

HABITAT SUITABILITY RATING FOR WILD HORSES AND BURROS IN NEVADA

DONALD J. ARMENTROUT, Bureau of Land Management, Winnemucca District, 705 East Fourth Street, Winnemucca, NV 89445

RODGER BRYAN, Bureau of Land Management, Battle Mountain District, PO Box 1420, Battle Mountain, NV 89820

RICHARD WHEELER, Bureau of Land Management, Winnemucca District, 705 East Fourth Street, Winnemucca, NV 89445

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Abstract: An additive Habitat Suitability Index format rating system was developed for use in managing wild horse (*Equus caballus*) and burro (*E. asinus*) 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, straightforward, predictive and robust. The system is being tested 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 ($R^2 = 0.94$) (adjusted for small sample size, $R^2 = 0.88$). Of the life requisites cover is the most weakly correlated. Eliminating the cover variable resulted in $R^2 = 0.91$. 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.

During 1986 the Bureau of Land Management in Nevada began developing a habitat rating system which would allow them to evaluate wild horse (*Equus caballus*) and burro (*E. asinus*) habitat and analyze the impacts of management actions such as proposed range improvement projects, and provide the BLM with the ability to predict the capability of unoccupied habitat to support wild horse and burro populations (BLM 1986). The rating system was to meet four basic criteria. It should be: (1) management oriented (useful to managers), (2) computer compatible, (3) straightforward, and, (4) robust (applicable to all of Nevada). Testing of the rating system began in 1987. This paper discusses the basics of the rating system and the results of testing completed to date.

STUDY AREAS

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

METHODS

Rating System

In order to meet the four basic criteria 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 third-order 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 BLM's latest vegetation inventories. Base values were derived from research done by Berger (1986), Hansen (1982), USDI BLM (1976) and others. A base value was assigned to each ecological site or plant community according to its capability to provide 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 (Table 2). A final Forage Suitability Index (FSI) 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 BLM'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 (WSI). For example: 80 percent coverage equals a 0.8 WSI. Total gallons per day of water produced is balanced against horse, burro, livestock, and wildlife

Table 1. Herd management area size, wild horse and burro densities, habitat suitability indexes (SI), ratings (HSR), and limiting factors. Asterisks (*) indicate most limiting factor.

Herd Management Area	Size (acres)	Density (per mi ²)	Food SI	Water SI	Cover SI	Space SI	HSR
Little Humboldt	59,860	1	0.44*	1.00	0.54	0.77	0.44
Buffalo Hills	85,846	2	0.55*	0.90	0.80	0.72	0.55
Blue Wing Mtns	21,411	2	0.45*	0.90	0.54	0.90	0.45
Shawave Mtns	98,386	1	0.46	0.41*	0.78	0.80	0.41
Lava Beds	256,637	1	0.48*	0.58	0.61	0.80	0.48
Nightingale Mtns	85,630	1	0.42	0.30*	0.69	0.80	0.30
N. Stillwater Range	188,939	1	0.30*	0.65	0.70	0.70	0.30

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. This is done to cushion an area against increases in water consumption or drought. If demand exceeds production 0.2 is subtracted from the base water value. This value is referred 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 0.2 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 we felt that topography would influence their use of an area. Using information provided by experienced wild horse and burro specialists we developed a word model which describes the slope and topography as it occurs at 1.0 through 0.0. Optimum cover was described as rolling hills 18-30 percent 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 such as aerial predation or harassment. 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 (CSI).

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. Percent of negative impact is determined using a word model which describes the intensity of activity and number of days averaged throughout the year in the herd management area. The two values are added together then averaged to determine the Space SI (SSI).

The overall Habitat Suitability Rating (HSR) is the most limiting factor. In this case the most limiting factor is the lowest ranking habitat variable.

APPLICATION

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

Table 2. Adjustments to number of acres according to seral stages or condition (see text for details).

Ecological Sites	Condition	Adjusted By:
Potential natural community (PNC)	Excellent	1.00
Late seral	Good	0.75
Mid seral	Fair	0.50
Early seral	Poor	0.25

Table 3. Simple correlation coefficients (*r*) between wild horse and burro population density and each independent variable.

Independent Variable	<i>r</i>
Food	0.92
Water	0.91
Cover	0.87
Space	0.90

evaluated on the ecological site basis.

Water data were taken from previously completed BLM 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.

Wild horse and burro population densities, and herd management area boundaries have been established by the BLM throughout Nevada using at least ten years aerial survey and population monitoring data.

Stepwise 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 $R^2 = 0.94$. When adjusted for the small sample size the $R^2 = 0.88$. The correlation is highly significant ($P < 0.05$) for the multiple regression. Simple correlation was significant ($P < 0.05$) for food, water and space. Cover was not statistically significant ($P > 0.05$) (Table 3). 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 $R^2 = 0.94$ (adjusted $R^2 = 0.91$).

Other results obtained during testing apply to the rating system's usefulness within the BLM'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 BLM'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 highly 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 topographic 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.

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