Fallow Lengths and the Structure of Property Rights*

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Abstract

Across societies, communal land rights have been more common than private land rights, particularly in sub-Saharan Africa, Latin America, and parts of Asia. We test the hypothesis that longer fallowing requirements – the time needed to leave land uncultivated to restore fertility – led to a higher prevalence of communal property rights. Longer fallowing requirements may lead to communal property rights because there are higher protection costs and greater need for social insurance. We construct an ecological measure of the optimal fallow length for the most suitable staple crop across grid cells based on soil type, temperature, and climate. We find that places where land needs to be fallowed for longer periods are more likely to have communal property rights both historically and presently. We then examine the implications for efforts to title land. We find that World Bank land titling interventions are less effective in places with longer fallowing requirements, suggesting a mismatch between development policy and underlying institutions. Finally, we examine implications for income, income inequality, and conflict. We find that longer fallowing requirements are associated with less inequality and less conflict. Our results highlight the origins of property rights structures and how communal property rights interact with development policies.

Keywords: Property Rights, Communal Land, Titling Reforms
JEL Classification: P14, Q15, O43

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1 Introduction

This paper examines a fundamental institution in many societies: the structure of property over land. In many contemporary Western societies, private property – where an individual or a nuclear family own land – is the predominant way of organizing land rights. However, many societies instead rely on communal land rights, in which extended families or communities jointly own and allocate land. In fact, historically, forms of communal property rights were common. Over 50% of societies in the Ethnographic Atlas relied exclusively on communal land rights and over 70% had at least partially communal land rights (Murdock and White 1969). This presents a puzzle: under what conditions are communal relative to private property rights more likely to evolve?

Theoretically, there are many potential benefits of private property over land (e.g. de Soto 2000; de Soto and Cheneval 2006), despite the prevalence of communal land rights. This view has led to many land titling policies in developing countries – at times with disappointing results in terms of take-up and effects on agricultural productivity and investment (e.g. Platteau 1996, 2000; Easterly 2007; Fenske 2011; Vendryes 2014). Understanding what drives variation in the structure of property rights may also generate insight into when land titling policies are likely to be effective.

To understand what drives variation in the structure of property rights over land, we test the hypothesis from Boserup (1965) and Demsetz (1967) that the need to leave land fallow for long periods leads to communal land rights. Fallow land is land that is usually cultivated but that is allowed to lie idle for several years in order to let it recover its fertility. The amount of time that land should be left fallow is a product of the types of inputs used, the main crop grown, and features of the soil and climate. Longer fallowing requirements may lead to communal land rights for several reasons. First, land that must remain fallow for longer periods generates higher protection costs. These protection costs can be more easily managed by a community rather than an individual. Second, longer fallowing requirements generate greater need for social insurance; communal property rights may offer a flexible mechanism for land reallocation.

We combine ethnographic and ecological data to systematically explore the relationship between fallowing and communal land rights. Using models from the FAO, we construct an ecological measure of the optimal fallow length for the maximum caloric suitability crop across 5′ x 5′ degree cells worldwide. The FAO fallow requirement measure is a non-linear

function of soil types, temperatures, and climate.

We take several steps to validate the FAO fallow requirement measure. First, we test whether the fallow requirement measure predicts historical fallowing practices using a variable from the Standard Cross-Cultural Sample (SCCS), a data set that captures historical ethnic-group level practices. The variable is a proxy for the amount of land that lay fallow in a given year. We find that the fallow requirement predicts historical fallowing practices; longer fallow requirements are significantly correlated with having more land under fallow. Second, we turn to present day plot-level data for 9,500 households across 11 countries in sub-Saharan Africa (Waha et al. 2016). While limited to sub-Saharan Africa, the benefit of these data is that they provide detailed information on the fallowing status of plots in the household. We find that the fallow requirement measure is predictive of present day fallowing practices in this sample.

We use the fallow requirement data to explore how fallow lengths are related to the choice of property rights regimes across societies historically. Consistent with Boserup (1965), we find that communal land rights are more common in places with longer fallowing requirements using data from the SCCS and Ethnographic Atlas (EA).

We also examine contemporary land tenure arrangements, using data from sub-Saharan Africa (Waha et al. 2016). Consistent with the historical results, we find that the fallow requirement measure is associated with a greater likelihood of a plot being held under communal land tenure relative to private land tenure.

Thus far our results suggest that fallow requirements lead to a greater likelihood of communal land tenure. We now examine how longer fallowing requirements affect land titling reforms, given the relatively lackluster success of titling reforms in some settings. Easterly (2007) posited that land titling reforms are unsuccessful because they ignore underlying property rights norms that are often communal rather than individual.[1] To explore this hypothesis, we use World Bank project data that provide information on projects that have been implemented, the type of project, and ratings of how successful the project was. We find that land titling projects are significantly less successful in places with longer fallowing requirements. This negative effect is specific to land titling projects, and not more general to projects in other domains. These results suggest that when there is a mismatch between underlying institutions and development policies, the policies may be less successful.

Finally, we examine mechanisms that may explain the persistence of communal property

[1] See also Home (2013).

rights, despite the theoretical benefits of private property over land. We focus on the relationship between communal land rights and inequality and conflict. Communal land rights may be associated with less inequality because they allow for scope for social insurance through the redistribution of land to those in need. Likewise, communal land rights may actually mitigate conflict over land.

Using data from the Demographic and Health Surveys (DHS) for countries in Africa, Asia, and Latin America, we find that longer fallowing requirements reduce wealth inequality. However, longer fallowing lengths are not associated with lower wealth levels. Using ACLED conflict data, we find that conflict is lower in places with longer fallowing requirements. The negative relationship is particularly strong in settings with low state capacity. This suggests that communal land rights might be better able to reduce conflict in settings where states are weak and ineffective at enforcing private land rights.

Our findings contribute to several strands of literature. First, we contribute to the literature exploring the origins and evolution of property rights over land (Boserup 1965; Demsetz 1967; Alston et al. 2012; Bowles and Choi 2019). We provide novel causal evidence on how ecological factors influence the structure of property rights over land. In this paper, we focus on how fallowing lengths affect the emergence and persistence of communal property rights over land. Additionally, existing research has focused on the emergence of private property rights in settings where a counterfactual property rights regime does not exist, i.e. the counterfactual is unregulated "open-access" resources (e.g. Demsetz 1967).[2] However, this is not the only relevant counterfactual for many resources – such as agricultural land. The more common counterfactual property rights regime is often regulated communal property rights (Boserup 1965; Ostrom 1990; Baland and Platteau 1996; Lee Alston and Mueller 1999; Platteau 2000).[3] Thus, we provide evidence on a factor that drives the emergence of communal property rights over land.

Our results also speak to the literature on how differences in property rights over land affect economic development (e.g. Galiani and Schargrodsky 2011). One challenge in quantifying the effects of private property rights is that it is difficult to disentangle whether the differences in outcomes arise from differences in the organization of property rights (e.g. communal vs. individual) or differences in the security of rights. Studies have found strong evidence that the *security* of property rights is essential (e.g. Besley 1995; Acemoglu and

[2]In these cases, the property rights are often held by the state (e.g. Alchian and Demsetz 1973).

[3]For instance, unlike open-access rights, communal land rights allow the exclusion of outsiders from village land (Platteau 2000).

Johnson 2005; Goldstein and Udry 2008; Fenske 2011) and even influences cultural norms (e.g. Di Tella et al. 2007). However, as noted by Platteau (2000), communal land rights may actually offer higher security in many settings relative to private land rights – in particular in places with low state capacity or a long history of communal land rights. The endogenous formation of land rights has meant that there are few causal studies on how the organization of land rights matters. We provide evidence that fallow requirements lead to more communal land rights relative to private land rights, and that this difference has implications for comparative development.

Additionally, the results show how underlying institutions and cultural norms regarding land rights are important determinants of the success of land titling reforms. These findings contribute to a growing body of work highlighting the need to tailor development policies to the local institutions and cultural norms where projects are implemented (Alsan et al. 2019; Ashraf et al. 2020; Lowes and Montero 2021; Bau 2021). In particular, we highlight that the way property rights over land are understood and how people view their relationship to land may be quite different across W.E.I.R.D. and non-W.E.I.R.D. societies (Henrich 2020). Our results highlight the potential for mismatch between development policies and the underlying institutional and cultural context.

Finally, our paper contributes to a growing literature studying how ecological and environmental forces shape culture and institutions (e.g. Alesina et al. 2013; Fenske 2014; Alsan 2015; Galor and Ozak 2016; Becker 2019; Giuliano and Nunn 2020; Buggle and Durante 2021; Fouka and Schläpfer 2020; Mayshar et al. 2022; Le Rossignol and Lowes 2022). A few of these papers have focused on how ecological factors influence culture and institutions through their effects on pre-industrial agricultural practices of societies (see e.g. Alesina et al. 2013; Galor and Ozak 2016; Mayshar et al. 2017, 2022). We contribute to this literature by focusing on an understudied but prevalent economic institution – communal property rights over land – and show that historical ecological differences in fallowing requirements influence land institutions and development policies.

The rest of this paper is organized as follows. Section 2 provides background on fallow practices, land rights, and the conceptual framework describing our main hypothesis that longer fallow requirements increase the prevalence of communal land rights. Section 3 describes the ecological and ethnographic data we use to test our hypotheses. Section 4 provides our empirical results examining how fallow requirements influence the structure of property rights. Section 5 examines the implications of our results for land titling policy

success. Section 6 explores the mechanisms behind our results. Section 7 concludes.

2 Background & Conceptual Framework

2.1 Fallow Land

The agricultural practice of fallowing land involves allowing land that is usually cultivated to lay idle for periods of time, often several years, in order to let it recover its fertility. Fallowing is the oldest and most widespread agro-forestry practice for restoring land fertility lost in cultivation (Young 1989). The fallow period replenishes nutrients in the land by allowing other natural vegetation to grow.[4] The length of the necessary fallow period depends on soil types, climate conditions, the inputs applied, and the types of crops cultivated (Fischer et al. 2012).[5] Fallow periods that are shorter than optimal (given local conditions and crop choice) lead to low soil fertility and low productivity. Additionally, fallow periods that are too short lead to soil erosion as crops do not develop sufficiently strong root systems to protect against flooding and sliding. Rotating between crop cultivation and fallowing, also known as shifting cultivation, remains a common practice in many countries in Sub-Saharan Africa and Latin America to restore soil fertility and limit soil degradation (López 1998).

Allowing land to fallow is key to restoring land fertility, but it is a complex decision for agricultural producers. Letting land fallow, while an investment in future productivity, is a source of potential insecurity for two reasons. First, by letting land fallow instead of cultivating it, individuals may face consumption insecurity in the absence of social insurance or if they lack access to sufficient non-fallow land (De Zeeuw 1997; López 1998). Second, in settings with weak state capacity, fallow land may be subject to expropriation by outsiders or other villagers (e.g. Goldstein and Udry 2008). The investment and insecurity aspects of the fallowing decision may interact: more security may increase the extent of fallowing (e.g. Goldstein and Udry 2008; Fenske 2011), yet fallowing itself may lead to less security. For these reasons, rather than letting fallow land remain completely unregulated and open to outsiders (i.e. "open-access"), villages often defined property rights over fallow land.

[4] In more modern agricultural systems, instead of relying solely on naturally occurring vegetation during fallow periods, specific vegetation – such as grasses, a grass-legume mix, or a green-manure crop rotation – are used to further enhance soil fertility during fallow periods (Fischer et al. 2012).

[5] Eventually, all land should be left fallow after a given period of cultivation (Fischer et al. 2012).

2.2 Communal vs. Private Land Rights

Property rights over land are a bundle of rights related to the use, access, and transfer of land. These rights can take various forms, but they almost always involve some regulations regarding how land can be used, if it can be transfered, and who can access it. In other words, land – including fallow land – is not completely "open-access" land; instead, villages define a set of land rights to govern and manage agricultural land (Platteau 2000).

In societies with private property rights over land, all land rights for a given plot are held by a sole individual or by a nuclear family (as a single household). In contrast, in societies without fully individual private property rights, villagers manage land communally, where several or all land rights are held and granted by a community (Boserup 1965; Platteau 2000). Communities in these cases are defined as a collective group of people who are either extended families, clans, villages, or members of an ethnic group (Binswanger and McIntire 1987; Platteau 2000). This form of kin-based communal land ownership was the dominant form of property rights even in pre-industrial western societies (Boserup 1965; Goody and Goody 1983; Henrich 2020).

Communal land rights can consist of more or less "communality" depending on how many components of rights (e.g. use, access, transfer) are allocated to the community. However, communal land rights tend to have the following characteristics. First, land that is owned communally by villages or lineages has strict restrictions on its use by outsiders (López 1998).[6] Second, individuals often have exclusive use rights on the land that they are currently cultivating and the crops they produce on the land, but, once the land is left fallow, the land can be reallocated by the community (López 1998; Pande and Udry 2005; Goldstein and Udry 2008).

2.3 Evolution of Land Rights

In contexts with weak states, communal property rights are the key counterfactual property rights regime to private property rights (Platteau 2000). A fundamental debate in anthropology and economics revolves around the evolution and emergence of various property rights structures. Boserup (1965) highlighted that societies transition across different modes of agriculture in the process of development, often due to increasing population pressures. These systems are characterized by differences in their fallowing methods (ranging from

[6] In other words, communal land is "common property with closed or highly restricted access for external potential users" (López 1998).

long fallow systems to multi-cropping systems). Boserup (1965) posited that as population pressures increase (and, therefore, land becomes more scare), societies both transition from extensive to intensive agriculture and tend to develop private property rights for land instead of relying on communal rights.[7]

In a similar vein, an influential view in economics has subsequently argued that individual and private property rights emerge as resources become more scarce and the benefits of privatization exceed its (non-negligible) costs. In particular, Demsetz (1967, pg. 350) summarized the view as follows: "It is my thesis that... the emergence of new property rights takes place in response to the desires of interacting persons for adjustment to new benefit-cost possibilities... property rights develop to internalize externalities when the gains from internalization become larger than the costs of internalization." Together, this set of hypotheses from Boserup (1965) and Demsetz (1967) became known as the evolutionary theory of property rights (*ETPR*) (Platteau 1996).

One critique of the *ETPR* is that it implicitly assumes that private land rights grant more tenure security, thereby leading to more investment due to an assurance effect. However, this assumption relies on the existence of a strong state or neutral third-party for enforcement. In many settings, this assumption is unlikely to hold and, in fact, communal rights might provide more tenure security (Atwood 1990; Platteau 2000; Brasselle et al. 2002). As noted by Platteau (2000, pg. 140) "as is apparent from the... survey of the African situation, there is no solid basis for claiming that increased individualization of land rights generates an assurance effect. As it turns out, in customary land areas basic use rights seem to be sufficient to induce landholders to invest and the adding of transfer rights (with the possible exception of the right to bequeath land) does not appear to significantly improve investment incentives."

2.4 Implications of Fallow Requirements for Land Property Rights

Both Boserup (1965) and Demsetz (1967) noted a likely relationship between longer fallowing periods and the presence of communal land rights. We build off of Boserup (1965) by focusing on how different fallowing requirements might lead to different property rights structures. Boserup (1965) noted that fallow periods play an important role in the evolution of property rights:

> *"The attachment of individual families to particular plots becomes more and more impor-*

[7] See Figure C7 for a summary of Boserup (1965) provided by Datoo (1978).

tant with the gradual shortening of the period of fallow and the reduction of the part of the territory which is not used in the rotation... As more and more land is subject to specific cultivation rights little land will be available for redistribution by the chief, and valuable land for redistribution will become available mainly when a family dies out or leaves the territory... Redistribution of land thus becomes a less important and less frequently exerted function of the chief, and in the end it disappears altogether" (Boserup 1965, pg. 80-81)

In other words, shorter fallow periods are likely associated with more private land rights and less communal land rights. Similarly, Demsetz (1967) highlighted the likely relationship between shorter fallow periods and the emergence of private land rights:

"Once a crop is grown by the more primitive agricultural societies, it is necessary for them to abandon the land for several years to restore productivity. Property rights in land among such people would require policing cost for several years during which no sizable output is obtained. Since to provide for sustenance these people must move to new land, a property right to be of value to them must be associated with a portable object. Among these people it is common to find property rights to the crops, which, after harvest, are portable, but not to the land. The more advanced agriculturally based primitive societies are able to remain with particular land for longer periods, and here we generally observe property rights to the land as well as to the crops." (Demsetz 1967)

We build off these insights by Boserup (1965) and Demsetz (1967), and provide a conceptual framework for what longer or shorter fallowing periods imply for individuals under both private and communal rights. We first discuss how fallow requirements affects incentives under private and communal rights, and then discuss the predictions of the framework.

As in Baland and Francois (2005), consider a rural setting where binding enforcement of contracts is limited and privatization costs are non-negligible.[8] Societies face a decision on whether to use communal land rights (including to manage fallow land and to allocate land) or private property rights. Individuals are risk averse and face liquidity constraints; this means that states of the world without access to cultivatable land are costly and undesirable. Additionally, lack of access to land might also increase intra-community unrest.

[8]These are important and realistic assumptions, as otherwise both property rights would be optimal under no transaction costs and complete markets: "under some conditions, including the absence of transaction costs, the two solutions [regulated communal ownership and private ownership] are theoretically equivalent and they lead to a Pareto-efficient outcome" (Platteau 2000, pg. 78).

Under these conditions, communal land rights will be better able to manage risk and insecurity through the reallocation of land (Baland and Francois 2005).[9] However, since communal land rights may face a tragedy of the commons, especially when the size of a village is large (López 1998), private land rights may be better at internalizing the future gains from choosing to fallow land. Thus, there is a potential trade-off between social insurance under communal land rights and efficiency gains under private land rights that depends on the length of the fallow period.

Therefore, all else equal, land with longer fallowing requirements creates a greater need for communal management for social insurance during fallow periods (Ostrom 1990; Baland and Platteau 1996; De Zeeuw 1997; Platteau 2000; Baland and Francois 2005). As noted by Platteau (2006), when the fallow length is shorter:

> *"Since less land returns periodically to the village pool, there are also fewer possibilities to adjust the endowments of community members when the need arises. The scope of the social security mechanism that operates through such adjustments is correspondingly reduced to eventually vanish when all land plots are under the permanent control of their individual possessors."* (Platteau 2006, pg. 847)

Conversely, land with shorter fallow duration is more valuable land, as it can be cultivated more often and induces less insecurity during fallow periods.[10] This creates greater incentives towards private property rights formation (Boserup 1965; Demsetz 1967).

This simple conceptual framework offers a set of predictions, summarized in Table 1. Primarily, it suggests that increases in the fallow requirements are associated with more communal land rights; conversely, land with shorter fallow requirements is more likely to have private land rights. The framework also offers a set of secondary predictions. First, it suggests that interest in land titling reforms that grant private land rights will be less desirable in settings with longer fallow requirements. Second, it suggests that communal land rights to manage fallow periods provide social insurance (Baland and Platteau 1998; Goldstein and Udry 2005); this suggests they reduce income inequality and conflict particularly in settings with longer fallow requirements.

[9] See also De Zeeuw (1997); Platteau (2006). Reallocating land to other members facing insecurity during fallow periods reduces the intra-community expropriation risks. Additionally, communal land rights may lead to better protection of fallow land if there are returns to scale to group monitoring and defense from outsiders (Platteau 2000).

[10] By insecurity, we mean both consumption insecurity and expropriation insecurity.

Table 1
Summary of Conceptual Framework Predictions

	Prediction:	*Empirics:*
Main Prediction:		
↑ Fallowing Requirements	↑ Communal Land Rights	↑ Prevalence of Communal Land Rights
Secondary Predictions:		
↑ Fallowing Requirements:	↓ Interest in Private Rights	Success of World Bank Land Titling Projects
↑ Fallowing Requirements:	↓ Inequality & Unrest	↓ Income Inequality & Conflict Events

However, this framework abstracts from many important aspects. In particular, the framework assumes that state enforcement of land rights is missing. This stands in contrast to some modern settings where states are effective at arbitrating disputes and enforcing private land rights. Communal land rights are likely to be particularly beneficial when the state is unable to enforce private property rights. Additionally, the framework ignores elite capture, either in state enforcement (e.g. Behrer et al. 2021) or in land allocation under communal land rights (e.g. Goldstein and Udry 2008).

3 Data

3.1 Fallowing Requirements

We use FAO GAEZ data and models to construct the extent to which various crops require fallowing. The FAO estimates fallow requirements for various crop types as a non-linear function of: local soil type, temperature, crop growth cycles, and climate (moisture) (Fischer et al. 2012). The FAO models express fallow requirements as the percentage of time during the fallow-cropping cycle the land must be under fallow. For instance, a fallow requirement of 50% means that after three years of cultivation, the land needs to remain fallow for three years; likewise, a fallow requirement of 70% implies that after three years of cultivation, the land needs to remain fallow for seven years.[11] The fallow requirements are calculated for rain-fed agricultural production using low input levels.[12]

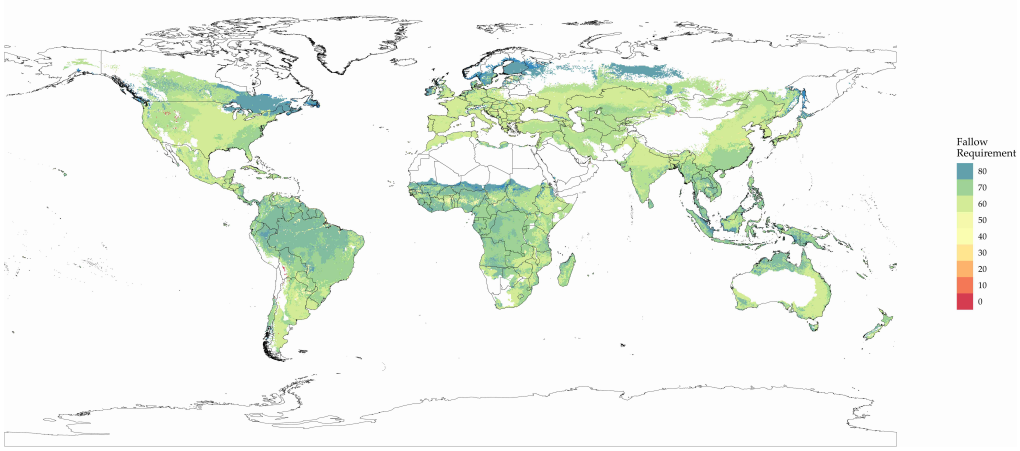
Using the FAO models, we construct the fallowing requirement for the maximum caloric

[11]The fallow requirements developed by Fischer et al. (2012) were based on previous work estimating fallow periods across different regions (e.g. Young and Wright 1980; FAO/IIASA 1991).

[12]For intermediate level of inputs, the FAO sets fallow requirements at one third of the fallow period requirement under low input levels, and sets fallow requirements uniformly at 10% for high input levels (Fischer et al. 2012).

suitability crop (as defined by data from Galor and Ozak 2016) for 5′ x 5′ degree cells across the world (approximately 100 km^2).[13] Figure 1 presents a map of fallow requirements across the world.

Figure 1
Fallow Requirements Across the World



Notes: The map presents the fallowing requirement for the maximum caloric suitability crop for the world in 5′ by 5′ grid cells. The fallowing requirement for a crop is defined as the optimal percentage of time during the fallow-cropping cycle that land must be under fallow (Fischer et al. 2012). Cells shaded in white represent regions where the land is not suitable for agriculture.

3.2 Ethnographic Data

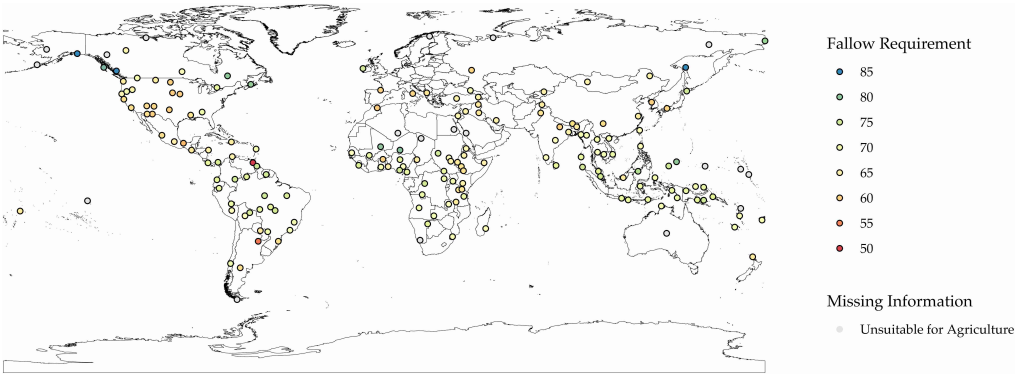
We use two ethnographic data sources for information on societies' agricultural practices historically. First, we use data from the Standard Cross-Cultural Sample (SCCS) (Murdock and White 1969). This data source contains very detailed ethnographic questions – including on land rights – for 186 cultures. To study a larger set of societies, we also use data from the Ethnographic Atlas (EA), which provides ethnographic data on 1,265 societies (Murdock 1967). The SCCS societies were chosen from the full sample of societies in the EA; this sample was chosen to be representative of the full EA sample and to be culturally and historically independent from other societies samples.[14] While the EA covers a larger set of societies than the SCCS and can be linked to modern linguistic groups, the EA does not contain detailed questions on land rights.

[13] See Galor and Ozak (2016) Figure A.1 for a map showing the maximum caloric suitability crop for 5′ x 5′ degree cells.

[14] To select societies for the SCCS, they first grouped the 1,265 societies from the EA into 186 clusters of closely-related cultures, and then one representative and well-documented society was chosen from each cluster to be part of the SCCS (Murdock and White 1969).

For both ethnographic data sources, information on each society is coded for the earliest possible period that contains satisfactory ethnographic data.[15] This information has been coded to attempt to reflect conditions prior to industrialization and (where applicable) prior to European contact. Both data sources contain longitude and latitude measures for the centroid of a societies historical location. Figures 2 present a map with the centroids of SCCS societies, and the estimated fallow requirements (described in Section 3.1) for a 100 km buffer around these centroids. See Appendix Figure C8 for the equivalent map for EA societies.

Figure 2
Fallow Requirements Across SCCS Societies



Notes: The map presents the fallowing requirement – percentage of time during the fallow-cropping cycle that land must be under fallow – for the maximum caloric suitability crop for each group in the SCCS. Grey dots represent groups where the land is not suitable for agriculture.

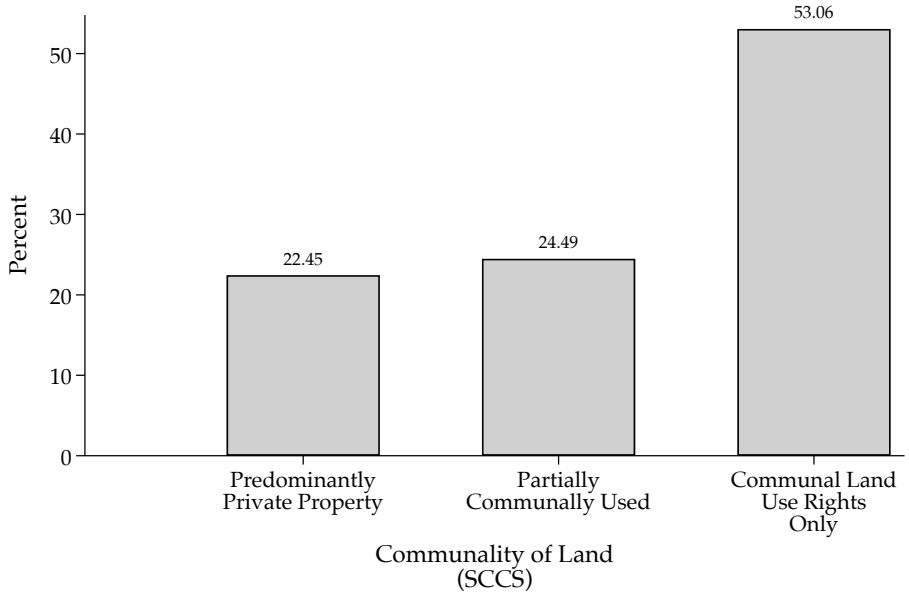
3.2.1 Measuring Land Rights: SCCS

To examine whether a society in the SCCS has communal land rights or private land rights, we use variable 1726 denoted as measuring the "Communality of Land" (Murdock and White 1969). This is a 1 to 3 categorical variable, where 1 = land is predominantly private property, 2 = land is partially communally used, and 3 = communal land use rights only.

Figure 3 presents the distribution for the "Communality of Land" variable. 53.06% of SCCS societies had communal land rights use only, 24.49% had partial communal land rights, and 22.45% had predominately private property rights. Figure 4 presents a map of the communality of land measure across SCCS societies. Communal land rights are particularly prevalent in South America, Sub-Saharan Africa, and parts of Asia.

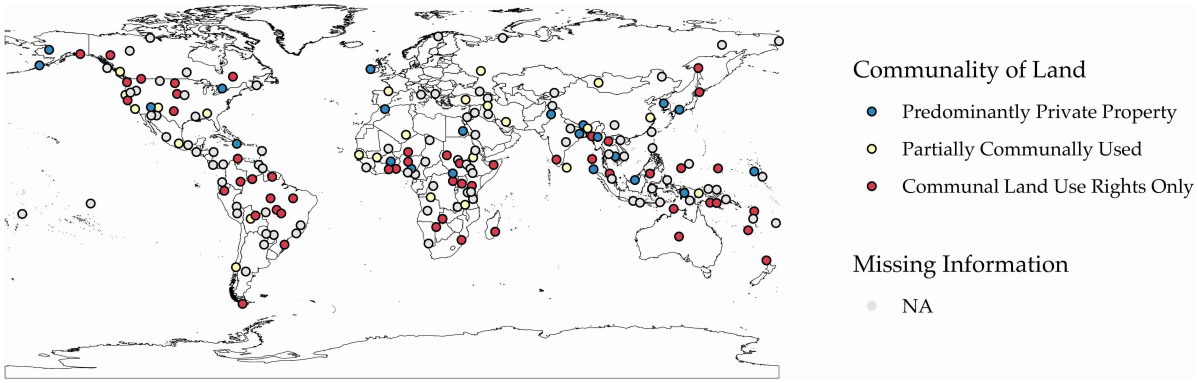
[15]For societies with a written history, the dates of this written history are the observation dates. For groups without written histories, the dates of observation refer to the dates of earliest observation of these cultures by

Figure 3
Communality of Land in the SCCS



Notes: The Figure presents a histogram for the "Communality of Land" variable for societies in the SCCS.

Figure 4
Communal Land Rights Across SCCS Societies



Notes: The map presents the extent to which land rights are organized communally in the SCCS.

To validate that our measure of fallowing requirements correlates with the actual amount of fallow land in a society, we use variable 1128 from the SCCS, labeled as the "Cropping Index (Rough indicator of Fallowing) for Major Crops" (Murdock and White 1969). This variable measures the "percentage of total land used for major crops in any given year," where land that is not used is presumed to be fallow land (Pryor 1986).[16] For societies that practiced agricultural production, the variable is a 1-5 categorical variable, where 1= less than 10% of land used per year, 2 = 10% - 29% of land used per year, 3 = 30% - 49% of land used per year, 4 = 50% - 99% of land used per year, and 5 = 100% or more of land used per year.[17]

3.3 Ethnologue to Link Ethnographic Data to Modern Data

While some outcomes of interest (such as land rights historically) are available at the society-level, some more modern outcomes of interest are available at the country level. Thus, for analyses involving these modern outcomes, we construct measures of fallowing requirements at the country level using the data and methodology developed by Alesina et al. (2013) and Giuliano and Nunn (2018). The country-level measure corresponds to the average fallowing requirement faced by the ancestors of individuals currently living in a country. To create this measure, we use data from Giuliano and Nunn (2018) on (i) the location of ethnic groups using over 7,000 different languages or dialects from Ethnologue 16 linked to societies in the EA, and (ii) information on the global population densities (at a one-kilometer resolution) from the Landscan database. By using the link between the EA societies and each of the 7,000+ Ethnologue dialects, we create a measures of ancestral fallowing requirements for all individuals living in a country today. Figure C9 presents a map of the fallowing requirement for the Ethnologue dialects linked to EA societies, and Figure C10 presents a map of the ancestry-adjusted fallow requirements across countries.

ethnographers.

[16] It notes that tree crops are considered to have no fallow.

[17] The amount of land used for major crops can be over 100% due to double cropping.

4 Results: Fallowing Requirements & Property Rights

4.1 Empirical Strategy

We examine the correlation between the fallowing requirement and our outcomes of interest (e.g. communal land rights) in ethnographic data by estimating the following equation:

$$y_{sc} = \gamma_1 FallowRequirement_{sc} + \mathbf{X}_{sc}^{'G}\mathbf{\Gamma} + \mathbf{X}_{sc}^{'H}\mathbf{\Phi} + \delta_{r(c)} + \varepsilon_{sc} \quad (1)$$

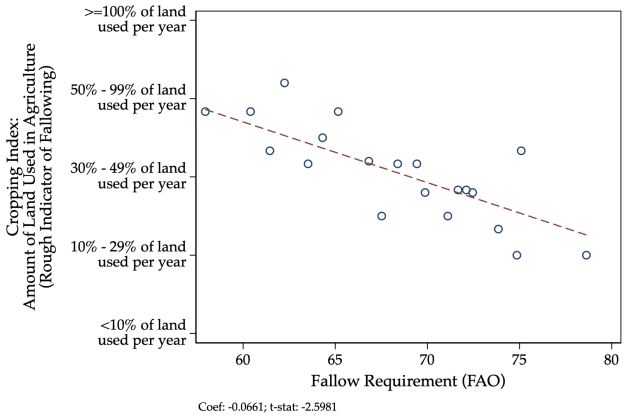
where y_{sc} is the outcome of interest for society s in country c. We measure $FallowRequirement_{sc}$ as the average percentage of time during the fallow-cropping cycle that land must be under fallow for the maximum caloric suitability crop of a society s using a 100 km buffer around the society's centroid. We include $\mathbf{X}_{sc}^{'G}$, a vector of geographic covariates at the society-level, and $\mathbf{X}_{sc}^{'H}$, a vector of historical pre-colonial ethnographic covariates. The society-level geographic and ethnographic controls and are described in detail below. We also include continent fixed effects, $\delta_{r(c)}$ (where $r(c)$ is a function that maps countries c to continents $r(c)$), to account for time-invariant differences across regions, and we estimate robust standard errors.

4.2 Validating the Fallow Requirement Measure

We first confirm that the FAO fallowing requirement measure is correlated with observed fallowing practices across societies. We estimate equation (1) for SCCS societies where the outcome variable is the "Cropping Index" (i.e. percentage of total land for major crops used in any given year). If our fallowing requirement measure is a valid proxy for agricultural practices historically (and subsequent property rights), then we would expect a strong negative relationship between fallowing requirements and the percentage of land used for major crops in a given year.Figure 5 presents a binscatter between a society's estimated fallow requirement and the cropping index measure. We find a negative and statistically significant relationship between a society's estimated fallow requirement and the cropping index measure, helping validate our fallow requirement measure.

We further investigate the robustness of this relationship to geographic covariates. This addresses the concern the relationship between fallowing requirements and amount of land used might be driven by omitted differences in geographic characteristics. Table 2 presents the estimates for equation (1) where we sequentially add a number of geographic covariates

Figure 5
Fallowing Requirements & Observed Fallowing Intensity: SCCS



Notes: The figure presents binscatters between the fallowing requirements and the reported share of a land used for major crops (a proxy for the amount of land lay fallow in a given year). The unit of observation is a SCCS group. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the SCCS group level.

that might affect the amount of fallow land. In particular, we include continent fixed-effects (in columns (2)-(5)); controls for latitude, longitude, average precipitation, average temperature, and agricultural suitability (in columns (3)-(5)); controls for malarial suitability and tsetse fly suitability (in columns (4)-(5)); and, fixed-effects for the maximum caloric crop for each society (in column (5)) to account for unobserved differences across crops (which is an importance concern given recent work on how differences across crops lead to differences in state institutions (Mayshar et al. 2022)).[18] Throughout, we continue to find a negative and statistically significant relationship between fallowing requirements and the amount of agricultural land used in a given year: a 10 percentage point increase in fallow requirements is associated with using 4.5% less land in a given year. These results further validate that the fallow requirement measure is a strong proxy for historical fallowing practices.[19]

We also examine whether the fallow requirement measure predicts contemporary fallowing practices. In developed countries, the practice of fallowing has decreased over the

[18] All controls aside from latitude and longitude are calculated using a 100 km buffer around an SCCS societies centroid.

[19] Similarly, Boserup (1965) noted that longer fallowing requirements would also be associated with more extensive (less intensive) agricultural production. Table C3 presents estimates for the relationship between longer FAO fallow requirements and the intensity of agriculture across societies in the SCCS. We find evidence consistent with Boserup (1965): longer FAO fallow requirements are associated with more extensive agricultural production. This provides further evidence that the FAO measure of fallow requirements is a strong proxy for historical fallowing practices.

Table 2
Effect of Fallow Requirement on Amount of Land Used For Agriculture in SCCS (Rough Indicator for Fallowing)

	Dependent Variable:				
	Amount of Agricultural Land Used				
	(1)	(2)	(3)	(4)	(5)
Fallow Requirement	−0.122***	−0.105***	−0.122***	−0.121***	−0.137***
	(0.029)	(0.034)	(0.040)	(0.038)	(0.035)
Continent FEs	N	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y
Disease Controls	N	N	N	Y	Y
Crop FEs	N	N	N	N	Y
Outcome Mean	3.00	3.00	3.00	3.00	3.00
Adjusted R2	0.179	0.210	0.252	0.247	0.305
Beta Coef.	-0.438	-0.376	-0.439	-0.436	-0.491
Observations	63	63	63	63	63

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS). Robust standard errors in parentheses. The dependent variable *Amount of Agricultural Land Used* is a 1 to 5 categorical variable, where 1=<10% of agricultural land used per year, 2=10-29% of agricultural land used per year, 3=30-49% of agricultural land used per year, 4=50-99% of agricultural land used per year, and 5=≥100% of agricultural land used per year. *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

last century due to increased access to modern inputs. Therefore, we focus on data from Africa to investigate the relation between fallowing requirements and contemporary fallowing practices. For this exercise, we rely on data from an agricultural survey of 9,500 farm households conducted in 11 countries (Waha et al. 2016). This dataset provides information on the farming system for all the plots in each farm household. For a given plot, respondents answer a question about how the land is used.[20] Respondents can select one of the six following farming systems: (i) shifting cultivation (with long fallow period), (ii) continuous cropping (no fallow period), (iii) continuous cropping with multiple rotations (includes short fallow period), (iv) livestock grazing land, (v) other, and (vi) combination of above.

We focus on the first three categories, which together account for 93% of the farming systems in the sample.[21] We generate a 0 to 2 variable where 0 stands for "continuous cropping (no fallow period)", 1 stands for "continuous cropping with multiple rotations (includes short fallow period)", and 2 stands for "shifting cultivation (with long fallow period)". We

[20]The precise question is: "Please answer the following land use questions with respect to total amount and type of land operated by members of the household: System of Farming".

[21]See Figure C11 for a histogram of the number of plots per category.

estimate a variant of equation 1, where the unit of analysis is a plot. Standard errors are two-way clustered by country and ethnologue group. Table 3 presents the results. The positive sign associated with Fallowing Requirement suggests that longer fallowing requirements are correlated with systems of farming that rely more on the practice of fallowing.

Table 3
Effect of Fallow Requirement on Contemporary Fallowing Practices

	Dependent Variable:				
	Contemporary Fallowing Practices				
	(1)	(2)	(3)	(4)	(5)
Fallowing Requirement	0.012**	0.017**	0.016**	0.019***	0.022***
	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
Country FEs	Yes	Yes	Yes	Yes	Yes
Geographic Controls	No	Yes	Yes	Yes	Yes
Disease Controls	No	No	Yes	Yes	Yes
Crop FEs	No	No	No	Yes	Yes
Ethnographic Controls	No	No	No	No	Yes
Outcome Mean	0.76	0.76	0.76	0.76	0.77
Adjusted R2	.04	.04	.04	.05	.05
Beta Coef.	.061	.086	.079	.093	.109
Observations	7914	7914	7914	7914	7649
Clusters	93	93	93	93	88

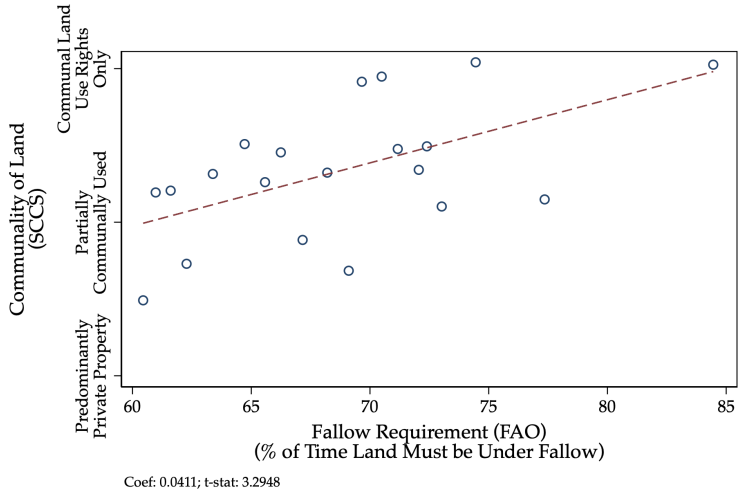
Notes: The unit of observation is a plot in the *An agricultural survey for more than 9,500 African households* survey (Waha et al. 2016). Standard errors are two-way clustered by country and ethnologue group. *Geographic Controls* include longitude, latitude, average rainfall, average temperature, elevation, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development for the ethnologue group of each Enumeration Area. * p < 0.1; ** p < 0.05; *** p < 0.01

4.3 Fallowing Requirements & Land Rights

We next test the main hypothesis that longer fallowing requirements are associated with a higher probability that a society has communal land rights instead of private land rights. We estimate equation (1) for SCCS societies where the outcome variable is the "Communality of Land" variable.[22] Figure 6 presents a binscatter examining the relationship between a society's FAO fallowing requirement and the extent to which land rights were communal. Consistent with Boserup (1965) and Section 2.4, we find that societies that had longer fallowing requirements were more likely to own land communally rather than privately.

[22]This question is only available in the SCCS data and not in the EA data.

Figure 6
Effect of Fallowing Requirement on Communal Land Rights: SCCS



Notes: The figure present the binscatter between the fallowing requirements and the communality of land property rights. The unit of observation is a SCCS group. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the SCCS group level.

Table 4 presents the estimates for equation (1) while sequentially including geographic and ethnographic covariates. Columns (2)-(5) include the geographic covariates included in Table 2; column (6) adds additional ethnographic controls, including an indicator for the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement complexity (e.g. nomadic vs. settled), and an index of political development (i.e. jurisdictional hierarchy beyond the local level).[23] Across all specifications, we find that a positive and statistically significant relationship between longer fallowing requirements and the presence of communal land rights: a 10 percentage point increase is fallow requirements is associated with a 4.1 percentage point higher probability of communal land rights being present. The results suggest that fallowing constraints were an important factor determining how communities organized land ownership.

In Table C5, we analyze a complementary measure of communal rights, which we borrow from a recent anthropological publication (Ember et al. 2020). Ember et al. (2020) make use of three sources of data – Human Relations Area Files, (Pryor 2005, 2011), and CONAN project (Lang 1998) – to generate a *communal land rights* variable coded for 133 societies from

[23]Note that many of these variables could also be affected by fallowing lengths and are likely "bad controls". For this reason, we show results with and without their inclusion.

the SCCS sample. This variable takes the value zero if "the typical land-holding unit that controls customary legal claims over land or territory is primarily a family household unit (considered as private ownership)", and one if "the land-holding unit is a communal unit (larger than an extended family, such as a corporate descent group, another type of kin group, or a residence-based group)". Figure C12 shows the distribution of this variable for 133 societies in the Social Cross Cultural Sample and Figure A2 shows the spatial distribution of the sampled societies. In this alternative sample, we find a positive and significant relationship between the fallow length measure and communal land right.

Table 4
Effect of Fallow Requirement on Communal Land Rights

	Dependent Variable:					
	Communality of Land Rights					
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement	0.043***	0.039***	0.035**	0.037**	0.038**	0.046**
	(0.013)	(0.014)	(0.014)	(0.015)	(0.017)	(0.022)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	2.33	2.33	2.33	2.33	2.33	2.29
Adjusted R2	0.098	0.113	0.131	0.115	0.203	0.209
Beta Coef.	0.329	0.296	0.265	0.282	0.290	0.337
Observations	88	88	88	88	88	82

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS). Robust standard errors in parentheses. The dependent variable *Communality of Land Rights* is a 1 to 3 categorical variable, where 1=land is predominantly private property, 2=land is partially communally used, and 3=communal land use rights only. *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In Appendix C.2 Table C6, we also use present day data on constitutions (Elkins et al. 2009). We examine whether fallow length also affects the codification of property rights in constitutions. We focus on whether the constitution grants individuals rights to transfer property, own property, testate property, and inherit property. We find evidence that longer fallow requirements are associated with less protections for these individual property rights.

5 Land Titling Policy Success

We have shown that longer fallow requirements lead to the development of more communal land rights. We now ask what are the consequences of communal land rights for development. We explore the implications of communal land rights for the success of land titling policies.

How does the presence of communal property rights for land influence the success of development policies? Many scholars have posited that private property rights for land are essential for economic development and, therefore, policies should aim to increase their prevalence in developing economics (e.g. de Soto 2000; de Soto and Cheneval 2006). This influential view led to multiple reforms aimed at titling land, especially in the 1990 and 2000s across Africa and Latin America.[24] However, many of these titling reforms have often had mixed and often disappointing results (e.g. Platteau 1996, 2000; Jacoby and Minten 2007; Vendryes 2014; Lawry et al. 2017).

Given these lackluster results despite immense foreign investment in titling policies, Easterly (2007) hypothesized that the lack of success may often occur because land titling reforms often ignore underlying property rights norms, where land rights are often communal rather than individualistic.[25] For instance, the British colonial land reforms in Kenya sought to privatize land in settings where customary land rights were strong and well-defined; this led to low levels of take-up and, instead, efforts to recognize communal land rights (Easterly 2007; Home 2013). Similar efforts were undertaken by the Belgians in the Belgian Congo, though a scheme called the *paysannat*. The goal was to modernize

To explore whether the success of titling reforms interacts with the underlying land right structures, we use World Bank project data provided by AidData (2017). This data covers World Bank funded projects between 1995 and 2014 and includes information on the location, description, and sectors. To examine the success of projects, we explore the outcome rating of projects. A subset of these projects are given an outcome rating based on "the extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently". The outcome rating is a six point categorical scale ranging from highly unsatisfactory to highly satisfactory project. We limit the sample to those projects that are given a rating.

[24] For instance, in 2005, the World Bank alone was supervising a portfolio of more than U.S.$1 billion worth of land administration projects (Galiani and Schargrodsky 2011).

[25] See also Miceli and Kieyah (2003) for a theoretical model on why titling policies often fail to succeed.

We use information on project sectors and project description to classify whether projects involved land titling or not. In particular, we define a project as being a land titling project if one of its five sector categories or project title refers to land titling.[26]

We test whether countries that have higher ancestral fallow requirements (and therefore more communal land rights) have less successful land titling projects. In particular, we compare the success of land projects and non-land projects by ancestral fallow requirements. We present the results of a pooled regression of the project outcome on the ancestral fallow requirement measure in Table 5. On average, World Bank projects receive a rating between moderately satisfactory and satisfactory in our sample. For land titling projects, we find a sizable and negative effect of fallow requirements on the rating received: a one standard deviation increase in the fallow requirement is associated with approximately a one point decrease in the project rating (equivalent to moving from moderately satisfactory to moderately unsatisfactory). Reassuringly, this effect for fallow requirements is only found for land titling projects, and not other types of World Bank projects. Additionally, in Figure C13, we present binscatters of the relationship between fallow requirements and World Bank ratings for titling and non-titling project separately. The figure shows that land titling projects are significantly less successful in places with more communal ownership norms, and that this relationship does not hold when examining other types of projects. These results suggest that the success titling reforms may depend on the underlying property rights regimes.

6 Mechanisms: Social Insurance and Conflict

We examine the implications of different property rights structures for income, inequality, and the incidence of conflict. We also examine heterogeneity by quality of institutions.

6.1 Income & Inequality

How does a history of communal land rights impact income and inequality? Section 2.4 highlighted how communal land rights served an important role in redistributing land across households. Thus, communal land rights might be associated with lower income inequality. Additionally, the conceptual framework notes that communal land rights may particularly reduce inequality in areas with low state capacity.

[26] Specifically, the project is labeled as a titling project if the description or sector includes one of the following key words: titling, title, land reform, property right, land administration, land registration, land development project, cadastre, land records, land management.

Table 5
Effect of Fallow Requirement on World Bank Project Success

	Dependent Variable: *World bank Project Rating*					
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement × *Land Titling Project*	−0.955***	−0.914***	−0.894***	−0.766***	−0.783***	−0.725***
	(0.253)	(0.247)	(0.261)	(0.254)	(0.252)	(0.206)
Continent FEs	N	Y	Y	Y	Y	Y
Project Sector FEs	N	N	Y	Y	Y	Y
Project Year FEs	N	N	Y	Y	Y	Y
Geography Controls	N	N	N	Y	Y	Y
Ethnographic Controls	N	N	N	N	Y	Y
Country FEs	N	N	N	N	N	Y
Outcome Mean	4.24	4.24	4.23	4.23	4.23	4.23
Adjusted R2	0.010	0.033	0.136	0.165	0.176	0.296
Beta Coef.	-0.057	-0.054	-0.053	-0.046	-0.046	-0.043
Observations	21,228	21,228	21,172	21,172	21,172	21,172
Clusters	87	87	87	87	87	87

Notes: The unit of observation is a project-country pair. Standard errors are clustered at the country level and presented in parentheses. The dependent variable *World Bank Project Rating* is a variable ranging from 1 to 5, where 1 = a project was rated as highly unsatisfactory, 2 = unsatisfactory, 3 = moderately unsatisfactory, 4 = moderately satisfactory, and 5 = satisfactory. *Fallowing Requirement* is the country-level population-weighted measure of a country's fallowing requirement. *Land Titling Project* is an indicator variable equal to 1 if the project description mentions land titling. *Geography Controls* include longitude, latitude, elevation, land suitability, and malaria suitability. *Ethnographic Controls* includes settlement complexity, mean size of local community, political complexity, historical reliance on pastoralism, and historical reliance on agriculture. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To examine modern-day income and inequality, we use Demographic and Health Survey (DHS) data. We assembled all DHS samples that included geographic coordinates for enumeration clusters. In total, the sample includes 123 surveys spanning 47 countries; Figure A3 presents a map of the location for the DHS clusters in our sample. The DHS data includes wealth score measures for each surveyed household. This wealth score is constructed using principal component analysis of household asset ownership within each country-year survey. We use the wealth score measures to examine cluster-level income levels and inequality levels. We link DHS clusters to ethnologue groups based on their location to determine the historical fallowing requirement for each DHS cluster.

Table 6 presents the regression estimates for the relationship between wealth scores in the DHS data and the ancestral fallowing requirements of ethnologue groups. Interestingly, we find little evidence that fallowing requirements affect average wealth levels (columns 5 and 6): the point estimates are small in magnitude and statistically insignificant. We then turn to examining the implications of fallowing for income inequality. We find that longer fallowing requirements are associated with less income inequality, as proxied by either the standard deviation (columns 1 and 2) or the inter-quartile range (columns 3 and 4) of the wealth score. These results are robust to a number of geographic and ecological covariates,

population density controls, and country-survey-year fixed-effects.[27] The results suggest that societies with longer fallow requirements and more communal land rights experience less income inequality.

Table 6
Effect of Fallow Requirement on Income and Inequality:
Demographic Health and Surveys (DHS)

	Dependent Variable: ... of DHS Wealth Score					
	Inter-Quartile Range		*Standard Deviation*		*Average*	
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement	−0.400**	−0.425*	−0.260**	−0.293**	−0.503	−0.628
	(0.192)	(0.223)	(0.126)	(0.146)	(0.536)	(0.540)
Country-Year FEs	Y	Y	Y	Y	Y	Y
Geography Controls	Y	Y	Y	Y	Y	Y
Disease Controls	Y	Y	Y	Y	Y	Y
Crop FEs	Y	Y	Y	Y	Y	Y
Ethnographic Controls	N	Y	N	Y	N	Y
Population	N	Y	N	Y	N	Y
Outcome Mean	72.59	72.83	60.33	60.68	0.45	2.16
Outcome SD	95.24	97.65	72.21	74.20	156.76	160.13
Adjusted R2	0.538	0.541	0.619	0.621	0.244	0.241
Beta Coef.	-0.021	-0.022	-0.017	-0.018	-0.016	-0.019
Observations	84,937	79,996	82,371	77,430	84,937	79,996
Clusters	122	122	117	117	122	122

Notes: The unit of observation is a DHS cluster. Standard errors in parentheses are two-way clustered by country-survey wave and ethnologue group. In Panel A, the outcome variable is the standard deviation of the DHS wealth score. In Panel B, the outcome variable is the inter-quartile range of the DHS wealth score. In Panel C, the outcome variable is the average DHS wealth score. All regressions control for cluster size and rural-urban status. *Geography Controls* include longitude, latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Population* includes log population for each ethnologue group. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development for the ethnologue group of each DHS cluster. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.2 Conflict

How does a history of communal land rights impact the incidence of conflict? The conceptual framework in Section 2.4 highlights the important role that land-conflict management plays in the choice of property rights regime. It also highlights that private property rights may increase the amount of land-related conflicts in areas with low state capacity and enforcement. Communal property rights in these setting might therefore be associated with less conflict.

To explore this mechanism, we use two complementary sources of data. First, we use georeferenced conflict data from ACLED. This data has a broader coverage, capturing conflict events from 1997-2021 for Africa, 2016-2021 for Latin America, and 2018-2021 for all other countries. However, the ACLED data does not consistently disentangle whether conflict events were land-related or not. To capture whether a conflict event was due to land conflicts,

[27] See Table C8 for results on each outcome when controls are included sequentially.

we follow the methodology in Eberle et al. (2020) to construct measures of "land-related" violence using the "notes" recorded for each event to find instances that mention land issues in the description. Second, to complement the ACLED data and use a measure of land-specific conflict, we use data from the Institutional Profiles Database (IPD) that records the severity of land-related conflicts at the country level. The IPD data was constructed using surveys completed by country or regional Economic Services agents of the French Ministry for the Economy and Finance. The benefits of these data are that they provide high-quality measures from experts. However, the data covers only 95 countries and relies on perceptions rather than on specific reports or instances of conflict.

Table 7 presents the regression estimates for the relationship between the number of conflict events in the ACLED data and ancestral fallowing requirements of ethnologue groups. We find that longer fallowing requirements are associated with less conflict. These results are robust to a number of geographic and ecological covariates, population density controls, and country fixed-effects. The results suggest that societies with longer fallow requirements and more communal land rights experience less conflict. Interestingly, result is in contrast to accounts that private rights reduce conflict. However, as highlighted in Section 2.4, in settings with low state capacity, communal land rights might be better at providing social insurance and reducing social conflict.

6.3 Heterogeneity by State Capacity

We also examine whether the effects of fallowing requirements for income inequality and conflict varies by the extent of state capacity. Specifically, we examine this relationship by separately estimating effects for at countries with high (above median) and low (below median) "Rule of Law" as measured by the World Bank Governance Indicators data.

Figure 7 presents the binscatter for the standard deviation of the wealth score by high and low rule of law countries. We find that the negative relationship between inequality and fallowing requirements is concentrated in low rule of law countries. This provides suggestive evidence that communal land rights might be particularly effective at reducing inequality in settings with weak states.

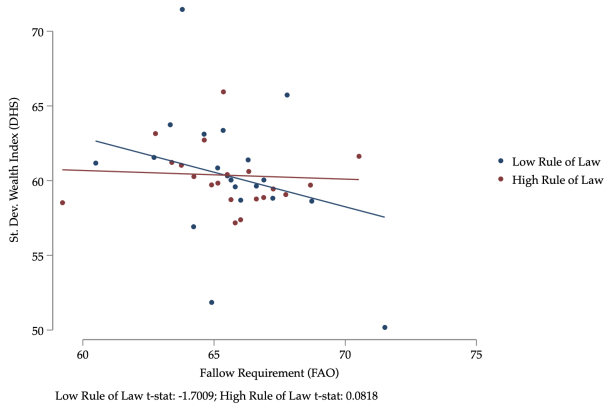
Figure 8 presents the binscatter for the number of conflict events in the ACLED data by high and low rule of law countries. We find that the negative relationship between conflict and historical fallowing requirements is concentrated in low rule of law countries. This suggests that communal land rights (relative to private land rights) might be particularly

Table 7
Effect of Fallow Requirement on Conflict

	Dependent Variable: *Number of Conflict Events*					
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement	−10.160**	−10.815***	−10.713***	−11.221***	−10.917***	−9.747***
	(4.208)	(3.933)	(3.943)	(4.250)	(4.037)	(3.761)
Country FEs	Y	Y	Y	Y	Y	Y
Geography Controls	N	Y	Y	Y	Y	Y
Disease Controls	N	N	Y	Y	Y	Y
Crop FEs	N	N	N	Y	Y	Y
Population	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	142.44	142.65	142.65	142.65	142.65	152.68
Outcome SD	1460.57	1461.65	1461.65	1461.65	1461.65	1539.02
Adjusted R2	0.157	0.158	0.158	0.162	0.192	0.195
Beta Coef.	-0.032	-0.034	-0.034	-0.035	-0.034	-0.029
Observations	6,719	6,709	6,709	6,709	6,709	5,983
Clusters	6,719	6,709	6,709	6,709	6,709	5,983

Notes: The unit of observation is an ethnologue group. Standard errors clustered by ethnologue group in parentheses. The dependent variable *Number of Conflict Events* is defined as the number of conflict events per ethnologue group in the ACLED data (1997-2021). *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Population* includes log population for each group. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 7
Fallowing Requirements & Income Inequality:
Heterogeneity by Rule of Law

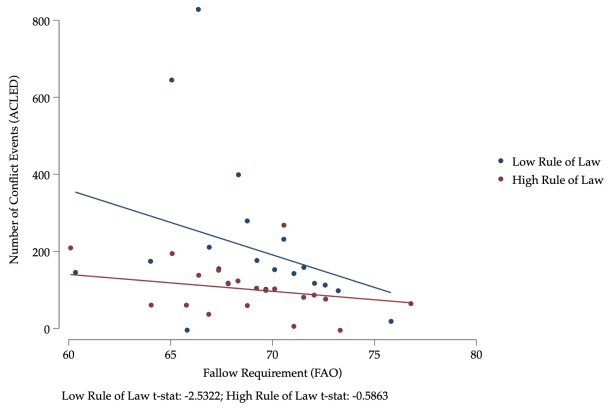


Notes: The figure presents binscatters between the fallowing requirements and standard deviation of the DHS wealth score measure. The unit of observation is a DHS cluster. The figure presents results separately for groups in countries with low (below median) and high (above median) Rule of Law measures from the World Bank Governance Indicators dataset. Regressions control for country-survey-year fixed effects, geography controls, and disease controls. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic for each subset of countries. Standard errors are clustered at the ethnologue group level.

effective at reducing conflict in settings with weak states.

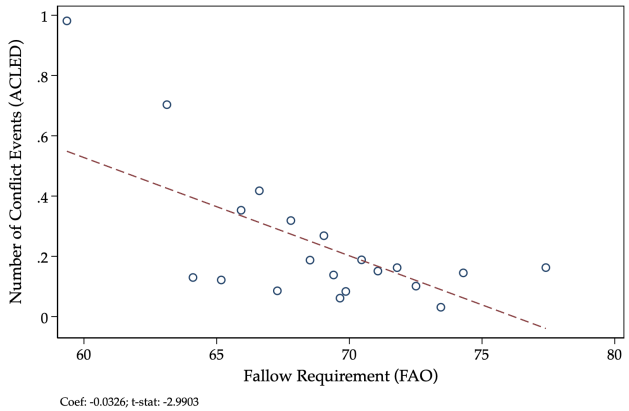
Finally, we examine the relationship between historical fallowing requirements and land-specific conflict events. Figure 9 presents the binscatter for the number of land-related conflicts in the ACLED data. It shows that areas with longer historical fallowing requirements have lower amounts of land-related conflict. Figure 10 provides the binscatter for the severity of land-related conflict across countries from the IDP data. It shows that countries with longer historical fallowing requirements tend to have less land-related conflict. These results together suggest that communal property rights are associated with lower land-related conflict.

Figure 8
Fallowing Requirements & Conflict:
Heterogeneity by Rule of Law



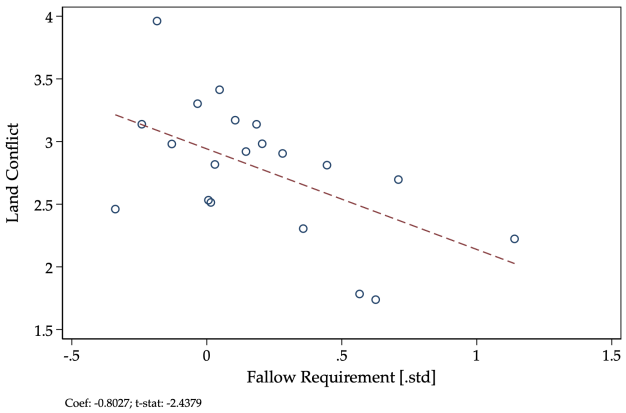
Notes: The figure presents binscatters between the fallowing requirements and the number of conflict events in the ACLED data. The unit of observation is a ethnologue group. The figure presents results separately for groups in countries with low (below median) and high (above median) Rule of Law measures from the World Bank Governance Indicators dataset. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic for each subset of countries. Standard errors are clustered at the ethnologue group level.

Figure 9
Fallowing Requirements & Conflict: Land-Related Conflicts



Notes: The figure presents binscatters between the fallowing requirements and the number of land-related conflict events in the ACLED data. The unit of observation is a ethnologue group. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the ethnologue group level.

Figure 10
Fallowing Requirements & Land-Related Conflict: IPD Data



Notes: The figure presents binscatters between the fallowing requirements and the severity of land-related conflict in rural areas in the IPD data. The unit of observation is a country. Land conflict is a 0 to 4 categorical variable, where 0 = No land-related conflict in rural areas, and 4 = Serious land-related conflict in rural areas. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the country level.

7 Conclusion

Most societies have historically had communal land rights rather than private land rights. However, there has been a strong focus on private land rights in development policies, specifically with the implementation of various tilting reforms in developing countries. What explains the disconnect in the prevalence of communal land rights and the importance placed on private land rights?

We show that these communal land rights evolve endogenously and matter for the success of development policies. In particular, we systematically test the hypothesis that communal land rights were more common in areas with longer fallowing requirements. This is because fallow land requires community protection, which favors the adoption of communal land rights over private land rights in settings with low state capacity. Combining various ecological and ethnographic data sets, we provide empirical evidence that longer fallowing requirements are strongly associated with communal land rights over private land rights. Furthermore, we show that longer fallowing requirements are associated with less granting of individual property rights in constitutions. We then use this variation to show that the underlying property rights in land affect the success of land policies: titling reforms are less successful in places where communal land rights are more common. We provide sugges-

tive evidence that this may be because communal land rights are relatively more effective at reducing land conflicts in places where states are weak, which is relevant for many of the titling reforms in developing countries.

Our results provide insight into the economics of property rights. Property rights are a bundle of various rights (e.g. use rights, inheritance rights, transfer rights) and these bundles display considerable variation worldwide, especially in non-W.E.I.R.D. contexts. A fruitful avenue for further work might explore the implications of various non-western components to land rights for economic development policies. Additionally, our results show that the success of common development land policies depends on the underlying land rights and cultural norms regarding the ownership of land. These results suggest that tailoring policies to local land rights may be important for the design of development policies.

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Online Appendix for:

Fallow Lengths and the Structure of Property Rights

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August 17, 2023

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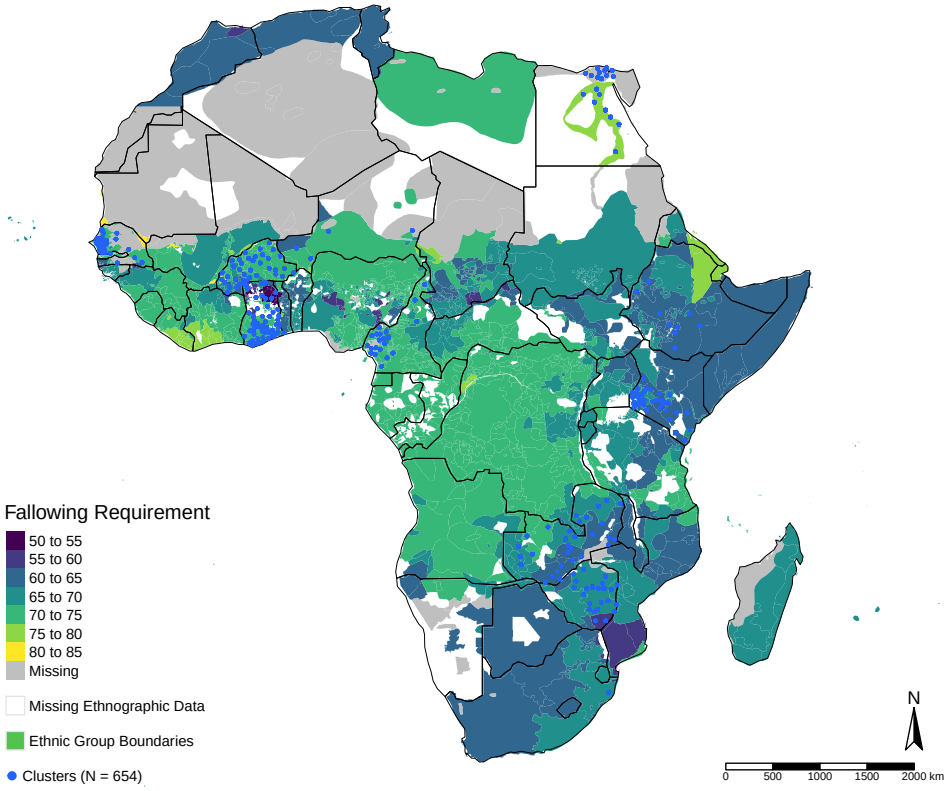
Appendix A Data Sources, Samples, and Variable Definitions

A.1 Samples

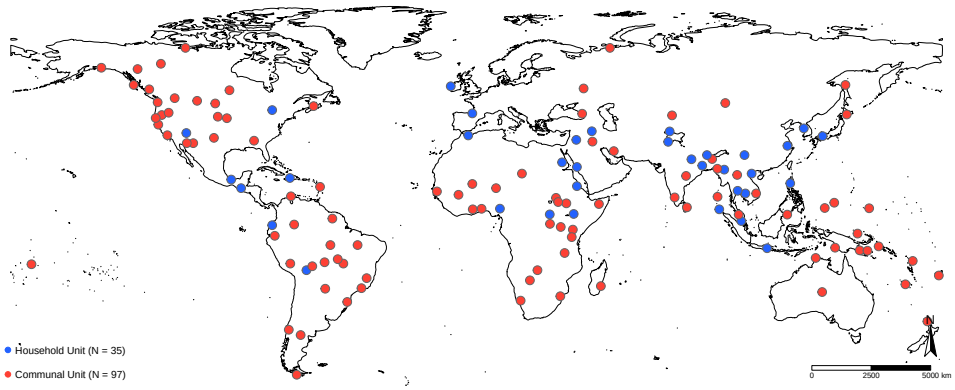
Figure A1
An agricultural survey for more than 9,500 African households survey Sample (Waha et al. 2016)



Notes: The map presents the cluster location for the agricultural survey for more than 9,500 African households survey data sample.

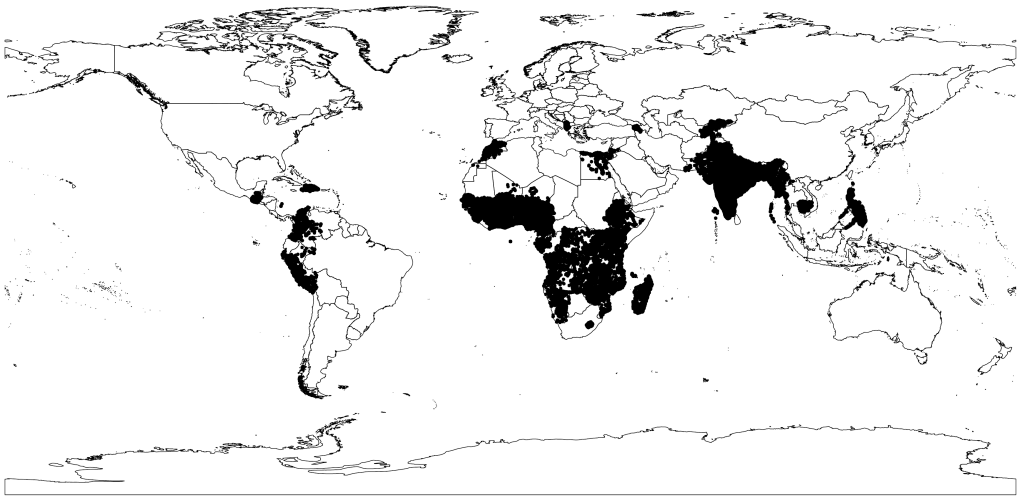
Table A1 provides a description of the datasets and samples we use for our main analysis.

Figure A2
Distribution of Ember et al. (2020)'s SCCS Sample



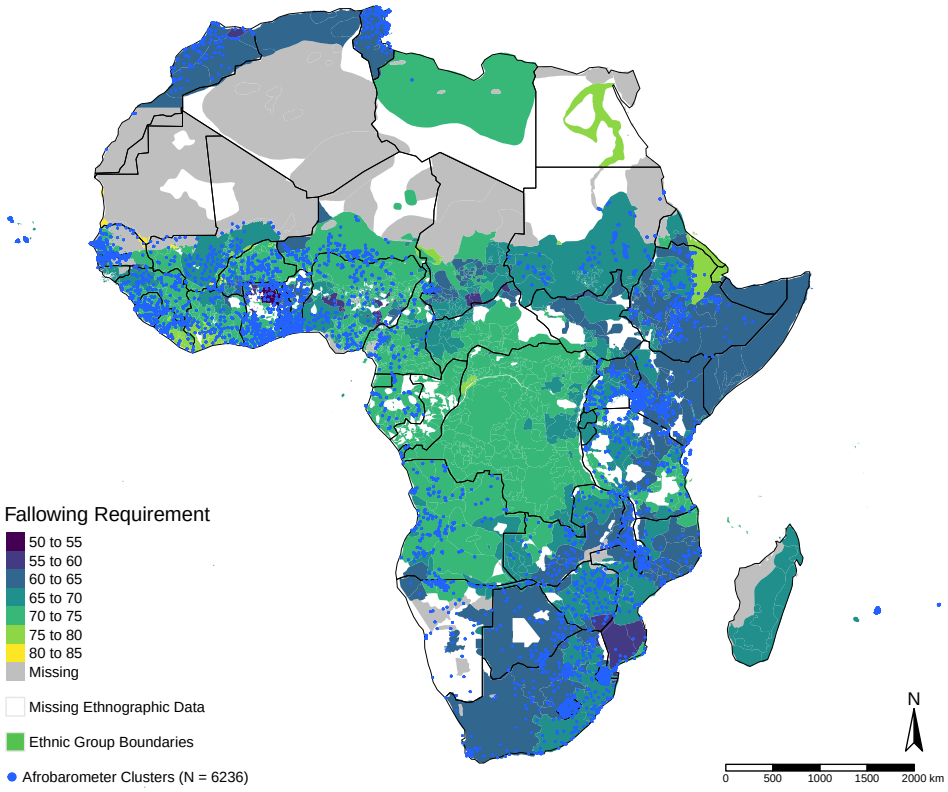
Notes:

Figure A3
DHS Sample



Notes: The map presents the cluster location for the Demographic and Health Survey (DHS) data sample.

Figure A4
Afrobarometer Round 8 Sample



Notes:

Table A1
Samples

Sample	Acronym	Outcome(s)	Number of Observations in: Raw Data	Our Tables	Exclusion Criteria
Standard Cross	SCCS	Amount of Agricultural Land Used	186	145	Exclusion of missing values
Cultural Sample		Communality of Land Rights	186	88	Exclusion of missing values
Ethnographic Atlas	EA	Kinship Tightness	1,265	1,125	Exclusion of missing values
Comparative Constitutions Project	CCP	Transfer Property Own Property Testate Property Inherit Property Index of Property Rights			
World Bank Project	-	World bank Project Rating		21,228	
Armed Conflict Location & Event Data Project	ACLED	Number of Conflict Events Land-Related Conflicts			
Institutional Profiles Database	IDP	Land-Related Conflicts	95	95	Not Appropriate
World Value Survey	WVS	Trust: General Trust: In vs. Out			
Demographic and Health Survey	DHS	Wealth Score			

Appendix B Proxies for Land Rights in the EA

B.1 Defining Land Right Proxy Measures in the EA

Unfortunately, the EA data does not contain the "communality of land" variable (nor the "cropping index" question). However, we construct a proxy for the strength of private land rights in the EA. The EA data contains a variable on whether a society has private rights for the inheritance of land (variable v74). Specifically, variable v74 measures the Inheritance Rule for Real Property (Land), where code 1 corresponds to an "Absence of individual property rights or rules".[28] We define an indicator variable for the existence of private inheritance rights for land that equals 1 when variable v74 does not indicate an absence of individual property rights or rules.

However, using this variable as a direct measure of land rights has two shortcomings. First, the variable measures only property rights for land inheritance and not property rights for land use. However, these property right dimensions tend to be correlated historically: private land inheritance often followed from private land use rights (and not vice-versa) (Platteau 2000). Thus, it can be thought of as proxy for the existence of private land use rights. Second, more importantly, not all societies relied exclusively on agricultural production, meaning that the measure corresponds to all subsistence patterns (e.g. nomadic pastoralists, settled groups, mixed groups). Therefore, to construct our proxy the strength of private land rights, we weight the indicator for private inheritance rights by a society's reliance on agriculture for subsistence (variable v4).[29] The logic of our proxy is similar to how Becker (2019) and McGuirk and Nunn (2022) construct measures of reliance on pastoralism.[30] Specifically, we define a measure for the strength of private land rights as:

$$\begin{aligned} \textit{Strength of Private Land Rights} = \textit{Reliance on Agriculture} \times \\ \textit{Private Inheritance Rights} \end{aligned} \tag{2}$$

To validate this measure, we also construct the Strength of Private Land Rights measure for the sample of societies in the SCCS and explore its correlation with the Communality of

[28] Codes 2-7 correspond to kinship inheritance rules for land (e.g. matrilineal (sister's son), patrilineal (sons), etc).

[29] The reliance on agriculture measure in the EA is a 0-9 variable ranging from 0-5% dependence to 86%-100% dependence. We scale this measure to be 0-1.

[30] The Becker (2019) constructs a pastoralism measure for societies in the EA by weighting an indicator variable that equals one if the primary large animal in a society is suitable for herding (variable v40) a societies reliance on animal husbandry for subsistence (variable v4).

Land variable. We find that the Communality of Land variable is strongly correlated with the Strength of Private Land Rights measure (correlation coefficient of -0.424). Additionally, we find that this correlation is much larger than the correlation between the Communality of Land and the (unweighted) indicator variable for Private Inheritance Rights alone (-0.358), highlighting the importance of weighting by the historical reliance on agriculture.[31]

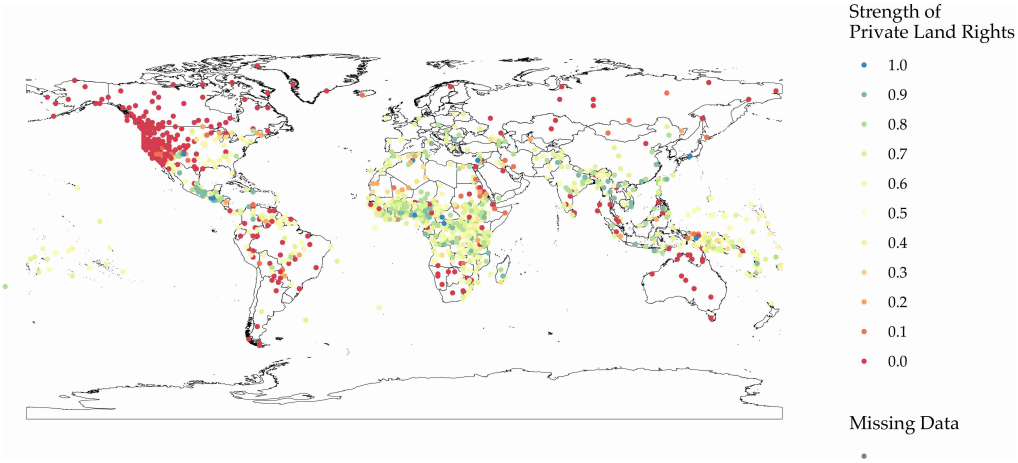
Figure B5 presents a map for the strength of private land rights for each society in the EA. Similar to the map in Figure 4, the strength private land rights is lower in non-Western societies.

B.2 Effect of Fallow Requirements on Land Right Proxies in the EA

We use our proxy measures for land rights in the EA and explore the extent to which fallowing requirements are correlated with our measure for the strength of private land rights. While this measure is an imperfect proxy (as it is derived on whether land inheritance has private rights, not land use), it helps us explore whether this relationship between fallow requirements and the structure of land rights holds for a larger sample of societies. Figure B6 presents a binscatter examining the relationship between a society's FAO fallowing requirement and the strength of private land rights in the EA. We find that societies that had longer fallowing requirements were less likely to have strong private land rights. Table B2 presents regressions estimates for this relationship for SCCS societies in Panel A and EA societies in Panel B. We continue to find evidence that longer fallowing requirements are associated with less strong private land rights. However, this relationship is less precisely estimated once we include the full set of controls. The results provide additional evidence that suggests that societies that faced longer fallow requirements were less likely to adopt private land rights.

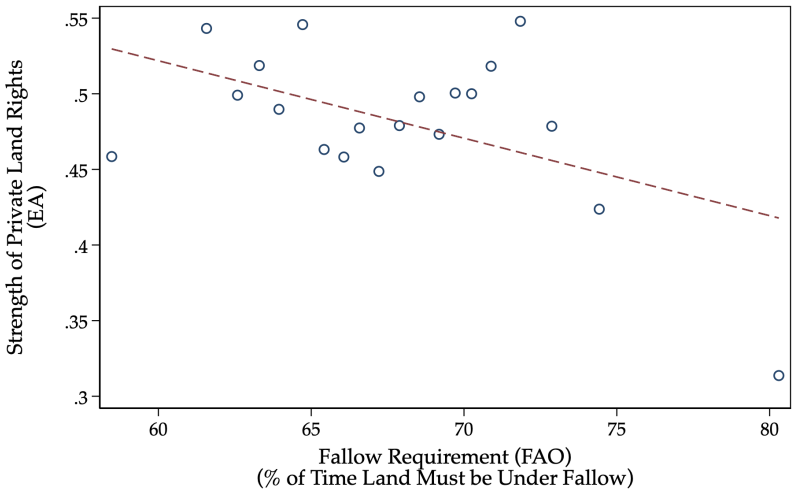
[31] Additionally, when we regress the Communality of Land variable on both measures, only the Strength of Private Land Rights measure is statistically significant (t-value of -2.73, coefficient of -1.15) while the (unweighted) indicator variable for Private Inheritance Rights alone is statistically insignificant and of small magnitude (t-value of -0.37, coefficient of -0.11).

Figure B5
Land Rights Across EA Societies



Notes: Map presents the strength of private land rights for each group in the EA.

Figure B6
Fallowing Requirements & Private Land Rights: EA



Coef: -0.0051; t-stat: -3.1554

Table B2
Effect of Fallow Requirement on the Strength of Private Land Rights

	Dependent Variable: *Strength of Private Land Rights*					
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: SCCS Societies			
Fallow Requirement	−0.008	−0.012***	−0.005	−0.006	−0.006	−0.002
	(0.005)	(0.004)	(0.005)	(0.006)	(0.006)	(0.005)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	0.40	0.40	0.40	0.40	0.40	0.40
Adjusted R2	0.013	0.176	0.218	0.212	0.217	0.572
Beta Coef.	-0.143	-0.196	-0.077	-0.105	-0.093	-0.030
Observations	138	138	138	138	138	126
			Panel B: EA Societies			
Fallow Requirement	0.002	−0.005***	−0.003*	−0.003*	−0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	0.48	0.48	0.48	0.48	0.48	0.46
Adjusted R2	0.001	0.328	0.383	0.387	0.429	0.659
Beta Coef.	0.039	-0.084	-0.058	-0.051	-0.036	0.021
Observations	1,154	1,154	1,154	1,154	1,154	1,005

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS) in Panel A or the Ethnographic Atlas (EA) in Panel B. Robust standard errors in parentheses. The dependent variable *Strength of Private Land Rights* is the interaction between a societies reliance on agriculture and an indicator equal to one if the society had private inheritance rights for land. *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix C Additional Tables and Figures

C.1 Additional Results: Other Ethnographic Variables

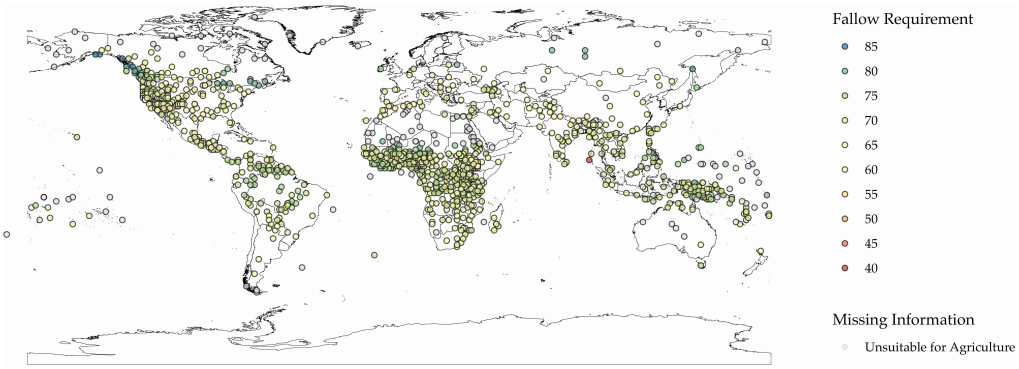
Figure C7
Fallow System, Agricultural Mode, and Institutions

FALLOW SYSTEMS				AGRICULTURAL TECHNIQUES				SOCIO-ECONOMIC STRUCTURES			
AGRICULTURAL STAGE	YEARS CULTIVATION	YEARS FALLOW	FALLOW LANDSCAPE	AGRICULTURAL TOOLS	FERTILISATION METHODS	LAND IMPROVEMENTS	LABOUR INPUT	LAND TENURE	SETTLEMENT FORM & TRANSPORT NETWORK	DIVISION OF LABOUR & EXCHANGE	SOCIAL & POLITICAL ORGANISATION
MULTI-CROPPING	2—3 per year	Negligible	None	Mechanised equipment including tractors	Chemical fertilisers. Green manuring. Marling. Composts. Silt etc.	Irrigation. Terracing	Long hours of regular, daily work	Permanent ownership	As below, more intensive, more feeder roads	Out-migration	Shift of power to (remote) urban centre
ANNUAL CROPPING	Yearly	Several months	None	As in multi-cropping	As in multi-cropping	Irrigation (in dry regions). Terracing		Peasant ownership. small farms (freehold)	Urbanised to some extent	Long work hours. greater division of labour. landless/ wage labourer group	Differentiated forms of social organisation, domain over land
SHORT FALLOW	1—2	1—2	Grass	Hoe, plough, draught animals	Manure from droppings of draught animals	Rare	Pronounced seasonal peak	Individual usufructory tenure, pledging to retain control	Permanent settlements, roads	Some professional artisans and traders	Differentiated forms of social organisation, domain over people
BUSH FALLOW	from 1—2 to 6—8	6—10	Bush	Hoe, axe, fire	Ash, supplemented by burnt or unburnt vegetable materials from outside	None	Redistribution of land becomes less frequent	Specific right to cultivate a given plot subject to authority	Stable and larger settlements	Some division of labour, village markets with part-time artisans	A little more central authority
FOREST FALLOW	1—2	20—25	Forest	Digging stick, axe, fire	Ash in situ	None	Few hours of irregular work	General right to cultivate land, no permanent occupation of plots	Unstable, dispersed settlements, trails	Rudimentary	No central authority

Fig. 1. Boserup's Theory of Agricultural Change. (Modified after an unpublished paper by P. Porter.)

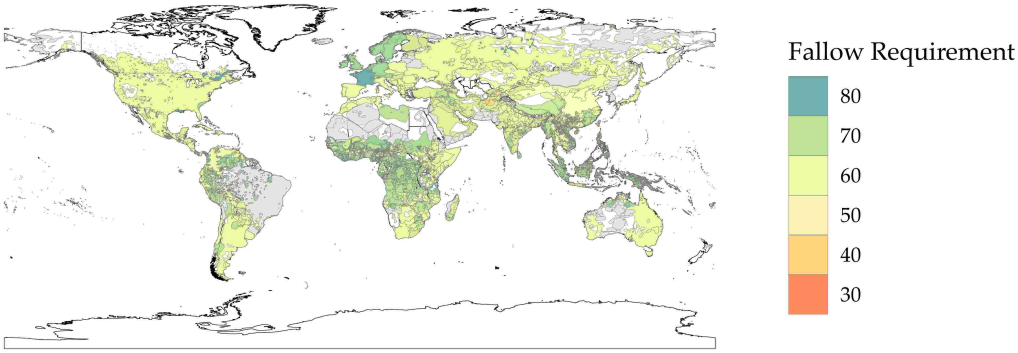
Figure shows Datoo (1978)'s summary of Boserup (1965) theory.

Figure C8
Fallow Requirements Across EA Societies



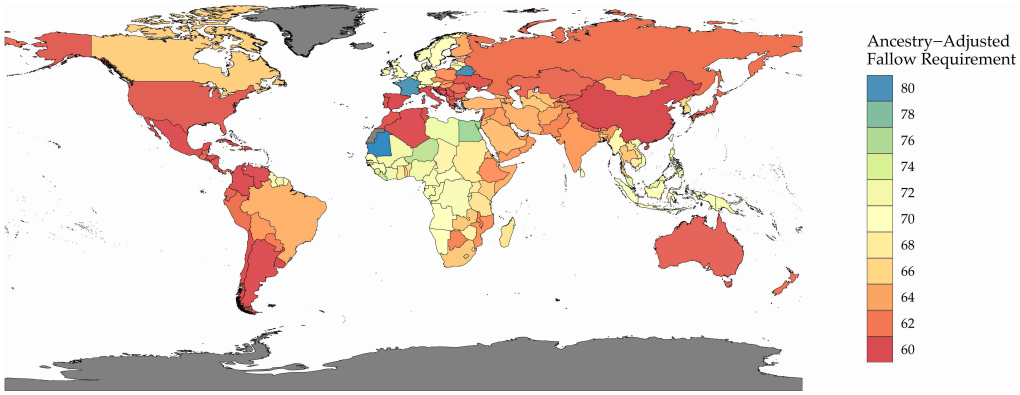
Notes: The map presents the fallowing requirement – percentage of time during the fallow-cropping cycle that land must be under fallow – for the maximum caloric suitability crop for each group in the EA. Grey dots represent groups where the land is not suitable for agriculture.

Figure C9
Fallow Requirements Across Language Groups



Notes: Map presents the fallowing requirement – percentage of time during the fallow-cropping cycle that land must be under fallow – for the maximum caloric suitability crop for each language group in the Ethnologue linked to the EA (Giuliano and Nunn 2018). Grey areas represent groups where the land is not suitable for agriculture.

Figure C10
Ancestry-Adjusted Fallow Requirements



Notes: Map presents the ancestry-adjusted fallowing requirement – percentage of time during the fallow-cropping cycle that land must be under fallow – for the maximum caloric suitability crop for each country using the methodology from (Giuliano and Nunn 2018). Grey areas represent groups where the land is not suitable for agriculture.

Table C3
Effect of Fallow Requirement on Intensity of Agricultural Production

	Dependent Variable: *Intensity of Agriculture*					
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement	−0.052**	−0.058***	−0.052**	−0.057***	−0.035	−0.027
	(0.023)	(0.020)	(0.021)	(0.022)	(0.025)	(0.027)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	3.47	3.47	3.47	3.47	3.47	3.46
Adjusted R2	0.029	0.199	0.194	0.186	0.207	0.490
Beta Coef.	-0.186	-0.206	-0.186	-0.203	-0.123	-0.094
Observations	167	167	167	167	167	154

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS). Robust standard errors in parentheses. The dependent variable *Intensity of Agriculture* is a 1 to 6 categorical variable, with higher values related to more intensive agricultural production. *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C4
Effect of Fallow Requirements on Jurisdictional Hierarchy

	Dependent Variable: *Extent of Jurisdictional Hierarchy*					
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: SCCS Societies			
Fallow Requirement	−0.026	−0.021	0.009	0.015	0.031*	0.026
	(0.016)	(0.013)	(0.016)	(0.017)	(0.017)	(0.016)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	2.14	2.14	2.14	2.14	2.14	2.14
Adjusted R2	0.009	0.247	0.274	0.288	0.316	0.456
Beta Coef.	-0.124	-0.097	0.040	0.071	0.145	0.118
Observations	165	165	165	165	165	152
			Panel B: EA Societies			
Fallow Requirement	−0.005**	−0.005**	−0.004	−0.001	−0.001	0.000
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	0.24	0.24	0.24	0.24	0.24	0.24
Adjusted R2	0.004	0.204	0.221	0.247	0.251	0.290
Beta Coef.	-0.067	-0.061	-0.049	-0.010	-0.007	0.001
Observations	1,023	1,023	1,023	1,023	1,023	1,005

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS) in Panel A or the Ethnographic Atlas (EA) in Panel B. Robust standard errors in parentheses. The dependent variable *Extent of Jurisdictional Hierarchy* measures the degree of jurisdictional hierarchy beyond the local level, ranging from 0=no levels, to 5=four levels. *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure C11
Distribution of Farming Systems *An agricultural survey for more than 9,500 African households survey* Sample (Waha et al. 2016)

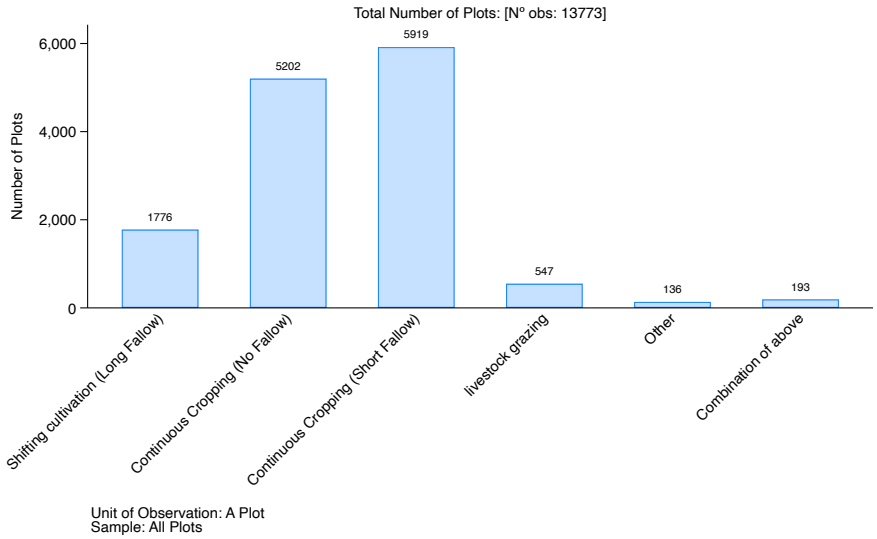
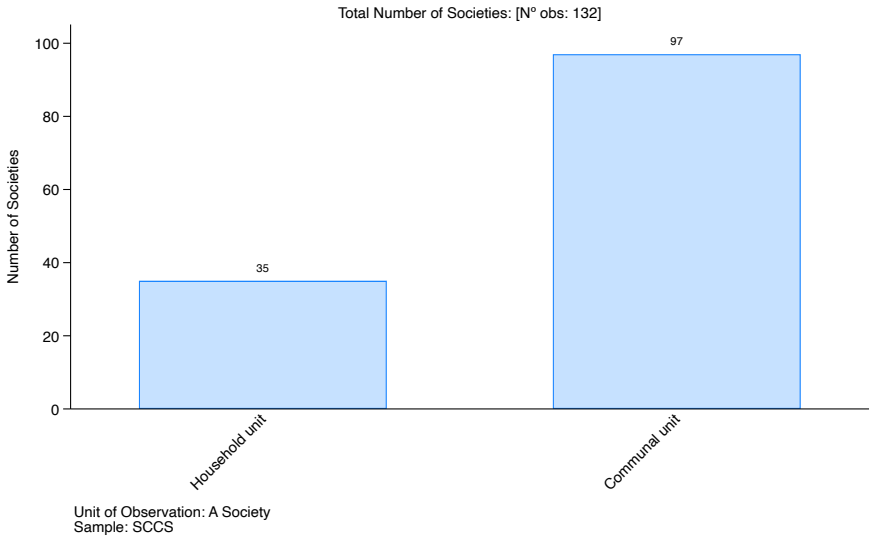


Table C5
Effect of Fallow Requirement on Communal Land Rights: Data from (Ember et al. 2020)

	Dependent Variable: Communal Land Rights					
	(1)	(2)	(3)	(4)	(5)	(6)
Fallow Requirement	0.018***	0.015***	0.014**	0.011*	0.012*	0.008
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Continent FEs	N	Y	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y	Y
Disease Controls	N	N	N	Y	Y	Y
Crop FEs	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	0.72	0.72	0.72	0.72	0.72	0.72
Adjusted R2	.06	.15	.19	.18	.21	.24
Beta Coef.	.101	.088	.078	.066	.072	.043
Observations	120	120	120	120	120	110

Notes: The unit of observation is a society in the Standard Cross Cultural Survey (SCCS). Robust standard errors in parentheses. The dependent variable *Communal Land Rights* is a dummy variable taking the value 1 if a society developed communal land rights and zero otherwise. The data comes from (Ember et al. 2020). *Geography Controls* include centroid longitude, centroid latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development. * p < 0.1; ** p < 0.05; *** p < 0.01

Figure C12
Distribution of Land Rights in SCCS: Data from (Ember et al. 2020)



C.2 Additional Results: Constitutions

The results in Section 4.3 show that longer fallowing requirements are associated with a historically higher prevalence of communal land rights and a lower prevalence of private land rights. We now explore whether this relationship continues to hold in more contemporary measures of land rights. We use data from the Comparative Constitutions Project (hereafter CCP) (Elkins et al. 2009). The CCP database is a systematic codification of the characteristics (form and content) of all the world's constitutions, both past and present. The database covers country-year pairs for most independent countries since 1789. In addition, the database records all changes made to the constitution of a country over time (amendments, new constitutions, reinstatement, interim constitution). In the following analysis, the unit of observation is the constitution in force in a given country on December 31st of a given year since that country has had a written constitution. We examine five different measures of property rights; each measure a different dimension of property rights. We define indicator variables equal to one if a constitution grants individual rights to: (1) transfer property, (2) own property, (3) testate property (right to give property at death), and (4) inherit property. We view each of these measures as proxies for stronger private property rights. Additionally, we combine all four measures in a index for private property rights that is computed as the average of the other four variables. The variables are defined as follows.

Transfer Property: Data comes from (Elkins et al. 2009). Survey question: *Does the constitution mention the right to transfer property freely? 1 = Yes; 2 = No; 96 = other.* In the paper Transfer Property is a dummy variable equals to one if the constitution of a given country in a given year grants the right to transfer property, zero otherwise.

Own Property: Data comes from (Elkins et al. 2009). Survey question: *Does the constitution provide for a right to own property? 1 = Yes; 2 = No; 90 = left explicitly to non-constitutional law; 96 = other.* In the paper Own Property is a dummy variable equals to one if the constitution of a given country in a given year grants the right to own property, zero otherwise.

Testate Property: Data comes from (Elkins et al. 2009). Survey question: *Does the constitution provide for a right of testate, or the right to transfer property freely after death? 1 = Yes; 2 = No; 96 = other. Testate or testacy refers to the right to give property.* In the paper Testate Property is a dummy variable equals to one if the constitution of a given country in a given year grants the right to testate property, zero otherwise.

Inherit Property: Data comes from (Elkins et al. 2009). Survey question: *Does the constitution*

provide for inheritance rights? 1 = Yes; 2 = No; 96 = other. Inheritance refers to the right to receive property. In the paper Inherit Property is a dummy variable equals to one if the constitution of a given country in a given year grants the right to inherit property, zero otherwise.

Index of Property Rights: We compute our Property Rights index with data from (Elkins et al. 2009) as the mean of Transfer Property, Own Property, Testate Property, and Inherit Property.

Table C6 presents the estimates for the relationship between these outcomes and the ancestry-adjusted fallowing requirement measure (described in Section 3.3). Even columns only condition on continent fixed-effects, while odd columns also include the same ancestry-adjusted geographic and ethnographic covariates that are in Table 4. We find that higher ancestral fallowing requirements have a negative and statistically significant relationship with most of these measures of individual property rights. The exception is "inherit property", where the coefficient is negative but not significant. For the index of property rights (columns (9) and (10)), a 10 percentage point increase in the ancestry-adjusted fallow requirement is associated with a 1.3% reduction in the index of property rights measure. These results provide evidence that ancestral fallowing requirements continue to shape the organization of property rights today.

Table C6
Fallowing Requirements and Property Rights in National Constitutions

	Dependent Variable: Right to [...] in Constitution								Index of	
	Transfer Property		Own Property		Testate Property		Inherit Property		Property Rights	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fallow Requirement	-0.017***	-0.015**	-0.012**	-0.018***	-0.008**	-0.010*	-0.011	-0.013	-0.014***	-0.017***
	(0.005)	(0.007)	(0.006)	(0.007)	(0.004)	(0.005)	(0.009)	(0.009)	(0.003)	(0.004)
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnographic Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Outcome Mean	0.22	0.22	0.82	0.82	0.10	0.10	0.09	0.09	0.35	0.35
Num. of Clusters	123	123	123	123	122	122	122	122	124	124
Observations	8262	8262	8098	8098	8362	8362	8153	8153	8707	8707
Standardized Effect	-.169	-.155	-.127	-.18	-.083	-.102	-.117	-.132	-.143	-.174
R^2	0.188	0.232	0.183	0.254	0.080	0.126	0.161	0.238	0.155	0.219

Notes: OLS estimates with robust standard errors clustered at the country level are reported in parentheses. The unit of observation is a country's constitution in a given year. Data are from the *Comparative Constitutions Project* (Elkins et al. 2009). Across specifications, outcomes are dummy variables equal to one if a constitution grants rights to (1-2) transfer property, (3-4) own property, (5-6) testate property, and (7-8) inherit property. The outcome variable in columns 9 and 10 is a property rights index computed as the average of the other four variables. Odd columns control for ancestry-adjusted geographic characteristics (latitude, longitude, elevation, land suitability, malaria) and ethnographic controls (settlement complexity, mean size of local community, political complexity, historical reliance on pastoralism and historical reliance on agriculture). Every specification controls for the log number of years since a constitution was first written, the total number of amendments made to each constitution, year dummies and continent fixed effects. The sample is restricted to countries where all groups practiced agriculture to varying degrees and for which information on fallow time is available.
* p < 0.1; ** p < 0.05; *** p < 0.01

In Table C7 we include additional control variables. Because constitutions of previously colonized countries may be influenced by former colonizers (La Porta et al. 2008) we include

controls for the legal origin of the law. We also show our results are robust to controlling population density in 1500 and GDP per capita in 2000.

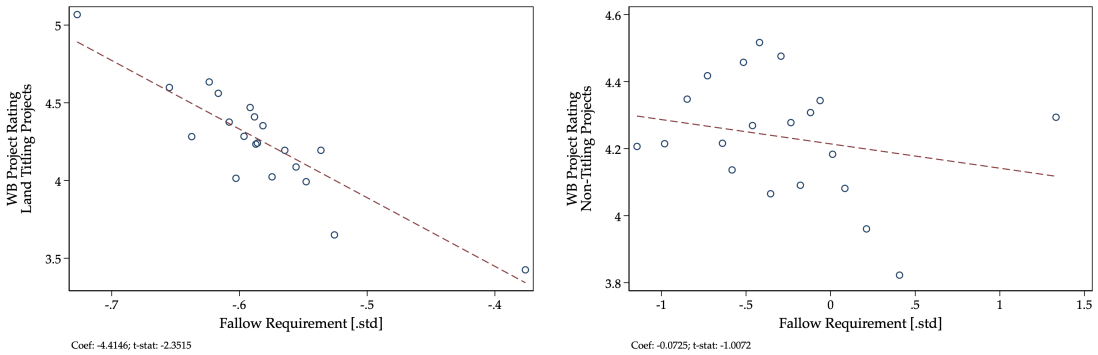
Table C7
Fallowing Requirements and Property Rights in National Constitutions:
Endogenous Controls

	Dependent Variable: Right to [...] in Constitution								Index of	
	Transfer Property		Own Property		Testate Property		Inherit Property		Property Rights	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fallow Requirement	-0.018***	-0.012	-0.014*	-0.019*	-0.007	-0.008	-0.002	-0.008	-0.012***	-0.016***
	(0.007)	(0.008)	(0.009)	(0.010)	(0.004)	(0.006)	(0.008)	(0.009)	(0.004)	(0.005)
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geography Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnographic Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Outcome Mean	0.23	0.23	0.82	0.82	0.11	0.11	0.10	0.10	0.36	0.36
Num. of Clusters	109	109	109	109	108	108	108	108	110	110
Observations	7545	7545	7358	7358	7597	7597	7418	7418	7942	7942
Standardized Effect	-.18	-.125	-.148	-.191	-.069	-.083	-.021	-.083	-.125	-.16
R^2	0.197	0.258	0.217	0.271	0.094	0.145	0.331	0.380	0.181	0.241

Notes: OLS estimates with robust standard errors clustered at the country level are reported in parentheses. The unit of observation is a country's constitution in a given year. Data are from the *Comparative Constitutions Project* (Elkins et al. 2009). Across specifications, outcomes are dummy variables equal to one if a constitution grants rights to (1-2) transfer property, (3-4) own property, (5-6) testate property, and (7-8) inherit property. The outcome variable in columns 9 and 10 is a property rights index computed as the average of the other four variables. Odd columns control for ancestry-adjusted geographic characteristics (latitude, longitude, elevation, land suitability, malaria) and ethnographic controls (settlement complexity, mean size of local community, political complexity, historical reliance on pastoralism and historical reliance on agriculture). Every specification controls for the log number of years since a constitution was first written, the total number of amendments made to each constitution, year dummies and continent fixed effects. The sample is restricted to countries where all groups practiced agriculture to varying degrees and for which information on fallow time is available. * p < 0.1; ** p < 0.05; *** p < 0.01

C.3 Additional Results: World Bank Projects

Figure C13
Communal Land Rights and World Bank Project Success

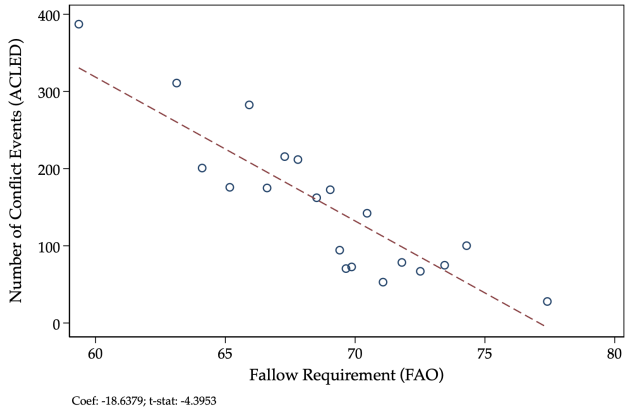


a. Land Titling Projects b. Non-Land Titling Projects

Notes: The figure presents binscatters between the world bank project success rating for projects related to land titling (a.) or projects not related to land titling (b.), and population-weighted fallowing requirement. The unit of observation is a project-country pair. The bottom-left of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the country level.

C.4 Additional Results: Conflict, Income, Local Leaders

Figure C14
Fallowing Requirements & Conflict: All Conflicts



Notes: The figure presents binscatters between the fallowing requirements and the number of conflicts in the ACLED data. The unit of observation is a ethnologue group. Regressions control for latitude, longitude, and continent fixed-effects. The bottom-right of each figure presents the estimated bivariate coefficient and t-statistic. Standard errors are clustered at the ethnologue group level.

Table C8
Effect of Fallow Requirement on Income and Inequality:
Demographic Health and Surveys (DHS)

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Standard Deviation of Wealth Scores					
Fallow Requirement	−0.106	−0.273**	−0.250**	−0.260**	−0.273**	−0.291*
	(0.173)	(0.113)	(0.117)	(0.126)	(0.123)	(0.148)
Country-Year FEs	Y	Y	Y	Y	Y	Y
Geography Controls	N	Y	Y	Y	Y	Y
Disease Controls	N	N	Y	Y	Y	Y
Crop FEs	N	N	N	Y	Y	Y
Population	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	60.31	60.33	60.33	60.33	60.33	60.68
Outcome SD	72.18	72.21	72.21	72.21	72.21	74.20
Adjusted R2	0.609	0.619	0.619	0.619	0.619	0.621
Beta Coef.	-0.007	-0.018	-0.016	-0.017	-0.018	-0.018
Observations	82,451	82,371	82,371	82,371	82,371	77,430
Clusters	117	117	117	117	117	117
	Panel B: Inter-Quartile Range of Wealth Scores					
Fallow Requirement	−0.212	−0.407**	−0.370**	−0.400**	−0.418**	−0.423*
	(0.248)	(0.171)	(0.176)	(0.192)	(0.186)	(0.225)
Country-Year FEs	Y	Y	Y	Y	Y	Y
Geography Controls	N	Y	Y	Y	Y	Y
Disease Controls	N	N	Y	Y	Y	Y
Crop FEs	N	N	N	Y	Y	Y
Population	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	72.56	72.59	72.59	72.59	72.59	72.83
Outcome SD	95.20	95.24	95.24	95.24	95.24	97.65
Adjusted R2	0.527	0.537	0.537	0.538	0.538	0.541
Beta Coef.	-0.011	-0.021	-0.019	-0.021	-0.022	-0.021
Observations	85,017	84,937	84,937	84,937	84,937	79,996
Clusters	122	122	122	122	122	122
	Panel C: Average Wealth Score					
Fallow Requirement	−0.696	−0.585	−0.504	−0.503	−0.682	−0.630
	(1.134)	(0.482)	(0.494)	(0.536)	(0.504)	(0.545)
Country-Year FEs	Y	Y	Y	Y	Y	Y
Geography Controls	N	Y	Y	Y	Y	Y
Disease Controls	N	N	Y	Y	Y	Y
Crop FEs	N	N	N	Y	Y	Y
Population	N	N	N	N	Y	Y
Ethnographic Controls	N	N	N	N	N	Y
Outcome Mean	0.43	0.45	0.45	0.45	0.45	2.16
Outcome SD	156.69	156.76	156.76	156.76	156.76	160.13
Adjusted R2	0.017	0.243	0.243	0.244	0.245	0.241
Beta Coef.	-0.022	-0.019	-0.016	-0.016	-0.022	-0.019
Observations	85,017	84,937	84,937	84,937	84,937	79,996
Clusters	122	122	122	122	122	122

Notes: The unit of observation is a DHS cluster. Standard errors in parentheses are two-way clustered by country-survey wave and ethnologue group. In Panel A, the outcome variable is the standard deviation of the DHS wealth score. In Panel B, the outcome variable is the inter-quartile range of the DHS wealth score. In Panel C, the outcome variable is the average DHS wealth score. All regressions control for cluster size and rural-urban status. *Geography Controls* include cluster longitude, cluster latitude, average rainfall, average temperature, elevation, plough suitability, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Population* includes log population for each ethnologue group. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development for the ethnologue group of each DHS cluster. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C9
Fallow Requirement and Influence of Traditional Leaders

	Dependent Variable: Influence of Traditional Leaders in:			
	Governing Community		Allocating Land	
	(1)	(2)	(3)	(4)
Fallow Requirement	0.011**	0.012**	0.015***	0.013**
	(0.005)	(0.005)	(0.006)	(0.006)
Country FEs	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Geographic Controls	Yes	Yes	Yes	Yes
Disease Controls	Yes	Yes	Yes	Yes
Crop FEs	Yes	Yes	Yes	Yes
Ethnographic Controls	No	Yes	No	Yes
Outcome Mean	2.83	2.83	2.65	2.65
Adjusted R2	.12	.12	.12	.13
Beta Coef.	.048	.05	.057	.05
Observations	38927	37591	38803	37467
Clusters	622	587	622	587

Notes: The unit of observation is a respondent in the Afrobarometer Surveys round 8. Standard errors are two-way clustered by country and ethnologue group. All regressions control for a respondent's age, age squared and gender as well as rural-urban status. Enumeration areas' latitude and longitude included in every specification. *Geographic Controls* include longitude, latitude, average rainfall, average temperature, elevation, and agricultural suitability. *Disease Controls* include malaria suitability and tsetse suitability. *Crop FEs* are fixed effects for the maximum caloric suitability crop in each society. *Ethnographic Controls* includes the presence of large domesticated animals, the proportion of the local environment that is tropical or subtropical, an index of settlement density, and an index of political development for the ethnologue group of each Enumeration Area. * p < 0.1; ** p < 0.05; *** p < 0.01