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HABITAT SUITABILITY RATING FOR WILD HORSES AND BURROS IN NEVADA

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Abstract: An additive Habitat Suitability Index format rating
system was developed for use in managing wild horse and burro
habitat in Nevada. The model evaluated the four life requisites
of food, water, cover and space. Requirements for the rating
system were that it should be management oriented, computer
compatible, straight forward, predictive and robust. Testing
the rating system is being accomplished by rating occupied
habitat and regressing the results against the densities of
horses and burros occurring in the habitat unit. To date the
rating system has been tested in northern Nevada with a
correlation coefficient of 0.9403. When adjusted for the small
sample size the correlation coefficient is 0.8809. Of the life
requisites cover is the most weakly correlated and analysis not
incorporating the space variable results in an adjusted

correlation coefficient of 0.9105. Whether this shift in correlation is important to the rating systems application is for managers to determine. Additional testing throughout Nevada will be necessary to determine if the rating system is as accurate over all as it is in northern Nevada.

INTRODUCTION

During 1986 the Bureau of Land Management in Nevada began development of a habitat rating system which would allow them to evaluate wild horse (Equus caballus) and burro (Equus asinus) habitat and analyze the impacts of management actions (USDI 1986). As well as being accurate the rating system was to meet the four basic criteria of being 1) Management oriented (useful to managers); 2) computer compatible; 3) straight forward and; 4) robust (applicable to all of Nevada). Testing of the rating system began in 1987. This paper will discuss the basics of the rating system and the results of the testing completed to date.

RATING SYSTEM

In order to meet the four basic criteria established an additive Habitat Suitability Index (HSI) format was chosen to analyze the four life requisites of food, water, cover and space. Within this format, a rating of 1.0 indicates optimum

habitat while 0.0 is unsuitable. The analysis is performed on horse management areas which are geographical areas delineated within a district.

Food

Each herd management area is divided into ecological sites based on order 3 soil survey ecological site correlation inventory data. In cases where a soils and ecological site survey have not been completed the unit is broken into the broad plant communities used during the Bureau's latest vegetation inventories. Using work documented by Berger 1986, Hansen 1982, USDI BLM 1976 and others a base value was given to each ecological site and plant community in accordance with that sites or communities capability of providing preferred forage under normal conditions. The base value is multiplied times the acres covered by each site or community. This value is then adjusted using seral stages for ecological sites or condition for the plant communities as follows:

Ecological Sites	Plant Communities	Adjust By
Potential Natural Community (PNC)	Excellent	1.0
Late Seral	Good	0.75
Mid Seral	Fair	0.5
Early Seral	Poor	0.25

A final Suitability Index (SI) is obtained by dividing the total
adjusted acres by the total acres in the unit.

Water

Water is evaluated in relation to distribution, amount, and
seasonal availability. Only perennial, potable waters are
rated. All water sources in the unit are plotted using the
Bureau's water inventory data. A four mile radius circle is
superimposed on each water source. The percent of the herd unit
covered by the radial arcs is determined. This percentage
figure is the base value for the water SI. For example: 80%
coverage equals a 0.8 SI. Total gallons per day of water
produced is balanced against horse, burro, livestock, and
wildlife demands. If production exceeds demand nothing is
subtracted from the base value. If demand equals production 0.1
is subtracted from the base water value. If demand exceeds
production 0.2 is subtracted from the water base value. This
value is referenced to as the flow value. Seasonal availability
applies to water developments which may be shut off during
portions of a year due to grazing management or other causes, or
natural sources which dry-up seasonally. Should this adjustment
cause the total demand to exceed total production an additional
0.1 is subtracted from the flow value. This final value is
recorded as the Water SI.

Cover

Because horses are very mobile and use flight to escape danger it was felt that topography would most influence their use of an area. Optimum cover was described as rolling hills 18-30% slope, broken frequently by broad washes or high density of trees present. Broad washes are used as thermal cover. Trees while used as thermal cover are also used as escape cover enhancing components in special circumstances. Degrees of steepening or flattening of the terrain from the optimum have a corresponding decrease in value. Lesser valued topography can be enhanced by the presence of trees. The value applied to the topography descriptions in the system are the Cover SI.

Space

Finally the value of an area to horses or burros can be adversely impacted by natural or manmade barriers as well as disturbances caused by man's activities. Barriers such as fences or canyons are evaluated as to the percent of degradation caused to the usefulness of the unit by wild horses and burros. Disturbances such as grazing, mining, development or frequency of man's intrusion into the unit are rated by percent of negative impact. The two values are added together then averaged to determine the Space SI.

An overall Habitat Suitability Rating (HSR) is the most limiting factor. In this case the most limiting factor is the lowest ranking Suitability Index.

STUDY AREAS

Seven herd units were tested in northern Nevada within four representative vegetation associations (Kuchlar 1964). The Little Humboldt Herd Unit is approximately 110 miles northwest of Elko, Nevada in the Sagebrush Steppe (Artemisia spp. - Agropyron spp.) Association. The Buffalo Hills Herd Management Area is located 110 miles northeast of Reno, Nevada in the Juniper Steppe Woodland (Juniperus osteosperms - Artemisia spp. - Agropyron spp.) Association. Blue Wing Mountains, Shawave Mountain, Lava Beds and Nightingale Mountains Herd Management Areas are 80 miles east of Reno, Nevada in the Saltbush-greasewood (Atriplex spp. - Sarcobatus spp) Association. North Stillwater Range Herd Management Area is 60 miles south of Winnemucca, Nevada in the Great Basin Sagebrush (Artemisia spp.) Association with inclusions of juniper woodlands. The herd management areas are basically yearlong and contain all life requisite variables. These areas provided a range of habitat suitability ratings and limiting factors (Table 1).

METHODS

Two herd management areas, Buffalo Hills and the North Stillwater Range do not have complete soil surveys with mapped ecological site status. These were divided by plant community while the remaining five units were evaluated on the ecological site basis.

Water data were taken from previously completed Bureau inventories to establish the base values. Horse and burro water requirements were 10 to 12 gallons per day dependent upon the geographical area.

Cover was determined for each ecological site using the soil survey percent slope and site description information. Cover in plant communities was field checked or wildlife habitat inventory and rangeland monitoring data were used where available.

Space suitability criteria was evaluated using range improvement maps, mining use information, personal field experience, recreation use data and field checks.

Multiple regression was used to correlate the overall relationship of habitat variables with wild horse and burro densities as described by Irwin and Cook 1985. Simple

correlation coefficients were analyzed to establish the relationship of each individual independent variable to horse density.

RESULTS

Multiple regression analysis resulted in an R-squared value of 0.9405. When adjusted for the small sample size the R-squared value became 0.8809 indicating a strong correlation between the combination of the 4 independent variables and horse density. The correlation is statistically significant ($P < 0.5$) for the multiple regression. Simple correlation was significant ($P < 0.5$) for food, water and space. Cover was not statistically significant ($P > 0.5$) (Table 2). All variables are positively correlated.

Because of the lack of statistical significance for cover another regression analysis was made without the cover variable. The results of this analysis were an R-squared of 0.9403 with an adjusted R-squared of 0.9105.

Other results obtained during testing apply to the rating system's usefulness within the Bureau's overall rangeland management. These results show the rating system uses shared data from other programs, is predictive, can be used effectively

in cost/benefit analysis and, can be compatible with the Bureau's Automated Resources Data System (ARDs).

DISCUSSION

Nevada BLM assumed the four variables of food, water, cover, and space were important in evaluating wild horse and burro habitat. They also assumed these variables are related to wild horse and burro densities. The data supports these assumptions even though cover is not statistically significant.

Removal of the cover variable from the rating system will increase statistical reliability. Field observations of wild horses and burros appear to substantiate the lack of importance for topogrpahic cover. Wild horses and burros have been observed moving in respect to availability of food and water irrespective of the steepness or flatness of slope.

Space is statistically the second least important variable. Removal of this variable from the rating system, however, may be premature. The herd management areas analyzed do not have appreciable man made disturbances at this time. In the event of proposed disturbances such as fencing through a herd management area this variable would be needed to predict the impacts of the management action.

Although the results of the testing show the reliability of the rating system in northern Nevada reliability has not been proven for central or southern Nevada. Testing should be completed in these locations to confirm the robustness of the rating system. Until tested throughout Nevada it is improper to say the Bureau in Nevada has met all four basic criteria established at the beginning of system development.

ACKNOWLEDGMENTS

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Table 1. Herd management area size, wild horse and burro densities, habitat suitability ratings (HSR), and limiting factors

Herd Management Area	Size (acres)	Density (No./mi.^{2})	HSR	Limiting Factor
Little Humboldt	59,860	1	0.44	Food
Buffalo Hills	85,846	2	0.55	Food
Blue Wing Mtns.	21,411	2	0.45	Food
Shawave Mtns.	98,386	1	0.41	Water
Lava Beds	256,637	1	0.48	Food
Nightingale Mtns.	85,630	1	0.3	Water
N. Stillwater Range	188,939	1	0.3	Food

Table 2. Simple correlation (r) between wild horse and burro
population density and each independent variable

Independent Variables	r
Food	0.9190
Water	0.9046
Cover	0.8736
Space	0.8978