Evaluation of long-term economic consequences of continuous and multi-paddock grazing in southern tallgrass prairie

Tong Wang  
Texas AgriLife Research  
P.O.Box 1658, Vernon, TX 76385  
Email: Tong.Wang@ag.tamu.edu

Seong C. Park  
Texas AgriLife Research  
P.O.Box 1658, Vernon, TX 76385  
Email: scpark@ag.tamu.edu

W. Richard Teague  
Texas AgriLife Research  
PO Box 1658, Vernon, TX 76385  
Email: rteague@ag.tamu.edu

Stan J. Bevers  
Texas AgriLife Extension Services  
PO Box 2159, Vernon, TX 76385  
Email: sbevers@ag.tamu.edu


Copyright 2014 by Tong Wang, Seong C. Park, W. Richard Teague and Stan J. Bevers. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.
Objectives

To study rangeland grass species composition and forage production differences under various ranch management strategies.

To infer animal productivity and long term economic consequences from animal daily grass consumption changes.

Introduction

Cow-calf operations in the South Central U.S. face great financial challenges as a result of volatile cattle prices and historically high forage and grain prices, combined with a multi-year drought.

It is vital for ranchers to adopt management practices that maximize the long term profitability.

Meanwhile, maintaining or restoring rangeland ecosystem health and resilience is of equal importance.

There is much anecdotal and experimental evidence from producers that, if applied appropriately, multi-paddock grazing can lead to improved forage and livestock production.

Materials & Methods

Our model is an extension of the simple grazing system model as employed by Noy-Meir (1976).

Our mathematical model describes the selective grazing behavior by assuming the existence of two types of grass, palatable and unpalatable.

We include different grass utilization rates that are contingent on grass species and grazing practices.

Simulations are carried out, utilizing the parameters that capture the Texas Rolling Plain pasture growth and cow consumption conditions.

Results

- Compared to continuous grazing, rotational grazing generates a higher proportion of palatable grass in the long run.
- Higher average animal density will lower the proportion of palatable grass.
- The degree of rotational grazing will also change grass species composition. Compared to moderate rotational grazing, intensive rotational grazing increases the percentage of palatable grass.
- Cows under intensive rotational grazing consume most palatable grass, and in the long run most grass in total, followed by moderate rotational grazing and then continuous grazing.
- Palatable crop such as legumes can increase daily weight gain by finishing steers by 0.2 to 0.49 lb (Blais et al. 1969; Rayburn et al. 2004). We can infer that cow daily weight gain, and economic profit in return, are highest under intensive rotational grazing practice.

References


Tables

Table 1: Parameters of the Simulation Model

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
<th>Units</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>mV</td>
<td>maximum plant biomass</td>
<td>g/m²</td>
<td>400</td>
</tr>
<tr>
<td>0V</td>
<td>initial plant biomass</td>
<td>g/m²</td>
<td>200</td>
</tr>
<tr>
<td>rV</td>
<td>... between two grasses - 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mc</td>
<td>maximum consumption rate</td>
<td>kg/cow/day</td>
<td>12.5</td>
</tr>
<tr>
<td>H</td>
<td>average animal density</td>
<td>cows/1000 m²</td>
<td>0.027</td>
</tr>
</tbody>
</table>

Figure 1. Plant biomass change under continuous and rotational grazing (High animal density: for continuous grazing utilization rates are 60% for palatable grass and 10% for unpalatable grass; for rotational grazing there are 10 paddocks and the grazing period on each paddock is 2 days; utilization rate is 95% for palatable grass and 90% for unpalatable grass).

Figure 2. Sensitivity analysis on plant biomass change with different grazing period for rotational grazing (there are 4 paddocks and the grazing period on each paddock is 5 days; utilization rate is 95% for palatable grass and 90% for unpalatable grass, other conditions the same as that in Figure 1).

Figure 3. Sensitivity analysis on plant biomass change with different animal density (low animal density, other conditions the same as that in Figure 1).

Figure 4. Sensitivity analysis on plant biomass change with different initial biomass (high initial biomass, other conditions the same as that in Figure 1).

Contacts

Dr. Tong Wang | Texas A&M University | Dr. Seong C. Park | Texas A&M University