Published in Human Nature (2013) 24: 33-58; DOI 10.1007/s12110-012-9157-5

Risk, Uncertainty, and Violence in Eastern Africa
A Regional Comparison

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Abstract Previous research on warfare in a worldwide sample of societies by Ember and Ember (1992a) found a strong relationship between resource unpredictability (particularly food scarcity caused by natural disasters) in nonstate, nonpacified societies and overall warfare frequency. Focusing on eastern Africa, a region frequently plagued with subsistence uncertainty as well as violence, this paper explores the relationships between resource problems, including resource unpredictability, chronic scarcity, and warfare frequencies. It also examines whether resource scarcity predicts more resource-taking in land, movable property, and people, as well as the commission of atrocities. Results support previous worldwide results regarding the relationship between resource unpredictability and warfare frequency. Results regarding resource-taking and atrocities are more nuanced and complex. In almost all findings, relationships are generally in opposite directions in nonstate and state societies. In post-hoc analyses, atrocities are significantly more likely to be committed in states than in nonstates.

Keywords Warfare, resource unpredictability, resource scarcity, eastern Africa, resource-taking, atrocities

Famines with high mortalities have become increasingly rare in recent years except in parts of Africa, particularly in the Horn (Devereux et al. 2002). The news from Somalia, Ethiopia, and parts of Kenya portrays shocking pictures of people suffering “mass mortality famines” of the kind previously occurring in many historically-famine-prone countries (Devereux 2000). As in the past, many of the current famines in eastern Africa are partially caused by natural disasters, primarily periods of prolonged drought. We recognize that droughts alone do not cause famine (Sen 1981) and that famines are multi-phased processes (Rangasami 1985) that evolve from bad to worse when people’s ability to access food is deliberately jeopardized by political and social means (de Waal 1989). Nonetheless, we think it important to systematically evaluate the relationships between various types of food risks to see to what degree they predict warfare in

the eastern African region. We employ cross-cultural synchronic methods to address the relationships between different types of resource scarcities and various aspects of warfare—frequency, taking of land and other resources, and the conduct of combatants during warfare, particularly whether atrocities are committed. The food risks we examine range from extremely serious unpredictable events (e.g., famines or natural disasters that destroy substantial amounts of food supplies)[1] to more predictable, chronic shortages (seasonal or nonseasonal).

The research reported on here focuses mostly on anthropological descriptions of eastern African societies while they were still fighting in traditional ways prior to the imposition of colonial rule and later post-independence governments, because many of the societies in eastern Africa had peace deliberately imposed upon them. To include such pacified societies as "low or rare" warfare societies would weaken our chances of finding relationships between resource problems and warfare.

This research is part of a larger project designed to develop agent-based computer models to predict the conditions under which violence occurs in eastern Africa, an area still frequently plagued by risk and uncertainty mostly caused by famine and drought. Ecological conditions are one of the main sets of conditions being modeled, along with subsistence/economic strategies, social organization, and the effects of international and national actions and conditions. The importance of models is that they allow manipulation of parameters and assumptions, but to be useful the modelers need to know what key assumptions they need to make and what reasonable parameters to put into the models. And so we employ a regional, cross-cultural comparison to empirically evaluate theories about relationships between resource scarcities and warfare.

Background

The idea that resource scarcity would increase the likelihood of war is not new, but it was brought into prominence by ecological anthropologists in the 1960s and 1970s, particularly by Vayda (1967, 1976, but see 1989), Rappaport (1967:114–117, 224–229), Harris (1974, 1984), and Gross (1975). For example, as Vayda and Rappaport discussed, a population may at times approach or exceed its carrying capacity, and the aggression and warfare that may result at those times could reduce the population pressure because of casualties and/or shifts in who possesses resources. In this scenario, warfare should cease when the population is more in line with its resources. More recently, Gat (2006:662-672), Kelly (2000:132-133), and LeBlanc (2003:69) have pointed to resource scarcity as an important cause of warfare, particularly in simpler societies. Given the high mortality estimated for males in warfare (simpler societies appear to have higher rates than complex societies—see Gat 2006:664 and Pinker 2011:53), how is willingness to risk your life for others individually adaptive? Durham (1976) proposed a complementary relationship between cultural and biological evolution, arguing that ultimately individual fitness must increase as a result. If resources are in short supply or threatened by others, group action in warfare, if successful, should enhance individuals' fitness benefits.[2] Bowles (2009) suggested that the emergence of willingness to sacrifice in warfare for others—parochial altruism—will be selected for as long as groups with a larger number of altruists are more likely to gain resources from losers. Although not said directly, resource scarcity would presumably increase the fitness gains to winners compared with losers.[3]

A more proximate mechanism that might lead to the increase of conflict is the increase in frustration or irritability that individuals would experience with chronic scarcity, which would, in turn, increase the likelihood of violence (LeVine 1980; Bolton 1973; Bolton and Vadheim 1973). LeBlanc (2003:69–70) postulates a different proximate mechanism, namely, people's perception that they are falling below their minimal standard of living—LeBlanc suggests that hunger will

motivate taking food or food-producing land from others if no higher political authority is there to stop them. States, on the other hand, he argues, can let some people starve. Humans work cooperatively, so they will likely try to take resources by group action, or warfare.

The "population pressure" theory was tested on a worldwide sample by the Embers (Ember and Ember 1992a). Although their results were consistent with the "population pressure" argument, in that some measures of resource scarcity strongly predicted more warfare, particularly in nonstate societies, a couple of puzzling results prompted them to suggest an alternative explanation. The first puzzling result was that in a multiple regression analysis, only unpredictable scarcity was significant—chronic scarcity was not. If anything, chronic shortages should be a better measure of population pressure than unpredictable scarcity. Second, the Embers' data suggested that people were not just taking resources when they are in trouble. Not many societies had more than two unpredictable disasters in the 25-year time period measured. And yet, most of those societies had warfare at least once every year. That fact prompted the Embers (1992a:256) to suggest that it seemed to be the fear of economic loss, rather than actual loss, which seemed to motivate people in nonstate societies to fight. Using the word "fear" may suggest that the impetus for war is more psychological than economic. However we would argue that if you don't know when disaster will hit, having somewhat more to start with would usually be better than starting with less. If the land will only yield one-third of a crop in a drought, then starting with more cropland would be better. If a larger herd can be supported in good times, a larger herd even if decimated 75% will still leave you with more livestock. Given that you don't know when that disaster will hit—it could be any year—taking resources in advance may make some economic sense. It could also be argued that taking resources from the losers gives the winners even greater economic and political advantages over the losers in future confrontations.[4] Obviously there are very high costs to lives and resources as well. It is difficult for researchers to evaluate whether the payoffs outweigh the costs.[5]

The effect of resource unpredictability is also supported by temporal studies in coastal southern California (Lambert 1997), the U.S. Southwest (Lekson 2002), Korea (Kang 2000), and China (Zhang et al. 2007). And a recent study of livestock raids in northwestern Kenya found the most intense violence occurred in drought years (Ember et al. 2012).[6]

Burtsev and Korotayev (2004:35; see also Korotayev 2008), reanalyzing the Embers' (1992a, 1992b) data, reported that state societies showed strong opposite effects—in state societies, unpredictable disasters significantly predicted less overall warfare. These findings prompted us to analyze results separately for nonstate and state societies, and based on that reanalysis we now predict negative effects in state societies.[7]

If resource scarcity is a driver of warfare, we expect that the victors will take resources when they win to compensate for their resource deficits. Hence, we expect both that taking resources is the norm and that the more serious the resource problems, the more resources would be taken. However, we hypothesize that taking people would work oppositely in the face of resource scarcity, since generally more people require more food. The relationships between resource problems and outcomes of warfare or behaviors exhibited during warfare, which we will examine here, have not to our knowledge been systematically examined.

Warfare is not pretty; whenever there is armed combat, people are killed. But societies vary in their customary behavior regarding combatants and noncombatants. We are dealing with societies that for the most part in the time frame described had no equivalent of international conventions and agreements regarding appropriate conduct in warfare; therefore we are not using the term "war crimes." Nevertheless, some societies had customs that limited the harm directed toward noncombatants or the number of combatants killed, whereas others exhibited little

restraint. We focus our research on behaviors that the international community agrees are war crimes (ICRC 2012): killing noncombatants purposely, torture, rape, and the needless destruction of property. We also looked at killing combatants to see if it appeared excessive (e.g., slaughtering the entire group). We use the word "atrocities" as a shorthand term. Why terrorize others? It can be argued that terrorizing will make it more likely that the victims and their families will flee or give up access to their current resources,[8] so we expected that resource scarcity should increase such behaviors in all types of societies (states and nonstates).

With regard to behavior toward combatants, a few cross-cultural studies and reviews have looked at killing captured combatants and noncombatants (Hobhouse, Wheeler, and Ginsberg 1915; Keeley 1996:87; Otterbein 2000:439). Although previous results are contradictory regarding the type of society likely to kill captured warriors (Otterbein found less-complex societies less likely to do so; the other studies mentioned above found such societies more likely), such behaviors appear to be partially related to political organization, which we plan to examine here. In addition, Otterbein (2000) found that societies that kill enemy captives are likely to also kill women and children, suggesting a pattern of terrorizing behavior in different domains.

Because previous research found that the state-nonstate contrast makes a difference in both the strength and direction of correlations, we distinguish the states from nonstates throughout the analyses.

Hypotheses

To summarize, our hypotheses regarding resource scarcity and warfare frequencies, resource-taking, and atrocities are as follows:

Warfare Frequency

Hypothesis 1: Resource scarcity will be associated with higher warfare frequencies in nonpacified societies.

- 1a. More specifically, in nonstate societies, resource scarcity will be positively associated with warfare (and, by extension, with internal, external attacking, and external attacked frequencies).
- 1b. In state societies, resource scarcity will be negatively associated with warfare (and, by extension, with internal, external attacking, and external attacked frequencies).
- 1c. Unpredictable scarcity will be more predictive of higher warfare frequencies than predictable (chronic) scarcity.

Taking Resources

Hypothesis 2. Taking of resources occurs in most societies during the course of warfare.

Hypothesis 3. Resource scarcity will be associated with frequency with which resources are taken in the course of warfare.

- 3a. More specifically, the more resource scarcity, the more likely land and movable property will be taken in warfare.
- 3b. The more resource scarcity, the less likely people will be taken in warfare.

Atrocities

Hypothesis 4. The more resource scarcity, the more likely atrocities will be committed in warfare.

Methods

Most systematic cross-cultural studies employ synchronic analyses, looking to see if variables are related in ways predicted by the theories and hypotheses. In a synchronic comparison it is vital to measure all the variables for each case in more or less the same time period (Ember et al. 1991; Ember and Ember 2009) If there is a causal relationship, the presumed cause and effect should occur in close time proximity. If different variables are measured at different time periods, there will be considerable measurement error (Divale 1975). By "same time period" we do not mean that each society in the sample has the same time focus. We mean that all the variables for each society are measured for that society's focal time and place. For the purpose of studying warfare, the earliest time frame is generally preferable. Regardless of the time frame chosen for each society, the assumption is made that if there are lawlike patterns, the patterns should hold for any time and place.

Every case rated in our study was pinpointed to a 25-year time period, usually −15 and +10 years around a selected "ethnographic present." The initial starting point for a focus came from the sample we used (see below). If the society was already pacified (that is, all warfare ceased because of colonial authorities), we tried to go back earlier in time to find traditional warfare patterns. However, in a few cases we moved the time period forward to a time that was no longer pacified. By definition, pacification means that fighting was effectively halted.

Warfare and resource problems were rated by the second and third authors, who were not aware of the hypotheses when the variables were coded. Although we initially decided that each would read the ethnographic material independently, we did not have enough time to continue this practice, so in most cases one of the authors read the ethnographic literature and took notes, usually with verbatim quotes; the other coder independently rated from the notes.

We use multivariate regression to evaluate the independent effects of unpredictable resource scarcity versus chronic scarcity on warfare frequencies in nonstate and state societies separately. Because the earlier study (Ember and Ember 1992a:250) noted but did not publish the multivariate analyses comparing unpredictable with predictable scarcity, we have reanalyzed the data for the worldwide sample. The other relational hypotheses are evaluated bivariately.

Sample

To maximize variation in resource problems, we needed to include a broad range of econiches and so our regional comparison encompasses a broad region from the Horn of Africa in the east to the eastern Congo in the west, the southern Sudan in the north, and the northern parts of Zambia, Malawi, and Mozambique in the south. This region does not technically have a name, but we will refer to it as "eastern Africa."

We resorted to three sources of data to get a sample size of about 40 cases. We first included all the societies in this area in the HRAF Collection of Ethnography (paper and eHRAF World Cultures) as of 2009. We next included all the eastern African cases in the Standard Cross-Cultural Sample (SCCS) (Murdock and White 1969) that were not in eHRAF, and then we randomly sampled (using a table of random numbers) additional societies from this region from the *Ethnographic Atlas* (EA) (Murdock 1962 and subsequent issues). Because eHRAF includes many time and place foci, we used the time and place foci in the SCCS or EA as a starting point. In all cases, if there wasn't sufficient information to code warfare frequency for the ethnographic

present listed in the SCCS or EA, or if the society was already pacified, we looked for a nonpacified time period that could be rated with sufficient ethnographic information. If we could not find warfare descriptions for a nonpacified time period, we went on to the next randomly sampled case. About 60 societies were examined in this study, but only 38 societies had sufficient information on at least one nonpacified time period (see the sample cases and the foci in the Appendix). In general, the societies in the HRAF Collection of Ethnography had more information than those randomly sampled from the EA.

This sampling procedure resulted in overlap between the worldwide Ember and Ember (1992a) study based on the SCCS and the eastern African sample. To ensure that the worldwide results were not conflated by the inclusion of eastern African societies, we reanalyzed the data from the worldwide sample (Ember and Ember 1992b),[9] omitting all the overlapping eastern African societies. To alleviate concern about the fact that the eastern African sample contains neighboring societies, possibly compromising the independence of cases (if one society attacks the other, the ratings of overall warfare may be higher in each), we reanalyze our eastern African results by omitting one case from a set of neighbors.[10]

Definitions and Coding Procedures

This section describes the variables we considered in broad terms—the coding scales are described in the Appendix. The coded data can be found at www.yale.edu/hraf/Ember2013.

Warfare. As in the Ember and Ember (1992a:248) study, warfare is defined as "socially organized armed combat between members of different territorial units (communities or aggregates of communities)." Note that the scale and organization of warfare in our sample generally differs considerably from warfare in modern nation-states. Any socially organized armed combat between communities or larger units was considered warfare regardless of the stated intent. By this definition, we focus on armed combat of socially organized groups, not on motives for fighting. Accordingly, some feuding will be considered warfare, if the episode is between communities or larger units and if at least one socially organized group is present on at least one side.[11]

For this study, we rated a number of dimensions of warfare during the focal period for each society—frequency (overall frequency, internal frequency, external frequency, external attacking frequency, and external attacked frequency), outcomes of warfare (taking of land, taking of people, taking of nonland, nonpeople resources—"movable property" for short), and harm inflicted on combatants and noncombatants.

With regard to internal versus external warfare frequency, we follow Ember and Ember (1992b:173) in distinguishing internal from external warfare as follows: "internal warfare is defined as socially organized armed combat between territorial units (communities or larger aggregates) within the same society. . . . External warfare refers to war between the focal society and other societies." *External attacking* refers to the frequency with which the focal society attacks other societies, and *external attacked* refers to the frequency with which the focal society is attacked by others. Because external attacking and external attacked are very highly correlated with overall external warfare, we omit analyses with overall external warfare frequency here and focus on the components.

In terms of outcomes, we distinguish the taking of three kinds of resources when the victors win—land, movable property, and people. We also coded harm inflicted on combatants and noncombatants (see Appendix for the scales). Both outcomes and inflicted harms were coded separately for internal and external warfare.

Resource Scarcity. Two kinds of resource scarcity are distinguished here—unpredictable scarcity and chronic scarcity. Two types of unpredictable resource problems are analyzed for the 25-year period—(1) frequency of famine and (2) frequency of natural disasters that seriously destroy food supplies. These two variables follow the coding rules of Ember and Ember (1992a, 1992b). Although we also initially followed the Embers' earlier coding scheme for chronic scarcity, we subsequently decided that the scale really tapped two different kinds of chronic problems, and so for analytic purposes we separated the scale into two parts: (1) prevalence of chronic shortages for the population ("chronic nonseasonal scarcity") and (2) chronic seasonal shortages (i.e., hungry months) and we recoded accordingly—see Appendix.

Results

Resource Unpredictability, Chronic Shortages, and Frequencies of Warfare

The hypotheses regarding resource scarcity and warfare frequencies (1–1c) are largely supported in the eastern Africa sample (Table 1) and are generally consistent with reanalyzed data from the Ember and Ember (1992a) study shown in Table 2. Because our hypotheses predict an overall effect of one or more resource scarcities on warfare frequency and also postulate that resource unpredictability has more of an effect than chronic scarcity, we have put both types of scarcity into the multiple regression models. We only use the stronger measure of unpredictable scarcity—disasters—rather than famine in the multiple regression model because independent variables should not be highly correlated (the rho between famine and disasters is 0.85, $p< 0.001$, two-tailed, n=41). We leave both chronic scarcity measures in the model because they are not highly correlated.

[Tables 1 and 2 near here]

As noted earlier, since few of the cases in the sample are neighbors, we display our results for nonstate societies with all usable cases in the first of a pair of columns and with one of each pair of neighbors omitted in the second. The results are virtually the same, suggesting that the inclusion of some neighbors was not problematic.

Consistent with hypothesis 1, regarding the predicted relationships between resource scarcity and warfare, all of the nonstate regression results (Table 1, cols. 1–8) show one or more types of resource scarcity significantly or marginally significantly predicting warfare frequencies (cols. 1–8), judging by the standardized betas for the individual resource scarcity measures. Half of the overall models (cols. 1, 2, 5, 6) are also significant. In state societies (cols. 9–12), despite the small sample size, in three of the models (cols. 9, 11, and 12) one or more significant or marginally significant resource scarcity measure predicts warfare frequency.[12] And two of the overall regressions are significant or marginally so (cols. 9 and 11). The strongest models for both nonstates and states involve overall warfare frequency and external attack frequency. Hypothesis 1 is generally supported.

However, while resource scarcity of some kind appears to predict warfare frequencies, they do not do so in the same directions. Hypotheses 1a and 1b postulate that nonstates and states will have relationships in the opposite direction—resource scarcity is predicted to be positively associated with higher warfare frequencies in nonstate societies and negatively in state societies. In Table 1, 11 of 12 of the standardized betas for the main nonstate models (cols. 1, 3, 5, 7) are positive. In the state societies (cols. 9–12), all 4 of the betas for disasters and all 4 of the betas for chronic nonseasonal scarcity are negative. The only exception is chronic seasonal scarcity, for

which all the betas are positive. When we examine the significant results, all 7 of the significant betas in the nonstate columns are positive, and 4 of 5 of the significant betas in the state columns are negative. We conclude that the nonstate/state divide is critical for predicting the direction of the effect of resource scarcity on warfare frequencies.

Hypothesis 1c predicts that unpredictable scarcity will be more predictive of warfare frequency than chronic or predictable scarcity. Hypothesis 1c is supported in nonstate societies (cols. 1–8), but not in state societies (cols. 9–12). In nonstate societies our measure of unpredictable scarcity ("disasters") has a higher beta in all models than either of the chronic scarcity measures. Moreover, in the main models (1,3,5,7), the betas for disasters are significant or marginally significant, whereas only one beta out of 8 for chronic scarcity is significant (see column 5 for external attacking frequency). However, in state societies (cols. 9–12), disasters is only higher in column 11 for external attacking frequency, but not in other models.

Since we were looking to see if the eastern African data replicated the Embers' (1992a) previous worldwide finding regarding resource unpredictability and overall warfare frequency, we have displayed the original worldwide published results (labeled Model 1) in column 1 of Table 2 along with reanalyses of the worldwide data in columns 2–4, 6, and 7. Comparable eastern African analyses from the current study appear in columns 5 and 8. The first set of reanalyses (cols. 2 and 4 in Table 2) of the worldwide data exclude any eastern African societies because we want to ensure that the overlap in samples did not account for similar results in the two studies. Although we were not able to rate socialization for mistrust for this study, we note that results regarding disasters in the worldwide sample are basically similar to those we have found for eastern Africa. First, the standardized betas for disasters are strong, positive, and significant in nonstate societies (cols. 1 and 3 in Table 2) even when the eastern African cases are omitted from the worldwide sample (see cols. 2 and 4 in Table 2). Second, in nonstate societies, when disasters and chronic scarcity are both in the model (labeled Model 2), only disasters predicts overall warfare frequency significantly (see cols. 3 and 4). Third, the sign of the beta coefficients for disasters reverses in state societies (cols. 6 and 7) as predicted. In other words, disasters in state societies appear to be associated with less, not more, overall warfare. Note that in Table 2 we use the overall chronic scarcity measure that the Embers (1992a) used, rather than the two new disaggregated measures, to enable a more direct comparison of our data with previous results (see col. 5 in Table 2). In column 5, the beta for natural disasters in nonstate societies is significant and the beta for overall chronic scarcity is not significant.

[Table 2 near here]

Outcomes of Warfare

We hypothesized that most societies will take resources during warfare if they can. Looking at the median score (see Appendix for scales), our data are consistent with hypothesis 2. In eastern Africa, the median scale score for taking movable property (almost always livestock) in both internal and external warfare is "always." Taking people is the next most common category—the median is "usually" for internal warfare and "always" for external warfare. Land is somewhat less likely to be taken, although it is not uncommon. The median score for both internal and external warfare is "the defeated are sometimes driven from their territory and the victorious sometimes use the land of the defeated." Our eastern African findings parallel the findings from the Embers' (1992a) worldwide comparison that resource-taking is the norm.

Turning to our hypotheses about resource scarcity and taking of resources (3, 3a, and 3b), our results are equivocal. We hypothesized that resource scarcity would increase the taking of land or movable property during warfare (3a) but make it less likely to take people (3b). Our strongest results are consistent with the "people" hypothesis (3b) for nonstate societies (Tables 3 and 4). Of the 8 possible relationships in nonstate societies, 5 of the results are significantly negative, as expected, and another is negative and marginally significant. The two correlations that were not negative for nonstate societies were between "taking people" and chronic seasonal scarcity. Since chronic seasonal scarcity is probably the least troublesome type of resource problem, we think the hypothesis regarding the lower likelihood of taking people during warfare in nonstate societies is mostly supported. The number of state societies that could be rated on outcomes and resource problems is very small, so it is difficult to get significant results. However, we note that the three substantial correlations (0.66, 0.67, and 0.60) are in the opposite direction. These results tentatively suggest a different direction of relationship in state societies. We discuss why the result might be positive for state societies, rather than negative, in the discussion section. In sum, the hypothesis is partially supported and appears to apply to nonstate societies.

[Tables 3 and 4 near here]

Hypothesis 3a postulates that both movable property and land will be more likely to be taken the higher the resource scarcity. The results for movable property and land are not the same. Taking movable property first (middle rows of Tables 3 and 4), the results only narrowly support the hypothesis in two specific conditions—nonstate societies and external warfare. Table 4 (external warfare) shows three significant or marginally significant positive results. In external warfare, nonstate societies with more famine and chronic seasonal scarcity are significantly more likely to take movable property, and societies with more disasters are marginally significantly more likely to take movable property. Notice that for state societies, external warfare correlations are in the opposite direction, contrary to the hypothesis (albeit only one correlation is marginally significant). With internal warfare in nonstate societies (the top of the middle row in Table 3) there are no significant relationships between taking movable property and any of the resource scarcity measures; in state societies, only famine is marginally significantly related to more taking.

With regard to taking land in nonstate societies (Tables 3 and 4), none of the relationships are significant. Only two results for state societies are significant or marginally significant, and they only relate to state societies during internal warfare; with chronic scarcity of either type, there is more taking of land in internal warfare (see Table 3).

Behavior toward Combatants and Noncombatants

Before we discuss the test of the hypothesis regarding atrocities, we note that atrocities are not infrequently committed in the course of warfare in this region of the world. The median rating for both killing noncombatants and the rape of women is "sometimes." Both torture and destruction of resources occur more commonly—the median rating for both is "usually" in both internal and external warfare. Non-physical intimidation varies by type of warfare. For internal warfare, the median rating is "always"; for external warfare it is between "sometimes" and "usually." We discuss nonstate/state differences in the following section.

Do resource problems increase the likelihood of atrocities as hypothesis 4 predicted? On the whole, the overall pattern of results does not support the hypothesis. At best, there is only narrow support in state societies, where chronic seasonal scarcity predicts more atrocities committed in the course of external warfare. However, in nonstate societies, most of the relationships are in the opposite direction.

Tables 5 and 6 show the relationships between unpredictable scarcities and atrocities in internal warfare and external warfare for both nonstates and states. The nonstate and state societies clearly show very different patterns. With regard to internal warfare (Table 5), 11 of the 12 correlations in nonstate societies are negative, 5 of them significant or marginally significant, suggesting, contrary to expectation, the more there are unpredictable scarcities in nonstate societies, the *less* likely atrocities (we show results of two-tailed tests when results are opposite our predictions). On the other hand, 11 of the 12 correlations for state societies are positive, suggesting that unpredictable scarcity has the opposite effect in state societies. Even though the number of cases on the state side is very small, two of the positive correlations are significant or marginally significant—with more famine and more natural disasters, killing of noncombatants in internal warfare is more likely. The picture with regard to external warfare (Table 6) is similar. Ten of the 12 nonstate correlations are negative; 2 are marginally significant. On the other hand, for state societies all 12 correlations are positive, and just as with internal warfare, both famine and disasters strongly and significantly predict more killing of noncombatants.

[Tables 5 and 6 near here]

Now let us turn to the relationships between chronic resource problems and atrocities in internal warfare (Table 7) and in external warfare (Table 8) in nonstates and states. As mentioned above, there is narrow support for the hypothesis regarding chronic scarcity in state societies. The most obvious pattern (Table 8) is that in state societies, both types of chronic resource problems have only positive relationships to atrocities when warfare is external (12 of 12). Five of the 6 correlations are significant or marginally significant with chronic seasonal scarcity—the more seasonal scarcity in state societies, the more atrocities are committed. Other patterns are far from clear. Turning to internal warfare, there are few significant correlations. In nonstate societies, the correlation between more chronic seasonal resource problems and higher killing of combatants is significant, but the other atrocities generally do not show the same pattern. In state societies there are only two significant correlations, between seasonal and nonseasonal scarcity and the greater likelihood of killing noncombatants.

[Tables 7 and 8 near here]

In sum, our expectation that resource problems would increase the likelihood of atrocities at best only applies to state societies with regard to chronic scarcity. Perhaps more interesting is the fact that the relationships in states and nonstates are generally in the opposite direction. Forty-five of the 48 correlations shown in Tables 5 through 8 are positive in state societies. More telling, in state societies all of the significant or marginally significant associations (12 of 12) are positive. Most of the relationships in nonstate societies are negative (33 of 48), and 8 of the 11 significant or marginally significant correlations are negative. Admittedly, our sample of state societies is quite small; nevertheless the difference in direction is striking, suggesting that resource problems have opposite effects in the two types of society.

Discussion and Conclusions

This study focused on whether unpredictable and chronic resource problems predict aspects of warfare in the eastern African region. One of our main purposes was to see if previous worldwide results (Ember and Ember 1992a) regarding resource problems are replicated in this region. Our results support earlier findings regarding overall warfare frequency. Unpredictable resource problems significantly predict more overall warfare frequency in nonstate societies. In addition, in nonstate societies unpredictable scarcity also predicts internal warfare, external attacked and external attacking frequencies. With one exception, the two chronic scarcity measures drop out in multivariate analyses, just as they did in the worldwide comparison, suggesting that in nonstate societies chronic problems are not as important as unpredictable problems. Since unpredictable problems do not occur that often with the 25-year time period measured and taking of resources is the norm, our results in eastern Africa are consistent with the theory (Ross 1988) that fear of loss is more motivating than actual loss in a fight for resources.

Consistent with a reanalysis of the Embers' worldwide data (Burtsev and Korotayev 2004), we expected and found a general reversal in the sign of correlations in our eastern African state societies. We agree with Burtsev and Korotayev's (2004:35; see also Korotayev 2008:46–47) suggestion that state societies, usually with complex military infrastructure requiring resources, would face serious obstacles in the face of serious natural disasters. In addition, state societies often have redistributional mechanisms to deal with disasters (Ember and Ember 1992a:258; see also discussion in Korotayev 2008:47. For both reasons, conducting war in the face of serious resource problems would ordinarily be counter-productive.

We also hypothesized that resource scarcities would predict two other kinds of variation in warfare—the frequency of taking resources from others and the commission of atrocities. With respect to these sets of predictions, our hypotheses are generally not supported and the significant results are complex, varying by whether warfare is internal or external, or whether the society is a state or not. All of this suggests that the frequency or seriousness of resource problems is not central to understanding these variations.

In the remainder of the discussion, we concentrate on what seems more central to our findings regarding resource-taking and atrocities—whether societies are states or nonstates.

States versus Nonstates

Although we anticipated that results regarding resource scarcity and warfare would be different in state and nonstate societies, we did not anticipate that the contrast would be significant in other aspects of warfare examined here. States often not only differ from nonstates in resource-taking and atrocities, they often show opposite patterns. With regard to atrocities, a post-hoc analysis finds that state societies commit atrocities during warfare significantly more often than nonstate societies. These findings are stronger for internal warfare. Table 9 contrasts states and nonstates on each of the atrocity measures. All 6 of the internal warfare correlations are positive; 5 are significant and 1 is marginally significant. All of the external warfare correlations are also positive; 3 are significant and 1 is marginally significant. We also found (not shown) that in internal war, when torture is practiced, state societies are significantly more likely than nonstate societies to torture noncombatants more often than combatants (ρ=0.60, n = 16, p <0.05, two-tailed). These findings are generally consistent with Otterbein's (2000) earlier finding that centralized polities are more likely to kill male captives and to practice terrorizing behavior.

TABLE 9 GOES HERE

Societies that commit one form of atrocity are strongly likely to commit others (not shown). Of the 30 possible correlations between the variables shown in Table 9, 23 are significant, 4 are marginally significant, and only 3 are not significant. For example, in internal warfare, killing of noncombatants is significantly correlated with rape of women (ρ =0.74), with torture (0.74), with intimidation (0.79), and with higher levels of killing combatants (0.71). And behavior during internal warfare is highly related to the same behavior in external warfare (e.g., rape in internal warfare correlates highly with rape in external warfare)—all of the correlations are significant, and 5 correlations are above 0.91.

We had an auxiliary code for the numbers of people affected by such behaviors, ranging from a few individuals to the whole group (e.g., a village). Given what we know about the significantly higher practice of atrocities in warfare in state societies, it is not surprising that state societies are more likely to practice these behaviors on a larger proportion of the population. All 10 of the correlations are positive—5 are significant (two-tailed tests) and 1 is marginally significant. When we use one-tailed tests, 6 are significant and 3 are marginally significant.

Why should state societies commit more atrocities? Is it because state societies, at least in the anthropological record, tend to be autocratic (Ember et al. 1992)? Although we don't have systematic evidence that autocratic societies in the anthropological record typically use physically coercive and terrorizing methods to control their own people, we do know in the cross-national record that terror against one's own people is most likely to be practiced by authoritarian governments (Rummel 1997). If authoritarian states deliberately use terror as a mechanism to induce submission of their own people, this behavior may be imitated during warfare (or possibly promoted) against enemies. We also know that more complex societies have harsher socialization and less affection shown to children (Ember and Ember 2005), which makes it more likely that individuals will strike out at targets that are available to them in fear-arousing and chaotic situations, such as the battlefield. We intend to explore these possibilities in future research.

We looked at one other aspect of warfare with regard to resource problems—the extent to which military glory was emphasized in the society. Although an emphasis on military glory is not significantly different in frequency in states and nonstates, the two show different patterns with respect to military glory and atrocities (results not shown). In state societies, an emphasis on military glory is significantly related to killing noncombatants, killing more enemy combatants, torture in both internal and external war, and destruction of resources in external war. In nonstate societies, there are no significant relationships between military glory and atrocities. Since military glory is obviously a culturally inculcated value—in fact, the highest point on the scale (see Appendix) includes the taking of trophies—it may be that states and nonstates emphasize military glory in slightly different ways.

Why should the results regarding resource problems and atrocities be in opposite directions in nonstate and state societies? We speculate that in nonstate societies people are more likely to have to fall back on extended kin and nonkin networks in difficult times, and therefore, even if they increase their warfare frequency during unpredictable scarcity, as the results in Table 1 suggest, warriors may be more likely to temper behavior during war because it may not be forgiveable in the future when extended networks are needed. In state societies, on the other hand, which usually have standing armies, there aren't direct connections between the behavior of warriors and effects on future livelihood. In addition, if political leaders find that terrorizing is

effective against populations they are fighting, causing them to capitulate more readily, they may encourage such behaviors during warfare.

Another set of differences between states and nonstates relates to taking resources during warfare. Although not part of our original hypotheses, state societies take some kinds of resources more often than nonstate societies. We would not expect any difference in the taking of movable property, since "usually" or "always" is by far the norm in all societies in the sample. However, state societies (not shown) are marginally significantly more likely to take land in internal warfare than nonstate societies (ρ=0.33, p< 0.07, two-tailed, n=31) and significantly more likely to take people (ρ=0.46, p< 0.02, two-tailed, n=27). The same tendency appears in external warfare, but only the result regarding land is marginally significant (ρ=0.34, p<0.06, n=33). We looked back at our coding notes to see what reasons were given for taking people and the two most common reasons were slavery (either for sale or for labor) and for incorporation into the family as wives and children. Although societies with lower levels of political hierarchy were sometimes selling slaves (e.g., Luguru, Chagga), sale of slaves was more common in polities with higher levels of integration (e.g., Shambala, Mbundu, Nyoro, Bena, Suku, Giriama). In addition, in more complex societies slaves or captives often provide labor for the elite. Capturing women for wives was somewhat more likely with lower levels of political hierarchy (e.g., Gusii, Maasai, Gikuyu). If slaves were more often a source of revenue in state societies, this could account for their greater likelihood to take people. These reasons for capturing people could help explain why more resource scarcity generally predicts less taking of people in nonstates, but more taking of people in states. First, if people are more likely to be incorporated into nonstates, more people may be a burden in the face of scarcity. Second, if captives are sold as slaves for revenue in state societies, resources are increased. If captives mostly go to elite households, such households can afford to feed them. Furthermore, captives may enhance the wealth in elite households by increasing production or providing the elite with wives or mistresses for whom no bride-price is needed. An alternative explanation is that famine and disasters are likely widespread and affect neighboring societies and broad areas within the society. Although Table 1 suggests that states that experience more disasters are less likely to go to war, when they do so, they might find the opportunities for depleting the enemy enhanced by their enemies' weakness from famine or disasters. Taking people depletes the capacity of the defeated group now and in the future. As long as the elite can feed the captives and make use of their labor to increase production on their land or captured land, taking people may advantage the victors.

As often happens in research, more questions arise than we have answered. Why do states and nonstates differ so much in their patterns regarding warfare? What kinds of contingency plans do societies (and subgroups) have for famines and disasters? Does the quality of contingency planning affect a society's option to go to war, and if so (and if successful), what to take? Are famines and disasters sometimes opportunities, and if so, are they more often for elites? Does the type of state (such as corporate or network; Blanton & Fargher 2008) influence how warriors behave in warfare?

Appendix: Sample Cases (Table 10) and Coding Definitions

TABLE 10 GOES HERE

Frequency of Warfare

For ratings of warfare frequency in societies represented in the HRAF Collection of Ethnography, the coders were asked to read the full-text information in categories 578, 628, 648, 721, 723, and 726 of the Outline of Cultural Materials (OCM), the HRAF subject-indexing system.

All frequency ratings were based on a five-point ordinal scale used by each of the two coders: (1) Warfare seems to be absent or rare (coders were instructed not to code warfare as absent simply because there is no information, unless the ethnographer explicitly states that there is little or no warfare, or unless the ethnographer describes intercommunity and intra- and inter-societal contacts but does not mention hostilities); (2) Warfare seems to occur once every three to ten years; (3) Warfare seems to occur at least once every two years; (4) Warfare seems to occur every year, but usually only during a particular season; (5) Warfare seems to occur almost constantly and at any time of the year.

Definitions of warfare, internal and external, are provided in the Methods section. Substitute "internal warfare," "external warfare," "warfare in which the focal society attacks other societies" "warfare in which the focal society is attacked by other societies" to replace the word "warfare" in the 5-point scale above. The latter two are referred to as "external attacking" and "external attacked," respectively, in the paper. Each of the five warfare frequency scales is summed across the two coders for a scale that is minimally 2 and maximally 10 in the analyses reported here. Missing values indicate that one or both coders did not find enough information or found it confusing.

Pacification

In the HRAF Collection of Ethnography information on pacification was generally contained in OCM categories 177 and 636. For this study, only societies rated 1 or 2 were used: (1) Not pacified for all or part of the 25-year time period as reported by ethnographer; (2) Inferred to be unpacified because warfare frequency is greater than or equal to 3 by individual coder. For the remainder of the scale see Ember and Ember (1992b).

Outcomes of Warfare in Terms of Resource Acquisition

The following scales are used for rating internal warfare and external warfare separately. With external warfare the point of reference is what the focal society is doing during warfare, not what the external society is doing to them.

In the HRAF Collection of Ethnography, most of the information for these ratings came from categories 726 and 728.

Taking of land resources: (1) the defeated are never driven from their territory; (2) the defeated are sometimes driven from their territory, but the victorious rarely use the land of the defeated; (3) the defeated are sometimes driven from their territory and the victorious sometimes use the land of the defeated; (4) the defeated are usually driven from their territory and the victorious sometimes use the land of the defeated; (5) the defeated are usually driven from their territory and the victorious usually use the land of the defeated; (7) not applicable because warfare does not occur during time period; (8) don't know; (9) confusing or contradictory.

Taking of movable property and taking of people: The following scale is used with both the phrases "non-land resources and non-people resources (e.g., animals, food, tools, transport)" and "people": (1) are never taken from the defeated; (2) are sometimes taken from the defeated; (3) are usually taken from the defeated; (4) are always taken from the defeated; (7) not applicable

because warfare does not occur during time period; (8) don't know; (9) confusing or contradictory.

Behavior toward Combatants and Noncombatants

The point of reference is what the focal group does to the other side when engaged in armed combat. If there is a specific community or district focus, this focus may be used for behaviors in internal warfare. For external warfare the focus is the named society, not how other societies behave when attacking the focal society.

Killing or attempting to kill noncombatants: (1) Noncombatants are never or rarely attacked with the intent to kill; (2) Noncombatants are sometimes attacked with the intent to kill; (3) Noncombatants are usually attacked with the intent to kill; (4) Noncombatants are always attacked with the intent to kill; (7) not applicable because warfare does not occur during time period; (8) don't know; (9) confusing or contradictory.

The following behaviors are rated with essentially the same scale (1–4, 7–9). Replace the phrase marked XX with "never or rarely" for a score of 1, "sometimes" for a score of 2, "usually" for a score of 3, and "always" for a score of 4.

Rape of women associated with armed combat: "Women are XX raped."

Torture or mutilation of noncombatants and/or combatants: "Torture or mutilation is XX practiced." Coders were asked to separate killing itself from deliberate attempts to promote or prolong physical and/or psychological pain and suffering.

Destruction of resources (e.g., crops destroyed, houses burnt): "Resources are XX destroyed."

Nonphysical intimidation of noncombatants: "Intimidation of civilians is XX."

Military glory: This rating follows Philip Slater's (1964:6–7) code for Pursuit of Military Glory. The three-point scale is: (1) low (war is viewed as abhorrent, military virtues are not valued, or saving's one life is considered appropriate); (2) moderate (defensive virtues are valued in war—military resistance, endurance, fortitude; values other than military predominate although military values are important; contests of bravery, skill, or endurance are important parts of masculine relationships; raids are frequent but conducted primarily for economic reasons); (3) high (warriors seek death in battle or view it preferable to defeat; being a warrior is viewed as the principal road to earthly or other-worldly glory; war is considered glorious, the primary source of status and prestige; war is waged for obtaining rank, honor, or fame; military virtues, such as valor, recklessness, and fighting skill, are the most important in the society; military trophies are the principal source of rank and prestige).

Killing of combatants: This three-point scale ranged from (1) low (attacks are aimed at one or a few individuals, or a few individuals are killed out of a large group) to (2) moderate (a considerable number of enemies are killed in the course of particular battles) to (3) high (try to kill most of the enemy combatants in battle); (7) not applicable because warfare does not occur during time period; (8) don't know; (9) confusing or contradictory.

Resource Problems

The two measures of unpredictable resource problems were "threat of famine" and "threat of natural (weather and pest) disasters." *Famine* is a time of starvation when either many human deaths occur or it is reported that a substantial portion of the society has to move because of a lack of food. [Note: ordinary seasonal migration is not counted, nor is chronic hunger.] The famine scale is shown below. For threat of natural disasters the coders were asked to rate the

incidence of severe weather or pest problems that seriously destroyed food resources. Coders using the HRAF Collection of Ethnography were asked to look for information in 730 (particularly 731 and 735), 132, 133, and 312.

Threat of famine: (1) low threat of famine—food is reported to be ample or adequate, with no report of famine; or famine occurred only in the past (not in the 25-year time period); or occasional periods of food shortage are reported, but the scarce foods are reported to be replaced by other available foods; or there may be chronic hunger in the absence of the conditions included in the following scores (2–4); (2) moderate threat of famine—there is no reported famine during this period, but the ethnographer states there is an ever-present threat of famine; (3) moderately high threat of famine—one famine occurred during the 25-year time period; (4) high—more than one famine occurred during the 25-year time period; (8) don't know.

Threat of natural disasters: The same scale is used as for threat of famine (above) replacing the word "famine" with "severe natural disrupters of food supply."

Chronic resource problems: In contradistinction to unpredictable resource problems, there might be chronic or predictable problems. Coders were told that early ethnographers sometimes suggested that hunter-gatherers or other mobile groups lived precariously because they constantly had to move in search of food. This was not to be taken as chronic hunger as long as other foods were usually obtained within a day or so. Coders were asked to look for information in OCM categories 146 and 261–262. We originally rated chronic resource problems as the Embers (1992b) did: (1) low or rare—food is reported to be adequate or abundant for the population with no report of the following problems; (2) there are "hungry times" during the year, when people complain that they do not have enough food or enough of a particular food; (3) some members of the population usually do not have enough to eat; and (4) most members of the population usually do not have enough to eat—i.e., they are chronically undernourished; (8) don't know.

However, when we decided to distinguish between chronic seasonal and nonseasonal scarcity, we realized that societies scoring 3 or 4 (to be conservative, we recoded all those scoring 2.5 or more) needed to be recoded because they could have chronic seasonal as well as nonseasonal hunger. The resulting scales were *chronic seasonal scarcity:* (1) absent—either because hunger was judged low or rare (1–1.5) or (2) present—either coded "hungry times" during the year (1.75–2.25 on the original scale) or "present" if original scores were 2.5 or higher. Chronic nonseasonal scarcity was a three-point scale: (1) absent (1–2.25 on the original scale); (2) moderate (2.5–3 on the original scale); and (3) high (3.5–4 on the original scale).

Acknowledgments The comparative research in eastern Africa was supported by the Office of Naval Research ONR under MURI grant no. N00014-08-1-0921 to George Mason University with a subaward to the Human Relations Area Files (PI: Claudio Cioffi-Revilla; co-PIs: Carol R. Ember, Sean Luke, and Kenneth De Jong). The opinions, findings, and results are those of the investigators and do not reflect the views of the sponsors. The earlier work on warfare was supported by the program in cultural anthropology at the National Science Foundation (BNS-8211024 and 8606337) in grants to Hunter College, CUNY (PIs: Carol R. Ember and Melvin Ember). A presentation of the major results was given by Carol Ember at the 2010 annual meeting of the American Anthropological Association (New Orleans) in the organized session "Circulation, Exchange, and Redistribution of Resources, People, and Power: Relationship to Risk and Security." The session was sponsored jointly by the Society for Anthropological Sciences and the Evolutionary Anthropology Society. A similar presentation

was made at the 2011 annual meeting of the Society for Cross-Cultural Research (Charleston, SC) in the organized session "A Tribute to Herbert Barry" (Alice Schlegel, organizer).

Notes

1. The expectation that droughts would predict more violence has long been held among humanitarian organizations and climate change advocates (e.g., UN OCHA/Kenya 2010; Smith 2009).

2. Durham (1976:391) was more specific, suggesting that scarcity and fighting over resources produce fitness benefits only when resources are dependable and of high quality and only if at least some of the aggressors obtain resources as a result of war. In a similar vein, Manson and Wrangham (1991:374) argued that fighting for material resources is likely when they are of sufficient value and alienable.

3. We note that resource competition is not necessarily the same thing as resource scarcity. For instance, Manson and Wrangham (1991) and Wrangham and Glowacki (2012) suggest that chimpanzees and humans in simpler societies take resources opportunistically when they have an asymmetrical advantage. However, Wrangham (1999) noted that chimpanzee attacks were more frequent where competition is intensified by longer dry seasons.

4. The likelihood of a group winning and hanging on to resources taken may depend heavily on the evolution of cooperative group behavior; see Bowles 2008, 2009.

5. Kelly (2005) points to the potential loss of territory because of the need to avoid border regions when clear dominance is not possible.

6. Not all studies have shown this linkage—for example, Witsenburg and Adano (2009) reported for Marsabit District that wet years and wet months were more likely to exhibit the most casualties during livestock raids.

7. However, Letrendre, Fincher, and Thornhill (2010:682) suggest that resource deprivation in state societies will be positively associated with internal war.

8. Tooby and Cosmides (2010) suggest that humans are evolved to have a special emotional rage for combat, which, if so, could explain atrocities, but we don't see how this would explain variation.

9. The first author has used her personal data file, which is available from the author upon request. These data were later published in World Cultures in somewhat different form.

10. We used random elimination where we could. In a few instances, we chose to eliminate the society that caused the least number of lost cases.

11. Some authors, such as Otterbein and Otterbein (1965), Ericksen and Horton (1992), and Fry (2007), have advocated keeping feuding and warfare separate.

12. Because the number of state societies is quite small, we did not remove neighbors. Note that such removal did not make much difference for nonstates.

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Table 1. Multiple regression analyses predicting warfare frequencies in eastern African societies (standardized betas; **bold** values are significant or marginally significant)

	Nonstate societies								State societies			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Overall warfare	(1) with neighbors omitted	Internal warfare	(3) with neighbors omitted	External warfare: attacking	(5) with neighbors omitted	External warfare: attacked	(7) with neighbors omitted	Overall warfare	Internal warfare	External warfare: attacking	External warfare: attacked
Natural disasters[a]	**.51****	**.59****	**.43***	**.47***	**.50****	**.52****	**.37+**	**.40***	**−.60***	−.17	**−.89****	**−.56+**
Chronic seasonal scarcity[b]	.26	.13	.11	−.03	**.48‡**	.34	.09	.05	**.60‡**	.63	.28	.38
Chronic nonseasonal scarcity[b]	.05	.13	.03	.12	−.04	.04	.12	.15	**−.77‡**	−.19	**−.80‡‡**	−.57
N	24	21	24	21	24	21	24	21	12	11	10	10
R	.59	.67	.46	.53	.64	.63	.45	.49	.76	.56	.90	.59
R^2	.35	.45	.21	.28	.42	.40	.20	.24	.58	.32	.80	.35
p	**.03**	**.02**	.19	.13	**.01**	**.03**	.20	.19	**.06**	.41	**.02**	.43

[a] Collapsed into three groups (1–2.5, 3–3.5, and 4) to make the relationships more linear; one-tailed significance levels used.

[b] Two-tailed significance levels used.

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 2. Multiple regression analyses predicting overall warfare frequency in worldwide sample (col. 1 from Ember and Ember 1992a; cols. 2–4, 6, 7 reanalyzed data from Ember and Ember 1992b) compared with eastern African sample (cols. 5, 8). Standardized betas; bold values are significant.[a]

	Nonstate Societies					State Societies		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Model 1: worldwide sample (original result)	Model 1 with eastern Africa omitted from worldwide sample	Model 2: worldwide sample	Model 2 with eastern Africa omitted from worldwide sample	Model 2: eastern African sample	Model 1: worldwide sample	Model 2: worldwide sample	Model 2: eastern African sample
Natural disasters[b]	**.63*** **	**.56** **	**.79*** **	**.81*** **	**.50** **	−.40	−.19	−.15
Socialization for mistrust[c]	**.35***	**.44** **				−.46		
Chronic scarcity[d]			.06	.00	.28		−.31	−.01
N	20	17	17	16	24	10	12	12
R	.82	.82	.82	.81	.59	.45	.43	.15
R^2	.66	.67	.67	.66	.34	.20	.19	.02
p	.000	.000	000	.000	.012	.45	.39	.90

[a] Unlike in Table 1, the original chronic scarcity measure (4-point scale with seasonal and nonseasonal scarcity following Ember and Ember 1992b) is used here for comparative purposes.

[b] Collapsed into two categories in the worldwide sample (1 vs. 2–4) and into three in the eastern African sample (1–2.5, 3–3.5, and 4).

[c] Sign of beta reversed to reflect mistrust as hypothesized to predict higher warfare.

[d] Two-tailed significance levels used for this variable.

Significance (one-tailed): + p<.10, *p<.05, **p < .01, ***p<.001; (two-tailed): ++ p<.10, ‡p <.05, ‡‡p<.01, ‡‡‡ p<.001

Table 3. Bivariate relationships between resource scarcities and the taking of resources in internal warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Resource Taken		Famine[a]	Disasters[b]	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Land	Nonstate	−.17 (23)	−.17 (22)	−.07 (23)	.00 (23)
	State	.34 (8)	.01 (8)	**.76**** (8)	**.58**+ (8)
Movable property	Nonstate	.05 (22)	−.06 (21)	.10 (22)	−.19 (22)
	State	**.58**+ (8)	. 12 (8)	.15 (8)	. 29 (8)
People	Nonstate	**−.51**** (21)	**−.58****(20)	.15 (21)	**−.39*** (21)
	State	.66 (6)	.67 (6)	.25 (6)	Not calculable

[a] Collapsed into four categories (1, 2–2.5, 2.75–3, and 3.5–4).

[b] Collapsed into three categories (1–2.5, 3–3.5, and 4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$

Table 4. Bivariate relationships between resource scarcities and the taking of resources in external warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Resource Taken		Famine [a]	Disasters [b]	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Land	Nonstate State	−.03 (22) −.16 (11)	−.02 (21) −.21 (11)	.10 (22) .40 (11)	−.08 (22) .10 (11)
Movable Property	Nonstate State	**.43*** (21) −.06 (10)	**.30** + (20) −.13 (10)	**.41*** (21) −.13 (10)	.19 (21) **−.60** ++ (10)
People	Nonstate State	**−.48*** (20) .00 (8)	**−.60**** (19) .00 (8)	.26 (20) .60 (8)	−.24 (20) Not calculable

[a] Collapsed into four categories (1, 2–2.5, 2.75–3, and 3.5–4).

[b] Collapsed into three categories (1–2.5, 3–3.5, and 4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 5. Relationships between behavior toward combatants and noncombatants in internal warfare and unpredictable scarcity in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State Societies	
Type of Behavior in Internal Warfare	Famine[a]	Disasters[b]	Famine[a]	Disasters[b]
Killing noncombatants	−.12 (16)	−.21 (15)	**.97*** (8)**	**.75*** (8)
Killing combatants	**−.56** ‡‡(21)	**−.43 ++** (20)	.11 (9)	−.05 (9)
Rape of women	−.14 (12)	−.34 (12)	.29 (8)	.06 (8)
Torture or mutilation (combatants and noncombatants)	−.19 (11)	**−.60**‡ (11)	.48 (8)	.23 (8)
Destruction of resources	**−.61** ++ (10)	**−.61** ++ (10)	.22 (8)	.07 (8)
Nonphysical intimidation	.00 (7)	−.42 (7)	.47 (7)	.35 (7)

[a] Collapsed into two categories (1 vs. >1).

[b] Collapsed into two categories (1–2.75 vs. 3–4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 6. Relationships between behavior toward combatants and noncombatants in external warfare and unpredictable scarcity in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State societies	
Type of Behavior in External Warfare	Famine[a]	Disasters[b]	Famine[a]	Disasters[b]
Killing noncombatants	-.02 (17)	-.21(16)	**.65*** (9)	**.76**** (9)
Killing combatants	**-.38++** (20)	-.25 (20)	.24 (11)	.04 (11)
Rape of women	.33 (8)	.15 (8)	.32 (9)	.41 (9)
Torture or mutilation (combatants and noncombatants)	-.16 (10)	**-.60**++ (10)	.38 (9)	.36 (9)
Destruction of resources	-.48 (11)	**-.55**++ (11)	.38 (9)	.21 (9)
Nonphysical intimidation	.35 (7)	-.16 (7)	**.66*** (9)	.43 (9)

[a] Collapsed into two categories (1 vs. >1)

[b] Collapsed into two categories (1–2.75 vs. 3–4)

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 7. Relationships between chronic resource problems and atrocities in internal warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State Societies	
Type of Behavior in Internal Warfare	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Killing noncombatants	-.07 (16)	.00 (23)	**.76**** (8)	**.58+** (8)
Killing combatants	**.41*** (22)	-.02 (21)	.31 (9)	.24 (9)
Rape of women	−.44 (12)	−.48 (12)	.29 (8)	.28 (8)
Torture or mutilation (combatants and noncombatants)	−.10 (12)	.03 (12)	. 20 (8)	.35 (8)
Destruction of resources	−.17 (10)	−.32 (10)	−.33 (8)	.22 (8)
Nonphysical intimidation	.00 (7)	.54 (7)	−.26 (7)	.17 (7)

**p* < .05, two-tailed

Significance (one-tailed): + *p*<.10, **p*<.05, ***p* < .01, ****p*<.001

Table 8. Relationships between chronic resource problems and atrocities in external warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate		State	
Type of Behavior in External Warfare	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Killing noncombatants	−.19 (17)	−.20 (17)	**.80**** (9)	.30 (9)
Killing combatants	**.51** (20)**	−.10 (20)	**.62*** (11)	.15 (11)
Rape of women	−.22 (8)	−.15 (8)	**.67*** (9)	.36 (9)
Torture or mutilation (combatants and noncombatants)	.12 (10)	.05 (10)	.38 (9)	.36 (9)
Destruction of resources	.00 (11)	−.21 (11)	**.55**+ (9)	.24 (9)
Nonphysical intimidation	−.18 (7)	**. 68*** (7)	**.66*** (9)	.30 (9)

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$

Table 9. Relationships between state vs. nonstate societies and behaviors in warfare (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Behavior	Internal Warfare	External Warfare
Killing noncombatants	**.50**‡ (24)	.32 (26)
Killing combatants	**.41**‡ (31)	.27 (31)
Rape of women	**.58**‡‡ (20)	**.59**‡ (17)
Torture or mutilation (combatants and noncombatants)	**.41** ++ (20)	**.40** ++ (19)
Destruction of resources	**.69**‡‡ (18)	**.47**‡ (20)
Nonphysical intimidation	**.60**‡ (14)	**.70**‡‡ (16)

Significance (two-tailed): ++ $p<.10$, ‡$p<.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 10. Cases in eastern African sample

Culture Name	Focus	State?	Date of Rating
Acoli	entire society	No	1920
Amhara	Gondar Province	Yes	1953
Azande	Yambio Chiefdom	No	1905
Barundians	Burundi (Kingdom/Republic)	Yes	1910
Bemba	Zambia branch	No	1897
Bena	Njonge, Ulanga and Kilombero districts	No	1897
Chagga	General, Chagga society	No	1875
Dar Fur	Jebel Merra	Yes	1999
Ganda	Kyaddondo district, around Kampala	Yes	1875
Gikuyu	Motume district (Fort Hall)	No	1885
Giriama	entire society	Yes	1900
Gisu	General	No	1900
Gusii	Kisii District	No	1915
Hadza	entire society	No	1930
Hehe	Iringa group	No	1890
Ila	General	No	1880
Jie	entire society	No	1950
Kaffa	Entire kingdom	Yes	1905
Konso	Town of Buso	No	1935
Lozi	Ruling Luyana	Yes	1900
Lugbara	entire society	Yes	1920
Luguru	Morogoro district	No	1895
Maasai	Kisonko or southeastern Maasai, Tanzania	No	1900
Mbundu	Bailundu subtribe	No	1880

Ngonde	General	No	1895
Ngoni	General	Yes	1898
Nuba	General	No	1938
Nuer	General	No	1930
Nyoro	General	Yes	1897
Oromo	Oromo of Arsi and Jima	No	1890
Pare	South Pare	No	1890
Rwandans	General	Yes	1986
Shambala	entire society	No	1890
Shilluk	Entire Kingdom	No	1910
Somali	Dolbahanta subtribe	No	1900
Suku	Feshi territory lineage center	Yes	1920
Teda	Nomads of Tibesti	No	1950
Turkana	entire society	No	1918

Table 1. Multiple regression analyses predicting warfare frequencies in eastern African societies (standardized betas; **bold** values are significant or marginally significant)

	Nonstate societies								State societies			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Overall warfare	(1) with neighbors omitted	Internal warfare	(3) with neighbors omitted	External warfare: attacking	(5) with neighbors omitted	External warfare: attacked	(7) with neighbors omitted	Overall warfare	Internal warfare	External warfare: attacking	External warfare: attacked
Natural disasters[a]	**.51****	**.59****	**.43***	**.47***	**.50****	**.52****	**.37+**	**.40***	**−.60***	−.17	**−.89****	**−.56+**
Chronic seasonal scarcity[b]	.26	.13	.11	−.03	**.48‡**	.34	.09	.05	**.60‡**	.63	.28	.38
Chronic nonseasonal scarcity[b]	.05	.13	.03	.12	−.04	.04	.12	.15	**−.77‡**	−.19	**−.80‡‡**	−.57
N	24	21	24	21	24	21	24	21	12	11	10	10
R	.59	.67	.46	.53	.64	.63	.45	.49	.76	.56	.90	.59
R^2	.35	.45	.21	.28	.42	.40	.20	.24	.58	.32	.80	.35
p	**.03**	**.02**	.19	.13	**.01**	**.03**	.20	.19	**.06**	.41	**.02**	.43

[a] Collapsed into three groups (1–2.5, 3–3.5, and 4) to make the relationships more linear; one-tailed significance levels used.

[b] Two-tailed significance levels used.

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 2. Multiple regression analyses predicting overall warfare frequency in worldwide sample (col. 1 from Ember and Ember 1992a; cols. 2–4, 6, 7 reanalyzed data from Ember and Ember 1992b) compared with eastern African sample (cols. 5, 8). Standardized betas; bold values are significant.[a]

	Nonstate Societies					State Societies		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Model 1: worldwide sample (original result)	Model 1 with eastern Africa omitted from worldwide sample	Model 2: worldwide sample	Model 2 with eastern Africa omitted from worldwide sample	Model 2: eastern African sample	Model 1: worldwide sample	Model 2: worldwide sample	Model 2: eastern African sample
Natural disasters[b]	**.63*** **	**.56** **	**.79*** **	**.81*** **	**.50** **	−.40	−.19	−.15
Socialization for mistrust[c]	**.35***	**.44** **				−.46		
Chronic scarcity[d]			.06	.00	.28		−.31	−.01
N	20	17	17	16	24	10	12	12
R	.82	.82	.82	.81	.59	.45	.43	.15
R^2	.66	.67	.67	.66	.34	.20	.19	.02
p	.000	.000	000	.000	.012	.45	.39	.90

[a] Unlike in Table 1, the original chronic scarcity measure (4-point scale with seasonal and nonseasonal scarcity following Ember and Ember 1992b) is used here for comparative purposes.

[b] Collapsed into two categories in the worldwide sample (1 vs. 2–4) and into three in the eastern African sample (1–2.5, 3–3.5, and 4).

[c] Sign of beta reversed to reflect mistrust as hypothesized to predict higher warfare.

[d] Two-tailed significance levels used for this variable.

Significance (one-tailed): + p<.10, *p<.05, **p < .01, ***p<.001; (two-tailed): ++ p<.10, ‡p <.05, ‡‡p<.01, ‡‡‡ p<.001

Table 3. Bivariate relationships between resource scarcities and the taking of resources in internal warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Resource Taken		Famine[a]	Disasters[b]	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Land	Nonstate	−.17 (23)	−.17 (22)	−.07 (23)	.00 (23)
	State	.34 (8)	.01 (8)	**.76**** (8)	**.58**+ (8)
Movable property	Nonstate	.05 (22)	−.06 (21)	.10 (22)	−.19 (22)
	State	**.58**+ (8)	. 12 (8)	.15 (8)	. 29 (8)
People	Nonstate	**−.51**** (21)	**−.58****(20)	.15 (21)	**−.39*** (21)
	State	.66 (6)	.67 (6)	.25 (6)	Not calculable

[a] Collapsed into four categories (1, 2–2.5, 2.75–3, and 3.5–4).

[b] Collapsed into three categories (1–2.5, 3–3.5, and 4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$

Table 4. Bivariate relationships between resource scarcities and the taking of resources in external warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Resource Taken		Famine [a]	Disasters [b]	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Land	Nonstate State	−.03 (22) −.16 (11)	−.02 (21) −.21 (11)	.10 (22) .40 (11)	−.08 (22) .10 (11)
Movable Property	Nonstate State	**.43*** (21) −.06 (10)	**.30** + (20) −.13 (10)	**.41*** (21) −.13 (10)	.19 (21) **−.60** ++ (10)
People	Nonstate State	**−.48*** (20) .00 (8)	**−.60**** (19) .00 (8)	.26 (20) .60 (8)	−.24 (20) Not calculable

[a] Collapsed into four categories (1, 2–2.5, 2.75–3, and 3.5–4).

[b] Collapsed into three categories (1–2.5, 3–3.5, and 4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 5. Relationships between behavior toward combatants and noncombatants in internal warfare and unpredictable scarcity in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State Societies	
Type of Behavior in Internal Warfare	Famine[a]	Disasters[b]	Famine[a]	Disasters[b]
Killing noncombatants	−.12 (16)	−.21 (15)	**.97*** (8)**	**.75*** (8)
Killing combatants	**−.56** ‡‡(21)	**−.43 ++** (20)	.11 (9)	−.05 (9)
Rape of women	−.14 (12)	−.34 (12)	.29 (8)	.06 (8)
Torture or mutilation (combatants and noncombatants)	−.19 (11)	**−.60**‡ (11)	.48 (8)	.23 (8)
Destruction of resources	**−.61** ++ (10)	**−.61** ++ (10)	.22 (8)	.07 (8)
Nonphysical intimidation	.00 (7)	−.42 (7)	.47 (7)	.35 (7)

[a] Collapsed into two categories (1 vs. >1).

[b] Collapsed into two categories (1–2.75 vs. 3–4).

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p < .05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 6. Relationships between behavior toward combatants and noncombatants in external warfare and unpredictable scarcity in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State societies	
Type of Behavior in External Warfare	Famine[a]	Disasters[b]	Famine[a]	Disasters[b]
Killing noncombatants	-.02 (17)	-.21(16)	**.65*** (9)	**.76**** (9)
Killing combatants	**-.38++** (20)	-.25 (20)	.24 (11)	.04 (11)
Rape of women	.33 (8)	.15 (8)	.32 (9)	.41 (9)
Torture or mutilation (combatants and noncombatants)	-.16 (10)	**-.60**++ (10)	.38 (9)	.36 (9)
Destruction of resources	-.48 (11)	**-.55**++ (11)	.38 (9)	.21 (9)
Nonphysical intimidation	.35 (7)	-.16 (7)	**.66*** (9)	.43 (9)

[a] Collapsed into two categories (1 vs. >1)

[b] Collapsed into two categories (1–2.75 vs. 3–4)

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$; (two-tailed): ++ $p<.10$, ‡$p <.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 7. Relationships between chronic resource problems and atrocities in internal warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate Societies		State Societies	
Type of Behavior in Internal Warfare	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Killing noncombatants	-.07 (16)	.00 (23)	**.76**** (8)	**.58+** (8)
Killing combatants	**.41*** (22)	-.02 (21)	.31 (9)	.24 (9)
Rape of women	−.44 (12)	−.48 (12)	.29 (8)	.28 (8)
Torture or mutilation (combatants and noncombatants)	−.10 (12)	.03 (12)	. 20 (8)	.35 (8)
Destruction of resources	−.17 (10)	−.32 (10)	−.33 (8)	.22 (8)
Nonphysical intimidation	.00 (7)	.54 (7)	−.26 (7)	.17 (7)

**p* < .05, two-tailed

Significance (one-tailed): + *p*<.10, **p*<.05, ***p* < .01, ****p*<.001

Table 8. Relationships between chronic resource problems and atrocities in external warfare in nonstate and state societies (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

	Nonstate		State	
Type of Behavior in External Warfare	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity	Chronic Seasonal Scarcity	Chronic Nonseasonal Scarcity
Killing noncombatants	−.19 (17)	−.20 (17)	**.80**** (9)	.30 (9)
Killing combatants	**.51** (20)**	−.10 (20)	**.62*** (11)	.15 (11)
Rape of women	−.22 (8)	−.15 (8)	**.67*** (9)	.36 (9)
Torture or mutilation (combatants and noncombatants)	.12 (10)	.05 (10)	.38 (9)	.36 (9)
Destruction of resources	.00 (11)	−.21 (11)	**.55**+ (9)	.24 (9)
Nonphysical intimidation	−.18 (7)	**. 68*** (7)	**.66*** (9)	.30 (9)

Significance (one-tailed): + $p<.10$, *$p<.05$, **$p < .01$, ***$p<.001$

Table 9. Relationships between state vs. nonstate societies and behaviors in warfare (Spearman's ρ; *N* in parentheses; **bold** values are significant or marginally significant)

Type of Behavior	Internal Warfare	External Warfare
Killing noncombatants	**.50**‡ (24)	.32 (26)
Killing combatants	**.41**‡ (31)	.27 (31)
Rape of women	**.58**‡‡ (20)	**.59**‡ (17)
Torture or mutilation (combatants and noncombatants)	**.41** ++ (20)	**.40** ++ (19)
Destruction of resources	**.69**‡‡ (18)	**.47**‡ (20)
Nonphysical intimidation	**.60**‡ (14)	**.70**‡‡ (16)

Significance (two-tailed): ++ $p<.10$, ‡$p<.05$, ‡‡$p<.01$, ‡‡‡ $p<.001$

Table 10. Cases in eastern African sample

Culture Name	Focus	State?	Date of Rating
Acoli	entire society	No	1920
Amhara	Gondar Province	Yes	1953
Azande	Yambio Chiefdom	No	1905
Barundians	Burundi (Kingdom/Republic)	Yes	1910
Bemba	Zambia branch	No	1897
Bena	Njonge, Ulanga and Kilombero districts	No	1897
Chagga	General, Chagga society	No	1875
Dar Fur	Jebel Merra	Yes	1999
Ganda	Kyaddondo district, around Kampala	Yes	1875
Gikuyu	Motume district (Fort Hall)	No	1885
Giriama	entire society	Yes	1900
Gisu	General	No	1900
Gusii	Kisii District	No	1915
Hadza	entire society	No	1930
Hehe	Iringa group	No	1890
Ila	General	No	1880
Jie	entire society	No	1950
Kaffa	Entire kingdom	Yes	1905
Konso	Town of Buso	No	1935
Lozi	Ruling Luyana	Yes	1900
Lugbara	entire society	Yes	1920
Luguru	Morogoro district	No	1895
Maasai	Kisonko or southeastern Maasai, Tanzania	No	1900
Mbundu	Bailundu subtribe	No	1880

Ngonde	General	No	1895
Ngoni	General	Yes	1898
Nuba	General	No	1938
Nuer	General	No	1930
Nyoro	General	Yes	1897
Oromo	Oromo of Arsi and Jima	No	1890
Pare	South Pare	No	1890
Rwandans	General	Yes	1986
Shambala	entire society	No	1890
Shilluk	Entire Kingdom	No	1910
Somali	Dolbahanta subtribe	No	1900
Suku	Feshi territory lineage center	Yes	1920
Teda	Nomads of Tibesti	No	1950
Turkana	entire society	No	1918