

Drought exposure decreases altruism with salient group identities as key moderator

Received: 22 November 2022

Stefan Döring ^{1,2}✉ & Jonathan Hall ¹

Accepted: 16 June 2023

Published online: 24 July 2023

 Check for updates

Previous research on climate change impact regularly considers conflict outcomes, thereby disregarding cooperative behaviour such as altruism. Drought has the potential to fuel inter-ethnic cleavages, thus contributing to conflicts. Yet this runs against resilience arguments suggesting people who experience environmental hardship are more cooperative. Here we examine altruism in survey experiments in a natural setting among refugees from Syria and Iraq. We match survey responses to observational data on drought and socioeconomic variables. Our findings speak to both arguments. First, we show that drought exposure is associated with decreased altruism for survey respondents generally. We further show how group identity moderates the relationship between drought and altruism. Our results suggest a decrease in altruism due to drought is much larger when the target of altruism is presented as a member of an antagonistic ethno-religious outgroup.

The latest Intergovernmental Panel on Climate Change report states with high confidence that climate change is causing substantial damage and increasingly irreversible losses to ecosystems with magnitudes higher than previously estimated. Climate change also has drastic socioeconomic consequences connected with deteriorating natural adaptive capacity¹. Counting the last 50 years, extreme weather damages, on average, account for US\$202 million in economic losses every day². Direct and indirect effects from climate change have also been found to impair general health and mental well-being^{3–7}. Extensive research has provided further insights into societal consequences of climate, especially regarding conflict and migration^{8–10}. However, such literature has mostly neglected how climate change impacts cooperation. Whereas climate-induced disasters have been linked to patterns of cooperation^{5,11,12}, much of this literature focuses on floods or other sudden-onset events, providing limited insights into how cooperation, including altruism, is shaped by slow-onset changes such as drought. We understand altruism as one key aspect of cooperation. For this study, altruism is defined as the willingness to compromise individual welfare for the sake of the welfare of someone else. Unless specified differently, the terms prosociality and altruism are used interchangeably throughout the paper.

More recent social-psychological research on cooperation vis-à-vis intergroup relations and external shocks addressed consequences of resource scarcities, providing many insights into what explains

prosociality. There is some evidence for ‘altruism born of suffering’ arguments but also variation when considering the social categorization of cooperation targets^{13,14}. For instance, group identity represents a key modulator for prosociality in the aftermath of disasters^{15–17}. Whereas we observe greater altruism following sudden-onset disasters, our understanding of possible behavioural change from exposure to gradual environmental hazards remains limited despite established negative consequences for individual well-being⁷. Direct or indirect exposure to environmental stressors has, for example, been associated with anxiety, depression or post-traumatic stress, even many years after events took place^{18–20}.

Several gaps emerge based on the existing findings. First, much of the literature on the impact of drought focuses on conflict with far less emphasis on potential mechanisms for cooperation. Second, while social psychology and related research on altruism consider the role of resource scarcity due to war or natural hazards, these studies have largely neglected consequences of slow-onset environmental changes. Those few studies that look at drought are restricted to samples in high-income countries^{5,6,21}. Particularly on climate change and mental health, there is little empirical research on positive psycho-social impacts from exposure to extreme weather events^{7,12}.

Altruism is a key aspect of cooperation. Being able to cooperate with other individuals or as part of group networks is the foundation of human progress. Cooperation among humans has been widely

¹Department of Peace and Conflict Research, Uppsala University, Uppsala, Sweden. ²Peace Research Institute Oslo (PRIO), Oslo, Norway.

✉e-mail: stefan.doring@pcr.uu.se

recognized as a function of prevailing situational norms and possible sanctions for those disregarding social norms. Altruistic emotions and preferences are key aspects that moderate the extent of self-interest and prosociality, for example, how much we strive for equity or how much we value the well-being of others^{14,22–24}.

Building on previous insights, we expect altruism to decrease with increasing drought exposure either directly or indirectly. Direct pathways arise through negative effects on health, including mental health, for example, greater post-traumatic stress, anxiety and depression^{3,5,11,12,21,25}. These outcomes even emerge via indirect channels from reduced access to food and nutrition, loss of livelihoods or the general financial constraints from decreased incomes. Diminished livelihoods and ensuing poverty are also drivers for risk aversion and stress^{20,24,26}. More generally, lower altruism is associated with increased stress and worse well-being^{24,27}. Overall, extreme scarcity can have crucial consequences for decision-making, including attitudes towards cooperation. In times of sustained scarcity, individuals may choose to prioritize their own welfare over the welfare of others. We expect prosociality to decrease through drought-related cognitive changes due to fear of negative consequences on health and livelihoods.

We furthermore expect group membership to moderate the effect of drought-associated decreases in altruism. Decreases in altruism due to drought should be larger when the social interaction occurs between, rather than within, ethno-religious groups. A prominent argument distinguishes environmental stressors based on sudden-onset events from gradual, slow-moving shifts²⁸. Whereas sudden-onset change can strengthen solidarity, gradual exposure to environmental stress such as drought is more likely to solidify group differences. Droughts are recurring features in almost all arid regions. The severity of climate-induced water scarcity differs annually, but recent decades saw a gradual increase in extreme droughts¹. The resulting coping and adaptation strategies related to such gradual environmental changes can vary across individuals and groups^{29,30}. This means some actors will be more successful than others when coping with drought conditions. Such differences can give rise to individual perceptions of relative deprivation and grievances that are less likely when experiencing sudden scarcities and more likely through long-term, gradual exposure to environmental stress. Differing individual perceptions of deprivation, in turn, shift how people evaluate cooperation with others. Factors such as resource scarcity, assumed reciprocity and social boundaries impact how much individuals value their welfare relative to another person^{31,32}. The absence of material resources can also make individuals feel more vulnerable to threats by others³³. Experiencing threats should lead individuals to favour ingroup interactions. Furthermore, sharing the burden of scarcity can make ingroup belonging more salient^{14,34–36}. In addition, group identities should be especially salient in places that have seen violence, particularly where conflicts overlap with group identities. In sum, we expect group identity to moderate the impact of drought on altruism, that is, a decrease in altruism due to drought should be larger when the interaction occurs between, rather than within, ethno-religious groups.

This study makes three important contributions. First, we depart from climate-conflict research with violence as the outcome variable, instead focusing on drought and prosociality (or altruism). Second, our findings show drought exposure is associated with reduced altruism; this holds even when considering previous exposure to violence or other potential traumatic events. Third, while our general results suggest drought reduces altruism, this is more pronounced towards outgroups. We show with exposure to severe drought, individuals are more altruistic towards ingroup members compared to outgroup members, especially when the ingroup–outgroup relationship is characterized by antagonism and hostility due to war. This is important as reducing the impact of drought could both increase altruism and reduce parochial tendencies.

Table 1 | Summary table, main variables

	Mean	SD	Minimum	Maximum
WTR	0.97	1.42	–1.67	2.67
Drought SPEI-12 average	–0.67	0.79	–2.59	2.42
Drought SPEI-12 (d)	0.38	0.48	0	1.00
Drought growthend average SPEI-6 (d)	0.43	0.50	0	1.00
Age	2.30	1.36	1.00	8.00
Urban (d)	1.50	0.50	1.00	2.00
Education years	4.49	1.32	1.00	6.00
Socioeconomic status	5.54	2.61	0	10.00
Exposure to traumatic events	3.39	3.51	0	16.00
Observations	4,103			

Drought and altruism

To examine the effect of drought exposure on altruism, we rely on responses from two survey experiments among Iraqi and Syrian refugees living in Turkey, who reside both in a refugee camp ($N = 2,292$) and in out-of-camp communities ($N = 1,811$). On the basis of our drought measure, we estimate about 38% of respondents have been exposed to drought before displacement. Situated in a very arid region, Syria and Iraq have seen recurring droughts, and both countries have witnessed intense civil war linked to group identities. This unique setting allows the capture of drought variation and possible moderating group-level effects from salient in- and outgroup differences. From survey responses, we also derive information on age, education years, gender, socioeconomic status and war exposure. The latter is measured through a 16-item-version Harvard Trauma Questionnaire³⁷. We match drought conditions to the respective year each survey respondent reported to have left their home. We consider several measures based on the Standardized Precipitation and Evapotranspiration Index (SPEI)³⁸ to capture intra-annual drought variation: one- and two-year drought averages, growth season drought for major crops, measures for rainfed agriculture, high-value rainfed agriculture and several combinations within those mentioned^{39,40}. For the analysis of our first hypothesis (H1), we create dichotomous variables that take the value 1 if SPEI values fall below -1 (drought conditions) or 0 if otherwise. Altruism among the participants is measured through the welfare trade-off ratio (WTR), which was developed to evaluate the degree to which a respondent values their own welfare relative to another person's welfare⁴¹. This is an established measure for altruism in social psychology^{32,42–44} (Table 1).

We first focus on the results (Fig. 1) for effects on altruism measured through the WTR. Here we use different hierarchical models with random intercepts for the governorate respondents reported to have resided last. Note that respondents in this sample are, on average, highly altruistic. This is in line with other studies on refugees that differ from several lab-based experiments that typically find much lower WTR values. The sample mean for WTR is 0.97 (minimum = -1.67 , maximum = 2.67). A WTR of 1 represents a high level of altruism, that is, valuing the other person's welfare and one's own welfare equally, whereas a WTR of 0 implies complete selfishness and below 0 spitefulness, that is, the willingness to pay a cost to deprive the other of a benefit.

Finding support for our first hypothesis, we observe drought exposure to correlate with lower altruism values. This holds when controlling for age, gender, education, socioeconomic status and whether respondents come from urban or rural settings (Fig. 1a). The effect is statistically significant ($p < .001$) across several model specifications. Respondents with drought exposure show substantially lower WTRs. The effect size is about 0.4 units on our WTR scale. This represents a considerable effect, reflecting approximately 40% decrease in altruism

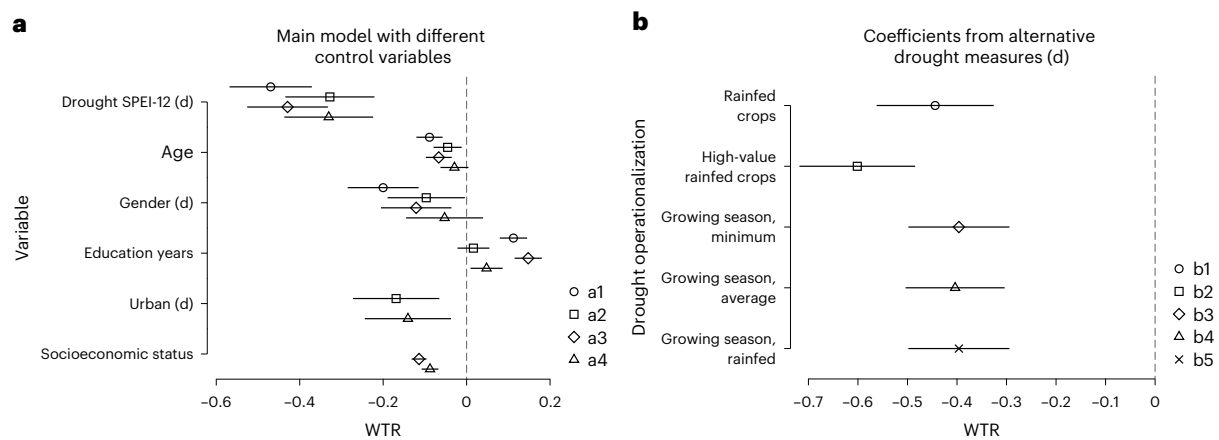


Fig. 1 | Drought exposure and altruism. Results for the effect of drought exposure on altruism measured as WTR, displaying coefficients for mixed effects linear regression with error bars indicating 0.95 confidence intervals (two-tailed). **a**, Specifications with different key individual-level variables. Model a1 ($n = 4,037$) represents results from our basic model, while models a2 ($n = 3,165$), a3 ($n = 4,034$) and a4 ($n = 3,163$) provide results with combinations of additional controls for urban (a2, a4) and socioeconomic status (a3, a4). **b**, Coefficients from five different models ($n = 4,037$) with varying drought operationalizations,

all controlling for age, gender and education (Supplementary Information includes complete tables). Error bars indicate 0.95 confidence intervals (two-tailed). Model b1 considers annual drought for rainfed crops and b2 for rainfed crops with high economic value, whereas b3–b5 consider six-month drought aggregates for the last month of the major crop's growing season with b3 based on the lowest values, b4 the average value and b5 for rainfed crops. d, dummy variable.

relative to the mean in our sample. The reported relationship also holds using an array of alternative drought measures or when accounting for exposure to traumatic events, including violence.

In addition, we report coefficients for separate models with varying drought operationalizations but all controlling for age, gender and education (Fig. 1b; Supplementary Information includes full tables). For the additional drought measure, we show that results hold also when solely considering the annual average for SPEI to capture drought in areas with rainfed crops (b1) and rainfed crops with high economic value (b2). To better account for seasonal effects, we further consider drought based on SPEI-6 values for the last month of a major crop's growing season, based on the lowest value for a governorate (b3), the governorate average (b4) and for areas with rainfed crops (b5). Overall, we find very similar results both regarding magnitude and statistical significance irrespective of the drought measure. We believe this points to the wider impact of drought for society but also for possible compounding effects of droughts during armed conflict.

Moderating impact of in- and outgroup belonging

To study possible moderating effects of in- and outgroup belonging (H2), we use the same welfare game and take advantage of the between-subjects treatment (ethno-religious group affiliation). On the basis of the treatment design, we assign the following ethno-religious group affiliations as welfare game targets: Sunni Arab, Yazidi or Shia Arab. Previous research shows ethno-religious outgroup members are treated less favourably in welfare games^{32,44}. There are two differences to the H1 analysis. First, the sample is restricted to Sunni respondents, the great majority of survey respondents. Second, we use the full scale for SPEI with our focus remaining on negative values. A value of -1 corresponds to a condition that is 1 standard deviation drier than the long-term average; accordingly a SPEI value of 1 represents conditions 1 standard deviation wetter than the long-term average.

We find respondents from regions with relatively more arid conditions treat in- and outgroup targets very differently. For example, we consider average marginal effects and differences in predictive margins of ingroup targets (as compared to outgroup targets) over different values of SPEI-12 (Fig. 2a,b). The results reveal altruism to be higher towards ingroup members for respondents with decreasing SPEI values, that is, increasing exposure to drought. This holds for mild to

severe drought conditions and becomes stronger with higher exposure to drought. The moderating effect on altruism declines as SPEI values become higher, that is, as values no longer represent drought conditions. This difference is statistically significant for SPEI values up until about 1, which includes the majority of the sample.

The analysis for H1 revealed a clear correlation between drought exposure and decreased altruism. Here we show this relationship is moderated by group membership. While respondents with higher drought exposure show less prosociality, they still display higher prosociality towards ingroup members. In other words, drought decreases altruism more for outgroup targets compared to ingroup targets. We reiterate that refugee samples often show overall high altruism levels^{13,44}. In substantive terms, respondents with high exposure to drought ($\text{SPEI} < -1$) appear to value the welfare of ingroup targets about the same as their own ($\text{WTR} = 1$) but they value the welfare of outgroup targets about half as much as they value their own welfare ($\text{WTR} = 0.5$).

Our findings support the view that drought exposure exacerbates ethnic divides in line with arguments concerning the effect of gradual environmental changes²⁸. Likewise, it is possible that climate adaptation entails parochial altruism, with cooperation directed towards the ingroup. Speaking more generally to social psychology literature, the findings support realistic conflict theory by providing evidence that scarcity increases parochial altruism^{45,46}.

We further observe differences based on the nature of the ingroup–outgroup relationship (Fig. 2c,d). The results suggest that among Sunni respondents, the moderating effect of group identity is stronger when the outgroup target is defined as Shia Arab compared to when the outgroup target is defined as Yazidi. Under drought conditions ($\text{SPEI} < -1$), Sunni Arab (ingroup) targets are met with greater altruism than Yazidi targets, which are, in turn, met with greater altruism than Shia Arab targets. Thus, while we find drought decreases altruism, it does so more towards members of hostile outgroups (here manifested through the armed conflict) compared to either ingroup members or members of a more neutral outgroup. Parochial altruism appears directed more at a specific group resulting from the experience of drought. This suggests intergroup relations, and historical antagonisms remain a key moderator of the impact of drought, as it could highlight existing grievances, inequality and negative emotions towards outgroup members. The latter is in line with existing work on group hostility and altruism⁴⁴.

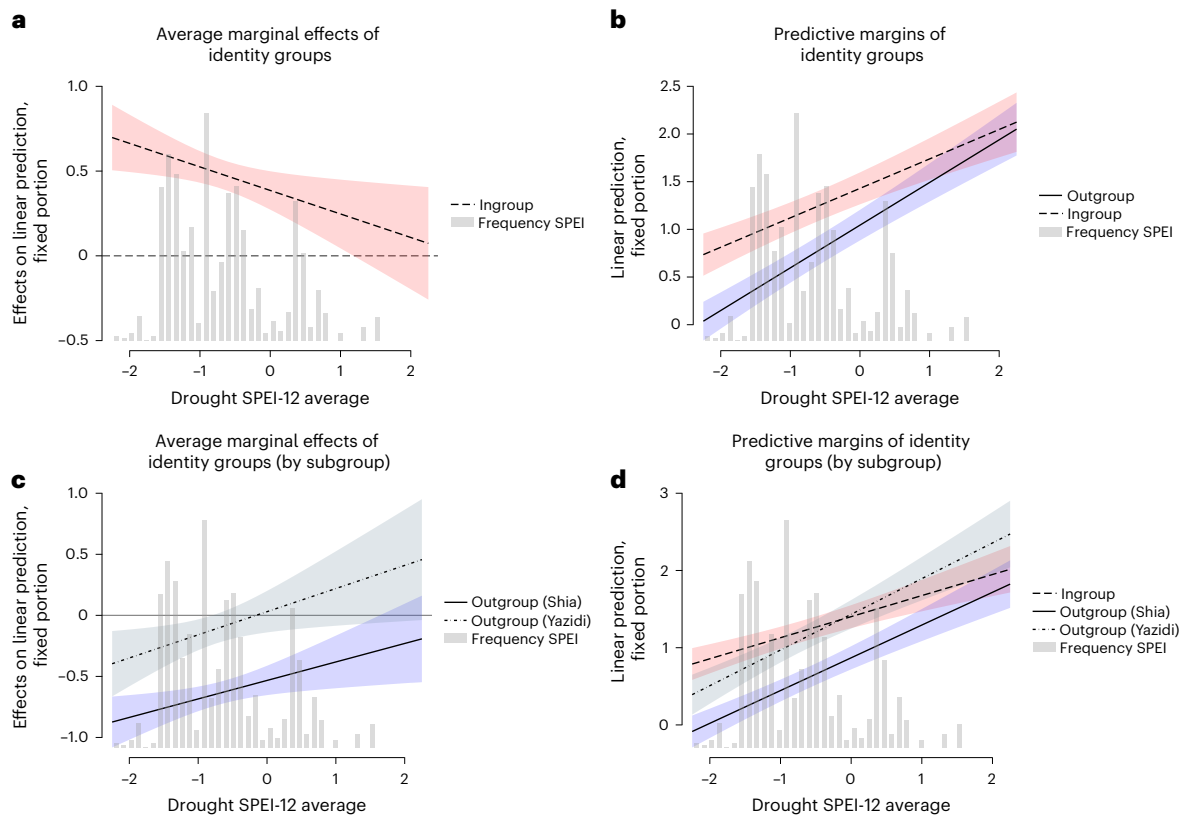


Fig. 2 | Drought moderating in- and outgroup effects on altruism. Point estimates derived from marginal effects and predictive margins for altruism over different values for SPEI-12. Ingroup refers to Sunni respondents and outgroup can be either Shia, Yazidi or both. Overlaid histograms show the distribution of drought SPEI-12 average in the sample. For all sub-figures, shaded areas (pink, ingroup; purple, Shia outgroup; grey, Yazidi outgroup) indicate confidence bands at 0.95 (two-tailed, $n = 3,765$). **a**, The average marginal effect of ingroup

membership on altruism, with outgroup as a base category. **b**, For the same model, predictive values for altruism based on in- and outgroup treatment. Here outgroup can be both subgroups. The underlying model for the lower panel uses two outgroup treatments. **c**, The average marginal effect of outgroup membership, with ingroup as base category. **d**, Predictive values for altruism based on in- and outgroup treatment.

Discussion

Our findings suggest drought exposure is associated with decreased altruism. On the basis of the survey experimental design, we further show how intergroup relations moderate drought's impact on prosociality. The latter could be an important insight for stakeholders working on initiatives to mitigate environmental change for populations most affected by it.

Our findings contribute to the research on resource competition and the wider climate-conflict literature, which links climate-induced hardship with attitudes towards violence^{9,10}. If hardship decreases altruism, repeated instances of selfishness (non-altruism) could create incentives for some individuals to favour violence. Poverty through livelihood loss might also redirect otherwise general cooperative tendencies to recipients of specific groups, such as ethnic ingroups or those sharing a similar burden. Yet, disputes relating to scarce resources are not binary; they can oscillate between collaborative processes and conflictual actions. Exposure to drought may not necessarily increase support for violence directly⁴⁷. However, lowered cooperation typically precedes disputes. Studying altruism or other types of cooperation can therefore provide cues on behavioural changes due to environmental scarcity and violence. More generally, we should expect increased competition over scarce resources. Our study suggests drought-induced scarcity is associated with sustained cooperation within but not between groups. Thus, disputes might ensue not as a result of active exclusion of outgroups but rather indirectly due to the shift in locus of cooperation to the ingroup. This might be

an important puzzle regarding intergroup disputes. It is crucial to understand disputes both as potential breeding grounds for conflict but also as sources of cooperative action. In the long term, habitual interactions shape cooperative solutions as most actors will determine conflict to be too costly as compared to collaboration⁴⁸.

The results also speak to more general studies on migration. Insights from such research give important clues as to the motivations of migrants (including refugees) to leave their homes. Exposure to environmental stress shapes incentives to migrate within and across national borders, including moderating aspects of armed conflict on migration patterns⁴⁹. Our results enrich literature on refugees' attitudes in host countries and can inform more targeted policy action. In 2020 about 90 million people were recorded as displaced persons, including 10 million due to conflict and a further 30 million due to disasters—the highest such numbers since monitoring started⁵⁰.

While many of these migrants are fleeing primarily war, debates persist over how climate change contributes to conflict. Recent work finds climate-conflict interactions not occurring through direct effects, but if at all, rather indirectly through agricultural dependence and political exclusion^{9,10}. While research on the climate-conflict nexus continues, many conflict regions are already affected by climate change. Acknowledging that environmental stress and armed conflict co-occur, we should not only ask if drought and war are linked but how drought and war shape those affected, especially regarding mental health and decision-making.

Our study is also limited in that respondents are from highly drought-prone areas that experienced devastating civil wars.

As other research with refugee populations, our sample could suffer from different biases due to selection and survivorship biases. Future studies should consider the consequences of both fast- and slow-onset events in populations affected and not affected by war. However, researchers should recognize that many areas affected by armed conflict correlate with exposure to natural hazards. In addition, our study's insights on group identity are limited to specific groups. It is plausible that majority–minority relations affect group hostility and altruism. Indeed, our study finds a moderating role of group identity to be more important when intergroup relations are characterized by antagonism and hostility. This opens for several follow-up investigations, for instance, research could consider factors determining the differential treatment of varied outgroups. Furthermore, research could consider different group distinctions, such as refugee–host community relations, both within and beyond Iraq or Syria.

Online content

Any methods, additional references, Nature Portfolio reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at <https://doi.org/10.1038/s41558-023-01732-2>.

References

- IPCC Summary for Policymakers. In *Climate Change 2022: Mitigation of Climate Change* (eds Shukla, P. R. et al.) (Cambridge Univ. Press, 2022).
- WMO *Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019)* (World Meteorological Organization, 2021).
- Costello, A. et al. Managing the health effects of climate change. *Lancet* **373**, 1693–1733 (2009).
- Haines, A. & Patz, J. A. Health effects of climate change. *JAMA* **291**, 99–103 (2004).
- Evans, G. W. Projected behavioral impacts of global climate change. *Annu. Rev. Psychol.* **70**, 449–474 (2019).
- Crandon, T. J. et al. The clinical implications of climate change for mental health. *Nat. Hum. Behav.* **6**, 1474–1481 (2022).
- Romanello, M. et al. The 2022 report of the *Lancet* countdown on health and climate change: health at the mercy of fossil fuels. *Lancet* [https://doi.org/10.1016/S0140-6736\(22\)01540-9](https://doi.org/10.1016/S0140-6736(22)01540-9) (2022).
- Abel, G. J., Brottrager, M., Cuaresma, J. C. & Muttarak, R. Climate, conflict and forced migration. *Glob. Environ. Change* **54**, 239–249 (2019).
- Mach, K. J. et al. Climate as a risk factor for armed conflict. *Nature* **571**, 193–197 (2019).
- Buhaug, H. & von Uexkull, N. Vicious circles: violence, vulnerability, and climate change. *Annu. Rev. Environ. Resour.* <https://doi.org/10.1146/annurev-environ-012220-014708> (2021).
- Berry, H. L., Waite, T. D., Dear, K. B. G., Capon, A. G. & Murray, V. The case for systems thinking about climate change and mental health. *Nat. Clim. Change* **8**, 282–290 (2018).
- Hayes, K., Blashki, G., Wiseman, J., Burke, S. & Reifels, L. Climate change and mental health: risks, impacts and priority actions. *Int. J. Mental Health Syst.* <https://doi.org/10.1186/s13033-018-0210-6> (2018).
- Bauer, M. et al. Can war foster cooperation? *J. Econ. Perspect.* **30**, 249–274 (2016).
- Vollhardt, J. R. & Staub, E. Inclusive altruism born of suffering: the relationship between adversity and prosocial attitudes and behavior toward disadvantaged outgroups. *Am. J. Orthopsychiatr.* **81**, 307–315 (2011).
- Rapaport, C. et al. The relationship between community type and community resilience. *Int. J. Disaster Risk Reduct.* **31**, 470–477 (2018).
- Drury, J., Cocking, C. & Reicher, S. Everyone for themselves? A comparative study of crowd solidarity among emergency survivors. *Br. J. Soc. Psychol.* **48**, 487–506 (2009).
- Vardy, T. & Atkinson, Q. D. Property damage and exposure to other people in distress differentially predict prosocial behavior after a natural disaster. *Psychol. Sci.* **30**, 563–575 (2019).
- Jermacane, D. et al. The English National Cohort Study of Flooding and Health: the change in the prevalence of psychological morbidity at year two. *BMC Public Health* <https://doi.org/10.1186/s12889-018-5236-9> (2018).
- Fernandez, A. et al. Flooding and mental health: a systematic mapping review. *PLoS ONE* **10**, e0119929 (2015).
- Shiba, K. et al. Long-term associations between disaster-related home loss and health and well-being of older survivors: nine years after the 2011 great East Japan earthquake and tsunami. *Environ. Health Perspect.* **130**, 077001 (2022).
- Vins, H., Bell, J., Saha, S. & Hess, J. The mental health outcomes of drought: a systematic review and causal process diagram. *Int. J. Environ. Res. Public Health* **12**, 13251–13275 (2015).
- Fehr, E. & Fischbacher, U. The nature of human altruism. *Nature* **425**, 785–791 (2003).
- Kay, T., Keller, L. & Lehmann, L. The evolution of altruism and the serial rediscovery of the role of relatedness. *Proc. Natl Acad. Sci. USA* **117**, 28894–28898 (2020).
- Rhoads, S. A., Gunter, D., Ryan, R. M. & Marsh, A. A. Global variation in subjective well-being predicts seven forms of altruism. *Psychol. Sci.* **32**, 1247–1261 (2021).
- Stanke, C., Kerac, M., Prudhomme, C., Medlock, J. & Murray, V. Health effects of drought: a systematic review of the evidence. *PLoS Curr.* <https://currents.plos.org/disasters/article/dis-13-0001-health-effects-of-drought-a-systematic-review-of-the-evidence/> (2013).
- Haushofer, J. & Fehr, E. On the psychology of poverty. *Science* **344**, 862–867 (2014).
- Sandi, C. & Haller, J. Stress and the social brain: behavioural effects and neurobiological mechanisms. *Nat. Rev. Neurosci.* **16**, 290–304 (2015).
- Koubi, V., Böhmelt, T., Spilker, G. & Schaffer, L. The determinants of environmental migrants' conflict perception. *Int. Organ.* **72**, 905–936 (2018).
- Folke, C. Resilience: the emergence of a perspective for social-ecological systems analyses. *Glob. Environ. Change* **16**, 253–267 (2006).
- Adger, W. N. Social capital, collective action, and adaptation to climate change. *Econ. Geogr.* **79**, 387–404 (2003).
- Delton, A. W. & Robertson, T. E. How the mind makes welfare tradeoffs: evolution, computation, and emotion. *Curr. Opin. Psychol.* **7**, 12–16 (2016).
- Hall, J., Kahn, D. T., Skoog, E. & Öberg, M. War exposure, altruism and the recalibration of welfare tradeoffs towards threatening social categories. *J. Exp. Soc. Psychol.* **94**, 104101 (2021).
- Pitesa, M. & Thau, S. A lack of material resources causes harsher moral judgments. *Psychol. Sci.* **25**, 702–710 (2014).
- Drury, J., Brown, R., González, R. & Miranda, D. Emergent social identity and observing social support predict social support provided by survivors in a disaster: solidarity in the 2010 Chile earthquake. *Eur. J. Soc. Psychol.* **46**, 209–223 (2015).
- Levine, M., Prosser, A., Evans, D. & Reicher, S. Identity and emergency intervention: how social group membership and inclusiveness of group boundaries shape helping behavior. *Pers. Soc. Psychol. Bull.* **31**, 443–453 (2005).
- Jetten, J. et al. Advancing the social identity approach to health and well-being: progressing the social cure research agenda. *Eur. J. Soc. Psychol.* **47**, 789–802 (2017).

37. Mollica, R. F. et al. The Harvard Trauma Questionnaire: validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *J. Nerv. Ment. Dis.* **180**, 111–116 (1992).
38. Beguería, S., Vicente-Serrano, S. M. & Angulo-Martínez, M. A multiscale global drought dataset: the SPEIbase: a new gridded product for the analysis of drought variability and impacts. *Bull. Am. Meteorol. Soc.* **91**, 1351–1356 (2010).
39. Portmann, F. T., Siebert, S. & Döll, P. MIRCA2000—global monthly irrigated and rainfed crop areas around the year 2000: a new high-resolution data set for agricultural and hydrological modeling. *Glob. Biogeochem. Cycles* <https://doi.org/10.1029/2008gb003435> (2010).
40. International Food Policy Research Institute. Global spatially-disaggregated crop production statistics data for 2010 version 2.0. *Harvard Dataverse* <https://doi.org/10.7910/DVN/PRFF8V> (2019).
41. Kirkpatrick, M., Delton, A. W., Robertson, T. E. & de Wit, H. Prosocial effects of MDMA: a measure of generosity. *J. Psychopharmacol.* **29**, 661–668 (2015).
42. Canevello, A. Hall, J. & Walsh, J. I. Empathy-mediated altruism in intergroup contexts: the roles of posttraumatic stress and posttraumatic growth. *Emotion* <https://doi.org/10.1037/emo0000803> (2022).
43. Delton, A. W., Petersen, M. B., DeScioli, P. & Robertson, T. E. Need, compassion, and support for social welfare. *Polit. Psychol.* **39**, 907–924 (2017).
44. Hall, J. & Kahn, D. T. Exposure to wartime trauma decreases positive emotions and altruism toward rival out-groups (but not nonrival out-groups): a survey experiment in a field setting among Syrian refugees. *Soc. Psychol. Personal. Sci.* <https://doi.org/10.1177/1948550619876631> (2020).
45. Sherif, M. *Group Conflict and Co-operation* (Psychology Press, 1967).
46. Campbell, D. T. Stereotypes and the perception of group differences. *Am. Psychol.* **22**, 817–829 (1967).
47. Linke, A. M., Witmer, F. D. W., O’Loughlin, J., McCabe, J. T. & Tir, J. Drought, local institutional contexts, and support for violence in Kenya. *J. Confl. Resolut.* **62**, 1544–1578 (2018).
48. Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action (Political Economy of Institutions and Decisions)* (Cambridge Univ. Press, 1990).
49. Hoffmann, R., Dimitrova, A., Muttarak, R., Crespo Cuaresma, J. & Peisker, J. A meta-analysis of country-level studies on environmental change and migration. *Nat. Clim. Change* **10**, 904–912 (2020).
50. McAuliffe M. & Triandafyllidou, A. (eds) *World Migration Report 2022* (IOM, 2021).

Publisher’s note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2023

Methods

This analysis builds upon two original, large-scale and comparable survey experiments conducted among refugees from the wars in Syria and Iraq living in Turkey. We matched the survey data to geo-referenced observational data on drought and other variables. This survey represents a unique sample to study drought and altruism. Syria and Iraq are part of a drought-prone region, which means individuals living in this area have been subject to varying degrees of water scarcity. Exposure to war and severe drought endanger livelihoods, often creating notable poverty. In both Iraq and Syria, even areas away from civil war fighting experienced extreme water scarcity and general resource shortage as critical infrastructure such as water services or irrigation were damaged^{51,52}. Water scarcity further exacerbates coping with shortages and puts additional pressure on livelihoods. Thus, the countries represent more likely cases for observing varying drought conditions and attitudes towards cooperation. Furthermore, both countries have experienced intense civil war fighting along ethno-religious identities. We should therefore expect those group identities to be more salient due to the prevailing conflict.

Survey sample and data collection

Survey responses were collected for refugees from Syria and Iraq residing both inside and outside of refugee camps in Turkey during 2017. The data collection was finalized before the data analysis began. One part of the data is a large and diverse sample drawn from a refugee camp in Mardin, located in Southeastern Anatolia, Turkey ($N = 2,292$). However not all refugees from Iraq and Syria reside in camps. Drawing only from such a sample could induce bias. We addressed such concerns by conducting the second survey of a community-based, out-of-camp sample of Syrian and Iraqi refugees, drawn from multiple cities in the Central Anatolia region of Turkey ($N = 1,811$). The survey flow involved participants first completing a demographic questionnaire followed by the welfare game, questions on attitudes towards the welfare game target and finally the checklist of potentially traumatic events. The full list of survey items is included in the Supplementary Information.

Sampling for the community-based survey relied on community trust networks, which means that participants reach out to prospective participants through their own social networks. Data collection was conducted through trained administrators, which increased cultural sensitivity and interpersonal trust. These recruited assistants are themselves refugees from Iraq and Syria. We would like to highlight that this research would not have been feasible without the key effort and hard work by local enumerators. The data collection can be considered cluster sampling, which is relatively common in conflict research, even if this could entail underestimating population variance⁵³. The data collection was continuously evaluated, including implementing further efforts to diversify the sample, for instance, by approaching refugees standing in public transportation hubs, breadlines, outside aid organizations, at universities and in front of refugee camps. Participants of the community-based survey were enrolled in Ankara, Eskişehir, Konya, Istanbul and Yalova until the sample met requirements about diversity and size. One hundred seventeen participants were excluded from data as their age was reported as under 18. From the raw dataset, 87% identified as Sunni Muslim Arabs. As some responses were incomplete in key aspects, we retain a total of 4,103 survey observations. Analyses in the Supplementary Information show the results are not sample dependent.

While psychology studies often use WEIRD (that is, Western, educated, industrialized, rich and democratic) or student-based response samples, survey participants in this study may have experienced high exposure to war trauma. Planning and executing such survey designs requires special care because refugees are considered particularly vulnerable with substantial personal tragedies tied to their journeys. For instance, some research suggests that Syrian refugees face difficulties in maintaining social networks, which also involves decreased

emotional and financial support⁵⁴. Contacting female participants was established through female research assistants. In addition, survey responses were recorded with informed consent in a secluded area on tablet devices in the absence of an enumerator. The only exception to that was when the person was illiterate. Considering increasing numbers of refugees worldwide, it is important to study exposure to violence among refugees because insights from research can meaningfully inform policy decisions and thereby support social cohesion in a sustainable way. The survey project was approved by the regional Ethical Review Board in Uppsala in 2016 (case number 2016/189).

Addressing problems with potential in-sample homogeneity, the data were stratified based on gender and country of origin. Regarding the former, 50% of respondents identified as female and 50% as male. For the community-based sample, about 50% of the survey was completed by respondents from Syria and Iraq, respectively. Yet, Syrian responses make up 78% of the full, pooled sample. Syrian respondents predominately left their countries after 2012, making up 65% of the sample. Furthermore, about half of respondents reported to have completed at least 9 years of schooling and 25% have 12 years of education or more. Self-reported socioeconomic status for the country of origin was reported on an 11-point scale (0–10) with an average of 5.51 (SD = 2.61). The settlement structures for participants' homes of origin were reported as urban by 50% as compared to rural.

The sample largely aligns with populations relevant to climate-conflict research. Both Iraq and Syria have been exposed to varying drought events and armed conflict. Furthermore, people affected by war or environmental scarcity usually reflect a range of socioeconomic backgrounds^{55,56}.

Part of the analysis relies on geographic information, particularly on governorates participants reported to have lived in. Certain regions from the countries of origin are over-represented, probably a result of the conflict dynamics and the respective proximity to Turkey. For Syrian respondents, 25% reported to have lived in the Aleppo Governorate, 15% in Damascus, 10% in Raqqa, 9% in Deir ez-Zor, 8% in Daraa, 8% in Al-Hasakah, 6% in Homs and 5% in Idlib. Respondents from the remaining four governorates each represent between 1 and 3% of the Syrian responses. There is less variation within the Iraqi sample. Here most participants are from Saladin (0.31), Baghdad (0.24), Nineveh (0.18), Al Anbar (0.11) and Basra (0.10). All other Iraqi regions are represented by less than 3%, respectively. More disaggregated geographic data were not collected due to ethical concerns.

Altruism and survey treatment

Altruism among the participants is measured through the WTR, which was developed to evaluate the degree to which a respondent values their own welfare relative to another person's welfare⁴¹. This is an established measure for altruism with existing literature providing several examples of this strategy^{32,42–44}.

The WTR measures the relative value placed on a respondent's own welfare relative to the welfare of someone else. In the survey task, the participants were requested to make 13 consecutive decisions and are told to evaluate each decision independently. In each of the scenarios, the participant is asked to imagine a target individual, presented as a refugee with a specific ethno-religious group affiliation (that is, Sunni Arab, Yazidi or Shia Arab). The characteristics of the target individual remain the same for all 13 scenarios. While we focus on ethno-religious affiliation of WTR recipients, we note that the survey participants are randomly assigned to a total of 12 different conditions ($3 \times 2 \times 2$ between-subjects design) established through combinations of age (25 or 65 years old), gender (female or male) and group affiliation. For example, the question was phrased as 'Imagine you must allocate money between you and a 25-year-old Sunni Arab male refugee. Which option would you choose?' In each scenario, the respondents are asked to choose between giving the target individual a sum of money, held constant in all scenarios (30 Turkish Lira) or receiving a specific amount

of money for themselves. In each scenario, the monetary reward that they would get for themselves becomes progressively lower. To calculate the WTR, we first locate the respondent's 'switch point', that is, the average of the last sum of money the participant opted to keep for themselves and the first sum of money they chose to give to the other person. The WTR is calculated by dividing the switch point by the sum allocated to the other person. The WTR ranges between -1.67 and 2.67 , with higher values indicating a greater degree of altruism. WTR values equal to 1 mean a respondent values their own welfare and others' welfare equally. Values above 1 reflect individuals who value the other person's welfare more than their own. A WTR equal to 0 implies valuing solely one's own welfare, that is, complete selfishness. Lastly, a WTR below 0 implies a respondent is willing to pay to deprive the other of benefits, that is, spitefulness.

A key component of the described trade-off task includes the random assignment to social features of a fictitious person, the recipient of the allocated money. We are aware of issues with hypothetical biases, which have been discussed in the literature^{57,58}. On the basis of the literature, we expect less pronounced bias due to the field setting and because we are less interested in exact magnitudes than in switch points.

For the second hypothesis, H(2), we limit the sample to the ethnic Sunni respondents to ease interpretation for the group treatment variable. This setup allows us to compare in- and outgroup identities from the survey experiment. We treat the 'Sunni Arab' treatment as the ingroup, while 'Shia Arab' and 'Yazidi' are considered outgroup treatments. We then analyse both a combined and disaggregated outgroup treatment (Fig. 2). In the Supplementary Information, we show our result holds when controlling for the two other treatment categories (gender and age) and considering solely Shia-outgroup targets.

Drought

Research suggests that weather perceptions match well against meteorological observations in agriculture-dependent societies⁵⁹. Yet, many countries in the Middle East suffer from regular water shortages and in many places discussing water shortage is considered a 'taboo' seldom done in the public domain⁶⁰. Using observational climate data to obtain drought measures is thus less prone to biases of self-reports. Because drought exposure can have an important impact on livelihoods, particularly in arid regions, we assume such effects to be potentially long lasting^{4,5}.

We match drought conditions to the respective year each survey respondent reported to have left their country. Our analysis builds on several different measures for drought that we aggregate to the governorate level, derived from a 0.5 by 0.5 decimal degree grid⁶¹. Drought conditions might matter more for areas with important crops, especially regarding rainfed agriculture. We therefore consider several SPEI measures³⁸ to capture intra-annual drought variation: annual drought aggregates, six-month measures for growth season drought of major crops, measures for rainfed agriculture, high-value rainfed agriculture and several combinations^{39,40}. For our annual drought measures, we use governorate averages of SPEI-12 for December of each relevant year, based on the SPEI³⁸. For variables considering harvesting periods, we use the lowest SPEI-6 value at the final month of the crop growth season for an area within a given governorate. For instance, if the last month of the local crop's growing period is given as August, SPEI-6 values in our analysis would represent the conditions for the six-month period covering March to August. We consider a local major crop as the respective crop with largest harvest area based on global data for irrigated and rainfed crops³⁹. The Supplementary Information further details aggregation and coding procedures for all drought measures, including additional results showing our findings are robust to different operationalizations.

The mean value for SPEI is 0, and the standard deviation is 1. SPEI values are spatially and temporally comparable. For ease of

interpretation, we use dummy variables in our models for direct effects (Hypothesis 1) and the full SPEI scale for Hypothesis 2. For the former, the variable takes the value 1 if at least one area within a governorate reports SPEI values below one standard deviation, thus indicating more than usual dry conditions.

Using governorate-based aggregates for respective drought-year assumes that local drought affects wider areas. We find this plausible as local droughts can have spillover effects and because environmental hazards can create a sense of exposure for those nearby even if they were not directly affected⁶²⁻⁶⁴. Some survey respondents left their home countries before 2010. For those responses, the survey uses intervals to mark the time periods when individuals left, and we aggregated data for the intervals accordingly. The exact phrasing is 'When did you leave Syria/Iraq?' The time periods are: 1994 or earlier, 1995-1999, 2000-2004 and 2005-2009.

Control variables and estimation

We carefully considered potential confounding variables based on other findings. In some situations, altruism can vary with gender^{65,66}; moreover, previous research suggests climate resilience to drought differs by gender⁶⁷. Other work also shows that drought impacts people differently depending on their age, while under some conditions, age may explain prosocial attitudes^{32,68}. Altruism is also affected by mental health. The interactions of mental health and drought have been shown to differ by rural or urban dwelling⁶⁹ and by how much people are exposed to poverty²⁶. Thus, we should expect areas with higher population density (like urban areas) to be affected differently by drought or include demographics that explain variation in altruism. Ethnically motivated civil conflict can trigger more parochial views, thereby making in- and outgroup differences more salient. This salience could diminish prosociality or inter-ethnic cooperation commonly found in drought-experienced communities. Respondents in our sample have had varying exposure to war, which can have notable effects on altruism. Furthermore, in the case of Syria, research finds violence to be higher during the cropping season⁷⁰. Thus, it is important to control for possible exposure to potentially traumatic events, including war-related violence^{13,71}. On the basis of these insights, we use the following controls derived through the survey: age, gender, education, urban versus rural background and socioeconomic status before leaving. Furthermore, we use governorate-level data to capture population density and disaggregated gross domestic product data.

Exposure to wartime trauma was assessed using Part I of the Harvard Trauma Questionnaire³⁷. The version of the Harvard Trauma Questionnaire we use contains a checklist of 16 traumatic life events, determined to be relevant for Syrian and Iraqi refugees. The instrument includes the following comprehensive list: (1) 'Lack of food or water', (2) 'Ill health without medical care', (3) 'Lack of shelter', (4) 'Imprisonment', (5) 'Physical abuse', (6) 'Serious injury', (7) 'Combat situation', (8) 'Indiscriminate shelling or bombing', (9) 'Being close to death', (10) 'Forced evacuation', (11) 'Forced separation from family', (12) 'Murder of family or friend', (13) 'Unnatural death of family or friend', (14) 'Murder of stranger or strangers', (15) 'Kidnapped' and (16) 'Torture'.

In our estimation strategy, we employ hierarchical linear models with random intercepts for governorates to account for variation at that administrative level. It is possible that the effect of drought also varies by governorate; we therefore conduct robustness tests with random coefficients for drought in addition to random intercepts (appendix includes results and other robustness tests). Following ref. 72, we can write the varying-intercept model more generally as $y_i = \alpha_{j[i]} + \beta x_i + \varepsilon_i$. The equation for both varying slopes and coefficient is represented as $y_i = \alpha_{j[i]} + \beta_{j[i]} x_i + \varepsilon_i$. The annotation follows those commonly used for linear regression. y represents our unit-level outcome variables. We consider i to represent individual responses, which is our unit of analysis, $j[i]$ indexes governorates where a respondent i has resided before leaving.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

The dataset analysed during the current study is available in the Harvard Dataverse repository, <https://doi.org/10.7910/DVN/SWEYRW>.

References

51. Eklund, L., Degerald, M., Brandt, M., Prishchepov, A. V. & Pilesjö, P. How conflict affects land use: agricultural activity in areas seized by the Islamic State. *Environ. Res. Lett.* **12**, 054004 (2017).
52. Eklund, L. & Thompson, D. Differences in resource management affects drought vulnerability across the borders between Iraq, Syria, and Turkey. *Ecol. Soc.* <https://doi.org/10.5751/es-09179-220409> (2017).
53. Eck, K. in *Understanding Peace Research: Methods and Challenges* (eds Höglund, K. & Öberg, M.) 165–181 (Routledge, 2011).
54. Stevens, M. R. The collapse of social networks among Syrian refugees in urban Jordan. *Contemp. Levant* **1**, 51–63 (2016).
55. Claassen, C. Group entitlement, anger and participation in intergroup violence. *Br. J. Polit. Sci.* **46**, 127–148 (2014).
56. Kaczan, D. J. & Orgill-Meyer, J. The impact of climate change on migration: a synthesis of recent empirical insights. *Climatic Change* **158**, 281–300 (2019).
57. Haghani, M., Bliemer, M. C. J., Rose, J. M., Oppewal, H. & Lancsar, E. Hypothetical bias in stated choice experiments: part II. Conceptualisation of external validity, sources and explanations of bias and effectiveness of mitigation methods. *J. Choice Model.* **41**, 100322 (2021).
58. Penn, J. M. & Hu, W. Understanding hypothetical bias: an enhanced meta-analysis. *Am. J. Agric. Econ.* **100**, 1186–1206 (2018).
59. Linke, A. M., Witmer, F. D. W. & O’Loughlin, J. Do people accurately report droughts? Comparison of instrument-measured and national survey data in Kenya. *Climatic Change* <https://doi.org/10.1007/s10584-020-02724-3> (2020).
60. De Châtel, F. The role of drought and climate change in the Syrian uprising: untangling the triggers of the revolution. *Middle East Stud.* **50**, 521–535 (2014).
61. Tollefsen, A. F., Strand, H. & Buhaug, H. PRIO-GRID: a unified spatial data structure. *J. Peace Res.* **49**, 363–374 (2012).
62. Ntontis, E. et al. Collective resilience in the disaster recovery period: emergent social identity and observed social support are associated with collective efficacy, well-being, and the provision of social support. *Br. J. Soc. Psychol.* <https://doi.org/10.1111/bjso.12434> (2020).
63. Lujala, P., Bezu, S., Kolstad, I., Mahmud, M. & Wiig, A. How do host-migrant proximities shape attitudes toward internal climate migrants? *Glob. Environ. Change* **65**, 102156 (2020).
64. Döring, S. & Mustasilta, K. Spatial patterns of communal violence in sub-Saharan Africa. *J. Peace Res.* (2023, in the press).
65. Andreoni, J. & Vesterlund, L. Which is the fair sex? Gender differences in altruism. *Q. J. Econ.* **116**, 293–312 (2001).
66. Boschini, A., Dreber, A., von Essen, E., Muren, A. & Ranehill, E. Gender and altruism in a random sample. *J. Behav. Exp. Econ.* **77**, 72–77 (2018).
67. Perez, C. et al. How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. *Glob. Environ. Change* **34**, 95–107 (2015).
68. Sparrow, E. P., Swirsky, L. T., Kudus, F. & Spaniol, J. Aging and altruism: a meta-analysis. *Psychol. Aging* **36**, 49–56 (2021).
69. O’Brien, L. V., Berry, H. L., Coleman, C. & Hanigan, I. C. Drought as a mental health exposure. *Environ. Res.* **131**, 181–187 (2014).
70. Linke, A. M. & Ruether, B. Weather, wheat, and war: security implications of climate variability for conflict in Syria. *J. Peace Res.* **58**, 114–131 (2021).
71. Bauer, M., Cassar, A., Chytilová, J. & Henrich, J. War’s enduring effects on the development of egalitarian motivations and in-group biases. *Psychol. Sci.* **25**, 47–57 (2014).
72. Gelman, A. & Hill, J. *Data Analysis Using Regression and Multilevel–Hierarchical Models* (Cambridge Univ. Press, 2007).

Acknowledgements

We especially thank D. Karakus for his excellent research assistance during data collection. S.D. and J.H. were funded by RJ (M21-0002). S.D. was funded by VR (2022-00183). J.H. was also funded by VR (2015-06564). S.D. acknowledges support from the International Centre for Water Cooperation, Stockholm.

Author contributions

S.D. and J.H. conceptualized the paper and methodology and wrote the original draft. J.H. conceived and designed the experiments. S.D. performed data curation, formal analysis and visualization.

Funding

Open access funding provided by Uppsala University.

Competing interests

The authors declare no competing interests.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1038/s41558-023-01732-2>.

Correspondence and requests for materials should be addressed to Stefan Döring.

Peer review information *Nature Climate Change* thanks Raya Muttarak, Quynh Nguyen and Nicholas Seltzer for their contribution to the peer review of this work.

Reprints and permissions information is available at www.nature.com/reprints.

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a | Confirmed

- The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement
- A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
- The statistical test(s) used AND whether they are one- or two-sided
Only common tests should be described solely by name; describe more complex techniques in the Methods section.
- A description of all covariates tested
- A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
- A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
- For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
Give P values as exact values whenever suitable.
- For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
- For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
- Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection

Data analysis

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender Addressing problems with potential in-sample homogeneity, the data was stratified based on gender and country of origin. Regarding the former, 50% of respondents self-identified as female and 50% as male. Gender (variable taking the value 2 for female) is a covariate in all analyses conducted.

Population characteristics All respondents are refugees. For the community-based sample, about 50% of the survey was completed by respondents from Syria and Iraq, respectively. Yet, Syrian response make up 78% of the full, pooled sample. Syrian respondents predominately left their countries after 2012, which makes up 65% of the sample. Furthermore, about half of respondents reported to have completed at least 9 years of schooling and about a quarter have 12 years of education or more. Self-reported socioeconomic status for the country of origin was reported on an 11-point scale (0-10) with an average of 5.54 (SD = 2.61). The settlement structures for participants' homes of origin were reported as urban by 50% as compared to rural.

Recruitment Community-based sample:
In order to gain access to this population, a Turkish fieldwork coordinator and a team of local assistants, themselves refugees from Syria and Iraq, were recruited and trained to administer the survey. Using local assistants to administer the survey helped to ensure that the study was carried out with cultural sensitivity and in a context of interpersonal trust. We acknowledge the important contribution and immense work effort invested by these local research assistants; this research would not have been possible to carry out without them.

Data collection was initiated and completed in 2017. The same procedure for participant recruitment was carried in the cities of Konya, Yalova, Istanbul, Ankara, and Eskisehir. Potential survey participants were informed about the University conducting this study. Those approached were also provided with relevant contact information. Before being asked to give consent to participate, those approached were informed that their participation was completely voluntary and they could leave at any time and for any reason. Those who chose to participate received a small amount of money as compensation (20 Turkish lira). The study was administered inside private homes on tablet computers individually and anonymously. The only exception was made for illiterate participants. In these cases, the research assistant conducted an oral interview. Female RAs interviewed female respondents. This project received approval from the Ethical Review Board.

Camp-based sampling procedure:

Six months prior to collecting the second survey sample for this study, the research team invested substantial time and effort developing relationships and broad access within local communities living in the Midyat refugee camp, the nearby city of Mardin, and surrounding villages for a separate project. During this period, the team established trust with individuals and families that were well-known and well-regarded in the local community. The team further approached local non-governmental organizations to facilitate contacts with minority communities. This was very helpful for recruitment and developing a positive reputation locally. To establish trust, the background and purpose of the study was explained in broad terms using the background information sheet prepared by the project leader.

We obtained the support of the local governor and camp headmaster to conduct the study as long as the interviews were conducted outside the camp. To limit crowding in the city, the camp management limited the number of camp residents that could visit the city each day to 300-400 persons and alternated on a rolling basis. Living arrangements in the camp were segregated by country of origin and ethnicity. A gender-stratified sample of Arab residents leaving the camp to visit the city were approached each day by our team of research assistants (RA) and offered to participate. Potential participants were informed that the study aimed to better understand how experiences during war and displacement impact decision-making. Potential participants were informed about the University conducting this survey and were provided with the contact information of the second author. Before being asked to give consent to participate, those approached were further informed that participation was completely voluntary and they could discontinue their involvement at any time and for any reason.

Those who agreed to participate were given a small sum of money (20 Turkish Lira) as compensation. The RAs were fluent in Arabic and familiar with local customs. They had received training and instructions in research methodology, in addition to having experience with similar research. Female RAs interviewed female respondents. Interviews occurred in a secluded area of a local tea shop and involved survey participants completing the survey questionnaire on a tablet device in the absence of the RA. The only exception was made for illiterate participants. In these cases, the RA conducted an oral interview. This project was approved by the Ethical Review Board.

Ethics oversight Regional Uppsala Ethical Review Board, May 2016 (Case number/Dnr 2016/189)

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

Life sciences Behavioural & social sciences Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	This is a quantitative study.
Research sample	To study the impact of drought in a refugee sample, reaching populations directly affected by war is of central importance. Community-based samples of refugees with a high degree of exposure to potentially traumatic events are rarely researched due to the inherent difficulties in gaining access to such populations and the logistical barriers for surveys. We thus designed our sampling approach to ensure we could include a diverse sample of refugees living both inside and outside of Turkish refugee camps.
Sampling strategy	<p>Community based sample: Building on the established trust networks, we employed chain-based sampling, whereby existing participants recruit future participants from among their social networks, a sampling procedure frequently employed to identify otherwise hidden populations. The team was trained in the city of Konya and then went to other cities depending on their personal networks and knowledge of local neighborhoods. In every location, teams of 2-3 assistants first established relationships of trust with individuals and families that were well-known and well-regarded in the local community. Upon completion of the session, the participants were asked to put us in contact with additional families for future sessions. Much of this work occurred in the evenings after work. During the day, strategy was evaluated and efforts were made to further diversify the sample, for instance, by approaching refugees standing in breadlines, outside aid organizations, in public transportation hubs, at universities and in front of refugee camps.</p> <p>Camp-based: We obtained the support of the local governor and camp headmaster to conduct the study as long as the interviews were conducted outside the camp. To limit crowding in the city, the camp management limited the number of camp residents that could visit the city each day to 300-400 persons and alternated on a rolling basis. Living arrangements in the camp were segregated by country of origin and ethnicity. A gender-stratified sample of Arab residents leaving the camp to visit the city were approached each day by our team of research assistants (RA) and offered to participate. Potential participants were informed that the study aimed to better understand how experiences during war and displacement impact decision-making.</p> <p>In order to determine sample sizes, we carried out power analysis, using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009), which indicated that a sample size of 1,548 ($1 - \beta > .95$) was sufficient to detect a small effect (effect size $f = 1/4 \cdot 10$) in each sample.</p> <p>Reference: Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. <i>Behavior research methods</i>, 41(4), 1149-1160.</p>
Data collection	<p>Researchers were blind to the experimental condition.</p> <p>Community based sample: The study was administered inside private homes on tablet computers individually and anonymously. The only exception was made for illiterate participants. In these cases, the research assistant conducted an oral interview. Female RAs interviewed female respondents.</p> <p>Camp-based: Interviews occurred in a secluded area of a local tea shop and involved survey participants completing the survey questionnaire on a tablet device in the absence of the RA. The only exception was made for illiterate participants. In these cases, the RA conducted an oral interview.</p>
Timing	<p>Community-based sample: July 9, 2017 - August 11, 2017</p> <p>Camp sample: August 8, 2017 - September 8, 2017</p>
Data exclusions	117 participants were excluded from data as their age was self-reported as under 18.
Non-participation	Before being asked to give consent to participate, those approached were informed that their participation was completely voluntary and they could leave at any time and for any reason. No dropouts were observed.
Randomization	Treatment was randomly assigned through Qualtrics software on a tablet device.

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

- | n/a | Included in the study |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Antibodies |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Eukaryotic cell lines |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology and archaeology |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Animals and other organisms |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Clinical data |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Dual use research of concern |

Methods

- | n/a | Included in the study |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> ChIP-seq |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Flow cytometry |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> MRI-based neuroimaging |