

**Climate change and  
Sino-nomadic wars  
during 206 BC–906  
AD**

Y. Su et al.

# Relationship between climate change and wars between nomadic and farming groups from the Western Han Dynasty to the Tang Dynasty period

Y. Su<sup>1</sup>, L. Liu<sup>1</sup>, X. Q. Fang<sup>1</sup>, and Y. N. Ma<sup>1,2</sup>

<sup>1</sup>School of Geography and Remote Sensing, Beijing Normal University, Beijing, China

<sup>2</sup>Sun Yat-Sen Memorial Middle School, Zhongshan, Guangdong Province, China

Received: 13 June 2015 – Accepted: 6 July 2015 – Published: 31 July 2015

Correspondence to: Y. Su (suyun@bnu.edu.cn)

Published by Copernicus Publications on behalf of the European Geosciences Union.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



## Abstract

In ancient China, the change in regional agriculture and animal husbandry productivity caused by climate change led to either wars or peaceful relations between nomadic and farming groups. From the Western Han Dynasty to the Tang Dynasty there were 367 wars between the two groups. The nomadic people initiated 69% of the wars, but 62.4% were won by the farmers. On a 30 year-period timescale, warm climates corresponded to a high incidence of wars. The conflicts between the nomadic and farming groups took place in some areas which are sensitive to climate change. During the cold periods, the battlefields were mostly in the southern regions. The main causes which leading to the above results are following: (1) warm climate provided a solid material foundation for nomadic and farming groups, especially contributed to improve the productivity of nomadic group; meanwhile, the excessive desire for essential means of subsistence in nomadic group could led to wars. (2) During the cold periods, people of farming group moved to the south and construct the south, meanwhile, nomadic group occupied the central plains, thus the battlefields also changed. As the background, climate change plays an indirect role in wars between groups.

## 1 Introduction

The association between violent conflicts and environmental change has attracted much research attention recently. Since 2007, more systematic research on the effect of climate change on security issues has emerged. The theoretical model linking climate change to intrastate conflict incorporates case studies as well as conflict statistical studies. Three effects of climate change (natural disasters, sea-level rise, and increasing scarcity of resources) may lead to loss of livelihood, economic decline, and increased motivation for instigating violence (Halvard et al., 2008). Climate change is a contributing factor to conflict (Collier and Hoeffler, 2005; Homer-Dixon et al., 1993; Maxwell and Reuveny, 2000), acting in many cases as a “threat multiplier”. The latest

CPD

11, 3567–3595, 2015

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion





## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

[Title Page](#)

[Abstract](#)

[Introduction](#)

[Conclusions](#)

[References](#)

[Tables](#)

[Figures](#)



[Back](#)

[Close](#)

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)



group was predominantly of Chinese Han ethnicity, and was a combination of ancient Huaxia people and other ethnic groups. The main tribes of the Huaxia were the Huang Di, Yan Di, and Chi You. The history of the exchanges and collisions between these two groups is an important part of Chinese civilization (Tian and Ma, 2008). In China, the northern nomadic tribes moved from place to place in search of water and grass for their herds. Nomadic settlements in the vast temperate arid or semi-arid steppes offered harsh conditions; cold in winter and infrequent rainfall. In contrast, the farmers mainly of Chinese Han ethnicity adopted a self-sufficient way of production and distributed themselves in the eastern monsoon region, where the rainfall and high temperatures were synchronous, with relatively abundant precipitation. The natural climate conditions in these areas were comparatively favorable (Fig. 1). Therefore, the farming group was mainly engaged in agricultural production and living a sedentary life.

The evolution of inter-group relations in China has a long and complex history, which, when combined with long-term historical documentation, is conducive to the relationship studies between climate change and group conflicts. Hinsch (1998) referred to the climate change in East Asia, Europe, and North America and discussed the relationship between Chinese history and different climate change periods. He pointed out that China was traditionally an agrarian society, which was particularly vulnerable to the effects of climate change. He also summarized the periodic changes of warm and cold periods in China, and described the competition and integration of the ecological environment of the nomadic and farming civilization. Based on the ancient administrative divisions in the *Historical Atlas of China* (Tan, 1982), Wang (1996) studied the latitude change of the southern boundary of the national regime established in the southward migration process of the northern nomadic groups starting with the Qin and Han Dynasties. From this, he concluded that in warm periods, the nomadic and farming groups maintained a peaceful relationship, while in cold periods, the nomads moved southward, leading to instability of the Central Plain regime and confrontations between the two groups (Wang, 1996).





## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



one side as “effective defense” or “effective counterattack”, or described the other side as “unable to conquer the adversaries” or “attempted attack failed”. In these cases, the defending side was categorized as the victor. In three cases (0.82 %), one side begged for truces or made peace by marriage, and we considered them to be the losing party. The other two cases (0.54 %) were related to wars that involved multiple battlefields and varying outcomes of different wars. For these, we classified the outcome according to the last war.

5. For 351 cases (95.64 %) the location of the war was given. In two special situations, there was no relevant information, and we thus used other criteria. There were 11 cases (1.99 %) that recorded the battlefield location as “on the border”. In this situation, we referred to the *Historical Atlas of China* (Guo, 1996) and used the middle point of the border as the battlefield location. In five other cases (1.36 %), as only the information of the armies involved was recorded, we used the locations of army camps as the battlefield location.

We calculated the total number of wars, the average latitude of the battlefields, the frequency of nomadic vs. farming groups’ initiation of the conflict, and the dates of their victory, on a 10 year period timescale. We reconstructed the timeline of community group wars from the Western Han Dynasty to the Tang Dynasty. By analyzing the variation characteristics of the sequences, we divided up the historical periods into several stages, drew a scattergram of the major battlefield distribution, and made a spatial analysis of the transfer and distribution of the conflicted regions. We also analyzed the possible relationship between the sequence of wars, the distribution of conflicted regions, and climate change.

### 2.2 Climate change sequences

Currently, two high-resolution quantitative temperature series provide data to cover both the study period and the study areas. One series, which was reconstructed from stalagmite data from the Beijing Shihua Cave (Tan et al., 1997), indicates temperature





of the dry/wet ratio. High-resolution data are conducive to the research on the impact of dry/wet ratio on the relationship between the nomadic and farming groups.

### 3 Analyses

#### 3.1 War sequences between nomadic and farming groups

##### 3.1.1 War frequency

A total of 367 wars (average 3.3 times per 10 years ( $3.3 \text{ wars} (10 \text{ yr})^{-1}$ )) occurred between the farming and nomadic groups from the Western Han Dynasty to the Tang Dynasty (Fig. 2). The wars between the two groups were concentrated in different periods. Wars were more frequent ( $14 \text{ wars} (10 \text{ yr})^{-1}$ ) within three periods (111–120 AD, 311–320 AD, and 621–630 AD). Based on the descending order of the frequency of war in each dynasty, the first 15% of periods with a frequency of more than (or equal to)  $7 \text{ wars} (10 \text{ yr})^{-1}$  were regarded as high incidence. There were 18 such periods that accounted for 169 wars. In other words, during 16% of the time span (1112 years), 46% of the wars occurred. The last 15% of the periods, which witnessed wars less than (or equal to)  $1 \text{ war} (10 \text{ yr})^{-1}$ , were regarded as a low incidence. In these 41 periods, only 20 wars occurred (36% of the time span, 5% of the wars). Periods of no wars occurred mainly in the late period of a dynasty or during periods between dynasties in the Central Plain, when there was no extra power to initiate wars or resist enemies. However, we do note that during periods between dynasties there is a lack of records.

Statistical classification of wars in different dynasties suggested that in a 10 year period during the Eastern Han Dynasty, the Western Jin Dynasty and the Eastern Jin Dynasty, the frequency of war was far higher than the average ( $3.3 \text{ wars} (10 \text{ yr})^{-1}$ ), and these dynasties were the periods with a high incidence of group wars (Table 1). There were 14 high-incidence periods of wars within these three dynasties, making up 78% of all the high-incidence periods. In other dynasties, the frequency of wars, on a 10 year

### Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

[Title Page](#)

[Abstract](#)

[Introduction](#)

[Conclusions](#)

[References](#)

[Tables](#)

[Figures](#)



[Back](#)

[Close](#)

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)





total (36 % of the total,  $3.6 \text{ wars } (10 \text{ yr})^{-1}$ ). The frequency of wars initiated by the farming groups in this period was significantly higher than that of the earlier period, rising to 38.5 % of the total, but they achieved only 42.3 % of the victories.

The third period was the Sui Dynasty and the Tang Dynasty (581–906 AD), which was a low-incidence period. In this period, there were 89 wars in total (24 % of the total,  $2.7 \text{ wars } (10 \text{ yr})^{-1}$ ). Besides the high incidence of wars during the alternation periods of different dynasties, the frequency of war decreased overall. As in the first period, the farming groups initiated fewer conflicts (34.8 % of the total), but won most of them (76.4 %).

### 3.2 Distribution and change in the conflict regions between farming and nomadic groups

The wars in the first period (206 BC–220 AD) mainly occurred between an ethnic group (such as the Hun, Qiang, Xianbei, or Wuhuan) and the farming group who established the Western and Eastern Han Dynasty. The border between the Hun, Wuhuan, and Xianbei ethnic groups' territory and the Han Dynasty was located at approximately  $44^\circ \text{ N}$ , and extended to  $41^\circ \text{ N}$  to the southeast (Guo, 1996). The main conflict regions were from  $33$  to  $42^\circ \text{ N}$  and from  $100$  to  $118^\circ \text{ E}$ , and distributed along the Hexi Corridor, on the Loess Plateau south of the Yellow River and north of the Qin Mountains (high-incidence regions), in the regions from the east of the Plain and Step Lands to the west of the Taihang Mountains (high-incidence regions), and regions along the Great Wall in the north of the North China Plain. In summary, the major battlefields were mostly in the border regions (Fig. 3a).

In the second period (221–580 AD), wars mainly broke out between the ethnic Xianbei and the Hun against the Western Jin Dynasty, as well as between the Eastern Jin Dynasty and the nomadic tribes that invaded the Central Plain. During the Western Jin Dynasty, the border between the two groups ran from the northeast of the Tianshan-Hexi Corridor,  $36^\circ \text{ N}$  north of the Qin Mountains, the Yellow River to the Great Wall of

CPD

11, 3567–3595, 2015

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



that time (40° N). During the Eastern Jin Dynasty, the border was near the Qing Mountains and the Huaihe River, around 33° N (Guo, 1996). The main battlefields were at 105–120° E, 30–38° N and scattered along the Qin Mountains, the North China Plain and the Huanghuai Plain west of Shandong Peninsula (Fig. 3b), which shows that these latitudes were notably to the south (around 3–4 latitudes).

Wars in the third period (581–906 AD) were mainly between the nomadic groups like the Tuyuhun, Turk, Khitan, Tibet, and Uyghur tribes, and the Sui and Tang Dynasties. The border between the minorities in the north and the dynasties in the Central Plain was along the 42° N region (Guo, 1996). The conflicts were widely distributed within 98–113° E, 33–42° N, mainly in the northwestern region. Furthermore, some of the wars extended to present-day Kazakhstan and Kyrgyzstan, with scattered sites in the Tianshan Mountains, Hexi Corridor (high-incidence regions), the Loess Plateau south of the Yellow River and north of the Qin Mountains, regions east of the Plain and Step Lands and west of the Taihang Mountains, and regions along the Great Wall north of the North China Plain (Fig. 3c).

An overall examination of the these periods showed that the battlefields were mainly distributed in the Hexi Corridor, the Loess Plateau south of Yellow River and north of Qin Mountains, and the whole North China Plain. These regions were the adjoining areas of the nomadic and farming groups in the semiarid ecological transitional band. Meanwhile, they were on the fringes of the agricultural production areas. This region corresponds to the location of the 400 mm isohyets, the demarcation line between the monsoon region and non-monsoon region and the Great Wall, which are all extremely sensitive to climate change.

The battlefields in the first period (the Western and the Eastern Han Dynasties) and the third period (the Sui and Tang Dynasties) were far away from the capitals of the farming regime and mainly in the north. In contrast, the battlefields in the second period (the Three Kingdoms, the Western and Eastern Jin Dynasties, and the Southern and Northern Dynasty) were near the capitals of the farming areas, even directly south of the capital.

**Climate change and Sino-nomadic wars during 206 BC–906 AD**

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures

◀

▶

◀

▶

Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



### 3.3 Impact of the climate on the ethnic wars

#### 3.3.1 Climate change from the Western Han Dynasty to the Tang Dynasty

There were warm periods during the Western and Eastern Han Dynasties, and in the Sui and Tang Dynasties; and cold periods in the Wei and Jin Dynasties, and in the Northern and Southern Dynasties. Dryness and wetness variations fluctuated periodically (sequence a and b in Fig. 2). During the Western and Eastern Han Dynasties the annual change of temperature reached its maximum in the middle stage and relatively cold periods occurred in the later stages. The Wei and Jin Dynasties and the Northern and Southern Dynasties were colder and drier, and the coldest period took place in the Northern and Southern Dynasties. The climate became warmer from the late Northern and Southern Dynasties and reached its warmest period in the mid-Tang Dynasty. Although the humidity of this period fluctuated slightly, it rarely went beyond the normal level.

#### 3.3.2 Ethnic wars and climate change

On a centennial or longer scale, there was no significant difference between the number of wars and climate change (Fig. 2, Table 3). However, in terms of the spatial variable, group wars between farmers and nomadic tribes corresponded to climate changes (Figs. 2f and 3). In warm periods, the battlefields were mostly in the northern areas (average latitude 38.92° N). In the cold period, the battlefields were in the southern parts (average latitude 34.66° N).

On a 30 year period scale, a warm climate corresponded to a high incidence of wars, while a cold climate corresponded to a low incidence of wars. During the warm climate of the Western and Eastern Han Dynasties, the correlation index between the frequency of the wars and climate change was 0.143, and the correlation index was 0.577 during the Sui and Tang Dynasties (cold climate). In the cold period of the Wei and Jin Dynasties, the correlation between the frequency of wars and climate change

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



---

**Climate change and  
Sino-nomadic wars  
during 206 BC–906  
AD**

Y. Su et al.

[Title Page](#)[Abstract](#)[Introduction](#)[Conclusions](#)[References](#)[Tables](#)[Figures](#)[Back](#)[Close](#)[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)

was negative ( $-0.223$ ). The number of wars decreased to its lowest point in the cold period of the late Tang Dynasty. The highest frequency of wars was 14 times higher during the warm period of the Western Han Dynasty (111–120 AD, the temperature departure was  $0.4^{\circ}\text{C}$ ), the cold period of Wei and Jin Dynasties (311–320 AD, the temperature departure was  $-0.5$ ), and the warm period of the Sui and Tang Dynasties (621–630 AD, the temperature departure was  $0^{\circ}\text{C}$ ). In the 18 high-incidence periods of group wars, 13 of them (72 %) broke out in a warm period, with an average temperature departure of  $0.28^{\circ}\text{C}$ . 20.6 % of the warm periods were also high-incidence periods of group wars.

There was no significant correlation between the frequency of wars and the dry/wet series. Only the longest drought period, 302–421 AD, corresponded to the high incidence of wars in the Eastern Jin Dynasty. The peak of the war frequency saw about 20–30 years' delay compared with that of the extreme drought.

The farming groups maintained a low frequency of initiation, with no correlation to climate change, while the nomadic groups were always the aggravating party. The peak of the frequency of war almost corresponds to that of the temperature departure, and reaches a maximum value in the cold period of the Eastern and Western Jin Dynasties.

The farming groups had a greater chance of winning, especially in the warm period. However, in the cold period, the two groups had almost the same chance of winning the wars, with the nomadic groups gaining the upper hand.

#### **4 Mechanism of the impact of climate change on the wars between the farming and nomadic groups**

Our conclusions that groups wars were more prevalent during warmer periods are different from those of the study conducted by Zhang Dian (Zhang et al., 2006), who concluded that the frequency of wars in cold periods was higher than that of warm periods. One possible reason is that the frequency of war in our study only accounts for wars between the nomadic and farming groups without considering any other types

---

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

---

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



of war (e.g., civil wars in cold periods lead to insufficient food). From Table 3 we can see that the vast majority of all wars were initiated by nomadic group and the frequency of war initiated occupy a large proportion in the total war frequency, however, farming groups got more victory; and the location of the key battleground also changed with climate. Why do the above aspects of wars change, what role does the climate play?

Firstly, nomadic economy was single and vulnerable, and the war plunder which cost less but obtained more was a way of getting a variety of agricultural products and wealth for nomadic group. Northern nomadic groups and farming groups varied greatly in their culture and economic stability. The nomadic economy relied highly on nature and applied few technologies to the production of goods. In addition, their simple socioeconomic structure was more vulnerable to natural disasters. There were few opportunities for internal trade, therefore the nomadic groups traded with farming groups (He, 2003). These differences between the two groups resulted in an unbalanced complementary relationship in their product structures, such that the nomadic economy depended on the farming economy. Therefore, the nomadic groups had to resort to mutual trade and wars to obtain agricultural products and crafts from the farmers, which made them the primary initiators of wars. The purpose of nomadic groups waging war was to open commodity circulation channels and ensure continuous access to more agricultural products. Compared with farming group, in the cold-weapon age, one of the important characters of nomadic group was a combination of military and production. Advantages which fighting on horses and the accuracy of shooting with the bow in nomadic group can get training in daily life, and farming group can not do this (Zhao and Yu, 2013). Therefore, nomadic group often became the part of launching in wars. Nomadic group which living in the cold condition had the character of advocating force, and during the period of strong of nomadic group (warm periods) wars which was predatory and expansionary were brought to the central plains by the nomad (Ma, 2011). The purpose of the most wars was to get necessary survival items and luxury goods, and the way they took usually was robbing. It was just because they did not intend to obtain a large area of land and cities, they just wanted to use the lower cost to get higher interests













periods. These results may indicate that multiple mechanisms contribute to the observed relationships and that different mechanisms dominate in different contexts. It seems likely that climatic changes influence wars through multiple pathways. Further research should be to identify these mechanisms.

5 *Acknowledgements.* This study was supported by the National Natural Science Foundation of China (Grant no. 41371201).

## References

Chu, K. C.: The preliminary research on climate change in China of past five thousand years, *Sci. China Ser. A*, 2, 15–38, 1973 (in Chinese).

10 Collier, P. and Hoeffler, A.: Resource rents, governance and conflicts, *J. Conflict Resolut.*, 49, 625–633, 2005.

Cui, Y.: Study on ancient Chinese wars in the view of agricultural and nomadic husbandry, MSc thesis, Northwest A&F University, Yang Ling, 17–19, 2011 (in Chinese).

15 Cui, Z. J. and Song, C. Q.: Holocene periglacial processes and environmental changes in the Daqingshan Mountains, Inner Mongolia, China, *Journal of Glaciology and Geocryology*, 14, 325–331, 1992 (in Chinese).

D'Arrigo, R., Jacoby, G., Pederson, N., Frank, D., Buckley, B., Nachin, B., Mijiddorj, R., and Dugarjav, C.: Mongolian tree-rings, temperature sensitivity and reconstructions of Northern Hemisphere temperature, *Holocene*, 10, 669–672, 2000.

20 D'Arrigo, R., Jacoby, G., Frank, D., Pederson, N., Cook, E., Buckley, B., Nachin, B., Mijiddorj, R., and Dugarjav, C.: 1738 years of Mongolian temperature variability inferred from a tree-ring width chronology of Siberian Pine, *Geophys. Res. Lett.*, 28, 543–546, 2001.

Duan, W.: The Flood Disasters in the Han Dynasty, Managing Measures to the Yellow River and The Relieving Measures, MSc thesis, Capital Normal University, Beijing, 1–4, 2002 (in Chinese).

25 Ge, Q. S., Zheng, J. Y., Fang, X. Q., Man, Z. M., Zhang, X. Q., Zhang, P. Y., and Wang, W.-C.: Winter half-year temperature reconstruction for the middle and lower reaches of the Yellow River and Yangtze River, China, during the past 2000 years, *Holocene*, 13, 933–940, 2003.

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures

◀

▶

◀

▶

Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion







## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion



Xia, Y. M.: Study on record of spore-pollen in high moor peat and development and successive process of peat in Da and Xiao Hinggan Mountains, *Scientia Geographica Sinica*, 16, 337–344, 1996 (in Chinese).

Xiao, Q. Q.: Examination on the various causes of southward invasion of northern asia nomadic, *Shin-Huo Monthly*, 1, 609–619, 1972.

Zhang, D. D., Jim, C. Y., Lin, G. C.-S., He, Y. Q., Wang, J. J., and Lee, H. F.: Climatic change, wars and dynastic cycles in China over the Last Millennium, *Climatic Change*, 76, 459–477, 2006.

Zhao, Y. and Yu, W. H.: Combination of military and production resource allocation and size of the nomad and farming nationality, *Research on Institutional Economics*, 2, 137–146, (in Chinese) 2013.

Zheng, J. Y., Wang, W.-C., Ge, Q. S., Man, Z. M., and Zhang, P. Y.: Precipitation variability and extreme events in Eastern China during the past 1500 years, *Terr. Atmos. Ocean. Sci*, 17, 579–592, 2006.

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

[Title Page](#)
[Abstract](#)
[Introduction](#)
[Conclusions](#)
[References](#)
[Tables](#)
[Figures](#)
[Back](#)
[Close](#)
[Full Screen / Esc](#)
[Printer-friendly Version](#)
[Interactive Discussion](#)


**Table 1.** Frequency of wars between the farming and nomadic groups from the Western Han Dynasty to the Tang Dynasty in China.

Dynasty	Total	Frequency (times (10 yr) <sup>-1</sup> )	High-frequency periods
Western Han	46	2.00	–130s
Eastern Han	102	5.28	90s–130s, 150s–170s
Three Kingdoms	3	0.66	
Western Jin	38	7.45	270s, 300s–320s, 350s
Eastern Jin	48	4.66	370s
Southern and Northern	41	2.43	
Sui	9	2.50	
Tang	80	2.78	620s, 680s–690 s
Sum/average	367	3.30	



## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

**Table 2.** Frequency of war initiation and victories of farming and the nomadic groups.

Dynasty	Farmers Total initiation	Percentage (%)	Total victories	Percentage (%)	Nomads Total initiation	Percentage (%)	Total victories	Percentage (%)
Western Han	11	23.91	28	60.87	35	76.09	18	39.13
Eastern Han	21	20.59	78	76.47	81	79.41	24	23.53
Three Kingdoms	3	100	1	33.33	0	0	2	66.67
Western Jin	11	28.95	19	50	27	71.05	19	50
Eastern Jin	19	39.58	16	33.33	29	60.42	32	66.67
Southern and Northern	17	41.46	19	46.34	24	58.54	22	53.66
Sui	3	33.33	9	100	6	66.67	0	0
Tang	28	35	59	73.75	52	65	21	26.25
Total/Average	113	30.8	229	62.4	254	69.2	138	37.6

[Title Page](#)[Abstract](#)[Introduction](#)[Conclusions](#)[References](#)[Tables](#)[Figures](#)[◀](#)[▶](#)[◀](#)[▶](#)[Back](#)[Close](#)[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.

[Title Page](#)

[Abstract](#)

[Introduction](#)

[Conclusions](#)

[References](#)

[Tables](#)

[Figures](#)

[⏪](#)

[⏩](#)

[◀](#)

[▶](#)

[Back](#)

[Close](#)

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)



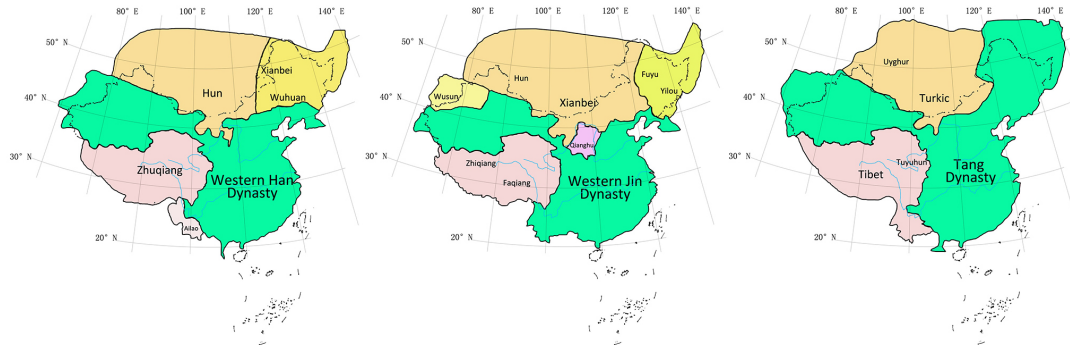
**Table 3.** Frequency of wars in cold and warm periods.

Time	Stage	Cold-warm phase		Frequency over 10 year periods				
		fluctuations	Trends	the ethnic wars	wars initiated by farming groups	wars initiated by nomadic groups	wars won by farming groups	wars won by the nomadic groups
210–31 BC	The Western and the Eastern Han Dynasties warm period	Warm	Drop in temperature	2.39	0.50	<b>1.89</b>	<b>1.44</b>	0.94
30 BC–30 AD		Cold	Drop in temperature	0.50	0.17	<b>0.33</b>	<b>0.33</b>	0.17
31–120 AD		Warm	Rise in temperature	5.33	1.78	<b>3.56</b>	<b>4.33</b>	1.00
121–210 AD		Warm	Drop in temperature	5.89	0.56	<b>5.33</b>	<b>4.22</b>	1.67
211–360 AD	The three Kingdoms, the Wei and Jin Dynasties, and the Northern and Southern Dynasties cold period	Cold	Drop in temperature	4.13	1.67	<b>2.47</b>	1.73	<b>2.40</b>
361–390 AD		Warm	Rise in temperature	6.33	2.33	<b>4.00</b>	2.00	<b>4.33</b>
391–510 AD		Cold	Drop in temperature	3.17	0.92	<b>2.25</b>	1.50	<b>1.67</b>
511–570 AD		Cold	Rise in temperature	1.50	<b>1.17</b>	0.33	<b>1.00</b>	0.50
571–720 AD	The Sui and Tang Dynasties warm period	Warm	Rise in temperature	4.13	1.40	<b>2.73</b>	<b>2.93</b>	1.20
721–780 AD		Warm	Drop in temperature	3.83	1.67	<b>2.17</b>	<b>2.83</b>	1.00
781–906 AD		Cold	Drop in temperature	0.54	0.15	<b>0.38</b>	<b>0.54</b>	0.00

The warm period in the cold–warm fluctuation refers to the temperature departure that is above or equal to 0°C, while cold refers to that of lower than 0°C. The cold–warm trend statistics are generated from comparing them with former phases. Bold values: a larger proportion of wars initiated (or won) by the nomadic and farming groups.

## Climate change and Sino-nomadic wars during 206 BC–906 AD

Y. Su et al.



**Figure 1.** Distribution of the regions of the nomadic and farming groups during the Western Han Dynasty, the Western Jin Dynasty, and the Tang Dynasty (Tan, 1982).

Note: regions where the regime was established by the farming group in different periods are in green. Regions identified with other colors correspond to different regimes established by several nomadic ethnicities.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures

◀

▶

◀

▶

Back

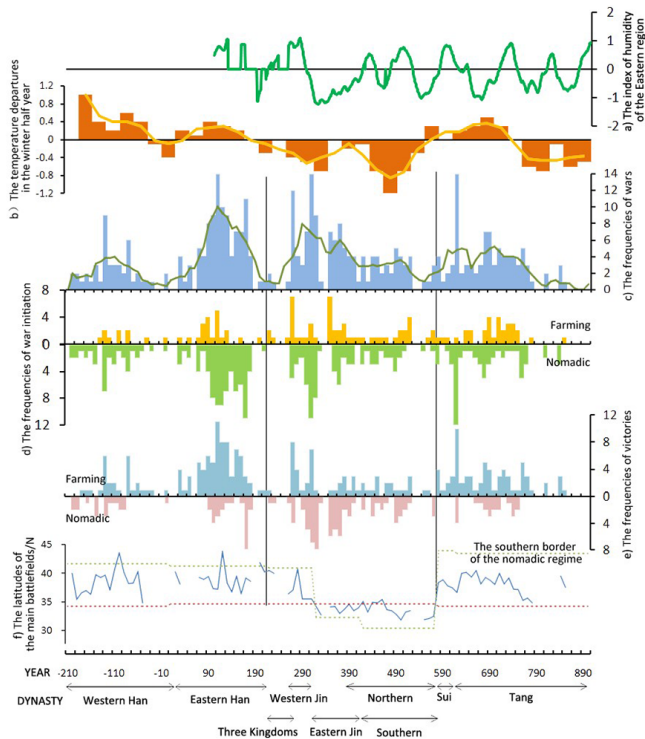
Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion





**Figure 2.** Sequence of wars between the northern nomadic and farming groups. **(a)** Annual humidity index of China from 105 AD to the middle of the Tang Dynasty (Zheng et al., 2006); **(b)** mean temperature departures and three-point moving average curve for winter half-years from the Western Han Dynasty to the Tang Dynasty (30 year period timescale) (Ge et al., 2003, 2010); **(c)** frequency of war and five-point moving average values; **(d)** frequency of wars initiated by the farming and nomadic groups; **(e)** frequency of victories of farming and nomadic groups; **(f)** latitude of the main battlefields (north latitude/N, blue solid line), latitude of the capitals of the farming regime (red dotted lines), changes of the southern border of the nomadic region in each dynasty (green dotted lines) (Huichang, 1996).

**Climate change and Sino-nomadic wars during 206 BC–906 AD**

Y. Su et al.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures



Back

Close

Full Screen / Esc

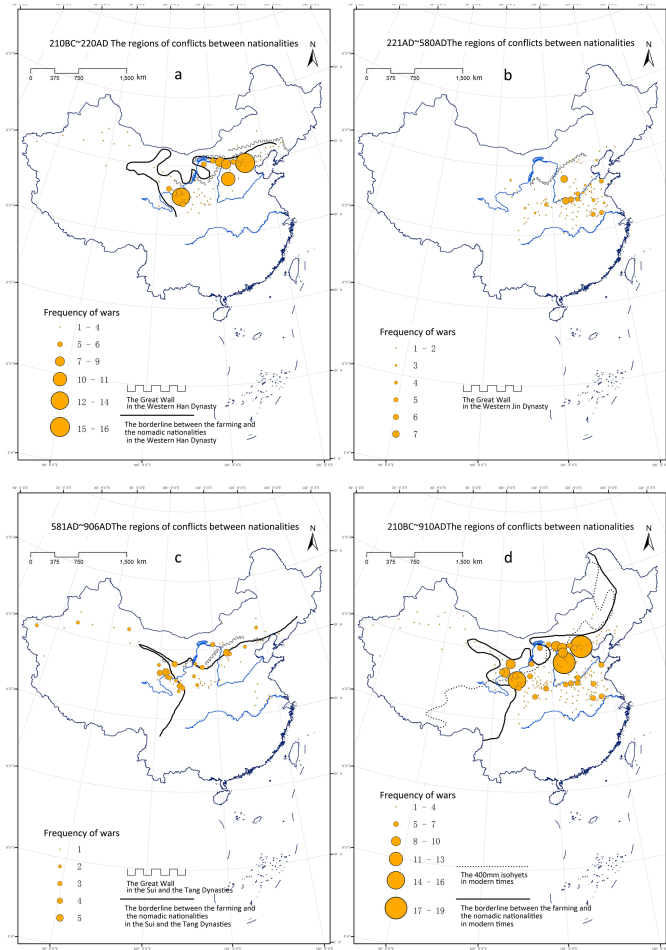
Printer-friendly Version

Interactive Discussion



**Climate change and Sino-nomadic wars during 206 BC–906 AD**

Y. Su et al.



**Figure 3.** Distribution of ethnic relations in China from the Western Han Dynasty to the Tang Dynasty.

Title Page

Abstract

Introduction

Conclusions

References

Tables

Figures

⏪

⏩

◀

▶

Back

Close

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

