The effect of pasture type on sheep grazing behaviours

J.R. Edwards[AC], *J.K. Manning*[A], *G.M. Cronin*[B], *T. Bishop*[A] *and L.J. Ingram*[A]

[A] The Sydney School of Agriculture, School of Life and Environmental Sciences, The University of Sydney, Centre for Carbon, Water and Food, 380 Werombi Road Camden NSW 2570 Australia

[B]The Sydney School of Veterinary Science, School of Life and Environmental Sciences, The University of Sydney, 425 Werombi Road Camden NSW 2570 Australia

[C]Department of Economic Development, Jobs, Transport and Resources, Horsham, VIC 3400 Australia

The use of a range of technologies such as the Global Positioning System (GPS), accelerometers and multispectral spectroradiometers have vastly improved our understanding of spatial distribution, foraging patterns and behaviours of wild and domesticated animals. The aim of this paper was to investigate the grazing behaviour of sheep in native and improved pastures and how they may vary seasonally. In this study, Merino wethers were used to ascertain differences in behaviour on native or improved pasture in April (Autumn) and July (Winter) in the Monaro region of southern NSW. Wethers allocated to each pasture type, were fitted with UNETacker II GPS tracking collars and IceTag sensor accelerometers Sheep activity was analysed during the two peak grazing periods of the day (morning and afternoon). Normalized difference vegetation index (NDVI) using a CropCircle ACS-470 (Holland Scientific) was determined in both pastures prior to sheep grazing them in each season.

In each treatment paddock ("Native" vs "Improved") a mob of 25 sheep were used. The study took place over two six day periods in both April and July to represent the seasons of Autumn and Winter. Of the 25 sheep in each paddock, 15 wethers were fitted with GPS tracking collars which were programed to 'sleep' for four minutes and the wake up to take five positional 'fixes' over a minute. Kernel Density Estimates (KDE) of home ranges (50% of time spent) and total range (95% of time spent) were also calculated and compared. Random Forest modelling was applied to account for the impact NDVI, elevation, eastings, northings, distance from trees and distance from watering points had on spatial distribution of sheep. NDVI, elevation, eastings, northings, distance from trees and distance from watering points were the predictors.

Distance travelled was higher in Winter on both pasture types and grazing periods compared to Autumn. In Autumn distance travelled was always significantly higher ($P = 0.034$) in the improved pasture (2,717 m) compared to the native (2,651m). In Winter the distance travelled was greater ($P = 0.027$) during morning grazing for the improved pasture (3,054 m vs native, 2,752 m) while in the afternoon it was significantly greater ($P = 0.034$) on the native pasture (3,341 m vs improved, 3,191 m). The average speed paralleled that of distance travelled with sheep on improved pasture always moving at a greater speed than sheep on native pasture regardless of season. Motion index (calculated using accelerometer data) found season had no impact on afternoon grazing and pasture type had no effect on morning grazing.

The NDVI of the improved pasture was higher than the native in both seasons and as expected NDVI declined in winter. The Random Forest model found NDVI to be an important predictor of spatial distribution in Autumn across both pasture types. The removal of NDVI saw the mean square error (MSE) of the model increase by 110% on the improved pasture and by 77% on the native. In Winter NDVI lost predictive power on the improved pasture (MSE increase of 74%) however remained similar in native pasture (MSE increase of 76%). This was due to high quality feed in the improved paddock being in the most exposed part of the paddock, sheep preferred to shelter from the harsh westerly winds.

The total range of sheep in the native pasture was smaller than that recorded for sheep in the improved pasture in both seasons (Table 1). In Winter total range and home range increased in native pasture compared to Autumn, while on improved pasture, total range and home range decreased (Table 1).

Table 1: Area (ha) occupied by sheep in Total Range (95% KDE) and Home Range (50% KDE) for both pasture systems and seasons.

		Total Range area (ha)	Home Range area (ha)
Autumn	Native	4.42	0.45
	Improved	10.81	0.74
Winter	Native	5.88	0.47
	Improved	7.70	0.66

We found sheep spent more time in areas of higher NDVI across both native and improved pastures. It was also found more energy and time was invested in foraging behaviours in the improved pasture system. This is in part due to the complex nature of environmental/behavioural interactions. Although it is likely that the improved sheep were expending more energy grazing and associated travel the quality of what they were grazing was much higher resulting in weight gains relative to sheep on the native pastures.

Email: jackedw92@gmail.com