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ABSTRACT: A new system developed for locating pairs of comparable areas consists of three steps: (a) characterizing each of two areas according to 18 site factors and soil properties, (b) rating each pair of characteristics for comparability, and (c) rating the two areas for comparability by using the individual ratings as the basis. Two areas scoring 85 or more points out of a possible 100 are considered sufficiently comparable in characteristics not easily affected by treatment to justify establishing study plots on them.

Locating Pairs of Comparable Study Areas . . .

new system developed

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Two grazing treatments are being used on the Lassen National Forest in northeastern California. The two treatments are rest-rotation grazing on Harvey Valley and season-long grazing on neighboring allotments. To evaluate them, we needed comparable macro plots on comparable study areas. These areas must, in theory, have equal potential to respond to treatment. Two comparable areas given the same treatment would be expected to respond in the same way.

We have developed a new system for finding comparable study areas. We established macro plots, 1/4-acre or larger, on the pairs of comparable areas. One member of each pair was on the Harvey Valley allotment; the other on a neighboring allotment. The plots were enough alike, in characteristics not easily affected by grazing, that present differences and future change in range conditions would most likely be due to grazing treatment.

The need for a new system was spurred by the lack of adequate soil surveys in the general area. Adequate soils surveys would reduce the need for such a system by lessening the chances of getting unlike soils on two areas. But even with an adequate soil survey, a system of determining comparable areas still would be valuable. For even within a homogeneous mapping unit of one soil series, other soil series with more or less wide ranges of characteristics may be included.

NOT A NEW IDEA

The idea of using comparable plots to study the effects of a grazing treatment is by no means new. This approach has been used by Reed and Peterson[1] and by Goebel and Cook.[2] In these studies the plots were located across fence lines--there was not much question as to their comparability. In forage yield and utilization work we often attempt to pair plots to have them comparable. One plot is usually protected from grazing, while grazing is permitted on the other.

CHARACTERISTICS USED TO DETERMINE COMPARABILITY

To determine comparability of two areas, the logical procedure is to compile a set of characteristics useful

[1] Reed, M.J., and Peterson, R.A. *Vegetation, soil, and cattle responses to grazing on Northern Great Plains ranges.* U.S Dep. Agr. Tech. Bull. 1252, 79 pp. 1961.

[2] Goebel, Carl J., and Cook, C. Wayne. *Effect of range condition on plant vigor, production, and nutritive value of forage.* J. Range Manage. 13: 307-313. 1960.

in making a decision. The particular set of characteristics used will be dictated by the requirements of the problem. Klemmedson and Murray[3] divided characteristics useful in site evaulation into "site factors" and "soil properties." We used this kind of breakdown but with a somewhat different list of factors and properties (table 1). Each of 18 characteristics was selected for one or more of these reasons:

1. It exerts important influences on the potential of the site to produce forage.

2. It is not easily altered by grazing.

3. It influences grazing intensity.

4. It can be measured within time and cost limitations.

Each characteristic was placed into one of three classes according to its importance (table 1). The classification was based on the apparent ecological importance of the characteristic and the reliability of the sampling scheme used to measure the characteristic. In addition, five soil profile detractors were used--characteristics which, if different, would greatly detract from the comparability rating. They were: (a) presence or absence of B horizon, (b) drainage, (c) $CaCO_3$, (d) hardpan and cementation, and (e) parent material.

FINDING COMPARABLE AREAS

The system consists of three steps. First, characterize the two areas by site factors and soil properties; second, rate each pair of characteristics for comparability; and finally, rate the two areas for comparability.

[3]Klemmedson, James O., and Murray, Robert B. *Use and measurement of site factors and soil properties in evaluation of range site potential.* U.S. Dep. Agr. Misc. Publ. 940. pp. 68-77. 1962.

STEP NO. 1

First, select an area in the test treatment. In Harvey Valley, the area selected was an apparently homogenous site, subject to grazing, and expected to receive the planned grazing use. Next, make a "characterization record" for the area. This record should contain the information on the site factors needed to determine comparability. Dig a soil pit. Describe each soil horizon according to the desired soil properties. Soil texture and gravel content can be determined by laboratory analyses. In this study, we also made a micromonolith of the profile and photographed it to make visual comparison.

Next, make a careful search in an area serving as the control. In this study, neighboring allotments were the controls. The search was limited to areas of acceptable size (e.g., considerably larger than planned study plot size), with the same general site factors (e.g., broad vegetation type, slope, etc.). From soil samples taken with an auger, we decided if there was a chance that soil properties would be about the same. If so, a characterization record was made, a soil pit dug, and the soil profile sampled and described as was done for the test area.

STEP NO. 2

The next step is to find whether individual pairs of characteristics from the two areas are comparable. To do this, compare the value given a characteristic from the test area with the value given the same characteristic from the control area.

Both single and multi-value characteristics are used to determine comparability. In general, site factors, e.g., slope, have one value; soil properties, such as texture, have several values for the profile.

Table 1.--*Characteristics used to judge comparability of two areas and their importance classes*[1]

Site factors	Soil properties	Importance class
Vegetation type Elevation Distance to water Accessibility to livestock	Depth of solum Thickness of A and B horizons pH pH trend Texture	A
Percent surface rock Timber cover	Color Structure	B
Aspect Slope	Percent gravels Cobble and rock content Rooting depth	C

[1]A complete set of standards used with this system may be obtained by writing to the Director, Pacific Southwest Forest and Range Experiment Station, P.O.Box 245, Berkeley, California 94701.

For a pair of characteristics of only one value, we use the narrative ratings of "comparable," "comparable minus," "similar," "similar minus," or "dissimilar." "Comparable" is used when the values are both within established limits, which permitted but little difference between values. "Similar" describes the case in which differences between values are large enough to have moderate influences on response to treatment. "Minus" is used to give a finer classification for both "comparable" and "similar." "Dissimilar" describes the case in which differences between values are great enough to have major influences on response to treatment.

As an example, two areas were rated comparable in elevation, if their elevations differed by no more than 50 feet. The rating was reduced for each 50 feet of difference in elevation. Thus if their difference was greater than 50 but less than 100 feet the elevations were rated comparable minus. When the difference in elevation was greater than 200 feet, two areas were rated dissimilar in this characteristic.

If a characteristic has several values, give the individual pairs of values, e.g., texture of like soil horizons, one of the narrative ratings described above. Second, assign a number of points for each pair of values--depending on the narrative ratings. Average these points for the particular characteristic and, depending on the average number of points, give the characteristic an average narrative rating.

For example, soil textures from five horizon pairs from two areas were rated comparable, comparable, comparable minus, dissimilar, and similar from the A to the B_3 horizons, respectively. Each pair of comparable values was given 4 points. Three points were given for the comparable minus and 2 points for the similar rating. No points were given for the dissimilar rating. Because the average (rounded to the nearest full number) was 3, soil textures of the two areas were rated comparable minus.

STEP NO. 3

Finally, decide to accept or reject a pair of areas for study plots according to their over-all comparability. To help decide, give each of the 18 site factors and soil properties a number of points, depending on its importance class and comparability rating (table 2). Dissimilar characteristics receive no points.

Table 2.--*Points given in determining total comparability points*[1]

Importance class	Comparability rating[2]				
	C	C-	S	S-	D
A	9.00	6.75	4.50	2.25	0.00
B	3.00	2.25	1.50	.75	.00
C	1.40	1.05	.70	.35	.00

[1]Points given a characteristic depend upon (a) its comparability rating and (b) its importance class.

[2]C = Comparable, C- = Comparable minus, S = Similar, S- = Similar minus, D = Dissimilar.

The points given for comparability are added to give total comparability points. Finally, examine the information to determine if any of the profile detractors apply. Make deductions of 4.5 or 9 points depending on severity of difference between the soils, for each profile detractor. The result is the final comparability points.

There are 100 possible points in the system. A *comparable* rating is given when the final comparability points totaled 91 or more. *Comparable minus* ratings are given when the final points are not less than 81.

The use of a 10-point break between comparability ratings, e.g., at 91 and 81, is arbitrary. However, as we used the system it appeared that areas with final comparability points of less than 85 should not have plots established on them to use in comparing treatment effects. Differences in some of the characteristics were wide enough to result in different responses to treatment.

DOES THE SYSTEM WORK?

The system has been helpful in setting up comparable study plots even as much as 8 miles apart. It is stringent enough so that out of 37 likely pairs we examined, only 8 made the fully comparable rating. The accepted pairs were comparable enough in site and soil characteristics so that differences in comparative range condition were likely caused by the only factor that was greatly different--the grazing treatment.

This system should have value in other studies requiring plots of the same potential to produce vegetation. And it could be used to measure the degree of departure from comparability on study areas of different potential. Greater knowledge of how soil and site characteristics influence the potential of an area to produce vegetation can be brought into the system to make it even more effective.

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