ICAR-NBSS&LUP
at a glance

ICAR-National Bureau of Soil Survey and Land Use Planning
Amravati Road, Nagpur – 440 033, Maharashtra

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ICAR-National Bureau of Soil Survey and Land Use Planning – A Profile

Institute established under the umbrella of the Indian Council of Agricultural Research in 1976 with Headquarters at Nagpur, Maharashtra. The Bureau has been identified as the nodal organization for soil survey, mapping, and spatial database management on soil resources in the country under the responsibility matrix of National Geospatial Policy 2022.

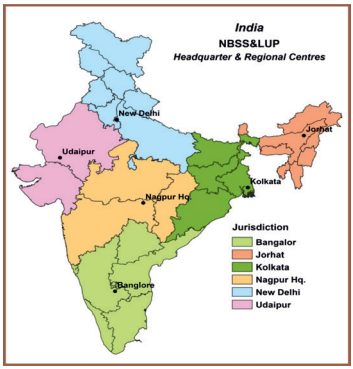


Fig. 1. Location map of ICAR-NBSS&LUP

RESEARCH DIVISIONS

- Division of Remote Sensing Applications
- Division of Soil Resource Studies
- Division of Land Use Planning

REGIONAL CENTRES & JURISDICTION

- Bangalore : Southern India
- Delhi : Northen India
- Jorhat : North-Eastern India
- Kolkata : Eastern India
- Udaipur : Western India

MANDATE

- To undertake soil survey and mapping of soils of the country to promote scientific and optimal land use programmes in collaboration with relevant institutions and agencies.
- To conduct and promote research in the National Agricultural Research System in the area of pedology, soil survey, land evaluation, and land-use planning.
- To impart training and education and promote awareness on the soil resource and its state of health and utilization.

MISSION

To spread the knowledge/awareness on land and soil resources for its preservation, conservation, increasing productivity, and ensuring sustainable agricultural production.

VISION

To be the National Custodian of the country's land and soil resources and land use-related database and to support scientific and judicious land use planning at various levels to ensure food and income security.

STAFF POSITION OF THE BUREAU (AS OF July 2023)

For conducting research in the mandated areas with available staff strength of 216 against the sanctioned position of 372 as given below, which is 41 % less than the sanctioned strength.

Category	Sanctioned	Filled	Vacant
Research Manager Position	1	1	Nil
Scientific	97	60	37
Technical	164	99	65
Administrative	72	35	37
Skilled Supporting Staff	38	21	17
Total	**372**	**216**	**156**

INFRASTRUCTURE

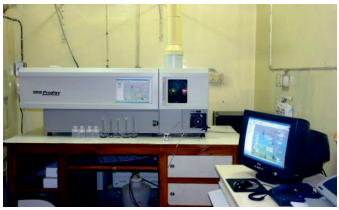
Bureau is equipped with advanced analytical instruments namely-Inductively Coupled Plasma, Atomic emission, X-Ray Diffractometer, Scanning Electron Microscope, and Atomic Absorption Spectrometer for in-depth detailed studies on soils, water, and minerals, and a Visible to Near InfraRed Hyperspectral Spectroradiometer for soil reflectance studies (Fig. 2). A Data Centre has been established to process the remotely acquired data and has state of the art remote sensing (RS) and Geographic Information System (GIS) infrastructure, and is linked with replicas maintained at the Regional Centres (RCs) through BHOOMI Geoportal platform (www.bhoomigeoportal-nbsslup.in)dedicated to disseminate information on soil and land use. The Bureau also has a dedicated website to disseminate information on various activities of the Bureau (https://nbsslup.icar.gov.in/). The Bureau houses a fully computerized specialized library both at the Hqrs. and at RCs.

AWARDS AND HONOURS

1. ICAR-Best Annual Report Award for Large Institute 2017-18.
2. Dwitiya Puraskar of Rajarshi Tondon Rajbhasha Puraskar for outstanding work in Hindi during 2016-17.
3. Dr. M. S. Raghuvanshi, Principal Scientist, LUP Division conferred Fakhruddin Ali Ahmed award for Outstanding Research in Tribal Farming Systems 2019.
4. Dr. G. P. Obi Reddy, Principal Scientist and Head, Division of Remote Sesning Applications (RSA) conferred prestigeous Fellow of National Academy of Agricultural Sciences (NAAS) with effective from 1st January, 2023.

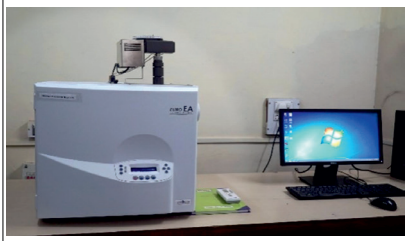
RESOURCE GENERATION (Rs. in lakh)

2018-19	2019-20	2020-21	2021-22	2022-23
409.84	479.14	168.35	174.50	333.92



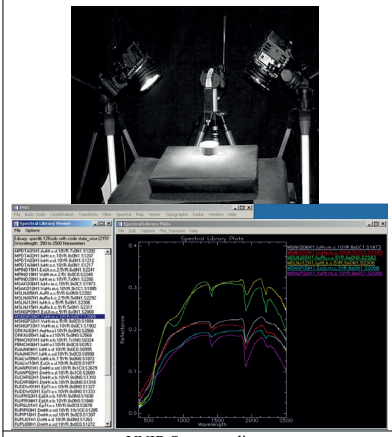
Inductively Coupled Plasma - Atomic Emission Spectroscopy

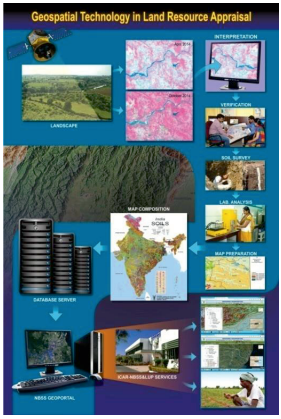
Atomic Absorption Spectrometer (AAS)



CN Analyser

X-Ray Diffraction unit





VNIR Spectroradiometer	Data Centre

Fig. 2. Infrastructure at ICAR-NBSS&LUP

COLLABORATIONS AND LINKAGES

International Institutes/Organizations

- National Research Institute for Agriculture, Food and the Environment (France)
- Colorado State University, Colorado, USA
- Institute of Food and Agricultural Sciences, University of Florida, Florida, USA
- International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria
- International Soil Reference and Information Centre (ISRIC), Wageningen, The Netherlands
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan (through APN)
- United Nations Environment Programme (UNEP), Kenya (through UNEP-SCOPE)
- University of Reading, UK
- University of Sheffield, UK
- The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Hyderabad
- University of Sydney

National Institutes/Organizations/Departments

- NITI AAYOG, Govt of India, New Delhi
- Brahmaputra Board, Ministry of Jal Shakti, Government of India, Guwahati
- Central Muga Eri Research and Training Institute, Govt. of India Lahdoigarh, Jorhat
- Central Sericultural Research & Training Institute, MoT, Govt. of India, Berhampore, WB
- Department of Science and Technology, New Delhi
- Indian Institute of Technology,Mumbai
- Indian Meteorological Department, Pune
- ISRO-National Remote Sensing Centre (NRSC), Hyderabad
- National Environmental Engineering Research Institute(NEERI), , Nagpur
- Bhaskaracharya National Institute for Space Applications and Geo-informatics (BISAG-N)| National Portal of India BISAG, Gandhinagar, Gujarat
- National Institute of Electronics and Information Technology, MeitY, Jorhat
- Soil and Land Use Survey of India, Ministry of Agriculture, Govt. of India, New Delhi

ICAR Organizations

- ICAR-Indian Institute of Soil and Water Conservation, Dehradun
- ICAR-Central Soil Salinity Research Institute, Karnal
- ICAR-Indian Institute of Soil Science, Bhopal

State Institutes/Organizations/Departments

- State Agricultural Universities
- State Department(s) of Agriculture
- Vasantrao Naik State Agriculture Extension Management Training Institute (VANAMATI), Nagpur
- Action for Food Production (AFPRO),
- Tamil Nadu State Land Use Research Board, Chennai
- State Departments of Soil & Water Conservation and Watershed Management
- Forest Development and Management Corporation, Maharashtra
- Meghalaya Basin Development Authority, Govt. of Meghalaya
- Department of Agriculture Arunachal Pradesh.
- Vishwa Bharati University, Santiniketan, Bolpur, West Bengal

Private Companies/Organizations

- KEC International Ltd
- Sterlite Technologies Ltd
- Adani Transmission Ltd
- Tata Projects Ltd

Technology for Commercial Purpase

1. The prediction model for engineering properties of soils is commercialized and used by KEC International Limited, Mumbai for India and overseas power transmission works.
2. Prediction of soil depth and rock type to lay optical fibre cables in India is commercialized and used by Sterlite Technologies Limited, Mumbai
3. Models for civil engineering application in power transmission lines is commercialized and used by Adani Transmission Limited

SIGNIFICANT ACHIEVEMENTS

1. Appraisal and Mapping of Land Resources

(a) Soil Resource Map of India: The first soil map of the country at a 1:1 million scale was published by the ICAR-NBSS&LUP in 2002 (Fig. 3(a)). The Bureau has also mapped the soils of Indian states at 1:250000 scale (Fig. 3(b).

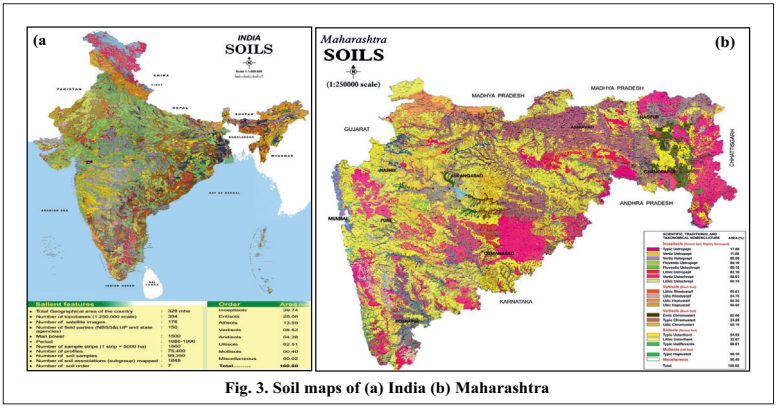


Fig. 3. Soil maps of (a) India (b) Maharashtra

(b) Delineation of Agro-ecological Region (AER) and Subregions (AESR)

India has been categorized under 20 AERs, which were further divided into 60 Agro-ecological sub-regions (AESRs) map in 1999 to facilitate policy planners in making informed decisions and in transferring soil-based agro-technologies. The AER map was revised with 20 AERs in 2016 by using the new estimates of the length of crop growing periods and refined boundaries, and based on the soil data at a 1:1 million scale and climatic resource database of 600 weather stations.

(c) Assessment of Land Degradation

Soil degradation status of the country was first mapped by the Bureau on a 1: 4.4 M scale using the GLASOD methodology, indicating that 187 M ha land was adversely affected by various forms of degradation. In 2010, consortia of NRM Institutes of the ICAR including NBSS&LUP, Nagpur, IISWC, Dehradun, CSSRI, Karnal and CAZRI, Jodhpur, in association with NRSC, Hyderabad, agreed upon a harmonized national land degradation figure of 120 M ha (Fig. 5).

(d) Soil Organic Carbon Stock of India

The Bureau, along with IISS, Bhopal, estimated and mapped the extent and spatial distribution of soil organic carbon (SOC) stock of India, based on the data from 2 lakh geo-referenced sample points at 1 km soil grids. The map is now a part of the Global SOC map published by FAO (Fig. 6). The majority of the soil (>50%) are deficient (<1%) in SOC content. The soils of arid and semi-arid climates are the most deficient in organic carbon but rich in inorganic carbon ($CaCO_3$). Based on the estimates of SOC and soil inorganic carbon stock, vast areas of arid (49 million hectares) and semiarid parts (116 million hectares) of the country are prioritized for soil carbon management.

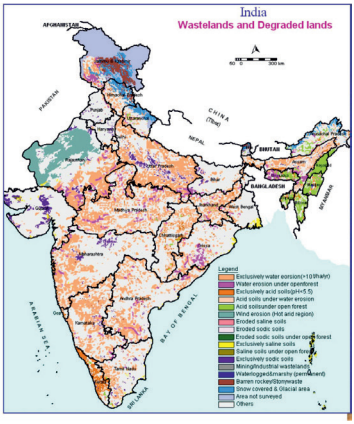


Fig. 5. Degradation map of India

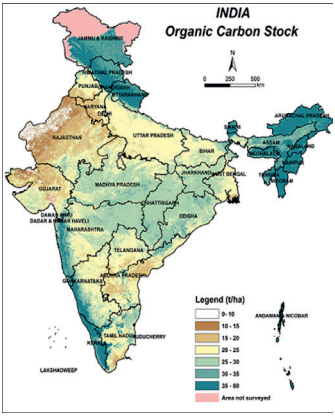


Fig. 6. SOC map of India

(d) Potential Soil Loss Map of India

Soil erosion in Indian states was estimated by the Bureau in collaboration with ICAR-IISWC, Dehradun by employing the Universal Soil Loss Equation, following which potential soil loss of the county was generated on a 1:1 million scale (Fig. 7).

(e) Soil Spectral Library

The Bureau has developed analog and digital libraries of 128 benchmark soils across different physiographic regions of India through codification of relationships between soil spectra and selected soil properties. Hyperspectral (300-2500 nm) prediction of soil characteristics through modeling approach has been ramped up during the last two decades, with the addition of more than 8000 soil spectral signatures.

2. Land Resource Inventories

(a) A Standard Operating Protocol

A much needed standard operating protocol (SOP) was developed at the Bureau to obtain consistency and uniformity in soil survey and mapping procedure. The SOP integrates the advanced RS and GIS techniques with traditional methods of soil survey across the country to develop large-scale, cost-effective and quicker land resource inventories (LRI) as compared to the traditional method. The SOP outlines the procedure for landform mapping and soil sampling, soil analysis, and land use planning along with a few pertinent case studies.

(b) LRI at different scales across India

Eighty-two districts of the country representing various agroecological zones were surveyed at 1: 50,000 scale for detailed soil information (Fig. 8 (a)). Figure 8(b) illustrates the soil map of Aurangabad district in Maharashtra, as an example. Further, soils of 339 blocks/tehsils were surveyed and mapped on 1:10000 scale (Fig. 9).

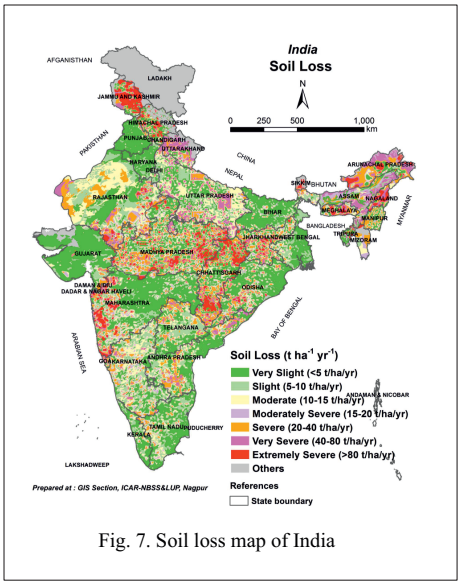
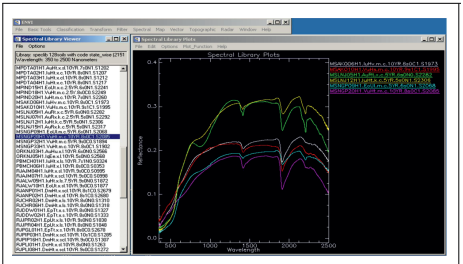
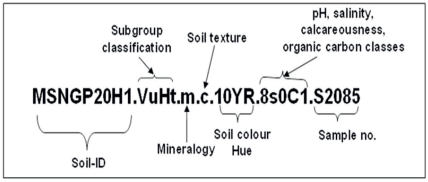


Fig. 7. Soil loss map of India



Reflectance spectra developed in ENVI software



Sample spectral code

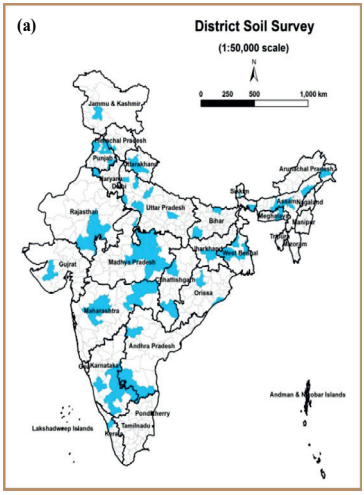
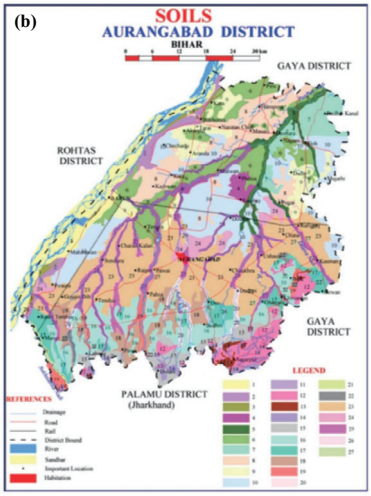


Fig. 8. Soil survey of (a) different districts of India



(b) Soil map of Aurangabad district, Bihar

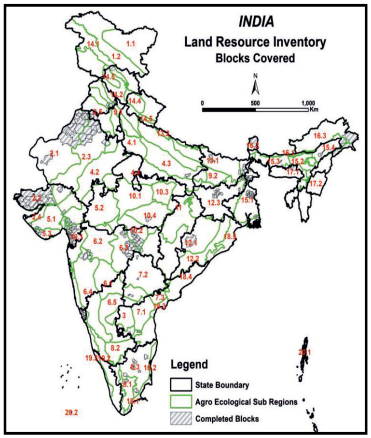


Fig. 9. Map showing the blocks covered for LRI

State	No. of blocks	State	No. of blocks
ANDAMAN & NICOBAR	3	MAHARASHTRA	37
ANDHRA PRADESH	3	MEGHALAYA	3
ARUNACHAL PRADESH	25	MIZORAM	1
ASSAM	4	NAGALAND	6
BIHAR	19	ODISHA	8
CHHATTISGARH	1	PUNJAB	14
GOA	12	RAJASTHAN	32
GUJARAT	51	SIKKIM	1
HARYANA	7	TAMIL NADU	22
HIMACHAL PRADESH	3	TELANGANA	4
JAMMU & KASHMIR	1	TRIPURA	2
JHARKHAND	21	UTTAR PRADESH	3
KERALA	1	UTTARAKHAND	1
MADHYA PRADESH	7	WEST BENGAL	47
TOTAL	339		

(c)LRI of Bundelkhand and Vidarbha regions

A high-resolution land resource inventory of the Bundelkhand region, comprising 14 districts and spanning across 7.09 m ha, was generated to formulate pragmatic agricultural land use plans. Digital soil maps of key soil physical and chemical properties (pH, EC, OC, $CaCO_3$, sand, silt, clay) for six depths (0-5 cm, 5-15 cm, 15-30 cm, 30-60 cm, 60-100 cm, and 100-200 cm) were prepared in collaboration with Soil and Land Use Survey of India, New Delhi. A digital map of soil organic carbon is depicted in Fig. 10. A similar exercise has also been completed for the Vidarbha region (Fig. 11).

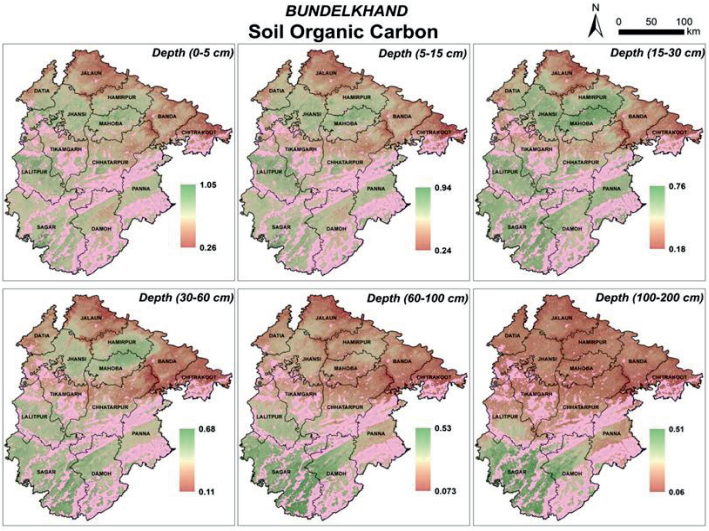


Fig. 10. Digital soil maps of SOC (depth-wise) for Bundelkhand

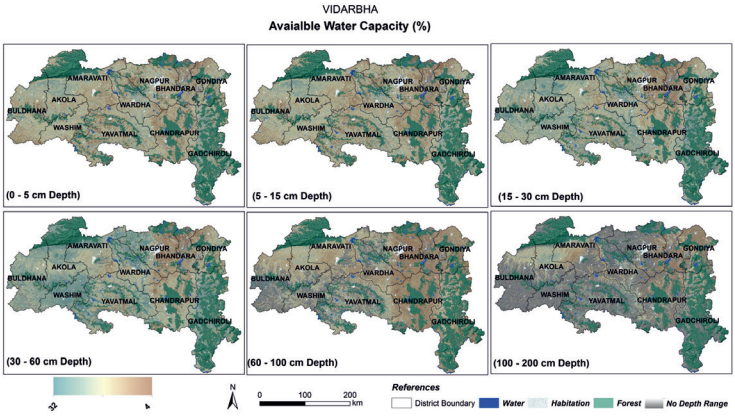


Fig. 11. Digital soil maps of depth-wise available water capacity for Vidarbha region.

(d)LRI as a basis for watershed development

More than 5000 micro-watersheds in Karnataka were developed by using LRI data for agricultural land use planning and soil & water conservation strategies under the 'Sujala-3' project of the state Funded by the world Bank (Fig. 12 illustrates the soil map of one such watershed). The success of this project has prompted the government of Karnataka to extend the LRI Approach to the entire state through 'Rejuvenating Watershed for Agricultural Resilience through Innovative Development' (REWARD Funded by the world Bank) project. Andhra

Pradesh and Odisha are also implementing REWARD with the collaboration of the Bureau. Noting the success, Department of Land Resources, Ministry of Rural Development, Government of India has made it mandatory for the state level nodal agencies/ watershed development department to implement watershed development plans under pradhan mantri krishi sinchai yojana in at least 10% of the ares in consultation with ICAR-NBSS&LUP.

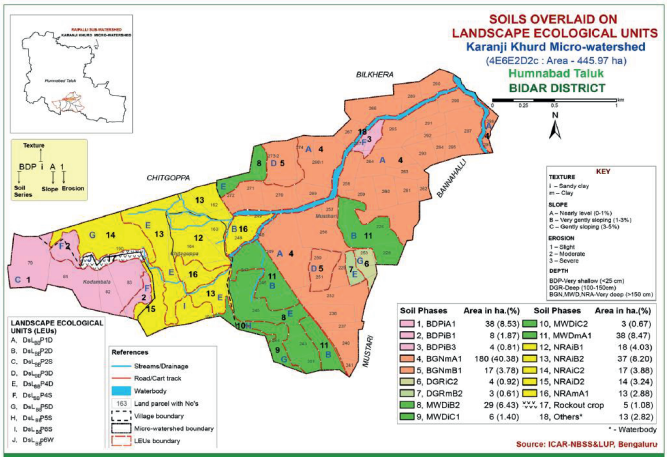


Fig. 12. Soil map (phase level) of Karanji Khurd micro-watershed, Bidar district, Karnataka

3.Basic Pedological Research

(a)Weathering of biotite: Soil Genesis

Clay illuviation in the sodic soils of the Indo-Gangetic plains has not always exhibited clay skins. Decreasing trend of clay mica in alluvial soils is a sure test of clay illuviation even when clay skins are absent. Thin section studies of ferruginous soils of southern peninsular India indicate the argillans not due to the process of illuviation but as an in situ weathering product of biotite (Fig. 13).

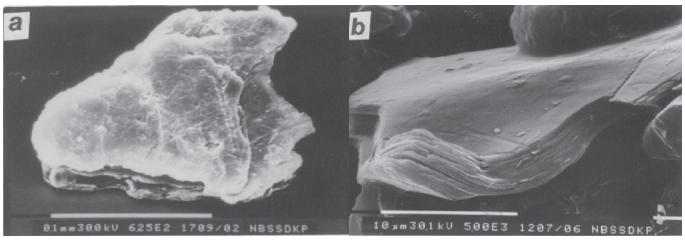


Fig. 13. SEM photomicrographs showing weathering of biotite in (a) alluvial soils of Indo-Gangetic Plains and (b) ferruginous soils of southern India.

(b)Formation of Gibbsites: Soil Genesis

The formation of gibbsite in the presence of large amounts of 2:1 minerals indicates that the anti-gibbsite hypothesis is not tenable in acidic Ultisols and Alfisols of tropical India. Gibbsites were formed in an alkaline environment at the early stages of weathering (Fig. 14). Its occurrence as pseudomorphs after Silliminate and Feldspars in soils of NER and Kerala, respectively proves this fact. Thus the presence of gibbsite should not be considered as an index of advanced weathering.

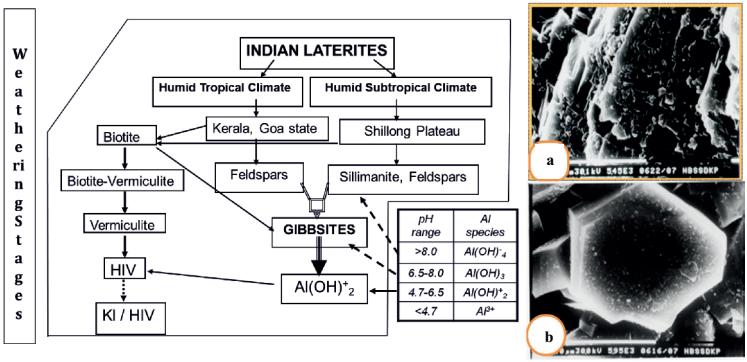


Fig. 14. Parallel pathways of gibbsite and hydroxy-interlayered vermiculite formation in Indian laterites under humid tropical and subtropical climate. Representative SEM photographs of sand sized fractions (a) Highly weathered feldspar grain with the dissolution features and etch pits with gibbsite and (b) Well developed hexagonal prisms of individual gibbsite as pseudo morphs after feldspar.

(c)Formation of Pedogenic Calcium Carbonate: Soil Degradation

Micro-morphological study indicates Vertisols contain both non-pedogenic calcium carbonate (NPC, Fig. 15(a)) and pedogenic calcium carbonate (PC, Fig. 15(b)) irrespective of the ecosystems. Formation of PC is mainly responsible for a rise in pH, decrease in Ca/Mg ratio of exchange site with depth, and development of subsoil sodicity leading to natural soil degradation. However, the basic process for the development of sodicity suggested that all sodic soils are calcareous, but all calcareous soils may not be sodic.

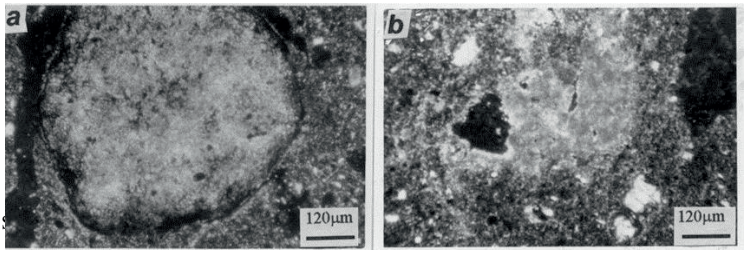


Fig. 15. Thin section studies showing (a) typical non-pedogenic $CaCO_3$, and (b) pedogenic $CaCO_3$

(d) Zeolites as Soil Modifier

Ca-Zeolites are present in soils developed from Deccan basalt. Zeolites prevented the complete transformation of smectite to kaolinite and preserved the black soils in the tropical humid climate of western India. It protects the biodiversity of the Western Ghats and also the persistence of Mollisols and Alfisols in Satpura and Western Ghats.

(e) Carbon Transfer Model: Management of Soil Degradation

The carbon transfer model illustrates the pathway of conversion of the inorganic form of carbon to organic form by plants (through photosynthesis) and by soils (through the incorporation of organic matter and its decomposition) (Fig. 17). Inorganic carbon sequestration in soils through the formation of pedogenic $CaCO_3$ (more so in arid and semi-arid regions) is a bane and requires management interventions. Chemical treatments of soils along with vegetative cover (either plantations and/or agriculture/horticulture) help in dissoluting the native $CaCO_3$ which may protect them from further degradation.

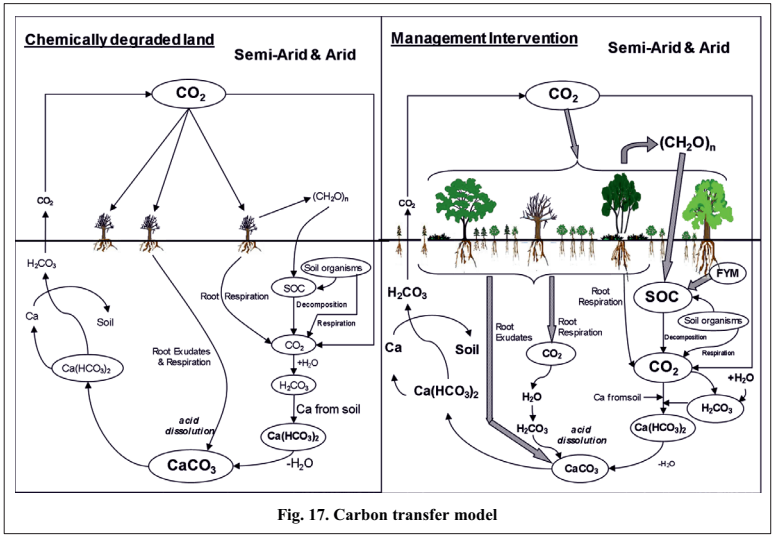


Fig. 17. Carbon transfer model

4. Land Use Planning

(a) Delineation of Prime Lands

Prime agricultural lands (PAL) offers the best combination of physical and chemical characteristics for producing food, feed, forage and fiber, and are capable of producing economically sustained yield with proper management under acceptable farming methods. The first approximation developed by the Bureau (Fig.18) reveals that:

The extent of prime agricultural land in India is about 58 m ha.

More than 40% of the PAL is in the Indo-Gangetic Plains.

Maharashtra, Madhya Pradesh, and Rajasthan together contribute 25 % to the total area delineated under PAL, while the southern states of Andhra Pradesh, Telangana, Tamil Nadu, and Karnataka contribute 19% (11.2 m ha).

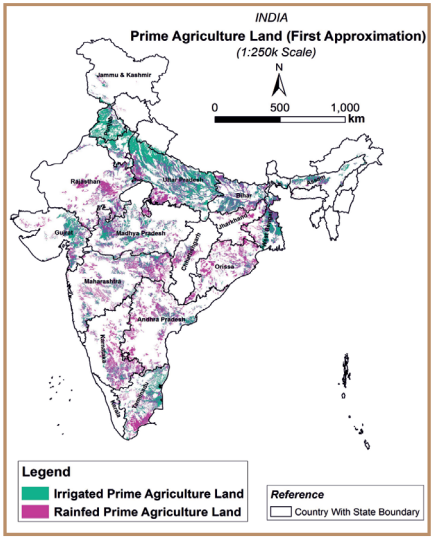


Fig. 18. Prime lands of India

(b) Assessment and Mapping of Sustainable Areas for Major Crops in India

The 1649 soil mapping units of India at a 1:1 M scale were regrouped into 610 land management units (LMUs), defined in terms of soils, rainfall, agroecological regions and length of growing period. The LMUs formed the base for mapping the production efficiency zones of 17 major crops in the country and for developing soil-land use models. Few examples namely wheat, rice, cotton, and maize are given (Fig. 19 to 22).

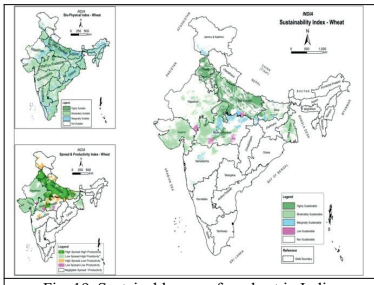


Fig. 19. Sustainable areas for wheat in India

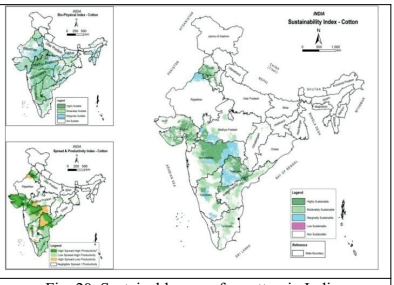


Fig. 20. Sustainable areas for cotton in India

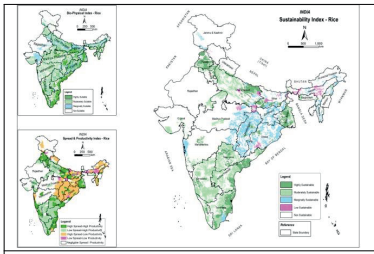


Fig. 21. Sustainable areas for rice in India

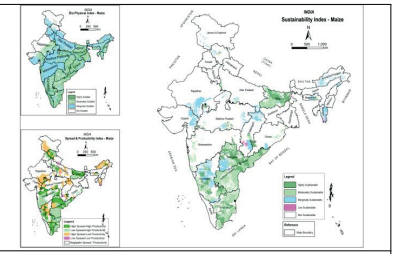


Fig. 22. Sustainable areas for maize in India

(c) Delineation of Crop Colonies for Agricultural Land Use Planning of Telangana

Potential areas for the cultivation of major cereals, pulses, oilseeds, and horticultural crops of Telangana state were delineated at the agro-climatic zone and district levels on the basis of relative area & relative yield index integrated with soil and weather parameters, in collaboration with Prof. Jayashankar Telangana State Agricultural University, Hyderabad. For example paddy, cultivated in about 61.42 lakh ha, more or less equally distributed across Central Telangana, Northern Telangana and Southern Telangana Zones, has a moderate to high potential in terms of productive performance. (Fig. 23). The maps developed for different crops are used by the Telangana Government for crop planning in the state.

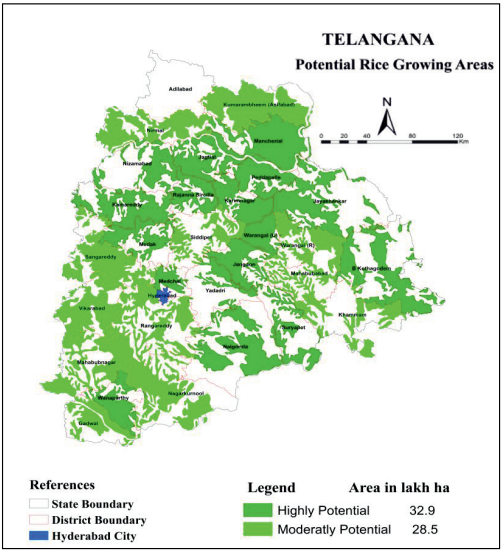


Fig. 23. Potential area for Rice

(d) Agricultural Land Use Planning for Bundelkhand and Vidarbha Regions

Agricultural land use, including soil and water conservation plans were formulated for Bundelkhand and Vidarbha regions with the help of LRI database. The prime focus was on integrated farming systems involving cropping systems, forestry, fishery, and livestock. Rice/ maize/soybean during the *kharif* season and wheat/ potato/ onion/ lentil/ linseed/ vegetables/ floriculture during the *rabi* season are the most suitable crops recommended in plains and adjoining landscapes representing major areas of Bundelkhand (Fig. 24). In case of Vidarbha, two distinct cropping patterns *viz.* cotton-based and paddy-based for western and eastern Vidarbha, respectively during *kharif* season, and chickpea/ wheat/ linseed/ vegetables in western and rice/ linseed/ chickpea/vegetables in *rabi* season are the most suitable cropping systems for eastern Vidarbha (example of Nagpur district is given in Fig. 25). Non-arable lands can be utilized for fodder production and to support cattle rearing.

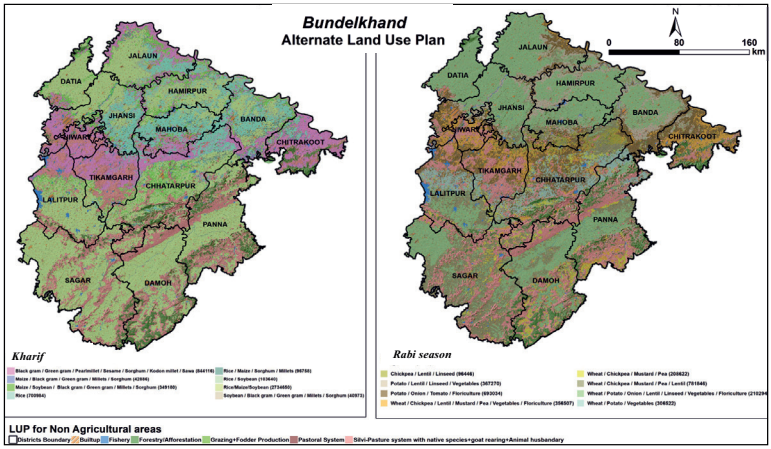


Fig. 24. Proposed alternate land use plan for Bundelkhand

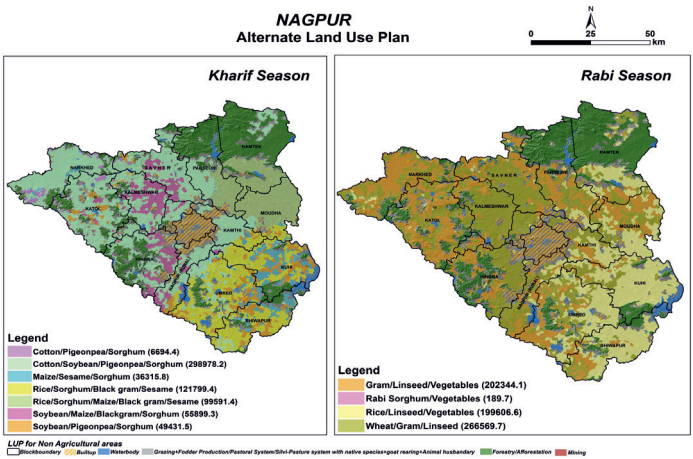


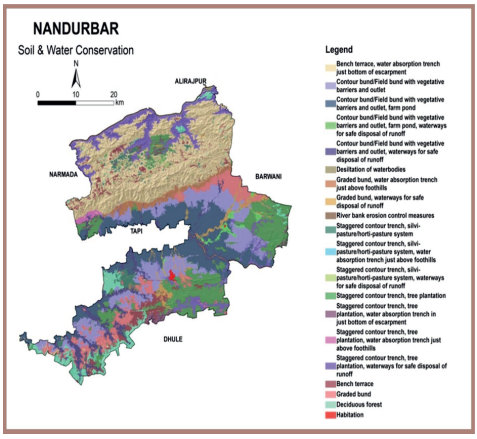
Fig. 25. Proposed alternate land use plan for Nagpur district of Vidarbha.

(e) Land Use Planning for Climate-Resilient Agriculture in Maharshtra

The Project on Climate Resilient Agriculture (PoCRA) in Maharashtra has been supported through the Land Resource Inventory of 500 villages. The first phase was concluded in 2021 and now similar support is being extended to 4500 villages located in 16 districts of Maharashtra. The soil information generated is used for water budgeting, crop advisory, and agriculture development decisions by the Department of Agriculture, Government of Maharashtra. Based on the Available Water Capacity data, the farmers and the agriculture department have been advised to prepare a climate-resilient plan

(f) Agricultural Land Use Planning – Aspirational Districts

Under the initiative of NITI Aayog, ICAR-NBSSLUP has developed agricultural land use plans for 27 aspirational districts of different states (Fig. 26 illustrates soil and water conservation measures of Nadurbar district, Maharashtra). The agricultural land use plans can be accessed in the Champions of Change dashboard of NITI Aayog (Fig. 27).



State	Districts	Name of districts
Assam	5	Barpeta, Darrang, Dhubri, Goalpara, Baksa Katihar, Begusarai,
Bihar	5	Sheikhpura, Araria, Sitamarhi
Jharkhand	2	Sahibganj, Pakur
Maharashtra	1	Nandurbar Damoh, Singrauli,
Madhya Pradesh	5	Barwani, Vidisha, Khandwa
Odisha	2	Rayagada, Kalahandi
Rajasthan	2	Baran, Jaisalmer Chitrakoot, Balrampur,
Uttar Pradesh	5	Bahraich, Sonbhadra, Shravasti
Total	27	

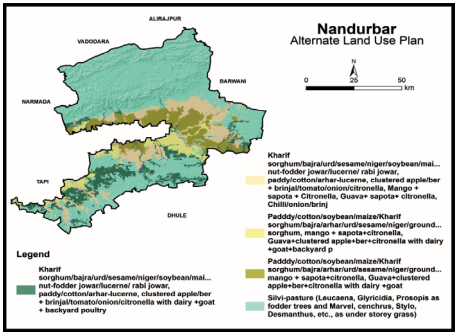


Fig. 26. Soil and water conservation and Alternative land use plan of Nandurbar district

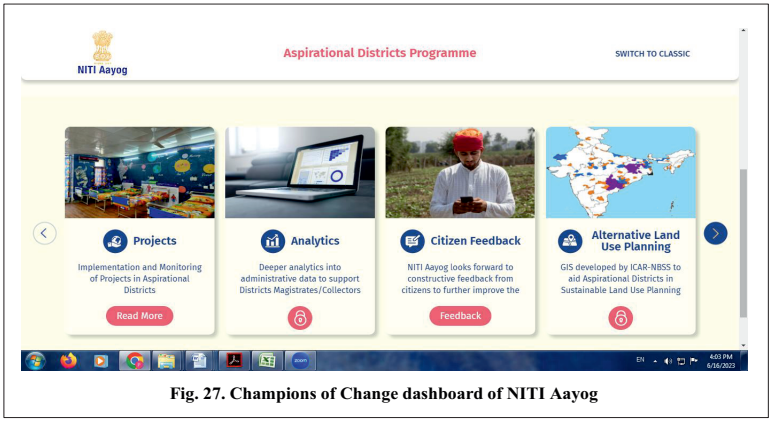


Fig. 27. Champions of Change dashboard of NITI Aayog

(g) Region-specific Soil-based Land Use Models

Using the LRI data, region-specific soil-based land use models were developed based on a holistic approach (Figs. 28-29). A comprehensive land-use plan includes execution of soil and water conservation plan, selection of right land use based on soil suitability together with best management practices to ensure enhanced crop productivity, improve land quality and ground-water recharge.

Fig. 28. Land use model (Desiltation, cotton, and pigeon pea on deep soils and sorghum on medium and shallow soils) for basaltic terrain, Maharashtra

Fig. 29. Land use model for Mysore district, Karnataka

Integrated Farming Model for Improved livelihood (Jorhat, Assam)

A sustainable integrated farming model in 1 ha of land produced an annual net profit of Rs. 67,000 in Namdeuri village, Jorhat district of Assam. The crop component consisted of high yielding varieties of rabi crops (Kufri Jyothi-potato, Godie-pea, TS-38-mustard and Green express-cabbage). The other components are piggery (Cross bred Hampshire and Rani), poultry (50 Nos. of Rhode Island breed), duck farming (Khaki Camphel and Australian White), fish farming (Common carp, Grass carp and Catla) and apiculture.

5. Digital Platforms

(a) Bhoomi Portal: The Bhoomi Geo-portal was conceptualized and developed (Fig. 30) for collating the geo-referenced soil and allied resources database in GIS. It provides a knowledge gateway to visualize, access, query soil data and disseminate the land resource information to the users. The portal has structured soil maps of 1:1M, 1:250000, 1:50000, and 1:10000 scales, and provides various other thematic maps such as prime agricultural lands; soil nutrient status; types and severity of land degradation and desertification; potential areas for crops; dominant cropping patterns; areas under different horticultural crops, *etc.*

(b) Potential Crop Zone (*PCZ*) Mapper: An android-based mobile application titled Potential Crop Zone Mapper was developed. This derives information from the Bhoomi Geo-portal (http://nbsslup.in Bhoomi; https://ncog.gov.in/SIS) and facilitates easy visualization, dissemination, and sharing of the database on crop suitability and potential crop zone of the country. The app can be downloaded from the Google play store free of cost. Some components of the app are displayed in figure 31.

Fig. 30. Snapshot of BHOOMI Geoportal

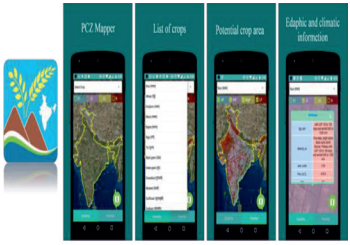


Fig. 31. Snapshot of PCZ mapper

(c) Digital Soil Library: The library is specifically designed for maintaining and displaying the database of the Sujala project – an Integrated Watershed Development programme in Karnataka. In the library, the spatial data is populated in the ArcGIS environment for the creation of the digital library (Fig. 32). The software displays all the information on the selected land parcel *i.e.* soils, current land use, existing hydrological structures, proposed conservation measures, fertility status, and crop suitability (Fig. 33).

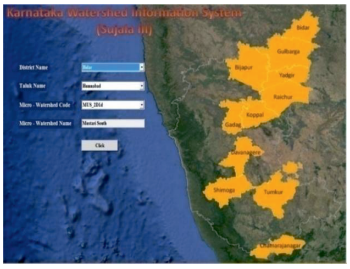


Fig. 32. Opening screen of the Digital Library software

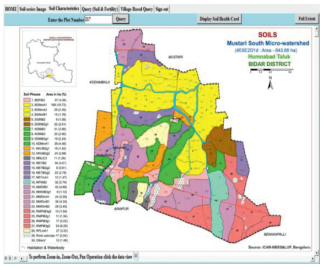
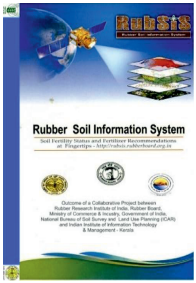


Fig. 33. Computer screen showing the soil map of the selected watershed

Rubber Soil Information System:

ICAR-NBSS & LUP in collaboration with the Rubber Research Institute of India undertook a detailed survey (1:50000) of rubber growing soils of South India to bring the entire rubber area in the country within the ambit of soil test based fertilizer recommendation. Web-based fertilizer recommendation "Rubber Soil Information System" was developed based on interpolated soil fertility data in collaboration with the Indian Institute of Information Technology and Management - Kerala.

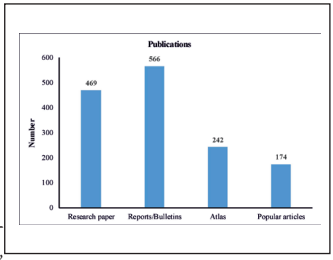


Major Ongoing Externally Funded Research Projects

S. No.	Name of the agency	Amount of the project (Rs.Crores)
1	REWARD Project : Watershed Development Department, WDD, Government of **Karnataka** (2021-22 to 2026-27) - (6 years) (WDD)	18.37
2	REWARD Project : Directorate of Soil Conservation & Watershed Development, (DSC & WD), Govt. of **Odisha,** Five (5) years from 2021-22 to 2025-26.	4.80
3	Karnataka Watershed Development Department (KWDD), Bengaluru (2021-22 to 2026-27) - (6 years)	1.037
4	Digital mapping of soil attributes for precision farming using imaging/non-imaging remote sensing data Project on Crop diversification in India	2.74
5	Land Resource Inventory of Vidarbha Region for Sustainable Land Use Planning POCRA Phase-II	1.97

PUBLICATIONS

During 2017-21, the Bureau disseminated its research outcomes through more than 1000 publications. The Scientists contributed more than 150 popular articles for the dissemination of research results to stakeholders. The following chart shows a summary of publications.



CAPACITY BUILDING (Training and Teaching)

Regular and customized training programmes are conducted by the Bureau for the state soil survey officials, Irrigation Offices and faculties of State Agriculture Universities on soil survey, mapping, and land evaluation. Recently an International Training Programme on the Application of Remote Sensing and GIS in Land Resource Inventorying and Management was also conducted. The Bureau has also initiated PG programmes and several scientists are involved in guiding M.Sc and Ph.D. students effected through signing of MoUs (list given below).

- Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia.
- Dr. PDKV, Akola, Maharashtra
- Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan
- Indira Gandhi Krishi Vishwavidyalaya, Raipur
- Chaudhari Charan Singh Haryana Agricultural University Hissar
- Tamil Nadu Agricultural University, Coimbatore
- GKVK, Bangalore
- SKN Agriculture University, Jobner

ORGANOGRAM

- HEADQUARTERS
  - RESEARCH DIVISIONS
    - Remote Sensing Applications (RSA)
    - Soil Resource Studies (SRS)
    - Land Use Planning (LUP)
  - ADMINISTRATION & ACCOUNTS
  - UNITS/CELLS
    - Priority Setting, Monitoring & Evaluation (PME)
    - Library &Documentation
    - Sales and Publication
    - AKMU
    - Official Language

- REGIONAL CENTRES
  - BANGALORE
  - DELHI
  - JORHAT
  - KOLKATA
  - UDAIPUR
- UNITS AT EACH CENTRE
  - Survey & Mapping
  - Soil Analysis Laboratory
  - Cartography & GIS
  - Administration
  - Priority Setting, Monitoring & Evaluation (PME) Cell
- ADVISORY BODIES
  - QRT
  - RAC
  - IRC
  - IMC