MODEL TESTING FOR FUTURE REINTRODUCTIONS OF DESERT BIGHORN SHEEP AT CAPITOL REEF NATIONAL PARK

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Objectives

The objective of the 1989 fieldwork was the testing of a model developed in 1988. The main project objectives are to: (1) evaluate the success of the transplant operations; (2) investigate habitat selection behavior of desert bighorn sheep (Ovis canadensis); and (3) develop a model which classifies areas suitable for sheep use. This model will then be incorporated into a Geographic Information System (G.I.S.) to examine macrohabitat use patterns. Software to be used includes: SAGIS, MAP, DBIII, and HOMER.

Methods

Seventeen habitat variables were analyzed using Classification and Regression Trees (CART) (L. Brieman et al. 1984). Analysis identified two variables, distance to escape terrain and degrees of unobstructed visibility, as having the greatest influence on habitat selection. While the original model was constructed with three hundred and seventy plots distinguishing between seventeen variables, it was proposed that the testing of these two variables be accomplished with two to three hundred new plots. A total of one hundred and eighty plots were sampled this summer and fall to test the model.

Test variables measured included slope, distance to escape terrain, distance to nearest cliff face, total visibility, and upslope visibility.

Results

The original CART analysis stated that a site will be used with 65% accuracy only if it was both less than thirty-three meters from escape terrain, and had total visibility greater

than fifty-five degrees. Failing to meet the visibility requirement, a plot had a probability of .73 of being classified as unused. Plots further than thirty-three meters from escape terrain had a probability of .85 of being unused (Figure 1).

Test data were run through the tree and the results are presented in Figure 2. If a test plot was both less than thirty-three meters from escape terrain, and had total visibility greater than fifty-five degrees, then it had a probability of .95 of being used. Failing to meet the visibility requirement, a test plot had only a probability of .70 of being unused. In both the original and the test data only a small percentage of all plots satisfied the visibility and escape terrain conditions, 28% and 11% respectively.

The largest difference between the two data sets was the importance of visibility. This lead to a separate CART analysis of the test data alone. Treating this data as if it were the first data received, CART analysis lead to a single split based on distance to escape terrain. If distance to escape terrain was less than or equal to thirty-four meters, a test plot had a probability of .87 of being classified as used. If a test plot had a distance to escape terrain greater than thirty-four meters, then it had a probility of .70 of being unused.

Discussion

The most notable difference between the original model and the test data is the absence, in the test data, of the importance of visibility. Three possible reasons for this are: (1) seasonal changes in visibility due to vegetative changes; (2) researcher variance; and (3) a switch from eight to four measurements of visibility.

Site specific visibility is affected by large boulders, topography and vegetation. While the first two factors change slowly, vegetation can vary greatly and affect visibility. Vegetative cover and vigor vary with season, degree of use, rainfall, and fluctuations in general weather conditions.

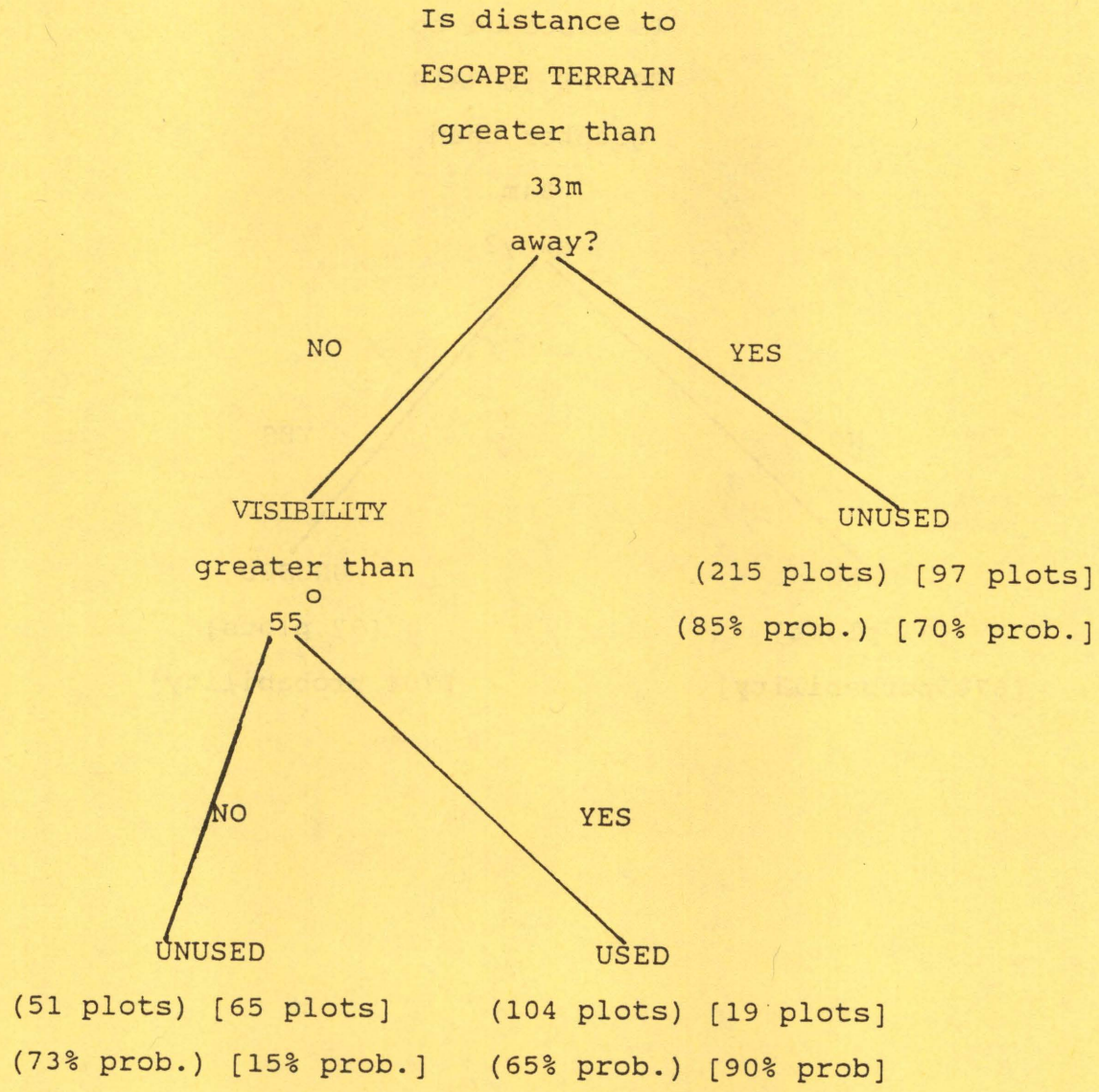

Figure 1. Comparison of (original) and [test] data with the tree diagram developed by CART showing the habitat variables which destinguish used sited from unused sites. Under each is the number of plots and the probabilities of each variable in correctly classifying the sites.

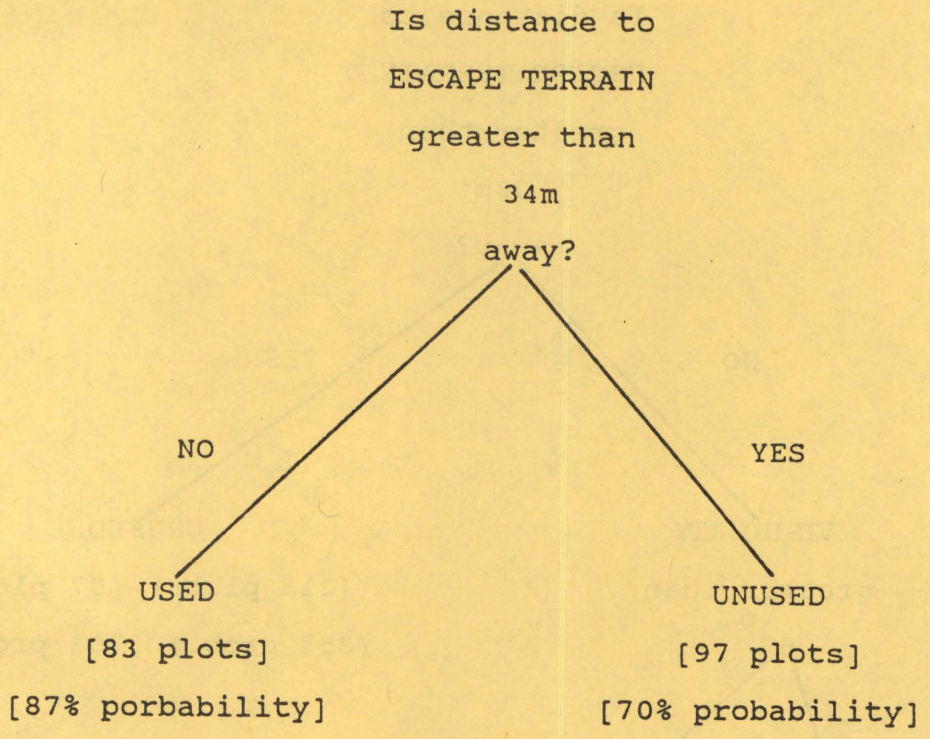

Figure 2. Tree diagram developed by CART using test data showing the habitat variables which distinguish used sites from unused sites. Under each is the number of plots and the probabilities of each variable in correctly classifying the sites.

The second possible reason for the observed difference is that each set of field work was performed by two separate researchers who had no previous contact with respect to this project. Although the definition of visibility was the same, personal judgement can vary as well as experience.

The final, and possibly most influential, reason for this discrepancy lies in the number of visibility measurements taken at each site. In the beginning, when vegetation was thought to be a major influence on habitat selection, it was shown that decreasing the number of vegetation transects from eight to four did not statistically change the vegetative composition calculated for a plot, thus allowing for quicker plot sampling (Steel and Workman 1987). Since one visibility measurement was taken on each transect line, the number of measurements taken per plot was also cut in half. However, not suspecting the importance of this variable, no tests were run to see if this had any effect on the visibility estimate.

Conclusions

Given the large size of the study area and the variability of visibility on any single plot due to vegetative and other possible, yet rare, events (i.e. geologic), it is not surprising that the importance of this variable differs between data sets. Other reasons discussed probably play a role in this discrepancy. However, it is important to note the high correlation of used sites with distance to escape terrain, thirty-three meters in the original data and thirty-four meters in the test data. When creating the G.I.S. it will be easier to locate areas which qualify as escape terrain using this criteria. Visibility on the other hand can only be measured on the ground. This, and its variable nature, makes incorporation of visibility into a G.I.S. difficult, if not, impossible. Based on field work, it is felt that first-order selection may play a role in limiting the distribution of desert bighorn sheep.

Literature Cited

Brieman, L., J. Friedman, R. Olshen and C. Stone. 1984. Classification and Tegression Trees. Bickel, P., Cleveland, S. and Dudley, R. (eds.). Wadsworth Inc., Belmont, California.

Steel, T. L. and G. W. Workman. 1987. The ecology of a reintroduced population of desert bighorn sheep at Capitol Reef National Park: Phase II. Habitat use patterns. UW-NPS Research Center Annual Report. 50 pp.