# Deriving an evidence-based estimate of livestock water productivity in communal rangelands of the north Eastern Cape Province, South Africa.

*B. Gusha*[A,C] *and A. R. Palmer*[A,B]

[A]Rhodes University, Department of Environmental Science, Grahamstown, South Africa, 6140
[B]Agricultural Research Council, Animal Production, Grahamstown, South Africa, 6140
[C]Corresponding author: P.O. Box 101, Grahamstown, 6140, Email:bgusha12@gmail.com

High livestock numbers have been maintained in communal areas of South Africa, which were significantly in excess of the official recommended stocking rate (Dovie *et al*. 2006). This excessive number of livestock has had long-term consequences in degradation of the rangelands leading to the perception that livestock production is unproductive (Vetter, 2013). However, this perception is based on rangeland assessment in terms of the changes in vegetation and standing biomass, thus evidences of rangeland degradation in these communal areas from time series livestock data resulted in the need for destocking. Although there have been studies looking at the role and importance of livestock production in communal rangelands of South Africa, attention has been focused mostly on reasons for keeping livestock and their value. However, livestock water productivity (LWP) which is the quantification of annual livestock beneficial goods and services to the amount of water used in producing those from communal rangelands is lacking. Studies such as Blümmel *et al.* (2014) indicate a scope for improving LWP and show a significant difference in LWP among farming systems and households.

This study used 120 household surveys to derive an evidence-based estimate of annual livestock goods and service with their associated prices obtained by households to quantify LWP in two rural villages. MODIS Evapotranspiration (ET) was generated from google earth engine (GEE) to calculate the amount of water used by the rangelands. Differences in mean annual livestock holding, expenditure, outputs and LWP among households were tested using one-way ANOVA. The data were compiled with the assumption of ANOVA when checked for normality and homogeneity of variance and transformed using Log function.

Table 1 shows that there were slight variations in LWP among households such as better off (0.17 US$.m-3) attained a high LWP followed by middle households (0.14 US$ m-3) and poor households (0.1 US$ m-3). These results could be explained by the differences in livestock holding, expenditure and annual outputs obtained by different household, suggesting that livestock holdings, and labour have a positive impact in improving LWP productivity.

**Table 1. Means of livestock water productivity and household characteristics among wealth groups.**

| **Household characteristics** | **Better-off (n=33)** | **Middle (n=33)** | **Poor (n=54)** |
|---|---|---|---|
| Livestock holding (TLU) | 2.04[a] | 1.78[b] | 1.98[c] |
| Expenditure (ZAR) (labour and additional feed) | 4.15 [a] | 4.10 [a] | 3.64 [b] |
| Outputs (ZAR) | 5.04[a] | 4.63[b] | 3.69[c] |
| LWP (USD.m$^{-3}$) | 0.17[a] | 0.14[b] | 0.10[c] |

Different superscripts [a, b, c] within a row represent significant differences at P< 0.05. TLU: Tropical livestock unit: 250 kg live weight

Based on the relationship between livestock holdings and outputs, strategies to improve LWP needs to focus on providing extra feed and labour. This study will help in providing an important direction to influence policy on possible interventions that reduce the livestock water footprint.

**References**

Blümmel M, Haileslassie A, Samireddypalle A, Vadez V and Notenbaert A (2014) *Livestock water productivity: Feed resourcing, feeding and coupled feed-water resource data bases: Animal Production Science*. **54**, 1584–1593.

Dovie DBK, Shackleton CM and Witkowski ETF (2006) *Valuation of communal area livestock benefits, rural livelihoods and related policy issues*: *Land Use Policy*. **23**, 260–271.

Vetter S (2013) *Development and sustainable management of rangeland commons: aligning policy with the realities of South Africa's rural landscape: African Journal of Range & Forage Science*. **30**, 1–9.

*Special thanks to the Agricultural research council, Water research commission and National research foundation for funding this work.*