Geomorphological Field Manual

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Geomorphological Field Manual

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Introduction

This book is not a text on geomorphological techniques. It is intended as a field handbook to be used during the conduct of geomorphological research. Its prime purpose is to act as an *aide memoire* containing information essential for efficient fieldwork. One fundamental assumption made in compiling this manual is that the user is familiar with at least the essentials of the techniques that he proposes to employ. However, where possible sufficient information has been included to refresh the user's memory on the basics of the various techniques. For fuller discussions on the relative merits of a wide range of geomorphological techniques and for further references on them, the user should consult appropriate texts such as Goudie (1981) or the series of technical bulletins produced by the British Geomorphological Research Group.

One of the stimuli that led us to the preparation of this manual was our realisation that, prior to any period of fieldwork, considerable effort was being repeatedly expended in collecting together the materials required in the form of mapping symbols, keys, tables, graphs and so on. Ever present were the risks that a crucial item would be omitted and that, in preparing for closely defined and specific tasks, opportunities would arise that were unforeseen at the time of planning and which therefore could not be capitalised upon. A second stimulus was a feeling that a greater degree of standardisation in recording field information would be beneficial.

The book was initially envisaged as a compilation of material designed to cater for our own personal requirements, but has been extended in order to cover as full a range of geomorphological activities as possible. However, in order to keep it an 'anorak pocket' book, much has, of necessity, been omitted.

Substantial parts of this manual are concerned with quantitative relationships, and therefore formulae are included where appropriate. It is assumed that the user normally has access to a scientific calculator. However, not all calculators are readily capable of computing things such as fractional exponents; the means to accomplish such tasks are included where appropriate. Some nomograms are also included for three further reasons. First, the user may be reluctant to take the calculator into the field; secondly, calculator malfunctions are not entirely unknown; and thirdly, some computations are rather cumbersome and require repeated solution. This is more readily achieved with a simple nomogram than with a non-programmable calculator. It must be noted that such nomograms give only approximate solutions and should be used only for preliminary interpretation and not for final analysis.

Some preliminary analysis of data after or during a day's fieldwork is often necessary in order to plan further fieldwork. Tables of constants, typical values of parameters and some relationships are included to facilitate this. Since much equipment still employs non-SI units, conversions between common units are also given. All formulae have been recast to employ SI units where this was necessary and acceptable. The value of the standard acceleration due to gravity (g) has been taken throughout to be 9.80665 m s^{-2}, and is not given for each individual occurrence.

Specifically excluded from the manual are information on laboratory testing and analysis and advice on the choice and purchase of equipment. Both of these topics are considered in Goudie (1981). Mathematical and statistical tables have also been excluded but the user should have access to appropriate tables, particularly if he does not have access to a calculator.

The structure of the manual follows that of Goudie's (1981) text as far as possible in order to facilitate cross referencing. This does, however, mean that some related items occur widely separated in this text – but they are appropriately cross referenced. Chapters 1–3 deal with the depiction and measurement of landform. The next three chapters deal with the exploration, mapping, recording and classification of landform materials. Chapters 7–11 cover fieldwork concerned with the principal geomorphological processes. Sampling is covered in Chapter 12. Finally, miscellaneous information on such diverse topics as photography, first aid and units of measurement is given in Chapter 13.

1 Topographic survey

This chapter contains materials for determining altitude and differences in elevation only. The user who is concerned primarily with the determination of slope angles should refer to Chapter 3. Most mapping tasks undertaken by the geomorphologist can be resolved into two aspects: first, the provision of a number of fixed points in plan; secondly, the addition of altitudinal information. The former task is essentially a problem in plane geometry and the simple trigonometric relations that may be required to solve such problems can be found in Chapter 13; the latter task is covered in this chapter.

Section 1.1 covers the conversion of apparent slant distances and angles of elevation or declination to a true horizontal distance and an altitude difference. The angles of elevation may be determined by theodolite or inclinometer, and the slant distance may be measured tacheometrically or directly by tape or chain. Section 1.2 contains details of some means of correction for temperature variation in barometric surveying. Finally, Table 1.3 gives a simple guide to map scales and mapping resolution.

1.1 Conversion of apparent slant distances to true horizontal and vertical distances

Tables 1.1 and 1.2 may be used to convert apparent slant distances to true horizontal distance and vertical height difference (Fig. 1.1). Table 1.1 sets out values of 100 $\cos^2 \theta$ for use in the formula

$$AC = 100pq \cos^2 \theta$$

Table 1.1 True horizontal distance from stadia intercepts.

Angle		*Apparent slant range*								
°	′	*100*	*200*	*300*	*400*	*500*	*600*	*700*	*800*	*900*
0	0	100.00	200.00	300.00	400.00	500.00	600.00	700.00	800.00	900.00
0	20	100.00	199.99	299.99	399.99	499.98	599.98	699.98	799.97	899.97
0	40	99.99	199.97	299.96	399.95	499.93	599.92	699.91	799.89	899.88
1	0	99.97	199.94	299.91	399.88	499.85	599.82	699.79	799.76	899.73
1	20	99.95	199.89	299.84	399.78	499.73	599.68	699.62	799.57	899.51
1	40	99.92	199.83	299.75	399.66	499.58	599.49	699.41	799.32	899.24
2	0	99.88	199.76	299.63	399.51	499.39	599.27	699.15	799.03	898.90
2	20	99.83	199.67	299.50	399.34	499.17	599.01	698.84	798.67	898.51
2	40	99.78	199.57	299.35	399.13	498.92	598.70	698.48	798.27	898.05
3	0	99.73	199.45	299.18	398.90	498.63	598.36	698.08	797.81	897.53

Table 1.1 – *continued.*

Angle		Apparent slant range								
°	′	100	200	300	400	500	600	700	800	900
3	20	99.66	199.32	298.99	398.65	498.31	597.97	697.63	797.30	896.96
3	40	99.59	199.18	298.77	398.36	497.96	597.55	697.14	796.73	896.32
4	0	99.51	199.03	298.54	398.05	497.57	597.08	696.59	796.11	895.62
4	20	99.43	198.86	298.29	397.72	497.15	596.57	696.00	795.43	894.86
4	40	99.34	198.68	298.01	397.35	496.69	596.03	695.37	794.70	894.04
5	0	99.24	198.48	297.72	396.96	496.20	595.44	694.68	793.92	893.16
5	20	99.14	198.27	297.41	396.54	495.68	594.82	693.95	793.09	892.22
5	40	99.03	198.05	297.08	396.10	495.13	594.15	693.18	792.20	891.23
6	0	98.91	197.81	296.72	395.63	494.54	593.44	692.35	791.26	890.17
6	20	98.78	197.57	296.35	395.13	493.92	592.70	691.48	790.26	889.05
6	40	98.65	197.30	295.96	394.61	493.26	591.91	690.57	789.22	887.87
7	0	98.51	197.03	295.54	394.06	492.57	591.09	689.60	788.12	886.63
7	20	98.37	196.74	295.11	393.48	491.85	590.22	688.60	786.97	885.34
7	40	98.22	196.44	294.66	392.88	491.10	589.32	687.54	785.76	883.98
8	0	98.06	196.13	294.19	392.25	490.32	588.38	686.44	784.50	882.57
8	20	97.90	195.80	293.70	391.60	489.50	587.40	685.30	783.20	881.10
8	40	97.73	195.46	293.19	390.92	488.65	586.38	684.11	781.84	879.56
9	0	97.55	195.11	292.66	390.21	487.76	585.32	682.87	780.42	877.98
9	20	97.37	194.74	292.11	389.48	486.85	584.22	681.59	778.96	876.33
9	40	97.18	194.36	291.54	388.72	485.90	583.08	680.26	777.44	874.62
10	0	96.98	193.97	290.95	387.94	484.92	581.91	678.89	775.88	872.86
10	20	96.78	193.56	290.35	387.13	483.91	580.69	677.48	774.26	871.04
10	40	96.57	193.15	289.72	386.30	482.87	579.44	676.02	772.59	869.17
11	0	96.36	192.72	289.08	385.44	481.80	578.16	674.51	770.87	867.23
11	20	96.14	192.28	288.41	384.55	480.69	576.83	672.97	769.10	865.24
11	40	95.91	191.82	287.73	383.64	479.55	575.46	671.38	767.29	863.20
12	0	95.68	191.35	287.03	382.71	478.39	574.06	669.74	765.42	861.10
12	20	95.44	190.88	286.31	381.75	477.19	572.63	668.06	763.50	858.94
12	40	95.19	190.38	285.58	380.77	475.96	571.15	666.34	761.53	856.73
13	0	94.94	189.88	284.82	379.76	474.70	569.64	664.58	759.52	854.46
13	20	94.68	189.36	284.04	378.73	473.41	568.09	662.77	757.45	852.13
13	40	94.42	188.84	283.25	377.67	472.09	566.51	660.92	755.34	849.76
14	0	94.15	188.29	282.44	376.59	470.74	564.88	659.03	753.18	847.33
14	20	93.87	187.74	281.61	375.49	469.36	563.23	657.10	750.97	844.84
14	40	93.59	187.18	280.77	374.36	467.95	561.54	655.12	748.71	842.30
15	0	93.30	186.60	279.90	373.21	466.51	559.81	653.11	746.41	839.71
15	20	93.01	186.01	279.02	372.03	465.04	558.04	651.05	744.06	837.07
15	40	92.71	185.42	278.12	370.83	463.54	556.25	648.95	741.66	834.37
16	0	92.40	184.80	277.21	369.61	462.01	554.41	646.82	739.22	831.62
16	20	92.09	184.18	276.27	368.36	460.46	552.55	644.64	736.73	828.82
16	40	91.77	183.55	275.32	367.10	458.87	550.65	642.42	734.20	825.97
17	0	91.45	182.90	274.36	365.81	457.26	548.71	640.16	731.62	823.07
17	20	91.12	182.25	273.37	364.50	455.62	546.74	637.87	728.99	820.11
17	40	90.79	181.58	272.37	363.16	453.95	544.74	635.53	726.32	817.11
18	0	90.45	180.90	271.35	361.80	452.25	542.71	633.16	723.61	814.06
18	20	90.11	180.21	270.32	360.42	450.53	540.64	630.74	720.85	810.96
18	40	89.76	179.51	269.27	359.02	448.78	538.54	628.29	718.05	807.80
19	0	89.40	178.80	268.20	357.60	447.00	536.40	625.80	715.20	804.60
19	20	89.04	178.08	267.12	356.16	445.20	534.24	623.28	712.32	801.36
19	40	88.67	177.35	266.02	354.69	443.37	532.04	620.72	709.39	798.06
20	0	88.30	176.60	264.91	353.21	441.51	529.81	618.12	706.42	794.72
20	20	87.93	175.85	263.78	351.70	439.63	527.55	615.48	703.41	791.33
20	40	87.54	175.09	262.63	350.18	437.72	525.26	612.81	700.35	787.90
21	0	87.16	174.31	261.47	348.63	435.79	522.94	610.10	697.26	784.42
21	20	86.77	173.53	260.30	347.06	433.83	520.59	607.36	694.12	780.89
21	40	86.37	172.74	259.11	345.47	431.84	518.21	604.58	690.95	777.32
22	0	85.97	171.93	257.90	343.87	429.83	515.80	601.77	687.74	773.70
22	20	85.56	171.12	256.68	342.24	427.80	513.36	598.92	684.48	770.04
22	40	85.15	170.30	255.45	340.60	425.75	510.89	596.04	681.19	766.34
23	0	84.73	169.47	254.20	338.93	423.66	508.40	593.13	677.86	762.60