Evaluation of the Loop Procedure of the 3-step Method in the Salt-Desert Shrub Type of Southern Idaho

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INTENSIVE management of range lands requires accurate, quantitative appraisals of forage production and trends in vegetation and site factors. The highly variable nature of most range areas complicates and renders difficult such evaluations.

New methods have been developed during the past few years for the evaluation of vegetational and site factors as related to range condition and trend on grazing allotments. A procedure, designated as the loop method (part of the 3-step method), has been developed by the Forest Service (Parker, 1950). This method appears to be superior to existing methods of vegetational analysis for such evaluations.

The present study was conducted to determine the suitability of the loop method for studies of range types in southern Idaho.

Review of Literature

Two reports issued by the Forest Service under the heading of Administrative Studies (Parker 1950, 1951) present the results of a study conducted by Kenneth W. Parker of the Washington office of the U. S. Forest Service. The study was western-wide in scope and had as one of its main objectives the development of a method or methods for measuring trend in range condition on national-forest range allotments. The loop method as developed by Parker in his 3-step method is an innovation combining the desirable features of the New Zealand point contact method with those of the line transect technique. Parker's comparison of data obtained by the loop method and the line intercept method revealed a linear relationship in vegetational density, litter cover and floristic composition. Density measurements obtained with the loop method, however, were several times greater than those obtained by the line intercept method.

Analyses of data obtained by the loop method in six western forest regions showed that differences among observers were not significant in 16 out of 26 cases involving segregation of items such as climax grasses, total grasses, weeds (forbs), browse, litter and bare soil.

The loop method was found to be reasonably sensitive in the delineation of trend or changes within a range condition class. A particular advantage of the method lies in the establishment of permanent sample units for checking changes over a period of time. The establishment of new sample units or transects each time a record was to be made would introduce additional errors of sampling (Parker, 1951) and require a larger number of transects for the same degree of accuracy. In the loop method, differences due to errors in replacement of lines were of minor importance.

Procedure

Three 100-foot transects were located at random within a 200 x 200 foot block in each of three vegetational types. Each transect was permanently marked with three 8-inch spikes and two metal stakes, each 36 inches long. The spikes were driven into the ground at the zero marker, two inches beyond the 100-foot marker, and between the 49 and 50 foot markers. The tape was stretched by means of two coil springs attached to harness swivel-snaps and the rings anchored by the metal stakes. The swivel-snaps permitted the tape to be turned or straightened after stretching.

A $\frac{3}{4}$ inch diameter loop welded to a $\frac{1}{8}$ inch diameter rod 36 inches long was projected to the ground at each foot mark on the tape. Records were made of plant species, litter, bare ground or other items occurring within the loop. Bare ground, rock or litter were scored if one-half or more of the loop was occupied. Hits were recorded for shrubs at basal level and foliage level; basal hits only were recorded for herbaceous vegetation. The total number of basal hits on each line was 100; the number of foliage hits varied with the line and vegetational type.

Preliminary tests of differences with observers and with the re-establishment of lines were conducted in a shadscale (*Atriplex confertifolia*) type during the latter part of the 1951 field season. Two lines were established and read on two consecutive days by four men, all of whom had had experience with the technique. Records made during this test permitted only a comparison of totals for each category.

During the 1952 season, three clusters of three transects each were read on two dates by three men. Each cluster was located in a different vegetational type, i.e., shadscale, saltsage (*Atriplex nuttallii*), and an area reseeded to crested wheatgrass (*Agropyron cristatum*). One of the men had previous experience with the method but the other two had had none. One-half day was devoted to instruction in the technique at the initiation of the tests. Data were recorded by individual loops in this test which made possible a more complete anal-

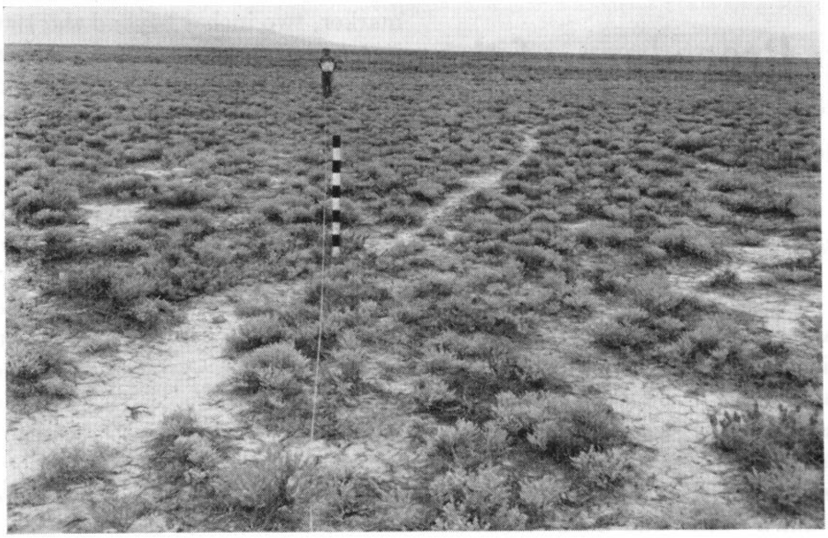

FIGURE 1. General view along transect in the shadscale type.

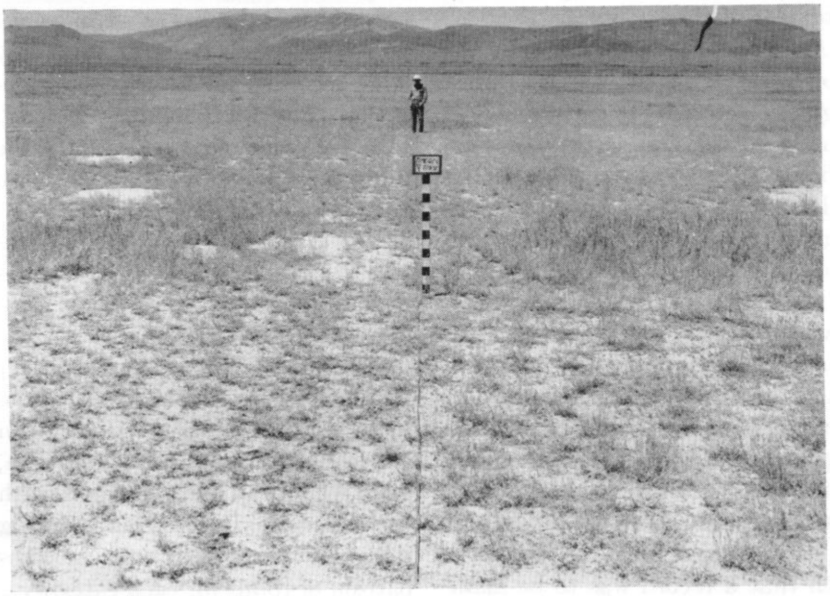

FIGURE 2. General view along transect in the saltsage type.

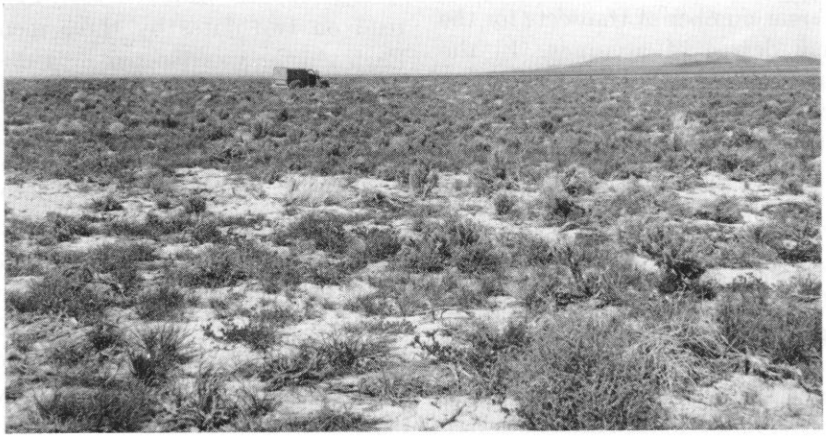

FIGURE 3. General view of transect location in the reseeded type.

ysis of differences due to men and re-establishment of lines.

The data were subjected to analysis of variance. The error value used for tests of significance was obtained from the pooled sum of squares of the first and second order interactions. Prior to pooling, each of the first order interactions was compared to the second order interaction to determine significance. Significant first-order interactions were removed from the pooled error-term for tests of significance on the mean squares for lines, men and trials. Comparisons of individual loop records were made for each man in the two trials and for all men in each trial and both trials.

Description of Area

The studies were conducted in the salt-desert shrub type in the Raft River Valley of Cassia County in southern Idaho. The three vegetational types selected for the tests are representative of the variations encountered in the salt-desert shrub of this region. Detailed descriptions of the types and areas are given by Tisdale and Zappettini (1953).

The shadscale type (Fig. 1) consisted of a low-growing matrix of shadscale with small amounts of perennial grasses such as Sandberg bluegrass (*Poa secunda*) and squirreltail (*Sitanion hystrix*) and pricklypear cactus (*Opuntia polyacantha* and *O. rhodantha*). The shadscale plants were infested with a snout moth (*Eumysia* sp.) and a scale insect (*Orthezia annae*). The area had been used as winter range but was not grazed during the year of the tests.

The saltsage type (Fig. 2) consisted of nearly a pure stand of *Atriplex nuttallii*. Scattered plants of downy chess (*Bromus tectorum*), perfoliate peppergrass (*Lepidium perfoliatum*) and stickseed (*Lappula redowski*) were found. The growing season of 1951 was extremely favorable for seed production by saltsage as evident by the large number of seedlings found in 1952. The area was grazed by cattle in fall and spring.

The reseeded area (Fig. 3) was planted to crested wheatgrass in the fall of 1950 and the stand had become well established by the spring of 1952. Small amounts of sagebrush (*Artemisia tridentata*) and yellowbrush (*Chrysothamnus viscidiflorus* var. *pumilus*) remained in the area. Annual plants, including halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola kali* var. *tenuifolia*), occurred sparingly in open areas. The area was protected from grazing at the time of the study.

Results and Discussion

Differences Due to Men

Close agreement was obtained among observers in recording hits on the various items in the three vegetational types. Table 1 presents data on mean squares and significance for the tests conducted in 1952. The differences among men in recording hits were significant in only two cases and highly significant in only one of the 19 cases analyzed. Differences among men were not significant for any of the items recorded in the 1951 test.

In the 1952 tests, the significant differences among men in the shadscale type for the unvegetated category (summation of bare ground, rock and litter) and for shrubs may be partially explained by the higher number of hits recorded for shrubs by Man No. 2. The readings of each man in the two trials were in close agreement: 4.3 and 4.7 for Man No. 1, 6.7 and 6.0 for Man No. 2, and 4.2 and 4.3 for Man No. 3, respectively.

The highly significant difference among men for shrubs in the saltsage type is also largely due to the high values recorded by Man No. 2. The means for the three examiners in the two trials are: 6.7 and 7.0, 10.0 and 11.0, and 7.0 and 8.7, respectively. The differences are due to the interpretation of a hit by the various examiners.

Table 1. Mean squares and significance of data obtained with the loop method in the 1952 trials

Category and Type	Lines	Men	Trials	Error
Degrees of Freedom	2	2	1	12
Bareground				
Shadscale	116.7*	33.5	56.9	25.9
Saltsage	94.0*	32.1	249.4**	16.6
Reseeded	72.1	45.4	296.0**	22.8
Litter				
Shadscale	10.9	7.7	26.9	17.1
Saltsage	16.9*	15.0	37.6**	4.2
Reseeded	16.2	24.6	355.6**	18.6
Unvegetated				
Shadscale	114.0**	8.2*	3.6	1.3
Saltsage	190.6**	16.1	480.5**	12.88
Reseeded	49.1**	14.4	2.7	5.0
Shrubs				
Shadscale	34.4**	7.4*	0.0	1.1
Saltsage	8.8	21.6**	4.5	3.1
Reseeded	2.4**	0.4	0.5	0.2
Perennial grass				
Shadscale	2.1	0.1	0.8	0.6
Saltsage	—	—	—	—
Reseeded	18.2**	6.5	12.5*	2.4
Annuals				
Shadscale	—	—	—	—
Saltsage	27.1**	0.5	22.2*	3.9
Reseeded	11.7*	5.1	0.5	1.9
Foliage				
Shadscale	99.4**	5.4	26.8**	2.5
Saltsage	471.1**	2.2	420.5**	6.0
Reseeded	17.1**	1.4	1.4	1.0

* Significant at the 5% level
** Significant at the 1% level

Although the data in Table 1 do not show significant differences among men for recording litter in the three vegetational types, the greatest inconsistencies among men and trials were noted for this category. The interaction mean squares of men x trials and lines x trials in the shadscale type and men x trials in the saltsage type were significant when compared to the interaction mean square men x lines x trials. The significance of these interactions indicates that the men were not consistent in recording litter in the shadscale and saltsage types in the two trials. A lack of consistency was also evident among individual examiners in recording litter on the three lines in the shadscale type. For example, Man No. 3 had the greatest number of hits on Line 1, the lowest on Line 3, and was intermediate in the number of hits scored on Line 2. Man No. 1 had the lowest records of hits in Trial 1 and the highest in Trial 2 in the shadscale type.

During the course of these trials and in previous work with the loop method, difficulty has been encountered in securing uniformity of

Table 2. Average number of loops on three transects with identical and compensating readings at ground level made by each man in two trials for the three vegetation types

Man	Shadscale		Saltsage		Reseeded	
	Average number of loops in the two trials		Average number of loops in the two trials		Average number of loops in the two trials	
	With identical readings	With compensating readings	With identical readings	With compensating readings	With identical readings	With compensating readings
1	78.7	18	59	29.3	67	19
2	78	17.7	58	31.7	71.7	20.3
3	80.7	10.3	65.7	21.7	69.7	18.3
Average..........	79.1	15.3	60.9	27.6	69.4	19.2

data for the litter category. Dry annuals and moss (*Tortula ruralis*) were inconsistently called litter, bareground, annuals, or moss by the same man on different lines and in different trials. Another major difficulty was judging whether or not dispersed litter filled one-half or more of the loop. Examiners who considered litter a highly important factor of the site tended to overemphasize this category; others tended to underemphasize the factor, but in both cases inconsistencies were evident.

More uniform records for litter were obtained on the reseeded area. Sagebrush rubble, created in the discing of the ground prior to seeding, constituted a large part of this litter and was relatively easy to distinguish.

Differences Due to Trials

The average number of identical basal hits in two consecutive trials is shown for the three examiners in Table 2. Items recorded in one loop in the first trial and in a different loop in the second trial are included as compensating readings. Similar information for foliage hits in each of the three vegetational types is presented in Figure 4.

During the 1952 test, the interval of time between the two trials amounted to approximately 2½ months. This interval was of such a length that actual changes in the vegetation and site factors might partially account for the relative lack of agreement in data recorded by the same observer in the two trials. These changes in vegetation and other site factors are also reflected in the data presented in Figure 5.

Identical basal hits averaged 79.1 percent in the shadscale type, 60.9 percent in the saltsage type and 69.4 percent in the reseeded type (Table 2). Only minor differences among men are noted in both Table 2 and Figure 4 for the proportion of loops in complete agreement and of compensating readings for the two trials.

Of the three types, the shadscale type was read with the greatest consistency in the two trials by each man and, as shown in Figure 5, for all men in each trial and in both trials. The saltsage type is the simplest of the three in its vegetational composition and presumably should be read with the greatest consistency. Actually, the high mortality of seedlings during the time interval between the two trials caused a lack of agreement of all individuals in both trials. Smallness of seedlings and lack of close observation during the second trial caused the men to be less consistent than in the first trial. Cloudy weather prevailed during the first test, whereas, during the second trial, the clear sky caused considerable glare to be reflected from the light-colored soil of this type. This difference in weather conditions may have had some influence on the observations recorded.

The principal cause for lack of agreement in consecutive loop readings appeared to be due to inconsistencies in recording litter and bare ground in all three types and to inconsistencies in records of sagebrush rubble, litter and bare ground in the reseeded type. If these items are grouped into a single category, the agreement of all men in both trials is 84 in the shadscale type and 71 in the reseeded area. The mor-

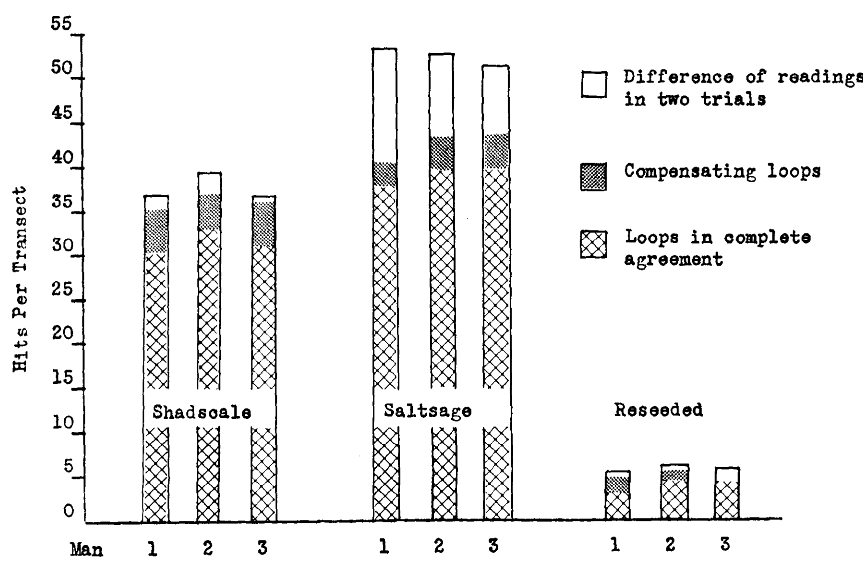

FIGURE 4. Number of identical, compensating and total foliage hits recorded by three men in two trials.

tality of seedlings in the saltsage type prevented a close agreement in the tests recorded.

Sources of Error

Actual changes in the vegetation and other site factors during the interval between trials were the principal causes for low percentages of agreement of all men in both trials. Other sources of error noted in the progress of the study which might contribute to differences between men and between trials were: differences in plumbing the loop, failure to observe the same standards of recording, lack of close observation, and the disturbance of vegetation on the line by a previous examiner. The vegetation in these types is relatively simple and errors due to mistaken identification are negligible.

Plumbing the loop was done visually by the examiner with the recorder frequently checking the alignment, both parallel and at right angles to the tape. The loop was read by the observer in a standing but slightly-stooped position.

The areas occupied by the basal portions of shadscale, saltsage and crested wheatgrass plants were variously interpreted by the three observers. Man No. 2 scored hits on horizontal branches of saltsage and crested wheatgrass plants at crown level, whereas the other two men scored hits only when the crowns of these plants were encountered.

Lack of close observation caused some individuals to overlook small, dry annuals and seedlings of saltsage. Dry annuals and foliage were sometimes destroyed or moved in the reading by a previous examiner, making it impossible for following examiners to record the same category. In general it is felt that satisfactory comparisons may be obtained in different years if data are secured at the same stage of growth of the vegetation.

Adaptability of the Loop Method

The loop method appears to be a promising method for securing certain quantitative data on vegetational and other site factors in the range types studied. Close agreement was obtained by individual observers in the two trials and by all men in both trials when the actual changes that occurred between tests are taken into account.

Improvement of the plumbing technique by the addition of a level bubble to the vertical rod has been suggested by George Garrison in personal correspondence. This improvement, together with the practice of offsetting the rod so that a vertical projection passes through the center of the loop as described by Short (1953), should increase the accuracy of the records obtained.

Certain of the errors noted in this study are associated with the procedure of testing the method. The disturbance and breakage incident to reading the line by a single observer would not affect the reliability of the data secured in the normal procedure.

Establishment of clear-cut criteria for recording the various items is essential in this method. Periodic records obtained by the loop method must be taken at the same stage of plant growth to be comparable.

The loop method has been used by personnel of the University of Idaho to secure: (1) basic information on the nature of range types and trends under existing management practices, (2) the effects of herbicidal spray applications on annual plants such as halogeton, and (3) the germination period of annual plants (halogeton) in field studies. Counts of plants within 2-inch diameter loops before and after spraying are used to determine the effectiveness of the spray treatments on halogeton. Periodic counts

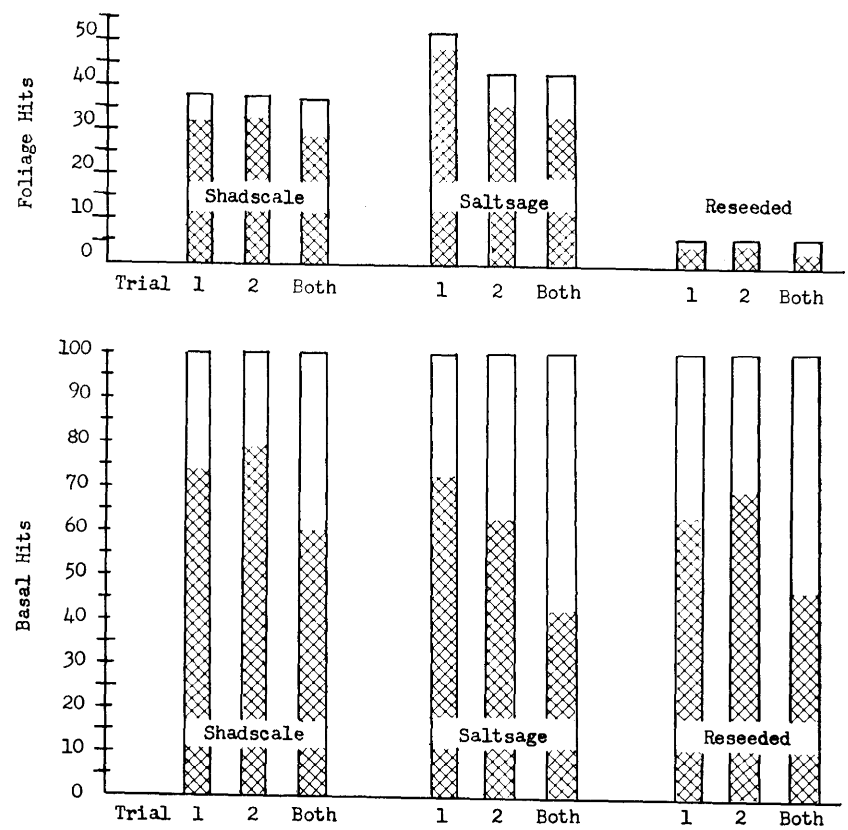

FIGURE 5. Number of identical loop readings (hachured) recorded by three men in basal and foliage hits per transect in each trial and in both trials.

within permanent 2-inch diameter loops give the amount and time of germination of such plants as halogeton.

The loop method has the advantage of multiple classification of data in the field record and a minimum of additional time required for compilation and summary. Simultaneous records can be obtained of the number and total cover of insect-infested or diseased plants. Litter can be separated in a number of ways such as animal excreta, brush rubble, or the current year's deposition. Details such as the relative amount of surface covered by ant mounds, rodent mounds, or desert pavement can be determined without changing the procedure for recording bare ground, rock, litter, or vegetation.

The method is relatively rapid and approximately 2½ to 3 hours are required to establish a cluster of three transects and secure the necessary data. This period includes a count of vegetation on a 5 square-foot center plot and a photograph of the cluster area along one of the transects. Follow-up readings are made in approximately one-half the time required to establish the cluster and record necessary information. The time required to read a single line of 100 loops varied from 12 to 45 minutes and averaged approximately 25 minutes per man.

Summary

The adaptability of the loop method (part of the 3-step method) was tested in the shadscale, saltsage and reseeded vegetational types in southern Idaho.

A cluster of three permanent transects was analyzed by three men on two dates in each of three types in 1952. Four men also analyzed two transects on two dates in a shadscale type in 1951.

Close agreement was obtained among observers in recording vegetational and site factors in the 1951 and 1952 tests of the loop method. The significant differences obtained for two factors out of nineteen analyzed in 1952 may be attributed to consistently high records for shrub components by one observer.

Identical readings by individual observers made in tests over a 2½ month interval gave an average agreement of 79.1 percent in the shadscale type, 60.9 percent in the saltsage type and 69.4 percent in the reseeded type. Complete agreement for individual loop readings by all men in both trials was 59.6, 42.3 and 47.3 percent for the shadscale, saltsage and reseeded types, respectively.

Differences in hits recorded for litter constituted the principal cause for lack of agreement in readings. The dispersal of old litter and the addition of new litter during the interval between trials was responsible for the major disagreement among men in the two trials. A high mortality of seedlings between the first and second trial in the saltsage type also contributed to the inconsistencies obtained.

The loop method appears to be reasonably well adapted for obtaining quantitative records of vegetational and other site factors on range areas of the types studied. Measurement of the changes occurring on an area can be accomplished with the loop method provided good techniques are used for plumbing the loop and standards of measurement are clearly defined. The method is rapid and advantageous for the determination of germination sequences, effects of herbicidal treatments and other quantitative studies.

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Call for Papers for Annual Meeting

Members who wish to present papers at the next annual meeting of the Society to be held in January, 1955 are requested to submit titles and 200-word abstracts to the Program Committee as soon as possible.—*Kenneth W. Parker*, Chairman, Program Committee, U. S. Forest Service, Washington 25, D. C.