The Effect of Climate Change on Livestock Carrying Capacity of Inner Mongolia

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Introduction Since 1949 annual temperatures have increased by 0.9±0.2℃ with 1.2±0.3℃ during winter (December to February), 1.2±0.2℃ during Spring (March to May) in central and eastern Inner Mongolia(Figure 1). Annual precipitation increased during the 1950's, decreased during the 1960's, increased during the 1970's, decreased during the 1980's, and decreased after the 1990's. More than ten warm winters have occurred since 1980 which benefited livestock compared with cold winters. Warm winters decreased the mortality of old, weak and young animal and increased herd sizes in following years. Large numbers of livestock lead to overgrazing and degeneration of the grassland. Temperature increases, precipitation decreases, and the changed of precipitation patterns, together with heavy stocking rates accelerated the process of grassland degeneration.

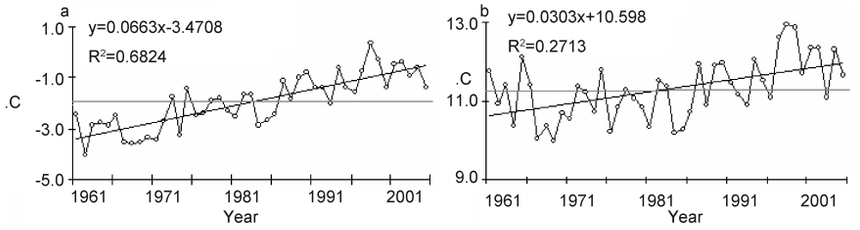

Figure 1 *Minimum(a) and maximum(b) temperature exchange in Inner Mongolia(54 stations 1961-2005).*

Methods A climate productivity model was used to calculate primary production, theoretical and actual carrying capacity over time. Four stations were choosen for the analysis (Table 1).

Table 1 *Characteristic of represent stations*

station	longitude and latitude	elevation (m)	Grassland type	Mean annual temperature(℃)	Mean precipitation (mm)
A1 :Dongwu	116°58′, 45°31′	838.7	Typical grassland	1.3	258
A2 :Xiwu	117°36′, 44°35′	995.9	Typical grassland	1.5	342
A3 :Xisu	112°42′, 42°43′	1101.7	Destification grassland	4.9	181
A4 :Wuchuan	111°27′, 41°06′	1595	Farming Area	2.9	351

Results The results show that warm winters is the main reason for causing the heavy stocking rate. Since the 1960's most of area were over-stocked by 20%-30%. Up to the mid 1980's, there were more than ten years with warm winter in succession. Temperatures were mild during winter each year, no heavy snow cover occurred in the grassland. Therefore it was good for old and weak animals to survive the harsh climate, hence decreased the mortality of livestock, and increased animal numbers in subsequent years. Unfortunately the stock number were not based on the primary productivity of the grassland. One reason is that herdsmen want to retain their animals, and the government has no strong policies to restrict animal numbers. Controlling weight loss was behind by the reasonable animal number. At the same time, the herds expanded so fast that by the 1990's degeneration of grassland had reached 30%-60%. More importantly, after 2000, there were continuous extremely droughty years, In some places even from early spring to late summer. The landscape of grassland looks brown. The climatic conditions during this period were sufficiently droughty to force even moderately stocked ranchers to destock by 30-50%.

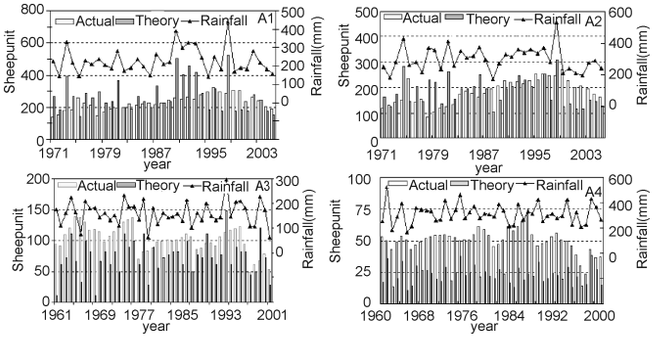

Figure 2 *The actual and theory carry capacity and growing rainfall in four banner of Inner Mongoiia (A1 Dongwu banner, A2 Xiwu banner, A3 XiSu banner, A4 Wuchuan county).*

Conclusions Over stocking is big problem in the grassland of Inner Mongolia, especially during the continuous drought season. Although grazing is forbidden in some place it is still legal in other places. This is very harmful to the ecological system, and if the grassland degradation can not be reversed, the ecological environment will be permanantly damaged.