Copyright and Photocopying

© The Australian Rangeland Society. All rights reserved.

For non-personal use, no part of this item may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior permission of the Australian Rangeland Society and of the author (or the organisation they work or have worked for). Permission of the Australian Rangeland Society for photocopying of articles for non-personal use may be obtained from the Secretary who can be contacted at the email address, rangelands.exec@gmail.com

For personal use, temporary copies necessary to browse this site on screen may be made and a single copy of an article may be downloaded or printed for research or personal use, but no changes are to be made to any of the material. This copyright notice is not to be removed from the front of the article.

All efforts have been made by the Australian Rangeland Society to contact the authors. If you believe your copyright has been breached please notify us immediately and we will remove the offending material from our website.

Form of Reference
The reference for this article should be in this general form;


For example:


Disclaimer
The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.

The Australian Rangeland Society
Implications of alternative feral goat management strategies for natural resource management polices in NSW rangelands

S.A. Khairo\textsuperscript{A}, R.B. Hacker\textsuperscript{B}, T.L. Atkinson\textsuperscript{B} and G.L. Turnbull\textsuperscript{C}

\textsuperscript{A} NSW Trade & Investment, 161 Kite Street, Orange, NSW 2800
\textsuperscript{B} Agriculture NSW, Trangie Agricultural Research Centre, PMB 19, Trangie, NSW, 2823
\textsuperscript{C} Agriculture NSW, 27 Mitchell Street, Bourke, NSW, 2840

Abstract:

This paper presents a brief summary of an economic analysis of alternative feral goat management strategies (no control, opportunistic harvesting, value added and goat-proof fencing) and their implications for natural resource management policies in NSW rangelands. Opportunistic and value added strategies are profitable for landholders. The profitability of investment in goat proof fencing to support livestock production could be comparable to current goat management practices if moderate increases in carrying capacity can be achieved through improved grazing management. Financial incentives that are based directly on measured resource condition (e.g. ground cover) and encourage investment in exclusion fencing and improved management would be preferable to incentives supporting goat harvesting activities. These activities are not necessarily favourable to resource conservation as they are driven by goat price rather than population and are, in any event, profitable for landholders. A ‘no control’ strategy has adverse economic consequences for pastoral properties.

Keywords: economics, feral goat, policy, NSW

Introduction

In Australian rangelands feral goats (\textit{Capra hircus}) are generally considered as agricultural and environmental pests because they compete with domestic animals for resources, promote resource degradation and threaten biodiversity (Harrington, 1976; Harrington, 1982; Russell \textit{et al.}, 2011; Parkes \textit{et al.}, 1996). On the other hand, feral goats also provide income for pastoralists and are the basis of an export industry. The choice of policy mechanisms to reduce feral goats for environmental conservation therefore depends on an assessment of the costs and benefits of alternative management scenarios available to producers. In this paper we evaluate alternative feral goat control strategies and their implications for natural resource polices in the rangelands of western NSW.

Methods

The study was based on synthesized ‘representative’ properties in the Bourke, Cobar and Broken Hill districts(Khairo \textit{et al.}, 2011). The feral goat control strategies modelled were:

1. No control: no control is carried out because of reduced goat price and/or other impediments;
2. Opportunistic harvesting: irregular harvesting when commercially attractive; modelled at two levels - current practice and maximum possible harvest through additional capital investment;
3. **Value added**: opportunistic harvesting with goat proof paddock/s established to grow out underweight animals; modelled at two levels – no reduction in domestic livestock, domestic livestock reduced to accommodate the goat paddock;

4. **Livestock with goat-proof fencing**: fencing to exclude feral goats from livestock paddocks, with opportunistic goat harvesting on the remainder of the property; modelled at three levels – boundary fencing, single paddock in ‘good’ country, single paddock in ‘goat’ country.

**Economic framework**

The cost-benefit analysis framework outlined by the Department of Finance (2011; 2006) was used to estimate and rank the Net Present Value (NPV) and Benefit:Cost Ratio (BCR) of the goat management strategies. The specific equations used are:

\[
\text{NPV} = \sum_{t=1}^{T} \frac{B_t - C_t}{(1 + r)^t}
\]

(1)

\[
\text{BCR} = \frac{\sum_{t=1}^{T} B_t}{\sum_{t=1}^{T} C_t} / \sum_{t=1}^{T} (1+r)^t
\]

(2)

Where \(B_t\) and \(C_t\) are benefits and costs in year \(t\), respectively, \(r\) is the discount rate and \(T\) is the time frame (20 years). The management strategy with the highest NPV and BCR greater than one is the most desirable. Sensitivity analysis was conducted using @RISK software that establishes the linear relationship between NPV and key input variables. The sign Negative and positive values of the regression coefficient indicates the direction of change in NPV with change in the key variables.

The costs of feral goat control strategies include fixed, variable and operating costs and environmental damage. The benefits are revenue generated from goat sales, net gains from increased domestic livestock production and improvement in natural resource condition. Sheep and goat gross margins and other key assumption used were adapted from the whole farm models developed by Khairo et al. (2008). Environmental costs and benefits could not be directly quantified.

**Results and discussion**

The pay-off matrix for feral goat management strategies in the Bourke district is presented in Table 1. Results for other districts were similar and are not presented.

**Table 1: The pay off matrix for feral goat management strategies in Bourke district**

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>No-control</th>
<th>Opportunistic</th>
<th>Value added</th>
<th>Livestock with goat-proof fencing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current</td>
<td>Max. harvest</td>
<td>Constant livestock</td>
</tr>
<tr>
<td>PVB</td>
<td>127,331</td>
<td>407,346</td>
<td>462,477</td>
<td>614,017</td>
</tr>
<tr>
<td>PVC</td>
<td>376,359</td>
<td>163,910</td>
<td>170,358</td>
<td>217,660</td>
</tr>
<tr>
<td>NPV</td>
<td>-249,029</td>
<td>243,436</td>
<td>292,119</td>
<td>396,357</td>
</tr>
</tbody>
</table>
The ‘value added strategy with reduced livestock’ provides the best return. Use of a goat paddock to grow out underweight goats is superior to use of such a paddock for livestock grazing. Opportunistic harvest scenarios are also superior to use of a ‘goat paddock’ for livestock grazing only. Fencing of good quality country for livestock production generates better returns but still less than the opportunistic harvest or value added strategies. The no-control and boundary fencing scenarios return negative NPV.

The sensitivity analysis (Table 2) shows that all scenarios are more sensitive (positively or negatively) to changes in goat price than goat population.

Table 2: Regression coefficients for sensitivity analysis

<table>
<thead>
<tr>
<th>District</th>
<th>Variables</th>
<th>No control</th>
<th>Opportunistic</th>
<th>Value added</th>
<th>Livestock with goat-proof fencing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current</td>
<td>Max. harvest</td>
<td>Constant livestock</td>
</tr>
<tr>
<td>Bourke</td>
<td>Price</td>
<td>-0.90</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>Population</td>
<td>-0.34</td>
<td>0.29</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Cobar</td>
<td>Price</td>
<td>-0.92</td>
<td>0.95</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Population</td>
<td>-0.36</td>
<td>0.29</td>
<td>0.29</td>
<td>0.32</td>
</tr>
<tr>
<td>Broken Hill</td>
<td>Price</td>
<td>-0.93</td>
<td>0.94</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>Population</td>
<td>-0.30</td>
<td>0.28</td>
<td>0.29</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Breakeven stocking rates

The relative increase in carrying capacity necessary for the boundary fencing strategy to breakeven is modest (Table 3) and could probably be achieved with improved grazing management. Differences between districts reflect the extent of boundary fencing feasible and consequently the feral goat harvesting opportunities that remain outside the fence. Even the increases in carrying capacity, through improved grazing management, required for exclusion fencing options to equal the best feral goat management strategies are not unreasonably high if they can be achieved over the whole property.
Table 3: Breakeven stocking rates

<table>
<thead>
<tr>
<th>District</th>
<th>Current carrying capacity (DSE/ha)</th>
<th>Increase in carrying capacity&lt;sup&gt;1&lt;/sup&gt; for boundary fencing to breakeven (%)</th>
<th>Increase in carrying capacity required to equal best feral goat management strategy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Within the fenced area</td>
<td>Over the whole property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goat country paddock</td>
<td>Good country paddock</td>
</tr>
<tr>
<td>Bourke</td>
<td>0.20</td>
<td>10</td>
<td>290</td>
</tr>
<tr>
<td>Cobar</td>
<td>0.25</td>
<td>4</td>
<td>640</td>
</tr>
<tr>
<td>Broken Hill</td>
<td>0.25</td>
<td>0.2</td>
<td>102</td>
</tr>
</tbody>
</table>

<sup>1</sup> Within the fenced area; Proportion of whole property fenced – Bourke 100%, Cobar 80%, Broken Hill 60%

Policy implications for natural resource management

Current management practices (opportunistic harvesting and value added) are profitable for landholders and require no support from government. Further, since harvesting operations are driven more by goat price than by population, financial support for such activities is unlikely to contribute to resource conservation objectives. Further, the feral goat population has increased in recent years despite significant commercial off take (Ballard<sup> et al.</sup>, 2011; Pople and Froese, 2012). While commercial harvesting encourages the maintenance of goat populations rather than control for environmental objectives (Parkes<sup> et al.</sup>, 1996) further development of the rangeland goat industry may contribute to resource conservation if it improves price stability.

Since (probably) achievable improvements in carrying capacity can result in favourable returns from exclusion fencing, any attempt to improve natural resource outcomes by public investment may be best directed at encouraging improved grazing management e.g. through incentives for achievement of ground cover targets as described by Hacker<sup> et al.</sup> (2010) and Moss<sup> et al.</sup> (2012). Such incentives could be short term, and designed to encourage capital investment and improved management, or incorporated as part of longer term drought assistance policies (Hacker<sup> et al.</sup>, 2010).

References


