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Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecocon

Surveys

Climate change and the farmer-Pastoralist's violent conflict: Experimental evidence from Nigeria

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ARTICLE INFO

JEL codes:

C9
D74
N5
Q34

Keywords:

Conflict
Developing countries
Survey experiment
Pastoralists

ABSTRACT

We examine how a better understanding of how climate change induces herder migration to other locations and subsequent conflicts with sedentary farmers influences respondents' support for policies that accommodate outgroup members. We conducted a pre-registered survey experiment with 550 residents of a conflict zone in Nigeria and discovered that as perceived herder vulnerability due to climate change increases, residents are inclined to support policies that accommodate these herders. In other words, rhetorical exposure that leads respondents to perceive climate change as the primary driver of herder migration to other communities increases support for accommodating policies (i.e., policies that support integrating outgroup members into their community). The effects are essentially consistent regardless of the respondents' proximity to the conflict, as measured by their loss experiences or their trust in outgroup members or dominant domestic institutions. These results highlight the need to conceptualise vulnerability as the primary driver of the herder-farmer conflict, which is a settled fact as opposed to other 'conspiratorial' narratives, allowing for new methods of mapping public opinion in favor of integrating both groups for peaceful coexistence in conflict zones.

1. Introduction

Climate change, particularly in low-income countries, is likely to exacerbate existing economic inequalities (Bai and James Kung, 2011; Burke et al., 2015; Adhvaryu et al., 2019). This can lead to increased economic and social vulnerability, and even intergroup conflict, such as the farmer-herder conflict in the Chad Basin (International Crisis Group, 2017, 2018; Vesco et al., 2020; Unger, 2021; Cattaneo and Foreman, 2023; Eberle et al., 2020). That is, climate stress triggers herders migration in search of grassland and water, as well as exacerbated resource competition between farmers and herders (Burke et al., 2009; Hsiang et al., 2013; Mach et al., 2019). As a result, when negotiations and regulations fail to resolve such heightened competition, it leads to violent conflicts.

As seen with transhumant pastoralism, climate change can exacerbate existing tensions between herders and farmers. This form of pastoralism, often seen with Fulani herders, is an adaptive strategy for herders in semi-arid regions, who engage in seasonal migration in search

of grazing fields. This way of life has evolved to cope with challenging environmental conditions. However, the practice often leads to conflicts with farmers, as herders may trespass on agricultural lands, damaging crops. Establishing clearer boundaries between grazing and farming areas could help foster peace between these groups.

To combat this violence, the Nigerian government enacted the National Livestock Transformation Plan to address climate-induced pastoralist migration and encroachment on sedentary farmlands, as well as prevent resource competition-related conflicts. This initiative is currently in its pilot phase in certain states, with full implementation anticipated by 2028. This policy intends to transition the grazing strategy from free-roaming herding to a confined system in ranches and grazing reserves, allowing the grazing zone to adapt for sustainability. However, religion and ethnicity profoundly divide Nigerians' support for such policies. Approximately three in four residents of the predominantly Muslim and Hausa/Fulani northern region of Nigeria are satisfied with the government's proposal to resolve the conflict, while less than one in four residents of the predominantly Christian southern region

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Received 4 July 2023; Received in revised form 29 August 2024; Accepted 2 November 2024

Available online 11 November 2024

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support the government's approach.¹ Anecdotal evidence suggests a strong public perception that this policy disagreement stems from deep-seated distrust of the government and settlers: while some advocate for confined ranches for animal husbandry, others view this policy as a plot to seize indigenous land and the government's intention to resettle large populations of members of a specific group—the Fulani herders (International Crisis Group, 2017). These divergent perspectives have fuelled the delayed implementation of the policy in other locations, despite the ongoing violent clashes.

This paper examines citizens' support for similar policies aimed at resolving the conflict between herders and farmers in light of an information treatment that highlights climate-induced migration as a plausible driver of the conflict.² It showcases experimental evidence of an intervention that aims to enlighten participants about a crucial factor contributing to the herder-farmer crisis: the climate-induced migration of herders into farmer communities, leading to conflict between the two groups. The study, a randomised controlled trial, aims to experimentally answer the following question: Does providing information about the extent to which climate change triggers herder-farmer clashes due to pastoralist migration and subsequent farm encroachment enhance citizens' support for conflict-resolution policy options? The importance of answering this question lies in its ability to test theories of resource competition, conflict, and peacebuilding in a context of intergroup mistrust, where identity cleavages and group favouritism influence policy support. These issues obscure our understanding of how exposure to such information about one cause of the conflict could stir sympathy towards herders and therefore influence attitudes towards the conflict.

We randomly assign residents of conflict-prone locations in Nigeria to participate in an information session, where we expose them to an expert review of how climate change is driving North-South herder migration, leading to encroachment and conflict with sedentary farmers. We provide a detailed explanation of how the decreasing quality of the environment, changes in rainfall patterns, water scarcity, drought, and heat that have dried up the grassland for pasturing and grazing in the Sahel and far north regions of Nigeria have pushed herders towards the south, which has a more moderate climate and greener grazing fields. This narrative serves as qualitative evidence, highlighting the Fulani herders' response to the primary reason for their migration to locations outside their homeland. We integrated this session into a survey and then assessed citizens' support for policies aimed at reducing herder-farmer confrontations and clashes. We assessed this by considering respondents' willingness to donate an amount from the 500 Naira (approximately 1.21 USD) gift that they received at the end of the study to a reputable NGO advocating for confined pastoralism or ranching. We also examine a different response to a series of questions on self-reported views about various policies, classified as integration and non-integration policies, depending on whether the policy seeks to integrate the two groups for peaceful conflict resolution. The purpose of soliciting support for diverse policy options is to establish a policy mix that citizens support based on their exposure to treatment.

We show from our result that, despite the highly charged nature of the herder-farmer conflict, exposing citizens to the consequences of

climate change in driving herder migration (and the resulting conflict with farmers) can increase support for policies that address the violence and promote peaceful resolution. Following the information session, experimental treatment participants supported non-governmental organizations that advocate for confined pastoralism or ranching policies. Their willingness to donate increased by 0.19 standard deviations, and they were 17 percentage points more likely to support policies that integrate herders into their respective communities. These findings suggest that a better understanding of the conflict driver can shift farmers' attitudes and behaviours towards outgroup herders.

Our analysis also explores the potential mechanisms driving the results. While we did not directly measure the treatment's impact on sympathy for herders, our analysis explores other potential mechanisms driving the results. First, we examined whether the intervention influenced individuals' perceptions about the importance of climate change in driving the herder-farmer conflict. To do this, we innocuously asked respondents to what extent they believe climate change, among other causes as prevalent in Nigeria's political discourse, is causing the herder-farmers conflict. Our results suggest that those in the treatment group were 9.3 percentage points more likely to agree that climate change and environmental disturbances caused the conflict between herders and farmers.

Second, we examined whether the intervention influenced individuals' perceptions about the effectiveness of sedentary ranching³ in fostering herder-farmer cohesion. To do this, we asked respondents whether the establishment of sedentary ranches would benefit, harm, or have no effect on cohesion. Our results suggest that the treatment increased by 15 percentage points the proportion of individuals who believed sedentary ranching would strengthen cohesion. This suggests that the treatment galvanized sympathy for the Fulani, as residents now understand that herders would have remained in their homeland for grazing purposes if they could have cushioned the climate shock. They are less likely to believe that sedentary ranching would have no effect on cohesion.

Our analysis also explores heterogeneous effects based on respondents' personal experience with the conflict. We argue that individuals' decisions are influenced by their personal experiences, which can attenuate or amplify framing effects (McElroy and Mascari, 2007). However, we found that the treatment's effect was consistent regardless of individuals' proximity to the conflict or their trust in outgroup members or public institutions.

Our study offers valuable insights into intergroup conflict and peacebuilding efforts by examining how framing a climate-driven conflict between herders and farmers could drive group cohesion in conflict-affected states in Nigeria. Nigeria is a hotspot for herder-farmer conflict in West and Central Africa, with an estimated annual loss of 14 billion dollars and 3641 casualties between 2016 and 2018 (International Crisis Group, 2017; Amnesty International, 2018). As a result, there are ongoing discussions about policies to reduce the conflict, including sedentary ranching. Since the escalation of the conflict in the 2010s, national discussions have focused on policy solutions that promote national unity while addressing the root causes of the violence. One such solution is sedentary ranching, a common practice in many developed countries. Other developing countries facing similar conflicts, such as Ghana, have advocated for this policy with caution due to concerns about identity discrimination and land seizure. By understanding how resource-motivated encounters drive the conflict between

¹ Computations from <https://noi-polls.com/nigeriaaes-security-challenge-s-an-urgent-need-to-resolve-herdsmen-and-farmers-conflict/> and <https://noi-polls.com/nigerians-express-dissatisfaction-over-governantaes-mediation-between-farmers-herdsmen/>

² Climate change, particularly prolonged droughts in semi-arid areas, pushes herders to migrate to farming areas for pasture, and population growth and expansion of agricultural land in grazing reserves intensify resource competition between farmers and herders (International Crisis Group, 2018, 2021).

³ We argue that sedentary ranching is an inclusive policy because it accommodates herders in the community of the farmers.

herdsmen and farmers,⁴ our findings can inform policy decisions, even in the face of “latent” prejudices and outgroup discriminatory behavior. Our study suggests that peacebuilding education interventions focused on addressing resource competition could be a crucial tool for societies in developing countries to manage diversity and recover from large-scale violent conflict.

Finally, our evidence directly speaks to the political resolution mechanism proposed in Eberle et al., 2020 and McGuirk and Nunn (2024). This study, in particular, shows that engaging information campaigns to explain how migration push factors drive the herder-farmer conflict helps to reframe the conflict issue and generate support for mechanisms that help to resolve land conflicts. This approach distinguishes this study from other relevant and recent papers that focus on mitigation tools for conflict resolution, such as livestock insurance (e. g., Gehring and Schaudt, 2023; Sakketa et al., 2023) and diversification (Fadare et al., 2024). While these mitigation tools can be effective in certain contexts, they may not be applicable to all low-income farmers who depend on agrarian activities for their livelihoods. On the one hand, smallholder farmers facing frequent losses may find livestock insurance unaffordable or inaccessible due to the lack of accounting for these losses in government or industry data, which drives insurance premiums even higher (Biese and Sarpong, 2022). On the other hand, diversification, although potentially beneficial, may necessitate significant upfront investments (Adhikari et al., 2023) and face limitations due to factors like ecological constraints, market access, or cultural preferences (Isbell et al., 2021; Makate et al., 2023). Therefore, our study highlights the importance of considering a range of approaches, including political resolution mechanisms, to address the complex challenges of land conflicts in low-income agrarian communities.

2. Study setting

2.1. Nomadic herding in Nigeria

Northern Nigeria is home to a nomadic tribe called the Fulanis, the only tribe in Nigeria known for herding. Ibrahim (1966) provides a history of the Fulanis in Nigeria, revealing that a significant section of this tribe continues to engage in this transhumant pastoralist practice, which involves nomadic movement to secure fresh grazing grounds. There are two groups of herding Fulanis: semi-sedentary Fulani, who are primarily farmers but maintain herds of cattle for which they must seek pasture in other locations, and pastoral Fulani, who rely entirely on their herds for subsistence and engage in continuous transhumance, migratory drift, and periodic migration (Stenning, 1957). Irrespective of the type of pastoral engagement by this group, there is documented evidence that this group exhibits a cyclical pattern of migration primarily driven by seasonal changes in rainfall and agricultural practices between the North and Southern Nigeria (Dyson-Hudson and Dyson-Hudson, 1980; Gefu and Gilles, 1990).

Migratory herders are usually composed of 10 to 20 families, with herds of 20 to 40 cattle, traveling an average distance from their homeland of about 180 miles⁵ (Lambrecht, 1976). This migration

⁴ McGuirk and Nunn (2024) explain that herders' migration into farming areas is the mechanism behind the increased violent events in farming areas that are near herders' ancestral homelands. Also, Eberle et al. (2020) find that areas with mixed residences of farmers and herders have more frequent violent events than other areas, as farmers and herders are disputing over land and water resources. McGuirk and Nunn (2023) also indicate the gap in economic development between farmers and herders as a source of conflict. Additionally, legal institutions play a significant role in determining whether disputes escalate into conflicts (Eck, 2014).

⁵ At a consistent walking speed of 3 miles per hour, it would require approximately 60 h to cover a distance of 180 miles. This is also the same as walking continuously for 2.5 consecutive days.

pattern usually occurs between five and six months, taking into account the potential for commerce (sales of processed dairy at the local market), rainfall patterns, and avoiding exposure of their herds to disease. Regardless of the migration pattern, whether on a seasonal or permanent basis, the issue with Nigeria's current social and economic construction is its potential for violent confrontations with the host community (Brottem, 2021).

For example, Nasarawa state, which is predominantly rural with an economy centered on arable agriculture for cash crops and sparse habitation, offers favorable conditions for both grazing and farming activities (Ayih, 2003). In 2017, it was estimated that over 2 million cows and thousands of herders arrived in the state seeking settlement and grazing land.⁶ This large influx, nearly equivalent to the state's population of about 2.5 million in 2017,⁷ could lead to fierce competition for increasingly scarce land resources, potentially causing confrontations and violent conflicts.

2.2. Environmental stressors and conflict in Nigeria

Fig. 1a illustrates that rainfall occurs throughout the year in Nigeria, with the heaviest precipitation occurring from April to October. In Nigeria, the average temperature decreases from April to October, whereas it increases from November to March. Nigeria is vulnerable to a wide range of climate hazards and is highly exposed to climate variability (The World Bank, 2021). Coping with such climatic shocks is also difficult because of high levels of poverty, underdevelopment, and reliance on rainfed agriculture. Hence, Nigeria exemplifies an African country faced with increasing climate risk and intensifying competition over natural resources.

At the state level in Nigeria, climatic conditions vary significantly (see Fig. 1b). As shown in the map, some locations have higher average temperatures than others. Such differences in climatic conditions may increase competition for finite natural resources due to migration from other states facing adverse climatic conditions. For example, due to higher variations in temperature and precipitation in the upper (north) region of Nigeria, which comprises the Fulani herders' homeland, there has been a continuous migration of herders from this location to other locations, mostly states in the mid-regions (Olaniyan and Okeke-Uzodike, 2015; International Crisis Group, 2017). This has led to violent confrontations between herdsmen and farmers over competition for arable and sparse vegetation grassland, making competition over access to grazing sites one of the primary causes of conflict (Amnesty International, 2018).

The competition for resources, exacerbated by climate change and migration, has led to a surge in violence between herders and farmers in Nigeria. In 2018, severe violence from confrontations between sedentary farmers and herders caused significant deaths, almost equivalent to sectarianism and extremist religious conflict. In addition to the loss of lives, the destruction of properties, schools, and facilities, has been estimated to cost Nigeria a sum of 14 billion US\$ annually (Amnesty International, 2018). The cost of rehabilitation, welfare for the displaced, and reconstruction is another burden on the Nigerian economy from this conflict. For example, in the second quarter of 2018, 28 million US\$ was spent on rebuilding villages affected by the crisis.

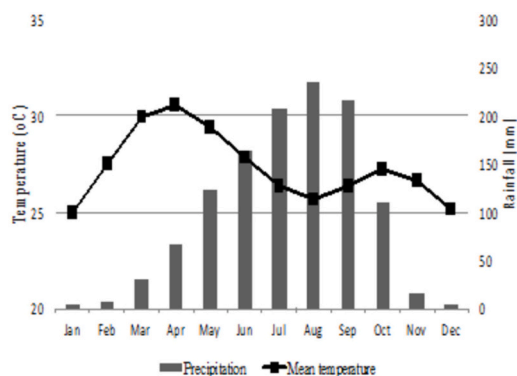
2.3. Open grazing policy in Nigeria

At the subnational level, open grazing prohibition laws exist in 15 states, namely, Abia, Akwa Ibom, Bayelsa, Benue, Delta, Ebonyi, Ekiti,

⁶ See the newspaper extract describing this situation - <https://punchng.com/anxiety-as-displaced-herdsmen-make-nasarawa-new-home/>

⁷ See state population by the National Bureau of Statistics, Nigeria [here](https://nbs.gov.ng/).

A. Average Monthly Temperature and Rainfall for Nigeria, 1991–2020



B. Mean Temperature in Nigeria (sub-national), 1991–2020

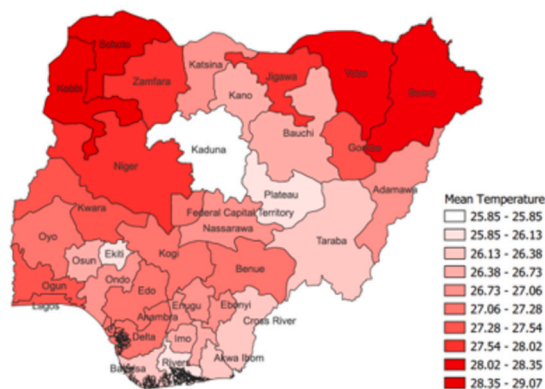


Fig. 1. Temporal and spatial distribution of temperature in Nigeria.

Note: Fig. 1A and B represent the observed averages for the months from 1991 to 2020. Fig. 1A shows the monthly average temperature and precipitation measured at the surface of the Earth over the 30-year period, from 1991 to 2020, while Fig. 1B shows the entire period averages for temperature across different states in Nigeria. Nasarawa State is located in central Nigeria. The states in the upper region of the map are those in northern Nigeria, while those in the lower region are those in the south.

Source: Authors computation from the World Bank Climate Change Knowledge Portal here.

Enugu, Lagos, Ogun, Ondo, Osun, Oyo, Rivers, and Taraba. See Fig. 1b for locations on the map.⁸ This policy outright bans the practice of open grazing by nomadic herders, aiming to address unrestrained grazing of cattle and the recurrent confrontation and conflict between sedentary framers and nomadic herders in Nigeria. Opponents of this law note that it increases hostility and antagonism against the pastoralist community, leading to more violent confrontations between herders and farmers, and that it contravenes the constitutional provision of free movement (International Crisis Group, 2018).

As a result of this law, there has been an exodus of herdsmen and cattle to neighbouring states, including Nasarawa, which has led to conflicts with farmers. In addition, the federal government launched the National Livestock Transformation Plan—2018 to 2027—a multifaceted intervention aimed at modernising livestock management, boosting productivity, and enhancing security (International Crisis Group, 2018). The federal government has selected ten states, including Nasarawa, as pilot locations, but opposition to this policy persists due to concerns that allowing Fulani groups to reside in the community could lead to ethnic hegemony, land grabs, and future conflicts (Adekola et al., 2022).

2.4. Study setting

Addressing the farmers-herders conflict necessitates a policy direction that addresses the requirements of both herders and farmers while confronting the primary issue of resource competition. This paper investigates one such policy and how to ensure citizen buy-in through an information treatment that emphasizes climate change as a plausible cause of the conflict. (Moritz and Mbacke, 2022). The sentiment underlying the cause of the conflict is typically related to other socio-cultural, historical, and political concerns (Moritz and Mbacke, 2022). This sentiment has been fueled by provocative headlines, political speeches, and media pundits who have persistently portrayed this violence in sociocultural and religious contexts. In the context of escalating violence across all 36 states and the Federal Capital Territory Abuja without much success by government agencies to curb insecurity (Mbaegbu and Duntoye, 2023), and an information vacuum that has been exacerbated by a climate of information suppression (Asunka and

Logan, 2021), these other narratives for this violence are pervasive.

In addition, these other narratives are rooted in a long history of mistrust between ethnic and religious groups in Nigeria, as well as other African nations, resulting from a variety of ethnographic, sociological, ancestral, and historical factors (see Nunn and Wantchekon, 2011; Gershman, 2016; Lowes et al., 2017; Okoye, 2020). The location of the study, the state of Nasarawa, is in the central region of Nigeria, which is one of the states with low levels of intergroup trust and social cohesion. When residents are asked whether communities are stronger when they are diverse or when they are homogeneous, 39 % of its residents believe that homogeneity in the composition of a community makes it stronger, making this location the third highest in this index.⁹ Residents report lower preference for cohabiting with individuals of different ethnic groups (approximately 82 % compared to the national average of 90 %) and residents report approximately 9 percentage points lower preference for cohabiting with individuals of different religion compared to the national average.¹⁰

The state of Nasarawa, where approximately 80 % of the population is engaged in agriculture,¹¹ is endowed with fertile land and a climate that encourages the development of vegetation and farming. It has lower annual mean temperatures compared to other states in Nigeria (Fig. 1b).¹² This state is also the country's “red zone” for herders-farmers conflicts (see Fig. 2). On the basis of these facts, it is probable that elevating the prevalence of climate change as a cause of the conflict in this context would have a significant impact on the attitudes of locals towards accommodating members of the outgroup.

Furthermore, in this region, conflicts between herders and farmers are pervasive (see Fig. 2). Between 2017 and 2018, the number of violent confrontations involving Fulani militias increased by 400 %, ¹³ making this location one of the conflict hotspots in Nigeria (see Fig. 2). This sudden spread leaves room for speculation about the underlying

⁸ For more detail, see <https://www.partnersnigeria.org/policy-brief-open-grazing-prohibition-laws-in-nigeria-policy-challenges-and-alternatives/>.

⁹ This statistic comes from the Afrobarometer 2022 survey and the average for other communities in Nigeria is 26 %.

¹⁰ These statistics comes from the Afrobarometer 2022 survey.

¹¹ Statistics gotten from a national newspaper analysis of Nasarawa state's farming potential – see <https://www.thisdaylive.com/index.php/2021/01/24/nasarawa-an-emerging-food-basket/>

¹² This, among other reasons, makes Nasarawa State one of the preferred locations for herders.

¹³ See ACLED (2018).

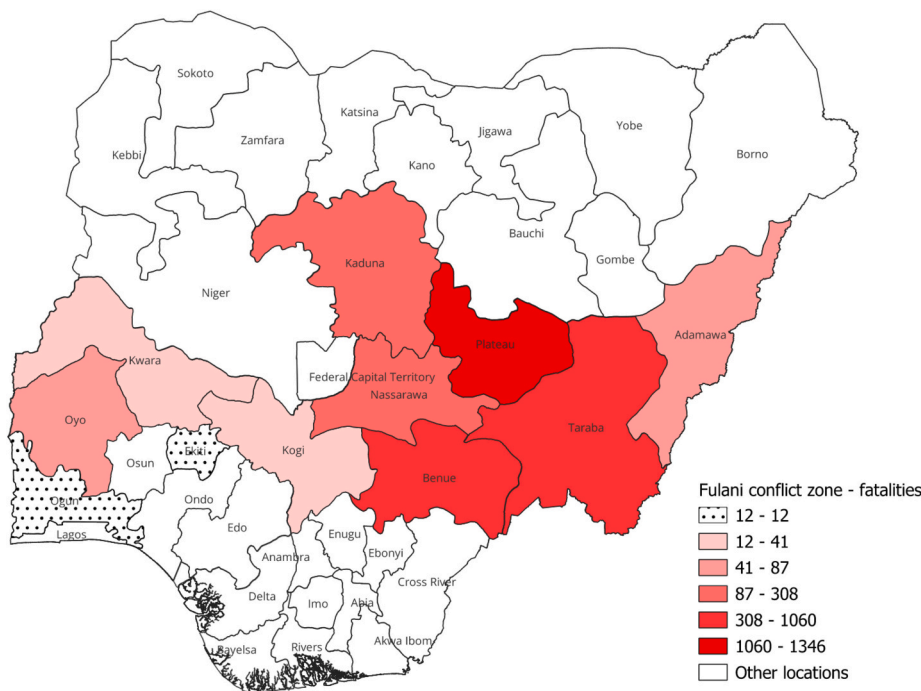


Fig. 2. Average conflict fatality from Herder-Farmer's conflict – 2011 to 2020. Note: The figure displays fatalities from the conflict caused by the conflict related to “Fulani-ethnic militia” and “Hausa-Fulani ethnic militia,” as labelled in the UCDP data. The fatalities are displayed across Nigerian states for which data is available. Nasarawa state is located in central Nigeria. Source: Data from the Uppsala Conflict Data Program (UCDP), Department of Peace and Conflict Research.

cause of the conflict and may reinforce widespread narratives about tribal and religious dominance as the root cause, thereby shaping social norms that discourage cohesion with members of other outgroups. This characteristic is frequently cited as a factor that complicates national policies, as diverse groups' competing and contradictory interests may determine policy preference.

3. The intervention

Before commencing data collection, we pre-registered the survey instrument and the primary econometric specifications in an online repository hosted by the Centre for Open Science.¹⁴ The full text of the treatments and key questions used are discussed in subsequent sections.

3.1. Data collection

In April 2023, our team contracted with Initiative for Policy, Evaluation, and Research, an experienced research firm based at Obafemi Awolowo University in Ile Ife/Abuja, Nigeria, to collect 560 survey responses.¹⁵ We surveyed adults in the state of Nasarawa, who were informed of 500 Naira (equivalent to \$1.10) as a token of appreciation for their participation in the survey.)¹⁶ We applied stratified sampling to obtain a sample that was representative of the population at the study site in terms of basic socio-demographic statistics.

Several features were incorporated into the survey experiment in an effort to ensure the validity of the collected data. The respondent¹⁷ must be at least 18 years old and have completed primary school or be able to read and understand complete sentences. This was determined by some

pre-screening information included in the reading of the consent form, in which the enumerators are instructed to obtain verbal or written consent based on the respondents' comprehension of the supplied information. Enumerators were instructed to inform respondents that it was crucial to the success of our research that they read the following treatment text attentively before continuing with the survey. Members of the research team conducted a periodic review with the enumerators and a daily check of the backend data to ensure that the enumerators collect data from the designated locations in the survey design to aid in the detection of manipulations and allow respondents to report any issues they encountered while completing the survey.

The survey design is such that we identified local government areas in Nasarawa state and the list of all enumeration areas, following the National Bureau of Statistics field survey protocol. We randomly selected LGAs to visit, without consideration of whether it is rural or urban designated.¹⁸ Consequently, we chose four enumeration areas (EAs) at random from the list of EAs for each LGA and proportionally distributed the sample size based on the number of EAs in each LGA. Following the selection of the EAs, we visited a central location in each EA, such as a market square, a place of worship, the town hall, or the chief's or traditional leader's lodge, from which we covered a random street. Enumerators knocked on every third door and conducted an interview with the person who answered based on the inclusion criteria previously outlined.

3.2. The survey experiment structure

After familiarizing respondents with the survey task and obtaining their consent, we use a draw-based random assignment method to assign respondents to read one of two informational treatments or a placebo text. We begin the survey experiment by inquiring about the socio-

¹⁴ Registration here <https://doi.org/10.17605/OSF.IO/BFRWA>
¹⁵ This sample size was determined by a power calculation, with details included in the pre-analysis document.
¹⁶ Exchange rate as at the survey period.
¹⁷ Predominantly non-Fulani indigenes in the study location. Only 0.36 % of our respondents are Fulani.

¹⁸ We selected about 50 % of the LGAs (6 of 13 LGAs), due to budget limitations.

demographic characteristics, political leanings, and conflict-related experiences of the respondents. After eliciting respondents' post-treatment policy preferences, we inquire further about their preferences for sedentary herding and other beliefs that the treatment could plausibly affect.

3.3. Experimental treatments

The treatments prime respondents to critically reflect on the origins of the violent conflict between Fulani herders and sedentary farmers. It describes the migration of Fulani herders from their homelands to other locations as a result of environmental stressors. To reduce the likelihood of identifying heterogeneous effects across locations, the treatment omits the precise direction of herders' migration, stating only that they migrate from their homelands to other places. Moreover, the presentation of the narrative as a research output from a reputable NGO enhanced its credibility and acceptability among respondents. About three-quarters of Nigerians (65 %) view NGOs as credible, which is higher than the global average of 57 %, and other advanced countries, including the United States (50 %), Germany (46 %), and the United Kingdom (49 %).¹⁹ Although the survey experiment setting is likely to artificially boost respondents' attentiveness, it seems reasonable to expect that exposure to a brief narrative about the cause of herders' migration and subsequent conflict with sedentary farmers will have a more muted effect on respondents' policy preferences than direct experience of the conflict or repeated exposure to media coverage of the conflict. In an attempt to enhance the treatment's efficacy, we, therefore, present an innocuous account of the climate change cause of the conflict.

The treatment starts by acknowledging in the opening statement the conflict between Fulani herders and sedentary farmers. It minimizes the use of inflammatory adjectives in the description, stating that: "*Fulani herders and farmers in Nigeria are increasingly at odds with one another. Herders are migrating away from their ancestral home, which is the root of this dispute.*" The treatment then introduces a study by an imaginary NGO, stating: "*To understand the factors influencing Fulani migration, researchers from a reputable NGO carried out a thorough investigation. A representative sample of Fulani herders were interrogated for this purpose. They enquired of the herders the reasons behind their herds' migration into new areas that had not been their original homes.*" The text goes on to emphasize how the changing climate spurred herders' migration to other locations, by stating: "*A number of events led to the herders migrating. Herders have been observed to move from their homes to other places in search of grazing opportunities as a result of changes in rainfall patterns, extreme heat, drought, and dwindling water supplies. They conclude that the drying up of grazing areas and water sources for their herds in their homeland due to climate change and harsh weather occurrences is what drives herders to migrate.*"

Our goal is to determine if exposing farmers to research highlighting climate change as a potential driver of herder migration and the subsequent conflict will influence their support for a specific policy. Therefore, our treatment does not mention ranching and sedentary herding to prevent respondents from being persuaded to support this specific policy direction. In addition, we do not include a general statement regarding the need for policy intervention because one of our outcomes evaluates specific policy preferences, such as donating to an NGO, which may suggest a deterministic solution to the problem. In order to ascertain whether exposure increases respondents' cognitive demand for a policy direction, we have chosen to remain silent about policy directions and the need for them.

The placebo text is used to determine baseline policy preferences. The text is intended to have no effect on respondents' policy preferences, but it states the obvious about the conflict and its fundamental cause, which is Fulani herders migrating from their homeland to other

locations, without elaborating on the cause of the migration. The placebo text begins with:

Fulani herders and farmers in Nigeria are increasingly at odds with one another. Herders are migrating away from their ancestral home, which is the root of this dispute.

In an effort to enhance engagement, respondents in the treatment and placebo groups were asked whether they are personally affected by the conflict or whether they know someone who is. Appendix A contains the complete text of all treatments and placebos.

3.4. Measuring policy preferences²⁰

We objectively assess the respondents' support for a sedentary ranching policy by analyzing their behavioral response to a solicitation for a real donation to a pro-ranching NGO, Actions for Peace Advancement - a fictitious and non-existing organization.²¹ We elicited the respondents' marginal substitution between money for themselves as compensation for the interview engagement and money for advancing the sedentary ranching policy in their community. We informed the respondent that they would receive a 500 Naira voucher at the conclusion of the survey. They may donate any amount between 0 (no donation) and 500 Naira at a rate of 25 Naira per increment to the *Actions for Peace Advancement*.²² They were informed that the discrepancy (if any) between the amount they donate and the voucher amount will be the amount of the complimentary voucher they will receive.²³ Respondents were informed at the conclusion of the survey that the NGO does not exist and was only included for research purposes. In addition, they were compensated with the complete amount regardless of the amount they were willing to donate.²⁴

In addition, we evaluated the effects on self-reported policy views regarding support for policies directed at sedentary ranching, given that our treatment was designed to alter citizens' perceptions of the need for herders' migration due to the deteriorating environmental condition, which led to farmers-herders conflict. We asked questions concerning commonly discussed policies pertaining to grazing sites, restricting or outright prohibiting open grazing, and spatially isolating herders to only graze in their ethnic homeland. We divided these policies into three categories. We ask respondents whether they support or oppose policies that: (a) mark out grazing sites and lands in each state or location and promote sedentary herding - integrating policy; b) The abolition and explicit prohibition of open grazing despite the absence of grazing sites - a non-integrated policy. (c) Limit ranches and open grazing to the herders' ethnic homeland or state of origin - a non-integrating policy. On a 5-point scale, respondents are required to indicate whether they firmly oppose (1) or strongly support (5) each of the three policy options.

3.5. Measuring beliefs

To determine whether the treatments have the intended effect of

²⁰ The policies discussed in this section are those popular in the Nigerian policy space, taunted by the incumbent government and those who oppose the government. We test these diverse policies to understand how exposure to the conflict influence attitudes towards integrating and non-integrating policy, as defined by the research team.

²¹ Again, this outcome has passed the IRB approval, and this kind of manipulation is not expected to cause significant harm or severe emotional distress to research participants.

²² For the regression analysis, we standardize this variable, such that the result interpretation will be based on standard deviation changes due to the treatment.

²³ At the completion of the survey, the balance for each respondent was sent as a call credit to the supplied mobile phone number.

²⁴ This compensation was in the form of a gift, equivalent to the full sum of 500 Naira.

¹⁹ Values are from [Edelman Trust Barometer, 2021](#).

influencing respondents' perceptions about the centrality of climate change in causing the Fulani-herder conflict in Nigeria and to identify potential explanatory mechanisms underlying any treatment effects, we elicit respondents' post-treatment beliefs and expectations regarding this issue. We ask this question directly, without obfuscation: Do you believe that the lack of grazing caused by climate change is a primary cause of Fulani herder migration and the ensuing conflict with farmers? Our objective is to elicit beliefs regarding the role of climate change in the herders-farmers conflict, with responses ranging from do not believe to strongly believe. This indicator's responses range from "do not believe" to "absolutely believe." For the subsequent analysis, we transform this variable into a binary indicator, climate belief, with a value of "1" if the response is "believe" or "absolutely believe" and "0" if the response is "do not believe" or "somewhat believe."

Next, we elicit respondents' beliefs about the sedentary ranching policy and how it could improve herders-farmers' relationships in their community. We ask, "In your opinion, tell us what you think about setting up sedentary ranches. Do you believe it could improve herders-farmers cohesion and reduce confrontation?" The response to this question is as follows: (a). help to improve herders-farmers cohesion (*improve cohesion*), (b). hurt herders-farmers cohesion (*hurt cohesion*), and (c). have no effect one way or the other on herders-farmers cohesion (*no effect on cohesion*). Again, we transform these variables into binary indicators for each response, such as "1" if the respondent selects option (a) and so on.

4. Data

4.1. Attrition

The rate of attrition was low. We routinely replaced survey respondents who left without completing their responses. This was accomplished by surveying participants from the next home or block and then recasting the draw to assign new participants to the treatment or control group. As anticipated by our power calculation, our sample size was precisely 550 respondents when we employed this method. We also ensured that the survey instrument was concise and free of unnecessary questions. This action may have increased respondents' concentration and contribute to the survey's high compliance rate.

4.2. Summary statistics

We compare the basic observable statistics of our data with the most recent Afrobarometer and Demographic and Health Survey (DHS) surveys. These features include gender, level of education, age, labor participation, and frequency of newspaper, radio, television, and social media news consumption. These latter indicators are binary if the respondent receives news from these sources weekly or more frequently than weekly. We also calculate the number of assets possessed by each respondent's household, which is measured as the sum of the following assets: television, refrigerator, automobile, motorcycle, and radio. We present mean values from these datasets, and Table 1's statistics depict a comparable sample with mean values for these observable characteristics from other data sources. Therefore, we can say that our sample is comparable to other credible surveys within the context of our study.

4.3. Randomization

To ensure randomness in the assignment of respondents to any of the groups – treatment and control, we perform a draw for each respondent to determine assignment into any of the groups. Based on this approach the respondents are randomly assigned with equal probability to one of the two groups. This approach ensures that we have a comparable group, such that the effect we find is attributed to exposure to the treatment. We verify the comparability claim in Table 2, which also shows summary statistics by experimental group. Of the specific variables tested, almost all of the variables yield statistically insignificant

Table 1
Summary statistics and comparison to other surveys.

Socio-demographics	This sample	Afrobarometer	DHS
Gender – 1 if male	0.715	0.522	
Education – primary school completion	0.089	0.087	
Education – secondary school completion	0.433	0.434	
Education – more than secondary school	0.445	0.400	
Age 18–34	0.429	0.478	
Age 35–54	0.498	0.404	
Age 55+	0.071	0.118	
Labor engagement – working in any sector	0.800	0.740	
Newspaper	0.260	0.211	
Radio	0.776	0.727	
Television	0.798	0.667	
Social media	0.845	0.909	
Number of years in current location (years)	25.665		27.409
Religion – 1 if Islam	0.382	0.434	
Assets	2.291		1.927

Note: We compared our data averages to those from other established datasets to assess overall consistency. As expected, some of the statistics are different, but overall, most of the statistics are within similar range.

Table 2
Balance across treatment groups.

	Placebo	Treatment
Gender – 1 if male	0.710 (0.455)	0.719 (0.450)
Education – primary school completion	0.094 (0.293)	0.084 (0.278)
Education – secondary school completion	0.446 (0.498)	0.420 (0.494)
Education – more than secondary school	0.399 (0.490)	0.493** (0.501)
Age 18–34	0.420 (0.495)	0.438 (0.497)
Age 35–54	0.493 (0.501)	0.504 (0.501)
Age 55+	0.083 (0.277)	0.058 (0.235)
Labor engagement – working in any sector	0.797 (0.403)	0.803 (0.399)
Newspaper	0.254 (0.436)	0.266 (0.443)
Radio	0.761 (0.427)	0.792 (0.407)
Television	0.779 (0.416)	0.817 (0.387)
Social media	0.815 (0.389)	0.816 (0.330)
Number of years in current location (years)	0.446 (0.498)	0.420 (0.494)
Religion – 1 if Islam	0.358 (0.480)	0.405 (0.492)
Assets	2.25 (1.270)	2.332 (1.268)
P-values of joint orthogonality tests:		0.110

Notes: Mean variable values and the standard deviations are presented for each variable. Specifically, the mean values for each covariates are for the treatment group are presented in the first row, while the standard deviations are presented in parentheses below the mean values. The values were derived from the *t*-test estimations. Asterisks indicate significant p-values from testing the hypothesis that the difference between the statistics of the *treatment* and *control* is not equal to zero. **p < 0.05. The joint orthogonality test was estimated through a regression analysis, to check whether there is a balance in the characteristics of the treatment and placebo group.

difference, consistent with successful randomization. Tests for joint orthogonality also show that the variables for those in the treatment group do not vary significantly from those in the placebo group.

5. Results

We begin by examining how the treatment influenced respondents' policy preferences, specifically their support for a more accommodating policy that integrates Fulani (outgroup members) into the host community through a sedentary ranching program. Our primary focus is on citizens' willingness to provide altruistic support for integrating herds- men into the host community to prevent conflicts. Next, we assessed how the treatment influenced support for integrating and non-integrating policies, along with beliefs about climate change and the potential of sedentary ranching to enhance herder-farmer relations. We argue that increased awareness of the environmental stressors driving herder migration and its associated conflicts likely shapes these outcomes.

5.1. Effect of the treatment on support for sedentary ranching

We estimate the effects of the treatments on the primary measure of policy preferences using OLS regression, as specified in Eq. (1).

$$Ranching_i = \beta_0 + \beta_1 Treatment_i + \beta_2 Z_i + \varepsilon_i \tag{1}$$

$Ranching_i$ is the extent to which individual i supports or oppose policies that promote sedentary ranching in the host community. This variable is measured by the individual's support for an NGO to push policies that promote state ranching. Since this is a donation, it is revalued on a standardized scale with a standard deviation of 1 and a mean of 0. The revaluation enhances the comparability of our effect size with other studies and allows for the application of a dimensionless outcome variable, comparable across diverse studies. $Treatment_i$ is a binary variable signaling i 's exposure (1) or not (0) to the information treatment that emphasizes how climate change is instigating the conflict between herders and farmers. Z_i is a vector of controls containing all socio-demographic variables listed in Tables 1 and 2. The inclusion (or not) of control variables does not change the results, as shown in subsequent analysis, which is consistent with successful randomization.

The estimates of Eq. (1) in Table 3 indicate that the treatment has a significant effect on the policy preference for the integration of outgroup members into the community by encouraging sedentary ranching. Individuals' willingness to donate increases by 0.19 standard deviations as a result of exposure to the treatment, which is consistent with the model that accounts for other observable covariates. The increased support for the policy could be attributed to two factors: participants' trust in reputable NGOs and their growing sympathy for herders. By understanding the herders' precarious situation and the role of climate change in forcing them to migrate, participants may be more likely to support

Table 3
Treatment effect on support for sedentary ranching.

	Outcome variable: A standardized value of donation towards sedentary ranching	
	[1]	[2]
Treatment	0.194** (0.085)	0.191** (0.084)
Covariates	No	Yes
Obs.	550	550
R-squared	0.009	0.009

Note: Robust standard errors are in parentheses. ** $p < 0.05$. Dependent variable: A standardize value of the donation by the respondents towards advancing the sedentary ranching policy. Treatment is exposure to the information that highlights climate change as a plausible cause of the herder-farmer conflict in Nigeria. Only column [2] includes the following covariates, Gender – 1 if male, Education – primary school completion, Education – secondary school completion, Education – more than secondary school, Age 18–34, Age 35–54, Age 55+, Labor engagement – working in any sector, Newspaper, Radio, Television, Social media, Number of years in current location (years), Religion – 1 if Islam, and Assets.

policies that address their needs. This finding is particularly significant given the historical hostility between indigenous residents and Fulani settlers, often rooted in ethno-tribal tensions (Vinson and Rudloff, 2021). Despite this animosity, our results suggest that educating the public about the “root” causes of the conflict can foster greater understanding and support for policies aimed at resolving it. By presenting indigenous residents with a clear alternative narrative that highlights climate change as a key driver of the conflict between herders and farmers, we were able to significantly increase their support for policies aimed at resolving the conflict, including financial commitments to sedentary ranching within their communities.

5.2. Treatment effect on policy preference

Having established that the treatment increases respondents' financial commitment for advancing sedentary ranching policy in their community, we next examine the effect on respondents' preferences to specific integrating (i.e., mark out grazing sites and lands in each state or location, and encourage sedentary herding) and non-integrating (i.e., abolition and outright ban of open grazing, despite no intention for grazing sites – non-integrating) policies. The purpose of evaluating these diverse policies is to determine whether exposure to the treatment influenced citizens to support policies that integrate herders into their community or to support non-integrating policies that do not accommodate these herds- men in their community. To determine these effects, we estimate using OLS regressions of the form presented in Eq. (2).²⁵

$$PolicyPref_i = \beta_0 + \beta_1 Treatment_i + \beta_2 Z_i + \varepsilon_i \tag{2}$$

$PolicyPref$ is the individuals' response to whether they support three policy proposals for resolving the herders-farmers conflict: mark out grazing sites and lands in each state or location, and encourage sedentary herding (*encourage sedentary herding*, integrating policy), abolish and outright ban of open grazing, despite no intention for grazing sites (*outright ban of open grazing*, non-integrating policy), and restrict ranches and open grazing only in the ethnic homeland or state of origin of the herders (*restrict ranches only in the ethnic homeland*, non-integrating policy). The response to these outcomes is coded on a five-point scale, from strongly oppose (1) to strongly support (5), but for ease of interpretation, it has been transformed into a binary indicator, with support or strong support of the policy coded as 1 and 0 otherwise. All other components remain as specified in Eq. (1).

Fig. 3 illustrates the effect of the information treatment on respondents' preference for specific integrating and non-integrating policies, revealing a 17 percentage point increase in their preference for a policy that integrates herders into their community (or 19 percentage points when covariates are not considered in the model). At baseline (i.e., without exposure to the treatment), approximately 60 % of respondents say they would support policies that encourage sedentary ranching in their community, with only about 1 in 6 residents strongly in favor of such a policy. Since policymakers are pushing for the creation of ranches for sedentary herding even though locals are strongly against it, a more detailed explanation of a plausible cause of herder migration and the conflicts that follow with farmers could be a good policy action to get people's support.

Regarding the impact of the intervention on so-called non-integrating policies, Fig. 3 demonstrates that educating locals about climate change being a plausible cause of the conflict makes them less likely to support measures that explicitly ban open grazing in their community and restrict ranches to only the Fulani herders' homeland. The support for outright banning open grazing in the farmers' community without a ranching solution declined by approximately 13 percentage points, and the support for restricting ranches to the herders' homeland also

²⁵ The results remain substantively unchanged when estimated using ordered logistic regression.

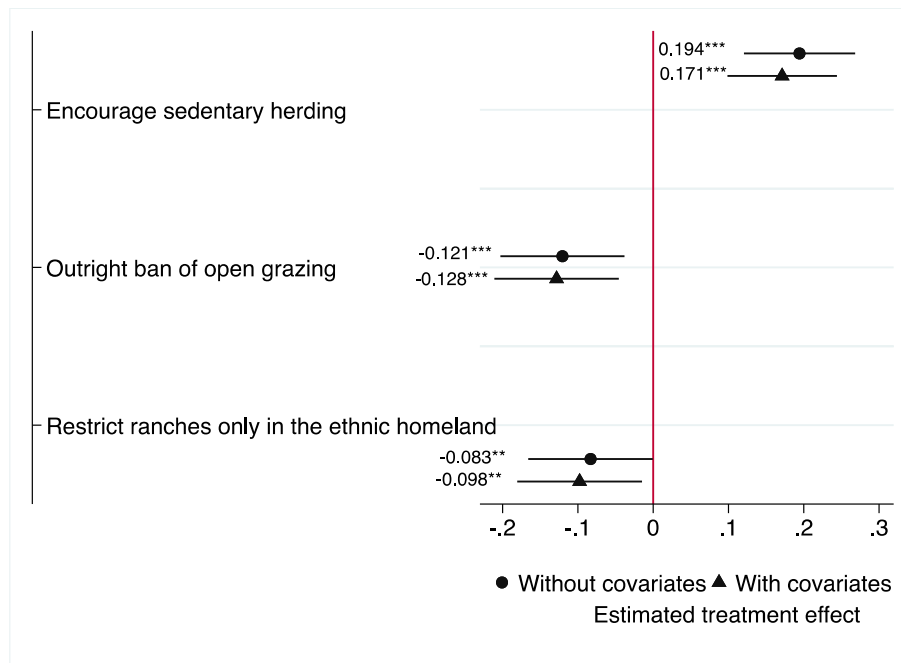


Fig. 3. Effect of treatment on different policy preferences.

Note: The figure presents a coefficient plot for all regressions based on Eq. (2). The figure visualizes the confidence intervals and their corresponding regression estimates when estimated with and without covariates. The three dependent variables are: a). encourage sedentary herding: mark out grazing sites and encourage sedentary herding; b). outright ban on open grazing: abolish and outright ban open grazing, despite no intention for grazing sites; and c). restrict ranches only in the ethnic homeland: restrict ranches and open grazing only in the ethnic homeland or state of origin of the herders. Robust standard errors used. The values in the figures represent the coefficients, with significance levels indicated as *** $p < 0.01$ and ** $p < 0.05$. As indicated in the figure, regression estimates are generated with and without covariates. The covariates included in the analysis are the following: Gender – 1 if male, Education – primary school completion, Education – secondary school completion, Education – more than secondary school, Age 18–34, Age 35–54, Age 55+, Labor engagement – working in any sector, Newspaper, Radio, Television, Social media, Number of years in current location (years), Religion – 1 if Islam, and Assets.

declined by approximately 10 percentage points. This suggests that the policy preferences of respondents exposed to the treatment are statistically different from the preferences of respondents not exposed to the information. The direction of the coefficients remains the same irrespective of whether the estimation models include the covariates or not.

These results suggest several insights into the reasoning behind accommodating outgroup members in response to information about the causes of conflict between in-group residents and out-group herders. First, it is evident that respondents do not regard all popular policies for resolving the conflict between herders and farmers in the same light. In response to the treatment, the preferences of treated respondents for the policies vary from those in the control group. Specifically, the significant favorable preference for constructing ranches in the community of in-group residents to encourage sedentary herding, regardless of the prevalence of dislike for cohabiting with individuals of different ethnic and religious groups, hints at a deeper insight on the expansion of the bargaining space for outgroup accommodation regardless of coalitional configurations. This preference may reflect the residents' sudden realization of the vulnerability of herders to the climate crisis, which leads them to favor policies that could address this vulnerability over policies that would provide no protection for the herders or imply hostility towards them, despite the imminence of the challenge. This study contends that conceptualizing vulnerability as the primary driver of the herder-farmer conflict, as opposed to other narratives, enables new methods of mapping public opinion in favor of integrating both groups for peaceful coexistence in conflict zones. This conclusion is comparable to those of other studies that have investigated conflicts in various regions. For instance, Manekin et al. (2019) studied the Israeli–Palestinian conflict and concluded that providing a more nuanced understanding of conflict can help in influencing tailored approaches to conflict resolution and greater political compromise.

Second, the response to the treatment indicates that fact-based argument plays an essential role in shaping the preferences of conflict-vulnerable individuals. While the treatment causes respondents' preference for policies that could be characterized as accommodating outgroup actors in a conflict, they are also prepared to commit financially to actions that could lead to the implementation of such policies in their community. Before analyzing the potential mechanisms underlying this effect, we examine the influence of the treatment on respondents' beliefs regarding the Fulani-herder conflict as a result of climate change.

5.3. Effect of treatment on beliefs

We examine whether people believe climate change is causing the Fulani-herder conflict and whether sedentary ranching can increase herders-farmers' cohesion and minimize violence. Examining the effects on these beliefs may be helpful in determining whether the treatment was successful in elucidating how resource competition aggravated by climate change is driving the earlier reported findings. The following four beliefs, specified in the pre-analysis plan, are shown to be affected by the treatment in Fig. 4: (i) the belief that Fulani herders' migration and the subsequent conflicts with farmers are caused by a lack of grazing sites (*climate belief*); (ii) the belief that sedentary ranching would help to improve herders-farmers cohesion (*improve cohesion*); (iii) the belief that sedentary ranching would hurt herders-farmers cohesion (*hurt cohesion*); and (iv) the belief that sedentary ranching would have no effect on herders-farmers cohesion (*no effect on cohesion*).

$$Beliefs_i = \beta_0 + \beta_1 Treatment_i + \beta_2 Z_i + \epsilon_i \tag{3}$$

$Beliefs_i$ represents the four belief (binary) indicators. All other components remain as specified in Eq. (1). Fig. 4 demonstrates that the treatment has a substantial impact on respondents' perceptions of the

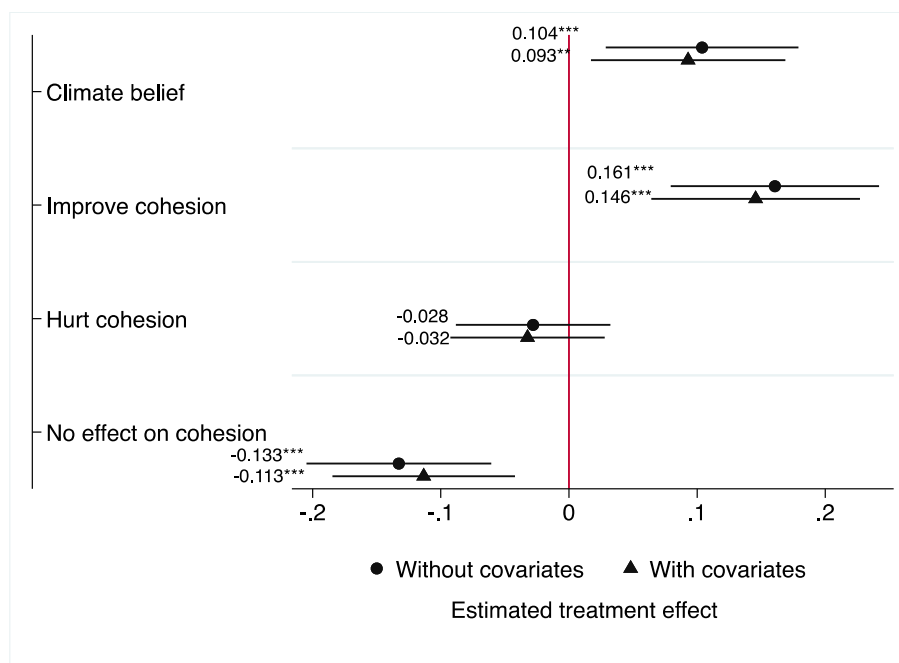


Fig. 4. Effect of treatments on respondents' belief.

Note: The figure presents a coefficient plot for all regressions based on Eq. (3). There are four dependent variables explored in this figure. They include: a). climate belief—the belief that Fulani herders' migration and the subsequent conflicts with farmers are caused by a lack of grazing sites; b). improve cohesion—the belief that sedentary ranching would help to improve herders-farmers cohesion; c). hurt cohesion—the belief that sedentary ranching would hurt herders-farmers cohesion; and d). no effect on cohesion—the belief that sedentary ranching would have no effect on herders-farmers cohesion. The values in the figures represent the coefficients, with significance levels indicated as *** $p < 0.01$ and ** $p < 0.05$. As indicated in the figure, regression estimates are generated with and without covariates. The covariates included in the analysis are the following: Gender: 1 if male, Education: primary school completion, secondary school completion, Education – more than secondary school, Age 18–34, Age 35–54, Age 55+, Labor engagement – working in any sector, Newspaper, Radio, Television, Social media, Number of years in current location (years), Religion – 1 if Islam, and Assets.

role of climate stress in aggravating violent conflicts between Fulani herders and sedentary farmers. For instance, respondents exposed to the treatment are 9.3 percentage points more likely to believe that the lack of grazing caused by climate change is the reason for Fulani herders' migration and subsequent clashes with farmers, which is a plausible cause of the herder-farmer conflict. This finding is relevant given that approximately 77 % of Nasarawa residents (three out of every four) do not believe that climate change is the cause of the herds' migration to their community.

Fig. 4 also demonstrates that exposure to the treatment information increased a respondent's likelihood of agreeing that the sedentary ranching policy would improve cohesion between farmers and Fulani herders. Specifically, the estimated predicted probability shifts show a 15-percentage-point increase in agreement with the social cohesion narrative of the ranching policy among those exposed to the treatment information, compared to those who do not receive such information (16 percentage points when we do not control for covariates). Similarly, those exposed to the treatment are less likely to agree that the sedentary ranching policy will harm cohesion between farmers and herders (although the effect is not significant at the traditional level). Moreover, they are significantly less likely (by 11 percentage points) to agree that sedentary ranching will have no effect on social cohesion. Specifically, they are less likely to be passive about policies that define social interaction between farmers and herders.

These results suggest that exposure to the treatment may have a significant and positive impact on the perceptions of residents of the conflict-affected state regarding the role of climate change in causing the farmer-herder conflict and the extent to which sedentary ranching promotes social cohesion between the two groups. These results are significant because they show that citizens' understanding of the conflict and their subsequent action in favor of a more accommodating policy

solution to such a conflict can be influenced by a low-cost intervention that promotes a fact-based campaign about the cause of the herder-farmer conflict, despite the prevalence of diverse narratives to explain the conflict.

5.4. Heterogeneity in policy support by personal conflict experience and trust

Next, we assess the heterogeneous effects of the treatments on individuals' policy preferences based on their proximity to the conflict and their level of trust in outgroup members and institutions. Within the framework of psychological trauma in political psychology literature, individuals' judgments and political beliefs are typically influenced by their exposure to conflict (Marsh, 2022; Adhvaryu and Fenske, 2023). Recent studies (e.g., Grossman et al., 2015; Cecchi et al., 2016; Adhvaryu and Fenske, 2023) have demonstrated that exposure to violence influences later preferences and behavior, such as a shift towards less risky outcomes and increases in ingroup cooperation while exacerbating out-group hostility or low support for interethnic cooperation.

In addition, individuals' actual trust and trustworthiness are measured incentive compatibility and are statistical markers of discrimination and non-cohesion with other outgroup members (Nunn and Wantchekon, 2011; Chuah et al., 2013). In light of these discussions, individuals' personal conflict experience and the degree to which they trust institutions or members of other groups may counteract the treatment effect, as they are significant predictors of political preference and outgroup accommodative decisions.

We determine respondents' proximity to conflict using two indicators derived from the survey. The first is a binary indicator indicating whether or not the respondent knows a community affected by the conflict between farmers and herders and whether or not that

community is for a close relative. 54 % of the respondents in our sample have been affected by the conflict, a proportion that is comparable between the control and treatment groups. The second indicator considers the respondents' losses as a result of the conflict, based on the question asking if they or someone close to them experienced losses as a result of the conflict and what type of losses they experienced. We considered five categories of losses, including injury, farm yield, farmland, other properties, and loss of life from which they are to check if they have encountered any of the losses.²⁶ Based on the responses, we compute an aggregate measure that sums these indicators, such that higher values indicate respondents' personal experience with the conflict and vice versa. The average respondent in the sample reports experiencing two of the five loss categories outlined above, which is comparable by treatment assignment.

The measure of respondents' trust level for individuals of other groups or religions, and trust for institutions is the next heterogeneous indicator. We focus on this variable because it defines the extent of social cohesion and trust for outgroup members (Nunn and Wantchekon, 2011). For the trust in outgroup members, we ask the respondent how much they trust other people who are not members of their tribe, religion, or whom they do not know. The response to these questions are "Not at all, 0", "Just a little, 1", "I trust them somewhat, 2" and "I trust them a lot, 3." Then, we compute a binary indicator indicating whether or not the respondent somewhat or completely trusts outgroup members. Approximately 47 % of the respondents in our sample say they trust members of other tribes, religions, or persons they do not know. In addition, we compute individuals' trust in institutions as the sum of their responses to a question asking how much they trust the federal government and its agencies, the state government and its agencies, the local government, the media, the police, the military, the court, and the traditional vigilante. The responses are "Not at all" (0), "Just a little" (1), "I trust them somewhat" (2), and "I trust them very much" (3). On the basis of the sample's aggregated level of trust in institutions, the sample's average score is 8, indicating a relatively low level of trust for the eight institutional categories.

To estimate the heterogeneous effect of proximity to the conflict and trust, we interact these indicators with the treatment, as shown in Eq. (4), to highlight the degree to which they counteract (or otherwise) with the treatment.

$$Outcomes_i = \beta_0 + \beta_1 Treatment_i + \beta_2 Factors_i + \beta_3 \frac{Treatment_i \times Factors_i}{i} + \beta_4 Z_i + \varepsilon_i \quad (4)$$

While all other components remain unchanged from previous equations, $Outcomes_i$ represents the indicators for ranching and policy preferences, which are the outcome variables in Table 3, and Figs. 3 and 4. $Factors_i$ represents the indicators of conflict proximity and trust, and $Treatment \times Factors_i$ is the main variable of interest, which shows the extent to which our treatment effect responds to these indicators.

Panels (A) to (D) of Fig. 5 depict the effects of each policy's treatment by proximity to the conflict and trust. As shown in Panel (A),²⁷ the indicators of respondents' proximity to the conflict and level of trust have no significant effect on the extent to which the treatment determines individuals' contribution to implementing the ranching policy. That is, the effect is homogeneous regardless of the respondents' proximity to the

²⁶ Assessing the magnitude of the loss these respondents have sustained would have been a more appropriate measure. Nevertheless, because we are constrained by a recall approach, we would have incorporated a significant recall bias into this measure by asking them to estimate the extent of the losses and may be inaccurately estimating the loss from the conflict.

²⁷ Although we find a significant effect on the standardized measure of donation for treated individuals with close proximity to the conflict, the sign and significant value of the coefficient are not robust since, when controlling for the covariates, the significance values earlier recorded were lost.

conflict and their levels of trust, as there is no robust heterogeneity for this policy outcome, since the effect is similar regardless of the individual's proximity to the conflict or its level of trust. Similarly, the individuals' conflict experience and level of trust have no effect on the treatment effect in terms of support for the policy that encourages sedentary ranching and bans open grazing in the respondents' community (see Panels (B) and (C)). However, our analysis only found one effect that was different: people who did not trust government institutions more were more likely to support one of the policies that did not help integrate herders (i.e., limiting ranches to the ethnic homeland of Fulani herdsmen; see Panel D). Those with a higher level of trust in government institutions are substantially less likely to support limiting ranches in the Fulani homeland after learning that climate change is a plausible cause of the conflict (see estimates at the tail end of Panel D). This decline is roughly twelve percentage points, and it is significant at the 5 % threshold.

This finding that proximity to the conflict and individual trust level does not significantly influence the treatment effect²⁸ may be due to the fact that the conflict is not linked to any historical material struggle or symbolic attachment to disputed territory resulting in battle for an enclave. As a result, the majority of respondents in this context are seeking an equitable resolution to the conflict, and any logical explanation for the conflict with a relevant solution that can address the concerns of both sides may be acceptable to the residents regardless of their prior losses as a result of the conflict or their perceptions of the relevant public institutions.

As indicated in a qualitative interview with farmers in a similar context in Nigeria, farmers affected by the conflict generally say that they do not blame the herders for coming to their community, while some others are not certain about the reasons why the herders have left their home land for their community (Adejumo et al., 2024). In another interview, one respondent noted that "I asked one Fulani man ... that came to my shop to buy [food stuff]... What brought you here?' He said there were no grasses in their place. So, they wanted to come to beg our chief to give them land that they will stay here and eat grass" (Adejumo et al., 2024). Farmers often hold conflicting narratives about the reasons behind the herders' migration into their community. Therefore, in such a context, identifying a relevant conflict driver may effectively influence the pursuit of a peaceful resolution, irrespective of the farmer's previous experiences with the conflict or their level of trust in outgroup members or national institutions.

6. Discussion and conclusions

As the farmer-herder conflict in Nigeria escalates, such that between 2016 and 2018 there were over 3600 recorded fatalities and an estimated annual revenue loss of 14 billion US dollars, policymakers have called for a variety of settlement approaches, including the establishment of sedentary ranching, among others. Yet, pursuing this policy direction has been met with intense opposition from subnational governments and residents in these subnational regions due to a lack of confidence for the Fulani group, a lack of trust for the public institutions, and other myths regarding the purported intentions of the Fulani group.

This study demonstrates that respondents' support for a peaceful resolution of the conflict tends to increase as their knowledge of a plausible cause of Fulani migration from their homeland to other locations and subsequent confrontation with sedentary farmers increases. For instance, once they are exposed to this information, they become financially committed to ensuring that sedentary ranching is implemented in their community in order to limit herdsmen' movements and subsequent conflict with farmers. Similarly, they are more likely to

²⁸ Except for those with a higher level of trust for the government institutions who are significantly less likely to support restricting ranches to Fulani homeland once they are aware that climate change is the driver of the conflict.

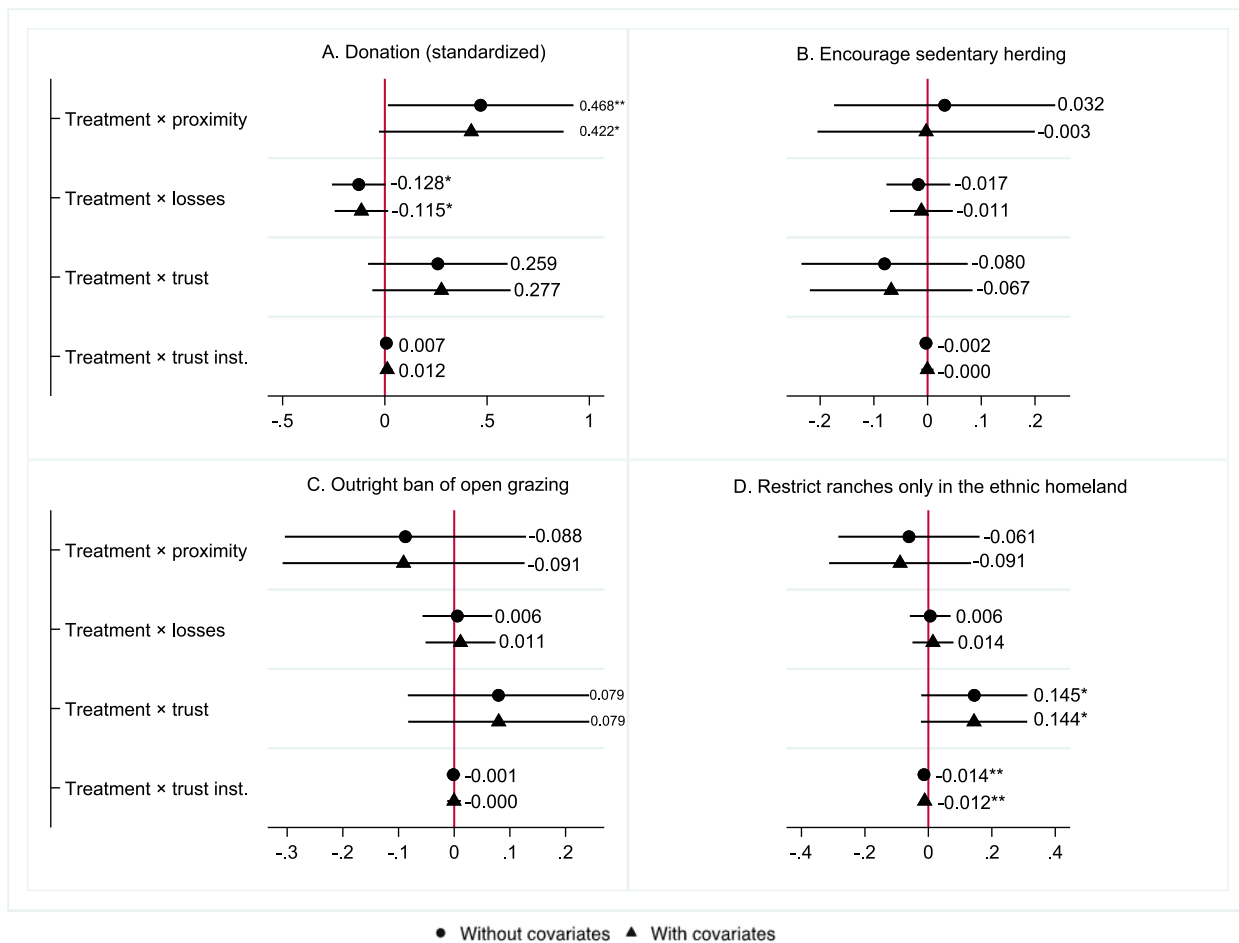


Fig. 5. Heterogeneous effect by proximity to the conflict and trust.

Note: The values in the figures represent the coefficients, with significance levels indicated as *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$. The dependent variables are listed at the top of each figure and represent standardized values of the respondents' donations towards advancing the sedentary ranching policy ("Donation"). The variables "Encourage sedentary herding," "Outright ban of open grazing," and "Restrict ranches only in the ethnic homeland" are binary indicators reflecting the respondents' support for each policy. All regressions include the main effects, though they are not shown in the coefficient plots to maintain clarity. Only interaction terms are displayed, as these are the primary variables of interest in this analysis. As indicated in the figure, regression estimates are generated with and without covariates. The covariates included in the analysis are as follows: Gender (1 if male), Education (primary school completion, secondary school completion, and more than secondary school), Age (18–34, 35–54, 55+), Labor engagement (working in any sector), Media exposure (newspaper, radio, television, social media), Number of years in current location, Religion (1 if Islam), and Assets.

support sedentary herding or ranching and less likely to advocate for an outright prohibition on open grazing and the restriction of ranches to the Fulani's ethnic homeland. These effects are largely consistent regardless of the respondents' prior exposure to the conflict or their level of trust for members of the outgroup or institutions. Nonetheless, some respondents with treatment exposure, specifically those with a higher level of trust in public institutions, are less likely to support a policy that restricts ranches to Fulani homelands.

We also demonstrate that, despite the "misconceptions" about Fulani herders in this context, exposure to alternative information about the cause of the conflict shapes the understanding of the conflict. Individuals' perceptions of the gravity of climate change as a factor in the herder-farmer conflict changed favorably as a result of treatment exposure. Consequently, conceptualizing vulnerability as the primary driver of the herder-farmer conflict, as opposed to other narratives, enables new techniques for charting public opinion in favor of integrating both groups for peaceful coexistence in conflict zones. For researchers working in this rapidly expanding field of study, especially as the conflict escalates in other Sahel countries, these findings highlight the need to look beyond the socio-economic driver of the conflict and the ethnographic explanation of herders' movement in order to fully

appreciate the climate implications and how it influences citizens' understanding of and support for peaceful resolution of such conflict.

This study's findings also highlight the importance of investigating respondents' preferences for conflict resolution at the level of specific policies in order to unearth insights that would be obscured if respondents' preferences for conflict settlement were considered in more general terms. In contrast to the prevalent norm of hostility towards outgroup members, the remarkably consistent increase in respondents' preferences for a policy that integrates herders into the communities of the respondents suggests that policymakers should not shy away from evidence-based explanations of the conflict cause prior to policy proposals.

While these findings are robust and based on a rigorous empirical design, policymakers should also consider addressing the identity crisis that has fueled mistrust between groups in society. Even though our research indicates that the treatment effect is consistent regardless of individuals' trust for outgroup members, the significance of this issue in a factional society cannot be neglected. More so, sedentary herding is by no means the only option for pastoralists, particularly in the context of seasonal migration driving herders from their homeland to the communities of farmers (McGuirk and Nunn, 2024). Policies such as modern

ranching, similar in spirit to sedentary herding, but emphasizes processes and inputs to extract higher value from herds in the form of dairy, meat, and leather. Future studies could also investigate whether exposure to factors beyond the climate-induced migration narrative, such as legal, political, and economic circumstances forcing herders to leave their home land, generates similar sentiments among sedentary farmers in support of conflict resolution policies.

CRedit authorship contribution statement

Uchenna Efobi: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Oluwabunmi Adejumo:** Data curation, Writing – original draft, Writing – review & editing. **Jiyoung Kim:** Data curation, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors of this paper do not have relevant material or financial interests in the subject of the research and do not report any actual, potential, or perceived conflicts of interest.

Data availability

Data will be made available on request.

Acknowledgment

We are grateful to the editor and the two anonymous reviewers for their comments and insights, which have greatly enriched the final version of this paper. This study is supported by a grant from the Working Group in African Political Economy/Center for Effective Global Action. The funder has played no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication. This study could not have been carried out without the help and support of many individuals. We are grateful to Daniel Posner (UCLA) for the invaluable guidance and constructive comments that have helped to improve the research design. We are also grateful to Graeme Blair, Amy Shipow, Eyoual Tamrat, and all the participants at the CEGA Global Workshop 2022 session for their excellent comments on the research design of this paper. The authors are also appreciative of comments provided by participants at various WGAPE seminars/workshops. Finally, appreciation goes to the research staff led by Ogwuikwe Obinna of the African School of Economics for their excellent fieldwork. The pre-analysis plan of this project is registered as <https://doi.org/10.17605/OSF.IO/BFRWA>.

Appendix A. The control group should receive the following statement

Fulani herders and farmers in Nigeria are increasingly at odds with one another. Herders are migrating away from their ancestral home, which is the root of this dispute.

The treatment group should receive the following statement:

Fulani herders and farmers in Nigeria are increasingly at odds with one another. Herders are migrating away from their ancestral home, which is the root of this dispute. To understand the factors influencing Fulani migration, researchers from a reputable NGO carried out a thorough investigation. A representative sample of Fulani herders were interrogated for this purpose. They enquired of the herders the reasons behind their herds' migration into new areas that had not been their original homes. A number of events led to the herders migrating. Herders have been observed to move from their homes to other places in search of grazing opportunities as a result of changes in rainfall patterns, extreme heat, drought, and dwindling water supplies. They conclude that the drying up of grazing areas and water sources for their herds

in their homeland due to climate change and harsh weather occurrences is what drives herders to migrate.

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