

Interactive comment on “Relationship between climate change and wars between nomadic and farming groups from the Western Han Dynasty to the Tang Dynasty period” by Y. Su et al.

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How to understand the Sino-nomad warfare in the context of climate change?

The conflict or warfare between nomadic groups and settled agrarian societies is of great signification for the history across much of the vast Eurasian continent, the reason is simple: such conflicts have shaped or even changed the destiny of nations involved in this area. The known examples include the Xiongnu (Huns) invasion of the Europe and resultant collapse of the grand Roman Empire and the Mongolian sweeping conquest of Eurasian continent. Therefore, this subject have attracted the attentions of various scholars with various disciplines for a long time. To cite few of them, the

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pioneer of climatic-determinist Huntington (1907), the great historian Toynbee (1937), palaeoclimatic scientist Lamb (1972), geographer Lattimore (1938), and anthropologist Barfield (1989). Various hypotheses have been put forward to explain the causes that responsible for the occurrence of pastoralist-farmer conflicts, and climatic hypothesis may be one of most influential explanations.

With respect to climatic hypothesis, since Huntington (1907) first systematically put forward it, the dominant view on the warfare between nomadic groups and settled agrarian societies is that adverse climate change either cooling or/and desiccation episodes would increase the incidence of warfare between the two antagonists (Jenkins, 1974; Zhang et al., 2010; Bai and Kung, 2011). Such an argument is highly plausible and even seems to be a commonsense at first sight, since the causal chains likening adverse climatic change to warfare can be convincingly established. It has been known that nomads depend their subsistence much on herds they rear and games they hunt, which in turn both depend on water and pasture for their survival and growth. However, the water and pasture all the way they pursue as ancient Chinese historian term it in the steppe are fragile ecological systems, which are highly susceptible to adverse climatic change. Even slight variations in either temperature or precipitation would exert a high consequence on their economy, and then result in subsistence crisis. If they unfortunately happen to meet such climatic conditions, and were stressed by severe food scarcity, the nomads would face decreased alternatives of choice due to absence of effective relief systems, they may either stay to death or migrate to those more favorable areas to the south, where they could compete with the settled agrarian societies for food. As a result, the frequency of conflict or warfare between nomadic groups and settled agrarian societies are expected to increase during adverse climatic period. The truth seems to be the case: as is expected, the increased Sino-nomad conflict incidence during climatic deteriorating period have been repeatedly substantiated by empirical evidence (Fang and Liu, 1992; Zhang et al., 2010; Bai and Kung, 2011), and such view has been remained to be unchallenged for a long time.

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But now, a quantitative reanalysis of Sino-nomad conflict in the context of climatic change by Su and her colleagues may alter such long-holding view. Using a Large-N approach, they make a comparison between the time-series of the reconstructed well-dated and highly-resolved climatic change and fine-grained Sino-nomad conflict or warfare sequence, and found that on a 30 year-period timescale warm climatic episodes corresponds to a period of a high incidence of wars, while a cooling period corresponded to period of a low incidence of wars. Such interesting findings are totally different from traditional view that the conflicts were more prevalent during colder periods. Based on these findings, they attempted further to establish the plausible causal pathways from climatic change and Sino-nomad conflict. In doing so, they provide a hypothesis that may have more explanatory power than those previous interpretations.

By contrast, many previous studies on the pastoralist-farmer relationship from the perspective of climate change usually suffer two defects, one is due to lack of solid evidence about climatic conditions of the time, another is the inherent flaw embedded in their study methodology.

With respect to the climatic evidence, when Huntington (1907) first put forward his famous climatic hypothesis, he was bitter to see that he is very lacking of long-term climatic evidence. To make matter even worse, during his time, the dominant view about climate change is that the climate changed gradually. Such a view seriously constrained researcher's consideration of climatic change as an important factor in human affairs. But Huntington is different. Having considered human adaptive nature, he innovatively argued that past climate must not change smoothly but rather changed in a pulse way. With these ideas in mind, he looked for evidence and found two pieces of climatic evidence to establish his hypothesis. One is tree-ring width of some American firs in California and another is the curve of the Caspian waterline fluctuations. Of course as you will see, these two pieces of evidence are both proxy indicators of precipitation. It seems to be commonsense that in the steppe water is more important than temperature for their herds and games. From the two proxy indicator curves, he

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found that climate altered obviously between moist and desiccation during most of historical times. Basing on this findings, he interpreted the history of nomadic migration and resultant conflicts with settled agrarian societies as highly related to the pulses of recurrent desiccation.

One hundred years later, we now know that the climatic evidence presented by Huntington is far from a robust one. The precipitation is characterized by a high-heterogeneity nature in its spatial distribution. In other words, a desiccation period occurred in California may not appear in the Eurasian vast steppe, and precipitation on a multi-decadal scale varies greatly even in the same region of the steppe. As matter of fact, more than forty years ago Jenkins(1974)have clearly pointed out the defects of the climatic evidence presented by Huntington. He was convinced that he could find more robust evidence of climatic change. Unlike Huntington who emphasized on evidence of desiccation, he thought that larger-scale temperature, if changed, must altered more uniformly across different regions than precipitation. Therefore, he paid attention to those proxy indicators that could reflect the cyclical variations in mean annual temperatures. In the end, he collected four items of palaeoclimtic evidence. They were: Norwegian snow-line variations; glacial alterations from Iceland, Switzerland and Alkska; temperature change reconstructed from Chinese historical documents, and records of climatic change in various parts of Southern Russia from records of chronicles. Jenkins(1974)found that these four temperature indicators collectively revealed a pronounced cooling episode during the thirteen century, which coincided in timing with the sudden rise of Mongol empire and its subsequent sweeping conquest of the Eurasian continents. Based on such findings, he put forward a hypothesis that sudden temperature dropping during 1175-1260 contributed to the Mongol conquest and resultant warfare. However, what he regarded as robust evidence indicating cooling during the thirteen century are in fact a pronounced warm period as is indicated by increasing solid evidence. We have systematically analyzed the precisely-dated and highly-resolved climatic evidence across the Eurasian continent and found that the rise and subsequent of Mongol conquest occurred not during cooling episode but from a

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pronounced warming period, which is known as the later parts of the "Medieval Warm Period"(Wu et al., 2009). It has been increasingly acknowledged such warming period occurs on at least a semi-hemisphere scale, and is well documented by various natural climatic archives across much of the Eurasian continent especially abundant historical documents(Ge et al., 2001; Wu et al., 2009) . Such brief review shows how the climatic evidence used may influence scholar's interpretation of the pastoralist-famer conflict.

Another setbacks is inherent in the qualitative individual case study method. Such a research methodology usually applies a process-tracing approach, which usually emphasis on exploring the causal mechanisms. However its interpretation subjects to multiple alternative explanations, especially when considering the degree of free will each decision-maker has or constrained rationality due to limited information about decision-making process.

. To take the pastoralist-famer conflict as an example. Hsiao Chi-Ching (1972) summarized seven basic factors that were usually invoked to explain the mechanism behind the warfare between pastoral nomads and agrarian Chinese Han communities over the course of history. Briefly, they are(1) climatic change, especially desiccation or drought; (2)the nomads' greedy and predatory nature(3) Malthusian overpopulation of nomad in the steppe ;(4)interruptions of trade on the part of the Chinese, which resulted in a difficult for the pastoral surpluses to be sold for other needed masteries including agricultural product(5)the desire of nomad leaders to build a supra-tribal polity(6)a need to supplement the low-level productivity of the fluctuating pastoral economy by plundering the surpluses of the more stable agrarian economy;(7)nomad psychology-a decisive to feel equal to the Chinese and a belief in the divine destiny of their own steppe kings to conquer the world. We may also add several other items to this long list, such as the overwhelming military superiority of the horse-mounted bowman over their agrarian opponents(8) stamina of the nomadic armies; or even some religious factors (Jenkin, 1974). Most of these factors are invoked as proximate causes, and some may be combined to work. However, in the absence of robust evidence es-

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pecially unambiguous historical written records, much of these explanations, though sounding plausible, have been left wide open to speculation and conjecture. Different researchers may have made different arguments, leading to an expression that each case needs a particular explanation and generalization seems to be impossible. The results thus usually lead to an explanatory particularism.

However, like natural science, social science also has been paying much attention to disclosing the general mechanism behind those recurrent human behavior(individually or collectively or as unit of community). It draws lessons from the controlled-experiment approach applied by natural science and attempts to make quasi-experiment method with an aim to quantitatively reveal the common mechanisms that operate on social system and contribute to the occurrence of recurrent social phenomenon. One of such methods is the large-N approach, which was used widely to reveal those common factors that hide behind those proximate factors.

During the past few decades, precisely-dated and highly-resolved climatic proxy indicators from various natural archives and historical records have been used to reconstruct reliable and accurate climate changes during the past 2000 years. Such an advance one hand provided solid climatic background against which the pastoralist-agriculturalist warfare occurred. On the other hand, it will make the interpretative results by large-N approach more convincing.

Recently, David Zhang and his colleagues pioneered in conducting quantitative study on the relationship between long-term climate change and warfare in historical China (Zhang et al. 2005), large-scale social crisis in Europe (Zhang et al., 2007; Zhang et al., 2008; 2011), and other contributions. Their research may stimulate other similar studies (Zhang et al., 2010; Bai and Kung, 2011), including the studies by authors of this paper (Su et al., 2014; Fang et al., 2015). They are more scientifically and convincingly to verify the relationship between climate change and human affairs.

Su and her colleagues in this paper also made a quantitative study. Unlike Zhang et

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al(2006) who include civil warfare in their verifying the relationship between climate change and warfare in northern China, these authors only accounts for wars between the nomadic groups and agrarian societies. They focused their attention on the period from the Western Han Dynasty to the Tang Dynasty, probably partly because much of their earlier works was mainly on this period. However, such period witnessed several apparent warm and cooling periods and periods with higher degree of political vicissitudes for both nomadic groups and the settled agrarian societies, a suitable period to construct their hypothesis. They constructed the fine-grained time-series of wars between nomadic groups and agrarian societies based on careful analysis of historical documents, selected one of most reliable climatic change series reconstructed based on historical documents, and compared two sequence to analyze the influence of climate change on Sino-nomad wars.

Like any other large-N studies, such approach may help to disclose those hiding common factors that varies in concert with those recurrent social phenomenon, which show a good correlation between two seemingly explanatory and dependent variables. However, correlation does not necessarily means causation. Although such correlation may demonstrate a possible causal effects, the causal mechanisms also need to be disclosed. In this manuscript, they offered several factors that they thought to be re-
poseful for such a correlation. Compared with earlier studies, especially those individual case studies, they made a progress on research methodology and the materials used especially the application of the recent advance in past climatic reconstruction.

However, their proposed mechanisms also need further rigorous testing with other independent data. One of such test method is to see whether such a correlation could be extrapolated to other historical periods. We have made a research that accounts for the rise of Mongol Empire and its subsequent three times of westward conquest of the Eurasian continent(Wu et al., 2009). Our results seems to support one of their concussions, i.e. the frequency of warfare between nomadic groups and settled agrarian societies would increase during warm period. It seems to me that all the period

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when the Mongol empire prevail is continuous warfare against agrarian societies including Song Dynasty in China and continuous conquests. However, I could also come up another evidence may contradict their conclusions. This occurred during Northern Song Dynasty. It is known that during 1004-1120AD the Northern Song dynasty and Liao dynasty made a peace agreement, i.e. "Chanyuan Alliance". Much part of these period corresponded with the "Medieval Warm Period". We would assume that during this period the war between Northern Song Dynasty and Liao groups would sharply be falling down. If this conjecture is true, the international structure may also play very important role in mitigating the impacts of climatic change on the relationship of Sino-nomad conflict or warfare. However, this is just a speculation made by a simple reasoning and commonsense, needing further empirical test.

Despite these questions and my conservation about parts of their assumptions and explanations, I congratulate the authors for making a careful quantitative work. This may prove one of the important contributions to understanding the Sino-nomad warfare in Chinese history and its northern nomadic counterparts. Their finding is very interesting and stimulating, which will stimulate the other researchers to rethink the possible relationship between nomadic pastoral groups and the settled agrarian societies. In doing so, we may be more close to those historical truths that were related to such pastoralist-agriculturist conflicts.

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