Auto-Planetabling, An Economical and Expeditious Method of Geographic Mapping

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With the advent of a new economic era has come the widespread realization that the material welfare of human society of any region, and of the nation as a whole, is dependent more and more on the proper conservation and utilization of our natural resources. The so-called regional planning programs of local communities, of state, and of nation, are based on the geographic principle that man exists in vital, intimate, mutual relationship with all the forms of his environment, and that if man individually and collectively is to enjoy the richest fruits of his labors, there must be the closest and most effective adjustment of his activities to environmental conditions; in other words, a harmonious integration of the forms of the human occupance and the forms of the natural environment.

To carry out this principle of coördination of the cultural and natural forms of landscape, detailed statistics and inventory surveys are essential. Since government statistics do not cover all classes of geographic data and are not in a form so as to lend themselves to environmental or regional correlations (except for large political units, such as counties and, more recently, township units, in some areas), much original field investigation and mapping is necessary. This program invites the patient and proficient geographer whose peculiar province it is graphically to portray the distribution of the several physical and cultural classifications of landscape data, and to point out the vital organic connections and processes which express the inter- and intra-regional relationships of areas.

Without such a comprehensive geographic investigation, based on quantitative measurements, only an imperfect picture may be had of the true economic and sociological conditions of a community or of a region.

Adaptation of the plane table to motor-mapping

But complete inventory mapping, as every geographer knows, is, at best, a tedious and expensive process. Much of it depends on time-consuming footwork. It is true, the airplane in recent years has phenomenally accelerated geographic mapping, particularly in regions of rugged terrain and dense vegetation; but airplane mapping still must depend on a considerable amount of ground work to furnish the detailed inventory for interpreting the aerial mosaics. Accordingly, a mapping project of the Kankakee Marsh of Northern Indiana and Illinois recently led the author to try a simple experiment with what we may call auto-planetabling, a form of motorized mapping, operated single-handed. The experiment proved to be a considerable time-saver.

Equipment and Method

In planning or devising the mechanical equipment to carry out the experimental mapping, the writer was guided by inexpensiveness of material and simplicity of design—an improvised set-up, we might say, which could be converted into a more permanent and efficient fixture, if desired, with little extra time and expense. The entire surveying outfit consisted of: (1) an ordinary plane table—a drawing board, with trough compass attached, resting by a ball and socket joint on the spindle of the tripod, together with a simple open-sight alidade (Fig. 1, *C*); (2) a frame of small, galvanized pipe attached to the steering column of the car to support the drawing board, instantaneously transferable from the spindle of the tripod onto the spindle of the fixture on the steering column, and vice versa, as needed (Fig. 1, *A*); (3) a distance meter gauge —revolution counter—secured to the right fender of the car, and connected by a linked series of heavy rubber bands with a bolt placed eccentrically on a revolving metal disk fixed to the hub-cap of the rear wheel

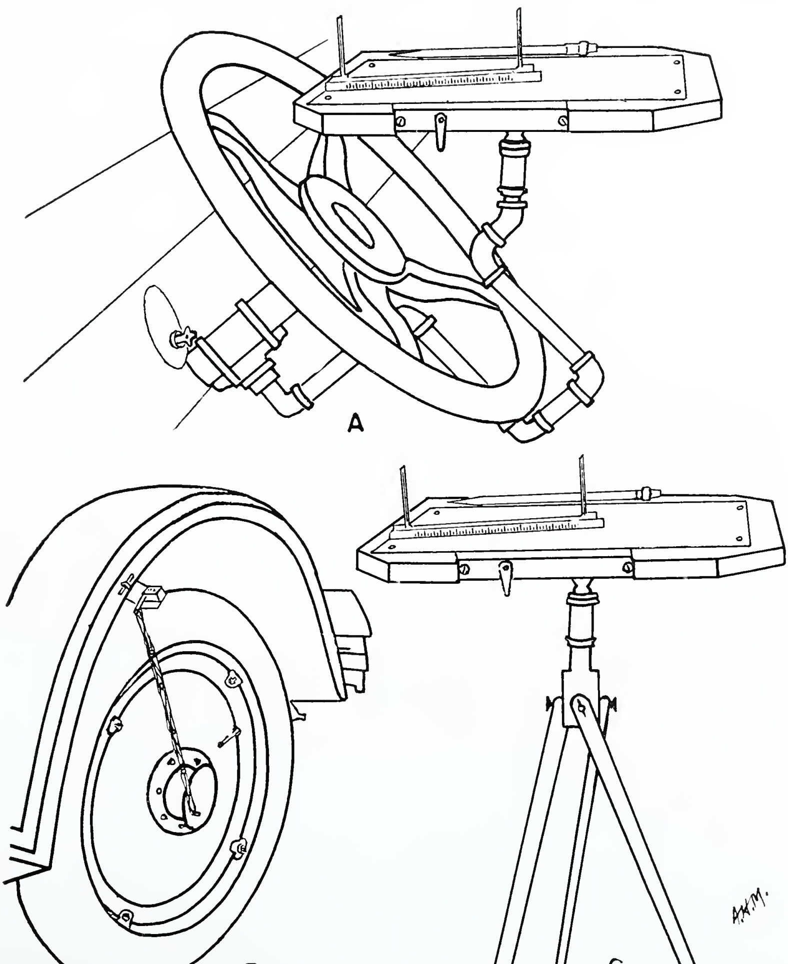

Fig. 1. Equipment for auto- and foot-planetabling.

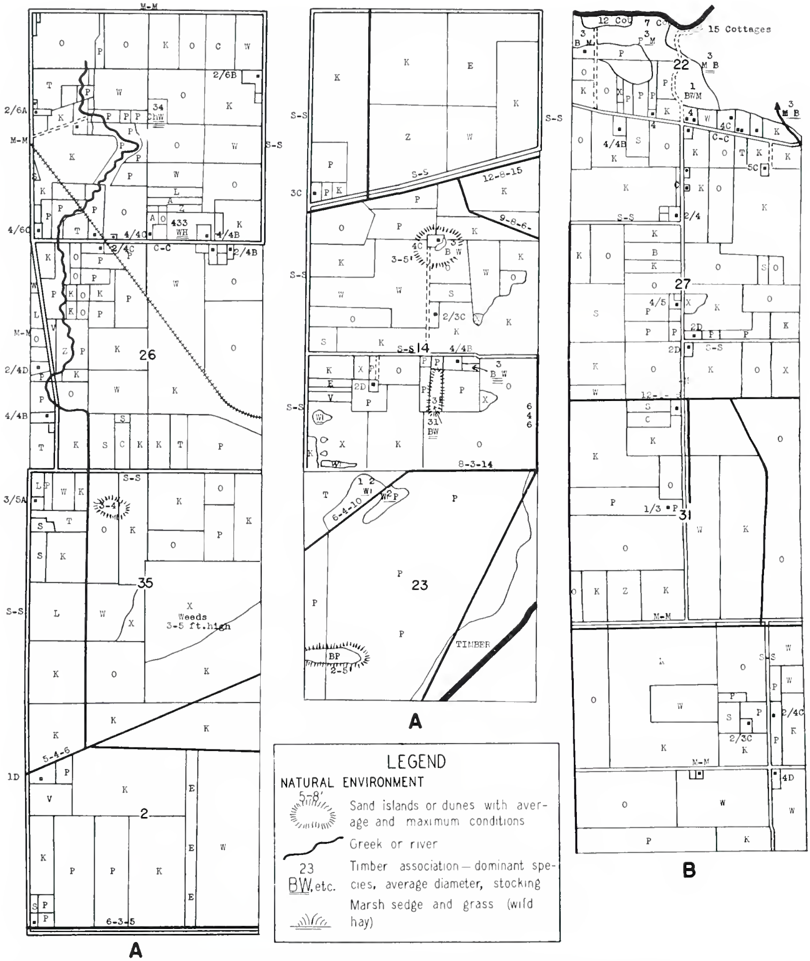

Fig. 2. Representative strip inventories mapped by the combined auto- and foot-planetabling method, showing in A, seven square-mile sections mapped in two days; in B, three and one-half sections completed in six hours.

(Fig. 1, *B*).[1] From this gauge, which registered the number of revolutions of the wheel from one stop to another, the field intervals, however small, could be plotted (8.9 revolutions, in this case, equalling one chain).

The procedure of auto-planetabling is essentially the same as ordinary foot-planetabling.[2] A sheet of mapping paper is affixed to the drawing board. The plane table is then set up, let us say, on a road intersection, sufficiently distant from the car to prevent the compass from being influenced by the car's magnetism. The board is then turned

[1]A speedometer adjustment graduated to give chain readings would, of course, be more convenient.
[2]Consult any surveyor's manual.

so that the compass points north, and a line is drawn along the alidade set in the line of sight of the road or route of travel. The board is now ready to be transferred to the support on the steering column, where it functions in the same way as on a tripod, except that preparatory to sighting a point or a line, instead of depending on the magnetically deflected compass for position, the board is turned into azimuth by placing the alidade on the road line previously drawn on the paper and sighting along the traveled road ahead or behind which serves as a guide in

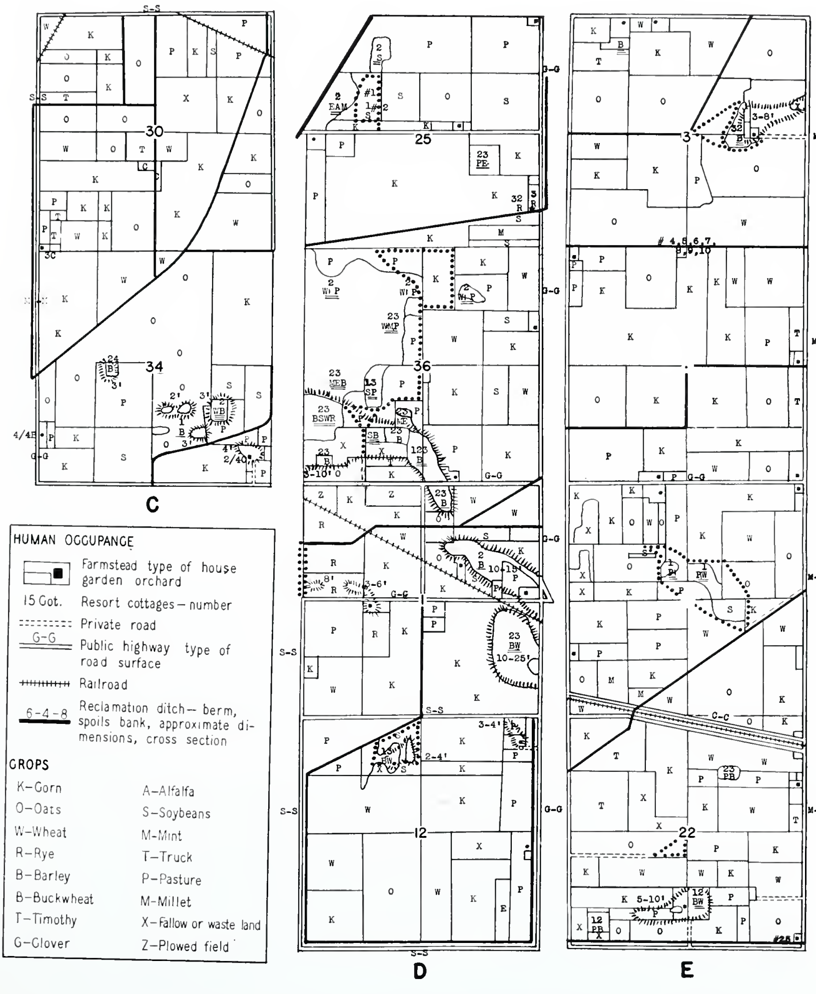

Fig. 3. Strip surveys illustrating the relation of auto- to foot-mapping as regards time and distance traveled. The west half of strip C was mapped in one hour with practically no footwork. Note in D and E the relative distances covered by car (along roads) and by foot (dotted lines); the ratio in D is about 2.5:1; in E, 5:1.

orienting the board.[3] It will be noted that the operation of the car and manipulation of the plane table is a one-man affair.

Having decided to stop at a certain point along the road to take one or several shots, as at a field boundary, we plot our position to scale as determined from the distance gauge, turn our board as outlined above, and then train the alidade on the line or point of the landscape to be charted, using our point of location on the board as a pivot. In addition to drawing in a field boundary directly, indefinite lines are drawn to fence corners or other landscape features readily visible and strategically placed to afford convenient intersections at the next stop and thus to determine the depth of fields or distances of objects without pacing.

In actual practice, where field units conform to regular forty-acre tracts or multiples thereof, few such intersectional lines need to be drawn, the mapper's eye becoming accustomed in time to judge field distances and proportionate dimensions quite accurately, as every geographer well knows. Because of the rapid succession of station stops, auto-planetabling seems particularly conducive to cultivating distance judging. Thus, in a flattish open country with rectangular fields, a strip, as much as a half-mile wide on either side of the road, or even wider, may be mapped without any intersecting lines.

Since much of the efficiency of car mapping depends on the extent of visibility of landscape features, it is highly essential to get the most suitable car for the purpose, one which permits a view in nearly every direction; the phaeton type represents the ideal, but the author got along with his landau sedan quite well. The author also found field glasses very useful, and frequently mounted the hood of his car, thus further extending the range of vision.

But even in a region most favorable to this type of car mapping, over any sizeable area one must expect to encounter conditions or features of one type or another which are so irregular or indistinct, if not altogether invisible, that in order to have contiguous a real inventory it becomes necessary to leave the car and complete the unfinished portion or section on foot. A very crooked boundary may have to be traced; timber may have to be inspected to determine association and stocking; crops hidden behind a ridge may need to be identified, etc. To complete this mapping, the drawing board is lifted off its base and set on the tripod for pedestrial mapping.

Sectional examples of auto-foot mapping

The extent to which the auxiliary auto-planetabling speeds up inventory mapping may best be seen by referring to specific sectional surveys, illustrated in the section-wide strip diagrams in Figures 2 and 3. These show the field, farmstead, and vegetation boundaries of the units mapped, together with other natural and cultural data as appear in the legend. On some of the strip surveys only a time record was kept for the combined auto-foot mapping. In connection with several others—strips *D* and *E* of Figure 3—the route actually traveled on foot to get

[3]The deflection-free compass doubtless would prove to be a convenient auto survey accessory.

at otherwise obscured lines or inaccessible data was plotted, thus revealing the proportionate distances of foot travel to car travel.

Except for the narrow swamp and river-ditch features, details of which were taken from an engineer's map, the seven sections shown in Figure 2, *A* were mapped in two days, despite the temperature's rising as high as 100° and 104° F., respectively.

Strip *B* (Fig. 2), comprising over three and one-half sections, was mapped from one o'clock till dusk, a farmer being consulted for a few crop data. The rectangularity of fields and conveniently aligned roads made pacing almost entirely unnecessary, except along the river swamp where several clusters of resort cottages, connected with the main highway by a winding road, necessitated abandoning the car.

A short time record for exclusive car planetabling is illustrated by strip *C* of Figure 3. The west half of the two sections was completed in about one hour, without getting out of the car.

A more exact impression of the relation of auto- to foot-mapping may be had by consulting strips *D* and *E* of Figure 3, where the actual routes and distances covered by auto and on foot respectively may be compared and associated with conditions in the field. In *D* the total distance traveled on foot, including return to the car, amounted to four and one-half miles, as compared to eleven miles traveled by car. The western half of Section 36, it will be noted, called for considerable footwork on account of the irregular forest and pasture lines unbounded by roads.

The area shown in strip *E* was particularly well adapted to autoplanetabling, requiring only two and three-fourths miles on foot, as compared to fourteen miles by car. One section, No. 10, was exclusively carmapped.

Types of landscape and inventory

The rate of progress inany geographic survey depends much on the conditions of the landscape and the number of details charted or otherwise recorded. A brief description, therefore, of the features of the Kankakee landscape is essential in properly evaluating this type of survey.

Except for sectional sandy, dune-like knobs and ridges, the Kankakee exhibits a markedly flat terrain with an average gradient of about one-third foot per mile from the head of the valley at South Bend, Indiana, to the western extremity of the original marsh at Momence, Illinois; its cross section has a correspondingly low gradient. The dunal islands which are scattered quite regularly through the valley are conspicuous for their elevation above the flattish terrain, a phenomenon accentuated by the farmsteads which characteristically surmount them. These elevated tracts range from a mere mound, barely large enough to accommodate a single farmstead, up to a section or so; they vary in height from a few feet to as much as 30 or 35 feet (commonly 5-10 feet), and are variously shaped, from circular knobs to very sinous ridges (Fig. 4).

At times interfering with the otherwise excellent visibility offered by the flattish terrain, these dune eminences now and then served as useful vantage points to shoot at or from; but their outlines frequently called for extra footwork in order to record the irregular field patterns which they typically produce.

Natural cover conditions in the Kankakee did not constitute a major handicap in mapping. Only in the Swamp rimming the Kankakee River do we find an extended timber stand irregularly bounding fields and pastures. Tree clusters of oak characteristically surmount and accentuate the dunal eminences on the reclaimed marsh prairies.

Geographic inventory included practically every natural and cultural form, excepting soils, which had previously been mapped by federal and state surveys. The various categories of field data charted are shown in the legends of the representative field sheets referred to above (Figs 2 and 3). In addition, notations were made from personal observations and interviews with farmers, together with a detailed record of photographed landscape phenomena. All these are included within the time schedules set forth above.

Summary and Conclusions

Auto-planetabling is a simple and economical form of motorized mapping intended to expedite detailed inventory studies of landscapes. It recommends itself not as a self-sufficient type of survey, but as a convenient and efficient aid to other methods of surveying in speeding up ground coverage.

This method was applied experimentally to the extensive and intensive mapping of the Kankakee region of Northern Indiana and Illinois, in which connection it has demonstrated its time and energy-saving value as compared to the exclusive pedestrial survey. Time records kept on several strip surveys indicate a total of almost twelve square-mile sections completed by the combined auto-foot mapping in three days; a number of sectional surveys show, on an average, that three-fourths of the total distance traveled was by car.

Auto-mapping saves time not only in traveling but also in actual mapping, since the plane table is ready for use the moment the car stops.

While this type of survey is of particular advantage in a prairie country with a well-developed rectangular road pattern, as is exemplified by the Kankakee reclaimed marsh, its advantageous use is not confined to such an area. Even in a region of considerable ruggedness, auto-planetabling may prove advantageous in strip mapping along roads or in reconnaissance surveys, and thus furnish a rapid basis for sampling landscape characteristics so essential in interpreting aerial mosaics.