–	-9.36 (49.70)	–	-7.07 (18.24)
Constant	-8.33^{***} (0.06)	-9.88^{***} (0.17)	-4.96^{***} (0.03)	-4.90^{***} (0.04)
Observations	588,575	463,952	588,575	463,952
Akaike Inf. Crit.	150,845.8	86,165.1	152,207.9	86,818.8

* indicates $p < .1$; ** indicates $p < .05$; *** indicates $p < .01$.
Variable coefficients are reported with standard errors in parentheses. Fixed effects by year are included, although not reported here.

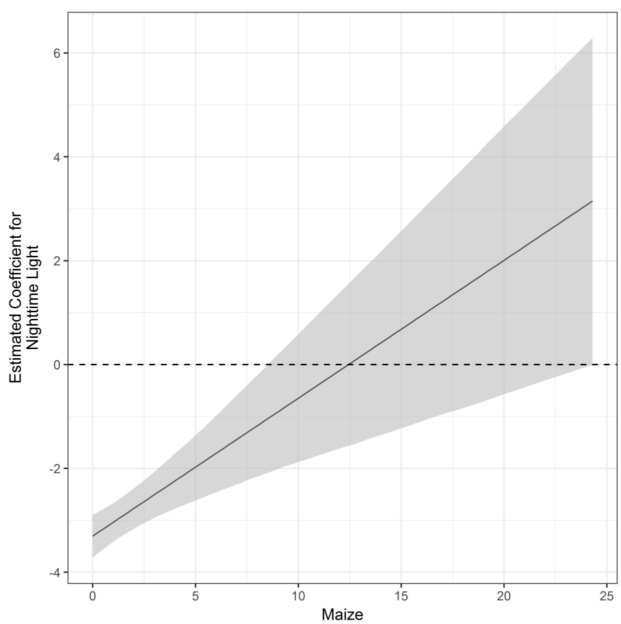
[1] Natural log in the GLM models

TABLE 2: Smoothed Parameter Estimates

	Baseline	**Full**
Maize area$_t$	4.91***	4.26***
	(428.46)	(66.70)
Nighttime light$_t$	6.05***	4.82***
	(2,222.1)	(350.02)
Maize area$_t$ × *Nighttime light*$_t$	7.93***	8.51***
	(61.89)	(28.87)
Population$_t$	5.10***	5.04***
	(5,211.6)	(1,222.6)
Travel time	–	3.38***
		(15.42)

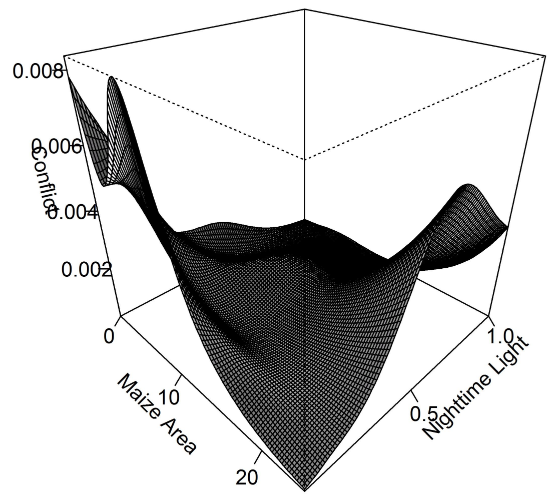
* indicates $p < .1$; ** indicates $p < .05$; *** indicates $p < .01$.
Estimated degrees of freedom are reported with χ^2 values in parentheses.

FIGURE 3: Change in *Nighttime light*$_t$'s Effect on *Rebellion*$_t$ across *Maize area*$_t$ values (GLM)



Finally, considering the importance of prediction for the study of conflict (Ward and Beger 2017), I also evaluate whether using GAMs improves our ability to *forecast* rebellion activity. While there are numerous ways of illustrating forecasting strength of a model—e.g., receiver-operator characteristic curves (ROCs)—for highly class-imbalanced data as the

FIGURE 4: Change in *Nighttime light$_t$*'s Effect on *Rebellion$_t$* across *Maize area$_t$* values (GAM)



ones used here (i.e., a very low ratio of rebellion to non-rebellion events, or 9%), ROC hide the asymmetric usefulness of predicting the rarer (presence of rebellion in this case) class. A preferred alternative is to use precision-recall curves (PRCs), which are better able to differentiate models that have divergent abilities to predict the rarer class, although their interpretation is not as straightforward as ROCs (Ward and Beger 2017).[10]

While there are numerous ways of validating the model in this fashion, for instance using k-fold cross validations, due to computational limitations I chose to rely on a simple out-of-sample data approach. Specifically, I re-estimate the full GLM and GAM on a subsample of my data for the years 1993-2005, and then use each model's estimates to forecast rebellion activity for the years 2006–2008.[11] Using 2006 to bifurcate the data into training and test sample provides for a long enough training period, but not too long as to induce overfitting.

[10]For comparison, ROC curves corresponding to both models are reported in Figures A6–A7, Supplemental Appendix.

[11]In these models fixed effects by year were not included due to the necessity to include all variables estimated in the in-sample data models within the out-of-sample data. Model estimates remained practically identical before and after these annual fixed effects were removed.

Figure 5 reports the PRCs of the full GLM and GAM models when used on out-of-sample data for 2006–2008. As these plots illustrate, the GAM provide a substantively modest (which is arguably unsurprising, considering the very large size of the sample) improvement in predictive power, with an area-under-curve (AUC) of 0.951, compared with an AUC of 0.949 for the GLM.[12] This indeed suggests that using a more flexible form of modeling—and the two "clusters" of rebellion it identifies—improves not only the model's explanatory strength, but also its forecasting power. Interestingly, however, although PRCs are presumably the best tool for testing forecasting power in highly class-imbalanced data, the GLM outperforms (or at least matches) the GAM on a wide variety of alternative indicators, including ROCs, precision, recall, F1 and F2 scores, and accuracy.[13] This suggests that, at least for forecasting purposes, the difference between GLMs and GAMs might not be very substantial, even though the GAM has a preferred PRC.

TABLE 3: Performance Indicators Comparison

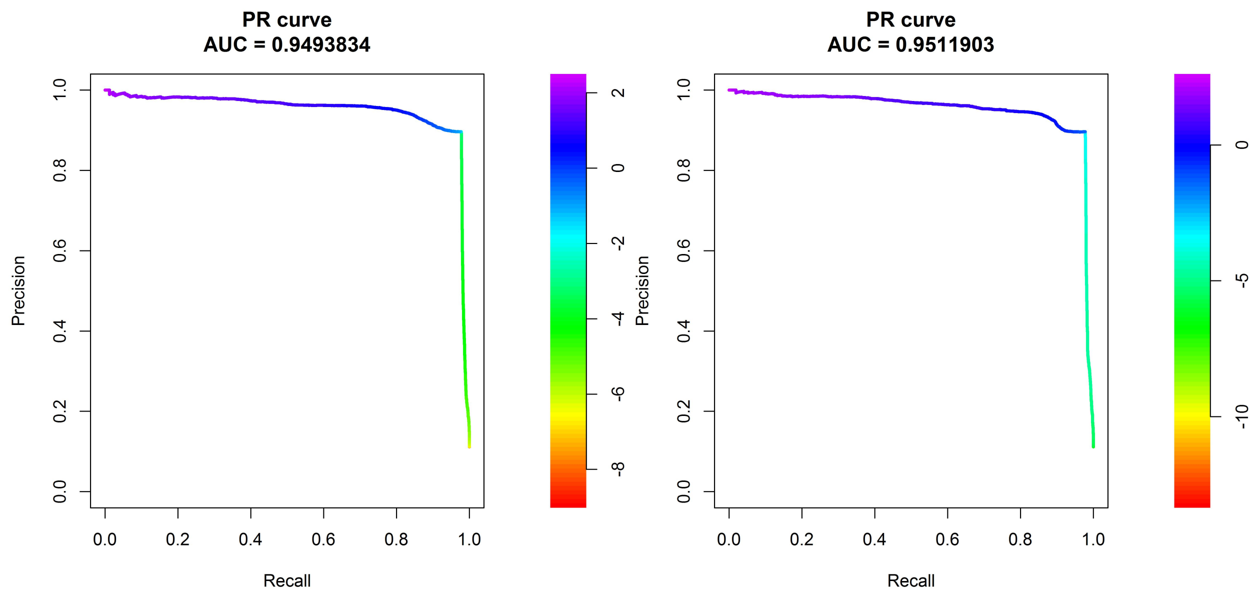
	GLM	**GAM**
PRC AUC	0.949	0.951
ROC AUC	0.990	0.990
Precision	0.954	0.954
Recall/sensitivity	0.771	0.705
F1	0.853	0.811
F2	0.533	0.507
Accuracy	0.970	0.963

To illustrate the substantive robustness of my results I examine numerous alternative specifications in Tables A3–A5, Supplemental Appendix. These models account for a large number of additional confounders, not included here, as well as my findings' robustness to

[12]This difference in AUCs is robust to choosing different years for bifurcating the training and test subsets of the data.

[13]As is the standard in forecasting research (e.g., Ward and Beger 2017), a threshold of 0.5 was used to identify a correct prediction for all indicators.

Figure 5: Comparison of Out-of-Sample PR Curves



GLM GAM

the inclusion of clustered standard errors, fixed and random effects at the country level, and rare-event bias, in addition to alternative smoothing parameter choices in the GAMs. Crucially, the positive and statistically significant effect of $\textit{Maize area}_t \times \textit{Nighttime light}_t$ holds in every case, suggesting that my hypothesis is reasonably robust to these important concerns.

The Mau Mau Rebellion: Archival Evidence

In this section I discuss archival documents on the Mau Mau rebellion in 1950s Kenya to evaluate the validity of my empirical findings and set them in a historical context. Due to space constraints, a background discussion on the origins of the Mau Mau rebellion is provided in the Supplemental Appendix. The Mau Mau case was chosen for four reasons. First, illustrating both the physical and morale-building aspects of food support on within-country rebellion patterns, and showing how the rebel group varies its behavior with respect to these resources requires a case where the role of staples is specifically and amply documented by contemporary sources, which is not easy to find. In Kenya, the British forces fighting the Mau Mau implemented a *food denial* campaign directly aimed at preventing the rebels from accruing nutritious, easily-obtainable food resources, while the rebels sought to move into high access points to improve their fighting capacity. The strategic decisions and deliberations of policymakers are extremely well documented, making it possible to distinguish between the physical and sociological/psychological aspects of regular access to staples on rebel activity.

Second, the documents cited here discuss in detail the role of maize, specifically, in the conflict, and how colonial officials perceived its potential impact on the Mau Mau fighting efforts. The Mau Mau case thus helps validate this article's empirical and theoretical focus on this particular staple.

Third, while the Mau Mau rebellion might differ from other rebellions in low-development contexts where rebel groups must "live off the land" due to its anti-colonial nature, this fact can also help to better account for the role of state power as influenced by food access compared with other types of civil wars. The asymmetries of power between the Mau Mau rebels—who often hailed from extremely poor communities (Kanogo 1987) and often fought with clubs or bows and arrows—on the one hand, and the well equipped British forces on the other hand, allow me to accurately capture how the incentives for securing nutritious food resources shaped the decision of rebels to attack regions where colonial forces had militarily superiority.

Finally, making an original contribution using archival-based evidence warrants relying on a case where the relevant documents have not been extensively analyzed before, which offers the opportunity to evaluate the relationship between food and conflict directly as it is reflected in these primary sources. The documents used throughout this section were collected at the National Archives of the United Kingdom, and some of these records have only become available within the past few years. This not only means that few studies have made use of these sources, but also that many of the documents, especially those related to food denial, are revealed here for the first time. Moreover, due to the exceptional level of detail found in these documents, the Mau Mau case is instrumental in illustrating the critical nature of staples in the context of armed rebellion.

As was shown in the previous section, the lessons of the Mau Mau rebellion with respect to staple availability and state power are clearly applicable to other, more recent contexts. Nevertheless, to illustrate this point, I plot the distribution of average maize, nighttime light, and rebellion levels (averaged by grid cell) as well as the correlations between each of the former two and the latter (by grid-cell year) for three countries—Burundi, Afghanistan, and Colombia—representing three distinct world regions (Africa, Asia, and Latin America) in Figures A8–A13, Supplemental Appendix. The reader may also refer to more recent illustrative cases that are not discussed in detail here due to space constraints, for instance, the Lord Resistance Army rebellion in Uganda,[14] the Soviet involvement in Afghanistan,[15] and the IS insurgency in Iraq and Syria,[16]

The food denial campaign

Shortly after the beginning of the rebellion, colonial officials came to recognize that regular access to food both provided easy fuel to the Mau Mau and served to boost the rebel troops' morale. These officials thus sought to *systematically* limit the rebels' access to locally sourced food, drawing on the active participation of provincial governors, district committees, the army, and local farmers (Bennett 2013: 255-257).

As guided by the high command, army forces and farmers prematurely harvested crops deemed particularly valuable for the Mau Mau, such as maize and potatoes. Between May and June 1953, the army reaped about 400 bags of potatoes, while units began clearing "shambas" (farms or plots of lands), preventing crops from being planted close to the forest, concentrating labor near farms, and enclosing cattle in "bomas," or pens. These food denial measures were intended to reduce the physical capacity of Mau Mau rebels and lower their

[14]See Doom and Vlassenroot 1999.
[15]See Alexiev 1984.
[16]See Jaafar and Woertz 2016.

morale. Indeed, both aspects were mentioned in an edition of the *East African Standard*, the strongly pro-colonial and most widely read newspaper in Kenya, from June 1953, which stated that, "the plan has the intention of making the gangs spend their time and energy searching for food so their raids and killings are cut down; and at the same time lower their resistance powers and morale as the offensive is stepped up by striking forces."[17]

The same dual logic was apparent in policymaking deliberations. For instance, the committee responsible for limiting rebel access to food around the Aberdare mountain range recognized that Mau Mau rebels operating in the region "could, if so compelled, subsist on game and the natural resources of the forest. For example, a buffalo cuts up at about 1500 lbs of meat: assuming that the Mau Mau gangs number approximately 700 men, an average of one buffalo a day would, statistically, suffice to feed them."[18] However, committee members believed that limiting rebels' access to food grown by local farmers would nevertheless be an advantageous strategy, because, "[a]lthough the gangs could live on the natural produce of the forests, the Committee consider that if they were forced to do so, their efficiency for operations would be much reduced; they would have to spend so much time and energy in feeding themselves that they would be much less formidable opponents than they are now. It is therefore worthwhile trying to deprive them of supplies which are more easily obtainable."[19]

On average, the decision to impose food denial measures quickly proved effective. As Bennett—author of arguably the most authoritative study of the Mau Mau rebellion from a military perspective—succinctly summarizes, "by mid-September [1953] Mau Mau redeployments favourable to the security forces appeared to be caused by food denial," and as a result, "the 39 Brigade placed greater emphasis on the policy, making it the second priority, after destroying gangs" (2013, 256). Senior military officials were quick to recognize the important

[17]"GANGS BEGIN TO FEEL THE PINCH: Food supplies denied them." *The East African Standard*, June 25, 1953.

[18]Document 7, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6201.

[19]Ibid.

role food denial played in their grand counterinsurgency strategy, so much that "[o]ver the summer of 1955 the new Commander-in-Chief of the British forces, Lieutenant-General Lathbury, took a direct interest in food denial, meeting farmers to explain the policy's rationale" (Bennett 2013: 256).

Many British units stepped up their food denial operations to guarantee that when the Mau Mau attacked, the army would be ready. For instance, the "49th Brigade placed food denial on the same footing as destroying gangs in late February 1955, when gangs were dispersed and depended on stealing food to survive. The hope was that starving Mau Mau would attack farms in a desperate bid to survive" (Bennett 2013: 256). As Figure 6—which plots the frequency of conflict incidents, the amount of irrigated land, and population densities in three contingent districts that experienced some of the highest rates of Mau Mau activity—illustrates, this was not an implausible expectation. The variations in violence between these three districts—Kajido, Machakos, and Narok[20]—closely follow the distribution of access to more cropland, regardless of population densities.[21]

To ensure that food denial measures produced "maximum squeeze"[22] on the Mau Mau, colonial officials placed the highest priority on limiting access to those food resources considered especially valuable, nutritious, and vulnerable to theft. For instance, the Rift Valley committee stated that, "[t]he following crops of value to the terrorists, i.e. maize, potatoes and sweet potatoes may not be grown within 3 miles of the edge of the Aberdares forest."[23]

By June 1953, guards and police in so-called "squatter shambas"—i.e., plots of land where local Kenyans, mostly from the Kikuyu ethnic group, lived as hired or temporary labor—

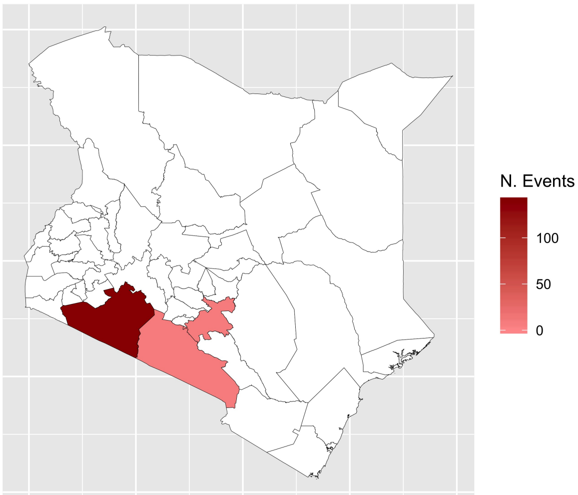
[20]The districts for which enough archival data and documentation on casualty statistics by location were available as to identify and code a relatively large sample of cases.

[21]Data for irrigated land were obtained through the PRIO-Grid dataset (Tollefsen et al. 2012) and summed by district. Data on population, also obtained from PRIO-Grid, were available for the 1970s only, and were extrapolated to their 1950 levels linearly by grid-cell before being summed to the district level.

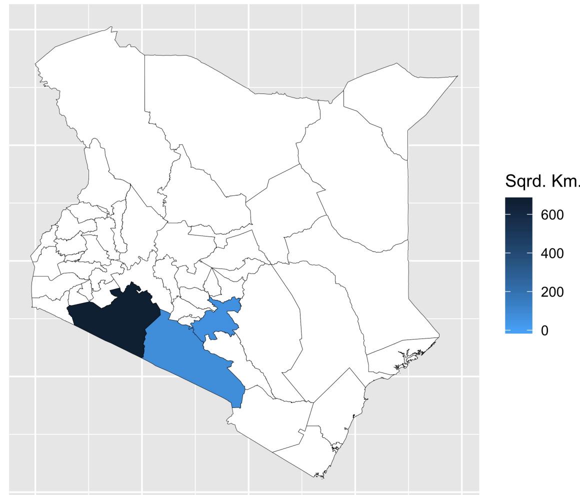
[22]Document 73, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6202.

[23]Document 48, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6201.

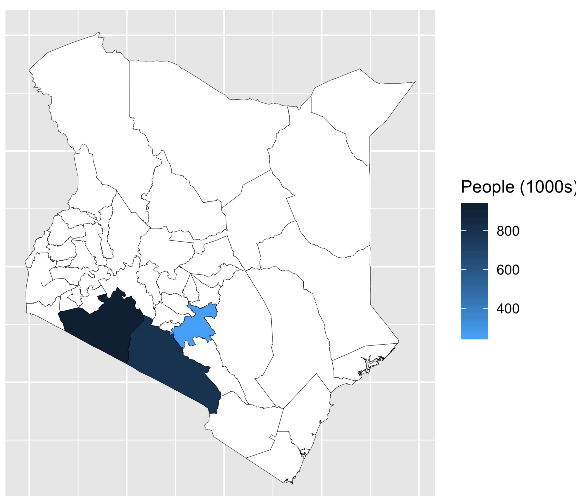
Figure 6: Variations in Violence for the Kajido, Machakos, and Narok Districts during the Mau Mau Rebellion



Conflict Events



Cropland



Population (1000s)

were ordered to, "keep and protect in stores at the homestead all squatter maize, beans, etc., and that squatters should draw their requirement daily from these stores."[24] In 1955 it was declared that, "[n]o potatoes, no maize, and no squatter stock will be permitted on

[24]Document 21, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6201.

a farm where there is normally no resident European."[25] As late as February 1956, when violence had largely subsided, military and police forces were instructed to remove potatoes and maize from local villages, and several councils ordered that no maize will be grown in their respective districts.[26]

In line with the argument advanced here, preventing the rebels from accessing maize supplies, specifically, was important for two reasons. First, a high-protein, high-starch crop, maize provided ample caloric intake, which—combined with the crop's durability—meant maize was the most energy-efficient crop Mau Mau rebels could obtain. Because it grows tall and thick, maize also allowed the rebels to more easily conceal themselves when moving out of the forest to capture other resources. For instance, in April 1955 colonial officials published "an Emergency Regulation forbidding the planting of maize...since this crop when planted amoung potatoes affords cover for the easy removal of the potatoes."[27]

Second, the main staple among the Kikuyu (Kanogo 1987: 112), maize was the "major food and cash crop" in Kenya (Kanogo 1987: 19), especially for "squatter" farmers. By growing it for their own consumption, "squatter" farmers were able to feed themselves, which freed them of the necessity to rely on the Europeans on whose farms they were employed for sustenance. By selling it externally and getting high prices, these farmers could also acquire socioeconomic value as independent producers during the inter-war period, when the British authorities overall increased their control over the "squatter" population (Kanogo 1987: 55-59). Indeed, the colonial officials were aware of the relative popularity of maize and its importance compared with other staple crops to many Kenyans. For instance, in January 1954, the Central District provisional commission commented that "[i]t was considered undesirable to prohibit the 'long rains' planting of maize since...[i]t would tend to lead to a mass civil disobedience campaign on the part of the women; cases occurred in 1953 in South

[25]Document 176, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6201.

[26]Document 61, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6202.

[27]Document 88/1, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6202.

Tetu when short rains planting of maize was forbidden."[28]

This archival evidence thus suggests that for the Mau Mau rebels, maize offered the greatest nutritional "bang for the buck" as a calorie- and protein-rich staple crop that could feed a large number of troops for a long period of time, and—if they were able to establish regular access to it—a valuable crop the group could sell on domestic markets. Maize was also relatively prevalent in regions where the Mau Mau could operate with relative ease, even after British authorities bolstered their defenses, or territories where Kikuyu—many of whom were supportive of the Mau Mau's aims—lived. Indeed, in line with the expectations delineated above, the imperative to secure maize and other staples was strong enough to push the Mau Mau to attack regions where the colonial forces were strong, as long as staple crops were also prevalent in these locations. At the same time, the Mau Mau generally refrained from attacking where the state was relatively strong but where not many staples were grown.

For instance, in July 1954, the provincial commissioner of the Southern Province noted that the Mau Mau operating in Narok district (the district with the most cropland and highest rate of violence in Figure 6) aimed, "to contaminate the Masai and thus spread the 'disease' to another part of the Colony," and that hence, "the forest area would have been used for widespread attacks on the European farms in the Lower Rift Valley," while, "gangs from outside the District may be transferred to the Mau forest area for this purpose."[29] Similarly, in 1955, the district officer of the Narok District complained about Mau Mau contingents operating in farmland regions, because these troops were, "obviously being fed and housed."[30] Indeed, a colonial official concluded in June 1955 that in Narok, "[t]he denial of food undoubtedly causing them [the Mau Mau] anxiety, but there are no signs of weakness," and that as a result, "we have, as yet, to achieve a mayor success against the

[28]Document 60, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6201.

[29]Document 25, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6528.

[30]Document 60, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6529.

terrorists."[31]

In contrast, in the neighboring Machakos district, where much less agricultural activity was taking place, officials noted that over the same period, "a mass of patrolling, investigation, arrest, and unremitting work by Police and Administrative Officers," meant, "no change, and no incidents to report"[32] despite the district's proximity to Nairobi, a hotbed of underground Mau Mau activity. A month later, officials noted again that, "[t]here have been no incidents during the past fortnight. Throughout the District every effort is made to maintain our 'defensive' precautions," including food denial efforts.[33] The British response in both Narok and Machakos was similar: to bolster defensive and offensive military and police capacity, and to ensure that access to nutritious food resources was regulated and controlled (Bennett 2013: 255-256). While these efforts seem to have worked out in Machakos, they did not effectively deter the Mau Mau operating in Narok, at least partly due to the higher access to cropland available in this region.

Conclusion

The results from the mixed-methods analysis provide evidence that rebellion patterns are strongly impacted by the interaction between access to local stales, in this case maize, and state power. The argument proposed that this empirical relationship likely results from rebels' imperative to secure *nutritious* resources for physical and morale-building purposes. Where rebels are able to secure access to more staples, they engage in more conflict-related activity even if the state maintains high presence in these regions. I was able to establish the validity of this relationship using a logit GLM. Using a logit GAM, I then identified two "clusters" of conflict over food resources. The first is where state capacity is low, but where maize productivity is moderate. This finding is in line with past research that focused on the

[31]Document 42, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6529.

[32]Document 15, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6524.

[33]Document 22, The National Archives, Foreign and Commonwealth Correspondence and predecessors (FCO), series 141/6524.

relationship between agricultural variability and conflict in developing areas, and especially in Africa (Butler and Gates 2012; Hendrix and Salehyan 2012; Koren 2018).

The second "cluster" suggests that rebellion likelihood increases in medium-to-high state capacity, high maize productivity cell-years. This finding is in line with evidence from more recent rebellions such as IS in Iraq and Syria (Jaafar and Woertz 2016) and India (Koren and Sarbahi 2018). An important conclusion is thus that by focusing on specific world regions where rebellions might be more frequent, scholars can miss potentially important implications for our understanding of the causes of conflict and violence more broadly (Adams et al. 2018).

This paper also illustrated how access to staples acts as a rebel-centric input of rebellion. The findings show that more access to nutritious staples improves capacity and provides strong enough incentives for rebels to attack state strongholds, thus nullifying the pacifying effect of state capacity on rebellion highlighted by past research (Fearon and Laitin 2003) in these contexts. This trend has two potential explanations. The first is that access to more staples improves the group's ability to recruit, support troops, and operate in larger contingents (Boring 1945), enabling it to wage a more effective challenge to the state. The second is that the state is more likely to station its forces in these regions to defend high access locations, but the rebels decide that the potential gains of securing high access to staples are worth the risk of attacking. Both claims were backed by original archival evidence illustrating how these dynamics unfold locally. From this perspective, future research will likely benefit from further studying how food access can work as a proxy for a rebel group's capacity levels, as a measure of its members' "wealth," or even as an alternative indicator of resource-intensity as reflected in civilians' and future rebels' incomes.

Another potential direction of research would be to analyze whether the effect of staple crops, and of the interaction between access to staples and state capacity, varies based on the type of rebellion (for instance secessionist vs. ethnic conflicts), or political violence more broadly. Indeed, recent research does suggest that the effect of staples might vary based on contexts, conflict, and actor type (Koren 2018; McGuirk and Burke 2017).

The emphasis on staples' role in conflict thus increases our understanding of why, when, and where rebellions might intensify and spread. As such, they can inform future endeavors that seek to identify the underlying mechanisms that drive violence, such as fine-grained case analyses, survey-research conducted in areas recently afflicted by conflict, and even agent-based modeling approaches that directly model complex interactions in a dynamic environment.

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