Simple pivot balance for measuring phytomass in quadrats

D.E. JOHNSON, M.M. BORMAN, AND MOHAMED BEN ALI

Abstract

An inexpensive, easily constructed balance was made to measure plant phytomass from clipped quadrats. It can be fabricated from materials generally available in developing countries and, within the designed range, it is accurate enough to provide reliable estimates of standing crop. Since balances are easily and inexpensively constructed they can be made in quantity and distributed to local extension agents and farmers.

Key Words: vegetation sampling, biomass estimation

In the developing world there is a need for rational utilization of rangeland resources. This requires that managers have a clear understanding of availability and yield of plants eaten by livestock throughout the seasons. We commonly use quadrats and gram or pencil shaped scales to estimate the standing crop. The values obtained are then averaged to calculate an estimate of the grazing days allowable. Quadrats are easily constructed in developing countries but relatively expensive pencil scales ($30–$45) must be imported. To overcome this limitation and to make the materials necessary for accurate estimation of phytomass more readily available to extension agents, we constructed a simple pivot balance.

This balance consists of a flat piece of metal, preferably aluminum or something else that is inoxidizable. The piece is cut as shown in Figure 1 and holes are drilled for a fulcrum wire, a clip wire, and an indicator wire. Holes should be large enough to permit the wires to move freely, yet small enough to maintain the wire in a fixed position. Hard metal wires are then inserted into the holes and bent over the back of the plate so that they cannot fall out but move freely.

The balance is then calibrated against standard weights. We use standard weights calibrated on a triple beam balance in our laboratory to indicate the position of the indicator wire for 5-g intervals. Marks are then either etched into the metal of the balance or drawn on a piece of paper that has been pasted to the face of the balance (Fig. 1). Finer division marks can be drawn within these 5-g intervals using a scaled ruler.

As can be seen in Figure 1, the distance between the marks is not uniform (because the scale pivots). As a result the relative accuracy of the balance is not uniform across its range; however, it is possible to construct an accurate balance within the desired range by changing the position of the pivot hole or by using a heavier or lighter metal plate. With proper construction, a balance that provides good readings for the desired range can be obtained.

At the time of this work authors were assistant professor and instructor, Department of Rangeland Resources, Oregon State University, Corvallis 97331; and director, Central Tunisia Rangeland Development Project Office de L'Elevage es des Paturages, Kairouan, Tunisia, respectively.
Submitted as Technical Paper 7973. Oregon Agriculture Experiment Station. Funding was provided by the Republic of Tunisia, Ministry of Agriculture and USAID contract 66312.8.
Manuscript accepted 4 August 1987.

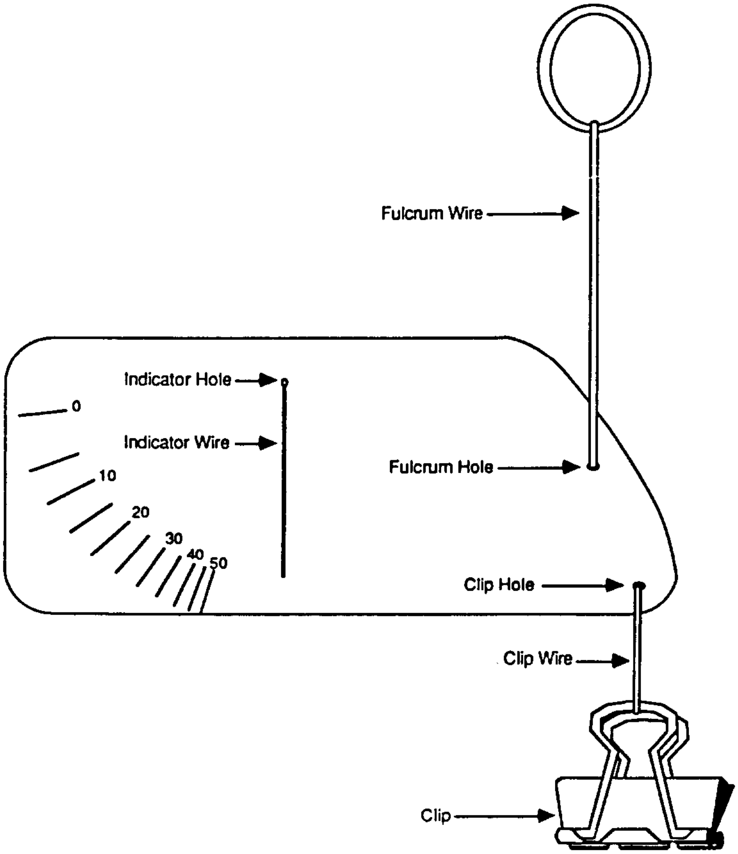

Fig. 1. *A simple pivot balance for measuring vegetation in quadrats.*

In order to test the potential accuracy of this type of balance and to compare it with a standard 100-g pencil scale, we constructed a 50-g balance and calibrated it to the nearest gram. Sixty samples ranging between 2 and 49 g were weighed on the pivot balance, the pencil scale, and a laboratory balance accurate to the nearest 0.01 g. Weights, as measured by the laboratory balance, were highly correlated to both the pivot balance and the pencil scale (correlation coefficients of 0.9998 and 0.9999 respectively). More important than the correlation is the error across the measured range. The average absolute error was 0.195 g for the pivot balance and 0.139 g for the pencil scale. Maximum error for the 60 readings was 0.58 g for the pivot balance and 0.54 g for the pencil scale. Although the pivot balance as we construct it is not as accurate as the pencil scale, our test balance gave consistent readings with less than 1 gram error in the design range.

We work with rangelands that normally have standing crops of from 500 to 2,000 kg of green material/ha and sample with 0.25-m^2 quadrats. Therefore, we construct balances that weigh from 0 to 50 g and are small enough to fit in a shirt pocket. Our balances cost about $0.50 for materials and require about 40 minutes to construct and calibrate. This type of balance should be useful for range managers in many developing countries.