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Paper-CC9 (*Unit-II*)

Cartographic Techniques

Slope Analysis by Henry & Smith Method

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Slope Analysis by Henry & Smith Method

Dr. Supriya

Introduction:

The term 'slope' denotes some small portion of the land surface which is inclined from the horizontal one. It may be scientifically explained as the ratio between the vertical rise and the equivalent horizontal distance on the surface of the earth. Slope is considered one of the most important morphological attributes which helps in studying the surface configuration of the terrain. The flow of running water, the amount of surface run-off, intensity of soil erosion, transportation and deposition are governed by the degree of slope. Therefore, it is regarded as the base of geomorphological map. Since it controls surface materials and weathering processes, it exerts strong influence on the land use. In the hilly terrain the pattern of crop land use and distributional pattern of settlements are governed mostly by the nature of slope. The soil survey of Great Britain considers slope as one of the five basic parameters influencing land use capability classes and the Forestry Commission treats slope as one of the three parameters in terrain evaluation. So the determination of slope and its reproduction requires careful attention and scrutiny.

Although from the very beginning of geomorphological studies, analysis of slope and its categorization have received due attention yet the scientific and systematic quantitative studies could start only in the first quarter of 20th century. Significant contributions on this aspect have been made by Rich (1916), Wentworth (1930), Raisz and Henry (1937), Smith (1938), Wood (1942), Robinson (1948), King (1949), Calef (1950), Strahler (1956), Monkhouse and Wilkinson (1964), Young (1972), Gerrard (1987) etc.

Methods of Slope determination: A contour map gives a good indication of slope on an areal basis suitable for most purposes but there may be some accession when it is necessary to draw attention to particular grades of slope and there are various methods by which this can be achieved. One method of producing a slope map is to divide the area concerned, which may be quite extensive, into a number of squares by using a grid; the difference in height between the highest and lowest Points in each square is noted in the centre of the square, and isopleths, joining points of equal relative relief, are then drawn. The division can then be shaded appropriately.

Slope is an important element of the landscape which deserves close observation. It is a measure of the rate of ascent or descent per unit horizontal distance (gradient) expressed in degrees. There are two schools of thought regarding the sequential evolution of slope, namely the 'Uniformitarian' or 'Praralled retreat' lead by lester king (1967) and 'climatic control' followed by Davis, W.M. (1909). Like absolute and relative relief, information regarding slope can be obtained from the contour map; it can also be determined by field measurements. This technique for calculation of slope was put forth as early as 1890 by Finsterwalder, who invented the following formula.

$$\text{Average Slope (in degree)} = \frac{\text{Average length of contours} * \text{Contour Interval}}{\text{Total Area}}$$

This method is very laborious and its use is considered limited to maps with a few widely spaced contours. It however, opened the way for J.L. Rich (1916), G.H. Smith (1935; 1938), C.K. Wentworth (1930), E. Raisz and Henry (1956), A.A. Miller & C.H. Summerson (1960) and R.J. Eyles (1965), who put forth new ideas that gave new dimensions to slope studies. Some of the popular method of average slope determination will be discussed in present topic and its Sub topics.

1. G.H Smith's Relative Relief method of Average Slope determination
2. C. K Wentworth's method of Average Slope determination
3. Slope Category Method of Raisz and Henry

1. Smiths' Relative Relief Method: Guy Harold Smith first gave his idea about slope analysis in 1935. He demonstrated his method by calculating relative relief (From difference of highest and lowest heights of relief in the 5 by 5 minute sheet.) and represented in a map of Ohio in Geographical review, Volume 15 in 1935 (see fig 1.a).

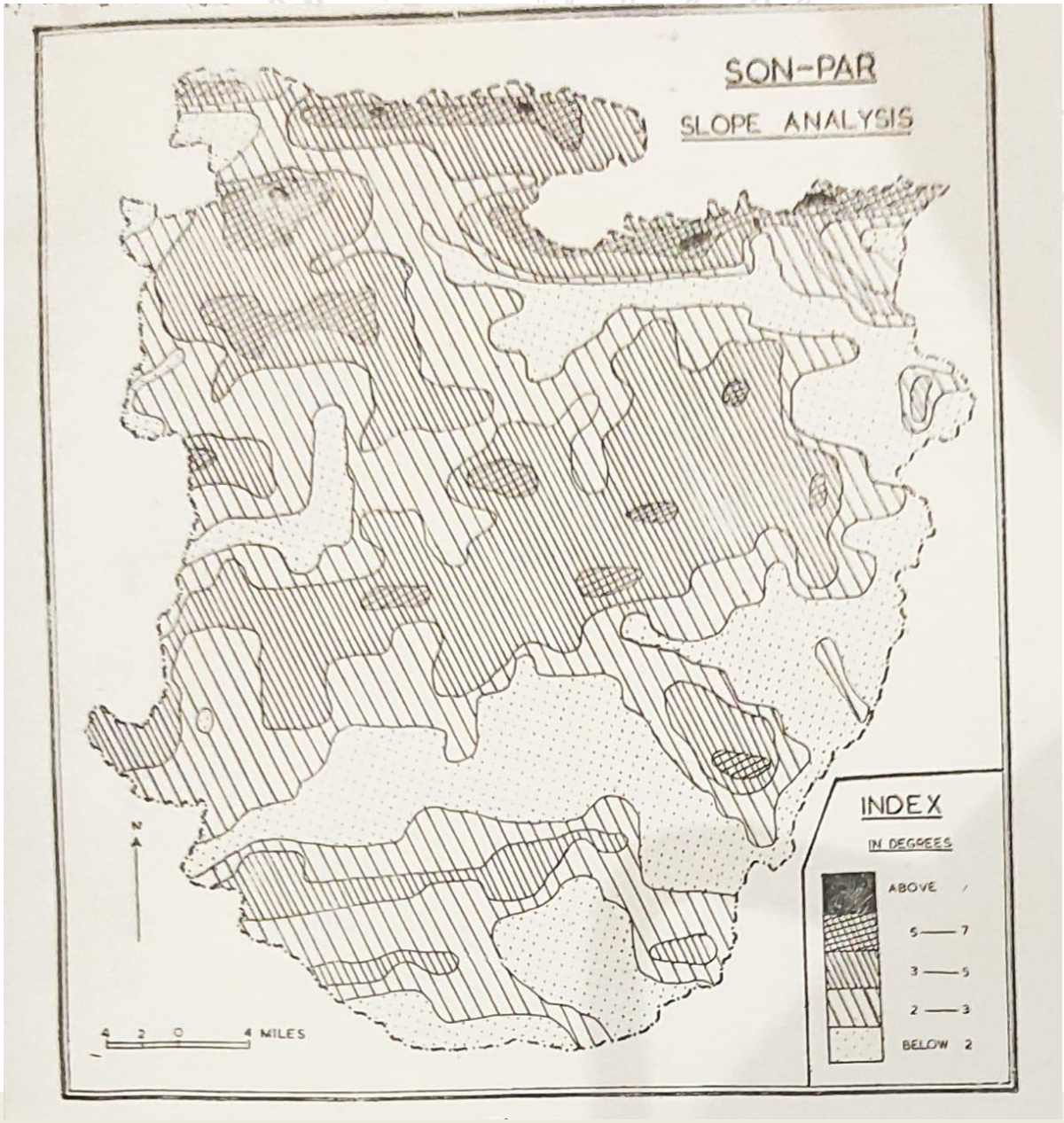


Fig. no. 1

Steps of slope analysis by Smith:

1. In this method the topographic sheet is divided into rectangles of five minutes of latitude and longitude.

2. In each rectangle the difference between lowest and highest elevation and amount and plotted on a smaller scale base map(on Paper).

3. Isopleths are drawn for each 100 ft., of relative relief by joining places of even differences.

4. At last variation of slope represented by appropriate tinting according to the range of elevation (Highest elevation-deep Moderate- semi deep and lowest will be lighter and so on.)

Pros: His method is good in maturely dissected plateaus and planes with horizontal rock structure;

Cons: It does not give satisfactory result in geologically and physiographically Complex region.

Example 1: Prepare a relative relief map of the area indicated in the given contour map

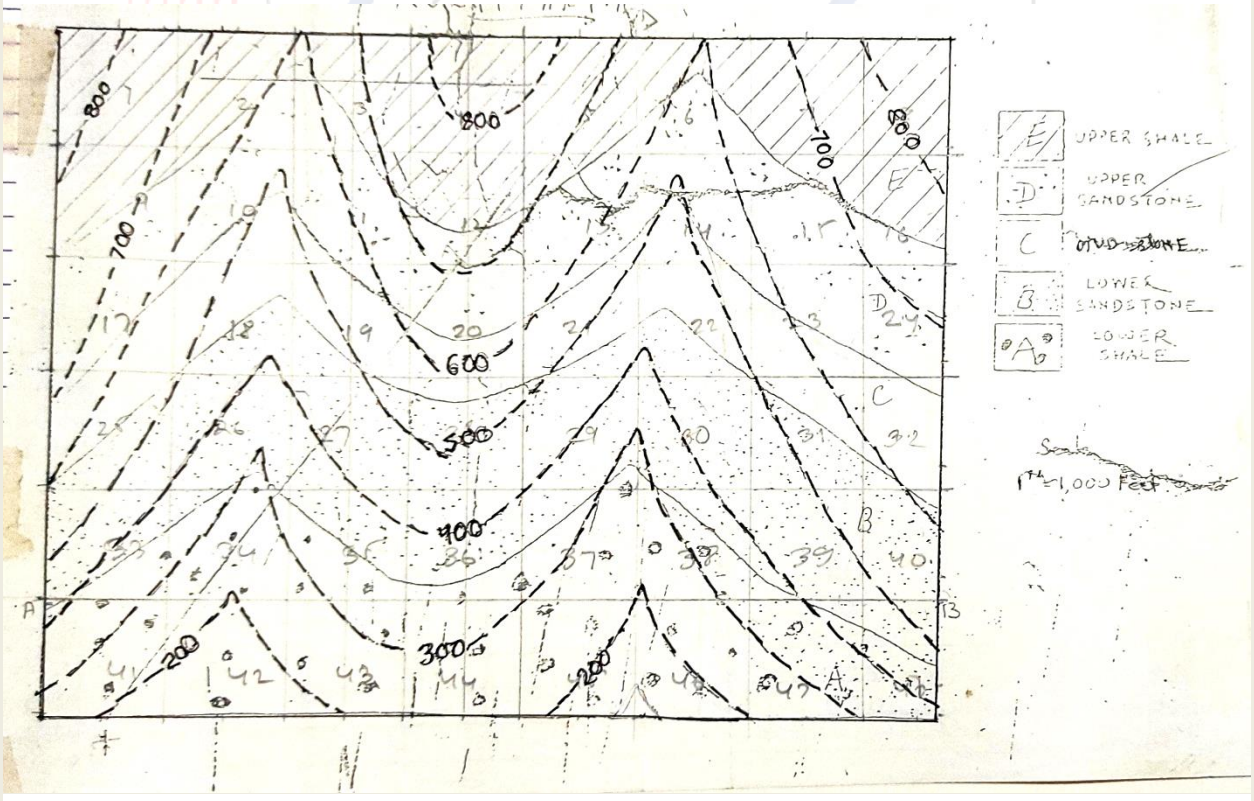


Fig. no. 2

Solution:

- ***Make grid of on the given contour map.***
- ***Put identification number like 1, 2, 3…….48.***
- ***Prepare a table of maximum and minimum elevation and their relative difference (see table 1.1)***
- ***Classify the range according to differences found in elevation.***
- ***Prepare same grid map in a drawing sheet and interpolate the relative difference in centre of each grid.***
- ***Draw isometric lines according to classified range and tint them with different shades with specific weighted shadings representing high, moderate, low, very low elevation in prepared slope map. (See fig. no.3)***

Table 1.1

Sl.no	*Maximum height (in meter)*	*Minimum Height (in meter)*	*Relative relief (in meter)*
1	*850*	*650*	*1g00*
2	*725*	*550*	*175*
3	*750*	*550*	*200*
4	*900*	*775*	*125*
5	*825*	*625*	*200*
6	*650*	*550*	*100*
7	*800*	*650*	*150*
8	*850*	*750*	*100*
9	*825*	*600*	*225*
10	*675*	*450*	*225*
11	*725*	*575*	*150*
12	*775*	*675*	*100*
13	*725*	*500*	*225*
14	*650*	*475*	*185*
15	*750*	*625*	*125*
16	*810*	*690*	*100*
17	*750*	*510*	*240*
18	*550*	*390*	*160*
19	*675*	*410*	*265*
20	*710*	*590*	*120*
21	*675*	*675*	*285*

22	*575*	*390*	*185*
23	*700*	*500*	*200*
24	*750*	*625*	*135*
25	*710*	*400*	*310*
26	*510*	*290*	*220*
27	*550*	*325*	*225*
28	*590*	*450*	*140*
29	*525*	*275*	*250*
30	*500*	*275*	*225*
31	*625*	*425*	*200*
32	*650*	*550*	*100*
33	*600*	*290*	*310*
34	*400*	*195*	*205*
35	*450*	*250*	*200*
36	*450*	*350*	*100*
37	*400*	*200*	*200*
38	*450*	*200*	*250*
39	*550*	*325*	*225*
40	*625*	*475*	*150*
41	*450*	*150*	*300*
42	*250*	*150*	*100*
43	*350*	*175*	*175*
44	*350*	*225*	*75*
45	*300*	*150*	*150*
46	*325*	*125*	*200*
47	*475*	*200*	*275*
48	*550*	*330*	*250*

Source: self computed

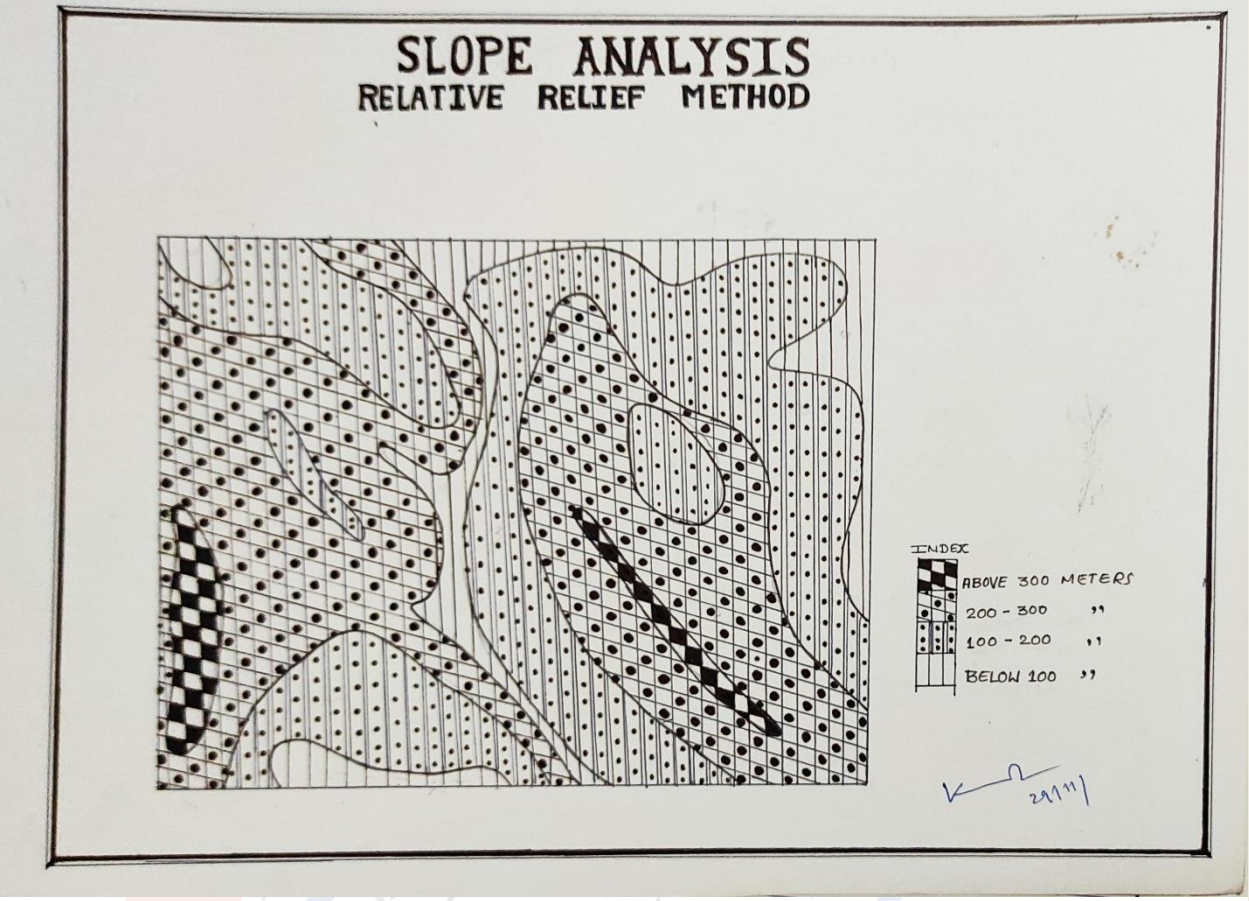
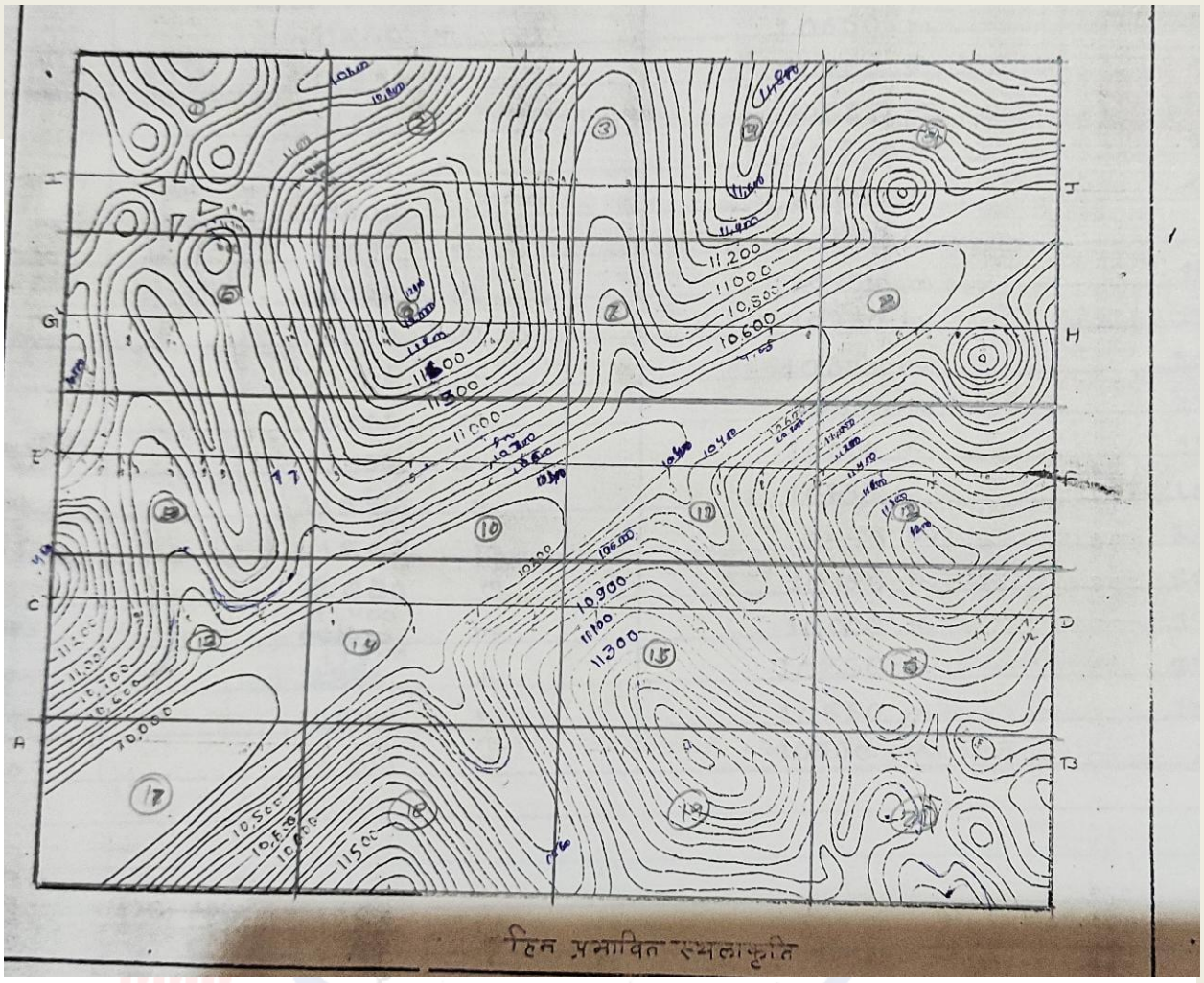


Fig. no. 3

Exercise for Practice:

Example 2: Prepare a relative relief map of the area indicated in the given contour map.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