

Use of Programmable Calculator in Range Surveys

Richard V. Ringleb and E. Earl Willard

Land management agencies and private landowners realize the value of monitoring rangeland vegetation and adjusting stocking rates to insure range protection and continued forage production. Periodic range surveys are necessary to evaluate range condition and current grazing capacity. Often, the areas being surveyed contain a broad array of vegetation types, topography, and annual precipitation zones. This ecological variety reaches considerable proportions when all rangelands within a state such as Montana are considered.

Recent advances in programmable calculators allow range specialists to carry a personal computing system into the field. Such calculators allow instant computation of an estimated grazing capacity following site analysis and permit on-the-site visual analysis of computed values. In contrast, normal procedure is to calculate grazing capacity in the office from previously collected field data. By this time, the conditions of an individual site are difficult to mentally recall. Thus, the calculated values are accepted as correct, with little or no possibility for adjustment. When Resources Analysis began a range survey in 1980, we recognized the need to compute grazing capacity while present on the site. Thus, we developed a program for a calculator to accomplish this.

The Range Survey

The range survey was for the Bureau of Indian Affairs on 670,000 acres on the Crow Indian Reservation, southeast of Billings, Mont. We used Soil Conservation Service (SCS) grazing guides (Zacek et al. 1977) developed for the State of Montana. The guides divide the state into 5 geographic areas with 1-3 precipitation zones in each area. Each precipitation zone contains 8-21 range sites. The Montana grazing guides, then, contain 174 potentially different sites.

To determine grazing capacity, one first determines the geographic area within which the rangelands occur. The precipitation zone (5"-9", 10"-14", 15"-19", 20"+) within which the site occurs is then determined from a map of Montana developed by the SCS (Ross et al. 1973). Finally, the range site is identified based upon the soil and climate. The range site, then, is the basic management unit for which grazing capacity is determined. Each site has a certain potential natural vegetation, which is well-described in the grazing guides. Range condition for the site is determined by estimates of the percentage of the current vegetation that would have been present in the climax community. Tables

within the grazing guides then relate range condition classes to grazing capacity, based on the assumption that the better the range condition the greater will be the grazing capacity. The grazing capacity values are usually expressed as a range (i.e., 0.5-0.6 AUM/Ac). However, certain problems may be encountered with this system.

Range condition does not reflect actual forage production on that particular site. It also does not take into account palatable invaders such as Kentucky bluegrass (*Poa pratensis*) and timothy (*Phleum pratense*) which depress range



Hand-held computer has been programmed with Montana SCS grazing guides for use in field.

condition because they are not part of the natural community. Other factors such as plant vigor, plant density, and slope steepness are not directly considered in the grazing capacity tables. Thus, there is a need to calculate grazing capacity on the site. Recommended rates can be calculated from the tables. Adjustments are then made, taking into account factors mentioned above.

When we began the range survey on the Crow Indian Reservation, we were faced with the problem of calculating grazing capacity on thousands of range sites. It was obvious that these calculations and adjustments had to be done on the site to assure reasonable accuracy. Thus, we saw the need to take a programmable calculator into the field to assist us.

Use of Programmable Calculator

The HP-41CV built by Hewlett-Packard Company was chosen because it possesses the following characteristics: *Alpha-numeric capability.* The machine can display both

Authors are with Resources Analysis, Inc., P.O. Box 2524, Missoula, Mont. 59806 and School of Forestry, University of Montana, Missoula 59812.

Editor's Note: This article verges upon being a bit technical, but in this highly complex, electronic age we are living in perhaps there is a place in a popular style magazine for this type of article occasionally.

words and numbers. Thus, it can be programmed to prompt user for needed information. Output information can also be labeled, i.e. 2.4 Ac/AUM. Another important feature is that special information can be placed into the machine and recalled for display at the push of a button. These capabilities allow persons inexperienced in using such machines to operate pre-programmed machines with ease.

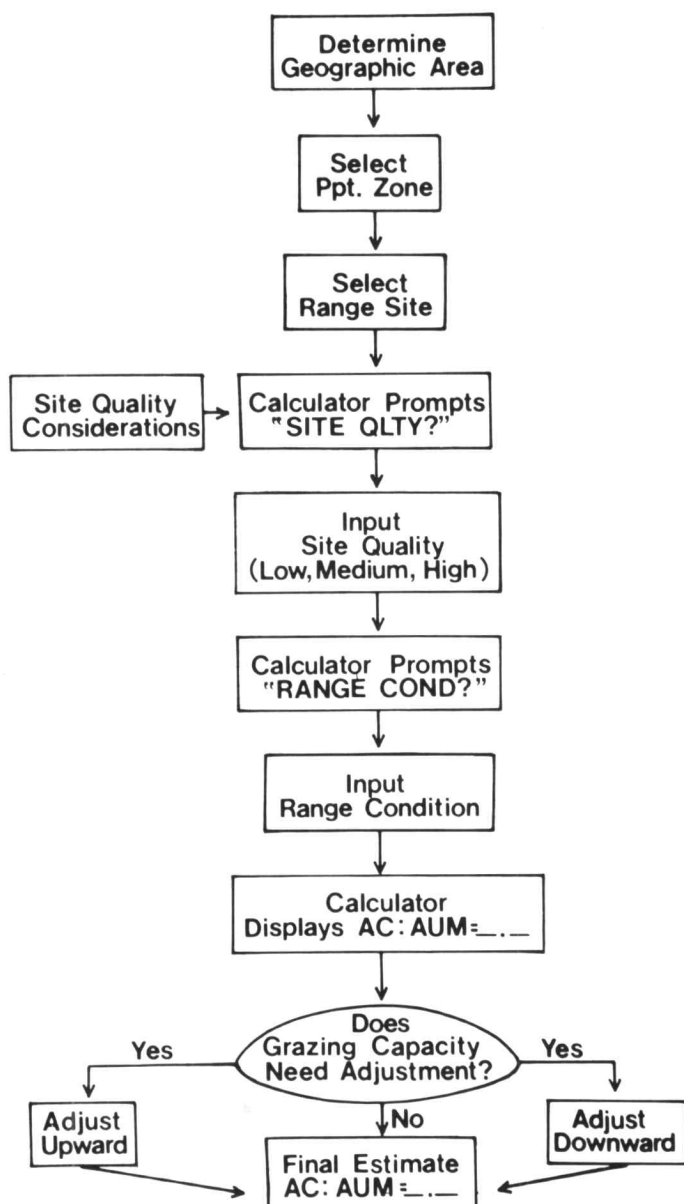
Large, continuous memory. The calculator is capable of providing over 2,000 lines of program. The memory remains when the machine is shut off. Equally important, the machine uses very little power and we found that a new battery lasts longer than a field season.

Programmable function keys. Most of the function keys can be assigned to represent an individual program. For example, a key can be assigned to calculate stocking rate for an individual range site.

Keyboard overlay. An overlay labeled with function assigned to each key may be built and placed on the keyboard for reference. In our program, the overlay shows assigned keys for each site, each precipitation zone, etc.



Richard Ringleb uses programmable computer in the field to estimate grazing capacity.



Building the Program

The logic used in building the program is demonstrated in Figure 1. Specifically, range condition (expressed as percent of climax) is calculated by standard SCS methods. The HP 41CV is then programmed to accept range condition data for a particular range site in a particular precipitation zone of a specified geographic area. These data are considered along with adjustments for site quality to estimate a grazing capacity. If visual considerations of the site suggest the values are too high or too low, further adjustments can be made. Stocking rate can be adjusted upward by calculating the grazing capacity at next higher precipitation zone; downward adjustment involves calculating capacity at next lower precipitation zone. We have built a program to cover the entire Montana grazing guides.

Operation of Program

The calculator is now programmed. The overlay labels the keys, so that the operator knows which keys to punch. Operation of program begins by depression of correct precipitation zone key (e.g., 10"-14"). Next, the proper range site key is depressed (e.g., Thin Hilly). Calculator then prompts operator by displaying "SITE QLTY?". Choices available are low, medium, or high, which have been assigned to keys labeled on the overlay. Adjustments based on site quality allow operator to select which position of variable stocking rate in grazing guides is to be used (e.g., 0.2-0.3 AUM/Ac at 100% range condition). Low site quality chooses lowest value (0.2 AUM/Ac), high quality chooses highest value (0.3 AUM/Ac), while medium quality chooses the intermediate value (0.25 AUM/Ac).

Determination of site quality involves consideration of several characteristics at each range site. A listing of these characteristics can be viewed on the screen by depressing a key labeled Site Qlty. The display shows PLANT (pause)

RESIDUES, (pause) SOIL SURFACE (pause) EROSION, (pause) COMPACTION, (pause) STABILITY (pause) and DEPTH.

Programs for range sites not listed with a variable stocking rate (e.g., 0.4 AUM/Ac) do not prompt for site quality.

After selecting appropriate site quality, the calculator prompts by displaying "RANGE COND?". The numeric value of the range condition for the site is punched into the calculator (e.g., 70). The machine then calculates the stocking rate and converts data to acres per AUM for display (e.g., AC:AUM=4.8).

The range specialist now knows current range condition and estimated grazing capacity while standing on the site. If visual considerations of site indicate rates are somewhat high or low, adjustments to stocking rate value can be made by punching button for "ADD P.Z." or "SUBT P.Z.".

Usefulness of Program

This program was developed before we began the range survey on the Crow Indian Reservation. The calculator was used to determine stocking rates on approximately 300,000 acres during 1981 field season. We are very pleased with the

functionality of the calculator and program. Adjustments in stocking rate were possible in the field as site conditions warranted. We noted large areas of Kentucky bluegrass and timothy that were in poor range condition class but had considerable forage. We were able to adjust for unusual deviations in plant vigor, plant density, and topographic features such as numerous rocks, steep slope, and soil erosion.

Repeated determination of stocking rates in the field allowed us to develop an excellent perspective in relating stocking rates to existing vegetation and other site factors. Thus, we feel that variability in range sites over a large area can be assessed and handled in a professional manner.

The program and its placement in HP-41CV are too complicated to include in this paper. Individuals interested in details are invited to contact the senior author.

Literature Cited

- Ross, Robert L., Earl P. Murray, and June G. Haigh. 1973. Soil and vegetation inventory of near-pristine sites in Montana. USDA, SCS. 55 p.
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Little Bluestem for the Northern Plains

Dwight A. Tober, Erling T. Jacobson, Russell J. Haas

Editor's Note: Most of us are probably not aware how new cultivars are developed. This article adequately describes the process.

Native grasses are vital to the livestock industry in the Northern Great Plains. They add stability to the economic base and longevity to erosion and sediment control practices. Little bluestem (*Schizachyrium scoparium* [Michx.] Nash) is a native, warm-season bunchgrass, dominant in the drier mixed-grass prairie on sandy soils or on shallow soils along ridges and steep slopes. Where moisture conditions are more favorable little bluestem occurs naturally in association with tall grass species.

Problem

There are no commercially available cultivars of little bluestem adapted to the northern plains. Increased use of native species for range seeding, surface mine revegetation, critical area planting, and recreational area development has prompted the need for additional commercially available warm-season grasses such as little bluestem. This species is a high forage producer, nutritious to livestock prior to matur-

ity, and capable of providing excellent ground cover on shallow, droughty sites.

Objective

In 1979 the United States Department of Agriculture, Soil Conservation Service Plant Materials Center, located at Bismarck, N.D., initiated a project to assemble, select, and release one or more cultivars of little bluestem for conservation use in the Northern Great Plains. The procedures outlined in this article may have application in the assembly and evaluation of other native species needed for revegetation purposes.

Assembly

The Bismarck Plant Materials Center (PMC) serves the three-state area of North Dakota, South Dakota, and Minnesota. Because of the variety of climate and soil in this region, the collection area was extensive and included 23 major land resource areas. Two to four sites per county in each state (except northeastern Minnesota) were sampled, depending on the size and diversity of the county. Six vegetative subsamples were collected at each site. Each subsample, approximately 6 inches square and 8 inches deep, was placed in a plastic bag and labelled. It was the intent to

The authors are employed by the USDA Soil Conservation Service, Bismarck Plant Materials Center; Dwight A. Tober (Soil Conservationist); Erling T. Jacobson (Plant Materials Specialist); and Russell J. Haas (Plant Materials Center Manager).