

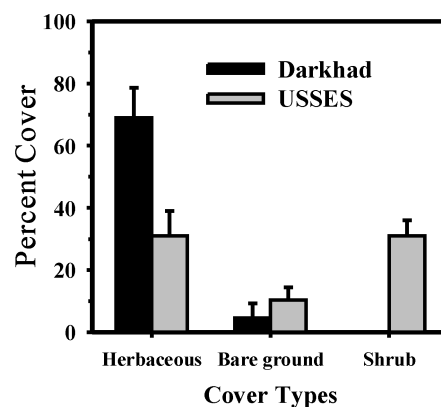
## Comparison of management effects on rangelands in western USA and Northern Mongolia using remote sensing and GIS

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**Introduction** Different cultures can have distinct effects on rangeland ecosystems through contrasting grazing management, policies, paradigms, traditions, and values. We are studying rangelands of the Darkhad Valley in northern Mongolia and rangelands of Intermountain Western Idaho, USA, using remote sensing, GPS, and GIS tools, to determine the effects of contrasting grazing management systems in biophysically-similar environments with similar growing seasons, precipitation, and temperature regimes. The Darkhad Valley rangelands are grazed at 3.3-5.9 AUM/ha by multiple livestock species of cattle, yaks, horses, sheep, and goats owned by nomadic herders, who migrate on seasonal basis. In contrast, the Idaho rangelands are grazed at much lower stocking rates of <0.62 AUM/ha by sheep only and managed by the U.S. Department of Agriculture-Agricultural Research Service, U.S. Sheep Experiment Station (USSES). We present results from the first year of a 3-year study.

**Materials and methods** In the field, total plant biomass and percent cover of shrub and herbaceous plants, litter, and bare ground were estimated at 100 random locations during the peak of the growing season in 2007 at both sites for image classification training and validation. Normalized Difference Vegetation Index (NDVI) was calculated using SPOT imagery and compared between the two sites. Spectral unmixing analyses were performed with SPOT and Landsat imagery to estimate and compare sub-pixel percent cover of shrub, herbaceous plants, and bare ground. In addition to the direct comparisons between sites, we compared the similarity index from each site, which was based on ecological site descriptions and site potential. The similarity index was estimated by calculating the difference in biomass production between the site and its reference site that is believed to have the historic climax plant community.

**Results and discussion** SPOT image analysis indicated that NDVI values estimated in the Darkhad Valley [mean=0.19 ( $\pm 0.06$ SD)] were significantly greater ( $p=0.002$ ) compared to those at the USSES [mean=0.15 ( $\pm 0.10$ SD)], which might be due to the high percent cover of herbaceous species in the Darkhad Valley, high percent cover of less spectrally determinable sagebrush species and the drought year at the USSES (Figure 1). However, total plant biomass clipped in the field at the USSES was significantly greater [ $p=0.039$ ] compared to the biomass measured in the Darkhad Valley (mean=193 gr/m<sup>2</sup> ( $\pm 22$ SE) and mean=143 gr/m<sup>2</sup> ( $\pm 4$ SE), respectively), possibly due to the greater stocking rate in the Darkhad Valley. The similarity index comparison indicated that the Darkhad Valley values were significantly greater ( $p=0.05$ ) than the USSES values [mean=0.38 ( $\pm 0.01$ SE) and mean=0.30 ( $\pm 0.03$ SE), respectively]. This suggests that the Darkhad Valley is closer to its reference site biomass production compared to the USSES. This is particularly interesting given the high stocking rates in the Darkhad Valley, which are not recommended or used on USA public grazing lands and are commonly believed to be unsustainable for rangeland productivity.



**Figure 1** Comparisons between different cover types at the two study sites.

**Conclusions** Our results from the first year of observation reveal interesting contrasts and comparisons between two sites with fundamentally different grazing management systems. In the summer 2007, the heavily-grazed Mongolia site had no shrubs and lesser bare ground, but greater percent cover of herbaceous species, which resulted in greater NDVI and similarity index values. In comparison, the Intermountain Western USA site had more equally-distributed cover of shrubs and herbaceous species, and bare ground. Our future work will focus on identifying other factors that might affect observed differences in addition to grazing management.