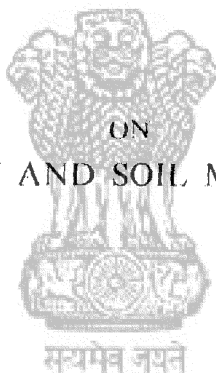


INTERIM REPORT
OF THE
NATIONAL COMMISSION ON
AGRICULTURE

ON
SOIL SURVEY AND SOIL MAP OF INDIA



GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
NEW DELHI
(AUGUST 1972)

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GOVERNMENT OF INDIA
VIGYAN BHAVAN ANNEXE, NEW DELHI
(AUGUST 1972)

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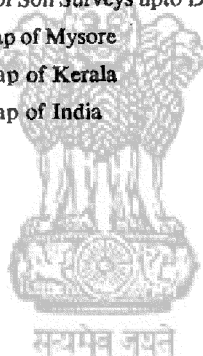
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SUMMARY OF RECOMMENDATIONS

1. In conformity with the international standard, a soil map of India in the scale of 1:1 million is considered necessary and adequate. (Paragraph 2.1)

2. The comprehensive system of soil classification developed by USDA should be suitably modified, where necessary, and adopted and brought in line with the international system (FAO) of soil classification. (Paragraph 4.2)

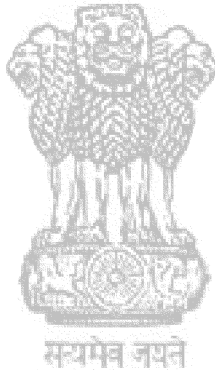
3. Expeditious measures should be taken to prepare the soil map in 1:1 million scale and to organise additional 170 soil survey parties in accordance with the specific requirements of the States and the Centre, and to place necessary facilities at their disposal. Aerial photographs, at least for the non-sensitive areas, should be made available for accelerating soil survey work. (Paragraphs 4.3 & 4.4)

4. The All India Soil and Land Use Survey Organisation which is at present charged with the training of soil survey personnel and soil correlation and classification at the national level, should be appropriately strengthened. An integrated training course in collaboration with the Indian Photo Interpretation Institute of the Survey of India should be organised. (Paragraph 4.5)

5. The State Soil Survey Organisations should be strengthened with properly trained personnel in order to carry out all new surveys as well as re-surveys on the standard pattern. (Paragraphs 4.6 & 4.8)

6. A close liaison between the Central and State Soil Survey Organisations is imperative. For this purpose, the State Coordination Committees, to wherever formed, should be activated, and wherever not yet formed, should be constituted as early as possible. (Paragraph 4.9)

7. State Coordination Committees should utilize the existing data on soil survey for land use and crop planning after due interpretation. (Paragraph 4.9)



INTERIM REPORT ON SOIL SURVEY AND SOIL MAP OF INDIA

SECTION I

INTRODUCTION

1.1 One of the Terms of Reference given to the National Commission on Agriculture relates to "Crop Production and Land and Water Development" encompassing (i) the various aspects of soil and water utilisation for production of balanced and nutritious food crops, commodities of industrial importance and export potential; (ii) soil and moisture conservation and measures for sustained soil use at optimum productive level; and (iii) soils of problematic nature particularly those affected by salinity, etc. and measures for amelioration. After analysing the various Terms of Reference and on account of commitment for submission of interim recommendations on a number of important aspects, the Commission decided to take up the study of the present status of soil survey in the country and make interim recommendations on the preparation of a scientific inventory of the soil resources of the country to form the basis of crop planning and intensive agricultural use. The Interim Report on Fertiliser Distribution of the Commission stressed the need of soil testing as a guide to an efficient and balanced use of fertilisers for realising economic crop yields. While reviewing the soil testing programmes throughout the country, it became evident that it failed to create the desired impact on farmers. The ineffectiveness of this developmental programme could be traced to various deficiencies, of which lack of properly prepared soil maps is the most poignant.

1.2 There are four basic conditions which determine optimum yields, namely, (i) balanced supply of plant nutrients, (ii) adequate moisture in root zone without disturbing air-water balance, (iii) crop varieties with genetic potential to respond

1.3. The present Interim Report is the outcome of the thinking of the Commission that all developmental programmes in agriculture will be dependent on the scientific knowledge of the basic resources, of which soil is an important one.

SECTION II

SOIL RESOURCES INVENTORY—NEED AND OBJECTIVE

2.1 Soil Survey provides the basic data essential for land use planning and soil resource development. It consists in studying and recording properties of soil and its environment in the field and measuring important soil characteristics in the laboratory. The data so obtained help in recognition of well defined classificational units and showing their extent on a map in an appropriate scale. In conformity with the international standard a soil map of India in the scale 1:1 million is considered necessary and adequate.

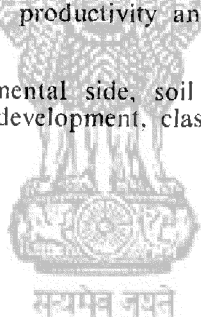
2.2 The present need to intensify and diversify activities in the fields of agriculture, animal husbandry, forestry, fishery, horticulture, engineering, urban development, recreation, etc. calls for priority attention in respect of soil survey. The soil survey, and the soil map based on it, will not only help assessment of soil potential for agriculture and other ventures, but will also help in locating problem areas, such as those affected with erosion, salinity, acidity, alkalinity and waterlogging. Once such potential and problem areas are identified, detailed surveys should be conducted with specific objectives in view. These objectives are related, for instance, to irrigation, drainage, water and soil conservation, soil reclamation and amelioration, etc.

2.3 The utility of soil maps may be considerably enhanced by interpretation of mapped units into capability classes based on the intensity and type of hazards and measures involved in land use. The land capability classification is based on : (i) inherent soil characteristics; (ii) external land features and (iii) environmental conditions. This will help in separating out land areas which are suitable for agriculture and other uses and those that are not so, but can be used for the purposes of pasture development, horticulture, forestry and recreation. The use of land based on the above classification will help

the conservation of the soil resource and its continued use without deterioration. The information furnished by soil surveys could also be used for engineering interpretation after being supplemented with such data as are required for designing various engineering structures, air fields, roads, etc. It is possible to achieve optimisation of agricultural production throughout the country by means of systematic crop planning. A thorough study of the climate and the soil is urgently needed to delineate regions which can be made to sustain, under favourable conditions, very high level of production of cereals, tubers, fruits, fibres, fodder, forests, etc. The necessary basic information on the right kind of land use for each such region is provided by soil surveys alone. They should, therefore, be the primary concern in any developmental works for the overall improvement of agricultural production.

2.4 Productivity grouping based on inherent soil properties reflects the behaviour of soil towards varied inputs. An integration of soil survey information with soil test data enables prediction of optimum productivity and formulation of fertiliser schedules.

2.5 On the fundamental side, soil survey provides basic knowledge on genesis, development, classification and nomenclature of soils.



SECTION III

PRESENT STATUS OF SOIL SURVEY

3.1 As early as the 16th century, utilitarian classification of soil was somewhat empirical based on the colour, texture, lay of land and above all the yield of crops. The scientific study of the soils of the country was taken up as early as 1898 when four major soil groups, viz., alluvial soil, red soil, black soil and laterite and lateritic soils were differentiated. With the initiation of agricultural research in the country, the emphasis was on nutrient content of the soil and hence soil fertility. The Royal Commission on Agriculture recognised the importance of soil survey and stated : "A soil survey would be desirable with a view to classifying and mapping these soils by modern methods. As soil survey of the whole of India on the lines of the soil survey now in progress in the United States of America would, however, be a gigantic enterprise we do not recommend that it should be undertaken at the present time. At a later period when scientific knowledge is more widely diffused and when competent workers can be trained in India the position may be considered". The Royal Commission further suggested that the Council of Agricultural Research should undertake the collation and publication of all the information in regard to the composition and characteristics of Indian soils, which was then available. The compilation, as suggested above, was made under an ICAR scheme and published in 1953. On the recommendation of the Royal Commission on Agriculture that soil surveys should only be undertaken when there was a specific problem to solve or when laboratory examination of soil was required to interpret information already on record, a few surveys were taken up in the cinchona growing tracts, clove growing tracts and sugar factory areas. The classification of soils on the basis of the above and other early profile studies often did not have the understanding of the genetic relationships and soil correlation as is being followed in more recent soil surveys. Soil profile studies received attention during 1930-40, when soil genesis and development came to be recognised as significant for the purpose of soil classification.

3.2 Pre-irrigation soil surveys were carried out in the various project areas by the Central Water and Power Commission and State Departments. The standard soil survey which is of a comprehensive nature was taken up in the year 1956 when the All India Soil and Land Use Survey Organisation was established. It is designed to furnish data about all important soil characteristics and associated features for the largest variety of users. There are various other agencies which carry out soil surveys for specific purposes and the information collected in each case is designed to suit a single purpose overlooking, as it were, the general aspect of soil survey. At present the following agencies are engaged in soil survey work in the country:

- (1) All India Soil and Land Use Survey Organisation
- (2) Central Water and Power Commission
- (3) Central Arid Zone Research Institute
- (4) Indian Photo Interpretation Institute
- (5) State Departments of Agriculture—Soil Survey and Soil Conservation Wings and Forest Departments
- (6) State Public Works Department (Irrigation)

3.3 The All India Soil and Land Use Survey Organisation has been carrying out (i) standard soil surveys of reconnaissance type throughout the country identifying various soils based on differentiating profile characteristics for correlation and classification, and mapping the differentiated soil units or their association in the scale of 1 : 50,000 (or 1" = 1 mile). The potential and the problem, if any, associated with each of the soil units are also interpreted, followed by recommendation for better land use managements; (ii) detailed soil surveys and mapping of the priority watersheds of the major river valley projects, mainly for soil conservation purpose, and of some forest lands for the purpose of land development for rehabilitation of refugees, and (iii) detailed soil survey in a number of research farms to help crop planning.

3.4 The Central Soil Mechanics Research Station of the Central Water and Power Commission has carried out pre-irrigation soil surveys on grid pattern in the command areas of more than 35 irrigation projects of different sizes covering an extent of 11.6 million hectares in the various States. These surveys are aimed at delineating lands suitable for irrigated agriculture, lands which need to be reclaimed, lands unfit for irri-

gation and lands which are susceptible to hazards of salinity, alkalinity and waterlogging.

3.5 The State Public Works Departments (Irrigation) have carried out similar pre-irrigation surveys in the command areas.

3.6 The State Departments of Agriculture and Soil Conservation have mainly been concerned with soil surveys for various developmental programmes like pre- and post-irrigation surveys in the command areas of both canal and tanks, survey of waste lands, saline and alkali lands and other problem areas, surveys of special crop areas and for soil conservation and soil fertility evaluation. Surveys have also been carried out for a broad understanding of the soils of the States to help correlation, classification and interpretation. In some of the States, the Forest Department has also carried out soil surveys in forest areas for planning afforestation.

3.7 Among the Central Organisations, the Central Arid Zone Research Institute has been carrying out integrated soil surveys in certain specific arid and semi-arid areas. The Indian Photo Interpretation Institute of the Survey of India at Dehra Dun also conducts soil surveys in certain project areas where field training is imparted to the State candidates. In addition, the Agricultural Colleges and Universities also carry out limited soil surveys, mostly as a part of the thesis work of students.

3.8 Map 1 shows the areas covered by Soil survey carried out by the above agencies. A statewide compilation of the data on the extent of areas covered by soil surveys is presented in Table 1.

3.9 The information gathered from the States has been compiled district-wise and presented in the Tables 2-20. Areas covered by the Central Organisation, State Agencies as well as other agencies under detailed and reconnaissance surveys have been indicated separately. For each State, the areas surveyed, nature of surveys carried out, soil survey reports and maps published and organisational set up are briefly described below. The soil maps of the different States are, unfortunately, not compiled on uniform mapping units. But for a comparative study they should be prepared on a unified pattern. So far this has been completed by the All India Soil and Land Use Survey Organisation for the States of Kerala, Tamil Nadu, Mysore and Andhra Pradesh. The maps (2 and 3) for Mysore

and Kerala are appended as specimens. The maps for the rest of the States are being compiled on the same uniform basis.

3.10 *Andhra Pradesh*.—The State comprises 20 districts having a total geographical area of 27.2 million hectares (Table 2). Soil surveys in the State have been carried out by the All India Soil and Land Use Survey Organisation and the State Department of Agriculture. The surveys carried out by the State Department of Agriculture are mainly of pre-irrigation type particularly in the Nagarjunasagar command areas. Reconnaissance soil surveys have been carried out by the All India Soil and Land Use Survey Organisation in the districts of Anantapur, Cuddapah, Chittoor and Nellore. No soil survey has been carried out in the districts of Hyderabad, Medak, Sriakulam and East Godavari. The surveys carried out by the Central Organisation are of reconnaissance and detailed types and have been carried out in the dry farming region of Rayalseema for soil and water conservation, forest areas for rehabilitation and some research farms for conducting experiment on the basis of soil map for soil and water management. Twenty-two per cent of the total area of the State has so far been surveyed. No soil survey organisation for reconnaissance survey on the standard pattern exists in the State and no Coordination Committee has also been set up for purposes of soil correlation and classification. The area covered by pre-irrigation surveys has also to be correlated and soil boundaries re-examined in order to facilitate the preparation of soil map of the State.

3.11 *Kerala*.—The State has got 9 districts covering a total geographical area of 3.9 million hectares (Table 3). The soil surveys in the State have been carried out by both the All India Soil and Land Use Survey Organisation and the State Department of Soil Conservation. Some surveys have also been conducted under the TCM Scheme of Soil Fertility and Fertiliser Use. Soil surveys of reconnaissance and detailed types have been carried out by the Central organisation in the districts of Cannanore, Kottayam, Palghat, Ernakulam and Trivandrum. The catchment area of Kundah in the Palghat district has been surveyed both by the Central and the State Soil Survey Organisations. Twenty-five per cent of the total area of the State has been surveyed so far. The forest areas in some of the hilly tracts are inaccessible. The terrain difficulty may also hinder the usual progress of surveys. The State Soil Survey Organisation functions under the Soil Conservation Department and the staff is adequately trained. Reconnaissance mapping has been

done at series level. The remaining areas can be surveyed by the existing field parties within a reasonable period of time. The work of the State Coordination Committee should be activated so that the same functions more effectively in respect of correlation and field checking of soil boundaries to help in preparation of an accurate soil map of the State.

3.12 *Mysore*.—Soil surveys have mostly been carried out by the All India Soil and Land Use Survey Organisation and the State Department of Agriculture. The latter has conducted surveys in the command areas of the irrigation and power projects. Areas on a very limited scale have been surveyed by the Coffee Research Institute for the purpose of identifying soil problems in the coffee estates. The Revenue Department has made settlement surveys of cultivated lands. The State comprises 19 districts covering an area of 19.3 million hectares and surveys have been carried out in parts of 18 districts excepting Hassan covering 5.5 million hectares (Table 4). The soil surveys carried out by the Central Organisation are mainly of reconnaissance type in the scale of 1"=1 mile and mapping has been done at series level or associations thereof. The detailed soil surveys have been carried out in the Tungabhadra catchment area in the scale of 8"=1 mile by use of cadastral base maps and aerial photographs of 1 : 20,000 scale. Soil surveys have been carried out by the State agency on standard pattern and are of reconnaissance and detailed types. Twenty-eight per cent of the area has so far been covered by various soil survey agencies. With correlation and field checking of the soil boundaries, the existing survey data can be utilised to prepare the soil map of the State. The State Coordination Committee should function more effectively for planning further surveys and correlating and establishing the differentiated soil series.

3.13 *Tamil Nadu*.—The State consists of 13 districts covering a total area of 13 million hectares (Table 5). Soil Survey has been carried out in the State mostly by the All India Soil and Land Use Survey Organisation and the State Department of Agriculture. Earlier, the surveys conducted by the State Department were mainly concerned with the determination of fertility status of soils. Pre- and post-irrigation surveys of the sugarcane growing areas were also carried out on a limited scale. The State Soil Survey Unit is now carrying out reconnaissance soil surveys on the standard pattern. Detailed soil surveys with land capability classification have been carried

out by the Central Organisation in catchment areas of Kundah and others for soil conservation purposes. The maps for reconnaissance soil survey are in the scale of 1"=1 mile and those of the detailed soil survey in the scale of 8"=1 mile, which include land capability classification as well. No soil survey has so far been taken up in the districts of Kanniyakumari, Tirunelveli and Ramanathapuram. In the districts of Chingleput, Tiruchchirappalli and Madurai very small areas have been covered by detailed soil survey. Fairly large areas have been covered by reconnaissance soil surveys in the districts of Coimbatore, Tanjore, Nilgiris and Salem. In the remaining districts the area surveyed is relatively small. The area surveyed constitutes about 17% of the total area of the State. The State Coordination Committee should function more effectively so that the survey data already available may be used, with reasonable accuracy after due correlation, for the preparation of a scientific soil map of the State.

3.14 *Assam* (including Meghalaya).—The State comprises 11 districts covering an area of 13.7 million hectares (Table 6). Very little soil survey has been carried out in the State. However, the All India Soil and Land Use Survey Organisation has carried out limited soil surveys in a few selected areas. The State Department of Agriculture has established a soil survey unit only recently but presumably owing to lack of adequate trained personnel, assistance from the Central Organisation will be required initially. Reconnaissance soil surveys have been done in the districts of Darrang, Nowgong and Lakhimpur. Only 3% of the total area of the State has so far been surveyed. Forest lands are extensive and inaccessible. A State Coordination Committee should be formed for planning field surveys on standard pattern and correlating the differentiated soils.

3.15 *Orissa*.—The State comprises 13 districts covering a geographical area of 14.8 million hectares (Table 7). Soil surveys have been carried out in the State mainly by the All India Soil and Land Use Survey Organisation. Some surveys of the pre and post-irrigation types have also been carried out by the Central Water and Power Commission in the command area of Hirakud Dam. The State Soil Survey Organisation which is equipped with trained personnel has so far conducted soil survey in limited areas including the waste lands. Reconnaissance soil surveys have been carried out in parts of Sundargarh, Koraput and Mayurbhanj districts. Detailed soil surveys are mostly concentrated in the catchment area of Hirakud

Dam. About 18% of the total area has so far been surveyed. There is no State Coordination Committee which requires to be formed early.

3.16 *Bihar*.—The State has 17 districts covering a total area of 17.4 million hectares (Table 8). Reconnaissance soil surveys have been completed in the State and the soil maps have been prepared in the scale 1"=1 mile or 1"=6 miles. These surveys have been carried out mostly by the State Department of Agriculture. All India Soil and Land Use Survey Organisation has covered only a few small areas. Although the entire State has been covered by soil survey, the soil series descriptions need critical scrutiny and correlation. The State Coordination Committee should function more effectively and take necessary action in respect of soil correlation, classification and interpretation. It may also be necessary to retrace some of the areas for the purpose of checking up soil boundaries. Since the State has a well established soil survey organisation with adequate staff, it will be necessary to coordinate the work of the State Soil Survey Organisation with the Central Organisation. A concentrated effort in correlation and boundary delineation will help in compilation of the State soil map.

3.17 *West Bengal*.—The State has 15 districts covering an area of 9 million hectares (Table 9). Rapid reconnaissance soil survey has been carried out throughout the State by the State Department of Agriculture. The purpose of such surveys was to classify the soils broadly and assess the distribution of soils for efficient agricultural production. 1"=1 mile topographical maps of the Survey of India have been used as base maps. Six-mile grid has been followed and profiles of 4-5 feet depth have been examined and described. The soil survey maps and reports are available for some districts. The soil maps of the districts of Nadia, Birbhum, Murshidabad and Bankura have been supplied to the National Atlas Organisation for compilation and incorporation into the district gazetteers. Detailed soil surveys have been carried out by the All India Soil and Land Use Survey Organisation in the districts of Birbhum, Bankura, Purulia, Midnapur and Jalpaiguri for the purpose of soil classification and irrigation and land development for refugee rehabilitation. The soil maps of varying scales from 2"=1 mile to 16"=1 mile with land capability classes superimposed thereon have been made. Soil surveys have also been carried out by the Central Water and Power Commission for finding out areas suitable for irrigation

Ninetytwo per cent of the area of the State has thus been surveyed. For the purpose of preparation of soil map of the State a good amount of correlation work will be necessary. The State Coordination Committee should be formed early for the purpose. Retraversing of most of the areas for checking up soil boundaries has also to be done.

3.18 *Gujarat*.—The State has 17 districts covering 17.5 million hectares (Table 10). Soil surveys have mostly been carried out by the State Public Works Department (Irrigation), Engineering Research Institute and the Central Water and Power Commission. The State Department of Agriculture conducted some profile studies in the waste lands. The State Soil Survey Unit is carrying out reconnaissance soil survey and mapping on the standard pattern. The All India Soil and Land Use Survey Organisation carried out detailed soil surveys with land capability classification in the Dhantiwada catchment area. Under the TCM Project of Soil Fertility and Fertiliser Use, some soil surveys and mapping have also been carried out. Thirtysix percent of the total area is covered by soil survey. It is, however, to be mentioned that the pre-irrigation soil surveys carried out by the Central Water and Power Commission do not give morphological description of soil profiles and field mapping of differentiated soil units. Unless retraversing of these areas for identification of soils and their correlation and drawing up of soil boundaries for differentiated soils is done, very little use of the Central Water and Power Commission data could be made. The State Coordination Committee should function more effectively and pool together the available data on soil surveys for correlation.

3.19 *Madhya Pradesh*.—The State consists of 43 districts having a geographical area of 44.4 million hectares (Table 11). Soil surveys have been carried out in 32 districts with partial coverage. Pre-irrigation soil surveys in the command areas of the various irrigation projects were conducted by the Central Water and Power Commission. The soil surveys of Government Farms and pre-irrigation soil surveys in the Chambal command areas were carried out by the State Department of Agriculture. The detailed soil surveys in the catchment areas of Hirakud falling in the State and the Chambal River Valley Project were carried out by the All India Soil and Land Use Survey Organisation. About 12% of the area of the State has been covered by soil surveys. Forests occupy fairly large areas in the State. The priority areas for survey are Tawa and

Narmada Projects. The soil surveys conducted by the State Department of Agriculture are on the standard pattern and could be used in the preparation of the soil map of the State after due correlation and checking up of soil boundaries. The surveys carried out by the Central Water and Power Commission lack in profile description and soil boundary differentiation. It will thus be necessary to retrace these areas for the preparation of soil map of the State. Necessary steps require to be taken for formation of the State Coordination Committee.

3.20 *Maharashtra*.—The State has got 26 districts covering a geographical area of 30.4 million hectares (Table 12). Soil surveys have been carried out by different agencies including the State Department of Agriculture. The State Irrigation and Power Department has done some pre-irrigation and drainage surveys in the command areas of a number of irrigation projects. The All India Soil and Land Use Survey Organisation has carried out both detailed and reconnaissance surveys in some of the districts. Reconnaissance soil surveys on the standard pattern have been carried out in the districts of Bhandara, Yeotmal, Akola, Poona and Ahmednagar. Only 11% of the total area of the State has so far been surveyed. The State Coordination Committee should be formed for planning further surveys and correlation of differentiated soils.

3.21 *Haryana*.—The State comprises 7 districts covering a geographical area of 4.4 million hectares (Table 13). Soil surveys in the State have been carried out by the State Department of Agriculture, the Irrigation Research Institute at Amritsar and the All India Soil and Land Use Survey Organisation. No soil survey has been carried out in the districts of Jind and Rohtak and only a small area has been covered in the Gurgaon district. The All India Soil and Land Use Survey Organisation has carried out reconnaissance soil survey in Hissar district. Fortythree per cent of the total area has been surveyed so far. Reconnaissance soil surveys carried out by the Central Organisation are on the standard pattern. For other areas field correlation and checking of soil boundaries by actual traversing will be necessary. There is no Coordination Committee in the State and this should be formed early.

3.22 *Himachal Pradesh*.—The State comprises 8 districts covering a total geographical area of 5.4 million hectares (Table 14). Most of the soil surveys in the State have been carried out by the All India Soil and Land Use Survey Organi-

sation. Waste land surveys have been conducted by the State Department of Agriculture. Detailed soil surveys have been carried out by the Central Organisation in the watershed of the Sutlej river. Only 4% of the area of the State has so far been surveyed. There are, however, large inaccessible areas which are either snow covered peaks or forests. Considering the difficulties of terrains the State Soil Survey Unit should be properly organised in sufficient strength. Initially, the Central Organisation should render suitable assistance.

3.23 *Jammu & Kashmir*.—The State has a geographical area of 22.3 million hectares (Table 15). A small area of 21,000 hectares has been covered by reconnaissance survey in Jammu district. The State has considerable inaccessible forests. Unfavourable terrain features would also reduce the speed of survey work. Initially the Central Organisation has to render necessary help in the work so that it is of the required standard.

3.24 *Punjab*.—The State consists of 10 districts having a geographical area of 5 million hectares (Table 16). The soil surveys in the State have been carried out by the State Department of Agriculture, Irrigation Research Institute at Amritsar and All India Soil and Land Use Survey Organisation. The surveys carried out by the Irrigation Research Institute are mainly of pre-irrigation survey type based on grids. Reconnaissance soil surveys have been carried out in the districts of Ludhiana, Patiala, Amritsar, Gurdaspur, Kapurthala, Jullundur, Hoshiarpur and Ferozepur. Detailed surveys have been carried out in selected areas. Forty-eight per cent of the total area has so far been surveyed. Since the major part of the areas surveyed is of pre-irrigation type and lacks in profile description, a good deal of retraversing and checking of soil boundaries followed by correlation would be necessary. The State Coordination Committee should function more effectively for the above purpose.

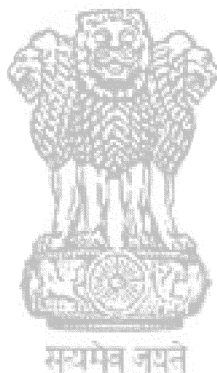
3.25 *Rajasthan*.—The State comprises 26 districts covering a total geographical area of 34.3 million hectares (Table 17). Most of the surveys in the State have been carried out by the State Department of Agriculture. The Central Water and Power Commission has conducted preliminary surveys in the Rajasthan Canal Project area for assessing the suitability of land for irrigation. This has been further followed up by detailed soil surveys by the State Soil Survey Organisation. The All India Soil and Land Use Survey Organisation carried out detailed soil survey in the Chambal catchment area. The dis-

tricts of Kota, Pali and Ganganagar have been surveyed more than once by different agencies. The Central Arid Zone Research Institute has carried out integrated surveys in Bikaner, Jaisalmer and Barmer districts. No soil surveys appear to have been carried out in the districts of Chittorgarh, Churu, Jaipur, Nagore, Bharatpur and Sikar. Soil surveys of one type or the other have been carried out in parts of 17 districts. Forty-two percent of the total area of the State has been surveyed so far. The Soil Survey Organisation of the State has trained staff and most of the surveys carried out are of the standard type. The State Coordination Committee should function more effectively for proper correlation and coordination of the already available data, so that these could be profitably utilised for the preparation of the soil map of the State.

3.26 *Uttar Pradesh*.—The State consists of 54 districts having a geographical area of 29.5 million hectares (Table 18). Soil surveys in the State have mostly been carried out by the Soil Survey Unit under the Agricultural Chemist, which has been in existence since 1948-49. The All India Soil and Land Use Survey Organisation has also carried out detailed soil surveys in limited areas in Jhansi, Dehra Dun and Kanpur, mainly for soil conservation work. Information on soils of the sugarcane growing areas has been compiled by the State Department of Agriculture. Out of 54 districts reconnaissance soil survey has been completed in 27 districts. Within the districts certain tehsils have also been surveyed in detail for delineation of soil types in order to facilitate agronomic experiments. Apart from these, soil surveys have been conducted in large *usar* blocks and waste lands. Thirty-five per cent of the total area of the State has been covered so far by soil survey. Quite a large volume of data pertaining to soil profile description and analysis are available with the State Soil Survey Organisation. With proper correlation of soils mapped and field checking of soil boundaries, the soil maps prepared for the various districts can be finalised and compiled. Coordination of work between the Central and State Soil Survey Organisations will help speedy correlation and completion of the soil map of the State for which the State Coordination Committee should be set up.

3.27 *Union Territories and Newly Formed States*.—Some soil surveys have been carried out in the States of Tripura and Goa by the All India Soil and Land Use Survey Organisation (Tables 19 and 20). Some exploratory soil survey has also been carried out in the Andaman and Nicobar Islands. For compilation of soil map, the data are insufficient.

3.28 From the data given in Table 1 it is observed that so far about 896 lakh hectares have been surveyed by the various agencies. This constitutes 27% of the total area of the country. Only about 5.6 % has been subjected to detailed survey. It may be desirable and perhaps necessary to re-survey some of the areas according to the standard pattern. Consequently, the value of soil map of India based on the available information has to be judged in this context. A Soil Map of India (Map 4) in the scale of 1 : 6 million, which incorporates the latest soil survey data has recently been published*. Differentiation of soil groups or associates by extrapolative method, small scale of mapping and somewhat arbitrary demarcation of soil boundaries, all these had to be done to prepare this map because of lack of sufficient data. The usefulness of the map is, therefore, limited.



*Published by the Indian Society of Soil Science in "Soil Research in India" in February 1971 on the occasion of the International Symposium on Soil Fertility Evaluation.

SECTION IV

PROPOSALS FOR SOIL SURVEY, CLASSIFICATION AND MAPPING

4.1 Out of the total geographical area, about 23 million hectares are accounted for by mountains, deserts and inaccessible areas, leaving 305 million hectares suitable for survey. Out of this, 89.6 million hectares have been surveyed by one method or the other, but some of the areas undoubtedly need re-survey. The area to be surveyed for the first time amounts to 216 million hectares. Again, although in some of the States, e.g., Bihar and West Bengal, where the entire or a large part of the areas has been covered by reconnaissance survey, there is very little work done in soil correlation. It is indeed an important scientific activity of soil survey organisation and consists in specially comparing the set of all significant characteristics of each soil with sets of characteristics of the already defined and named soils in the natural and taxonomic system of soil classification, and thereby giving each soil its name and place in the system.

4.2 The standard soil surveys should provide scope for correlation, classification and interpretation. Such a process will help in the general understanding of the properties of various types of soils recognised in the field and mapped. The comprehensive system of soil classification (Soil Taxonomy) as developed by the United States Department of Agriculture (USDA) commends itself for adoption with suitable modifications. The United States Department of Agriculture system of soil classification has, therefore, to be followed uniformly, as is being done at present. The FAO system of soil classification which is much more broad-based than the USDA system may simultaneously be adopted for bringing unification of soil information on an international basis. Some attempts in this direction have already been made with our soil survey data*.

*Classification of Indian Soils and their mapping, 21st International Geographical Congress, India, 1970, Vol. I, Part 3, Biogeography.

4.3 Because of the importance of soil map, priority needs to be given to this work in all its aspects. If within a reasonable period of time, say, 10 years, a useful soil map (1 : 1 million) is to be produced, necessary steps have to be urgently taken. These refer to the basic work of soil survey and provision of adequate technical personnel having the required training and equipments and materials. The speed of mapping will depend on the type of base maps used for soil survey. In case aerial photographs are made available, instead of the Survey of India toposheets, in the scale of 1:50,000 for reconnaissance survey, 40 to 60 per cent of time can be saved. Wherever developmental projects are being contemplated or under implementation, soil survey and soil mapping should receive priority attention. The best way to attend to these priority projects is to carry out soil survey with the help of aerial photographs. Fortunately, aerial photographs (mostly 1:50,000 scale) for the entire country have been carefully prepared by the Survey of India and they are eminently suited to soil survey work. For obvious reasons there are restrictions to the availability of the aerial photographs in respect of many of the regions which are of great value from the point of view of land use. It is, therefore, important that aerial photographs are made available for the non-sensitive areas at least, so that the soil survey work can be expedited in those areas.

4.4 Soil Survey Manual (1970)* of the All India Soil and Land Use Survey Organisation has given a norm of performance for a party of five, ** according to which the party can cover an area of nearly 0.8 lakh hectares per annum by reconnaissance survey and field mapping in the scale of 1:50,000 including the time spent in finalisation of field sheets. On the basis of this norm the number of parties that will be required for covering the areas still to be surveyed is around 270. There should be one supervisory officer for every four to five parties. The requirement of number of parties per State will depend on the areas to be covered (Ref. Table I) and the number of parties already available. At present 100 soil survey parties are working in different States and

*Published by the All India Soil and Land use Survey Organisation, IARI, New Delhi.

**Composition of field party for soil survey :

(1) Soil Survey Assistant	1
(2) Field Assistant	1
(3) Tracer or Surveyor	1
(4) Chowkidar or Khalasi	1
(5) Jeep Driver	1

under the Central Organisations. It will thus be necessary to have 170 additional Soil Survey parties and 35-40 additional supervisory officers distributed among the States depending upon the quantum of work. If air photos are made available, the number of parties may be reduced to about 120. Since, however, re-survey on standard pattern of certain areas in every State will be called for, the total number of parties will have to be near-about 170. As the standard soil survey envisages quantitative evaluation of certain physical and chemical properties of the soil, the soil survey organisations in the States and at the Centre should, therefore, be supported by adequate laboratory staff and facilities, including those for making maps.

4.5 In executing the above programme it will be necessary to strengthen the training facilities available with the All India Soil and Land Use Survey Organisation, so that the work goes on with the required efficiency and standard of performance. An integrated training course in collaboration with the Photo Interpretation Institute of the Survey of India at Dehra Dun will be highly desirable. The use of remote sensing techniques, multi-data imageries and satellite photography is being made for the purpose of soil survey in some of the developed countries where suitable interpretation techniques are also being developed. Such facilities may be availed of in our country in no distant future. In imparting soil survey training these recent techniques may also be dealt with in considerable detail depending on the knowledge so far available.

4.6 As the mapping units in the Soil Map of India will be largely based on quantitative rather than qualitative characteristics of the soils, it will be necessary to strengthen the Central Organisation with scientists who are familiar with the modern trends in soil correlation, classification and interpretation. It is estimated that about 1000 persons with different standards of qualification and training will be necessary. A tentative estimate is given below :

Field Survey

<i>Scientific/technical</i>							
Post-graduate level	Post-graduate level	Science graduate level	Skilled	Professional	Non-skilled	Other Supporting work*	Total
50	170	170	170	170	173	100	1000

*e.g., laboratory/laboratories cartography, training, etc.

The figures do not include the large number of local hands that have to be engaged temporarily to assist the survey parties.

4.7 The Central Organisation has so far (i.e., from 1956 to March 1972) spent for soil survey and soil mapping about Rs. 1.9 crores and plans a total expenditure of Rs. 6.15 crores (comprising Rs. 5.15 crores recurring and Rs. 1.0 crore non-recurring) over the next ten years for completing the 1:1 million scale soil map of India. The data on the expenditure on soil survey by the various States could not be obtained. However, a rough calculation may be made on the basis of the norm of expenditure arrived at in 1962 regarding cost of reconnaissance soil survey, namely, Rs. 0.15 per hectare. This figure ought to be increased now to Rs. 0.25 per hectare in view of a general price rise. Accordingly, the total expenditure is estimated at Rs. 5.4 crores for the reconnaissance soil survey of the remaining 216 million hectares.

4.8 Whenever reconnaissance soil survey is completed, the need for detailed survey of certain areas will be revealed. For such intensive work as detailed survey, additional staff would be required. Moreover, soil survey is bound to activate agriculture generally, and initiate particularly developmental works of varied nature, e.g., soil conservation, drainage, soil amelioration and intensive cropping which emphasises efficient use of soil and water, etc. Each of these ventures is going to encourage employment, both technical and non-technical, in varying numbers, depending on the size and complexity of the task to be handled.

4.9 For the purpose of unification of soil survey work throughout the country it is necessary to have a Coordination Committee for soil survey in each State, which will help in adoption of standardised techniques in soil surveys including preparation of the annual work plan of soil survey, field examination of soils, mapping, etc. Further, the Committee will pool the soil survey data obtained by various agencies in the State for the purpose of soil correlation, classification and interpretation and formulate policy matters pertaining to soil survey work. From a perusal of section III it will be seen that about a third of the total reported area of the country has been covered by soil surveys and an appreciable amount of scientific information on soils of the area so covered is available. Unfortunately, this information has not been fully utilised in most of the States. State Coordination Committees should, therefore, take necessary cognizance of these voluminous data and make use of the same, after due interpretation for land use and crop planning, concurrently with the action taken on correlation and classification. The State Co-

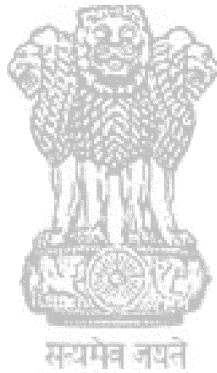
ordination Committee is ordinarily composed of the following members but its composition varies from State to State.

- (a) Director of Agriculture/Soil Conservation/Director of Research in Agricultural University (Chairman)
- (b) State Agricultural Chemist.
- (c) Professor of Soil Science and Agricultural Chemistry of the State Agricultural University.
- (d) Professor of Chemistry of such other Universities which have programmes of studying soils.
- (e) Soil Correlator of the Central Soil Survey Organisation of the region.
- (f) A representative of the State Forest/Irrigation Departments.
- (g) Soil Survey Officer or Officer Incharge of the Soil Survey of the State. (Convener)

The States of Tamil Nadu, Kerala, Mysore, Gujarat, Rajasthan, Bihar and Punjab have already constituted the Coordination Committees. The other States have not yet formed the Coordination Committees. Besides the State Coordination Committees, a Coordination Committee at the Centre will help in coordination of soil survey work at the national level. Such coordination will be of great help in the preparation of the scientific soil map of the country as envisaged in the present report. It is, however, stressed that there should be effective leadership with adequate knowledge and training both in the State and at the Centre so that the work is of the required standard. If the steps suggested above are not taken early, the present lacunae will persist and, in the long run, have a retrograde effect on subsequent work on soil correlation, classification and interpretation.

4.10 Adoption of standard soil survey methods throughout the country has been pointedly emphasised. This is, however, not easy to enforce if diverse organisations carry out soil survey work without having properly trained personnel. Such soil surveys, done often at great cost, serve only limited purposes. It is, therefore, essential that all soil surveys

and subsequent correlation and classification work are executed by the All India Soil and Land Use Survey Organisation or its counterparts in the States, not only for the sake of uniformity of procedures but also for a better utilisation of the information thus obtained. Whenever a concern is in need of soil survey for its own use it should take the help of the Central or the State soil survey organisations, whichever is convenient.



SECTION

ACKNOWLEDGEMENTS

5.1 The Commission takes this opportunity to thank all the Organisations and Institutions responsible for soil survey, both at the Centre and in the States and officials of the Central and State Governments for supplying available information on soil surveys and soil maps.

5.2 We wish to place on record our appreciation of the valuable contribution made by Dr. R. S. Murthy, Chief Soil Survey Officer, I.A.R.I., not only in the matter of collecting the entire soil survey data and providing all the maps presented in this Report but also in assembling the background materials for this Report. Our thanks are also due to Dr. N. R. Datta Biswas, Specialist (Soils) who has put in hard and conscientious work in the preparation of the Report.

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Randhir Singh

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N. K. Panikkar

J. S. Sarma

Member Secretary

NEW DELHI

11th August, 1972.

TABLES

NOTES

1. The State geographical area in Table 1 is according to the Surveyor General of India. The district-wise geographical area and the total area for each of the States in Tables 2-20 are according to the revenue records. As such, there is slight variation in the figures given in Table 1 and the Tables for the different States. Figures in Col. 10 refer to mapped data as distinct from reported data given in Cols. 4 to 9.
2. In the Tables, the figures have been rounded up in each individual case and, therefore, may be at slight variance in respect of totals.
3. In the case of a few States, some of the districts have been re-organised but the information relates to the position prior to re-organisation.

TABLE I
Area covered by soil surveys in the different States and the gap in coverage

		(thousand hectares)							
S. No.	Name of the State	Area covered by different types of surveys (under Central, State and other Agencies)		Total land area covered by soil survey**	Area remaining to be covered by soil survey (3-6)				
		Geographical area according to Surveyor General of India†	Reconnaissance*						
						3	4	5	6	7	8
1	2	3	4	5	6	7	8	9	10
1.	Andhra Pradesh	•	•	•	•	2,571	6,006(22%)	21,670	•
2.	Kerala	•	•	•	•	526	981(25%)	2,905	•
3.	Mysore	•	•	•	•	1,749	5,510(28%)	13,667	•
4.	Tamil Nadu	•	•	•	•	377	2,308(17%)	10,699	•
5.	Assam (including Maghalaya)	•	•	•	•	47	363(3%)	11,847	•
6.	Orissa	•	•	•	•	1,480	2,761(18%)	12,823	•
7.	Bihar	•	•	•	•	966	17,388(100%)	nil	•
8.	West Bengal	•	•	•	•	330	8,324(92%)	461	•
9.	Gujarat	•	•	•	•	747	7,089(36%)	12,509	•
10.	Madhya Pradesh	•	•	•	•	2,002	5,326(12%)	38,958	•
11.	Maharashtra	•	•	•	•	1,966	3,427(11%)	27,349	•
12.	Haryana	•	•	•	•	23	1,891(43%)	2,531	•

9 NCA/72-6.

9 NCA/72-6.

TABLE I—Contd.

	1	2	3	4	5	6	7
13. Himachal Pradesh	5,567	10	208	218(4%)	5,349
14. Jammu & Kashmir (b)	22,224	21	..	21(0.1%)	22,203
15. Punjab	5,036	2,322	70	2,419(48%)	2,617
16. Rajasthan	34,222	12,201	3,479	14,238(42%)	19,964
17. Uttar Pradesh	29,441	10,346	23	10,349(35%)	19,092
18. Tripura	1,048	..	..	409(39%)	639
19. Nagaland	1,653	..	..	..	1,653
20. Other smaller States and Union Territories	12,659	547	12	559(4.4%)	12,100
						Delhi A & N Islands Goa NEFA	
						101 74 361 23	
TOTAL	328,048			89,602(27%)	238,446 (73%)

*Source: Directorate of Economics & Statistics—Agriculture in Brief, 11th Edition, 1971.

*Includes areas covered by detailed-reconnaissance survey

****This is actual land area covered and not the total of reconnaissance and detailed survey areas. Detailed survey in most cases overlaps reconnaissance survey areas.**

(b) Excludes data in respect of areas under illegal occupation by China and Pakistan.

TABLE 2

Soil surveys carried out in Andhra Pradesh

		(thousand hectares)									
S. No.	Name of the district	Geo-graphical area	Area surveyed by the Central Soil Survey Orgn.		Area surveyed by the State Agencies		Area surveyed by other Agencies		Total area surveyed	Area remaining to be surveyed	
			Recon-naissance	Detail-ed	Recon-naissance	Detail-ed	Recon-naissance	Detail-ed			
1	2	3	4	5	6	7	8	9	10	11	
1.	Khammam	.	.	.	1,192	213	..	..	213	979
2.	Guntur	.	.	.	1,502	57	956	..	1,013	489	
3.	Nalgonda	.	.	.	1,387	242	..	..	242	1,145
4.	Adilabad	.	.	.	1,616	1	76	..	76	1,540	
5.	Kurnool	.	.	.	2,387	182	100	..	282	2,105	
6.	Mahbubnagar	.	.	.	1,916	45	..	..	47	1,868
7.	West Godavari	.	.	.	774	4	..	..	4	770
8.	Nizamabad	.	.	.	807	52	93	..	149	658	
9.	Krishna	.	.	.	908	..	240	..	240	667	
10.	Karimnagar	.	.	.	1,183	..	259	..	259	924	
11.	Cuddapah	.	.	.	1,535	589	5	39	629	907	
12.	Anantapur	.	.	.	1,914	1,299	9	86	1,299	615	
13.	Warangal	.	.	.	1,291	39	..	..	39	1,253

TABLE 2—Contd.

14. Chittoor	.	.	.	.	1,531	754	13	..	..	..	755	776
15. Visakhapatnam	.	.	.	.	1,348	158	..	..	..	..	158	1,189
16. Hyderabad	.	.	.	.	774	..	..	..	..	..	..	774
17. Medak	.	.	.	.	962	..	..	..	..	..	..	962
18. Srikakulam	.	.	.	.	101	..	..	..	..	..	..	101
19. East Godavari	.	.	.	.	1,084	..	..	..	..	..	..	1,084
20. Nellore	.	.	.	.	2,062	131	6	364	100	..	601	1,461
<i>Area surveyed in more than one district</i>												
Hyderabad and Mahbubnagar	.	.	.	.	..	238	8	..	..	..	246	..
GRAND TOTAL	.	.	.	.	27,186	..	..	..	..	..	6,006	21,181

TABLE 3
Soil surveys carried out in Kerala

S. No.	Name of the district	Geo-graphical area	(thousand hectares)									
			Area surveyed by the Central Soil Survey Organisation	Area surveyed by the State Agencies		Area surveyed by the other Agencies		Total area surveyed		Area remaining to be surveyed		
			Reconnaissance	Reconnaissance	Detailled	Reconnaissance	Detailled	Reconnaissance	Detailled			
1	2	3	4	5	6	7	8	9	10	11		
1.	Cannanore	711	52	4	..	N	..	..	53	658		
2.	Kottayam	602	66	..	10	N	..	..	76	526		
3.	Quilon	503	..	2	..	55	..	..	57	446		
4.	Palghat	514	115	16	..	104	..	..	221	293		
5.	Ernakulam	328	131	3	..	11	..	..	142	186		
6.	Trivandrum	219	184	3	218	218	..	..	218	2		
7.	Alleppey	184	..	..	86	40	..	..	96	88		
8.	Trichur	298	..	..	8	..	..	..	8	289		
9.	Calicut	529	..	..	102	68	..	..	110	419		
GRAND TOTAL		3,889							981	2,908		

N = Negligible.

TABLE 4
Soil surveys carried out in Mysore
(thousand hectares)

Sl. No.	Name of the district	Geographical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Total area surveyed	Area remaining to be surveyed
			Recon-	Detailed	Recon-	Detailed		
1	2	3	4	5	6	7	8	9
1. Karwar	.	1,030	269	..	..	3	272	757
2. Coorg	.	412	412	3	..	..	412	..
3. Kolar	.	826	538	..	..	..	538	288
4. Gulbarga	.	1,645	..	..	..	27	27	1,618
5. Chickmagalur	.	722	..	..	48	85	133	590
6. Chitaldurg	.	1,085	358	19	77	34	454	630
7. Tumkur	.	1,062	136	..	..	4	140	921
8. South Kanara	.	932	181	44	..	..	181	751
9. Dharwar	.	1,375	233	347	..	203	532	842
10. Bellary	.	991	485	175	..	283	768	223
11. Bijapur	.	1,708	286	2	..	1	289	1,418
12. Bidar	.	537	..	..	45	..	45	492
13. Belgaum	.	1,338	..	..	..	52	52	1,286
14. Bangalore	.	798	798	..	..	6	798	..

TABLE J
Soil surveys carried out in Tamil Nadu

S. No.	Name of the district	Geo-graphical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Total area surveyed	Area remaining to be surveyed	(thousand hectares)
			Recon-naissance	Detailed	Recon-naissance	Detailed			
1	2	3	4	5	6	7	8	9	
1.	North Arcot	1,211	..	..	5	..	5	1,206	
2.	Kanyakumari	167	..	..	..	..	..	167	
3.	Colombatore	1,560	358	22	514	283	588	971	
4.	Chingleput	794	..	..	..	N	N	794	
5.	Tiruchchirappalli	1,429	..	..	..	N	N	1,429	
6.	Tirunelveli	1,145	..	..	..	..	..	1,145	
7.	Thanjavur	969	..	..	671	..	671	298	
8.	South Arcot	1,089	..	..	..	16	16	1,073	
9.	Nilgiris	255	255	48	..	..	255	..	
10.	Madurai	1,273	..	N	..	N	N	1,272	
11.	Ramanathapuram	1,257	..	..	..	..	..	1,257	
12.	Salem	1,831	84	6	686	..	771	1,060	
13.	Madras	13	..	..	..	..	..	13	
GRAND TOTAL		12,994					2,308	10,686	

N—Negligible.

TABLE 8
Soil surveys carried out in Bihar

Sl. No.	Name of the district	(thousand hectares)									
		Geographical area	Area surveyed by the Central Soil Survey Organisation	Area surveyed by the State Agencies	Area surveyed by other Agencies	Total area surveyed	Area remaining to be surveyed				
1	2	3	4	5	6	7	8	9	10	11	
1.	Patna	561	..	..	561	..	..	..	561	Nil	
2.	Purnea	1,104	..	..	1,104	17	..	..	1,104	..	
3.	Monghyr	1,030	..	..	1,030	..	..	..	1,030	..	
4.	Bhagalpur	566	..	..	566	..	..	..	566	..	
5.	Saharsa	542	..	..	542	..	..	..	542	..	
6.	Palamau	1,276	..	..	1,274	..	..	71	1,276	..	
7.	Champaran	921	..	..	921	..	..	..	921	..	
8.	Darbhanga	867	65	..	870	..	..	..	867	..	
9.	Šaran	692	..	..	650	..	567	..	692	..	
10.	Ranchi	1,826	..	..	1,845	..	..	62	1,826	..	
11.	Singhbhum	1,345	..	..	1,345	..	..	..	1,345	..	
12.	Shahabad	1,142	..	..	1,134	66	..	..	1,142	..	
13.	Santhal-Paraganas	1,418	26	183	1,422	14	..	32	1,418	..	

1	2	3	4	5	6	7	8	9	10	11
14.	Hazaribagh	.	.	.	.	1,818	..	452	1,818	..
15.	Dhanbad	.	.	.	.	289	..	60	289	..
16.	Muzaffarpur	.	.	.	.	783	..	..	783	..
17.	Gaya	.	.	.	.	1,235	..	..	1,235	..
GRAND TOTAL		.	.	.	.	17,417			17,417	

TABLE 9
Soil surveys carried out in West Bengal

Don't surveys carried out in West Bengal

		(thousand hectares)												
Sl. No.	Name of the district	Geographical area	Area surveyed								Total area surveyed	Area remaining to be surveyed		
			by the Central Soil Survey Organisation		by the State Agencies		by other Agencies		Detail- ed	Recon- nais- sance				
			3	4	5	6	7	8						
1	2	3	4	5	6	7	8	9	10	11				
1.	24-Parganas	1,378	..	..	1,363	..	..	..	1,363	14		
2.	Howrah.	149	..	..	..	..	..	..	..	149		
3.	Nadia	396	..	..	391	..	..	..	391	5		
4.	Birbhum	704	..	..	452	69	..	..	521	183		
5.	Murshidabad	541	..	..	535	..	..	..	535	5		
6.	Malda	369	..	..	361	..	..	..	361	8		
7.	Darjeeling	301	..	..	311	..	..	..	301	..		
8.	Cooch Behar	338	..	..	342	..	..	..	338	..		
9.	Midnapur	1,364	11	9	1,361	4	..	..	1,364	N		
10.	Purulia	628	..	93	627	5	..	143	628	..				
11.	Bankura	687	..	..	686	6	..	..	687	N		
12.	Burdwan	704	74	..	701	..	..	..	704	N		
13.	Hooghly	315	26	..	313	..	..	..	315	..		
14.	West Dinajpur	548	..	..	197	..	..	..	197	351		
15.	Jalpaiguri	624	..	1	615	..	..	..	617	7		
GRAND TOTAL		9,048	..	..	..	..	..	..	8,324	724		
N—Negligible														

N—Negligible

TABLE 10
Soil surveys carried out in Gujarat

Sl. No.	Name of the district	Geographical area	(thousand hectares)									
			Area surveyed by the Central Soil Survey Organisation	Area surveyed by the State Agencies	Area surveyed by other Agencies	Total area surveyed	Area remaining to be surveyed					
1	2	3	4	5	6	7	8	9	10	11		
			Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed				
1.	Broach .	774	..	..	..	..	95	53	149	625		
2.	Bulsar .	..	..	..	160	..	..	..	160	..		
3.	Baroda .	766	..	..	..	..	55	8	63	..		
4.	Panchmahals .	903	..	..	..	..	52	46	99	804		
5.	Ahmedabad .	897	..	..	..	..	276	141	418	479		
6.	Mehsana .	1,121	146	..	..	..	..	28	174	946		
7.	Sabarkantha .	737	..	..	..	..	6	58	64	673		
8.	Kaira .	679	..	..	..	..	559	157	635	44		
9.	Banaskantha .	1,047	110	..	..	..	207	54	372	675		
10.	Bhavnagar .	1,206	39	..	..	..	35	43	117	1,089		
11.	Rajkot .	118	..	..	..	..	68	13	81	37		
12.	Junagadh .	1,028	39	..	..	..	9	55	64	964		
13.	Amreli .	400	..	..	..	..	10	26	36	364		

1	2	3	4	5	6	7	8	9	10	11
14.	Kutch	4,417	44	..	..	14	371	..	398	4019
15.	Jamnagar	1,022	..	..	..	..	3	9	12	1,010
16.	Surendranagar	1,096	..	..	..	..	14	..	14	1082
17.	Areas falling in more than one district	1,259	..	..	569	40	509	..	1,038	221
	Surat and Bulsar . . . . .	..	..	..	..	..	..	..	..	..
	Banaskantha, Mehsana, Ahmedabad, Kaira & Panchmahals . . . . .	..	..	..	..	..	803	..	803	..
	Broach & Baroda . . . . .	..	..	..	..	..	1,373	..	1,219	..
18.	11 districts of Gujarat . . . . .	..	..	..	..	..	3,009	..	1,170	..
GRAND TOTAL		17,471	..	..	..	..	7,089	..	10,382	..

TABLE 11
Soil surveys carried out in Madhya Pradesh

Sl. No.	Name of the district	Geographical area	(thousand hectares)									
			Area surveyed by the Central Soil Survey Organisation	Area surveyed by the State Agencies	Area surveyed by other Agencies	Total area surveyed	Area remaining to be surveyed					
			Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed	Recon- nais- sance	Detail- ed
1	2	3	4	5	6	7	8	9	10	11		
1. Gwalior.	.	519	26	..	..	..	..	..	26	493		
2. Bhopal .	.	933	26	..	..	..	..	..	26	907		
3. Hoshangabad	.	1,002	155	..	121	..	377	..	532	469		
4. Raipur .	.	2,129	92	237	..	..	269	..	631	1,497		
5. Indore .	.	383	59	174	..	..	..	..	234	149		
6. Jabalpur	.	1,015	..	N	..	182	..	..	183	833		
7. Surguja	.	2,235	..	69	..	..	..	..	69	2,167		
8. Raisen .	.	848	..	19	..	..	102	..	121	726		
9. Raigarh	.	1,312	..	276	..	..	41	..	318	995		
10. Bilaspur	.	1,974	..	27	..	N	261	..	289	1,685		
11. Durg .	.	1,964	..	138	..	..	..	..	138	1,825		
12. Dewas .	.	701	..	47	..	..	..	..	47	654		

13. Ujjain	612	..	145	..	..	..	145	466
14. Mandasaur	1,028	..	85	..	100	..	185	843
15. Dhar	816	..	21	..	..	..	21	795
16. Satna	730	12	..	..	59	..	71	658
17. Morena	1,163	..	..	319	344	..	359	804
18. Bhind	446	..	..	358	227	..	362	84
19. Khargon	1,348	..	..	223	..	..	223	1,125
20. Rajgarh	618	..	..	..	..	229	229	388
21. Rewa	250	..	..	..	..	22	22	228
22. Panna	704	..	..	..	..	55	55	649
23. Tikangarh	504	..	..	..	..	17	17	486
24. Sagar	1,027	..	..	..	8	48	56	971
25. Bhilsa	736	..	..	..	..	55	55	681
26. Chattarpur	876	..	..	..	..	39	39	837
27. Jabalpur and Narsinghpur	513	..	..	..	..	364	364	148
28. Khandwa and Khargon	2,419	..	..	..	61	..	30	2,389
29. Gwalior and Shivpuri	1,033	..	..	..	109	..	109	924
30. Seoni and Balaghat	2,058	..	..	..	83	..	83	1,975
31. Khargon and Dhar . . . . .	..	..	..	117	134	..	134	..
32. Satna and Rewa . . . . .	..	..	..	..	..	..	117	..
33. Other district area	12,479	..	..	..	..	..	..	12,479
<i>Areas falling in more than one district</i>								
Unchen Project on Sukhinalla a tributary loon, Parej Central Project	..	..	..	..	..	29	29	..
tons (Chachan Project)	..	..	..	..	..	..	..	..
GRAND TOTAL	44,379	..	..	..	..	..	5,326	39,053

N—Negligible.

TABLE 12
Soil surveys carried out in Maharashtra

Sl. No.	Name of the district	(thousand hectares)									
		Geographical area	Area surveyed by the Central Soil Survey Organisation	Area surveyed by State Agencies	Area surveyed by other Agencies	Total area surveyed	Area remaining to be surveyed				
1	2	3	4	5	6	7	8	9	10	11	
1. Thana	.	947	..	..	..	9	..	..	9	938	
2. Kolaba	.	706	168	..	..	14	..	13	195	510	
3. Ratnagiri	.	1,299	..	..	..	16	..	..	16	1,283	
4. Nasik	.	1,561	937	..	..	24	..	68	828	733	
5. Dhulia	.	1,304	..	..	..	16	..	8	25	1,278	
6. Jalgaon	.	1,186	..	..	79	16	..	92	187	999	
7. Ahmednagar	.	1,707	93	18	..	54	..	224	126	1,581	
8. Poona	.	1,559	111	168	..	32	..	171	270	1,289	
9. Satara	.	1,047	..	..	56	34	..	1	92	955	
10. Sangli	.	490	..	18	..	25	..	52	95	394	
11. Sholapur	.	1,506	..	..	..	57	..	237	274	1,233	
12. Kolhapur	.	812	..	..	..	49	..	19	68	744	
13. Aurangabad	.	1,636	..	N	..	8	..	..	8	1,627	
14. Parbhani	.	1,258	..	N	..	17	..	49	67	1,191	
15. Bhir	.	1,106	..	..	..	19	..	..	19	1,087	

16. Nanded	.	.	.	.	.	1,245	..	2	..	14	..	58	131	1,114
17. Osmanabad	.	.	.	.	.	1,433	1	..	..	22	..	..	24	1,409
18. Buldana	.	.	.	.	.	972	..	..	..	11	..	23	34	938
19. Akola	.	.	.	.	.	1,061	32	..	..	15	..	38	86	975
20. Amravati	.	.	.	.	.	1,224	..	12	..	14	..	..	27	1,197
21. Yeotmal	.	.	.	.	.	1,359	322	..	..	11	..	30	363	996
22. Wardha	.	.	.	.	.	629	..	..	..	12	..	27	40	589
23. Nagpur	.	.	.	.	.	996	43	..	..	15	..	..	58	938
24. Bhandara	.	.	.	.	.	928	257	..	..	10	..	89	356	573
25. Chanda	.	.	.	.	.	2,384	..	..	..	8	..	18	26	2,358
GRAND TOTAL	.	.	.	.	.	30,361	..	..	..	..	..	..	3,427	26,934

N—Negligible.

NOTE :—Excludes Bombay (Suburban) district.

TABLE 13
Soil surveys carried out in Haryana

(thousand hectares)										
Sl. No.	Name of the district	Geographical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Area surveyed by other Agencies		Total area surveyed	Area remaining to be surveyed
			Recon- naissance	Detailed	Recon- naissance	Detailed	Recon- naissance	Detailed		
1	2	3	4	5	6	7	8	9	10	11
1.	Ambala	331	..	N	35	1	78	..	115	216
2.	Karnal	796	65	..	..	..	..	..	65	732
3.	Gurgaon	962	..	..	1	..	..	..	1	961
4.	Mahendragarh }	330	..	..	..	..	..	..	..	330
5.	Jind	604	..	..	..	..	..	..	..	604
6.	Rohtak	1,397	400	..	59	5	638	..	1,103	294
7.	Hissar									
<i>Areas falling in more than one district</i>										
	Ambala and Karnal	..	..	..	..	16	195	..	255	..
	Mahendragarh	..	..	..	..	..	351	..	351	..
GRAND TOTAL		4,421							1,891	2,530

N—Negligible.

TABLE 14
Soil surveys carried out in Himachal Pradesh

Sl. No.	Name of the district	Geographical area	Area surveyed by the Central Soil Survey Organisation				Area surveyed by the State Agencies				Total area surveyed	Area remaining to be surveyed
			Reconnaissance		Detailed		Reconnaissance		Detailed			
			3	4	5	6	7	8	9			
1	2											
1.	Mandi	395	..	..	..	..	14	14	..	14	381	..
2.	Bilaspur	116	..	..	75	..	..	..	..	75	41	..
3.	Mahasu	1,212	..	10	47	..	..	..	..	57	1,155	..
4.	Kangra	1,264	..	..	27	..	..	1	..	28	1,236	..
5.	Simla	123	..	..	44	..	..	..	..	44	79	..
6.	Chamba	812	..	..	..	..	..	..	..	..	812	..
7.	Sirmaur	284	..	..	..	..	..	..	..	..	284	..
8.	Lahaul & Spiti	1,222	..	..	..	..	..	..	..	..	1,222	..
GRAND TOTAL		5,429								218	5,211	

TABLE 15
Soil surveys carried out in Jammu & Kashmir

(thousand hectares)							
Sl. No.	Name of the district	2	3	Area surveyed by the State Agencies		Total area surveyed	Area remaining to be surveyed
				Recon- naissance	Detailed		
1				4	5	6	7
1. Anantnag	.	.	Not available	..	..	..	..
2. Srinagar	.	.	Do.	..	..	..	..
3. Baramulla	.	.	Do.	..	..	..	..
4. Ladakh	.	.	Do.	..	..	..	..
5. Doda	.	.	Do.	..	..	..	..
6. Udhampur	.	.	Do.	..	..	..	..
7. Jammu	.	.	Do.	21	..	21	..
8. Kathua	.	.	Do.	..	..	..	..
9. Punch Rajouri	.	.	Do.	..	..	..	..
GRAND TOTAL	.	.	22,297	..	..	21	22,276

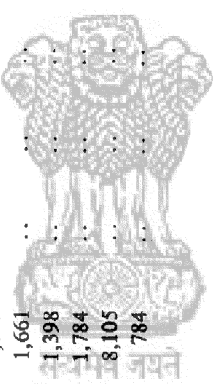
(thousand hectares)

TABLE 16
Soil surveys carried out in Punjab

(thousand hectares)											
Sl. No.	Name of the district	Geographical area	Area Surveyed by the Central Soil Survey Organisation	Area surveyed by the State Agencies	Area surveyed by other Agencies	Total area surveyed to be surveyed					
			Recon-	Detailed Recon-	Recon-	Detailed Recon-					
			naissance	naissance	naissance	naissance	8	9	10	11	
1	2	3	4	5	6	7	8	9	10	11	
1.	Ludhiana	343	..	..	225	..	71	..	297	46
2.	Patiala	546	62	..	388	1	..	..	391	155
3.	Ferozepur	1,064	..	..	..	3	189	..	192	873
4.	Bhatinda	584	..	..	..	3	..	..	3	581
5.	Hoshiarpur	579	..	30	48	2	..	..	99	481
6.	Gurdaspur	353	..	..	..	1	352	..	353	..
7.	Jullundur	346	77	..	5	..	443	..	295	51	
8.	Sangrur	513	..	..	45	..	..	..	45	468
9.	Amritsar	502	..	..	..	..	502	..	502	..
10.	Kapurthala	163	..	..	..	..	163	..	163	..
<i>Areas falling in more than one district</i>											
	Agricultural Research Farms	..	..	..	..	30	..	..	30	..
	Jullundur and Kapurthala	..	..	..	49	..	..	..	49	..
GRAND TOTAL		4,995						2,419	2,576		

TABLE 17
Soil surveys carried out in Rajasthan

(thousand hectares)											
Sl. No.	Name of the district	Geo-graphical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Area surveyed by other Agencies		Total area surveyed	Area remaining to be surveyed	Area surveyed
			Recon-nai-ssance	De-tailed	Recon-nai-ssance	De-tailed	Recon-nai-ssance	De-tailed			
1	2	3	4	5	6	7	8	9	10	11	
1.	Jhalawar	623	..	..	612	..	100	..	623	..	
2.	Bundi	559	..	..	559	..	16	..	559	..	
3.	Kota	1,243	253	32	1,246	16	23	..	1,243	..	
4.	Bhilwara	1,046	..	..	1,046	..	..	..	1,046	..	
5.	Tonk	714	..	1	..	14	..	..	15	699	
6.	Udaipur	1,764	..	..	..	3	..	..	3	1,761	
7.	Sirohi	512	..	..	..	5	..	..	5	507	
8.	Sawai Madhopur	1,055	..	..	168	19	..	..	187	867	
9.	Pali	1,242	104	..	38	..	526	N	1,242	..	
10.	Banswara	504	..	..	..	39	..	..	39	465	
11.	Ganganagar	2,073	..	..	255	413	..	..	466	1,606	
12.	Ajmer	851	65	..	..	..	..	..	65	786	
13.	Barmer	2,637	..	..	..	..	699	1	699	1,937	
14.	Dungarpur	378	..	..	..	6	..	..	6	372	



15. Jalore	1,274	..	..	..	398	..	398	876
16. Jodhpur	2,274	..	..	..	192	N	193	2,081
17. Bikaner	2,722	..	677	113	..	5	795	1,927
18. Jhunjhunu	592	..	..	..	..	4	4	587
19. Jaisalmer	3,864	..	759	..	3,884	..	3,864	..
20. Alwar	840	..	..	..	..	..	..	840
21. Chittorgarh	1,045	..	..	..	..	..	..	1,045
22. Churu	1,661	..	..	..	..	..	..	1,661
23. Jaipur	1,398	..	..	..	..	..	..	1,398
24. Nagaur	1,784	..	..	..	..	..	..	1,784
25. Bharatpur	8,105	..	..	..	..	..	..	8,105
26. Sikar	784	..	..	..	..	..	..	784

Area covered in more than one district

Ganganagar, Bikaner, Jaisalmer,
Jodhpur, Bharatpur, Pali, Ajmer,
Bhilwara, Jaipur, Nagaur and Jalore

1 2803

GRAND TOTAL 34,253

14,258 19,995

N—Negligible.

TABLE 18
Soil surveys carried out in Uttar Pradesh

(thousand hectares)										
Sl. No.	Name of the district	Geo-graphical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Area surveyed by other Agencies		Total area surveyed	Area remaining to be surveyed
			Recon-nais-sance	De-tailed	Recon-nais-sance	De-tailed	Recon-nais-sance	De-tailed		
1	2	3	4	5	6	7	8	9	10	11
1. Aligarh	.	503	..	..	413	..	..	..	413	89
2. Etah	.	445	..	..	337	..	..	..	337	107
3. Mainpuri	.	435	..	..	300	..	..	..	300	135
4. Agra	.	482	..	..	376	..	..	..	376	106
5. Bulandshahr	.	489	..	..	396	..	..	..	396	93
6. Kanpur	.	611	26	..	454	..	..	..	479	131
7. Farrukhabad	.	426	..	..	310	..	..	..	310	116
8. Fatehpur	.	421	..	..	305	..	..	..	305	116
9. Lucknow	.	253	..	..	165	..	..	..	165	88
10. Raibareli	.	456	..	..	285	..	..	..	285	171
11. Unnao	.	459	..	..	313	..	..	..	313	147
12. Hardoi	.	601	..	..	86	..	..	..	86	515
13. Varanasi	.	508	..	..	359	..	..	..	359	149
14. Mirzapur	.	1,133	..	N	437	..	..	..	437	696

15. Ghazipur	339	..	..	271	..	..	271	67
16. Ballia	306	..	..	252	..	..	252	54
17. Allahabad	725	..	..	532	..	..	532	194
18. Gorakhpur	632	..	..	495	..	..	495	137
19. Deoria	541	..	..	460	..	..	461	80
20. Bareilly	412	..	..	345	..	..	345	67
21. Moradabad	593	..	..	502	..	..	502	91
22. Lakhimpur (Kheri)	770	..	..	489	..	..	489	281
23. Pilibhit	350	..	..	218	..	..	218	132
24. Jhansi	1,008	..	..	556	..	..	575	432
25. Banda	764	..	..	527	..	..	527	238
26. Jalaun	457	..	..	365	..	..	365	91
27. Hamirpur	719	..	..	535	..	..	535	184
28. Dehra Dun	311	..	..	..	..	..	12	299
29. Meerut	602	..	..	..	..	111	111	49
30. Barabanki	444	..	..	..	..	..	N	444
31. Almora	705	..	..	..	..	..	42	664
32. Saharanpur	553	..	..	..	..	..	74	478
33. Tehri Garhwal	452	..	..	..	..	..	..	452
34. Nainital	683	..	..	..	..	..	..	683
35. Bijnor	483	..	..	..	..	..	..	483
36. Budaun	518	..	..	..	..	..	..	518
37. Rampur	232	..	..	..	..	..	..	232
38. Shahjahanpur.	457	..	..	..	..	..	..	457
39. Muzaffar Nagar	436	..	..	..	..	..	..	436

1	2	3	4	5	6	7	8	9	10	11
40. Mathura	380
41. Sitapur	579
42. Bahraich	679
43. Faizabad	442
44. Sultanpur	444
45. Pratapgarh	378
46. Basti	731
47. Azamgarh	576
48. Gonda	733
49. Jaunpur	400
50. Etawah	430
51. Garhwal	546
52. Uttar Kashi	782
53. Chamoli	914
54. Pithoragarh	723
<i>Area surveyed in more than one district—</i>										
Bareilly, Hardoi, Kanpur	.	.	.	N	.	.	.	.	N	.
GRAND TOTAL	10,349	19,109

N—Negligible.

TABLE 19
Soil surveys carried out in Tripura

(thousand hectares)									
Sl. No.	Name of the district	Geographical area	Area surveyed by the Central Soil Survey Organisation		Area surveyed by the State Agencies		Total area surveyed	Area remaining to be surveyed	
			Recon-naissance	Detailed	Recon-naissance	Detailed			
1	2	3	4	5	6	7	8	9	
1.	Belonia	102	..	..	31	1	32	70
2.	Dharmanagar	171	..	..	..	1	1	170
3.	Agartala	156	..	..	73	2	74	82
4.	Udispur	64	..	..	..	1	1	63
5.	Sonamura	53	..	..	..	1	1	52
6.	Amarpur	136	..	..	..	1	1	135
7.	Sabroom	62	..	..	..	N	N	61
8.	Kailashar	120	..	..	..	1	1	120
9.	Kamalpur	62	..	..	..	1	1	61
10.	Khowai	139	..	..	..	1	1	138
<i>Area falling in more than one district</i>									
	Hishalgach P.S., Ramachandrapur, Belonia, Kailashar, Agartala Agromonic Trial Centre	..	296	..	..	..	296	..
GRAND TOTAL		1,067	..	..	..	..	409	657

N—Negligible.

TABLE 20
Soil surveys carried out in the Union Territories
(thousand hectares)

Sl. No.	Name of the Union Territory	Geographical area	Area surveyed by the Central Soil Survey Organisation		Total area surveyed	Area remaining to be surveyed
			Reconnaissance	Detailed		
1	2	3	4	5	6	7
1.	Delhi	.	148	101	101	47
2.	Andaman & Nicobar Islands	.	833	74	74	759
3.	Goa, Daman & Diu	.	369	361	361	8*
4.	NEFA	.	8,149	20	22	8,127
5.	Nagaland	.	1,649	.	.	1,649
	Manipur	.	2,236	.	.	2,236
7.	Pondicherry	.	48	.	.	48
8.	Laccadive Minicoy and Aminidive Islands	.	3	.	.	3
9.	Dadra and Nagar Haveli	.	49	.	.	49

N—Negligible.



SOIL MAPS