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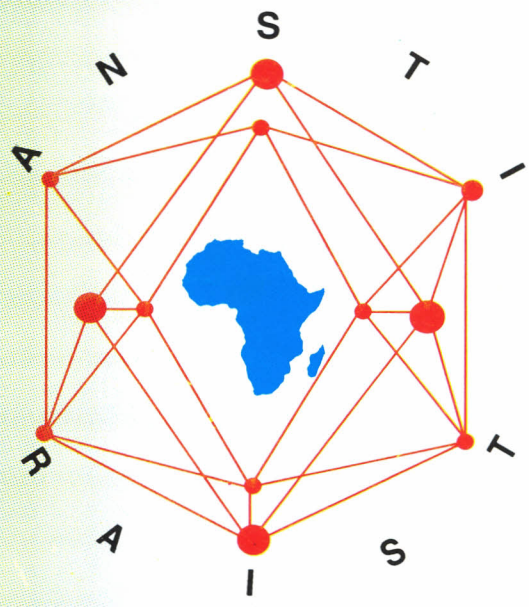

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RESULTS ON A QUESTIONNAIRE TO SOIL SURVEYORS AROUND THE WORLD RELATED TO EXISTING SOIL SURVEYS AND THEIR ATTRIBUTES

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ABSTRACT: *Seventy respondents from 40 countries replied to a questionnaire on methodologies used in soil surveys. Observations and conclusions worth noting are given. Some terminologies in soil surveys are not conceived and used consistently by soil surveyors. The nature of soil surveys is determined by soil surveyors themselves and only occasionally do users determine the nature of these documents. The most common immediate users of soil surveys are ministries of agriculture and natural resources, private farmers and land owners, engineering departments and state farms. Many soil surveyors do not monitor the utility of soil surveys to see if users are satisfied with them or not. Grid mapping is more commonly used in the very detailed inventories than in reconnaissance and exploratory surveys, while free-hand surveys are more widely used in detailed, semi-detailed and reconnaissance surveys. Detailed and semi-detailed surveys are the most often used both directly and indirectly through interpretation maps. Some of the reasons why soil surveys sometimes are not used despite their availability, include their complicated nature and insufficient knowledge about their existence. Some recommendations are given for improvement in future soil surveys.*

INTRODUCTION

Soil surveys are a convenient way of information gathering preceding decisions on soil management and/or land use. Many such surveys have been made in different parts of the world by different people and organizations based on different schools of thought. Hence, different methods have inevitably been employed, leading to the production of a wide range of soil resource inventories. Beckett and Bie (1978) ascertained that even within one country soil survey procedures can vary very widely.

Since the methods used in soil survey are not completely standardized, and moreover are not in many cases wholly documented in the soil resource inventories themselves (Msanya, 1987), comparative studies of such documents are likely to face some problems. For example the experiences of soil surveyors in terms of the different survey procedures employed in function of the survey objectives and factors related to the survey area can not easily be made use of.

The present study attempts to find out crucial information from soil surveyors on the methodologies used in soil survey and on the different norms governing decisions made in the process of making soil and land resource inventories. In this paper the term "Soil Resource Inventory" (SRI) refers to a document that describes the attributes and spatial distribution of soil and land resources. Soil surveys and land evaluations are typical examples of SRIs.

MATERIALS AND METHODS

A questionnaire was used in this study to obtain information from would-be respondents. Questions were focused mainly on information related to methods employed in the production of soil surveys (soil resource inventories) and their utilization. One hundred and seventy eight copies of the questionnaire were mailed world-wide to soil surveyors whose addresses were sought from professional association membership lists and through direct contacts with individuals and institutions. The total number of completed questionnaires received after 14 months since

the date of dispatch was 70 (about 39% mailed response rate) from 40 countries. Table 1 shows the countries in which the questionnaire was answered, Table 2 the fields of specialization of the respondents and their professional status, and Table 3 the institutions in which they work. The respondents include employees of government soil survey institutes, universities, ministries or departments of agriculture, research institutes/experimental stations and private soil survey consulting firms. Basically all the respondents were soil surveyors with or without other minor specializations.

Table 1. Countries in which questionnaire was answered

Country	Number of respondents	Country	Number of respondents
Australia	1	Malawi	1
Belgium	6	Mozambique	1
Botswana	2	Netherlands	6
Brazil	2	New Zealand	5
Britain	1	Nigeria	2
Burundi	4	Papua New Guinea	2
Cameroon	3	Peru	1
Canada	1	Philippines	2
Chile	2	Sudan	1
Denmark	2	Syria	1
Ethiopia	1	Taiwan	1
Finland	1	Tanzania	1
France	1	Togo	1
Greece	1	Turkey	1
Hong Kong	1	Uruguay	1
Indonesia	3	USA	2
Israel	1	West Germany	1
Italy	1	Yemen	1
Kenya	1	Zaire	1
Luxembourg	1	Zimbabwe	2

Total number of countries = 40 Total number of respondents = 70

Table 2. Fields of specialization and profession status of respondents of questionnaire

	Professional status			
Specialization	% Senior	% Mid-Career	% Junior	Total % of respondents
Soil survey & classification	36	6	3	45
Soil survey & classification (+ agronomy)	10	0	0	10
Soil survey & classification (+ agronomy + geography +	1	3	1	5
Soil survey & classification (+ agronomy + soil	3	1	1	5
Soil survey & classification (+ geography)	0	4	0	4
Soil survey & classification (+ geography + geomorphology)	4	1	1	6
Soil survey & classification (+ geology)	0	3	1	4
Soil survey & classification (+ geomorphology) '	3	3	1	7
Soil survey & classification (+ geomorphology + geology)	1	1	1	3
Soil survey & classification (+ land use planning)	3	1	0	4
Soil survey & classification (+ soil chemistry)	0	1	1	2
Soil survey & classification (+ soil chemistry + soil physics)	4	1	0	5

Table 3. Institutions in which respondents of questionnaire work

Institutions	Frequency	
	Numbers	%
Government soil survey institutions	24	34
Universities	20	29
Ministries/departments of agriculture	14	20
Research institutes/experimental stations	10	14
Private soil survey consultancy firms	2	3

RESULTS AND DISCUSSION

Terminology used to define soil survey intensity in function of map scale

Table 4 gives the types of soil resource inventories underaken by different soil surveyors and their categories based on soil survey effort (soil survey intensity) as expressed by map scale. From the results obtained it can be said that the terminologies used to define different survey intensities are not consistently applied by different soil surveyors. In many cases same categorical name is designated by different map scales and there is a lot of overlapping in the various survey intensities. However, the following generalizations could be made out of the results obtained:

i. Detailed surveys are made at scales between 1/5,000 and 1/20,000.

ii. Semi-detailed surveys are mostly made at scales 1/ 50,000 to 1/63,360. It is also common to find in this category, scales 1/10,000 to 1/25,000.

iii. Reconnaissance surveys are made at scales between 1/100,000 and 1/250,000.

iv. Exploratory surveys are made at scales 1/500,000 to 1/ 1,000,000.

Who determines the nature and contents of soil resource inventories

In Table 5 the responses on who determines the kind of soil resource inventory to be made are summarized. To a very large extent, the nature and contents of SRIs are determined by the survey institutions/surveyors themselves. This is particularly more apparent with site evaluations, detailed surveys, semi-detailed surveys and reconnaissance surveys where more than 50% of the respondents confirm this trend. Only to a less extent users or clients for SRIs determine the nature of these documents.

Table 4. Relationship between soil survey intensity and map scale

Type of SRI	Map scales	
Detailed surveys	1/5,000-1/10,000(41%) <1/20,000>1/50,000(10%)	1/12,000-1/20,000(21%)
Semi-detailed surveys	1/10,000-1/25,000(29%) 1/50,000-1/63,000(46%)	1/30,000-1/40,000(3%)
Reconnaissance surveys	1/50,000(3%) 1/400,000-1/500,000(4%)	1/100,000-1/250,000(57%)
Exploratory surveys	1/250,000(10%) <1/1,000,000(4%)	1/500,000-1/1,000,000(23%)

Based on 70 respondents

Table 5. Who determines the nature of soil resource inventories to be made based on 70 respondents

Type of SRI	Survey institution's/surveyor's			Client/agency paying for the SRIs		
	A&F	C&O	N	A&F	C&O	N
Site evaluations	47	9	44	13	14	73
Detailed surveys	57	11	32	26	20	54
Semi-detailed surveys	60	13	27	19	23	58
Reconnaissance surveys	64	6	30	13	22	65
Exploratory survey	33	3	64	6	4	90

A = always; F = frequently; C = commonly; O = occasionally; N = Never; Figures in %

N.B. The frequency classes used throughout this paper are as follows: A = 100% of cases; F = more than 50% of cases; C = more than 25% of cases; O = less than 25% of cases; and N = 0% of cases.

Users of soil resource inventories

Table 6 gives a summary of the responses regarding immediate users of SRIs. It is indicated that the major users include ministries of agriculture and natural resources, private farmers and land owners, engineering departments and state farms. At least 20% of the respondents give this view for all kinds of SRIs except reconnaissance and exploratory. Other minor users in order of decreasing magnitude are national planning agencies, military authorities,agro-industrial companies and ministries of education (for secondary schools and universities).

Table 6. Users of soil resource inventories based on 70 respondents

SRI Users	Type of SRI				
	SE	DS	SDS	RS	ES
Ministries of agriculture	41	61	70	63	26
Ministries of natural resources	21	34	44	49	20
Private farmers & land owners	41	57	44	22	9
Engineering departments	26	29	29	22	13
State farms	26	36	30	13	10
National planning agencies	9	9	14	13	4
Military authorities	7	9	17	7	6
Agro-industrial companies	4	3	1	0	0
Ministries of Education (Secondary Schools + Universities)	0	1	3	1	1

SE = site evaluations; DS = detailed surveys; SDS = semi-detailed surveys; RS = reconnaissance surveys and ES = exploratory surveys. Frequency classes omitted for simplicity; figures are in %.

Assessment of utility of soil resource inventories

The results on the question of whether soil surveyors make any attempts to measure the utility of the SRIs they produce are presented in Table 7. About 40 - 85% of the respondents variably depending on type of SRI indicated that they have never attempted to assess the utility of their products to check if users are satisfied with them or not. Msanya and Magoggo (1993) reported this kind of trend for the soil resource inventories made in Tanzania and emphasize that there is still to be established a routine of follow-up activities to determine how effective the results of soil surveys are and to use this feed-back in the design of future soil resource inventories.

The results of the current study have also pointed out that in the cases where assessment of utility of SRIs was made, this was done more for the detailed and semi-detailed surveys and site evaluations, most likely because these SRIs are largely aimed at solving problems at farm or project level.

Table 7. Assessment of utility of soil resource inventories

Type of SRI	% frequency based on 70 respondents				
	A	F	C	O	N
Site evaluations	6	13	11	14	56
Detailed surveys	3	11	16	24	46
Semi-detailed surveys	7	11	10	31	41
Reconnaissance surveys	3	4	4	23	66
Exploratory surveys	1	1	1	11	86

A = always; F = frequently; C = commonly; O = occasionally; N = never.

Methods used to monitor utility of soil resource inventories

The methods that have been employed by different people to monitor if users of SRIs are satisfied with these documents or not are summarized in Table 8. Rather few respondents (< 25% in all cases) responded to this question. However, it was clear from those who responded that four methods were used differently for different kinds of inventories. They include direct surveyor - SRI user contacts, use of occasional extension staff, sending of questionnaires to SRI users, and monitoring of sales and new orders of SRIs. At least 10% of the respondents indicated these methods for all except exploratory surveys. Few respondents commented that if SRI users or clients did not question them, they assumed that they were satisfied with the SRIs.

Table 8. Methods of monitoring utility of soil resource inventories

Methods	Type of SRI				
	SE	DS	SDS	RS	ES
Direct contacts between surveyor and user	17	20	22	14	9
Sending occasional extension staff to the field	19	24	21	14	6
Sending questionnaires to users	10	17	16	10	1
Monitoring sales and new orders of SRIs	13	16	17	11	3

SE = site evaluations; DS = detailed surveys; SDS = semi-detailed surveys; RS = reconnaissance surveys and ES = exploratory surveys. Figures are % of respondents.

Field soil mapping procedures

In Table 9 the different methods used by soil surveyors in mapping land resources are presented. The methods

Table 9. Soil mapping procedures based on 70 respondents

Procedures	Grid survey			Free-hand survey			Combined grid and free-hand survey			Physiographic survey		
Type of SRI	A&F	C&O	N	A&F	C&O	N	A&F	C&O	N	A&F	C&O	N
Detailed surveys	33	14	53	17	13	70	16	26	58	3	3	94
Semi-detailed surveys	20	16	64	39	13	48	19	20	61	6	3	91
Reconnaissance surveys	10	9	81	46	6	48	11	7	82	9	3	88
Exploratory surveys	6	1	93	26	4	70	6	4	90	10	0	90

A = always; F = frequently; C = commonly; O = occasionally; N = never. Figures are % of respondents.

Table 10. Extent of using soil resource inventories based on 70 respondents

	Directly used					Use through interpretation maps				
Type of SRI	A	F	C	O	N	A	F	C	O	N
Detailed surveys	10	21	16	11	42	13	23	14	13	37
Semi-detailed surveys	7	19	19	11	44	14	24	21	16	25
Reconnaissance surveys	3	11	9	14	63	17	19	16	14	34
Exploratory surveys	4	9	4	6	77	4	6	4	10	76

A = always; F = frequently; C = commonly; O = occasionally; N = never. Figures % of respondents

include:

i. Grid survey in which soil observation sites are spaced on a pre-determined rectangular grid; field work forms a major part of the work.

ii. Free-hand survey in which soil observation sites are not pre-determined but are chosen as representative of an area identified on the basis of landforms, vegetation, land use etc. as seen on the ground or on aerial photographs or other remote sensing imagery; field work forms about 25% of the work.

iii. Combined grid and free-hand survey; in which areas considered important and promising are treated with grid survey and those less important treated with free-hand survey.

iv. Another method indicated by very few respondents (< 15% in all cases) is physiographic survey based almost entirely on aerial photo interpretation and supported with very little or no ground check.

It was also apparent in this study that field soil mapping procedures are a function of the detail of the soil resource inventories. Generally, grid (particularly fixed-grid) survey is more commonly applied in the more detailed inventories than in reconnaissance and exploratory surveys. Free-hand surveys appear to be more widely used in semi-detailed, reconnaissance and exploratory surveys. The combined grid and free-hand surveys seem to be more common for all but exploratory surveys, while the physiographic surveys are more used for both reconnaissance and exploratory surveys.

Extent of using soil resource inventories in different countries

The comments of soil surveyors on the extent of using soil maps in different countries are presented in Table 10. The documents are used both directly or indirectly through interpretation maps. The results show clearly that interpretation maps are more commonly used than the soil maps themselves (more than 60% of the respondents support this trend variably for detailed, semi-detailed and reconnaissance surveys). Most SRI users would always ask for something practical and easy to use.

Reasons why soil resource inventories are not sometimes used

Table 11 contains a summary of the reasons why soil maps are sometimes not used. Soil surveyors themselves do admit that there are problems and the main reasons for not using soil maps as indicated by more than 20% of the respondents are:

i. Soil maps are too complicated and hence difficult to comprehend and use. In another questionnaire directed to SRI users (Msanya *et al.*, 1987), this reason was also indicated as one of the major bottle-necks frustrating usage of soil maps.

ii. Insufficient knowledge about their existence and availability. Most SRIs are kept in government offices where they are not easily accessible to the public. Another reason (as indicated by 1% of respondents) is:

iii. Soil maps are too expensive to make and many would-be users are not willing to incur the costs related to production of soil maps.

Table 11. Reasons for not using soil maps

Reasons	% of respondents
Soil maps are too complicated	23
People have no sufficient knowledge about their existence	21
Soil maps are too expensive	1

Based on 70 respondents

Publicity about the existence of soil resource inventories

The responses on whether SRIs are publicized or not are given in Table 12. In function of the type of SRI it can be said that 35 to about 75% of the cases publicity was not made. Publicity of SRIs was done only occasionally for detailed and semi-detailed surveys, reconnaissance surveys and site evaluations. Very little publicity was made for exploratory surveys.

Table 12. Publicity about the existence of soil resource inventories

Type of SRI	% frequency based on 70 respondents				
	A	F	C	O	N
Site evaluations	1	16	7	19	57
Detailed surveys	7	14	11	26	42
Semi-detailed surveys	13	11	7	34	35
Reconnaissance surveys	7	7	7	30	49
Exploratory surveys	1	9	3	13	74

A = always; F = frequently; C = commonly; O occasionally; N never

CONCLUSIONS AND RECOMMENDATIONS

Crucial information gathered from the respondents of the questionnaire is presented below.

i. Key terminologies and criteria used in soil surveys for example *soil survey intensity* and *field soil mapping procedures* are not conceived and used consistently. It is thus recommended that soil surveyors should standardize these terminologies and criteria to allow easy correlation and transfer of information.

ii. It was disclosed that to a great extent soil surveyors are the ones who determine the nature of SRIs to be made, and only occasinally do users have the opportunity to determine the nature of these documents. It is recommended that in those cases where users are competent they should be allowed to dictate the nature of documents that will suit their needs.

iii. Most soil surveyors do not monitor the utility of the SRIs they make. It is recommended that monitoring of the utility of SRIs should of necessity be a responsibility of soil surveyors (or survey institutions) to determine how effective these documents are, particularly in solving problems at farm or project level, and use such feed-back in the design of future works.

iv. It was indicated that SRI users prefer interpretation maps to soil maps. It is thus recommended that SRI producers should always provide interpretation maps to accompany the soil maps. Interpretation maps are important as they normally simplify the complicated technical language presented in soil maps

v. Soil maps are too complicated for users to comprehend the information registered in them. It is thus recommended that attempts should be made where possible to make simple legends. The provision of interpretation data as recommended in iv. above would also contribute towards solving this problem.

vi. Publicity about SRIs is not sufficiently made. It is recommended that more efforts should be invested in publicizing these documents not only to increase their use but also to prevent duplication of work.

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