THE HATCHET PLANIMETER

By L. H. ECKEL

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The Hatchet Planimeter is a simple, accurate and inexpensive instrument which has been brought to the attention of foresters in American and British forestry journals within the last decade. Yet it is neither used nor known widely. This is indeed difficult to understand after having seen and used this extra-ordinary device.

The Hatchet Planimeter is nothing more than a steel rod bent to form a tracing point at one end, and a sharp flattened piece—the hatchet—at the other. Figure I shows two convenient sizes. According to Hide, the ten-inch beam is convenient for measuring areas down to one square inch; below

FIGURE I: The Hatchet Planimeter in two sizes.

that the five-inch beam is the more convenient to use. Anyone familiar with metal work can easily make his own. Others will find that to have one made up at a metal working shop is not at all expensive.

To attain accuracy with this instrument it is necessary to adhere strictly to the following routine:

1. Mark the approximate centroid of the figure and draw through it two straight lines at right angles to each other. One of these lines should be the longest axis. Produce both lines to intersect the perimeter.
2. With the instrument perpendicular to the page, place the tracing point on the intersection "O" and swing the beam into position over the longest axis.
3. Point B (Position 1, Fig. II) is marked by gently pressing the knife edge into the paper.
4. Move the tracing point along OA to A; trace the perimeter in a clockwise direction and return to "O" along AO.
5. Point C (Position 2, Fig. II) is marked by pressing gently again on the hatchet.
6. With the tracing point held firmly on O and the hatchet on C rotate the figure through 180° . It is very important that neither the relative positions of the points be changed nor the instrument be allowed to shift.
7. Move the tracing point along OA_1 to A_1 ; trace the perimeter in a counter-clockwise direction, returning to O along OA_1 .

FIGURE II: Graphic Presentation of the Routine for obtaining the area of an irregular figure by two methods; i.e. rotating the figure and rotating the instrument.

8. Point D (Position 3, Fig. II) is marked in the established manner. If the tracing has been done precisely, D and B will coincide. The distance BC is measured with a steel scale graduated in hundredths of an inch. If B and D do not coincide the distance from C to the mid-point between B and D is measured.

9. Multiply this measurement by the distance between the tracing point and a permanent mark on the hatchet to obtain the area of the figure.

Ease and confidence with the instrument will be gained most readily with practice on figures the area of which can be verified arithmetically.

To obviate the difficulties one is bound to encounter in step 6 when working with large maps Hide offers two suggestions:

1. Work with tracings of the figures to be measured.
2. A change in the routine eliminating the need for revolving figures.

In the new routine after tracing the figures in a clockwise direction the planimeter is revolved 180° and a mark C_1 (Position 4, fig. II) is made a distance equal to BC below the clockwise direction and B_1 is marked (Position 5, fig. II). An average of the two distances BC and B_1C_1 is used to compute the area of the Figure.

FIGURE III

Treating BC as a chord instead of an arc as called for in the theory of this instrument, produces an error which normally is not significant. However, where the diameter of the figure is large in comparison to the length of the planimeter, this error is significant and must be corrected. By relating on a graph chord distances and arc distances subtended by several angles between 0° and 90° of radius equal to the distance between the tracing point and a permanent mark on the hatchet, the task of obtaining corrections is reduced.

To gain some idea of the accuracy of the hatchet planimeter as compared to the Polar planimeter and "Counting Squares" a two inch square, a three inch square and an extremely irregular figure (fig. III) were measured with each device. The operator was not skilled with any of these devices, but it was made certain that he knew and observed the basic rules for the accurate operation of each. The result (Table I) should deter the skeptical from dismissing the hatchet planimeter in haste.

TABLE I
TWO INCH SQUARE

Hatchet	Polar	Sq. Count
4.02	4.04	4.00
4.01	4.02	
4.01	4.03	

THREE INCH SQUARE

Hatchet	Polar	Sq. Count
9.10	9.03	9.00
9.05	9.04	
9.05	9.05	

IRREGULAR FIGURE
(see fig. III)

Hatchet Time	Polar	Time	Sq. Count	Time
8.45 12 min.	8.33	14 min.	8.61	18 min.
8.36 11	8.35	10	8.45	25
8.30 13	8.36	10	8.51	20
AVERAGE: 8.37 12	8.35	11	8.52	21

NOTE: For each reading of the Hatchet and the Polar planimeters, two tracings of Fig. III were made. The recorded time for each reading is the time taken for the complete operation i.e. setting up, tracing, recording.
The recorded time for "Square Count" is the time taken for one complete count.

Although this instrument is simply constructed and simple to use it must be remembered that shoddiness in workmanship and inept handling will give disappointing results. It would be well to attend closely to these points of Hide:

1. The tracing point and knife edge must be in the same plane.

2. The distance between the tracing point and the center of the knife edge must be measured with reasonable accuracy to give the multiplier i.e. 10", 5", 4", etc.
3. The knife edge must be kept sharp.
4. The instrument must be held properly upright during the tracing round the figure.
5. The tracing must be carefully done.
6. The tracing point must be loosely held by the fingers of the tracing hand.

Pryzt, a German, is credited with the invention of the Hatchet planimeter in 1894. So while you may find the accuracy and simplicity of this instrument surprising, more surprising is the obscurity enshrouding it even to-day. As the epitome of simplicity, robustness, and economy in an instrument it should be very popular unless we have been completely benumbed by the durable myth that complexity is always the work of exalted cerebration, and simplicity is always the work of simpletons.

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