



Next Generation Ruggedness Indices for Modeling Escape Terrain of Desert Bighorn Sheep at Lone Mountain, Nevada

MARCUS BLUM, *Department of Natural Resources and Environmental Science, University of Nevada Reno, 1664 N. Virginia Street Reno, NV, USA 89557*

THOMAS DILTS, *Department of Natural Resources and Environmental Science, University of Nevada Reno, 1664 N. Virginia Street Reno, NV, USA 89557*

KELLEY STEWART, *Department of Natural Resources and Environmental Science, University of Nevada Reno, 1664 N. Virginia Street Reno, NV, USA 89557*

ABSTRACT: Understanding habitat selection is critical to implementing management strategies that may benefit the population dynamics of mountain sheep. However, to ensure that resource selection functions are effective in identifying essential habitats to these mountain ungulates, the proper variables must be included in the modeling process. Delineating escape terrain has long been a primary focus of biologists trying to identify habitat that is used by females while they provision young. Several commonly used ruggedness metrics, such as vector ruggedness and arc-chord ratio, which attempt to quantify terrain ruggedness across the landscape, incorrectly identify features such as ridgetops and drainage bottoms as rugged. To alleviate these problems we have developed several new metrics. Two approaches, local vector ruggedness and standard deviation of curvature, only rely on a digital elevation model, whereas two other measures, proportion boulder/rock and the shadow index, used high-resolution aerial photography to develop a classification of these landscape features that indicate the presence of cliffs. We test the efficacy of each of these new methods at mapping rugged terrain against three commonly used ruggedness indices: vector ruggedness, arc-chord ratio, and planar to surface area ratio. Next, we compare both the old and new ruggedness indices, in combination with other variables, such as slope steepness, distance to ridgelines, and distance to drainages, to determine whether these new metrics more effectively delineate escape terrain for females with lambs. Our preliminary results suggest that these new ruggedness indices are effective at reducing confusion with ridgelines and drainages compared to the more traditional ruggedness indices, and may reduce the need for using additional variables, such as distance to ridgeline and distance to drainage bottoms to effectively delineate escape terrain. These ruggedness indices are widely applicable to any species that relies on escape terrain to avoid predators while provisioning young.

Biennial Symposium of the Northern Wild Sheep and Goat Council 21:1; 2018

KEYWORDS Desert bighorn sheep; *Ovis canadensis nelsoni*; habitat selection; terrain ruggedness; Nevada.