Range Condition and Soil Site Classification by Helicopter

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IN May 1949 the authors were given an opportunity to use a helicopter on a large-scale mapping job. The Land Management Division, Department of the Army, requested the Soil Conservation Service to prepare a land management plan for their 110,000-acre Firing Center near Yakima, Washington. Before the War the area was made up of several going livestock ranches. Grazing has been considerably restricted since then because the Firing Center is being used for field exercises by Fort Lewis artillery units. The plan was requested with the view of leasing grazing privileges on "safe" areas to individuals who formerly used the area.

Aerial Mapping

Although the range condition classification and the soil conservation survey were made separately and independently, the authors followed the same procedure in the field and office.

Preflight Preparation of Aerials

A set of 4-inch-to-the-mile aerial photos (1945 flight by U. S. Army) was furnished the authors. A flight index map was prepared and mapping portions (center) of the aerials were blocked with match lines.

Mapping in Flight

Aerial photos were arranged in the sequence. The line of flight used in mapping corresponded to the one in which the aerials were originally taken.

Range condition, roads, fences, and stockwater were mapped and located on the range photos. Likewise, soil units, slope, and erosion were mapped on the soil photos. Ground speed averaged around 45 m.p.h. Altitude varied between 25 feet to 500 feet, depending on air currents, topography, and the necessity of getting a closer view of physical and cultural features. The best altitude for mapping is between 100 to 200 feet. The medium, because of its strangeness, made mapping difficult at the outset. Flight position on the aerial photos was frequently lost. When this happened the pilot would obligingly land atop the nearest vantage point until bearings and flight position were regained. A total of 125,000 acres were mapped, 110,000 acres inside the Firing Center plus an additional 15,000 on its periphery. The range information was mapped in 6 hours elapsed flying time, the soils information in 5½ hours. Figure 1 shows the type of helicopter used in the mapping.

Advantages

(a) *The time element*—While the difference between comparative costs is negligible, the savings in technicians time is important. The soil scientists saved 176 man hours and the range specialists 171 man hours. The savings were equivalent to one man month in each specialty field.

(b) When vegetation is seen from 100 to 200 feet altitude, range condition lines are easier to see and map. This presup-

FIG. 1. Type of helicopter used in mapping for range condition classes and soil conservation survey on Yakima Firing Center, Washington.

COMPARATIVE COSTS

A. Range

(1) With helicopter

69 hours of P-3 time @$2.15 per hour	$148.35
10 hours of P-1 time @$1.43 per hour	14.30
6 hours rental of commercial helicopter and pilot (no cost to Service because Army donated use of the same) @ $60.00 per hour	360.00
TOTAL	$522.65

(2) By conventional method

250 hours of P-1, P-2 & P-3 time @ average of $1.79 per hour	$457.50
Pickup, 1500 miles @ $.10 per mile	150.00
TOTAL	$607.50

B. Comparative Cost-Soil Conservation Survey (using same basic wage scale as above)

(1) With helicopter

88 hours of P-3 time @ $2.15 per hour	$189.20
6 hours rental of commercial helicopter (no expense to Service as Army donated same) @ $60.00 per hour	360.00
TOTAL	$549.20

(2) By conventional method

266 hours of P-1, P-2 & P-3 time @ average of $1.79 per hour	$472.56
Car travel 1500 miles @ $.10 per mile	150.00
TOTAL	$622.56

poses, of course, a thorough knowledge of the area and the vegetation. This knowledge can come only after long experience in mapping range condition or soil unit areas.

(c) A better job of mapping can be done on the inaccessible areas where conventional methods require walking or a saddle horse.

(d) Stockwatering places were easier to spot and locate on the aerial photos. None were missed.

(e) Meandering fences that take off across country are easier to locate and map.

(f) Extent of physical circumstances may be more efficiently evaluated and non-essential detail is quickly eliminated.

(g) The ease of mapping was possible because our position of observation was identical to that of the camera that recorded, photographically, the details on the aerials we had in front of us.

Disadvantages

(a) Because of its speed the method can be used only by men who have had considerable experience in mapping range and land characteristics. Even an experienced mapper will require one or two hours in the air before he gets accustomed to the strange environment.

(b) If the land area is cut up by too many fences and small fields, speed of the helicopter becomes a disadvantage because it makes mapping difficult. It becomes necessary for the pilot to "hover" the helicopter or land on top of some nearby point. Hovering is expensive and hard on the pilot.

(c) Soil texture and depth cannot be mapped without frequent landings or by one experienced in mapping associations.

(d) Even under ideal flying conditions, the machine is difficult to handle. The onset of pilot fatigue is more rapid than in conventional aircraft.

(e) Temporary refueling bases have to be set up as near as possible to the area that is going to be surveyed. Maximum time in the air of the two-seated helicopter used was $2\frac{1}{2}$ hours.

(f) An acceptable mapping job can be made only if good aerial photos of recent "vintage" are available.

COMMENTS AND RECOMMENDATIONS

1. Seemingly the physical exertion which is a part of conventional survey methods can be eliminated. Actually the pressure of keeping located and getting all the necessary information on the aerials is so great that the resultant nervous exhaustion is more fatiguing than if conventional survey methods are used. It goes without saying that a man should be in the best of physical condition before going on an aerial mapping mission. The mapper should not be in the air more than $2\frac{1}{2}$ hours during each half day.

2. Helicopter mapping would be of very little practical value in the timbered range country.

3. To be used to the best advantage a man should have a general knowledge of the area to be mapped. The mapper should spend some time on the ground prior to the aerial mapping.

4. The authors recommend the use of 2-inch-to-the-mile aerials covering a greater area than the 4-inch which we used. This might be rather difficult to resolve because each aerial photo is presumably an enlargement of the original negative so that irrespective of scale, the area covered by each individual print would remain the same.

5. The method would be most advantageous only on large scale surveys, in which case more favorable rates than those quoted under comparative costs might be obtained.

6. On a comparative cost basis there doesn't seem to be a great deal of differ-

ence. The factor of time, however, is an important consideration, particularly where there is an immediate need for such information. Since the job has been completed, it has come to our attention that the U. S. Geological Survey used helicopters for topographic mapping in Alaska last summer. We talked with one of the pilots on this assignment and he said that the information gathered last summer would have taken thirty-five years to gather by conventional methods.

Conclusions

The authors were well satisfied with the quality of the mapping job made with the use of an Army helicopter on the Yakima Firing Center. It provided all the information needed to complete a land management plan for the area. With the limitations and qualifications stated, we believe the use of a helicopter will speed up the job of gathering the basic resource information needed to plan and establish conservation programs on large areas of range. It would be particularly valuable in Soil Conservation Districts where group planning procedures make it necessary to have *all* the basic resource information before attempting to develop a land use and conservation program for a specific group or community.

WHAT'S BECOME OF THE NATION'S WATER?

The water table has been dropping in many places throughout the continent during the past few years but this didn't excite anybody except conservationists and scientists. But when New Yorkers were called upon to forego their Friday bath and Sunday shave the whole country heard about it and the Federal government promptly decided to do something. President Truman appointed a temporary Water Resources Policy Commission which will study the water resources and supply of the entire country and report later with recommendations of what to do about it. Morris L. Cooke, an engineer living in Philadelphia and Washington, is the chairman. Other members are Leland Olds, former member of the Federal Power Commission; President R. R. Renne, of Montana State College; Lewis W. Jones, President of the University of Arkansas; Gilbert White, President of Haverford College; Samuel B. Morris, of the Los Angeles Department of Water and Power and Paul S. Burgess, Dean of the College of Agriculture at the University of Arizona.

It is fairly certain that the Commission will recommend (1) the cleaning up of polluted waters; (2) better flood control practices; and (3) replanting denuded areas to retard run-off from rainfall and melting snows.

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