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A Format for Field Soil Records for Computer-Based Data Management System

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Introduction

We are trying to set up a soil information system which allows rapid retrieval of soil data stored in various forms, e.g., field soil records, analytical data, soil maps, etc. The establishment of this system requires the provision of several modules, one of which, a format standardized for field soil records and easily transposable to a computer-compatible form is described herein. This format has been revised through experience gained mainly in west Japan.

A standardized format has to meet ends which are self-conflicting. It should provide items and terms which can convey the framework which the survey planner has in mind, and thus tends to fix and confine the framework of surveyors' observation. On the other hand, the surveyor's standpoint should be free and flexible when handling a very complicated matter like a soil. Is it then useful to follow a standardized format? The answer is "Yes." From detailed descriptions of soils found in various landscapes, a soil surveyor can gain a picture of the intricate interactions among soil formers. But he has to recollect and integrate all the soil individuals in order to draw a soil distribution pattern; and he has to analyse and simplify all the variations of soils into a few governing factors in order to extract substantial soil units. These processes have hitherto often been hampered by several factors, the most important of which in practice is the surveyor's inability to memorize all the details of the individual soil in relation to the site of the soil. It has been necessary, therefore, to cut off the trivial details at appropriate levels of soil recognition. This confinement also applies in data processing by manual procedures. The use of a computer as a data stocker and processor can release this confinement to a large extent. Large amount of data can be stocked effectively for the recognition of soils, provided that the observed items reflect the substantial soil conditions and the terms are stated with clear limits. The possibility of grasping all the details that fall within the scope of the field soil survey will allow a reappraisal of soil maps, soil units used therein and concurrent theories on soil genesis and distribution pattern.

We are aiming, then, to establish a common data bank in which presently available soil data is collected, to which further data can be deposited, and from which anybody can retrieve whatever data he needs. This is the background to our trial.

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I Requisites for Data Recording

The field soil records consist of site and soil profile records. These records should be stored in a computer-based data bank. The requisites for data recording are that these be recorded in a standardized and coded form in the field, that the coded cards be easy to read for later manual sorting, and that they should have enough space for free remarks.

The first requirement is to reduce the laborious task of recoding the uncoded records. To meet this, Hazelden *et al.* (1976) proposed a proforma compatible with 80-column punch cards. They take almost all field soil records in coded form in the field using an aide-memoire. In our experience, however, this method evidently reduces the efficiency of the field survey, because we have to search for a code number for a particular property from among many. In addition it is not very easy to read the survey card unless these many codes are completely memorized. The tick box method proposed by Lee *et al.* (1976) was easier to handle, since all possible terms were given on the card. The disadvantage of their method, however, is that little space is available for free or additional remarks. This format, therefore, cannot accommodate uncoded records, such as are often encountered in soil surveys in different localities from those for which the manual and the format were primarily designed.

After several trials, we concluded that the format should meet the following requirements: 1) the code number for properties should appear on the card to facilitate recording and reading; 2) properties like horizon names, color, texture, cutan nature, and mottle, etc., which are indexing characteristics for soils, should be written in uncoded form; 3) the columns allocated for each horizon should be kept blank in order to give enough space for additional remarks and for non-standardized uses; and 4) site file and profile description file should be cross-referenced through common indices.

II A Format for Field Soil Records

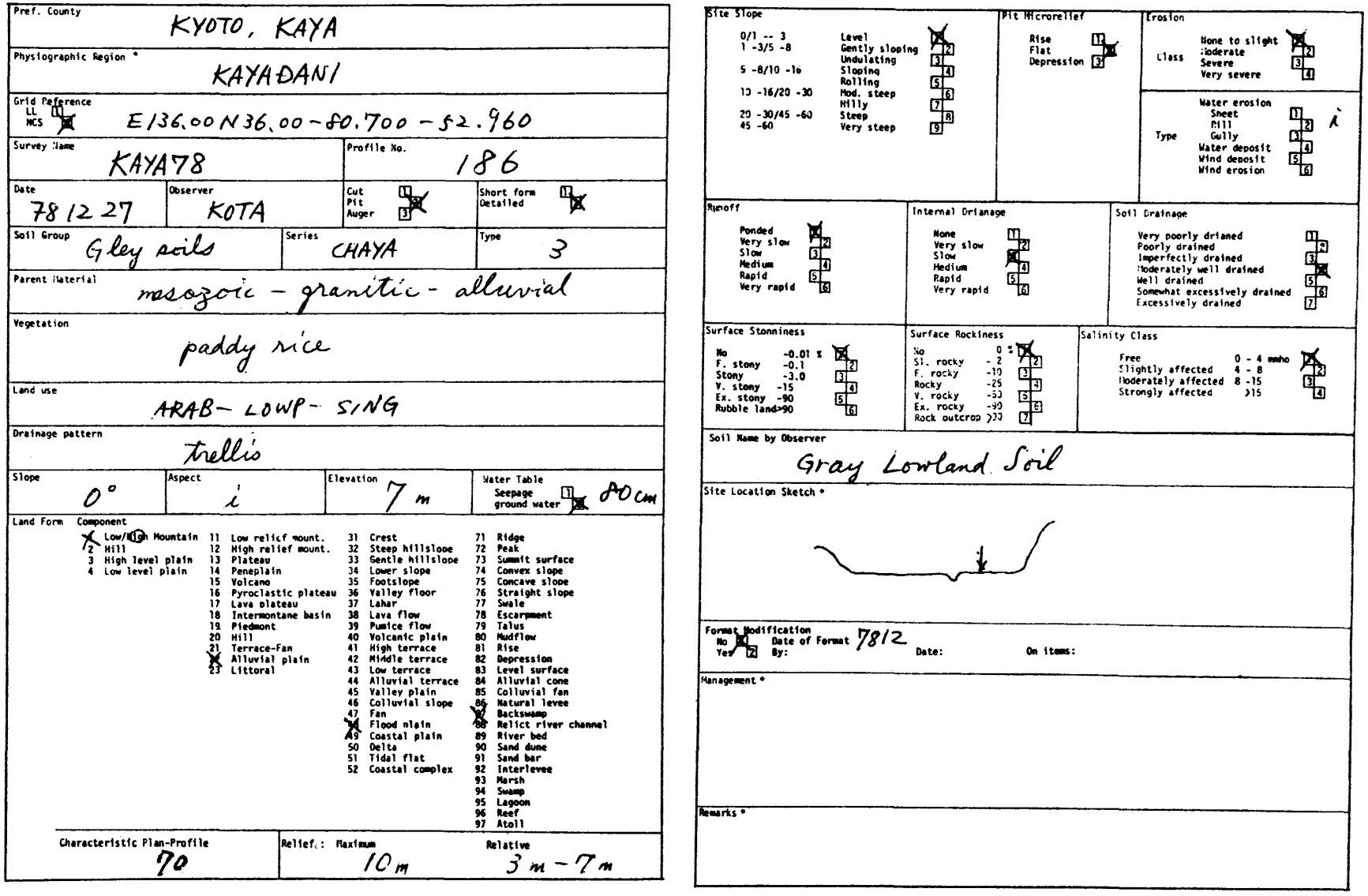
The final version of the format is shown in Fig.1. It is printed on A4 sized card, and uses both sides; one for the site and the other for the profile description.

Code numbers are given on the card; we can easily choose appropriate ones. Some items, however, are recorded in uncoded forms; survey name, parent material, horizon name, soil color, etc. If needed, for example, for data analysis, uncoded records can be easily coded by use of a subroutine program. Some codes are based on actual measurements; slope (degree), aspect, elevation(m), cone penetration (mm, kg cm^{-2}), etc.

Codes are needed for missing records and irrelevant items. For coding the missing records, 999 and blank are used for items in digit form and letter form, respectively. Irrelevant items are coded by 0 (zero) and i in a similar sense.

A soil profile is refered to the soil number consisting of survey name and profile number.

The location of observation site is digitized using a grid-type digitizer, and punched out on the site card or written on the site file tape, which can be cross-referenced with profile description file through indexing by the grid reference and the soil number.



Pref. County: KYOTO, KAYA

Physiographic Region *: KAYADANI

Grid Reference: LL [1] MCS [X] E136.00 N36.00 -80.700 -52.960

Survey Name: KAYA78 | Profile No.: 186

Date: 78 12 27 | Observer: KOTA | Cut [1] Pit [X] Auger [3] | Short form [1] Detailed [X]

Soil Group: Gley soils | Series: CHAYA | Type: 3

Parent Material: mesozoic - granitic - alluvial

Vegetation: paddy rice

Land use: ARAB- LOWP- SING

Drainage pattern: trellis

Slope: 0° | Aspect: i | Elevation: 7 m | Water Table: Seepage [1] ground water [X] 40cm

Land Form Component

X Low/(1)gh Mountain	11 Low relief mount.	31 Crest	71 Ridge
2 Hill	12 High relief mount.	32 Steep hillslope	72 Peak
3 High level plain	13 Plateau	33 Gentle hillslope	73 Summit surface
4 Low level plain	14 Peneplain	34 Lower slope	74 Convex slope
	15 Volcano	35 Footslope	75 Concave slope
	16 Pyroclastic plateau	36 Valley floor	76 Straight slope
	17 Lava plateau	37 Lahar	77 Swale
	18 Intermontane basin	38 Lava flow	78 Escarpment
	19 Piedmont	39 Pumice flow	79 Talus
	20 Hill	40 Volcanic plain	80 Mudflow
	21 Terrace-Fan	41 High terrace	81 Rise
	X Alluvial plain	42 Middle terrace	82 Depression
	23 Littoral	43 Low terrace	83 Level surface
		44 Alluvial terrace	84 Alluvial cone
		45 Valley plain	85 Colluvial fan
		46 Colluvial slope	86 Natural levee
		47 Fan	X Backswamp
		X Flood plain	88 Relict river channel
		49 Coastal plain	89 River bed
		50 Delta	90 Sand dune
		51 Tidal flat	91 Sand bar
		52 Coastal complex	92 Interlevee
			93 Marsh
			94 Swamp
			95 Lagoon
			96 Reef
			97 Atoll

Characteristic Plan-Profile: 70 | Relief: Maximum 10 m | Relative 3 m - 7 m

Site Slope: 0/1 -- 3 Level; 1 -3/5 -8 Gently sloping; 5 -8/10 -16 Undulating; 10 -16/20 -30 Sloping; 20 -30/45 -60 Rolling; 45 -60 Mod. steep; Hilly; Steep; Very steep

Pit Microrelief: Rise [1] Flat [2] Depression [X]

Erosion: Class: None to slight [X] :loderate [2] Severe [3] Very severe [4]

Type: Water erosion: Sheet [1] Rill [2] Gully [3] Water deposit [4] Wind deposit [5] Wind erosion [6]

Runoff: Ponded [X] Very slow [2] Slow [3] Medium [4] Rapid [5] Very rapid [6]

Internal Drainage: None [1] Very slow [2] Slow [X] Medium [4] Rapid [5] Very rapid [6]

Soil Drainage: Very poorly drained [1] Poorly drained [2] Imperfectly drained [3] :loderately well drained [X] Well drained [5] Somewhat excessively drained [6] Excessively drained [7]

Surface Stoniness: No -0.01 % [X] F. stony -0.1 [2] Stony -3.0 [3] V. stony -15 [4] Ex. stony -90 [5] Rubble land>90 [6]

Surface Rockiness: No 0 % [X] Sl. rocky - 2 [2] F. rocky -10 [3] Rocky -25 [4] V. rocky -50 [5] Ex. rocky -90 [6] Rock outcrop >90 [7]

Salinity Class: Free 0 - 4 mmho [X] Slightly affected 4 - 8 [2] :loderately affected 8 -15 [3] Strongly affected >15 [4]

Soil Name by Observer: Gray Lowland Soil

Site Location Sketch *

Format Modification: No [X] Yes [2] Date of Format 7812 By: Date: On items:

Management *

Remarks *

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Fig. 1 An Example of the Completed Format. Site Description.

Pref. County * KYOTO, KAYA | Survey KAYA 78 | Profile No. 186

		1	2	3	4
HORIZON NO.		1	2	3	4
HORIZON NAME		A1 6Op	A12 9O	BGo	CGo
THICKNESS cm		15	9	14	28
BLEACHING	1 2 3 4 5 6	1	1	1	1
ACCUMULATION	Material	i	i	Fe	i
	Class 1 2 3 4 5	1	1	2	1
BOUNDARY / Topogra.	Contrast: 1 abrupt-2cm 2 clear -5 3 gradual-12 4 diffuse>12	1/1	1/1	2/1	
	Topogra.: 1 smooth 2 wavy 3 irregular 4 broken				
COLOR	Matrix	2.5Y 4/1	5Y 5/1	5Y 5/1	10Y 4/1
	Crushed	〃	〃	〃	〃
MOISTURE	1 dry 2 moist 3 wet 4 v. wet 5 x. wet	4	3	3	3
TEXTURE		CL	CL	LiC	LiC
MOTTLE / CUTAN	Abundance: 1 none 2 few -5% 3 com. -10 4 many -30 5 abundant 30	2/1	4/1	4/1	3/1
	Abundance: 1 none 2 patchy 3 broken 4 continuous				
	Contrast /Surface: 1 faint 2 distinct 3 prominent	1/0	3/0	2/0	2/0
	Contrast /Surface: 1 grain 2 ped 3 void				
	Size/Thickness: 1 fine 2 medium 3 coarse	i/0	2/0	2/0	1/0
	Size/Thickness: 1 thin 2 moderate 3 thick				
	M. Color	10YR 5/6	7.5YR 5/8	10YR 5/6	10YR 5/6
	C. Color	i	i	i	i
	M. Shape	SPOT	FILM	TUBE	TUBE
	C. Nature	i	i	i	i
O.M.	Content: 1 low -2 % 2 medium -5 3 high -10 4 v. high -20 % 5 x. high >20	2	1	1	1
	Form/Decomposition	i	i	i	i
STONE D/S	Abundance: 1 none 2 few -5 % 3 common -10 4 many -30 % 5 abundant-50 6 dominant>50	2	2	2	1
	Size: 1 gravel -6mm 2 s. pebble-25 3 pebble -64 4 cobble -256mm 5 boulder>256	1	1	1	0
	Weather-ing: 1 none 2 slightly 3 moderate 4 strongly	2	2	2	0
	Shape	SA	SA	SA	i
	Type	Gr	Gr	Gr	i

Soil Group * | Land Use * | Grid Reference

MINERAL	Abundance 1 2 3 4	2	2	2	2
	Type	MFQ	MFQ	MFQ	FMQ
FERROUS	Class 1 2 3 4	1	1	1	1
COMPACT-NESS	1 loose 2 penetrable 3 deep f. p. 4 shallow f. p. 5 no f. p. 6 knife	3	4	4	3
	Penetrometer mm & kg cm^{-2}	13	20	18	16
PERMEA-BILITY	kg cm^{-2}	missing			
BULK DENSITY	Moist Soil	missing			
	Dry Soil				
STRUCTURE	1 Do. 2 Sub. 3 Br.	1	1/3	1/3	1
	Grade: 1 no 2 weak 3 moderate 4 strong	2	1/2	1/2	1
	Size: 1 v. fine 2 fine 3 medium 4 coarse 5 v. coarse	4	0/5	0/5	0
	D/S or B Type: 1 platy 2 prismatic 3 columnar 4 blocky 5 angular 6 granular 7 crumb 8 massive 9 single grain	4	8/4	8/4	8
CONSIS-TENCE	Moist/Dry: 1 loose 2 v. friable 3 friable 4 firm 5 v. firm 6 x. firm	3/	3/	3/	3/
	Wet: 1 non-stf./pl. 2 sl.sticky/pl. 3 sticky/plas. 4 v. sticky/pl.	2/3	2/3	4/4	4/4
POROSITY	Intra-/Interpeda: 1 f. porous-1mm 2 porous -3 3 spongy -5 4 cavern. -10 1 f. fiss. 2 fissured 3 w. fiss. 4 v.w. fiss. 5 x.w. fiss.	1/2	1/1	1/1	0
ROOT	Biopore Quant.: 1 none 2 few -2/100cm^2 3 freqquent-10 4 abundant >10	3	2	2	2
	Biopore Size: 1 small -3 mm 2 medium-12 3 large -30 4 coarse >30	1	1	1	1
	Quantity: 1 none 2 few 3 many 4 abundant 5 root mat	3	2	2	2
	Type/Distri.: 1 evergreen 2 deciduous 3 grass 4 others 1 horizontal 2 vertical 3 oblique 4 ubiquitous	3/4	3/2	3/2	0
FABRIC	1 earthy 2 sandy 3 rough 4 smooth	1	1	1	1
PAN	Cementation: 1 none 2 weakly 3 strongly 4 indurated	1	1	1	1
	Structure	i	i	i	i
SECOND-ARY FORMA-TION	Abundance 1 2 3 4 5 6	1	1	1	2
	Type	i	i	i	NCD
	Composition	i	i	i	FeCO3
SAMPLE	Bulk/Core 1 yes 2 no	1/1	2/2	1/1	1/2
PHYSICAL RIPENING	1 2 3 4 5	1	1	1	1

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Fig. 1 (cont'd) An Example of the Completed Format. Profile Description.

Those items not stored in the soil files are marked on the card by an asterisk. The detailed description of soil and crop management needs another format and file, which require further approximation.

The land form description given in an open-ended list also needs elaborations. Site location sketch is necessary to reevaluate this list.

The format may be modified if needed. The modification is identified by registering it in the relevant column.

A full description of a site needs two 80-column punch cards and that of one horizon needs three cards. This is a significant drawback in view of the punching efficiency as compared to those reported by others. This is due to our choice to hold a large number of uncoded records. But, the format itself is very easy to use and to read. Even a beginner can learn how to use it within a few days.

The data stored in magnetic tapes have been combined with a computer program to write a survey report, and to retrieve the point data plotted on a map. This is an effective aid in drawing a soil map. By plotting the point data on an existing soil map, which can be also retrieved from a cartographic file, the correspondence of the soil boundary with the new point data can be easily checked. These procedures as well as file management method will be reported separately.

Summary

A format for field records for use with a soil data bank is described. It is aimed to collect field soil data in detail, and to retrieve them as text or as plots showing attribute distributions on a map with or without processing. This is particularly important for reclassifying the soil profiles and for reconstructing the soil map and soil units.

The format is simple and easy to use, since many of the necessary properties are coded on the card.

The manual for soil description integrates several methods, and is published in Discussion Paper Series of the CSEAS of Kyoto University (Furukawa, 1979).

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