Monographs on Soil Survey

Soil survey contracts and quality control

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1478
1978

CLARENDON PRESS · OXFORD

Oxford University Press, Walton Street, Oxford OX2 6DP

OXFORD LONDON GLASGOW
NEW YORK TORONTO MELBOURNE WELLINGTON
KUALA LUMPUR SINGAPORE JAKARTA HONG KONG TOKYO
DELHI BOMBAY CALCUTTA MADRAS KARACHI
IBADAN NAIROBI DAR ES SALAAM CAPE TOWN

British Library Cataloguing in Publication Data
Western, S
Soil survey contracts and quality control.
–(Monographs on soil survey).
1. Soil-surveys 2. Contracts
I. Title
631.4'7 S592.14 78-40485

ISBN 0-19-854513-4

Printed in Great Britain by
Lowe & Brydone Printers Limited, Thetford, Norfolk

Foreword

Soil survey is carried out to provide soil information to organizations or individuals who want it. Its purpose is practical. It also has to be paid for. So the payer and the payee must first decide what is the best compromise between total information at near infinite cost and mere hearsay that is free. This discussion may be implicit in the case of national soil survey organizations, but it is explicit in the case of single projects by private firms or individuals, where negotiations and the drawing-up of a binding contract must precede survey.

Mr. Western discusses how the surveyor achieves his proposals for such negotiations, and how he then organizes his team to conduct the work as efficiently as possible. As a professional soil surveyor in a well-known firm of international consultants he is well qualified to do so. He also introduces the idea of quality control and discusses its implications. The author does not answer all the questions he raises, but it is certainly time that they were raised.

The editors add their thanks to Hunting Technical Services for allowing the use of unpublished material.

There are now four volumes in this series. The others are on remote sensing by L. P. White, on quantitative techniques by R. Webster, and on soil and site descriptions by J. M. Hodgson. Further volumes on soil classification for soil survey and on soil information systems are in preparation.

P. H. T. Beckett
V. C. Robertson
R. Webster

Preface

A communications gap exists within soil science between those who study soil for its own sake and those who have to shape the findings of soil surveys into a useful and respected aid to agriculturalists, foresters, economists, engineers, etc. An even greater gap exists between these various clients and the soil surveyor, which is by no means entirely the fault of the latter. The contribution of soil science in the practical world depends upon the rapid closing of both these gaps. Soil scientists are aware of this need and in recent years some progress has been made.

The aim of this book is to examine soil surveys as contracts which have to be tendered for and won and to show how contracts should be planned and negotiated, organized and executed, reported and applied. The quality of the map and report achieved by the survey is balanced against its cost to formulate the concept of 'survey value', a concept designed to satisfy both the user of the survey, who wants maximum quality, and the instigator, who wants minimum cost. It is hoped that the book will help soil surveyors to win and carry out successful contracts and also help both those who commission and those who use soil surveys to understand and anticipate the many problems which the surveyor has to face.

Particular emphasis is placed on the need to avoid undue detail and unwanted esoteric investigation and discussion. These cause unnecessary extra costs and deter the proper application of the survey; attempts to disguise soil survey as an exact science are perhaps the main cause of the disillusionment and even cynicism sometimes encountered in potential users. Soil surveys are one element in the development of natural resources but success ultimately depends on the human factor, the man on the ground who is supposed to benefit from the development. Chambers (1969), speaking of integrated agricultural development – the main use of soil survey contracts – aptly points out that, 'In essence great refinement in the techniques for assessing productivity on a purely physical basis may not be justified when considered against the background of the human factor. It is only when a high degree of management and skills can be assured that sophisticated techniques are justified'.

I have concerned myself primarily with formal soil survey contracts, for which the demand is mainly in countries and environments foreign to the surveyors who carry them out, and where organization and logistics are extremely important. A formal soil survey contract is almost always instigated for a pre-defined purpose, so that the book is devoted largely to soil surveys in which interpretation of the soils data in terms of the specified objective is the main element.

A great deal of the material and examples used relate to the soil survey organization with which I am most familiar, the soils and land classification section of Hunting Technical Services Limited, and particularly to a recent project in which I participated, the Lower Khalis Project in central Iraq, where soil, land classification and drainability surveys of some 93 000 ha were carried out during the design and implementation of a major irrigation and drainage scheme (HTS-MMP 1975). I am indebted to them for providing me with time, a wealth of material from their library, and the use of their typing and copying staff. For the extensive use of material from the Lower Khalis Project I am grateful to Said Abdul Wahab Mahmod Abdulla, Director General and Chairman of the Board of Directors, Khalis Agricultural Administration, Iraq. Further information was supplied by the following: the Soil Resources Development and Conservation Service, the Food and Agriculture Organization of the United Nations, Rome; Soil Conservation Service, United States Department of Agriculture, Washington; The Netherlands Soil Survey Institute, Wageningen; The Land Resources Division, Ministry of Overseas Development, Surbiton, Surrey; and the Soil Survey of England and Wales, Rothamsted, Herts. I am grateful to these and to the numerous authors and institutions who allowed me to use their figures and tables: the Agricultural Institute of Canada; Dr. D. F. Ball; Dr. P. H. T. Beckett; Dr. S. W. Bie; Booker Agriculture International, Ltd.; Dr. P. A. Burrough; Commonwealth Agricultural Bureaux; Elsevier Scientific Publishing Co.; the Food and Agriculture Organization; I.C.I., Ltd.; the Indian Society for Soil Science; the Institute of Agricultural Engineers; Dr. D. L. Mader; Professor R. T. Odell; the Department of Soil Science, University of Reading; the Soil Science Society of America; *Sols Africains*; Dr. K. W. G. Valentine; Dr. Ir. J. S. Veenenbos; Professor E. P. Whiteside; and Mr. D. R. M. Williams. Rothamsted Experimental Station allowed me the use of their library. Mr. D. Mackney of the Soil Survey of England and Wales and Mr. J. W. Trevett of Hunting Technical Services Limited provided some useful discussion. Additional typing was done by Mrs. Asdghib Andonian.

Lastly, I have received much help and advice from my editors, Mr. V. C. Robertson, Dr. R. Webster, and especially Dr. P. H. T. Beckett, whose exhaustive editing and discussion were invaluable.

Boreham Wood *August* 1977 S.W.

1. The soil survey contract

What is soil survey?

Before answering this question perhaps we should ask another: what is soil? The classical answer is Dokuchaiev's: soils are independent natural bodies, each with its own unique profile morphology resulting from a unique combination of climate, living matter, parent materials, and relief, acting over a given period of time (Glinka 1927).

A more practical definition is: soil is the natural medium for the growth of land plants, whether or not it has distinctive profile morphology (USDA 1951). This too can be qualified. It implies that soil is essential for the growth of plants, which the development of hydroponics and floriculture has shown not to be so. More important, this definition narrows the use of soil to agriculture, despite the increasing importance of soil knowledge for non-agricultural purposes. Nevertheless, the main contribution of soil science at present is to field agriculture, horticulture, cultivated pastures, and forestry, pursuits collectively described in this book by the term 'agroforestal'.

These two definitions of soil illustrate the 'pure' and 'applied' approaches to soil science. Whatever the approach, soil science must provide a basis for statements about the nature and distribution of the soils within any given area. Soil survey is the branch of soil science which does this. It is the process whereby soil classes are distinguished, defined, described, and mapped. It is 'commonly a laborious, and a costly, exercise in subjective judgement' (Beckett *et al.* 1967). A major concern of this book, therefore, is the effectiveness of soil surveys in relation to their cost in effort and money. Any of the following questions may need to be answered:

1. (a) What kind of soil (i.e. what classes of soil) are present?
   (b) In what proportions do they occur?
   (c) What are their properties?
   (d) What proportions of the area are occupied by soils with particular properties, or particular ranges of one or more properties?
2. (a) What is the soil class at any site of interest in the area?
   (b) What are the properties of the soil at any site of interest in the area?

3. (a) Where can soils of a particular class be found in the area?
   (b) Where can soils of particular properties be found in the area?

The aim of soil survey is to equip someone with a map and memoir, which will enable him to answer questions 2 or 3 above more precisely and with less trouble than he could have done without them (Beckett and Burrough 1971).

Types of soil survey

Soil surveys can be differentiated in two ways. First, there are differences of purpose and therefore of approach. Second, there are differences in the scale and intensity of survey.

Approaches to soil survey

The two definitions of soil illustrate the two main approaches to soil survey. The 'pure' approach defines and maps soils as natural bodies and assumes that the resulting map and memoir will serve a wide range of users as a basic scientific inventory of the area concerned. Such surveys are often called 'general-purpose' because they are based on intrinsic general-purpose soil classifications (Mulcahy and Humphries 1967). The more practical approach identifies the survey with a specific objective ('special-purpose survey') and so defines extrinsic special-purpose soil classes (Mulcahy and Humphries 1967) on criteria selected for their relevance to this objective. A particular type of special-purpose survey measures and maps a single soil factor.

Early soil surveys were mostly concerned with general-purpose mapping, and were confined to the developed world. Efforts were mainly directed towards understanding the soil as a natural phenomenon, and hence towards improving and refining pedological classifications. In recent decades the growing need for increased agricultural production and the greater scope for achieving this provided by improving technology has shifted the emphasis to special-purpose surveys. Where resources of time, money, and trained manpower are available, there is a strong case for a national general-purpose survey to provide a basis for planning more specialized surveys. Unfortunately these three resources are rarely to be found together in the developing world, where the need for producing more food and commodities is greatest, and special-purpose surveys are often initiated where no general-purpose soil survey has been carried out.

There is much debate among soil surveyors on the efficiency of general-purpose as compared with special-purpose survey. As in most scientific debates, extreme positions have sometimes been taken.

Gibbons (1961) has argued that no natural general-purpose classification can exist. He examined five surveys with widely different objectives in south-east Australia. These used a total of 18 soil criteria to distinguish soil classes but only two, soil texture and structure, were common to all five surveys. An increase in the number of different objectives and a wider geographical application would have greatly multiplied the number of criteria needed. General-purpose mapping, Gibbons concluded, was 'the collecting of limited information of uncertain significance for a multitude of purposes as yet unknown'. Butler (1964) agreed in principle with Gibbons and advocated an edaphic approach to survey in which soil classification would be based on the one or two soil properties which appeared to be relevant to the particular objective. He queried the soundness of a fundamental premise in soil science: that soil class and plant behaviour are covariant. This principle is discussed in detail in Chapter 8.

At the other extreme is the view that a single general-purpose soil classification can be applied all over the world to any conceivable objective. Soil scientists have invested immeasurable time, thought, and energy in this concept. *The soil map of the world*, prepared under the joint auspices of the United Nations Food and Agricultural Organization (FAO) and its Educational, Scientific, and Cultural Organization (UNESCO), is one example (FAO-UNESCO 1968) and the new *Soil taxonomy* (USDA 1975) is another. Both avoid overstating their aims and claims, but nevertheless both attempt to establish universal application. Many soil scientists who have carried out soil surveys in environments of contrasting physical and socio-economic characteristics find it difficult to accept that such a goal is either possible or desirable, especially at the expense of so much effort.

Until recently most national soil surveys in the developed world were also exponents of general-purpose survey, preparing maps for general or indeterminate purposes. Bie (1972) quoted some prominent soil survey administrators to illustrate this point:

> By soil surveying is meant the compilation of maps on which permanent features of the soil are depicted. Hence a soil map is designed to show the horizontal distribution and limits of pedological units (Steur 1961).
>
> The primary function of a soil survey program is to recognise and if possible group together soils of similar genesis, morphology and associated physical and chemical characteristics (Rennie and Clayton 1960).
>
> The soil survey is an inventory or stocktaking of the greatest of our natural resources and forms the logical basis on which to conduct a programme of soil research (Glentworth 1957).

Many of these have sought to increase the efficiency of their work by deriving interpretive classes from their soil classes and preparing interpretive maps for agroforestal uses.

The real answer probably lies in a balance between scientific and practical considerations. Murdoch (1972) maintained that the holistic and quantitative approaches to the assessment of land capability should be complementary and suggested that they usually are. Vink (1963) asked that a sufficient basic knowledge of the soils be gathered, but that too much concern with the theoretical background of the soils and their genesis be avoided. Even Smith (1965), principal author of the USDA classification, thought that 'to be useful, survey must be both practical in purpose and scientific in construction'.

The middle view may be: general-purpose survey in itself may be useful at small scales of mapping or at reconnaissance levels of investigation; in larger-scale or more intensive studies it may provide a framework on which to hang a more detailed special-purpose classification that defines soil classes relevant to the objective. Thus there is frequently considerable overlap between general- and special-purpose surveys.

The value of using a general-purpose classification and survey in this way is threefold:

(1) It links the soil map and its legend to the natural processes which are mainly responsible for the soil pattern.

(2) It makes it easier for the surveyor to draw on experience with broadly similar soils elsewhere: the difficulties of managing podzolic or vertisolic soils, for instance, have received much scientific attention in many parts of the world, the fruits of which could be applied at a new site once its soil was recognized and labelled as such.

(3) Most important of all, the data on which the survey is based, if retained, provide a permanent basis for what can never be more than temporary interpretive classes; an interpretive map must be adaptable to advances in technology, changes in socio-economic circumstances, and the like, but ideally without having to repeat the entire survey exercise at short intervals of time.

On the other hand, the future of applied soil science ultimately lies in special-purpose surveys for defined survey objectives. The trend away from independent soil survey and towards surveys integrated with a wide range of other disciplines will accelerate. Already soil surveys have been integrated with geomorphology, hydrology, ecology, forestry, agronomy, agricultural economics, sociology, economics, veterinary science, and with irrigation, drainage, sewage disposal, and highway and construction engineering. These disciplines can do little with a soil map as such. They need the soil map to be interpreted for their purposes and in terms they understand and can easily assimilate. But, just as it is essential that the soil surveyor should interpret his own map and legend, it is equally important that he should co-ordinate his interpretation fully with the needs and opinions of the prospective user. Survey in isolation is undesirable; interpretation in isolation is unacceptable.

Scales and intensities of survey

The other way in which soil surveys vary is in their scale or the intensity of survey effort. Scale and intensity usually correlate because large-scale mapping requires a high intensity of observations and narrowly-defined soil classes. Similarly, botn are usually associated with the purpose of survey. General-purpose surveys are typically at smaller scales with a low density of observations and broadly defined soil classes. Special-purpose surveys may be on any scale according to the objective, but they account for most large-scale, high-intensity surveys.

It is unfortunate that no single system of nomenclature for soil surveys according to scale and intensity has emerged. Almost every soil survey organization seems to have its own definitions, but practically all use the same terms. Thus to the United States Bureau of Reclamation (USBR) 'semi-detailed' means a scale of 1:12 000 (USBR 1953); but to the Land Resources Division (LRD) of the Ministry of Overseas Development (ODM) it means scales from 1:50 000 to 1:100 000 (Murdoch 1972), a vast difference. The FAO has attempted to avoid the traditional and frequently misused terminology of 'detailed', 'semi-detailed', etc., and also to standardize terms with other bodies, such as the World Bank (FAO 1974). There is much to be said for the general acceptance of the terminology they propose (Table 1.1).

Is soil survey necessary?

The significant point about this question is that it asks 'Is . . . ?' and not 'Why is . . . ?' Soil science in general and soil survey in particular suffer, sometimes with enthusiasm, from self-doubt. Wills is emphatic: 'The number of survey reports [of soil and land capability studies] produced without realistic chances of implementation should be causing concern' (Murdoch 1972). Robertson and Stoner (1970), speaking from a wealth of experience of soil survey for agricultural development, noted 'it is alarming to observe how little of the land resource data investigated

TABLE 1.1

Terminology of soil survey intensity in relation to final mapping scale and kind of mapping unit

Kind of survey	Range of scales	Kind of mapping unit
Very high intensity	Larger than 1:10 000	Phases of soil series; soil series occasionally soil complexes
High intensity	1:10 000 to 1:25 000	Phases of soil series: soil complexes
Medium intensity	1:25 000 to 1:100 000	Associations of soil series; physiographic units (enclosing identified soil series)
Low intensity	1:100 000 to 1:250 000	Associations of Great Soil Groups; occasionally—individual Great Groups; phases of Great Groups. Alternatively, land units of various kinds enclosing identified Great Soil Groups
Exploratory	1:250 000 to 1:1 000 000	Land units of various kinds (preferably enclosing identified Great Soil Groups)
Syntheses	Smaller than 1:1 000 000	Great Soil Groups and phases of Great Groups (having essentially taxonomic significance)

Source: FAO (1974), by permission

and mapped is actually used in development plans'. Young (1973) claimed that less use was being made of published soil surveys in feasibility and development studies than could be, either because surveys did not supply the right information or alternatively because the soil surveys were not necessary at all. Bie and Ulph (1972) pointed out that 'claims for the general economic benefits of soil maps as planning tools have remained largely unsubstantiated'. Stobbs (1970) based his paper on soil survey procedure on the premise that the influence of the large number of post-war surveys on agricultural development or productivity has not been commensurate with the effort they required.

So much for introspection. There is also considerable external doubt embodied in the large numbers of unused or barely used surveys and in the covert cynicism of many potential users. Some of this doubt cannot be blamed on soil survey. Members of other disciplines are often unwilling to make the necessary mental effort and adjustment to absorb soil survey information. The comprehension gap between the pedologist and the practical soil surveyor has already been noted. Even more serious is the lack of scientific communication between the soil surveyor and the potential user of his work.

Inevitably the doubts described above have led to over-reaction on the part of those who wish to extol the practical advantages of soil survey. Any mistrustful soil surveyor can find therapeutic reading in *Soil conservation*, the organ of the USDA Soil Conservation Service, e.g. (Klingebiel (1966). Eventually the most hesitant surveyor will be reassured, unless he begins to feel himself the victim of hard-sell techniques.

There is again a middle course. This recognizes the problems of obtaining and communicating relevant findings to users, and the numerous failures to do so. It also recognizes the many surveys which have been of considerable value and have been employed properly by their users. Most of these surveys were special-purpose and were either controlled by formal contractual agreements or by the close supervision and guidance of an experienced survey organization such as the LRD or the FAO.

The many examples of project failures and of agroforestal schemes which struggle on to this day in the face of agronomic problems which were discovered too late demonstrate that soil survey can be worthwhile. Many soil disadvantages which soil survey would identify immediately need several years to take full effect. By this time a great deal of capital is likely to have been expended and a great many social changes, such as settlement schemes, may have been wrought.

The East African groundnut scheme is one of the most spectacular post-war agricultural failures. Initiated by the British Government in 1947, it planned to put 1·3 million hectares of land in East Africa into a groundnuts-grass ley rotation. Lack of soil information was only one factor amongst many, and not the most important. Nevertheless the heavy and hard-setting clays made the harvesting and cleaning of the groundnuts very difficult and were one of the reasons for the scheme's failure.

Irrigation around Kerang in northern Victoria was initiated on the recommendation of Major Mitchell, an early explorer. According to tradition, Mitchell stood on Pyramid Hill, a solitary monadnock set in extensive level plains sweeping towards the Murray River, and pronounced the surrounding land ideal for irrigation. Today, as for several decades past, the Kerang Irrigation Area struggles against the poor drainage of the extremely heavy clay soils and the high natural salinity of the sediments in which the soil was formed. A soil survey would have precluded expensive investment for irrigation. Government subsidy is the price of maintaining the present population density on land which is not economically capable of supporting it, and is preferred to the politically and socially contentious alternative of attempting resettlement of a large and by now deep-rooted rural community.

Similarly, when large-scale irrigation began in the Larkana District in the Lower Indus Plains of Pakistan, rice was made the major crop. Unfortunately the area contains many well-drained soils associated with old river courses, so that there were excessive percolation losses from the paddy fields and water-use was very inefficient. The water-table rose rapidly from its initial depth of 10 m, and within a decade problems of salinity and waterlogging were becoming apparent. Subsequently this area became one of the most spectacular man-made examples of these twin problems in the world. Soil survey would not only have indicated that the Larkana area was not suitable for rice, but would also have shown that there were extensive areas of less permeable clay soils further south on the other bank of the Indus. Ironically these soils were planted with wheat and cotton, and even today the water-tables there are generally below the capillary zone and salinity is not widespread.

In fact, as every successful farmer knows, there is a definite element of truth in the cliché that 'the answer lies in the soil'. Careful study of several communities in Belgium revealed a definite correlation between soil type and land use (Tavernier and Maréchal 1962). The successful farmer knows his land and knows where significantly different soils occur, and eventually he learns how best to handle each class. The stress here must be on 'significantly different'. The sound farmer may feel he has three different soils on each of which he must vary his treatment in some way. But the enthusiastic soil surveyor, on the same land, is likely to present the farmer with not three but thirteen or even twenty-three soil classes, called by names the farmer does not understand and differentiated for reasons which seem to him to be either incomprehensible or irrelevant.

This seems to be the root of survey ineffectiveness: a tendency to refine too far, to create a complicated pattern of soil classes which, whatever their pedological background, do not differ significantly from each other for the practical purpose of the survey. The tendency results from carrying the general-purpose approach too far into the interpretive stage. Many other surveys, intended for a special purpose, are in essence general-purpose, because the emphasis has been put on separating soil classes rather than interpretive classes.

For most purposes there are unlikely to be many really significant differences within the soils of a defined area. The greater the effect of soil differences on land use, the more obvious are they likely to be for identification and mapping. High salinity, very low pH, poor internal drainage, poor surface drainage, and excessive slope are all factors likely to make a real difference to land capability, and generally all are easily recognized and delineated. Yet at least three of them – salinity, surface drainage, and slope – may be weakly related to conventional soil classes.

It is this confusion of what he terms the edaphic, pedologic, and geographic themes of soil science that is the source of much of Butler's (1958) criticism. They need to be clearly separated. Bie (1972) commented on the usefulness of many of the detailed surveys of the Murray Valley irrigation schemes which were intended to assess the land in terms of irrigation agriculture. The first generation of these surveys, carried out between 1927 and 1941, was so efficacious that in 1944 the Rural Reconstruction Committee recommended that all future irrigation schemes should be preceded by detailed soil surveys. This has become standard government policy (Blackburn 1962). Robertson (in Murdoch 1972) maintains that too much stress is put on soil–yield correlations because, unless there is a very great difference in soil factors, they will be greatly outweighed by variations in management. This is common-sense support for the need to simplify soil classification and mapping in special-purpose surveys.

The present rapid change in cultivation practices alone must have great significance for soil survey, demanding from interpretive maps and classifications a much greater adaptability to future modification than most soil surveyors are accustomed to considering. Another reason for the future importance of soil survey is that in many of the areas available for new agroforestal development the limiting factor is not land but the water to irrigate it. The Lower Khalis irrigation area in Iraq can expect water for only 56 000 ha of its gross 93 000 ha (HTS -MMP 1975). Crop yields in such areas should be assessed per unit of water, rather than of land, which gives a different emphasis in the soil surveyor's interpretive thinking. Soil survey is needed to identify the most rewarding land types and to ascertain their distribution. Indeed, with a growing water shortage in many parts of the developed temperate regions, such as south-east England, it is not only in the arid world that such considerations are pertinent.

The uses of soil survey

In view of the emphasis on special-purpose surveys in this book, we should briefly note the possible uses of soil survey:

(1) Further soil studies – the extension of a survey over adjacent, nearby, or similar areas of land, or the use of a survey as the basis for intensification into a more detailed study.
(2) Agroforestal uses – the major field for soil survey application but in itself a diverse group which can be split up as follows:
   (a) assisting general extension services to disseminate scientific information to farmers;
   (b) experimental work on experimental stations and plots, pilot farms, and schemes, etc.;
   (c) improvement or development of rain-fed agriculture;
   (d) improvement or development of irrigated agriculture;
   (e) drainage and reclamation – these are usually implicit in (d) but also constitute projects in themselves;
   (f) livestock and veterinary work;
   (g) forestry.
(3) Engineering uses – a steadily growing field with applications in the siting and construction of housing, complexes such as large schools or hospitals, highways, sewage disposal schemes, airports, manufacturing plant, etc.
(4) Planning uses – from oroad regional planning covering whole countries or large parts of them, to specific town and country planning at a more detailed level.
(5) Health and recreation uses – direct applications where soil type has been shown to influence human health, and also in helping to site golf courses, wildlife sanctuaries, ski-slopes, camp and picnic sites, etc.

(6) Fiscal and legal uses – in a growing number of countries soil survey plays a part in rural taxation assessment; it is also helpful in legal processes such as land consolidation.
(7) Conservation uses – not only in the narrow sense of preventing erosion but also in the broader sense of helping restoration after erosion, mining, quarrying, flood damage, etc.

What is a soil survey contract?

The concept of a soil survey contract is unfamiliar to many soil surveyors, because formal contracts are not a normal feature of the perennial general-purpose surveys conducted by most national survey bodies, which are typically initiated, financed, and executed within a single government department. A formal contract is not required because the survey is commissioned and carried out by essentially the same body.

Special-purpose surveys, on the other hand, are mostly carried out by consultant organizations or government and international aid agencies according to formal agreements. The survey requirements are carefully drawn up and may be formalized in a signed agreement. The work is usually of relatively short duration, often only a few months and rarely more than two years. Application of the data to the specified purpose may begin during the latter stages of survey or follow quickly afterwards, enabling the accuracy and relevance of the survey to be assessed and exposing any weaknesses in it.

It is evident that this book is concerned mainly with the latter type of survey, where the contract is formalized and the project of limited duration. However, some general inventory surveys are also carried out on contract (e.g. Carroll and Bascomb 1967). In any case, efficient survey organization and quality control are important to long-term general survey and much of what concerns us here relates to these as well.

Throughout the book a number of terms are used in a particular sense. They are defined below:

'Instigator'	The instigator is the organization which asks for and commissions the survey.
'Surveyor'	The surveyor is the soil survey organization which executes the survey, including its interpretive element.
'User'	The user is the organization which applies the survey to its predetermined objectives; often it is the same body as the instigator.
'Survey contract' or 'contract'	This is the entire procedure of the survey from its conception to the publication of the final report.