Herder Mental Stocking Rate in the Rangeland Regions of Northern China

Yanting Yin  
*Chinese Academy of Agricultural Sciences, China*

Xiangyang Hou  
*Chinese Academy of Agricultural Sciences, China*

David L. Michalk  
*Department of Primary Industries, Australia*

Xiangjun Yun  
*Chinese Academy of Agricultural Sciences, China*

Yong Ding  
*Chinese Academy of Agricultural Sciences, China*

*See next page for additional authors*

Follow this and additional works at: [https://uknowledge.uky.edu/igc](https://uknowledge.uky.edu/igc)

Part of the Plant Sciences Commons, and the Soil Science Commons

This document is available at [https://uknowledge.uky.edu/igc/22/3-4/4](https://uknowledge.uky.edu/igc/22/3-4/4)

The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.


Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.
Presenter Information
Yanting Yin, Xiangyang Hou, David L. Michalk, Xiangjun Yun, Yong Ding, Xiliang Li, and Jizhou Ren
Herder mental stocking rate in the rangeland regions of northern China

Yanting Yin AB, Xiangyang Hou B, David Michalk C, Xiangjun Yun B, Yong Ding B, Xiliang Li B and Jizhou Ren A

A College of Pastoral Agriculture Science and Technology, Lanzhou University, PO Box 61, Lanzhou Gansu Province People’s Republic of China
B Grassland Research Institute, China Agriculture Academy of Science, 120 East Wulanchabu Street, Hohhot, Inner Mongolia Autonomous Region, People’s Republic of China
C NSW Department of Primary Industries, Orange Agricultural Institute, 1447 Forest Road, Orange, NSW Australia 2800

Contact email: houxy16@126.com

Abstract. In 2002, the Chinese government issued the “balancing animals and grass” policy to control the degradation problem of northern China, but these programs have been widely resisted by herders. We proposed that herder had their mental stocking rate, which refers to the number of animals that the herders think they can place or maintain on a piece of rangeland over a specified period of time. It is the mental stocking rate that guides herder on how to adjust livestock-breeding practices. This study surveyed herder opinion of grass-animal balance in the meadow steppe, typical steppe and desert steppe regions of northern China. Most herders admitted that they bred more livestock than ten years ago, whereas they insisted that there was no overstocking in their rangelands and more than half even thought that their rangelands could still carry more livestock when the policy was implemented. Most herders hold that they took into account the carrying capacity of rangelands when making decisions about stock-breeding practices. Herders from three regions nominated the following mental stocking rates; 0.75-1.50, 0.60-1.50, and 0.50-0.75 sheep/ha, insisting these rates were necessary and reasonable.

Keywords: Carrying capacity, decision behaviour, overgrazing, adaptive management.

Introduction

China has vast areas of grassland resources, accounting for 42% of the national land area (Ren et al. 2008). However, 90% of useable grasslands are degraded because of over-population, over-grazing, improper reclamation and adverse effects of droughts exacerbated by climate change (Li 1999; Li et al. 2008). Many studies have showed that the lower stocking rates are necessary for rehabilitating the degraded grassland (Kemp and Michalk 2007). In 2002, the Chinese government introduced “balancing animals and grass” policy (hereafter refereed to as “the policy”) as a means to remediate grassland degradation. However, these programs are commonly resisted by herders (Li and Zhang 2009; Wang 2010) leading to an outcome best described as a “partial improvement amidst overall deterioration.” The reasons for apparent failure of the policy have been discussed by Yang and Hou (2005) and Waldron et al. (2010), but little research has been focused on herder decision-making behaviour regarding the balance between livestock and forage resources.

Under the Household Contract Responsibility System (HCRS), herders are responsible for managing China’s grasslands and their decisions have both direct and indirect impact on the balance between animal needs and forage supply. Herders hold that because they have lived in pastoral areas for generations, they better understand the grassland carrying capacity and condition, and can use their experience to identify “reasonable” stocking rate which we define as the “herder mental stocking rate”. This stocking rate guides herders to take adaptive measures such as leasing grassland and buying forage to balance their livestock needs with feed supply (Hou 2005; Hou et al. 2012). To develop more effective policies and programs to reduce grassland degradation, a better understanding of how the herders use mental stocking rates to guide management to balance livestock needs and feed supply is urgently needed.

Methods

Study area

The study area included Xinbaerhu Left Banner, Xilinhot and Sunite Right Banner which were selected to represent meadow steppe, typical steppe and desert steppe, respectively (Table 1). Since the HCRS has been in place since the 1980s in these three regions, households own livestock and hold grazing rights through contracts. Livestock production from grazing native vegetation is the primary income of households. Year-long grazing is the main source and cheapest feed source of livestock feed in these three counties. Due to the high cost of buying forage, herders conserve some forage, but insufficient reserves mean that households heavily depend on the rangeland in...
winter and early spring. Under this situation, livestock number/household is strongly positively related with grassland resources owned by herder.

Survey of households

Preliminary visits and interviews in 15 Gachas (villages) in each of the three counties were conducted in May-September 2010. During June and September 2011, the study recruited 90 herders to identify the important issues regarding mental stocking rate and herder decision-making behaviour for their livestock enterprise. During July-September 2012, the survey based on the issues identified was conducted in villages from these three counties. Pastoral agriculture is the primary income of households in each village. We used a random-stratified sampling procedure, 10-20 households were randomly selected from 4-5 Gachas, which belong to 3 Sumus (township) in proportion to its total household numbers. A total of 180 herders, aged 40 years or older, were interviewed.

Results

Proposal of mental stocking rate

To better understand the process of overgrazing and identify feasible solutions for China’s temperate grasslands, Kemp et al. (2011) used the relationship between animal production and stocking rate for grazing livestock (Fig. 1). Figure 1 shows that production/head decreases as stocking rate increases due to the decline in the quantity and quality of forage available per head. In turn, production/ha will initially increase and then begin to decrease reflecting the law of diminishing returns. Either side of the biological maximum there are two stocking rates (A or B in Fig. 1) that produce the same product output. For Chinese grasslands stocking rates are most often to the right of that produce the same product output. For Chinese herders, aged 40 years or older, were interviewed.

Table 1: Site location, Rangeland type, rangeland area (ha), useable rangeland area (ha), per capital net income (RMB), mean annual temperature (°C, 1980–2011), and mean annual precipitation (mm, 1980–2011).

<table>
<thead>
<tr>
<th>Site</th>
<th>Rangeland type</th>
<th>Rangeland area (ha)</th>
<th>Useable rangeland area (ha)</th>
<th>Per capita net income (RMB)</th>
<th>Annual temperature (°C)</th>
<th>Annual precipitation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xibaerhu</td>
<td>meadow steppe</td>
<td>1.94×10^6</td>
<td>1.79×10^6</td>
<td>9101</td>
<td>0.22</td>
<td>274.07</td>
</tr>
<tr>
<td>Xiinhhot</td>
<td>typical steppe</td>
<td>1.49×10^6</td>
<td>1.38×10^6</td>
<td>9587</td>
<td>2.98</td>
<td>258.73</td>
</tr>
<tr>
<td>Sunite</td>
<td>desert steppe</td>
<td>2.58×10^6</td>
<td>2.37×10^6</td>
<td>5140</td>
<td>5.49</td>
<td>194.63</td>
</tr>
</tbody>
</table>

Note: the data of per capita net income is from the Inner Mongolia Statistical Yearbook in 2010.

Figure 1. Basic relationships between animal production and stocking rate for grazing livestock following Kemp et al. (2011).

their livestock and grassland resources. We proposed the term “mental stocking rate” defined as the number of animals that the herders think they can maintain on a piece of grassland over a specified period of time (Hou et al. 2013).

Understanding mental stocking rate

Table 2 shows the indicators for herder judgment and opinion of mental stocking rate. In Xinaerhu, Xilinhhot and Sunite, overall 65%, 61% and 49% of respondents admitted they raise more livestock than when the policy was implemented in these three counties. Three-quarters of herders surveyed hold that their grassland is not overstocked, and 52%, 57% and 63% even thought that their grasslands could still graze more livestock. Surprisingly, 80%, 88% and 76% respondents still insisted that they always took into consideration the grassland carrying capacity when deciding whether to raise more livestock. Herders also nominated reasonable stocking rates in their opinion, were 0.75-1.50 sheep/ha, 0.60-1.50 sheep/ha, and 0.50-0.75 sheep/ha, respectively.

Our survey also revealed that overall 63%, 54% and 50% of herders do not see the need for implementing the policy in these three regions. More importantly, a majority of herders interviewed thought that the current policy was not reasonable and did not conform to the local environmental situation.

Discussion

A majority of herders insisted that grasslands were not overstocked in our study, and most thought that they could raise more livestock without ill-effect. Similar results have been reported in studies by Zhou (2008) and Da and NaRengawa (2011) who argued that their was only moderate overstocking rather than excessive.

These conclusions may be explained by the highly variable climate evident in the large inter-annual fluctuat-
participatory approach in which the questions and perspective to explore a bottom-up, adaptive and new animal-grass balance policy for sustainable grassland experiences of herders are taken into account to develop a of herder decision behaviour, it is crucial from a policy of livestock herds, the quantities of forage to conserve or mental stocking rate guided herders’ decisions on the size “own stocking rate” and took short-term adaptive measures to achieve animal-forage balance. We also found the situation which has meant that herders have maintained their mental stocking rate. These findings are consistent with the conclusion of Zhou (2008) that herders had their own stocking rate and took short-term adaptive measures to achieve animal-forage balance. We also found the mental stocking rate guided herders’ decisions on the size of livestock herds, the quantities of forage to conserve or buy, and whether to lease additional areas of grasslands. We conclude that since this mental stocking rate is the basis of herder decision behaviour, it is crucial from a policy perspective to explore a bottom-up, adaptive and participatory approach in which the questions and experiences of herders are taken into account to develop a new animal-grass balance policy for sustainable grassland management.

**Acknowledgments**

We thank all the interviewed herders for their generosity in allowing us to ask them many questions for many times. We acknowledge the assistance given by Dr Zhen Wang in improving earlier drafts of this paper. Authors were supported by the National Science Foundation of China (NSFC) (Project No.70933004).

**References**


© 2013 Proceedings of the 22nd International Grassland Congress

### Table 2. Mental stocking rate statement items: prevalence estimates by region

<table>
<thead>
<tr>
<th>Category</th>
<th>Xinbaerhu (N=51)</th>
<th>Xilinhot (N=58)</th>
<th>Sanite (N=57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeding more livestock than ten years ago</td>
<td>65%</td>
<td>61%</td>
<td>49%</td>
</tr>
<tr>
<td>No overstocking on rangeland</td>
<td>74%</td>
<td>79%</td>
<td>68%</td>
</tr>
<tr>
<td>Rangeland could still carry more livestock</td>
<td>51%</td>
<td>57%</td>
<td>63%</td>
</tr>
<tr>
<td>Always taking into account the carrying capacity of rangeland when deciding whether to breed more livestock</td>
<td>80%</td>
<td>88%</td>
<td>76%</td>
</tr>
<tr>
<td>Stocking rates that herders think are reasonable (sheep/ha)</td>
<td>0.75-1.50</td>
<td>0.60-1.50</td>
<td>0.50-0.75</td>
</tr>
</tbody>
</table>


