A collapsible frame of lightweight steel tubing is efficient for outlining plot boundaries in forest and range inventories. It is strong and durable, yet light and compact for easy handling. Because it can be assembled and dismantled quickly, it can be used in dense brush where a solid frame is practically worthless.

The four sides of the frame, plus a corner brace and a short spacer, are made of ¼-inch thin-wall galvanized steel conduit, which is available at electrical supply houses in 10-foot sections (Figure 1). Other materials are galvanized bolts, nuts, and washers as follows:

- Stove bolts, ¼-inch
  - 2 2⅜ inches long
  - 3 2½ inches long
  - 1 2¾ inches long
  - 1 1¾ inches long
- Flat washers, 3/16-inch
  - 18
- Lock washers, 3/16-inch
  - 5
- Hexagon nuts, ¾ inch
  - 9

All bolt holes are drilled slightly oversize, 17/64-inch, one inch from the ends of the tubing. To lessen collapsing of the conduit when bolts are tightened, a 3/16-inch flat washer is placed beneath each nut and each bolt head. A lock washer is placed under all nuts except where lock nuts are used.

Two sides of the frame are permanently joined at one end by a bolt 2¼ inches long. This forms a hinge joint, permitting the sides to fold together when the frame is dismantled. Two 3/16-inch flat washers placed between the sides prevent binding (Detail A). Lock nuts keep the joint tight.

A hole is drilled through the free end of one of the hinged sides. The free end of the other hinged member is fitted with a bolt 2½ inches long as shown in Detail C.

**Figure 1.** Diagram of collapsible plot frame.
A short section of conduit placed diagonally across the hinged corner squares the assembled frame. One end of this brace is permanently attached to a hinged side (Detail A). The other end is drilled to fit over a bolt 2⅛ inches long installed in the adjacent hinged side as illustrated in Detail B. A 6-inch section of tubing serves as a spacer to keep the corner brace level. An additional bolt, 1¾ inches long, helps hold the spacer in place. Thus, the hinged sides and the diagonal brace comprise an integral folding unit.

The two remaining sides are readily detachable. One side has a hole drilled at each end; the other is fitted with stove bolts 2½ inches long as shown in Detail C.

When the frame is being assembled, bolts at points B and C are inserted into corresponding holes in the adjacent members. This forms a secure yet readily detachable joint without the use of nuts. On uneven ground the threads bind in the holes, holding the joints fast.

The frame is relatively cheap, considering its durability. One a milacre in size can be constructed in about two man-hours at a cost of $2.65 for materials.

Because a bolt may occasionally break, several extras, together with spare nuts, washers, and a small wrench, should be carried in the field. Otherwise, frames rarely need repair despite rough use in heavy brush.

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**BOOK REVIEWS**

Edited by D. G. Wilson, Dept. of Watershed Management, Univ. of Arizona, Tucson.


This volume, prepared by a joint committee of the American Society of Agronomy, the American Dairy Science Association, the American Society of Animal Production, and the American Society of Range Management, and edited by G. O. Mott, is divided into six sections, each having its own editor, or co-editors, and several authors. As might be guessed from the list of societies contributing to the volume, it contains more information on humid pasture research than on range research. Treatments of the individual subjects range from brief general statements derived from the author's experience and training to rather complete reviews of the literature.

The first two chapters deal with the selection of experimental areas and the selection and management of experimental animals. These chapters boil down a lot of practical research experience and emphasize the importance of giving adequate consideration to all factors that may affect either the influence of the plant on the animal or of the animal on the plant. Attention is called to many possible pitfalls in grazing trials.

The section on determination of herbage quality explores the subjects of animal performance, use of indicator methods in herbage quality studies, in vitro rumen fermentation techniques, chemical composition of pasture herbage, and the palatability of herbage. One is impressed by the complexity of the subject and by the ingenuity of workers who have attempted to measure herbage quality. The chapter gives a good review of ratio and indicator methods of estimating digestibility, points out the strengths and limitations of chemical analysis of herbage, and reviews the complex subject of forage palatability. The impossibility of duplicating the forage intake of animals by hand plucking or clipping is emphasized. While most of the discussion applies best to improved pasture studies, this section might well be reviewed by the range researcher who wants to measure herbage quality.

The section covering herbage production and yield includes evaluations of methods measuring yield by animal performance, energy values, and herbage sampling. The importance of a proper balance between the herbage available and the number of grazing animals per unit area is emphasized in discussing the use of animal gains as a measure of pasture yield. The use of a variable number of livestock or variable acreage during the growing season is suggested.

Methods of estimating or measuring the energy values of pasture and range forage include the method of partitioning the energy losses, the slaughter technique, and conversion of animal responses to apparent digestible energy. The last method appears to be more useful in range work, though somewhat less accurate than the other two.

A review of results obtained by clipping, mowing, caging, and other mechanical methods of harvesting forage as compared with animal output is given. In general, the hand methods overestimate by 25 to 40 percent the values obtained by animal measure. Error associated with the comparison of agronomic and direct measurement of forage intake is related to manual sampling and to the selective and wasteful grazing by animals. The indicator techniques discussed in the section on herbage quality are recommended where they can be used.

The statement on herbage sampling for natural pastures and range lists most of the popular methods relating to weight measurements, weight estimates, double sampling, measuring utilization on grasses and shrubs, and a discussion of size, shape and number of plots. The con-