Chapter 4
The Role of Food Production in Incipient Warfare in Protohistoric Timor Leste

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Does climate change cause warfare? Several recent publications have noted significant correlation between climatic instability and warfare in the modern period (e.g., Hsiang et al. 2011; Scheffran et al. 2012; Zhang et al. 2011). However, the underlying causal links between the complexities of human group conflict and climate change (with its equally complex impact on human life) remain murky in these studies, which rarely cite archaeological data. Archaeologists, who have access to long records of warfare and climate, can provide useful data and explanatory models of potential causal links (e.g., Arkush and Allen 2006; Keeley 1996; Kennett and Kennett 2000; Lambert 2002). This chapter reviews the history of warfare in Timor Leste, located in the eastern half of Timor Island in Island Southeast Asia. A causal model, which links changes in rainfall and food production to chronological and spatial patterns of fortifications, was first proposed by Lape and Chao (2008). The model allowed for independent testing of the relationship between archaeological and climate proxy evidence. A recent critique of that model proposed alternate explanations for the archaeological patterns (O'Connor et al. 2012). This chapter analyzes that critique and suggests other ways to build our understanding of past causal relationships that may have relevance for understanding the causes of war in other regions and at other times.

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4.1 The Fortifications of Timor Leste

Scattered across the rugged landscapes of the north coast of Timor Leste (Fig. 4.1), fortifications have recently drawn the attention of archaeologists (Lape 2006; Lape and Chao 2008; Lape et al. 2015; O'Connor et al. 2012). In the Lautem district, they are built of dry stacked rocks with walls as tall as 5–6 m and as thick as 2–3 m at the base. They are often perched on the edge of limestone cliffs overlooking the Banda Sea. Structures located in low, flat parts of the landscape that lack natural cliffs usually have larger walls. On the higher elevation sites, the walls can be low enough for an adult human to easily climb over. There is also a concentration of similar structures on the hilltops overlooking the floodplains of the Laclo River near the town of Manatuto (Chao 2008; Lape and Chao 2008). These are typically walled terraces that modify the natural steep gravel hills. In both regions, local people identify these places as old villages, and they continue to play important and active roles in local memory and politics. Local narratives often describe the abandonment of these places as a result of inter-clan battles, which either extinguished all members of the clan living there or forced the survivors to relocate (McWilliam 2006, 2007, 2011; Pannell 2006, 2011).

Archaeologists interpret these places as *fortified* villages because of their placement and form, such as location on cliff edges or hilltops, with restricted entryways and views of the surrounding landscape (Lape 2006; Lape and Chao 2008; Lape et al. 2015; O'Connor et al. 2012). The presence of a broad assemblage of habitation remains, including faunal remains, pottery, and sometimes lithics, suggests use as permanent living spaces rather than occasional use for refuge or ritual practice. They are similar to other structures interpreted as fortifications throughout the Pacific, including other parts of Island Southeast Asia, although there is significantly less documentation of the Island SE Asian fortifications compared with those in Oceania (Field and Lape 2010).

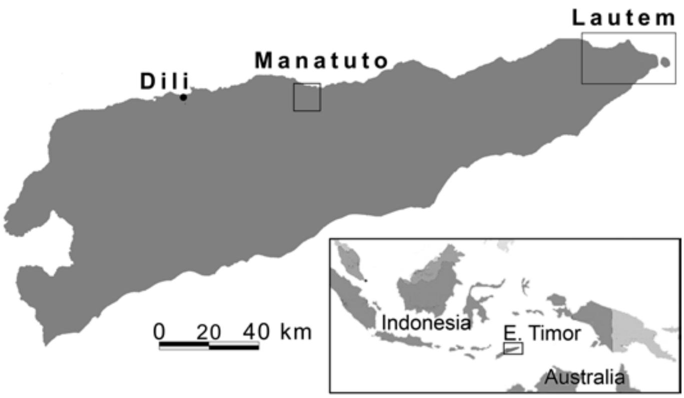

Fig. 4.1 Map of Timor Leste

The dating of the initial construction and subsequent use of these structures is difficult (Lape 2006). In the Lautem area, very thin soils overlying limestone bedrock provide little chance for the development of stratified cultural deposits. There is more sediment at the sites in Manatuto, but in both areas, continued anthropogenic burning up to the present means that charcoal not necessarily linked to archaeological target events is prevalent in the minimal sediments available. The location of the fortifications on hilltops and other high points in the landscape means that sediments are generally transported away from the structures downslope, often leaving completely deflated sites consisting of artifacts with larger rocks and almost no finer-grained sediments.

The resulting uncertainty in dating makes it difficult to establish chronological links between the fortification-building episodes and other environmental or historical events, as will be discussed below. Nevertheless, because of the relatively short occupation periods of the fortified settlements, it is possible to create a relatively coarse-grained chronology of fortification building and use in the context of Timor's culture history.

Humans have been present in Timor since at least 42 kya (O'Connor et al. 2002; O'Connor 2007). Between 3 and 4 kya, domesticated animals and possibly some domesticated plants were adopted locally or brought by new populations (Glover 1986; Oliveira 2006, 2008). Fortifications all appear to date to after 1100 C.E. This shift to fortification building stands out in contrast to otherwise relatively stable traditions of technology, foodways and landscape use, though this apparent cultural stability may be partly an artifact of the paucity of archaeological research in the region. This relatively late and quite prominent shift to fortification building invites hypothesizing about causes, and furthermore, suggests an important role for novel external forces. The ongoing use of these structures as important centers for sacred practice, social memory, and political symbolism provide intriguing hypotheses regarding their origin.

4.2 Food and Fortification: A Climate-Sensitive Model

Lape and Chao (2008) first provided a model for initial fortification building in Timor Leste, hypothesizing that people would initially choose to build fortifications under two conditions: (1) during times of unprecedented drought, when agricultural food production systems would be stressed and risk mitigation strategies (food storage, trade) would be underdeveloped; and (2) in the boundary areas between drought-sensitive and drought-tolerant agricultural landscapes, where conflict (raiding, land capture) would be most likely to erupt.

Testing the model required: (a) investigating whether there was a chronological correlation between initial fortification building and times of unprecedented drought; and (b) comparing fortification densities in boundary zones with those in non-boundary zones. Following Ferguson (1994, 2006), we assumed that fortification-building choice would be most dependent on external climate forcing at an incipient stage. Once fortifications existed on a landscape and social systems reorganized to incorporate group conflict and defense of land tenure, subsequent causal mechanisms become much more complex and environmental factors become relatively less emphasized.

We used data from a series of surveys and excavations of fortifications in both Lautem and Manatuto conducted from 2003 to 2006 to locate and date fortified sites. To date drought episodes, we relied on El Niño Southern Oscillation (ENSO) records. In the twentieth-century C.E., historical records indicate that El Niño years reliably bring drought to Timor Leste (and most of SE Asia) and also delay the onset of seasonal rains (Fig. 4.2). Unfortunately, we still lack local paleoclimate proxy data for the Timor area that has the resolution relevant to our timescale. Therefore, we used paleoclimate data from eastern and central Pacific proxy ENSO records to infer drought in Timor. This approach assumes that ENSO teleconnections existed in the past. Verification of this assumed teleconnection into the pre-twentieth-century past awaits better local paleoclimate proxy data for past rainfall, which may be available from lacustrine or marine sediment cores, or from speleothem samples from local caves.

We analyzed the landscapes of Lautem and Manatuto to identify boundary areas between drought-tolerant and drought-sensitive zones. This analysis considered rainfall or irrigation by surface channels only, not other factors like soil moisture capacity. The Lautem district has highly variable elevation-dependent orographic rainfall, bringing drought-tolerant and resistant areas into close proximity (Fig. 4.3). In Manatuto, the perennial Laclo River allows for drought tolerance via irrigated agriculture at the river's edge, while lands further from the river (where irrigation is impossible) are extremely drought sensitive. In the boundary between these two zones, the model predicts that conflict would be a likely choice for residents, though cooperation strategies were also likely employed

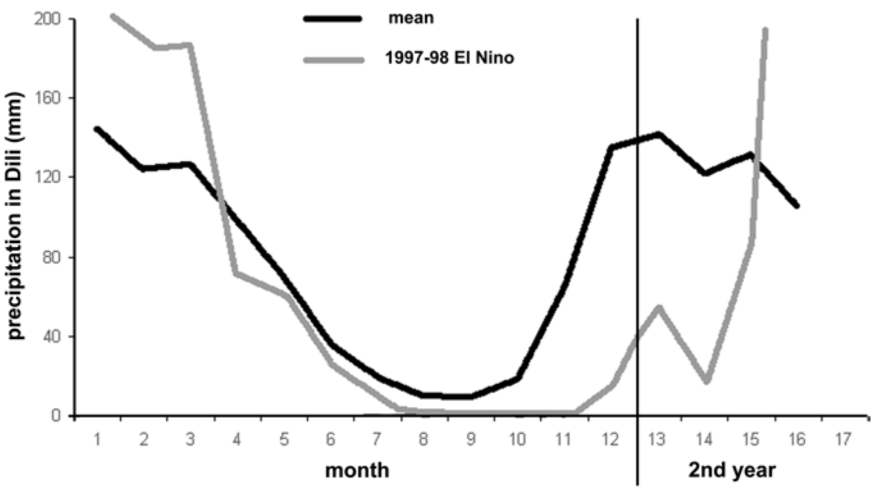

Fig. 4.2 Rainfall amount and seasonality in Dili, East Timor

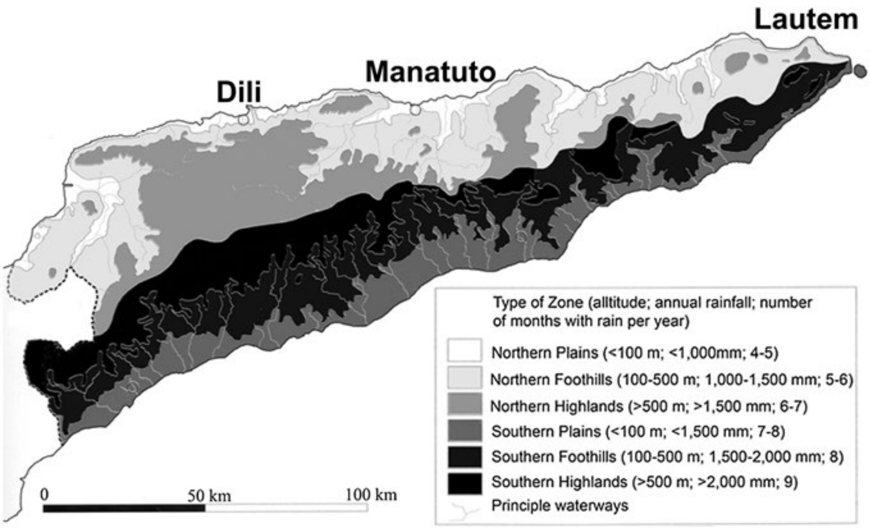

Fig. 4.3 Spatial distribution of rainfall in Timor Leste. Adapted from Durand (2002)

(and of course group conflict requires cooperation within and sometimes between groups). In this situation, fortification building would be a beneficial strategy. Fortifications would create a safe haven from raids on both people and stored food caches. Locating them at high points would allow for defense of claims on productive agricultural lands within their viewshed (Field 2008; Smith and Cochrane 2011). Building of them would be a cooperative group effort that would reinforce group identity, reify leadership roles, and channel excess labor, particularly potentially volatile young male labor, toward activities that promoted group cohesion (Goldstein 2001).

The results of our tests of chronological correlation between unprecedented drought and initial fortification building were mixed (Lape and Chao 2008). We concluded that there was a close correlation between a rapid increase in El Niños beginning at 1300 C.E. and patterns of initial fortification building in Manatuto, but that the fortifications in Lautem first appear 100–200 years after the El Niño peak. Spatial correlations were stronger. We found the highest concentration of fortifications in boundary areas between drought-tolerant and drought-sensitive zones in both Lautem and Manatuto.

4.3 Critiques of the Model

O'Connor et al. (2012) provide a critique of these conclusions. Their critique cites specific challenges to the data used to justify the conclusions in Lape and Chao (2008), but also raises larger issues of environmental determinism, causality, and model building. The response to that critique detailed below addresses both the specific questions about the data, but also the wider concerns, which should be relevant to larger debates about the causes of war (and how to use archaeological data investigate them).

O'Connor et al. (2012) provided dates for two additional fortified structures in the Lautem District excavated by their team, claiming initial construction dates during the eighteenth-century C.E. They conducted a Bayesian analysis of a combined set of AMS dates from our work and theirs (N = 31, from seven sites) in order to evaluate the chronology of fortification building in the Lautem and Manatuto Districts. This analysis, they argue, suggests that while fortification building and use likely began prior to 1300 C.E., it only became *widespread* later, around 1550–1750 C.E. The authors then suggest that this later period for widespread fortification building postdates the period of increased El Niño frequency (1300–1600 C.E.), thereby negating a causal role for ENSO droughts. They did not evaluate the spatial hypotheses of our paper.

The authors then propose several alternative hypotheses for the causes of fortification building, which in their view have a better chronological fit with their 1550–1750 C.E. chronology for widespread fortification building and use. These potential causes are not directly related to environmental forces or local food production. Instead, they propose causes related to the effects of post-sixteenth-century European colonial intrusions into social systems. One suggested cause is the intensification of slave trade to provide labor for European colonial plantations in SE Asia. In this case, fortifications may have been a defensive reaction to slave raids. Another possible factor they propose is the intensification of trade of local products such as sandalwood (*Santalum album*) and beeswax. In this case, fortifications may have been built to signify and protect ownership of these trade items, or been a response to local conflicts caused by social instability from intensified trade. They also propose population growth and autochthonous forces as other potential causes, albeit untestable ones.

Unfortunately, this critique misunderstands the Lape and Chao (2008) model with regard to chronology. The date of interest in our model is the initial or oldest dated fortification in a given geographic area. The fact that there are fortifications in Lautem dating to the eighteenth century is interesting and asks for explanation, but it is not relevant to our model. As mentioned above, once the first fortification was built, subsequent fortification building (even "widespread" building) is in part a response to that first one, much in the same way an arms race takes on a life of its own, delinked from other causes of group conflict. For example, social hierarchy and the power and activity of social group leaders may be enhanced during periods of initial conflict. These leaders subsequently use warfare (including the building of additional defensive sites) to maintain and reify their power. As another example, there are caves, redoubts, and other military buildings that were used by soldiers and refugees during WWII, and during the East Timor–Indonesia conflict from the early 1970s through 2000, but we do not count those as relevant to the initiation of fortification building in the region. Additionally, the total number of samples (31) used for the Bayesian statistical analysis of AMS dates is small and some would argue below the minimum to obtain statistically robust results. More importantly, however, is that the target event discussed by Lape and Chao (the oldest fortification in a given single region) is not the same as the target event in O'Connor et al. (2012) [the period of "widespread" building *and* use of fortifications in *all* regions]. The period identified from the latter may indeed be of historical interest and invite explanation, but it is quite different from the period of interest for the sensitivity model we proposed (Lape and Chao 2008).

Aside from the dating issues, the various social forces identified by O'Conner et al. (2012) are valid alternative hypotheses for fortification building. However, their paper fails to provide any kind of model or means of testing them. It is, however, a good reminder of the critique of deterministic (often environmentally deterministic) "explanations"—that chronological convergence does not necessarily equal causation.

4.4 Issues for Further Consideration

Advancing this important area of research will require more sophisticated models for fortification building than either Lape and Chao (2008) or O'Connor et al. (2012) have proposed. In the remainder of this paper, I explore some areas that may bring greater insight into the complex factors involved in decisions behind fortification building. In particular, I discuss trade and wild foods in the context of Timor's agricultural systems likely in place by 1100 C.E.

4.4.1 Sandalwood Trade

O'Connor et al. (2012) identify sandalwood trade as the most likely cause of fortification building, primarily on chronological grounds. Sandalwood trade in Timor was documented by Chinese accounts as early as 1227 C.E. and continued into the European colonial period. In other parts of the world, trade is indeed often a factor in increased group conflict (Ferguson 2006). It can reify leadership roles in parallel ways with those related to war and can bring new forms of wealth and warfare technology that can serve to escalate previously existing low-level conflict into more extensive and violent forms. While O'Connor et al. (2012) dismiss the possibility of archaeological testing of the sandalwood trade hypothesis, there are several ways we could further investigate this possibility. Sandalwood trees were not uniformly distributed throughout Timor. By using historical records and environmental reconstructions, one could map densities of historic sandalwood groves and compare those to densities of fortifications. Lautem, in fact, appears to have been less endowed with stands of sandalwood than Manatuto and other areas of the island (Chao 2008). Thus, the high density of fortifications in Lautem would appear to suggest that sandalwood trade was not a factor in fortification building, but this requires mapping of fortifications on other parts of Timor, which has yet to be done.

That said, the larger issue of trade in Timor is not a simple one. Although never politically or linguistically unified, the various communities in pre-colonial Timor were likely integrated through interconnected social networks mediated through trade and other forms of social interaction (including conflict). Sandalwood trade, even if focused on areas other than Lautem, may have had indirect consequences that might have resulted in fortification building there. For example, sandalwood trade might have stimulated an increase in the trade of other items, such as slaves, pottery, or food. Conflicts might have spilled over into adjoining regions with alliance relationships.

Sandalwood harvest and trade also likely had direct impacts on food production (Crespí et al. 2013). Sandalwood harvesting had significant environmental impacts in Timor. The highest quality sandalwood oil comes from the roots of the tree, so harvesters often dig up these roots in addition to cutting down the tree. In Timor's steep slopes, this can seriously destabilize soils leading to high rates of erosion on upland slopes and sedimentation in downslope valleys and nearshore coral reefs. Loss of tree cover in this case can be permanent, as supporting soils are quickly stripped away, and high evapotranspiration makes exposed soils too dry for new trees to become established. These effects are coupled with anthropogenic burning and grazing of goats (*Capra hircus*) and sheep (*Ovis aries*) that prevent new forests from establishing. Much of the current savannah landscape of northern Timor Leste probably has its origins in these anthropogenic processes. Ultimately, the combined effects of intensive sandalwood harvesting would have probably reduced the fertility of forest areas for swidden farming and changed the population dynamics of wild plant and animal ecosystems. Evidence for rapid, large-scale transport of sediments into the Laclo River floodplain abounds (Chao 2008). This may have had some beneficial results for farming in the floodplain (enlargement of areas suitable for irrigation, input of new fertile sediments), but would have negatively impacted the uplands and the coral reef ecosystems near the river mouth (e.g., Spriggs 1997). Increases in climate uncertainty related to ENSO may have further amplified these effects, through intensification of drought–flood cycles.

Trade booms and busts can also have social impacts that result in group conflict. When sandalwood was completely extinguished from the Manatuto area, people living there would have been left with a greatly changed local ecosystem that might have been unable to support a newly grown population base, a population which may have grown reliant on food obtained though trade.

4.4.2 Agriculture Versus Wild Terrestrial and Marine Food Resources

While domesticated plants (taro [*Colocasia esculenta*], yams [*Dioscorea* spp.], bananas [*Musa* spp.], tree crops) and animals (pigs [*Sus scrofa*], goats, cattle [*Bos taurus*]) were most likely available to people in Lautem and Manatuto by 1100 C.E., it remains unclear how much of the total food consumption was supplied by these various means (Oliveira 2006, 2008). During fieldwork in the early–mid-2000s, people in Lautem, particularly those living in the smaller villages far from the district capital, supplemented food from swidden fields with wild terrestrial plants (tubers and leafy greens) and animals (cuscus [*Ailurops* spp., *Strigocuscus* spp.], bats [Chiroptera], deer [Cervidae], civet cat [Viverridae], various birds), fish, shellfish, and seaweeds from beaches, reefs, and the open sea, freshwater fish from lakes, as well as food bought or traded from other areas (e.g., see Pannell and O'Connor 2010). Low population densities (at least partly the result of violent conflict in the region since the 1970s) and diverse habitats make these wild food supplies available to many. In comparison, the Manatuto region is characterized by relatively more intensive agriculture (irrigated rice [*Oryza sativa*] and corn [*Zea mays*] in place of swidden crops), but fewer wild resources due to drier and less productive and ecosystems and higher human populations densities.

For Lautem, at least, one question raised by O'Connor et al. (2012) that requires better archaeological evidence to answer is whether drought impacts on agriculture would have been easily mitigated by the availability of wild food resources. This question in turn raises a series of related questions. Would drought have had a similar negative impact on terrestrial wild plant and animal resources versus marine resources? Presumably marine resources would have been unaffected by drought (in fact, by reducing sediment loads carried by runoff, drought often benefits nearshore marine ecosystems). How would conflict over control of wild resources (both marine and terrestrial) be triggered? How would conflict over control of trade for food be triggered? How would the spatial patterns of wild food resources look different from those triggered by negative impacts on agricultural resources?

This set of questions should be archaeologically testable if we have cultural deposits with good faunal or botanical preservation spanning pre- and post-drought times. Thus far, this kind of site has been elusive in northern Timor Leste, but even compromised deposits may provide some insight into wild versus domesticated food sources.

Other areas that require more investigation are the social dynamics of agricultural production, particularly risk management strategies and climate variability. In Lape and Chao (2008), we proposed that ENSO droughts impacted farmers not just because of lower average precipitation, but also because ENSO changes the timing of seasonal precipitation. In El Niño years, rains come one to two months later than average, and they also tend to be heavier than average. This can be disastrous for farmers who plant seeds too early, as the seeds do not germinate and/or get washed away when the rains come to newly cleared and burned swidden fields. Farmers often develop strategies to deal with climate variability, at least variability that is within human memory timescale. Unfortunately, current ENSO data (and archaeological data) are uncertain at the century level, which is probably just outside typical human memory timescale. This means that our data do not work well for investigations of agent-based models of risk management. But with higher chronological resolution, we should be able to do more in this regard.

4.4.3 Conflict Metaphors in Contemporary Sacred Practice

As detailed in other publications, most fortifications in the Lautem district continue to be used today for sacred practice and memory (Lape 2006; Lape and Chao 2008; McWilliam 2006, 2007, 2011; Pannell 2006, 2011; Pannell and O'Connor 2005, 2013). This is also true in Manatuto, although currently it is much less documented in the anthropological literature, and on the surface, the cultural practices seem somewhat different from those in Lautem (Chao 2008). Although it cannot be directly linked to initial causes of war hundreds of years ago, the contemporary cultural use of fortified landscapes and sites in Timor Leste supports a link between food resources and warfare. Most Lautem fortifications contain physical markers that show the location of underground-dwelling spiritual beings (*tei*). *Tei* are also found in other places on the landscape besides fortifications, including rock art sites, graves, caves, or in people's houses. These spirit beings are potentially dangerous creatures or forces that must be regularly "fed" to control. They always hold the potential to emerge and cause damage to humans, such as eating them or making them sick (they can also be beneficial forces in some situations). The job of feeding *tei* falls to spiritual leaders, who are repositories of memories about *tei* characterization and location. They make regular visits to various *tei* to feed them, based on the events and needs. These might include planting and harvesting cycles, death or illness of community members, or national or international problems needing attention, such as providing support for warriors during the struggles for independence from Indonesia in the 1970s through 1990s. Feeding *tei* can require the sacrifice of chickens, pigs, or larger animals, or eggs and rice and other foods, along with fermented or distilled alcoholic drinks.

The overall metaphor of this sacred practice is that hunger equals danger. Danger, in the form of illness, accidents, violence, and environmental uncertainty, is always present in communities and on the landscape. Controlling this danger requires knowledge of *tei* stories, as well as the location of dozens or hundreds of *tei* locations on the landscape and the appropriate ritual protocol for each one and, above all, food. During our archaeological surveys in the Lautem area, we were strongly encouraged to work with spiritual leaders for our own and the community's protection. Wandering off course would lead to potential disaster, and areas of sacred knowledge were strictly circumscribed. If we needed to work beyond the boundaries of one practitioner's expertise, we were referred to someone else who could reliably guide and protect us.

A functionalist interpretation of these cultural practices might view it as a way to bring food production, land tenure, and leadership into synchronicity in order to manage the risks of uncertainty and variability in food production. The meme of a landscape filled with hungry, dangerous beings will limit people's willingness to transgress into new territories and will increase reliance on certain spiritual leaders who know the *tei* needs and locales. In the course of their regular travels over the landscape to feed *tei*, spiritual leaders gain knowledge of environmental and social conditions. They regularly see how things are growing in everyone's fields, how wild plants and animals are doing, and which people are working in which areas. The highest level of these leaders (lords of the land) are responsible for allocating swidden fields to people based on clan membership and history, which is partly embodied in fortified village locales and the stories attached to them. These leaders also take into account relative fertility of the land, time since last burning, and other factors.

If El Niño frequency indeed increased greatly between 1100 and 1600 C.E., then we can speculate how this system might have evolved in the face of unprecedented drought. Hunger may have become linked to a wide array of other social disruptions, and "feeding" or alleviating this hunger (both literally and figuratively) came to depend on leaders having a deep knowledge of ecological and social landscapes and their histories.

4.5 Conclusions and Future Research

Any model is necessarily and by definition a simplification of real social situations. Indeed, ethnographic studies of group conflict show that every group conflict situation has multiple and complex causes that are historically situated. Most of these causes are far beyond the reach of archaeological investigation, either because they have no archaeological or material correlates or because the timescale of archaeology is far too coarse to get at rapidly evolving social dynamics. Indeed, even contemporary violent conflicts, where we have access to living participants in real time, defy easy explanation. Our challenge is to use models in productive, archaeologically relevant ways to identify causal factors that might otherwise be hidden from view, while at the same time maintaining awareness that reality will always be more complex.

In Timor Leste, future model building and data collection will ideally proceed in tandem. To properly test the Lape and Chao (2008) model, we need local paleoenvironmental data (particularly rainfall) at the century scale or better. This may be obtainable from local reef cores, speleothems, or lake sediments (such as Lake Ira Laloro in Lautem). Accurate and precise dating of fortification building needs to continue and must be done in a way that addresses geoarchaeological complexities and targets initial building episodes. Poor organic preservation and local sensitivities have limited the data available from human skeletal evidence, but where possible, skeletal data could provide information about past violence as well as nutrition (Lape et al. 2015). Finally, foodways need much more intensive focus in this region. We need to target fortified sites with good organic preservation and minimal post-depositional disturbance.

Timor Leste is one of the world's newest nations, and its inhabitants have a keen interest in investigating their history. Research into the original causes and triggers of violent conflict is especially relevant for this nation, which has been ravaged by war for nearly 30 years before entering a new era of relative stability and peace beginning in 2000. Archaeological research thus has an important and ongoing role to play.

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