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Does drought exposure erode trust in the political system in Sub-Saharan Africa?

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Abstract
Climate change is expected to increase the frequency of severe droughts. As water scarcity can destroy vital resources such as crops and livestock, droughts pose major challenges to affected societies. Concerns arise that the resulting hardship and suffering could exacerbate social tensions. Trust in the political system, defined as citizens' overall confidence in the state to deliver satisfactory outcomes, is an integral foundation of stable state-society relations. To illuminate under what conditions droughts might exert a destabilizing effect, investigating their impact on trust in the political system is paramount. Our study is the first to investigate how drought exposure influences citizens´ overall confidence in the political system. Previous research shows that citizens tend to lose trust when dissatisfied with the living conditions and output that a system provides. While droughts emerge gradually and, thus, give states multiple opportunities to intervene, states in the Global South often struggle to master the challenging task of drought management, thereby demonstrating inadequate, dissatisfactory state performance. We argue that failures in successful drought management showcase what goes wrong in a political system, which in turn leads to an erosion of trust in the political system. Using individual-level survey data from Afrobarometer round five, matched with high-resolution water scarcity data, our analysis reveals that recently drought-exposed individuals exhibit significantly lower levels of trust in the political system compared to their unaffected counterparts. This effect is most pronounced in sub-national regions with low state capacity, where the implementation of successful drought relief measures might be particularly difficult.

Keywords Political trust · Drought · Climate change · Quantitative study · Africa

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1 Introduction

Scientists, policymakers, and activists alike point out that climate change will have serious negative consequences for people's livelihoods in many regions globally (IPCC 2021). One highly destructive implication is the more frequent occurrence of extreme weather events, such as prolonged drought periods. While political actors are not responsible for the occurrence of extreme weather events, such incidents carry a political dimension. Whether such events turn into disasters is heavily influenced by a state´s level of hazard preparedness and responses from policymakers. Under conditions where the state is unprepared and unable to respond properly to weather hazards, such events often unfold disastrous effects, destruction of essential resources, decreased economic opportunities, and thirst being only some of them (Cohen and Werker 2008; Tierney 2019; Fraser et al. 2021; Joshipura et al. 2022). Disaster prevention and emergency state aid thus constitute crucial political actions, determining severity and duration of extreme weather associated hardship.

Several studies have pursued the argument that if state institutions fail to protect citizens from disastrous consequences of environmental events, affected individuals lose trust in them (Han et al. 2011; Nicholls and Picou 2013; Uslaner and Yamamura 2016; You et al. 2020). Despite their invaluable findings on the association between disasters and confidence in political actors, we have identified two crucial blank spots. Our study aims to address these blank spots.

First, all existing studies concerned with how environmental events, including extreme weather events and similar environmental disasters, influence citizens´ perceptions of the reliability of state actors, ask about trust in specific political actors. Examples are confidence in central and local governments, the president, or the prime minister. However, trust in certain political actors and trust in the entire political system as such are similar but nonetheless distinct concepts. Confidence in individual institutions addresses citizens' satisfaction levels with recent actions of certain political actors, thereby reflecting short-term perceptions and evaluations of their performance (Citrin and Stoker 2018). Trust in the political system is a more comprehensive concept describing fundamental confidence in the entire spectrum of institutions. This sentiment goes way beyond confidence in individual actors and captures trust in a wide range of them simultaneously, including confidence in political institutions that enact policies (e.g., central, or local governments) but also others that implement the enacted policies and with which citizens interact particularly frequently (e.g., courts, police) (Rothstein 2009). To clearly differentiate between the two concepts, we always refer to "trust in the political system" when meaning the latter concept, to which we attribute particularly great importance.

Second, apart from Ahlerup et al. (2023), existing studies in this realm have focused on the impact of so-called rapid-onset events such as floods and storms. Rapid-onset events are defined as hazards that strike suddenly and unleash their destructive potential almost immediately (Nguyen et al. 2024; Freihardt 2024). Droughts on the other hand, constitute slow-onset events, as their devastating impacts build up over several weeks, months, or even years. While slow-onset events can cause as much harm as rapid-onset events, they often attract less attention as they unfold gradually. One must use caution when extrapolating implications from rapid-onset weather shocks on the consequences of less visible, more slow-onset weather catastrophes. Several studies have shown that the societal implications

of gradual and sudden disastrous hazards oftentimes differ (Renaud et al. 2011; Black et al. 2013; Koubi et al. 2016; Amarasinghe et al. 2020).

Building upon these findings, we examine whether drought, a slow-onset weather event, has the potential to diminish trust not only in certain political actors but the overall political system. We argue that droughts, especially because of their gradual emergence of disastrous impacts, often showcase inadequate state performance, leading to a likely erosion of trust in the entire political system. We stress that this trust-depressing effect should be most pronounced in regions with low sub-national state capacity because especially in those regions political institutions lack the resources to enact and implement successful relief programs. We test our argument by matching individual-level survey data from round five of the Afrobarometer to two drought indices based on spatially disaggregated SPEI-drought data (Tollefsen et al. 2012; Beguería et al. 2014; BenYishay et al. 2017; Peng et al. 2020). This enables us to measure how drought-exposed each respondent was in the time leading up to their survey interview. During the fieldwork for the fifth round of the Afrobarometer (2011-2012), two major droughts, one in East Africa and one in the Sahel zone, struck the African continent. The unusually arid conditions of the former were referred to by several aid agencies as "the worst drought besetting this region in over 60 years" (Ongoma et al. 2015; AghaKouchak 2015). In addition to the severity of drought exposure, Afrobarometer round five data is best suited for examining the outlined research question due to the exceptionally high within-country variation in drought exposure within the sample.

The results of several regression analyses with country-fixed effects, lend support to both parts of our theoretical argument. The findings show that citizens living in heavily drought-affected regions exhibit lower levels of trust in the political system. We further find that the trust-depressing effect of water scarcity is strongest among citizens in rural regions with low state capacity. Our findings remain robust against different operationalizations of drought and different model specifications. By splitting the sample into rural and urban regions, we, moreover, show that our measurement of state capacity does not just pick up differences between urban and rural regions. Even when just selecting individuals in rural areas, we observe great variation in how state capacity endowed their place of residence is. Our results suggest that slow-onset disasters negatively affect the extent to which citizens trust the political institutions and processes in place. However, our findings also emphasize that this effect depends on whether the government has the means to alleviate hardship and adverse conditions. Before presenting our theoretical argument in greater detail, we will provide a brief overview of the relevant literature.

2 How environmental disatsers shape political trust

Despite several scholars stressing that cultural factors and identity concerns influence political trust, there is widespread agreement that confidence in individual actors as well as trust in the political system mostly follow a performance-based logic (Mishler and Rose 2001; Espinal et al. 2006; Keele 2007; Askvik 2008; Schyns and Koop 2010; Stoyan et al. 2016; Godefroidt et al. 2017). This means that whether citizens confide in certain political actors or the system as such, is shaped by the output they deliver and whether it is in line with citizens´ expectations. "Good" political output includes for example a well-functioning economy and the provision of social services (Brinkerhoff et al. 2018; van der Meer 2018).

However, according to this reasoning, citizens will deem individual actors and ultimately the whole system less trustworthy if they find they fail to fulfil their designated purposes.

Several studies use this output-centered logic to connect the occurrence of disastrous weather events and other environmental disasters such as earthquakes and tsunamis to varying confidence levels in political institutions (Han et al. 2011; Nicholls and Picou 2013; Uslaner and Yamamura 2016; You et al. 2020). In times of crisis, citizens expect political actors to deliver a certain output, namely, to assist them when confronted with dire circumstances. Political institutions play a crucial role in determining how well-prepared societies are for disastrous incidents and how quickly the recover from them. This implies that in such times the quality of a state´s response to emergencies receives much attention and is evaluated which in turn might induce citizens to adjust their opinion accordingly (Healy and Malhotra 2009).

Such an effect could run in two different directions. On the one hand, political actors get the opportunity to show off to what lengths they are willing to go to secure their citizens' well-being. Efficient institutions that provide steady support and relief amidst hardship may reassure citizens that a regime can be relied upon if push comes to shove (Healy and Malhotra 2009; Lazarev et al. 2014; Ashworth et al. 2018). Consequently, proficient, and satisfactory crisis management by the state could boost citizens´ confidence in responsible institutions and lead to so-called "rally-around-the-flag-effects" where disaster-stricken individuals hold more trust after a disaster than before (You et al. 2020). Yet, if the sate struggles to provide aid and assistance, the opposite could materialize. In such a case, episodes of extreme weather events or disasters expose inadequacies in the state's performance resulting in less political confidence. To find out which of these two plausible effects applies more frequently, several studies have taken a closer look at different levels of trust in important political actors after such events. Table 1 provides an overview of the most important studies.

The first thing that stands out is that the results of those studies paint quite a diverse picture. While some studies find support for a rally around the flag effect (e.g., You et al. 2020; Lee 2020), others tend to observe the opposite (Akbar and Aldrich 2017; Lee et al. 2021). Moreover, other studies again observe both effects after the same disaster depending on which types of information disaster victims are exposed to, the political attention their region receives in the aftermath of a destructive event, or, most importantly, confidence in which level of government citizens are asked about (e.g., Han et al. 2011; Reinhardt 2015; Ahlerup et al. 2023). This last point refers to a crucial factor: the different dependent variables examined in the various studies. When contextualizing and interpreting their diverse findings, one must bear in mind that the studies we discuss here measure trust in a range of different political institutions (see, Table 1: *Dependent Variable*). While some focus on trust in governments at different levels, others look at trust in individual politicians such as the prime minister or the president. Still others focus on emergency officials, politicians, or political parties in general. Hence, the effect one observes regarding disaster exposure and political confidence might be strongly influenced by support for which actors one looks at.

A major research gap in existing studies becomes evident when paying closer attention to the different operationalizations of political trust. As can be gleaned from Table 1, it is noticeable that all studies focus on trust in specific *partial* political institutions (e.g., government actors) only reflecting the input-side of the political system (Rothstein 2009; Kulin and Johansson Sevä 2021). Partial political institutions are responsible for providing input into

Table 1 Summary of studies on environmental events and trust in political actors

Study	Independent Variable	Event Severity	Geographic scope	Dependent variable	Effect
Ahlerup et al. (2023)	Drought	/	Up to 33 African countries (2002–2018)	Trust in the president/prime minister	Mixed
Akbar and Aldrich (2017)	Floods	1.700 fatalities	Pakistan (2010)	Trust in local and central government	Negative
Albrecht (2017)	Storms, floods, extreme temperature	10 or more fatalities	United Kingdom, Austria, Belgium, Romanis, Czech Republic, Belgium, Slovenia, Germany, Switzerland (2002–2012)	Trust in politicians	Null
Han et al. (2011)	Earthquake	88.000 fatalities	Wenxian, Gansu Province, China (2008)	Trust in local and central government	Mixed
Lee et al. (2021)	Typhoon	699 fatalities	Taiwan (2010–2016)	Trust in central and local government township and village	Negative
Lee (2020)	Earthquake & tsunami	19. 617 fatalities	Tohoku region in Japan (2012)	Trust in local and central government officials (index)	Positive
Miller (2016)	Hurricane (in US), earthquake and tsunami (in Japan)	1.833 fatalities & 19. 617 fatalities	US (2005), Japan (2011)	Local, state, and central governments	Negative
Nicholls and Picou (2013)	Hurricane	1.833 fatalities	Louisiana and Mississippi in US (2008)	Trust in the central, state, and local government	Negative
Reinhardt (2015).	Hurricane	1.833 fatalities	Coastline from Texas through North Carolina, US (2006)	Trust in the president; governor; mayor; and federal, state, and local emergency management officials	Mixed
Uslaner and Yamamura (2016)	Earthquake and tsunami (in Japan)	19.617 fatalities	Japan, Hong Kong, Mainland China, South Korea, Malaysia, Cambodia and Indonesia (2005–2008, 2010–2012)	Trust in central and local government, Prime Minister, political parties, and parliament	Mixed
You et al. (2020).	Earthquake	88.000 fatalities	China (2008)	Trust in central state, and local government	Positive

the political system and enacting policies (e.g., presidents, parliaments, and governments). However, besides partial institutions there also exist impartial political institutions which are an integral component of every political system. Impartial institutions take on a more passive role and monitor the implementation of enacted policies (e.g., the police, courts, and administrative agencies). The stability of a society at large depends on citizens trusting these implementing agencies, as citizens interact with these institutions most frequently, and their staff composition is more durable. For example, in democracies low trust in this type of institution is associated with especially low confidence in democracy (Dahlberg and Holmberg 2014). By not including impartial political actors at all, existing studies fall short of assessing whether disastrous weather and the like can erode this crucial pillar of healthy functioning state-society relations. Thus, to enhance our understanding of the destabilizing potential of extreme weather episodes, it is essential to study their effect on trust in the entire political system, incorporating both partial and impartial institutions.

Furthermore, the overview in Table 1 highlights an additional knowledge gap pertaining to the independent variable, i.e., which type of environmental events studies have focused so far. Existing studies have primarily focused on the impact of a few well-known rapid-onset disasters with restricted geographic scope, such as the Wenchuan earthquake in China, the Triple Disaster in the Japanese Tohoku region, or Hurricane Katrina in the US (see Table 1: Events & Geographical Scope). All these events display an exceptional level of severity with an untypically high number of fatalities (see Table 1: Severity by fatalities). While these studies contribute greatly to understanding how sudden disastrous events affect confidence in political actors, one needs to be cautious when extrapolating these insights to what we should expect for more gradual events like drought periods. Several studies have shown that the societal implications of gradual and sudden destructive environmental events differ significantly (Renaud et al. 2011; Black et al. 2013; Koubi et al. 2016; Amarasinghe et al. 2020). These differences are re-emphasized by recent empirical evidence highlighting that individuals' perception of slow- and rapid-onset events are all but identical (Nguyen et al. 2024; Freihardt 2024).

3 Theoretical argument: droughts & trust in the political system

From previous findings we know that good living conditions are the main driver of citizens' confidence in a political system (e.g., van der Meer 2018). If citizens find that a system delivers satisfactory output, they tend to find it trustworthy, otherwise less so. Concerning the evaluation of what counts as satisfactory output, existing studies uncover few differences between low- and high-income contexts (e.g., Hutchison and Johnson 2011; Godefroidt et al. 2017). We argue that droughts often cause poor living conditions, which in turn reduce drought-affected citizens' trust in the political system compared to their unaffected counterparts. Prolonged droughts frequently destroy resources integral to the economic survival of certain societal groups, such as crops, thereby depriving farmers and agricultural employees of their livelihoods (von Uexkull et al. 2016). When a country's agricultural sector is hit by a drought, it may affect domestic food supplies, resulting in price increases or even food shortages (von Uexkull 2014; De Juan and Hänze 2021). Consequently, drought-exposed citizens are likely to experience economic decline and physical hardship over a longer period of time (Gleick 2014; Plänitz 2019; Döring 2020).

While the destruction caused by drought is more gradual compared to rapid-onset events, we argue that droughts offer at least as many or potentially even more "opportunities" for different political institutions to disappoint citizens. Thus, droughts might have particularly pronounced negative effects on trust in the political system. Precisely because the catastrophic effects of droughts build up over the course of several weeks or months the state gets numerous possibilities to intervene and demonstrate how well its partial and impartial institutions work and what good care it takes of its citizens (Johnson and Brown 2014; Cole et al. 2021). The gradual environmental changes associated with droughts allow partial institutions to carefully craft a response strategy to the unfolding weather event. At the same time, impartial institutions which implement the response strategy outlined by partial institutions get more time to prepare the realization of relief programs. Consequently, political institutions' ability to dismiss responsibility for droughts that turn into a disaster is limited. The gradual nature of droughts allows for the design and implementation of adequate relief programs for affected areas. If they fail to do so, this might be especially frustrating to citizens.

Political institutions can prevent or alleviate the translation of droughts into hardship at least at three different points in time (Kamara et al. 2019; Bandyopadhyay et al. 2020; Buhaug et al. 2021). First, political institutions can provide high-quality water infrastructure such as wells, water pipes, and water intake stations before a drought strikes or even build up infrastructure in regions at the verge of aridity. These measures determine to what extent disastrous dynamics unfold during prolonged aridity (MacDonald et al. 2019; Stewart et al. 2020). Second, governmental investments in hospitals and medical infrastructure may reduce the health damages and negative impacts of suffering from droughts. Even though this might not prevent drought victims from experiencing thirst in the first place, being able to get medical care within time could prevent more severe health consequences or death (Cooper et al. 2019; Lee et al. 2020). Third, enhanced state presence facilitates the extent to which governmental institutions may provide support in times of crisis, like the issuance of water and food should need be. In case of advanced droughts and when crops have failed, partial and impartial institutions need to cooperate to facilitate the allocation and distribution of aid to avoid the most disastrous consequences of droughts, such as malnutrition and famine (Rustad et al. 2020). The absence of such actions for which the state is commonly responsible should be very noticeable to struggling citizens amidst a drought. In addition to offering political institutions the opportunity to intervene over a longer time period, recent studies also highlight that the hardship and suffering accompanying slow-onset events are less often perceived as an exogenous shock but rather as political and economic mismanagement (Herbst 2014; Reinsberg et al. 2019; Nguyen et al. 2024; Freihardt 2024). This leads us to the following hypothesis:

H1: The more drought-exposed citizens have been recently, the lower is their level of trust in the political system.

As outlined, droughts should have the greatest trust-depressing effect when governmental provision, adaptation, and mitigation measures are inadequate. Since this involves aid issuance, such as the distribution of essential resources and relief supplies, a state will only be able to engage in successful drought management if its territorial reach extends into the affected areas. Studies, however, show that state capacity also varies on a sub-national level, meaning that most states cannot exercise infrastructural power uniformly within their territory. Consequently, the quality of governmental drought responses could fluctuate depend-

ing on whether the state has high levels of capacity in the drought-exposed region or not. While living conditions deteriorate gradually and citizens struggle to attribute economic decline to droughts, it is even more unlikely that they receive sufficient state aid in regions with low-state capacity. As a result, citizens living in areas with low sub-national state capacity will suffer to a greater extent when confronted with water scarcity. We, therefore, expect distrust in political institutions amidst drought periods to grow stronger in regions with low levels of state capacity and hypothesize:

H2: The negative effect of drought exposure on trust in the political system is stronger in regions with low levels of state capacity than in areas with higher levels of state capacity.

4 Research design

4.1 Data and case selection

To test our hypotheses, we analyzed individual-level survey data from the Afrobarometer project covering 14 African countries. More precisely, we draw on the dataset compiled during round five of the project, fielded between 2011 and 2013 (Ben-Yishay et al. 2017; Logan et al. 2024). The reasons for selecting round five of the Afrobarometer are three-fold. First, it provides reliable geocodes that allow us to assign high spatial resolution information on individual drought exposure in the previous twelve months to the survey participants. Second, compared to other recent Afrobarometer rounds, it offers the largest sample of politically stable countries that display high within-country variation on individual-level drought exposure. To test our theoretical argument adequately, we need a set of countries where parts of the citizenry have recently suffered a drought while others have not. Only this way we can find out whether drought-exposed citizens hold lower levels of trust in the political system in the same country than non-drought-affected individuals. Excluding conflict-torn countries from the sample helps us to rule out that tensions in state-society relations originate from civil war exposure. Third, the very small standardized mean differences between drought-exposed and unaffected individuals (see, Appendix Table 3) indicate a very balanced sample. This means there are hardly any systematic differences in our sample between respondents affected by aridity and those not affected. We estimate these differences with the R matchit package using the matchit function and including all relevant control variables (Ho et al. 2007).

Between 2011 and 2013 Sub-Saharan Africa experienced two very severe drought episodes, one in East Africa (2011) and the other in the Sahel zone (2012) (Ongoma et al. 2015; AghaKouchak 2015). Among the 35 countries surveyed by Afrobarometer in this period, we identified 14 countries with high within-country variation of drought exposure (see, Appendix Fig. 3; Table 4). We considered all respondents living in regions with values greater than 1 on our main drought measure as affected by water scarcity. We classified a country as displaying a high within-country variation of drought exposure if the standard deviation of our main drought measure for the country exceeded 0.5 on a scale ranging between -2.21 to 2.11 (see, Appendix Table 5).

4.2 Variables

4.2.1 Trust in the political system

The dependent variable of this study is trust in the political system, designed to capture whether respondents believe in the legitimacy of the system in place. The Afrobarometer includes several items asking about the level of trust a respondent holds in specific political institutions (i.e., the president, the parliament, the local government, parties, the tax department, the army, the police, and the courts) (see, Appendix Table 6). As respondents had four reply options ranging from "no trust at all" to "a lot of trust", we created an index of it by applying a generalized partial credit model, suitable for indices combining ordinally scaled indicators. To do this we use R mirt package (Chalmers 2012).

While we expect drought exposure to have a negative influence on trust in the entire political system, we want to avoid picking up an effect that is driven by distrust in a specific subset of institutions. Referring to existing work (e.g., Rothstein 2009) we therefore also distinguish between trust in partial and impartial political institutions to test the robustness of our results (see, Appendix Table 7). To this end, we create, in addition to an index of trust in the political system, separate indices for trust in partial and impartial political institutions. Appendix Figs. 5, 6, 7, 8, 9, 10, 11, 12 and 13 provide an overview of the different trust indices and their respective test statistics. The descriptives in Appendix Table 5 show that the distribution of all three indices is very similar.

4.2.2 Drought exposure

To measure drought exposure, we make use of two different objective drought indices. Large Standardized Precipitation Evapotranspiration Index (=SPEI) values can indicate both severely dry or severely wet conditions, depending on whether they are negative or positive (see, Appendix Table 8) (Peng et al. 2020). We, therefore, use a second drought measure that only captures episodes of severe drought to ensure that this sensitivity to both dry and wet conditions does not interfere with our results (see, Appendix Table 9). For our main analysis, we draw on the Pan-African High-Resolution Drought Index, which is based on the SPEI and combines information on precipitation deficits with atmospheric evaporative demand (Beguería et al. 2014). Since we reversed the index, higher values indicate more severe water shortages. To match data on drought severity to the individual respondents we used QGIS to draw buffer zones approximating a 10 km radius around each respondent´s place of residence and calculated how drought-exposed this region has been throughout the 12 months before the interview took place. As the interviews were conducted in different months, the 12-month long period used to estimate drought exposure is not identical for every respondent.

Second, we apply a drought measure made available by the PRIO-Grid project, also based on the SPEI (Tollefsen et al. 2012; Beguería et al. 2014). This dataset indicates artificial grid-cells of about 55×55 km in size to what extent a grid-cell was subject to a consecutive drought streak each year. If, for instance, a value of 0.5 is assigned to a respondent this means that their home region was drought-affected half of the year preceding the survey. As can be gleaned from Appendix Table 5 the pan-African high-resolution drought index shows great variance. This means that some respondents experienced severely dry condi-

tions while others experienced very wet conditions. The opposite is true for the PRIO Grid Drought Index which only takes on a value other than 0 if respondents were exposed to severely dry conditions over a longer period.

4.2.3 State capacity

The central moderating variable of this study is sub-national state capacity. Existing measures of state capacity often struggle to provide reliable information for sub-national units. For this reason, Luna and Soifer (2017) are the first to propose a survey-based measurement to capture regional variation in state capacity. When the in-person interviews for the Afrobarometer Wave 5 took place, interviewers needed to document and assess survey participants' neighborhoods. During this assessment, interviewers recorded many details about the degree of infrastructure present in an interviewee's place of residence (e.g., electricity grid, water system, schools, health clinics, police stations) (see, Appendix Table 10). By applying a two-parameter latent trait model we use that information to create an index that captures the level of sub-national state capacity for each respondent using the R Ltm Package (see, Appendix Figs. 14, 15 and 16 for an overview of the test statistics) (Rizopoulos 2007).

The state capacity index itself approximates a normal distribution and ranges from -1.64 to 1.11. Higher values indicate that higher levels of state capacity are present in the area where a respondent lives. Appendix Fig. 4 shows that higher levels of state capacity are more common in urban areas. While rural areas can also display high levels of state capacity, they do so less frequently. For this reason, we conduct several robustness checks with split samples (see Table 2: Models 4 and 5 in Empirical Results and Appendix Table 11).

4.2.4 Controls

We further control for several socio-demographic factors, as well as variables designed to account for other performance based and cultural explanations for varying levels of political trust (see, Table 12 in the Appendix). Results of recent studies stress the importance of more microlevel characteristics for drought resilience (Rustad et al. 2020; Uexkull et al. 2020; Buhaug et al. 2021; Linke and Tollefsen 2021). As they suggest that livelihoods immediately linked to the agricultural sector are especially susceptible to drought, a more nuanced measurement of individual-level drought resilience (e.g., profession, employment sector) would have been ideal. However, round five of the Afrobarometer, unfortunately, only asks more generally about educational levels. Thus, we expect more educated individuals to possess higher levels of coping capacity when confronted with severe water scarcity.

5 Empirical results

5.1 Drought exposure and trust in the political system

We test our first hypothesis that drought-exposed respondents hold lower levels of trust in the political system by relying on OLS regression models with country-fixed effects using the R function lm from the R Stats package. The replication files give further insight into all models on which the results we present in this study are based. First, we run a baseline

Table 2 OLS regression models with country fixed effects including the pan-African high resolution drought index and the political trust index (based on a general partial credit model)

Independent Variables	Dependent Variable: Trust in the political system				
	All areas			Rural areas only	
	M1	M2	M3	M4	M5
Pan-African High-Resolution Drought Index	-0.04 ***	-0.04 ***	-0.04 ***	-0.06 ***	-0.05 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
State Capacity Index	-0.03 *	-0.03 *	-0.02	-0.05 **	-0.04**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.0)
Pan-African Drought x State Capacity Index			0.02 *		0.03 *
			(0.01)		(0.02)
Rural	0.14 ***	0.11 ***	0.11 ***		
	(0.02)	(0.02)	(0.02)		
Education	-0.05 ***	-0.04 ***	-0.04 ***	-0.04 ***	-0.04 ***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Age	0.00 ***	0.00 ***	0.00 ***	0.00 **	0.00 **
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male	0.01	0.01	0.01	0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Performance of economy		0.15 ***	0.15 ***	0.14 ***	0.14 ***
		(0.01)	(0.01)	(0.01)	(0.01)
Corruption		-0.40 ***	-0.40 ***	-0.41 ***	-0.41 ***
		(0.02)	(0.02)	(0.02)	(0.02)
Exclusion of ethnic group		-0.25 ***	-0.25 ***	-0.27 ***	-0.28 ***
		(0.01)	(0.01)	(0.02)	(0.02)
Interpersonal trust		0.22 ***	0.22 ***	0.22 ***	0.22 ***
		(0.01)	(0.01)	(0.02)	(0.02)
Intercept	-0.03	-0.40 ***	-0.39 ***	-0.29 ***	-0.27 ***
	(0.04)	(0.05)	(0.05)	(0.07)	(0.07)
CountryFixed Effects	YES	YES	YES	Yes	Yes
R^2	0.18	0.29	0.29	0.28	0.28
Adj. R^2	0.18	0.29	0.29	0.28	0.28
Num. obs.	20,419	15,716	15,716	9274	9274

Note: $^{*}p<0.1$ $^{**}p<0.05$ $^{***}p<0.01$

model that includes only socio-demographic controls (see, Table 2, Model 1). In the second step we add performance-based and cultural variables (see, Table 2, Model 2). This enables us to assess whether the control variables we include in our model change the results of our OLS-models. The regression model diagnostics in Appendix Figs. 17, 18, 19, 20 and 21 demonstrate that our data conform to important assumptions underlying OLS models, namely linearity, homogeneity of variance and normality of residuals. In addition, this enables us to exclude the possibility that the results we present here are only driven by a few influential values. Since the cultural variables contain a substantial number of missing values the sample size varies decisively in-between models. Overall, the results of all four models indicate that citizens' trust in the political system is lower if they experience dryer conditions thereby lending support to our first hypothesis.

In Model 1 the coefficient of drought exposure is statistically significant with a *p*-value below 0.01 and holds the value of -0.04. This indicates a negative relationship and means that on a scale from -2.26 to 1.89 the level of trust in the political system can be 0.17 points lower if an individual lives in the driest region of our sample. This effect remains stable

against the inclusion of additional controls (see, Table 2, Model 2). Compared to the factor exhibiting the most substantive effect–corruption– the effect size of drought exposure is only moderate. All else equal, perceiving corruption as high should decrease trust in the political system by about 0.4 points. Still, the effect size of drought exposure is only barely smaller than the influence of cultural factors (exclusion of one´s ethnic group, interpersonal trust) often highlighted as important determinants of trust in the political system. While there might be even more influential drivers of trust in the political system (education, economic performance, corruption) this underlines that drought exposure has a non-negligible negative influence on trust in the political system. The additional models in Appendix Table 7 show that this effect is not restricted to a subset of political institutions but rather affects both partial and impartial institutions.

5.2 The role of sub-national variation in state capacity

We apply an interaction term to test our second hypothesis arguing that drought exposure decreases trust in the political system if citizens live in regions with low levels of state capacity (see, Table 2 Model 3 & Fig. 1). To do this, we draw on the binning approach proposed by Hainmueller et al. (2019) which accounts for the possibility that the interaction between drought exposure and sub-national levels of state capacity is non-linear. We do this because conventional OLS interaction models assume that interaction effects between two variables are linear. In addition, this approach avoids extrapolation of our estimates due to

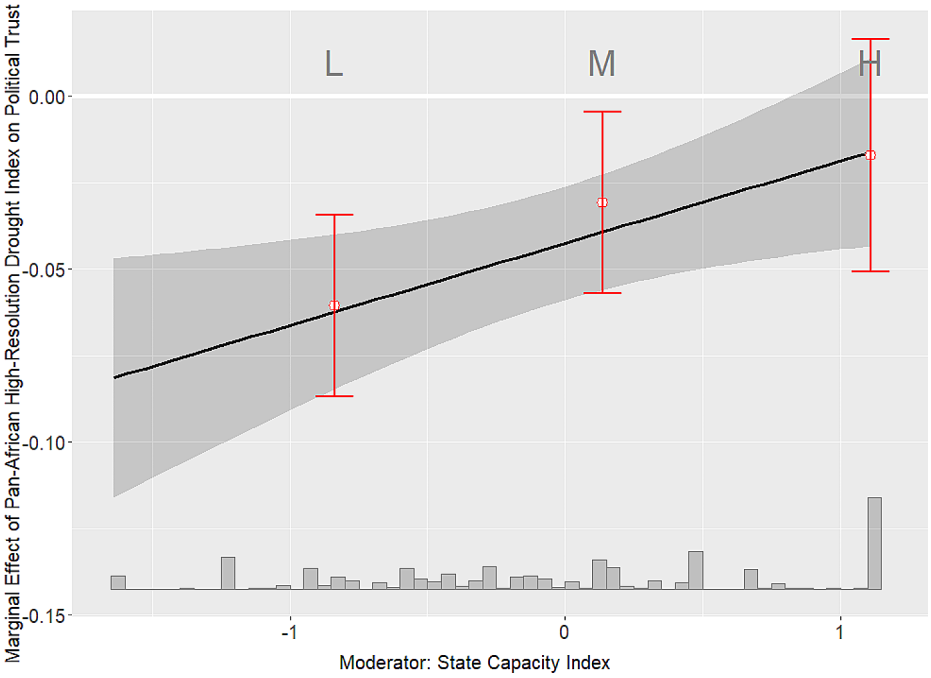

Fig. 1 Marginal effects plot for the interaction between the pan-African high resolution drought index and sub-national state capacity

sparse data by splitting our sample into the first, second, and third tercile of the moderator variable. We deploy the binning approach by relying on the R Interflex package (Hainmueller et al. 2019). The coefficient for the interaction term between the Pan-African high-resolution drought index and the level of subnational state capacity is significant at a level of 0.1 and holds a value of 0.02.

Figure 1 shows the marginal effects plot for the interaction between the Pan-African high-resolution drought index and the level of subnational state capacity. Since we applied the binning approach proposed by Hainmueller et al. (2019), the plot includes three red dots showing the marginal effects of the interaction at bins, representing the moderator's three terciles (low, medium, and high). The red whiskers indicate the 95% confidence intervals for each binning estimator. The black line and the dark grey area around it depict the results of the conventional OLS interaction model.

The marginal effects shown in Fig. 1 yield modest support for the hypothesis that drought exposure only leads to a decline in trust in the political system amongst citizens inhibiting regions with low levels of state capacity. The marginal effect for those living in regions with high-state capacity is insignificant. The marginal effects for those living in regions with medium and low levels of state capacity are negative and significant. However, confidence intervals of the marginal effects sizes overlap. Thus, we cannot rule out that the effect of drought exposure on trust in the political system is of similar magnitude in regions with low and high levels of state capacity outside of our sample. Several robustness checks show very similar results (see, Appendix Tables 7 and 9 and Appendix Figs. 22, 23 and 24). All interaction effects points run in the anticipated direction. However, only the robustness check focusing on partial trust (see, Appendix Fig. 22) yields significant differences between the marginal effects of drought exposure at different levels of state capacity.

Concerning effect sizes: citizens living in regions with low levels of state capacity may display 0.25 points lower trust in the political system if they are exposed to very severe drought conditions. This is still only a moderate effect compared to the influence of high levels of corruption perception but is more substantive compared to the influence of the Pan-African high-resolution drought index alone which has a value of -0.04 (see, Table 2 Model 2). The effect of drought exposure in interaction with low state capacity grows stronger when using the Prio Grid drought index instead of the Pan-African drought index (see, Appendix Fig. 23).

5.3 Trust in the political system and drought exposure in rural and urban areas

Within our sample higher levels of state capacity are more common in urban areas (see, Appendix Fig. 4). To ensure that our state capacity index does not only measure a rural-urban divide we run models including respondents in rural areas only (see, Table 2 Model 4 to 5). The counterparts, models only incorporating urban residents, can be found in Appendix Table 11 and Appendix Fig. 25. In the first model, the coefficient of the Pan-African high-resolution drought index is negative and significant which corroborates our theory. These findings are robust to the inclusion of an interaction term between drought exposure and state capacity. This means that empirical support for our first hypothesis remains true for a rural-only sample.

Figure 2 displays the marginal effects plot for the interaction between the Pan-African high-resolution drought index and state capacity in rural areas. In contrast to the marginal

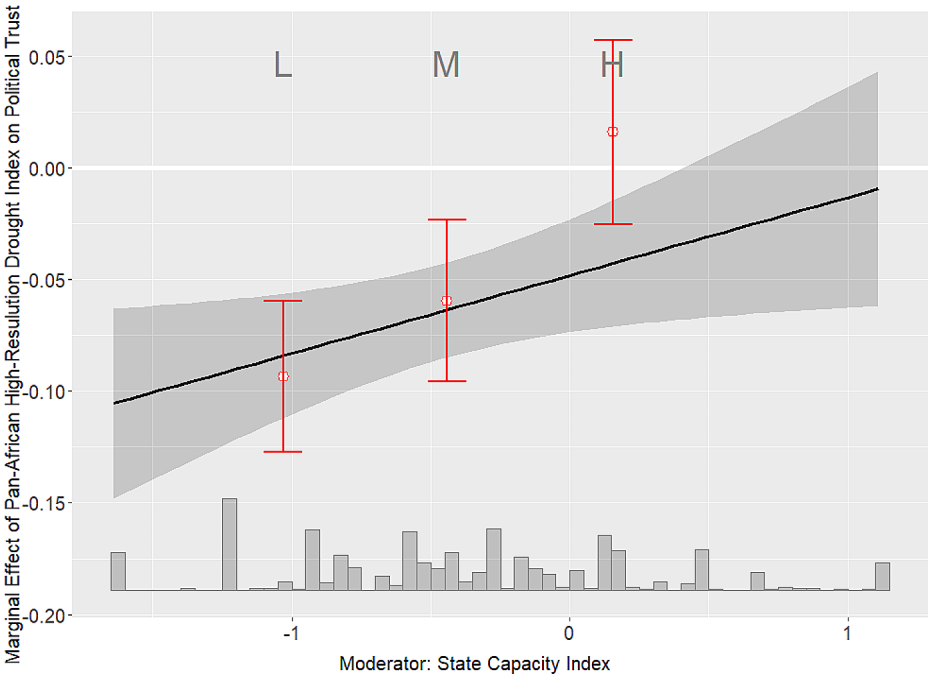

Fig. 2 Marginal effects plot for the interaction between the pan-African high resolution drought index and state capacity in rural areas

effects in the full sample, Fig. 2 reveals significant differences between the marginal effects at low and high levels of subnational state capacity in the rural respondents-only sample. While the marginal effect of drought exposure in rural areas with high state capacity is insignificant and positive, the marginal effect is significant and negative for rural areas with low levels of state capacity. In summary, the analyses on a restricted sample including only rural residents yield empirical support for both of our hypotheses.

6 Conclusion

This study sets out to answer whether individuals who have recently been affected by a drought hold less trust in the political system than unaffected citizens. Despite the projected increase in extreme droughts, we have limited understanding of how water scarcity impacts general attitudes toward the state. Existing findings suggest that extreme weather events and similar disasters could lead to strained state-society relations. Yet, this knowledge exclusively stems from single case studies of rapid-onset events (e.g., floods, storms, earthquakes) studying trust in individual political actors. We argue that the lacuna concerning the effect of more gradual disasters, like droughts, on overall political confidence in the legitimacy of a system as such ought to be filled. We stress that given the growing societal relevance of severe droughts in the years to come, finding out under what conditions extreme aridity can exacerbate distrust in the political system is of central importance. We argue that droughts should have a trust-depressing effect because, if not properly managed,

as it is often the case in low-capacity regions in states of the Global South, they demonstrate poor state performance.

We test the influence of drought on trust in the political system by drawing on geo-referenced survey data of 14 Sub-Saharan African countries collected by the Afrobarometer project between 2011 and 2013. We match this data with two different drought indices to assess the extent of drought exposure for each individual survey respondent in the twelve months prior to the interview. The results of numerous OLS regressions with fixed effects show that citizens in drought-ridden regions exhibit significantly lower levels of trust in the political system. This effect is not restricted to a specific drought measure or a specific subset of political institutions and provides robust empirical support for our first hypothesis. When estimating the interaction effects between drought exposure and state capacity, we observe that state capacity moderates the negative impact of drought on trust in the political system. The trust-depressing effect of drought exposure is stronger in regions with very low levels of sub-national state capacity. Thus, our study shows that findings from highly fatal sudden environmental disasters travel to more gradually evolving slow-onset events like droughts.

Previous studies in the field examined the relationship between sudden environmental disasters and trust in individual political institutions. In comparison, we apply a more encompassing definition and operationalization of political trust, focus on a gradual extreme weather event, and study a broader set of countries. Our findings make a significant contribution to this research strand by demonstrating that drought exposure can lead not only to a loss of trust in individual political actors but also in the political system. Since high levels of trust in the legitimacy and reliability of a political system are essential for stable, peaceful state-society relations, our findings have important implications for the literature on climate change and conflict. If droughts have the potential to dismantle citizens' trust in the entire political system, it is more likely that these events can serve as trigger points for political instability. Several recent examples corroborate such a line of reasoning and underline how often citizens hold the state responsible for inadequate disaster management. In July 2018, protestors blocked the highway connecting Nairobi and Mombasa demanding actions taken against the acute water shortages grappling Makueni County. In December 2021 residents of the Kiti village near Kalungo in Uganda took to the streets to complain about the severe water scarcity in the region demanding that that the government build a water pipe (Raleigh et al. 2010). Our findings suggest that the discontent with the political system voiced in such protests is rooted in increased distrust towards the political system.

Yet, there is still much to learn about the causal link between drought exposure and trust in the political system, which goes beyond the scope of this study. Our study points out that state-capacity may play an important role moderating the negative effect of drought on trust in the political system. However, our measure of state capacity is only a proxy for a state's actual response to an extreme weather event. A recent country case study by Petrova and Rosvold (2024) for instance shows that state aid is essential for shaping individuals' trust in government. Inferring from levels of overall state capacity to how well a disaster was managed and to what extent drought victims received help remains much left to be desired. Even if a state has the capacity to provide relief it does not automatically mean it will do so. Regional favoritism and other strategic political considerations might influence a state's willingness to aid in times of emergency (Ahlerup et al. 2023). We acknowledge that using a state capacity index as proxy measure limits the insights our study can provide about specific mechanisms at play. However, to the best of our knowledge, no comprehensive mea-

sure for the quality of state responses to extreme weather events for a larger set of countries exists. Compiling such a novel and comprehensive dataset on state responses to drought conditions, thus, constitutes a fruitful avenue for further research.

In the absence of such a dataset, it is essential that large-scale quantitative studies, like ours, are complemented with qualitative more in-depth case studies. Especially so, since public opinion on the quality of a state's response to extreme weather events may also be driven by news reports (see, You et al. 2020). Focusing on a few cases would enable researchers to trace the process of how drought exposure diminishes trust in the political system or study the contexts in which droughts translate into lower trust more thoroughly. Another approach, which could mitigate the drawback connected to our cross-sectional research design would be a panel study that surveys individuals several times over the course of several years. While such an approach is highly resource intensive it could yield insights on how slow-onset weather events shape individual-level perceptions about the state as they evolve slowly over time.

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Data availability All data generated or analysed during this study are included in this published article and its supplementary information files.

Declarations

Competing interests The authors declare that they have no conflict of interest.

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