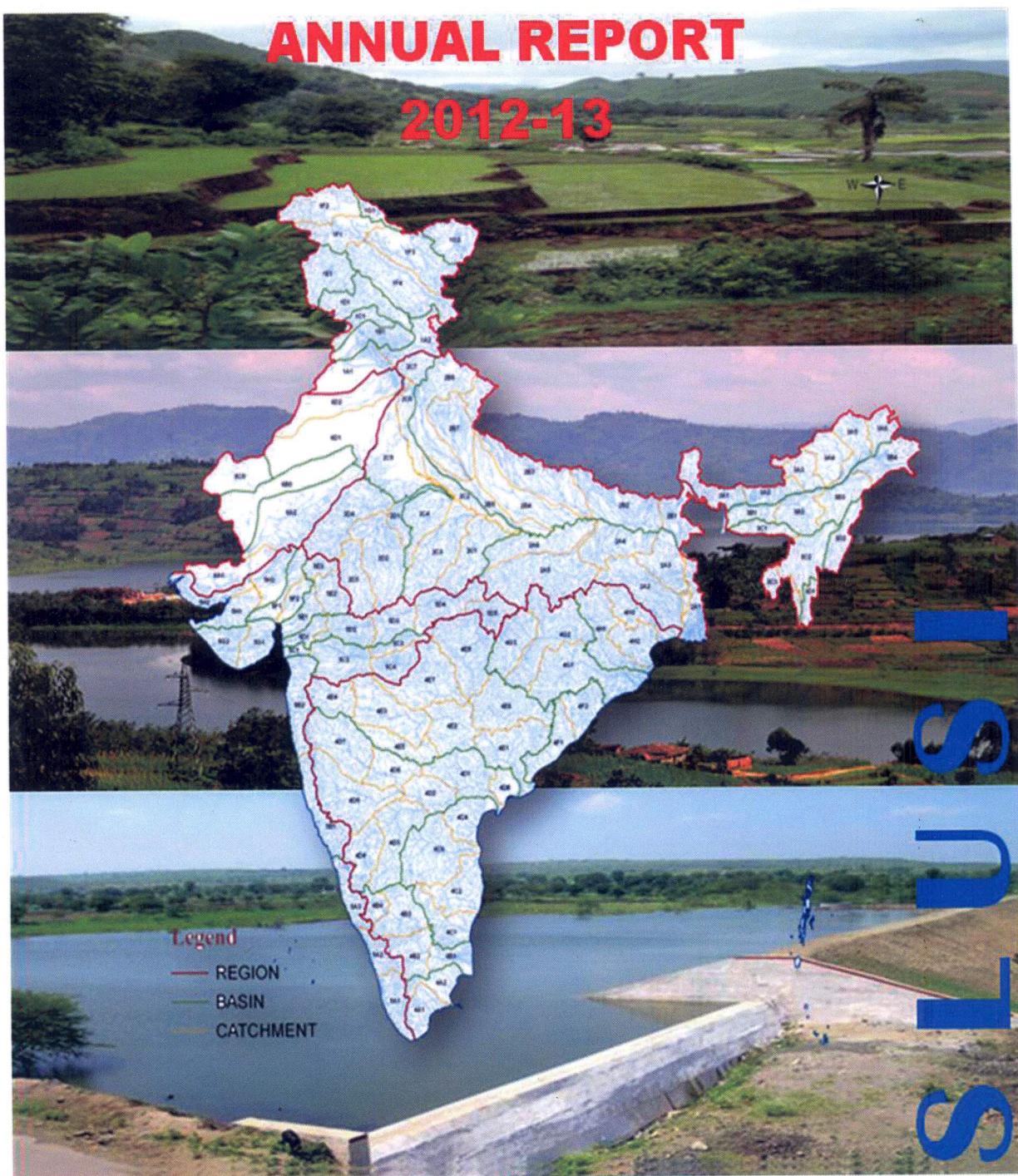


# वार्षिक रिपोर्ट

## ANNUAL REPORT

### 2012-13



भारतीय मृदा एवं भू-उपयोग सर्वेक्षण / SOIL AND LAND USE SURVEY OF INDIA

(कृषि एवं सहकारिता विभाग) / (Department of Agriculture & Cooperation)

कृषि मंत्रालय / Ministry of Agriculture

भारत सरकार / Government of India



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Annual Report  
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USE SURVEY OF INDIA  
(कृषि एवं सहकारिता विभाग) / (Department of  
Agriculture & Cooperation)  
कृषि मंत्रालय /Ministry of Agriculture

## Preface

Soil is one of the important natural resource, which is indispensable for livelihood of human beings. Soil & Land Use Survey of India serving the nation in engendering the digital spatial database on soil and land characteristics and watershed since last fifty five years, to facilitate the planning and implementation of soil and forest resource conservation and watershed development programmes in the country.

Remote sensing, GIS and RDBMS ect. has further expended the scope of soil data base use to the user communities and also for dissemination of information directly to different stake holders through web services.

This annual report embodies the various achievements made by the organization during the year 2012-13, in the field of soil survey and other activities to the benefit of users. Significant accomplishments of the year are the development of state wise digital watershed atlas for 13 states, which have successfully been uploaded on organization's website in order to make them available to the stake holders. Apart from it, many consultancy projects have also been taken up by the SLUSI during the year.

We are hopeful that the data base will be an important input for making the strategic plans for watershed based agriculture and rural development programmes.

I acknowledge the efforts and the contribution made by officers and staff of SLUSI in publication of the report. I am also thankful to the NRM division of Department of Agriculture & Cooperation, Ministry of agriculture, Govt. of India, for rendering support and cooperation in fulfilling the task.



(RAMESH KUMAR)

Chief Soil Survey Officer

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## कार्यकारी सारांश

भारतीय मृदा एवं भूमि उपयोग सर्वेक्षण, कृषि एवं सहकारिता विभाग, कृषि मंत्रालय, भारत सरकार के अंतर्गत कार्यरत हैं जिसका मुख्यालय, आई.ए.आई, पूसा में स्थित है। यह देश में मृदा सर्वेक्षण के क्षेत्र में सबसे प्राचीन एंव सर्वोच्च संस्था है। इसके भारतवर्ष में सात केन्द्र नौयडा, नागपुर, कोलकाता, बैंगलौर, हैदराबाद, अहमदाबाद एंव रांची हैं। जिनके माध्यम से विभिन्न प्रकार मृदा सर्वेक्षण का कार्य किया जाता है। मृदा सर्वेक्षण में विस्तृत मृदा सर्वेक्षण प्रमुख है। जिसमें क्षेत्र की मिट्टी एंव औद्योगिक स्थिति के बारे में विस्तृत जानकारी का प्रतिवेदन तैयार किया जाता है। जो क्षेत्र के समायोजित एंव संतुलित विकास के लिए काफी उपयोगी होता है। मृदा सर्वेक्षण में सुदूर संवेदन तकनीकी का भी पूरा उपयोग किया जाता है। जिसमें उपग्रह मानचित्रों से लेकर जी.आई.एस. तकनीकी शामिल होती है। मृदा सर्वेक्षण के कार्य में विभिन्न पैमानों के मानचित्रों का आधार मानचित्र के रूप में उपयोग किया जाता है।

### मृदा सर्वेक्षण एंव आंकड़े का विश्लेषण

भारतीय मृदा एवं भूमि उपयोग सर्वेक्षण का मुख्य कार्य विभिन्न नदी क्षेत्रों में मृदा सर्वेक्षण करना है। तत्पश्चात्, विस्तृत प्रतिवेदन तैयार किया जाता है। जिससे उपलब्ध आंकड़े, वैज्ञानिक भूमि उपयोग योजना तैयार करने तथा विभिन्न फसलों के लिए मृदा उपयुक्तता के मूल्यांकन एंव मृदा

एंव जल संरक्षण से संबंधित कार्यक्रमों के क्रियान्वन में महत्वपूर्ण भूमिका निभाते हैं। विभिन्न सर्वेक्षण जैसे विस्तृत मृदा सर्वेक्षण, त्वरित मृदा सर्वेक्षण, मिट्टी संसाधन सर्वेक्षण आदि विभिन्न नदी क्षेत्रों में आवश्यकतानुसार किये जाते हैं जो उस क्षेत्र की विकास योजनाओं में बहुत उपयोगी सामग्री के रूप में उपयोग किये जाते हैं। क्योंकि उस क्षेत्र विशेष की मृदा एंव भूमि की विस्तृत जानकारी सर्वेक्षण प्रतिवेदन में दी जाती हैं।

सुदूर संवेदन एंव जी.आई.एस. तकनीकी का भारतीय मृदा एंव भूमि उपयोग सर्वेक्षण मुख्यालय में सुदूर संवेदन एंव जी.आई.एस. इकाई कार्यरत है। जो आधुनिक उपकरणों से पूरी तरह संभव हैं। जिसमें विभिन्न प्रकार में मानचित्र तैयार किये जाते हैं तथा उपग्रह मानचित्रों की प्रीटिंग भी की जाती हैं। ये मानचित्र सर्वेक्षण कार्य में आधार मानचित्र के रूप में उपयोग में लिये जाते हैं तथा साथ ही भारतीय सर्वेक्षण विभाग के मानचित्र (टोपो शीट) भी आधार मानचित्र के रूप में उपयोग में लिये जाते हैं।

भारतीय मृदा एंव भूमि उपयोग सर्वेक्षण के सभी सातो केन्द्रों में सुदूर संवेदन एंव जी.आई.एस. प्रयोगशालाएं कार्यरत हैं जो सभी आधुनिक सुविधाओं से सुसज्जित हैं जो अपने केन्द्र पर किये जा रहे मृदा सर्वेक्षण कार्य के जी.आई.एस. तकनीकी से मानचित्र तैयार करने के कार्य में संलग्न रहते हैं।

## **मीटिंग एवं प्रशिक्षण कार्यक्रम**

भारतीय मृदा एवं भूमि उपयोग सर्वेक्षण मुख्यालय पर सभी कार्यालय प्रमुखों के साथ वर्ष में एक या दो बार तकनीकी तथा प्रशासनिक कार्यों का आंकलन किया जाता है तथा आवश्यक दिशा निर्देश दिये जाते हैं। इस वर्ष २५ जून, २०१२ एवं १२-१३ सितम्बर, २०१२ को इसी प्रकार की मीटिंग का आयोजन किया गया जिसकी अध्यक्षता संयुक्त सचिव, कृषि मंत्रालय द्वारा की गई तथा आवश्यक दिशा निर्देश दिये गये। इसी वर्ष दो प्रशिक्षण शिविरों का भी आयोजन किया गया। २१-२३ जनवरी, २०१३ को केन्द्रीय उर्वरक गुणवत्ता एवं प्रशिक्षण संस्थान, फरीदाबाद में किया गया जिसकी अध्यक्षता

संयुक्त सचिव भारत सरकार ने की। जिसमें हरयाणा प्रदेश के विभिन्न विभागों के अधिकारियों ने प्रशिक्षण प्राप्त किया।

दूसरा प्रशिक्षण कार्यक्रम १९-२१ फरवरी, २०१३ को केन्द्रीय मृदा एवं जल संरक्षण प्रशिक्षण संस्थान देहरादून ने किया गया। जिसमें उत्तराखण्ड प्रदेश के विभिन्न विभागों जैसे वन विभाग, मृदा संरक्षण विभाग, कृषि विभाग एवं उद्यान विभाग के अधिकारियों ने प्रशिक्षण प्राप्त किया।

इस प्रशिक्षण कार्यक्रम का उदघाटन मुख्य मृदा सर्वेक्षण अधिकारी की उपस्थिति में केन्द्रीय मृदा एवं जल संरक्षण प्रशिक्षण संस्थान के निदेशक डॉ पी. के. मिश्रा ने किया। प्रशिक्षणार्थी अधिकारीयों एवं कर्मचारियों ने भाग लिया एवं तकनीकी जानकारी प्राप्त की।

## **Executive Summary**

The efforts are being made to generate the soil inventory through Remote Sensing technology to meet out the users need as well as a step towards food through sustainable use as per the soil information generated.

1. The task is being implemented through its Head Quarter at Delhi along with its Survey Centre at Noida, Bengaluru, Kolkata, Nagpur, Hyderabad, Ahmadabad & Ranchi.
2. The important issues addressed by Soil & Land Use Survey are the generation of Digital Watershed Atlas of India on 1:2,50,000 as well as the micro watersheds of the State of India in 1:50,000 State, 13 States are completed up to microwatershed level till March 13. The task has been taken up as a challenge to digitalize all States of the country up to micro watershed level in 1:50,000 scale till March, 2014.
3. Furthermore, the Detailed inventory of the Soil on 1:12500 Scale and Rapid Reconnaissance inventory in 1: 50,000 supported by Remote Sensing & GIS technologies to fulfill the requirement of the desired database for sustainable development of the area and for new development planning. To update the knowledge of the officers & Staff, the Organization arranged various training programmes.
4. The organization also conducted trainings in different States. Involving the user officers of the concerned departments to update their knowledge in the respected fields and to make aware of the technology involved in soil database generated.
5. Remote Sensing and GIS lab located at Noida specially involved in the development of digital database in respect of Detailed Soil Survey, Rapid Reconnaissance Survey, Soil Resource Mapping & Land degradation mapping conducted in different RVP's and FPRs
6. As a major task of the organization, various types of soil survey are being conducted in different RVPs and FPRs of the country. The projects are based on the unique codification system up to watershed level on of India, so that the data could be generated in a desired area with required/suitable recommendation for sustainable development of the specific terrain. In this context, the SLUSI has conducted Detailed Soil Surveys (DSS) in Mahi-Anas RVP, Sabarmati catchments, Tunbhadhra sub catchment, Nagarjurna Sagar catchment, Delta mouth to Hirakund dam of Mahanadi basin, partial drainage of Tripura and Mizoram flowing into Bangladesh of Brahmaputra, Pocomped-Jayakwadi catchment, Ramganga Catchment, Ken FPR Catchment, Lower Rapti FPR catchments etc., And Rapid Reconnaissance Survey (RRS) in Nagarvalli catchment, middle Ganga catchment etc. and Soil Resource Mapping for 9 districts in different states during this year.
7. Furthermore, the different thematic layers of the area have also been developed to study and to establish the relationship between different characteristics of the area or terrain.

of the country. In this continuation organization that also developed a digital watershed atlas of India on 1:1M scale with unique codification system. Apart from it, the digital microwatersheds at individual State level have also been generated to make easy for the development plan at State district or the area specific level. Production of FCC from the data receives from NRSC is also done on the Remote Sensing Units. Generation of the digital database at different centres, related to their concerned areas is also a major task.

6. As a major task of the organization, various types of soil survey are being conducted in different RVPs and FPRs of the country. The projects are based on the unique codification system up to watershed level on of India, so that the data could be generated in a desired area with required/suitable recommendation for sustainable development of the specific terrain. In this context, the SLUSI has conducted Detailed Soil Surveys (DSS) in Mahi-Anas RVP, Sabarmati catchments, Tunbhadhra sub catchment, Nagarjurna Sagar catchment, Delta mouth to Hirakund dam of Mahanadi basin, partial drainage of Tripura and Mizoram flowing into Bangladesh of Brahmaputra, Pocomped-Jayakwadi catchment, Ramganga Catchment, Ken FPR Catchment, Lower Rapti FPR catchments etc., And Rapid Reconnaissance Survey (RRS) in Nagarvalli catchment, middle Ganga catchment etc. and Soil Resource Mapping for 9 districts in different states during this year.
7. Furthermore, the different thematic layers of the area have also been developed to study and to establish the relationship between different characteristics of the area or terrain.

8. Land evaluation and Land use planning is also a major part of our Detailed Soil Survey projects with suitable suggestions for land use with their capability classifications along with soil capability, land Irrigability classification and hydrological soil groupings.
9. The organization has also taken up special consultancy projects on request of State departments or user agencies. In this context, two special projects have been taken up by the organization on request of Kerala Government, namely Inventory of Soil & Land Resources of Palakkad District of Kerala State using Remote Sensing techniques and Inventory of Soil and Land Resource Mapping of Ernakulam district of Kerala State using Remote Sensing techniques. In spite of these, other consultancy projects are also in the pipeline, as per the request received from different State Governments and users' agencies. High intensity Detailed Soil Surveys are also taken up by the organization to fulfill the requirement of user agencies.
10. Sh. S.D. Dhargawe has attended an Interactive Workshop on "Findings of Baseline Study and Monitoring & Evaluation Framework" under SELM Projects and Consultative Meeting in Preparation of the 5<sup>th</sup> National Report to the UNCCD held at Secretariat at ICFRE, Dehradun During July 16-17, 2012.

Dr. Ramesh Kumar, Dr. T.K. Deb, Dr. V. Ranga Rao, Dr. S.P. Singh, Sh. R.K. Sharma, Sh. Bhajan Lal, Dr. Munish Kumar, Dr. A.K. Yadav, Sh. R.L. Yadav,

Dr. Ravi, Sh. D. S Sehmi and Sh. Ravi Gautam has attended the 13th ESRI User Conference held at the Radisson MBD Hotel, NOIDA during 5-6 December, 2012.

Dr. V. Ranga Rao, attended 9<sup>th</sup> Interactive Conference on e-Governance (ICEG-2012) at SCMS, Cochin, Kerala and presented a paper on "Understanding Common and Specific Applications of e-Government, the case from India" during 29-30 December, 2012.

Sh. Dinesh Patel and Sh. Pradip Jha has attended the "India Geospatial Forum 2013" during 22-24 January, 2013 held at HICC, Hyderabad.

Sh. R. L. Meena attended workshop on "Karnataka Geographical Information System (KGIS)" on 23Jan. 2013 at Hotel Atria, Bangalore.

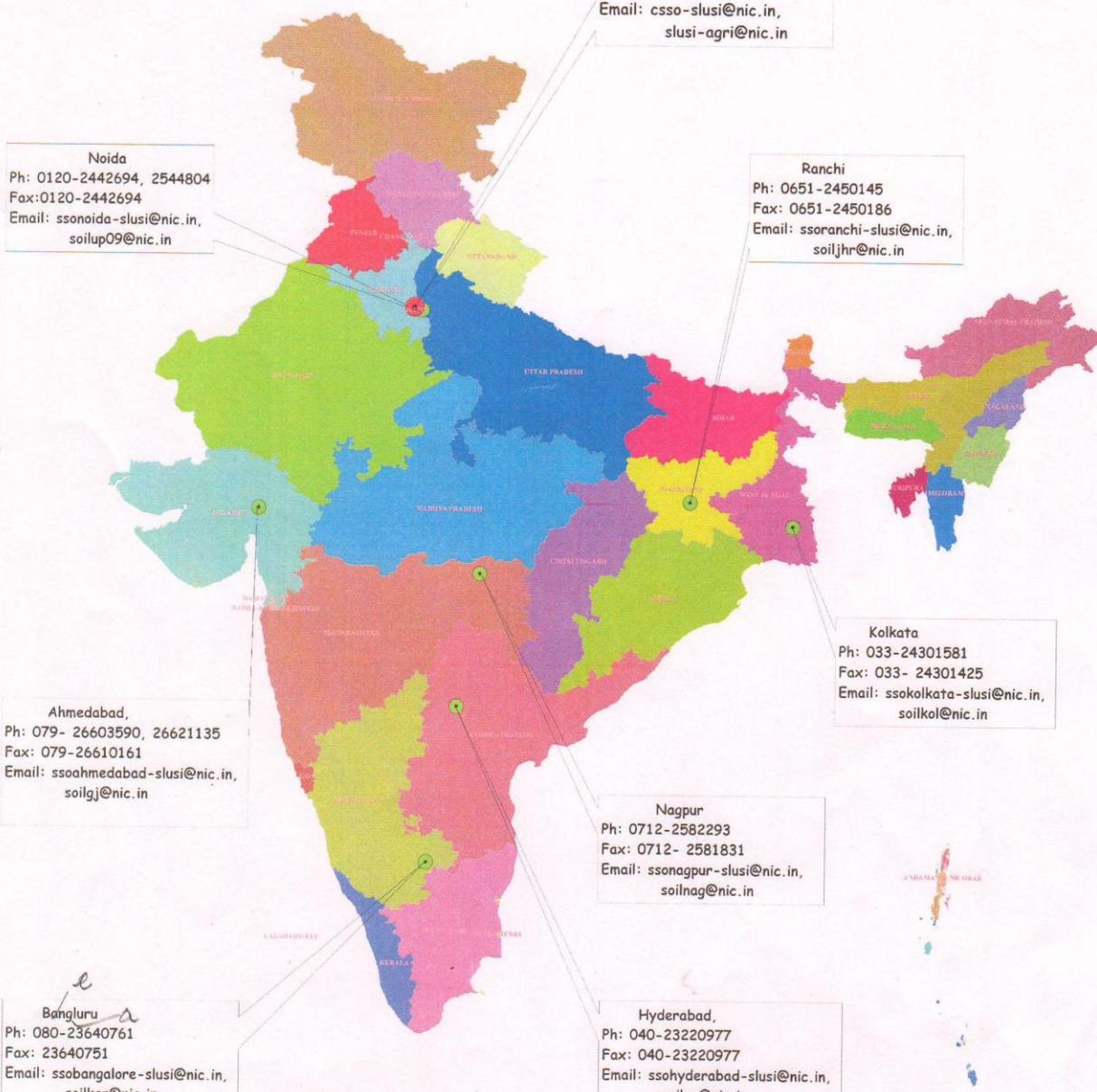
#### **11. The details of meetings conducted during the year are as under:**

25 June 2012- all heads of office met in Kolkata for a technical meeting. The Chief Soil Survey Officer chaired the meeting.

12-13 Sep 2012-Joint Secretary NRM chaired the meeting of all heads of office of SLUSI. J.S. (NRM) reviewed the technical as well as the administrative matters and instructed to achieve the assigned targets within stipulated time.

**SLUSI**  
**Headquarter & Centres**

<http://slusi.dacnet.nic.in>



**Legend**

- Headquarter
- Centres

## **1. Introduction**

Soil and Land Use Survey of India (SLUSI) earlier All India Soil & Land Use Survey (AISLUS) established in 1958 is an apex organization in the country which deals with Soil Survey and Land Resource Mapping. SLUSI is a subordinate office under the Department of Agriculture & Co-operation, Ministry of Agriculture. The Organization has completed *fifty five successful* years of different soil survey activities in the country.

In order to provide a scientific database for development programs, encompassing Soil & Water conservation planning, watershed development & scientific land use planning, SLUSI is primarily engaged in conducting Soil Surveys of different intensities.

The Organization is well equipped with modern facilities of air and space borne data interpretation laboratories, digital cartography & soil analytical laboratories.

The Soil & Land Use Survey Organization operates its mandate from Headquarters in New Delhi along with its seven regional centres located at Noida, Kolkata, Bengaluru, Nagpur, Hyderabad, Ahmadabad & Ranchi. Remote Sensing Cell of the Organization, which was established in 1982, dealt with the task of development of digital special data base using GIS & RDBMS for both catchment and district level including Image Analysis using computer aided software.

### **1.1 Facilities**

The Remote Sensing centre of soil and land use survey of India has requisite infrastructure and equipment support for both visual and digital image analysis of remote sensing data and generation of spatial and non spatial digital data base under GIS environment. The centre is equipped a number of advanced hardware and software

(FCC) of the IRS and PAN Digital data, covering a major part of the country are available with the Remote Sensing Centre. Under a collaborated project between DAC (SLUSI) and NIC for development of digital spatial database for GIS based application under G2G domain for planning purposes and hoisting of GIS base web services, additional hardware and software like desktop server and router 2821 etc. have also been installed in Remote Sensing Cell, Noida.

### **1.2 Photo Processing laboratory & Printing Cell**

Photo processing and reproduction laboratory equipped with the Devere Dichromat Vertical Enlarger, Panta Photo (20"X20"), Drust M605 Enlarger with Nikon Camera of 35mm format and a photo developing unit.

The printing cell is also well equipped with 1Duelo Digital Printer Model DP43S of A3 size digital printer model DP3100 of B4 size, Lethotex Vertical Camera. Collator Model DC10, Laminating machine of A0 size, spiral and spico binding machines etc.

### **1.3 Soil laboratory**

All seven regional centers are well equipped with a soil laboratory for analysis of soil, land and water samples to support the field observations and supplement data for interpretations and recommendations. The laboratory of each centre is managed by an Assistant Soil Chemist/ Assistant Soil Survey Officer with other technical staff. Both physical and chemical parameters are analysed for characterizations of soils to derive interpretation groupings for utility purposes like soil classification, soil management and to know about the development of soils.

## **1.4 Cartography**

For preparation and reproduction and soil maps one cartographic laboratory exists in each of the regional centre of the organization, and is managed by a Cartographic Officer or the Assistant Soil Survey Officer. The cartographic laboratory is equipped with required machines along with the Large Format Optical Enlarger having the capability of four times enlargement accommodating 9"x9" format at Nagpur and Kolkata Centers.

## **1.5 Library**

A central library at headquarter has been established. The library contains published soil survey reports of the organization, reference books, reprint bulletins, periodicals related to Pedology, Soil Survey, Soil Conservation, Remote Sensing related materials along with books related to official procedure and other essential subjects related to the office.

Administration, documentation & dissemination with the cataloguing of the literature is being looked after by an Officer which is assisted by other technical staff. Each regional center also maintains a library which also contains the Soil Survey Reports, Books on Soil Survey, Soil Science and Remote Sensing and Geographical Information System and other allied subjects.

## **1.6 Documentation and User Services**

Publications related to various kinds of Soil survey and special projects taken up by the organizations, are being published in the form of soil and land use survey reports and maps. These reports are made available to the user agencies of Central/State Governments and State Agriculture Universities, various institutions and other related organizations for planning and implementation of different development programmes on soil and water conservation,

land reclamation and other programmes on water managements etc. During the year 25 reports have been published by the organization out of which 13reports belongs to the Rapid Reconnaissance Survey, 09reports of Detailed Soil Survey and 03 reports of Soil Resource Mapping.

## **2. Mandate**

The mandate of the organization is to provide a detailed scientific database on soil and land resources to the various State User Departments for watershed based soil and water conservation planning and integrated natural resource management for sustainable agriculture development programme. The major activities of the organization were as under,

- Rapid Reconnaissance Survey (1:50K scale) in the catchment areas including the catchments of centrally sponsored River Valley Projects (RVPs), Flood Prone Rivers (FPRs) and non-RVP/FPR areas for prioritizing of subwatersheds / microwatersheds based on adjudged Sediment Yield/Run-off Potential for planning soil conservation and integrated watershed management programs.
- Detailed Soil Survey (1:4-1:15K scale) in high and very high priority subwatersheds / microwatersheds to provide a sound database for execution of soil conservation measures and recommendations for sustainable agriculture consistent with soil and land characteristics and terrain features.
- Development and promotion of space borne remote sensing techniques for application in mapping and monitoring of soils, land use, land

degradation, etc. and in identifying priority subwatersheds / microwatersheds as well.

- Development of digital soil and land resource map library for catchments using GIS and RDBMS.
- District wise Land Degradation Mapping on 1:50K scale using Remote Sensing Technique.
- Development of Soil Information System for data banking using GIS and RDBMS.
- Documentation and updating of the soil survey status of the country for providing previews of the nationwide availability of data to draw realistic balance sheets for soil survey programs.
- Consultancy projects related to watershed prioritization, monitoring and evaluation of the impact of watershed development programmes, soil resource mapping and development of digital soil database using Remote Sensing and GIS.
- Short Course Training for Officers of State User Departments.

Soil Conservation in the catchment a River Valley Project and Flood Prone Rivers (RVP & FPR) was being implemented by DAC through Macro Management of Agriculture (MMA) scheme till XI<sup>th</sup> Five Year Plan. Under this scheme Soil and Land Use Survey of India (SLUSI) prioritized the area by identifying and demarcating subwatersheds/microwatersheds yielding high sediment load/runoff in the a River Valley Project and Flood Prone Rivers (RVP & FPR) including Non-RVP Catchment through Rapid

Reconnaissance Survey. After XI<sup>th</sup> Five Year Plan RVP & FPR scheme was discontinued. Moreover, the National Mission for Sustainable Agriculture (NMSA), one of the eight missions envisaged under aegis of NAPCC was formulated for implementation of various interventions to address the issue of climate change in agriculture sector during XII<sup>th</sup> Five Year Plan. Therefore SLUSI revisited mandates in the light its role in NMSA with special reference to Soil Health Management activity. The revised mandates of SLUSI are;

- Detailed Soil Survey (DSS) using real time Remote Sensing data to generate detailed scientific database on soil and land characteristics for planning and implementation of various programme of soil and water conservation and Soil Health Management (SHM)
- Development of House for Technical Support Group (TSG) for providing support to the National Mission for Sustainable Agriculture (NMSA)
- Establishment of an advanced national level Nodal Soil Analytical Laboratory (NSAL) at Noida Centre for Macro/ Micro nutrient analysis and for monitoring/quality checking of soil analysis which are being done at state level soil analytical laboratories.
- Monitoring and evaluation of various development projects under NMSA and other national programme
- Development of MIS (Management Information System) for knowledge networking and monitoring

- Conducting training for capacity building of officers of state governments involved in different development programme of agriculture, forest, rural development, horticulture and soil conservations etc.
  - Preparation of state wise Platform free Microwatershed on 1:50 K scale
  - Collaborative project with central/state government department and also with research institutions and universities for research / other academic activities.
- Keeping abreast with the advancement in the field of soil survey and mapping development of digital base and hosting of web services, the organization has reoriented its activities.
- Organization has been making significant progress, during the period on prioritization of watersheds in catchment areas, detailed soil survey in selected watersheds, district wise soil & land or degradation mapping on 1:50k scale using remote sensing techniques, consultancy projects and other scientific/technical programs for which, the organization is fully devoted.

## 2.1 Highlights

- The Organization has been renamed as Soil & Land Use Survey of India (SLUSI) vide part I; Section-2 of the Gazette of India dated 14-20 July, 2007. Earlier it was All India Soil and Land Use Survey (AISLUS).
  - Organization ensured in the 55<sup>th</sup> successful year of Soil Survey activities in the country.
  - A Digital spatial database for the watersheds on 1:50K has been developed for 190m ha in collaboration with National Informatics under the projects on the hoisting of GIS based web services during the period.
- Now Bengaluru, Nagpur, Kolkata, Ahmadabad, Hyderabad and Ranchi centres have also been upgraded with GIS and Remote sensing facilities.
- Soil and Land Use Survey of India Organisation has developed Digital Watershed Atlas of India. The work is also going on to develop the state wise micro watershed atlas for implementation of various projects on the ground, considering micro watershed as a development unit for sustainable means. Till now the SLUSI has developed micro watersheds of 13 states and the same has been uploaded on the SLUSI website for user purpose.

### **3. Financial and Staff Position**

For the year 2012-13 the financial expenditure regarding the Budget sanctioned and the actual expenditure is made against the plan and non-plan and the staff strength

#### **3.1 Budget for the year 2012-13**

(Rs. In lakh)

	<b>Budget Sanctioned</b>	<b>Actual Expenditure</b>
<b>Plan</b>	1649.00	151.82
<b>Non Plan</b>	235.00	231.01

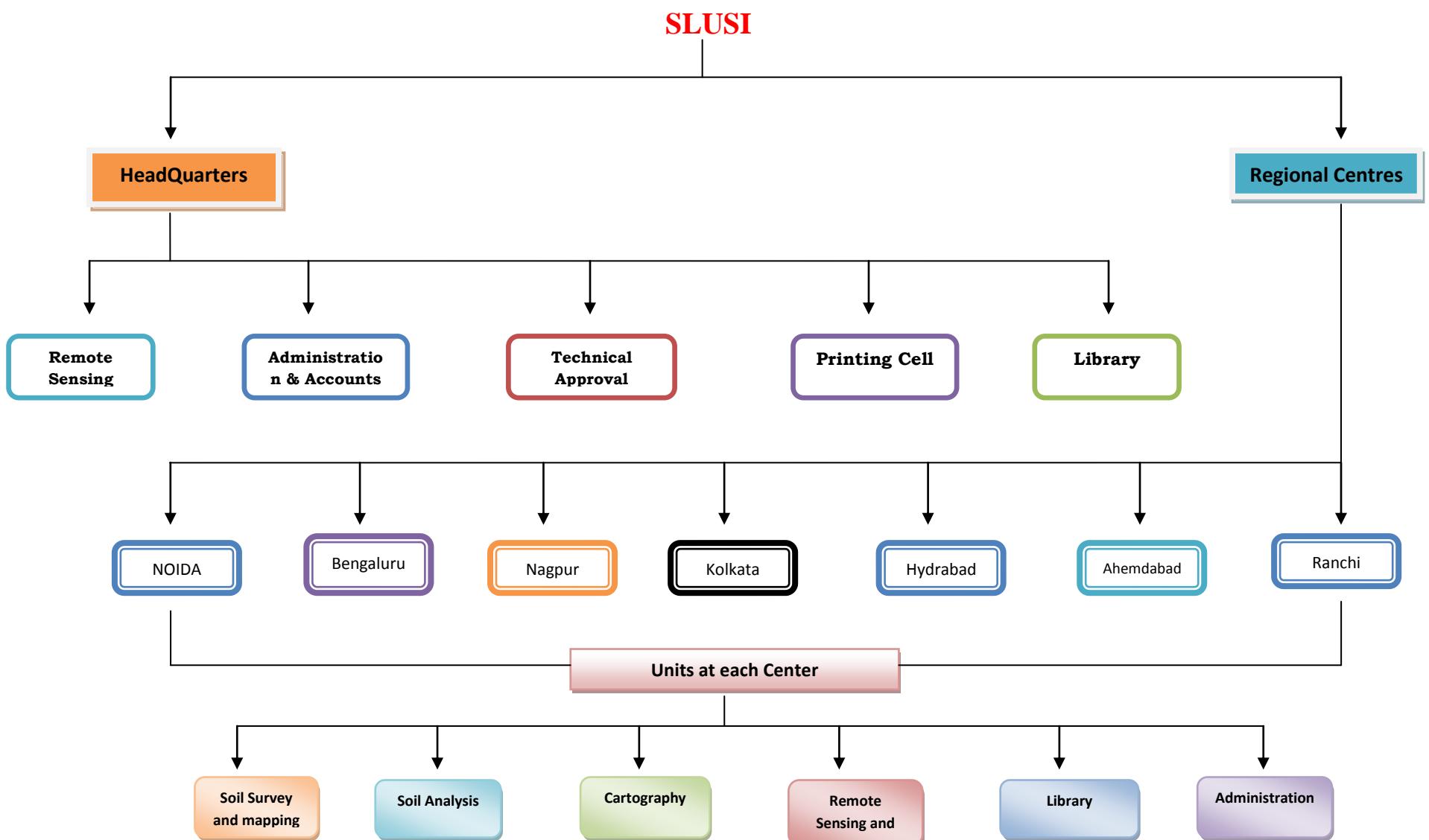
for group A, B and C is also given below with the number of vacant posts against each category.

#### **3.2 Staff Strength as on 31.03.2012**

<b>Category</b>	<b>Sanctioned Strength</b>	<b>In Position</b>	<b>Vacant</b>
<b>Group A</b>	40	25	15
<b>Group B</b>	190	104	86
<b>Group C</b>	218	161	57

3.3

## ORGANOGRAM



## **4. Programmes**

### **Targets and Achievements of Soil Survey**

#### **4.1 Soil and Land Resource Survey**

The SLUSI is conducting various types of surveys for mapping the soil and land resources. It comprises the soil and land use mapping and the preparation of survey reports for users' consumption, which helps in sustainable development and research programs.

The organization also conducts degraded lands mapping, water logged area mapping, and Remote Sensing application in soil studies and the management of soils & land resource data at National level. Physical target of the organization for the different surveys for the year 2012-13 is as under:

#### **SLUSI Target 2012-13**

S. No.	Type of Survey	Target (Lakh ha)	Achievement (Lakh ha)	Percentage of Achievements
1.	DSS	8.00	6.08	75.97
2.	RRS	30.00	23.74	79.13
3.	SRM	88.32	64.23	72.72

#### **4.1.1 Rapid Reconnaissance Survey (RRS)**

Soil and Land Use Survey of India has developed a methodology for prioritization of micro watersheds. It is based on the computation of Sediment Yields Index (SYI) and Runoff Potential Index (RPI) for each micro watershed within the catchment of River Valley Project (RVP) and Flood Prone Rivers (FPR) respectively. On that basis the

Erosion priority of subwatershed or microwatershed is fixed for management practices and sustainable development.

#### **4.1.2 Detailed Soil Survey (DSS)**

To generate the basic database on Soil and Land characteristic required for planning and implementation of soil conservation, integrated watershed management and other related rural development programmes, the Detailed Soil Survey (DSS) of medium density is undertaken by the organization in very high and high priority watersheds in different RVPs/FPRs catchment. For the development of scientific land use planning and to generate the Detailed Database on soil and land characteristic, medium to high-intensity Detailed Soil Surveys (DSS) are undertaken by the organization. Apart of it, such soil surveys provide the detailed information on spatial distribution of soils in map form and utilitarian interpretations for irrigation development projects, land reclamation planning, engineering planning and urban & rural land use plan.

#### **4.1.3 Soil Resource Mapping**

To map the soil series and their association in the area, the organization is conducting district wise soil resource mapping. During this survey landscape with their soil depth, physiography, land use and erosion categories are being taken into consideration. Survey of India toposheets on 1:50,000 scale is used as a base map along with the geocoded satellite imaginaries for mapping. During this year, nine districts have been mapped under Soil Resource Mapping.

## **5. राजभाषाहिन्दी कार्यक्रम**

राजभाषा अधिनियम १९६३ और उसके अन्तर्गत बने राजभाषा नियम १९७४ के अनुपालन एवं राजभाषा विभाग, कृषि मंत्रालय, भारत सरकार द्वारा समय समय पर जारी किये जाने वाले वार्षिक कार्यक्रमों में निर्धारित लक्ष्यों की पूर्ति के लिए अखिल भारतीय मृदा एवं भू उपयोग सर्वेक्षण मुख्यालय पर हिन्दी में सरकारी कामकाज लिखने व जारी करने का कार्य सराहनीय ढंग से किया जा रहा है। कर्मचारियों एवं अधिकारियों द्वारा नोट शीट एवं पत्र राष्ट्रभाषा हिन्दी में ही प्रस्तुत किए जाते हैं तदानुसार सभी आंचलिक केंद्रों को हिन्दी भाषित पत्रों द्वारा ही निर्देश दिये जा रहे हैं। साथ ही साथ मुख्यालय एवं आंचलिक केंद्र पर हिन्दी भाषामें पत्र-पत्रिकाएं प्रकाशित करने का कार्य भी प्रगति पर है।

### **5.1 हिन्दी पखवाड़ा का आयोजन**

अखिल भारतीय मृदा एवं भू उपयोग सर्वेक्षण मुख्यालय, नई दिल्ली एवं उसके सभी सात केन्द्रों (नोएडा, कोलकाता, बंगलुरु, नागपुर, हैदराबाद, अहमदाबाद एवं राँची) में हिन्दी सप्ताह सभाओं (२० सितम्बर, २०१२- ०४ सितम्बर २०१२) का आयोजन किया गया जिसमें संगठन के सभी अधिकारियों एवं कर्मचारियों ने राष्ट्रभाषा हिन्दी में ज्यादा से ज्यादा काम करने का संकल्प लिया। भारतीय मृदा एवं भू उपयोग सर्वेक्षण के मुख्यालय पर हिन्दी पखवाड़ा का उद्घाटन श्री मोहन सिंह, संयुक्त निदेशक (राज भाषा) द्वारा किया गया। उन्होंने हिन्दी भाषा को राज भाषा

बनाने की घटना का विस्तरत उल्लेख किया।

### **5.2 हिन्दी प्रतियोगिता का आयोजन**

दिनांक २५-०९-२०१२को श्रुत लेखन सम्बधि प्रतियोगिता का आयोजन किया गया। जिसमें आठ कर्मचारियों ने हिस्सा लिया। तथा अधिकतम् प्राप्तांक पाने वाले प्रथम तीन प्रतिभागियों को प्रशस्ति पत्र के साथ साथ हिन्दी की पुस्तकें पुरस्कार स्वरूप प्रदान की गई।

### **5.3 राजभाषा कार्यान्वयन समिति की तिमाही बैठक**

राजभाषा कार्यान्वयन समिति की पहली तिमाही बैठक दिनांक ०५-१०-१२ को डॉ तपन कुमार देब, की अध्यक्षता में सम्पन्न हुई। तथा राज भाषा कार्यान्वयन समिति की दूसरी तिमाही बैठक दिनांक ०९-०१-२०१३ को सम्पन्न हुई जिसमें विभाग के अधिकारियों एवं कर्मचारियों के अलावा डॉ रमेश कुमार मुख्य मृदा सर्वेक्षण अधिकारी एवं श्री मोहन सिंह, संयुक्त निदेशक (राज भाषा) ने भी हिस्सा लिया।

### **5.4 राजभाषा कार्यान्वयन समिति का निरीक्षण / मार्गदर्शन**

राजभाषा क्रियान्वयन समिति जिसमें माननीय सांसदों के समूह ने मुख्य कार्यालय के कामकाज का निरीक्षण किया तथा राजभाषा हिन्दी को कार्यालय में अधिक प्रभावशाली बनानेतथा दैनिक कामकाज हिन्दी में करने पर बल देते हुए आवश्यक दिशा निर्देश दिये। जिसका पालन करने का पूरा प्रयास किया जा रहा है।

## **6. Publication of Soil Survey Reports**

### **6.1 Rapid Reconnaissance Survey Reports.**

Report No.Agro.1429-Report on prioritization of Microwatersheds in 5B1A1-A7 Watersheds of 5B1A Subcatchment (Non RVP) in districts Dharwad, Haveri, Shimoga and Uttar Kannada of Karnataka State.

The report covers an area of 533569 ha comprises seven watersheds namely 5B1A1 to 5B1A7 falls in Dharwad, Haveri, Shimoga and Uttar Kannada of Karnataka State. Geographically the survey area lies between 74°15' to 75 °05' East longitude and 14°15' to 15°30' North Latitude covered by survey of India toposheets no. 48I/12, I/14, I/15, I/16, 48J/5, J/6, J/7, J/9, J/10, J/11, J/12, J/13, J/14, J/15, J/16, 48M/03, M/4 and 48N/1, on 1:50000 scale.

Physiographically, the survey is a part of Archaean Shield made up of predominately hilly, undulating to rolling and flat topography. The survey is grouped under seven major physiography such as: i. Alluvial plain ii. Coastal Alluvial Plain iii. Hillsides slope iv. Pediments v. Lower pediplain vi. Upper Pediplain vii. Stream banks.

Alluvial plains occur all along the major rivers that like Kali, Bedthi, Gangwali and Aghnashini in the surveyed area. Hills found almost throughout the area and are further subdivided into hill top and hillside slopes. The height of the hills varies considerably being low in the western and central part medium to high in central and eastern part. Pediments have gradually seen in the central and eastern position of the surveyed area. Lower pediments are generally noticed in central and eastern part of the surveyed area and above stream course. Upper pediplains are generally found central and eastern part

of the survey area between pediments and lower pediplains. The stream banks, which are around the major streams having the elevation ranges from 480-520meters above mean sea level.

Geologically, the survey is subdivided into 5 landscapes i.e. i. Granite ii. Laterite iii. Greywacke iv Alluvium v. Coastal alluvium. There is the part of Archaean shield which have undergone much folding, faulting, crushing, metamorphosis and weathering of rocks. Granite Gneiss Greywacke and Laterite have given rise to in-situ soils while coastal area is dominated by alluvium and secondary soils.

Climatically, the survey area experiences a very cool and pleasant climate throughout the year in the central and eastern part, except along the coastal track. The rainfall data depict that the area receives 1500mm to 2500mm rainfall annually and falls under Udicmoisture regime. The temperature data indicate that the area experiences mean annual temperature of 25°C with a mean maximum annual temperature of 30.7°C and mean minimum annual temperature of 19.2°C. The mean annual soil temperature ranges from 23°C to 27.7°C with Hyperthermic temperature regime.

The soils of the surveyed area are dominated by red soils and are derived from weathered productive of Granite, Greywacke, Laterite, Alluvium and Coastal Alluvium. Based on the solum thickness, soils are grouped into four major categories i. very deep soils ii. Deep to very deep soils iii. Shallow to moderately deep soils iv. Very shallow to shallow soils. The Very deep Alluvial soils are fluventic, brown to dark grayish brown,

very fine textured soils. These soils are good for cultivation of agricultural crops as well as for orchard & plantation like Coconut, Cashew nut etc. The very deep coastal alluvial soils are found by the side of sea cost of around 1-5 km in distance. These soils are light brown, brownish grey to strong brown in colour and coarse loamy in texture. These soils are usually under coconut plantation and at places, cultivated for rainfall crops like Paddy and Kagga. The deep to very deep hill soils are derived from weathered material of Granite Greywacke and laterite. The texture of these soils is gravelly, very fine, gravelly fine loamy and loamy. These soils are usually under deciduous forest area. The deep to very deep soils are usually under plantation like Coconut, Mango and at the places Cashew nut. At rainfed agricultural crops are also growing. The very deep red soil is derived from weathered material of Granite, Greywacke<sup>[R1]</sup> and Laterite and are usually under rainfed agricultural crops like Paddy, Maize, Sorghum, Cumbu<sup>[R2]</sup>, Groundnut etc. and at places Orchard, Plantation are also growing. The shallow to moderately deep

Soils are found in the hills as well as in the pediments and are derived from weathered material of Greywacke<sup>[R3]</sup> and Laterite. These soils usually on hills are in open scrubs and lower piedmonts. Rainfed agriculture and mirror crops are grown.

The survey area has four types of land use viz: i. Forest ii. Plantation iii. Agriculture iv. Open scrub. The area under forest is grouped into three classes like a forest, moderately dense and thin grass cover with scrub vegetation. The eastern part of surveyed area is mostly covered with forest. The area under plantation is broadly grouped into three categories based on ground cover i.e. 40-60%, 20-40% and 10-20%. The plantation includes the estate of Rubber, Cashew Nut, Coffee, Tea etc. along with horticulture plantation like Mango, Pepper, Vanilla, Tamarind, Coconut, Areca nut, Teak, etc.

The area under agricultural practices is mostly restricted to plain, pediments and valley area. Some places on higher slopes with bench terracing. Mainly on rainfed and occasionally irrigation with bore wells and tank. Mainly crops grown in the survey area are Sugarcane, Paddy, Pulse, Oilseeds, Cotton, Wheat & Jowar etc. The areas under open scrub are mostly restricted to crests and coastal lands.

#### *Priority categories of micro watersheds*

S.No.	Priority Categories(RPI)	No. of microwatershed	Area(ha)	Percentage
1	Very high(765)	8	11159	2.09
2	High(61-65)	136	189842	35.58
3	Medium(56-60)	214	303616	56.90
4	Low(51-55)	19	28952	5.43
Grand total		377	533569	100.00

*District wise distribution of priority area*

S.No.	Priority Category /No. of MWS	District				Total	Percentage
		Dharwad	Haveri	Shimoga	Uttar Kannada		
1.	Very High	0	0	0	11159	11159	2.09
	MWS	0	0	0	8	8	
2.	High	5820	0	46	183976	189842	35.58
	MWS	4	0	1	132	137	
3.	Medium	92741	13416	1699	195760	303616	56.90
	MWS	68	20	3	147	238	
4.	Low	2197	0	0	26755	28952	5.43
	MWS	3	0	0	18	21	
	Total	100758	13416	1745	417650	533569	100.00
	Total no. of MWS	75	20	4	305	404	

**Report No. Agri.1438-“Report on prioritization of microwatersheds in 5A2A1 to 5A2A4 watersheds of 5A2A subcatchment (non-RVP)”, in district Malappuram, Palakkad and Thrissur of Kerala State.**

The report area covers an area of 211615ha comprises four watersheds i.e. 5A2A1 to 5A2A4 falls in Malappuram, Palakkad and Thrissur district of Kerala State. The survey area lies between 76°23' to 77°35' East Longitude and 9°14' to 9°16' North Latitude covered by the Survey of India toposheets no. 58C/7, 8, 12, 16; 58D/9, 10, 13, 14, 15, 58H/1, 2, 3, 4, 5, 6, 7, 8, 11, 12 of 1:50,000 scale.

Physiographically, the Survey area is a part of ‘Archaean Shield’ make up of predominantly hilly topography, undulating to rolling topography and flat topography. The survey can be grouped into four major categories such as i. Alluvium plain ii. Coastal alluvial plains iii. Hills iv. pediplains. Alluvial plain occurs mainly on the river banks and river mouths. The coastal alluvial plains found all along the sea coast adjoining the Arabian Sea in the western part of the

survey area. The width of coastal plains occurs for a width of 2-3kms. The survey area has several big and perennial rivers. These rivers originate from Western Ghats, flow from east to west, and joined by several tributaries before joining the Arabian Sea. The drainage pattern is sub-dendritic in the central and eastern part of the survey area while it is parallel to sub-parallel in the western part near the sea coast.

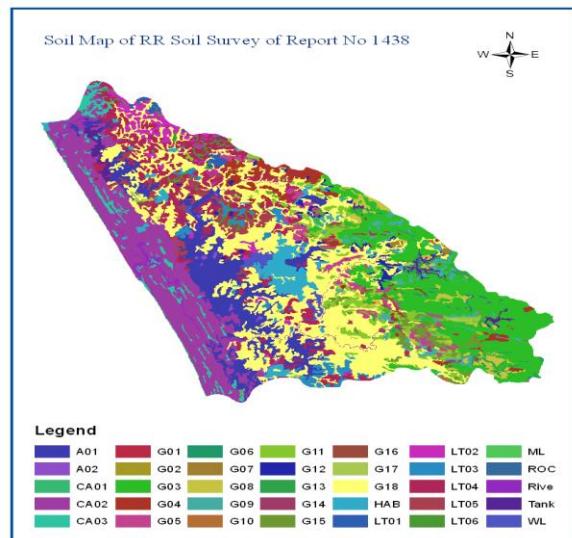
Geologically, the survey area is made up of four landscapes i.e. Granite, Laterite, Alluvium and Coastal Alluvium and is a part of Archaean Shield, which have undergone much folding, faulting, crushing, metamorphosis and weathering. Granite Gneiss Greywacke and laterite have given rise to in-situ soils while Coastal Alluvial has given rise to Alluvial of secondary soils.

Climatically, The rainfall data depict that the area receives 2765mm rainfall annually. The amount of rainfall being received is greatly reduced and only 25-30% of the annual rainfall is received. The moisture regime of the survey area is Udic. The temperature data depicts that the area experiences mean annual temperature of 27.6°C to with a mean

maximum annual temperature of 31.9°C and mean minimum annual temperature of 23.3°C. In general the area experiences a very cold and pleasant climate throughout the central and eastern part of the survey area except along the coastal track. The mean annual soil temperature ranges from 26°C to 29.8°C and the temperature regime is Iso-hyperthermic.

The soils of the area are derived from the weathered products of Granite, Laterite, Alluvium and Coastal Alluvium. Based on solum thickness these soils are grouped into two depth categories i.e. very deep & deep to very deep. In the survey area, a maximum of 111436 ha (53%) under very deep soils. Alluvial soils in the survey area are found below mean sea level of 5-10meters which are called 'Kole lands' in a local dialect. These soils are used mainly for the cultivation of Paddy crops. Coastal alluvium soils of marine origin are identified along the coastal plain. These soils are very deep with a sandy texture and have a high water table and the water holding capacity is poor due to the predominance of sand. These soils are mainly cultivated with coconut plantation. Very deep red soils are derived from weathered products of Coastal Alluvium and Granite. They are localized in occurrence and found mostly in all surveyed districts. They are usually very deep with clay loam to clay texture. A variety of crops such as Coconut, Areca nut, Banana, Yams, Pineapple, Fruit trees, Rubber Plantation are grown under proper management. Laterite soils mainly occur in the midlands at elevation 20-100meters above mean sea level as a strip between the coastal belt and hilly mid up land. These soils are active with low water holding capacity, soil erosion and reduced effective soil volume. These soils are generally suitable for most of the dry lands crops. It is mainly cultivated with Coconut, Banana, Yams, Pepper, Pineapple and other fruit trees. Deep to very deep red

soils are derived from weathered products of granite and laterite. These soils occur in all the physiographical positions and at all the slope ranges. The texture of the hills soils is loam to clay loam, with average gravel of 5-10%. These soils are suitable for dry land like Rubber, Coconut, Areca nut Fruits, Vanilla, Pepper and Estate Plantation like Rubber, Coffee, Tea, Cardamom, Spices etc. The texture of forests soils is the sandy clay loam to clay loam, dark reddish brown to yellowish red.



The survey area has five types of land use i.e. dense forest, multiple crops, open scrub, orchards and estates. Forests exist on different physiography such as hill, pediments and piedmonts. However, the extent of forest in hills is quite extensive. A maximum of the survey area was mapped under multiple crops (73921ha), followed by orchards (67756ha) and under dense forest (40065ha). The area under plantation is broadly grouped into three categories based on ground cover i.e. 40-60%, 20-40% and 10-20%. The plantation is noticed on different physiography such as hills, pediments, piedmonts, valleys and coastal plains. The important plantation crops are Areca nut, Cardamom, Coffee, Coconut, Banana, Rubber, Vanilla, Pepper etc. The

area under agriculture is mostly restricted to plain, narrow valleys and coastal plains. Major crop grown is paddy. The areas under *Priority categories of Microwatersheds*

open scrub are mostly restricted to crests and coastal lands.

S.No.	Priority Categories(RPI)	No. of microwatershed	Area(ha)	Percentage
1	Very high	14	18484	8.70
2	High	41	60273	28.50
3	Medium	68	95926	45.30
4	Low	26	36932	17.50
Grand total		149	2116165	100.00

#### *District wise distribution of priority area*

S.No.	Priority Categories/No. of MWS	District			Total area(ha)	Percentage
		Malappuram	Palakkad	Thrissur		
1.	Very high	0	0	18484	18484	8.70
	No. of MWS	0	0	14	14	
2.	High	384	1569	58320	60273	28.50
	No. of MWS	1	3	40	44	
3.	Medium	8234	6005	81687	95926	45.30
	No. of MWS	9	6	63	78	
4.	Low	8690	0	28242	36932	17.50
	No. of MWS	9	0	20	29	
Total area		17308	7574	186733	211615	100.00
Total no. of MWS		19	9	137	165	

#### **Report No. Agri.1439-Report on Prioritisation of Micro-watersheds of Mahanadi Basin (4GIE Sub-catchment) Districts Phulbani, Kalahandi, Boudh, Rayagada and Bolangir of Odisha State.**

The report covers an area of 620489ha falling in Phulbani, Kalahandi, Boudh, Rayagada and Bolangir districts of Odisha and is part of 4G1 catchment, lies between 19°43' to 20°50' North Latitude 83°5' to 84°17' East longitude and is covered by Survey of India toposheets no. 64P/3, 4, 7, 8, 10, 11, 12, 13, 14, 15, 16; 65M/1, 5, 6, 9, 13; 74A/1; 73D/3, 4, 8 on 1:50,000 scale.

Physiographically, the survey area is represented by undulating topography with depressional valley hill and terrain. Broadly

the area may be divided into five physiographic units i.e. Hills side slopes. Isolated hillock, Peniplain, Floodplain and Valley hills / depressional land. The area mostly moderately well drained in nature. The area is drained by Tel river and its tributaries namely Ronl, Utal, Kotak, Kodogo, Gumdi and Ret Nar. The drainage pattern is sub parallel to sub dendritic in nature, where the hilly part is having dendritic drainage pattern. The elevation of the area varies from 120-200 msl.

The geological formation of area consists of various types of rocks of different origin. The metamorphic rocks such as Granite, Gneiss, Schist, Charnokite, and Quartzite are found in the area with different mineralogical

composition. Sedimentary rock like sandstone is also found in some place of the area. Alluvium is mainly confined to the major rivers.

The Climate of the surveyed area falls under sub-humid tropical monsoon type. It has been defined into three distinct seasons namely summer, monsoon and winter. The temperature class and moisture regime of the catchment area are Hyperthermic and Ustic respectively.

The soils of the area show marked variation depending upon their physiographic position and parent material over which soils are developed. The relief seems to be more responsible for different moisture regime, erosion, translocation and transportation. Both sedentary or in-situ and also transported soils are found to occur in the area. The soils of the area developed over sandstones on hills, plateau plain and peniplain are sedentary in nature while the soils in the flood plains are alluvium. Both recent and old alluvium developed through transportation and sedimentation process by numerous rivers and streams. The soil of the hilly region on gentle to moderate sloping

hilltop to very steep hillsides slope are shallow to moderately deep , reddish brown to dark reddish brown in colour and loamy skeletal to fine loamy texture. In foothills and peniplain, the soil developed on very gently to moderately sloping land are moderately deep to very deep, reddish brown to dark brown and yellowish red to red, loamy skeletal to fine texture. In the valley plain, soils developed own level to gently sloping land are very deep, light yellowish brown to olive brown on nearly blue in colour.

The hills of the survey area are mostly covered with thin forest vegetation, but there is some barren area also. Some of the hills are covered with new plantation. Paddy, Arhar, Capa, Moong etc. are cultivated in the foothills and valley. The beds of the small stream and gullies in the valley have been reclaimed by the villagers for Paddy cultivation. Very few patches of the land are irrigated by stream for growing Paddy. Major crops of the area are Paddy, Maize, Ragi, Niger, Arhar, Groundnut, Moong, Wheat, Kulthi, Pea, Mustard, Till etc.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatersheds	Area(ha)	Percentage
1	Very high	60	55887	9.01
2	High	177	176761	28.49
3	Medium	204	187862	30.28
4	Low	120	114095	18.39
5	Very Low	94	85884	13.84
Grand total		655	620489	100.00

*District wise distribution of priority area*

S. No.	Priority Category	District					No. of MWS	Area (ha)	Percent age
		Bolangir	Boudh	Kalahandi	Phulbani	Ray aga da			
1.	Very high	0	2871	27753	24252	1011	60	55887	9.01
2.	High	2013	3087	43604	12500 5	3052	177	176761	28.49
3.	Medium	3648	13310	52589	11306 0	5255	204	187862	30.28
4.	Low	788	22123	80929	8549	1706	120	114095	18.39
5.	Very Low	6870	22325	55752	937	0	94	85884	13.84
Total		13319	63716	260627	27180 3	1102 4	655	620489	100.00

**Report No. Agri.1443-Report on prioritization of microwatersheds in 2C3B (Lower Sindh) subcatchment of Sind-Kunwari RVP catchment (2C3B1-6 watersheds) of Yamuna basin, districts Bhind, Datia, Gwalior and Morena of Madhya Pradesh State and Districts Etawah and Jalaun of Uttar Pradesh State.**

The report covers an area of 469693ha spread over Bhind, Datia, Gwalior and Morena district of Madhya Pradesh State and Etawah and Jalaun districts of Uttar Pradesh State falls under Sindh Kunwari catchment of Yamuna basin. The survey area lies between 78°04'10" to 79°14'07" East Longitude and 25°46'05" to 26°31'06" North Latitude and is covered by Survey of India toposheets no. 54J/2, 3,4,7,8,10,11,12,15,16; 54K/1,5,9 and 54N/3.

Physiographically, they survey area is a part of Bundelkhand plateau of Central India. The important features of Bundelkhand topography are its smooth and undulating character which is commonly known as senile topography. The entire region is marked by subdued topography that tends to grade into a level plain towards north.

Subaerial denudation has reduced the granite country into on undulating the surface of moderate relief with characteristic of late nature landscape. The segments and landscape unit as classified in the survey area are Denudational hills, Plateau plain, undulating plain, Alluvium Plain/floodplain and badland topography/deep ravines.

Geologically, the area under survey comes in Bundelkhand region. Three main geological systems represented in the survey area namely (i) Bundelkhand Granite complex of Archean systems and (ii) Quaternary alluvium of recent deposits (iii) Sandstone.

Climatically, the survey area falls under semi-arid type having hot and dry in summer and cold in winter season. The average annual rainfall is 888 mm of which 796mm i.e., nearly 90 percent is received during June to September. The mean annual temperature is 24.8°C with mean maximum temperature 32.3°C in the month of May. The area remains dry for more than 90 cumulative days and qualified for "Ustic" moisture regime is predominant. The difference between the mean summer and mean winter

is greater than 5°C which indicates the area is under “Hyperthermic” temperature regime.

The soils of the area show marked variation depending upon their geophysical condition and parent material. Besides this, climate and vegetation played an active role in the formation of the soils. The soils formation of the very gently to undulating plain and alluvial plain appears to be comparatively rapid under the prevailing climate condition. Weathering and leaching are so intensive that the soils developed in this season are mostly deep to very deep except in the hilly terrain. In-situ soils are restricted to hilly terrain and

plain area while transported soils occur in the alluvial flood plain area.

Agriculture is the main land use of the area followed by forest land. Wastelands are also found in the surrounding area. Rabi crop cultivation is occurred in the area where irrigation facility is available. Agriculture is the main occupation of the people of the surveyed area where both Kharif and Rabi crops are in practice. The principle crops of Kharif season are Jowar, Soyabean, Til, Arhar, Moong etc. whereas in Rabi season Wheat, Gram, Pea, Mustard etc. are major crops.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	233	158333	33.71
2	High	79	55633	11.85
3	Medium	75	51488	10.96
4	Low	73	51215	10.90
5	Very Low	210	153024	32.52
	Total	670	469693	100.00

#### *District wise distribution of area under different priority categories*

State	District	Full/part	Very High		High		Medium		Low		Very Low		Total	
			No. of MWS	Area										
Madhya Pradesh	Bhind	Full	109	77040	33	25042	29	19082	32	22999	101	81736	304	225899
		Part	23		5		5		2		22		57	
	Datia	Full	21	20801	4	4152	12	10800	3	3268	7	7272	47	46292
		Part	16		3		4		2		5		30	
	Gawalior	Full	75	54790	36	26439	28	20075	31	23663	75	57735	245	182702
		Part	11		6		1		1		16		35	
	Morena	Full	2	2376	0	0	2	1321	1	1015	3	6217	8	10929
		Part	1		0		1		0		8		0	
		Full	9	579	0	0	0	210	0	0	0	64	9	853
Uttar Pradesh	Etawah	Part	2		0		1		0		1		4	
		Full	3	2747	0	0	0	0	0	271	0	0	3	3018
	Jalaun	Part	4		0		0		1		0		5	

**Report No. Agri.1444-Report on prioritization of Microwatersheds in 4E2A, 4E2B and 4E2C sub-catchment of**

**Godavari Basin, Adilabad, Nizamabad, Karim Nagar, Medak and Warangal**

## **District of Andhra Pradesh State using RS and GIS Technique.**

The report covers an area of 2040432ha falls in 4E2 catchment of Godawari Basin spread over Adilabad, Nizamabad, Karim Nagar, Medak and Warangal District of Andhra Pradesh State. The survey area lies between 17°42' to 18°25' North Latitude and 79°05' to 80°02' East Longitude covered by Survey of India toposheets no. 56I/12, 16; 56J/2,3,5,6,7,8,9,10, 11, 14, 15, 16; 56K/9, 10, 13, 14; 56M/4; 56N/1,2,3,4,5,6,7,8,9,10,13,15,16; 56O/1,5,9,13; 65B/2,3,4,6.

Physiographically, the survey area is broadly divided into two major physiographic regions namely the ghats and the pedi plains stretching along the Eastern units of the area which lies as series of broken change of elongated hills forming a large crescent belt. The survey area is divided into three physiographic units i.e. the Hill region (hill tops/mesa/plateau) Hillside slopes; Isolated hillocks), Undulating plain (pedi plains, pediments), Alluvium (alluvial plains, recent alluvial plains). The relief of the area is normal to sub normal but excessive in hilly terrain.

Geologically, the area constitutes a peni plain part of the ancients and stable Deccan block. Though a number of geographical formation occur in this region, it is chiefly composed of the gneissic complex of pre-cambrian origin. The lower and upper gondwana appear in the forms of a long continuous belt in the Godavari basin where they are still preserved owing to their non vulnerable situation. The Deccan trap which chiefly originated during the Mesozoic and the cainozoic areas has got a few extension in the Western and the Northern part of the Telangana.

The climate of the area is characterized by semi arid to sub tropical monsoon type consist of hot summer and short duration of rain fall. The total rain fall of the survey area is 701mm. the temperature data depicts that the area experience mean annual temperature

26°C and the mean annual maximum temperature varies from 36°C to 37.7°C and mean monthly minimum ranges from 14.2°C to 20.1°C in the surveyed area. The mean annual soil temperature is more than 22°C and the difference between mean summer and mean winter temperature is less than 7.2°C, so the temperature region is assumed to be "Hyperthermic".

Generally, soils are grouped under four main categories viz. red, black, laterite and alluvial. Red soils covers largest part of the region occurring in the form of a large compact block between the Godavari and Krishna River and also occupying the major part of Andhra Pradesh. These are in-situ soils derived from the weathering of gneiss and granite. The black cotton soils are generally encountered of narrow strip and wider patches also found at places. These black soils are either soils in in-situ on basalt or developed over transported weathered materials. A laterite cap had been developed over the trap in the hilly region of Warangal district. The soil posses brick like red colour which high iron contents. Soil are poor in plants nutrient, organic matter and soluble salts. The alluvial soils occur along with the courses of the Godavari and Krishna River. Soils are transported and have been deposited as alternate pattern of sand and silt. In general soils of the area are moderate to poor in fertility status and low available moisture content except in clay enriched vertisol and old alluvium which need application of recommended doses of organic manure and fertilizer besides proper soil water conservation measures for sustainable development.

In the survey area generally Paddy crops are grown in rain condition and multiple crops i.e. is Sugarcane, Paddy twice or thrice in a year are generally grown nearby canals and banks of the Godavari basin. Paddy, Maize, Wheat, Pulses , Oils Seeds, Vegetable crops are grown in the rainfed condition. In Andhra Pradesh generally two types of

cropping pattern are prevalent viz. mono cropping and multiple cropping. The farmers practice mono cropping in rainfed area put multiple cropping in irrigated area. Only

both rainfed and irrigated cultivation is common in pedi plain and also in undulating uplands. Alluvial plain is under multiple cropping but too slopes forest plantation.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	15	14511	0.71
2	High	165	188041	9.22
3	Medium	829	951992	46.65
4	Low	830	885888	43.42
	Total	1839	2040432	100.00

#### *District wise distribution of the area*

S. No.	Priority Category	District					Total Area	%
		Adilabad	Karimnagar	Medak	Nizamabad	Warangal		
1	Very high	979	12719	0	813	0	14511	0.71
2	High	63	121076	12207	33101	21594	188041	9.22
3	Medium	958	521851	121645	156663	150875	951992	46.65
4	Low	3530	503068	100853	111125	167312	885888	43.42
	Total	5530	1158714	234705	301702	339781	2040432	100.00

**Report No. Agri.1442-Report on prioritization of microwatersheds in 5A2B1to 5A2B9 watersheds (Except 5A2B4 part & 5A2B7) of 5A2B subcatchment (Non-RVP), district Malappuram, Palakkad and Thrissur of Kerala state and Coimbatore of Tamil Nadu State.**

The report covers an area of 437195ha falls under 5A2B subcatchment (Non-RVP) spread over Malappuram, Palakkad and Thrissur district of Kerala State and Coimbatore district of Tamil Nadu State. The survey lies between 76°23' to 77°35' East Longitude and 9°14' to 9°16' North

Latitude covered by Survey of India toposheets no. 40N/13,14; 58A/4,8,; 58B/1,2,3,5,6,7,9,13,14, and 58F/1,2 on 1:50,000 scale.

Physiographically, the Survey area is a part of Archaean shield made up of predominantly hill terrain with undulating to rolling and flat topography. The survey area is grouped into four major categories such as coastal plain, stream banks, hills and pediplains. Hills occur on the Eastern part of survey area except in the Central and Western part along the sea coast. Hills are further separated into hilltops/plateaus and hill side slopes. Pediplains are generally noticed in the central portion of the survey area below the hills. The area under lower pediplains or narrow valleys are on gentle to moderately steep slopes (3-10%) and upper

Pediplains are on very gently to gentle slopes(1-5%). Coastal alluvial plains occur all along the sea coast adjoining the Arabian Sea in the Western Part of the Survey area with a width of 3-6kms.

Geologically, the survey area is made up of four landscapes namely Granite, Laterite, Limestone and Coastal Alluvial and is a part of Archaean Shield which have undergone much folding, faulting, crushing, metamorphosis and weathering. Granite Gneiss, Greywacke And Laterite have given rise to instu soils while coastal alluvial has given raised to alluvium or secondary soils.

Climatically, the rainfall data depicts that the area receives 1583mm rainfall annually. The moisture regime of the survey area is ‘Udic’. The temperature data depicts that the area experience mean annual temperature of 27.6°C to with a mean maximum annual temperature of 31.9°C and mean minimum annual temperature of 23.3°C . In general area experience a very cool at pleasant climate throughout the year in the Central and Eastern Part of the survey area except along the coastal track. The mean annual soil temperature ranges from 26°C to 29.8°C and the temperature regime is “Iso-hyperthermic”. Soils of the area are heterogeneous in character mostly due to their different hydro-geomorphic units.

Relief is the most responsible factor for different moisture regimes, micro climatic conditions, vegetation cover over parent material that results in different types of soil. The effect of the human influence is so significant in the area contributing to accelerated erosion/runoff restricting drainage and microbial activity in soil .

Agriculture is the main occupation of the survey area with 33% under cultivation and 35% under different orchards. Forest comprises 16% of the survey area as grouped/ classified into single storey with grass land occupying nearly 0.2% of the survey area. The Eastern of the survey area is mostly covered with forest. The area under plantation mostly estates and orchards are broadly grouped into three categories based on ground cover i.e. 40-60%, 20-40% and 10-20%. The plantation are noticed on different physiography such as Hill, Pediments, Pediplains, Valleys and Coastal plain. The important plantation crops are Areca Nut, Cardamom, Coffee, Coconut, Banana, Rubber, Vanilla, Pepper etc. The area under agriculture is mostly restricted to plain narrow valleys and coastal plain. Major crop grown is paddy. The area under open scrub is mostly restricted to crests and costal lands.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	16	20960	4.80
2	High	68	94665	21.60
3	Medium	204	275225	63.00
4	Low	36	46345	10.60
	Total	324	437195	100.00

*District wise distribution of priority categories*

S. No.	Priority category/ No. of MWS	Kerala			Tamilnadu	No. of MWS	Total Area	% 
		Malappuram	Palakkad	Thrissur	Coimbatore			
1.	Very High	0	14321	0	6639	16	20960	4.80
	No. of MWS	0	11	0	5			
2.	High	639	44963	20344	28719	77	94665	21.60
	No. of MWS	1	39	13	24			
3.	Medium	34624	179916	7434	53251	234	275225	63.00
	No. of MWS	30	144	13	47			
4.	Low	14547	21875	3672	6251	40	46345	10.60
	No. of MWS	10	19	5	6			
Total		49810	261075	31450	94860	367	437195	100.00
	No. of MWS	41	213	31	82			

**Report No. Agri. 1447-Report on prioritization of microwatersheds in 4B3D1 to 4B3D7 watersheds of 4B3D subcatchment (Non-RVP) in Mandya, Mysore, Ramnagar and Tumkur districts of Karantaka state.**

The report covers an area of 581734ha falls in 4B3D subcatchment (Non-RVP) spread over Mandya, Mysore, Ramnagar and Tumkur districts of Karnataka state. The Survey area lies between 76°34' to 77°20' East longitude to 12°09' to 13°11' North latitude covered by Survey of India toposheets no. 58C/7, 8,12,16; 58D/9,10,13,14,15and58H/1,2,3,4,5,6,7,8,11, 12.

Physiographically, the survey area is a part of Archaean Shield made up of predominantly hilly topography, undulating to rolling topography and flat topography. Landscape wise, the survey area is grouped into two major categories such Alluvial landscape (2995ha) and Granite landscape (550186ha). The survey area is divided into five major physiographic units i.e. Hilltops, Hills Side The soil of the survey area are grouped into four general categories on the basis of depth i.e. very shallow to shallow soils, shallow to moderately deep red soils, deep to very deep

Slopes, Pediments, Streambanks and Upper Pediplains.

The survey area is situated on the archaean complex and the rock formation are represented by the Granitic, Gneisses and Newer Granites. More or less geology comprises of granite base. They are highly metamorphosed and have undergone folding, folding, crushing and metamorphosis giving rise to synclinal ridges, anticline valleys. These Archaean rocks vary in structure, texture and petrological composition.

The climate of the area is semi-arid tropical. The average rainfall is 800mm with an average of 45 rainy days. The difference between mean annual summer temperature and mean annual winter temperature is less than 6°C, hence the soil temperature class for the area is 'Isohyperthermic'. The South and Western part gets more rainfall to its Northern and Eastern counterpart. The relative humidity is more during rainy days and dry weather prevails in other seasons. The temperature varies between 9°C to 38°C.

red soils and very deep red soils. Very shallow to shallow soils have a normal solum thickness of 7-15cm, fine loamy to coarse loamy, dark reddish brown to yellowish red

to strong brown, with gravels spread on surface at places stoniness also encountered, with rock out exposures. Shallow to moderately deep red soils are fine loamy to moderately to coarse loamy to fine loamy, dark reddish brown to yellowish red to dark red, with gravels spread at places along with rock out exposures. Deep to very deep red soils are moderately fine loamy to fine at places coarse to moderate coarse loamy, dark reddish brown to dark red with gravels spread at places, they generally occur in the slope range of 1-5% with some area under 1-10% slope gradient. Very deep soils are fine loamy to fine and at places coarse loamy, dark reddish brown to yellowish red and generally occur in a slope range of less than 3% slope gradient. They are well bunded and are prone to none to slight erosion hazards and are under cultivation with cereals and plantation crops.

Agriculture is the main occupation of the peoples of the area and nearly 75% population depends on agriculture. Most of the area where irrigation facilities available through tanks, rivers, seasonal rivers or channels. Paddy or sugarcane is the main crop cultivated followed by rabi crop mainly pulses. Most of the area is under dry farming due to unavailability of irrigation facilities. The farmers of the area are making use of underground water sources through wells and bore wells. At places these crops are also grown under lift irrigation facility or through tank irrigation. The major crops grown in the survey area are Paddy, Sugarcane, Jowar, Wheat, Pulses, Vegetables, Maize, Cotton, Chillies etc. The irrigation facilities are through canal, open wells and drawing water from the nearby river.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	24	24605	4.23
2	High	130	145657	25.04
3	Medium	359	411472	70.73
	Total	513	581734	100.00

#### *District wise distribution of the priority area*

S. No.	Priority category/ No. of MWS	Karnataka				Total Area	%
		Ramnagar	Mandya	Mysore	Tumkur		
1.	Very High	6527	17065	0	1013	24605	4.23
	No. of MWS	8	19	0	1	28	
2.	High	35316	96387	2044	11910	145657	25.04
	No. of MWS	36	90	2	13	141	
3.	Medium	88658	211479	31415	79920	411472	70.73
	No. of MWS	101	219	36	91	447	
Total		130501	324931	33459	92843	581734	100.00
	No. of MWS	145	328	38	105	616	

**Report No. Agri. 1448-Report on prioritization of microwatersheds in 4B3F1, 4B3F2, 4B3F3 and 4B3F6 Watersheds of 4B3F subcatchment (Non-RVP) in Chamrajangar, Kodagu, Mandya and Mysore Districts of Karnataka State.**

The report covers an area of 371985ha falls under 4B3F subcatchment falls under Chamrajangar, Kodagu, Mandya and Mysore Districts of Karnataka State. The survey area lies between 76°02' to 76°55' East longitude and 11°39' to 12°26' North latitude covered by the Survey of India toposheets no. 57D/4,7, 8, 11, 12, 15, 16 and 58A/1, 9, 10, 13 &14.

Physiographically, the survey area is a part of archaean shield made up of predominantly flat topography. The survey area are grouped into following physiography position such as Pediments, Pediplains, Stream banks and Undifferentiated hill slopes. The major portion of the area (50.8%) is made of pediplain with an area of 88590ha (23.8%) in pediments; 5322ha (13.5%) under alluvial and lower pediplains and 22473ha (6.1%) under hills. Most of the hills are having slope gradient of 10-50%.

The climate of the area a semi-arid warm sub tropical. The area experiences a mean maximum air temperature of 28.6°C to 34.4°C, mean minimum air temperature is 14.3°C to 21.6°C and average air temperature of 22.8°C to 28.0°C. The annual average rainfall in the area is between 720.6mm to 1131.1mm. The area receives also an equal amount of rainfall through North East and South West monsoon. These rain through north East and South West monsoon are helpful for agricultural activities. The summer rain helps in agricultural activities.

The geological formation of the area comprises the Archaean formation, such as Charnokite, Granites and basic intrusive.

The area mainly comprises of the granite base on which different landforms have developed. The metamorphosed form of granite found is gray and pink coloured Granite Gneiss and granodiorite followed by occasionally of Charnokites rocks. More or less, geology comprises granite base. They are highly metamorphosed and have undergone folding, faulting, crushing and metamorphosis giving rise to synclinal ridges, anticline valleys. These Archaean rocks vary in structure, texture and the petrological composition.

On the basis of the depth, the soils of the surveyed area are grouped in three categories such as shallow to moderately deep, deep to very deep and very deep soils. The alluvial soils are generally clayey in texture and rich in organic matter, the soils are cultivated with irrigated crops like Paddy, Sugarcane and at places Vegetables, Maize and Podder. The deep to very deep red soils are derived from weathered product of Granite and are found at mean sea level of 720-750m. The soils are having sandy clay loam to sandy clay at places clayey texture. The soils are mainly cultivated and rainfed condition, in places irrigated through the tank and bore well. The major crops grown in the area are Ground Nut, Maize, Pulses, Cotton, Chillies and Vegetables. The very deep red soils are having clay texture with high shrinking and swelling properties. The soils are cultivated under rain fed condition with various crops like Jowar, Maize, Sunflower and Cotton. The hilly soils are form and mean sea level of 760-1451m and are derived from weathered product of granite with gravelly loamy soil to gravelly sandy clay loam texture. The soils are generally under forests (20-40% canopy), open scrub and grass. The Nagarhole forest soil are formed at mean sea level of 700-60m and are derived from weathered product of granite with sandy clay loam to clay loam texture, with slope gradient of 1-5% and 3-

10% on different physiographic position. The soils are usually under thick forest (40-60% canopy) and protected area.

The crops generally grown under dryland farming are Ragi, Green Gram, Red Gram, Black Gram, Bengal Gram, Horse Gram, Cotton, Tobacco etc. whereas the crops grown under irrigated condition are paddy, sugarcane, banana and at some places sunflower, groundnut and pluses in the area

crops are grown through canal irrigation, tank irrigation or lift irrigation. In certain area where the irrigation facility is available for a longer period the two crops are taken while in the area where irrigation is available for shorter duration only one crop is taken in a year. Paddy is the only annual crop grown. Mango, Cashew nut, Nilgiri, Tamarind, plantation are also existing in the surveyed area.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	5	6902	1.90
2	High	87	112030	30.10
3	Medium	200	248274	66.70
4	Low	4	4779	1.30
	Total	296	371985	100.00

#### *District wise distribution of the priority area*

S. No.	Priority category/ No. of MWS	Karnataka				Total Area	%
		Chamrajnagar	Kodagu	Mandya	Mysore		
1.	Very High	2145	0	0	4757	6902	1.90
	No. of MWS	2	0	0	4	6	
2.	High	68175	0	0	43855	112030	30.10
	No. of MWS	58	0	0	42	100	
3.	Medium	31138	13894	15243	187999	248274	66.70
	No. of MWS	30	12	18	164	224	
4.	Low	0	935	1152	2692	4779	1.30
	No. of MWS	0	1	1	3	5	
Total		101458	14829	16395	239303	371985	100.00
	No. of MWS	90	13	19	213	335	

**Report No. Agri. 1449-Report on prioritization of micro-watersheds in 5A3A1-A8 Watersheds (except 5A3A5 & 5A3A8 part) of 5A3A subcatchment (Non-RVP) of Dakshina Kannada and Coorg districts of Karnataka State and Kannur, Kasaragod and Wayanad districts of Kerala state.**

The report covers an area of 445999 ha and falls under 5A3A subcatchment of Dakshina Kannada and Coorg districts of Karnataka State and Kannur, Kasaragod and Wayanad

districts of Kerala state. The survey area lies between 74°30' to 76°00' East longitude and 11°49' to 12°38' North latitude covered by Survey of India toposheets no. 48L/14,15; 48P/2,3, 4, 6, 7, 8, 10, 11, 12, 16 and 49M/5, 9 &13.

The survey area is a part of Archaean Shield made up of predominantly hilly terrain with undulating to rolling and flat topography. The area under report can be grouped into three major categories such as Hills Pediplains and Costal Alluvial plain. Hill

occurs on the Eastern part of the subcatchment except in the Central and Western part along the sea coast. Hills of the survey are further separated into hill tops/ plateaus and hill side slopes. The height of the hills varies considerably being low on the Western and Central portion and medium to high in the Eastern part. The slope gradually increases towards East. Pediplains are generally noticed in the Central portion of survey area below the hills. The area under lower pediplains or narrow valleys are on gentle to moderately steep slopes(3-10%) and upper pediplains are on very gentle to gentle slopes (1-5%). Pediments are found between hills and pediplains range as an extension with slope ranging 3-10%. Coastal alluvial plains occur all along the sea coast adjoining the Arabian Sea in the Western part of the survey area with a width of 3-6kms. The survey area has several big and perennial rivers. The drainage pattern is sub dendritic to dendritic in the Central and Eastern part of the survey area while it is parallel to sub parallel in the Western part near the Sea coast.

Geologically, the survey area is made up of three landscapes i.e. Granite, Laterite and Coastal Alluvial and it is a part of Archaean Shield. Granite Gneiss and Laterite have given rise to insitu soils while Coastal Alluvial has given rise to Alluvium or Secondary soils.

Climatically, the rainfall data depicts that the area receives 2923mm rain fall annually. The moisture regime of the survey area is Udic. The temperature data depicts that the area experiences cool and equable climate with mean annual temperature of 27.1°C to with a mean maximum annual temperature of 30.5°C and mean minimum annual temperature of 23.7°C. The annual temperature ranges from 26°C to 29.3°C and the temperature regime is Isohyperthermic.

The soils of the area are heterogeneous in character mostly due to their physiographic position and parent material over which soils are developed. The relief is the most responsible factor for different moisture regime, micro climatic conditions, vegetation cover over parent material that results in different types of soils. Coastal alluvial soils are of marine origin with an extension of 10-15km. These soils are very deep with sandy texture and the water holding the capacity is poor due to predominance of sand. These soils are generally observed under orchards. Very deep red soils are derived from weathered products of granite and are localized in occurrence and found mostly in all survey districts. They found in and around laterite soils. They are usually very deep with clay loam to clay texture. Soils are mainly under mainly under plantation crops such as Coconut, Areca Nut, Banana, Yams, Pineapple, Rubber and are properly managed. The laterite soils are mainly occurring in the mid lands at elevation 20-100mts above mean sea level as a strip between the coastal belt and hilly mid uplands. The soils are active with low to moderate water holding capacity, restricted soil erosion and reduced and effective soil volume. The hill soils are gravelly fine loamy with excessive drainage on surface run-off and moderate permeability. The soil under forest cover are moderately managed with controlled run off and good in organic matter resulting in moderate to good water holding capacity in surface soils.

Agriculture is the main occupation of the area, with 63% under cultivation while 29% and 31% under different orchards and estates respectively. Forest comprises 26% of the surveyed area as grouped/classified into single storey forest and double storey forest with grass lands occupying nearly 0.2% of the survey area. The Eastern part of survey area is mostly covered with forest. Forest exists on different physiography such as hill,

pediments and pediplain. However, the extent of forest in hills is quite extensive. The area under agriculture is mostly restricted to plain, narrow valleys and coastal plains. A major crop grown is Paddy. The areas under open scrub are mostly restricted to crests and coastal lands. The area under plantation mostly estates and orchards are broadly

grouped into three categories based on ground cover of 40-60%, 20-40% and 10-20%. The plantations are notice on different physiography such as hill, pediments, pediplains, valleys and coastal plains. The important plantation crops grown in the areArecanut, Cardamom, Coffee, Coconut, Banana, Rubber, Vanilla, Pepper etc.

*Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	24	27488	6.20
2	High	88	103397	23.20
3	Medium	137	158570	35.50
4	Low	104	125267	28.10
5	Very low	24	31277	7.00
	Total	377	445999	100.00

*District wise distribution of area (ha) under different priority categories*

S. No.	Pty Cat/ No. of MWS	State					Total No. of MWS	Total area	Perce ntage			
		Karnataka		Kerala								
		Dakshina Kannada	Kodagu/ Coorg	Kannur	Kasaragod	Wayanad						
1.	Very high	1545	14120	11565	246	12		27488	6.20			
No. of MWS		1	13	11	1	1	27					
2.	High	10783	49570	36098	5275	1671		103397	23.20			
No. of MWS		16	53	42	9	3	123					
3.	Medium	21524	13107	73088	50851	0		158570	35.50			
No. of MWS		24	22	64	50	0	160					
4.	Low	12370	22328	71018	19551	0		125267	28.10			
No. of MWS		12	20	60	20	0	112					
5.	Very low	0	0	23890	7387	0		31277	7.00			
No. of MWS		0	0	21	8	0	29					
Total Area		46222	99125	215659	83310	1683		445999	100.00			
No. of MWS		53	108	198	88	4	451					

**Report No. Agri. 1450-Report on prioritization of micro-watersheds in 4B3E1 to 4B3E5 watersheds of 4B3E subcatchment (Non-RVP) in Mandya, Hassan, Tumkur, Ramnagar and Bangalore Rural districts of Karnataka State.**

The report covers an area of 414245ha comprises five watersheds i.e. 4B3E1 to 4B3E5 falls within administrative jurisdiction of Mandya, Hassan, Tumkur, Ramnagar and

Bangalore Rural districts of Karnataka State. The survey area lies between  $76^{\circ}14'$  to  $77^{\circ}16'$  East longitude and  $12^{\circ}47'$  to  $13^{\circ}33'$  North latitude covered by the Survey of India toposheets no. 57C/8,11,12,15,16; 57D/9,13 and 57G/3,4,7,8.

Physiographically, the survey area is made up of predominantly undulating topography and major part of the survey area falls under upper pediplain and pediments. The five major physiographic sub divisions occurring

in the area are i) Undifferentiated hill side slopes, ii) Pediments, iii) Foot hill slopes, iv) Upper pediplains and v) Lower pediplains. The area is drained by Kunudavati and Jayamangli, tributaries of Pennar; Suvarnamukhi tributary of Vedavathi river. The Southern portion is drained by Shinsha river, tributary of Cauvery. The drainage pattern strongly controlled by geologic structure showing sub dendritic to sub parallel type.

The climate of the area is semi-arid tropical. The average rainfall is 800mm with an average of 45 rainy days. The difference between mean annual summer temperature and mean annual winter temperature is less than 6°C, hence the soil temperature class of the area is Isohyperthermic. The South and Western parts get more rainfall to its Northern and Eastern Counterpart. The Relative humidity is more during rainy days and dry weather prevails in other seasons. The temperature varies between 9°C to 38°C. Geologically, the survey area is situated on the Archaean complex and the rock formations are represented by the Crystalline Schists, Granite gneisses and newer granite. The major part of the area is covered by the complex of granite gneisses which are classified under a separate group called Peninsular Gneisses. Weathering is more intensive in the Southern part compared to Northern part. Red soils are found in southern part where sandy soil pockets, sodic and black cotton soils are found in the Northern part.

The soils of the area are grouped into four general categories i.e. deep to very deep red soils (79%), very deep red soils (25%), shallow to moderately deep soils (14.4%) and forest soil. Deep to very red soils are derived from weathered product of granite and are found in pediments and upper pediplains.

These soils are having fine loamy to gravelly fine loamy texture with yellowish brown to dark reddish brown colour. Generally, these soils are under rainfed cultivation in upper pediplain and in pediments. The major crops grown in these soils are ragi, ground nut, minor pulses etc. Very deep red soils are derived from weathered products of Granite and are found in lower pediplains. These soils are fine textured with yellowish brown to dark reddish brown colour. Generally, these soils are cultivated under irrigation with crops like Banana, Sugar Cane, Paddy etc. Shallow to moderately deep gravelly red soils are derived from weathered product of granite. These soils are gravelly fine loamy in texture with yellowish brown to reddish brown colour. These soils are generally under open scrub and grass cover with less than 10% canopy. Forest soils are derived from weathered product of granite. These soils are fine loamy in texture with yellowish brown to dark yellowish brown colour and occur in slope gradient of 1-5%. These soils are generally under forest with 20-40% canopy and in protected area.

Out of total surveyed are almost 87% of land is under cultivation and only 2.2% of land is under forest cover. Most of the farmers are generally using the traditional methods for cultivation. However, due to efforts of the agriculture extension services, which has a wide network in the area, a considerable number of people have now shifted to improve method of agriculture. The major agriculture crops are Paddy, Ragi, Maize, Ground Nut, Cereals, Pulses etc. The district is rich in horticulture produce also. The important fruits grown are Mango, Banana, Jack Fruits and Sapota. The important plantation crops are coconut and areca nut. Other important commercial crop grown is sugarcane.

*Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1	Very high	10	12952	3.13
2	High	97	115791	27.95
3	Medium	241	282332	68.15
4	Low	3	3170	0.77
	Total	351	414245	100.00

*District wise distribution of area (ha) under different prior category*

S. No . .	Priority Category/ No. of MWS	Karnataka					Total	Percen tage
		Bangalore Rural	Hassan	Mandiya	Ramanagar	Tumkur		
1.	Very high	1295	0	1383	0	10274	12952	3.10
	No. of MWS	2	0	2	0	10	14	
2.	High	5110	4752	10779	39	95111	115791	28.00
	No. of MWS	11	7	13	3	84	118	
3.	Medium	81	47402	33281	33	201535	282332	68.10
	No. of MWS	1	55	34	1	184	275	
4.	Low	0	0	2068	0	1102	3170	0.80
	No. of MWS	0	0	3	0	2	5	
Total		6486	52154	47511	72	308022	414245	100.00
No. of MWS		14	62	52	4	280		

**Report No. Agri.1451-Report on prioritization of microwatersheds in 5A1C1 to 5A1C8 watersheds of 5A1C sub-catchment (Non-RVP), districts Alappuzha, Ernakulam,Idukki, Kottayam and Pathanamthitta of Kerala State.**

The report covers an area of 517573ha falls under 5A1C sub catchment (Non-RVP) covered by Alappuzha, Ernakulam, Idukki, Kottayam and Pathanamthitta districts of Kerala State. The survey area lies between 76°14' to 76°58' East longitude and 9°21' to 10°07' North latitude covered by the Survey of India toposheets no. 58B/8,16 and 58C/1,5,6,7,9,10,11,13,14&15.

Physiographically, the survey area is a part of Archaean shield made up of predominantly

hilly, undulating to rolling and flat topography. The survey area is grouped into five major categories such as Hills, Pediments, Coastal Alluvial Plain, Alluvial Plain and Pediplains. Hills occur in the Eastern part of the sub catchment except in the Central and Western part of the sea coast and are separated into hill tops and hillside slope. The height of the hill varies considerably being low in the Western and Central portion and medium to high in the Eastern part. Pediments are found mostly in the Central portion of the survey area under hill area as an extension to slope range of 3-10% and elevation ranging 60-100mts intermingled with pediplain and narrow valleys. Pediplains are generally noticed in the Central portion of the survey area below the hills. The area under lower pediplains or

narrow valleys are on gentle to moderately steep slopes(3-10%) and upper pediplains are on very gentle to gentle slopes (1-5%). Coastal alluvial plains occur all along the sea coast add joining the Arabian Sea in the Western part of the survey area with a width of 3-6kms. Alluvial plains occur along side of coastal alluvial plains with elevation 20mts below mean sea level with slope range of 0-3% and under terraced cultivation with orchards spread in.

The rainfall data depicts that the area receives 2656mm rainfall annually. The moisture regime of the survey area is Udic. The temperature data depicts that the area experiences mean annual temperature of 27.6°C with a mean maximum annual temperature of 32.2°C and mean minimum annual temperature of 23°C. In general, the survey area is very cool and has a pleasant climate throughout the year in the Central and Eastern part of the surveyed area except along the coastal track being humid major part of the year. The mean annual soil temperature ranges from 26°C to 29.8°C and the temperature regime is 'Isohyperthermic'.

Geologically, the survey area comprises of four major landscapes mainly Granite, Laterite, Alluvium and Coastal Alluvium and is a part of Archaean Shield, which have undergone much folding, faulting, crushing, metamorphosis, and weathering. Granite Gneiss, Greywacke and Laterite have given rise to insitu soils while coastal alluvial has given raise to alluvium or secondary soils.

The soils of the area are heterogeneous in character mostly due to their different hydrogeomorphic units. Relief is the most responsible factor for different moisture regimes, microclimatic conditions; vegetation cover over parent materials that result in different types of soils. The effect of the human influence is so significant in the area contributing to accelerated erosion/run-off, restricting drainage and microbial activity in

the soil. Four types of soils under different landscape and physiography are Coastal Alluvial soils, very deep red soils, Laterite soils, and hill soils. Coastal alluvial soils of marine origin are identified along the coastal plain with an extension of 10-15kms. These soils are very deep with a sandy texture and have a high water table and the water holding capacity is poor due to the predominance of sand. These soils are mainly under coconut plantation. Very deep red soils are derived from weathered product of Granite. They are localized in occurrence and found mostly in all surveyed districts. These soils are usually very deep with clay loam to clay texture with moderate to high water holding capacity. Soils are mainly under plantation crops such as Coconut Areca Nut, Banana, Yams, Pineapple, Fruits Trees, Rubber and are properly managed. Laterite soils mainly occur in the midlands. These soils are active with low to moderate water holding capacity, restrict soil erosion and reduced effective soil volume and are generally suitable for most of the dry land crops. It is mainly cultivated with Coconut, Banana, Tapioca, Yam, Pepper, Pineapple and other fruit trees. Hills soils are gravelly fine loamy with excessive drainage and surface run-off and moderate permeability. These soils are under forest cover and moderately managed with controlled run off and good in organic matter resulting in moderate to good water holding capacity in surface soils. These soils are suitable for Rubber, Coffee, Areca Nut etc. plantation.

Agriculture is the main occupation of the area with 27% under cultivation 34% under estate and 18% under different orchards. Forest comprises 12% of the survey area grouped into single storey and double storey forest with grass land occupying nearly 2% of the survey area. The Eastern part of the survey is mostly covered with forest and exists on different physiography such as hill, pediment and pediplains. The area under plantation,

mostly estate and orchard are broadly grouped into three categories based on ground cover i.e. 40-60%, 20-40% and 10-20%. The important plantation crops are Areca Nut, Cardamom, Coffee, Banana, Rubber, Vanilla, Pepper etc. The area under

agriculture is mostly restricted to plain, narrow valleys and coastal plains. Major crop grown is paddy. The area under open scrub is mostly restricted to crests and coastal lands.

### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No.of microwatershed	Area(ha)	Percentage
1	Very high	21	27910	5.39
2	High	44	65818	12.72
3	Medium	185	280674	54.23
4	Low	83	142174	27.47
5	Very low	1	1000	0.19
	Total	334	517573	100.00

### *District wise distribution of area(ha) under different priority categories*

S. N.	Priority Category/ No. of MWS	Kerala					No. of MWS	Total	%
		Alappuzha	Ernakula m	Idukki	Kottayam	Pathanamthi tta			
1.	Very high	0	0	7883	20027	0	34	27910	5.39
	No. of MWS	0	0	15	19	0			
2.	High	0	6558	31962	25130	2168	57	65818	12.72
	No. of MWS	0	6	21	26	4			
3.	Medium	5	100517	31614	128285	20253	220	280674	54.23
	No. of MWS	1	78	26	95	20			
4.	Low	77244	17320	0	42653	4954	121	142171	27.47
	No. of MWS	63	16	0	37	5			
5	Very low	0	1000	0	0	0	1	1000	0.19
	No. of MWS	0	0	1	0	0			
Total		77313	125495	71521	216272	27404	433	517573	100.00
No. of MWS		64	100	63	177	29			

### **Report No. Agri. 1453-Report on prioritization of micro-watersheds of 4C3A1 to 4C3A6 watersheds of 4C3A sub catchment (non-RVP) of 4C3, Pennar Catchment, Cuddapah and Nellore districts of Andhra Pradesh State.**

The report covers an area of 475459ha comprises six watersheds of 4C3 Pennar catchment falls under Nellore and Cuddapah district of Andhra Pradesh. The survey area lies between 79°06' to 80°12' East longitude

and 14°12' to 14°53' North latitude covered by the Survey of India toposheets no.57N/1,2,3,5,6,7,8,9,10,11,13,14,15 and 66B/2&3.

Physiographically, the Western part of the surveyed area is a part of Archaean shield. The survey area is grouped under six major categories such as Hills (Slide slope), Foot slopes, Undulating upland/pediments, pediplain, Alluvial Plains and Coastal Alluvial plains. The Western part of the survey area is bordered by elongated shape hills. The height of hills arranges between

160mt and 760mt above mean sea level, which is a part of Eastern part. The slope ranges from 10 -50%. Foot slopes forms a narrow strip along the periphery of the hills and its extent/area in the surveyed area is quite less. Undulating uplands/pediments spread throughout the area and are mostly under open scrub (canopy less than 10%) and rainfed cultivation. Pediplains occurs below foot slopes and hills and its extent in the survey is very much larger. It occurs throughout the area. Alluvial plains are spread all along the big stream/river and in the Eastern part of the surveyed area. Coastal alluvial plains occur all along the sea coast adjoining Bay of Bengal sea in the Eastern part of the survey area and occurs for a width of 2-5kms.

The geological formation of the survey area varies widely, ranging from the oldest archaeans to the recent deposit and other alluvial. The major geological formation in the survey area is in the form of broad belts disposed on in a North-North- West- South directions. The geological successions met in the survey area are recent and sub recent, mio-plioce and archaeans.

The survey area has a hot climate which is dry and salubrious season followed by a South West monsoon season. The mean annual temperature is 29.4°C. The average rainfall is about 1225mm. The mean annual temperature is higher than 22°C therefore; the soil moisture regime qualifies Ustic. The climate is humid throughout the year in the coastal parts of the area. The humidity is on

an average 71%. The relative humidity in the Western part of the survey area is slightly lower.

The soil of the area show marked variation depending upon their geophysical conditions and parent materials. The climate and vegetation played an active role in the formation of the soils of the area. Based on geological formation, soils of the area are broadly classified as; 1. Soils on Granitic landscape, 2. Soils on Sand stone landscape, 3. Soils on Alluvial landscape, 4. Soils on the Coastal alluvial landscape. The major part of the survey area is occupied by Granitic landscape. It is furthered sub-divided as follows, hill side slopes, foot slope, undulating pediments, upper pediments, lower pediments, and stream banks. The area occupied by sandstone landscape is 70473 ha and is further sub-divided as hill side slope, pediments, upper pediplains, lower plains and stream banks. The alluvial landscape is further sub-divided as alluvial plains and dissected stream bank.

Out of the total surveyed area 46% is under agriculture, 26% is under open scrub, 12% is under forest 2% is under uncultivable waste land and 14% is under miscellaneous use such as habitation, river, tank, road and reservoir etc. There are two seasons of growing crops viz. Kharif and Rabi. The crops grown in Kharif season are Paddy, Bajra, Red Gram, Black Gram, Ground Nut, Sesamum, Cotton, Chillies and in Rabi Season are Paddy, Jowar, Ground Nut, Sugar Cane, Sunflower, Tobacco etc.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1.	Very high	62	74277	15.62
2.	High	106	135879	28.58
3.	Medium	134	168408	35.42
4.	Low	63	94304	19.83
5.	Very low	3	2591	0.54

	Total	368	475459	100.00
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*District wise distribution of area under different priority categories*

S.No.	Priority Category	No. of MWS	District		Total Area	Percentage
			Nellore	Cuddapah		
1.	Very high	62	25735	48539	74277	15.62
2.	High	106	131987	3892	135879	28.50
3.	Medium	134	167455	953	168408	35.42
4.	Low	63	94304	0	94304	19.83
5.	Very low	3	2591	0	2591	0.54
Total		368	422075	53384	475459	100.00

**Report No. Agri. 1459-Report on prioritization of microwaterhsheds in 5A2D1 to 5A2D5 watersheds of 5A2D subcatchment (Non-RVP) in Kannur, Kozhikode, and Wayanad districts of Kerala State and Mahe district of Pondichery State.**

The report covers an area of 244042 ha, comprises five watersheds i.e. 5A2D1 to 5A2D5 watersheds of 5A2D sub-catchment (Non-RVP) falls under Kannur, Kozhikode and Wayanad districts of Kerala State and Mahe district of Pondicherry State. The survey area lies between 75°37' to 75°59' East longitude to 11°09' to 11°56' North latitude covered by the Survey of India toposheets no. 49M/5, 6,9,10,11,13,14,15 and 16.

Physiographically, the survey area is a part of Achaean shield made up to predominantly hilly topography, undulating to rolling topography and flat topography. The survey area is grouped under three major categories such as Coastal, Alluvial, Hills, and Pediments Landscape. Hills occur almost throughout the area except for a small patch along the sea coast and are further separated into hill tops and hill sides slopes. The height of the hill varies considerably being low in the Western

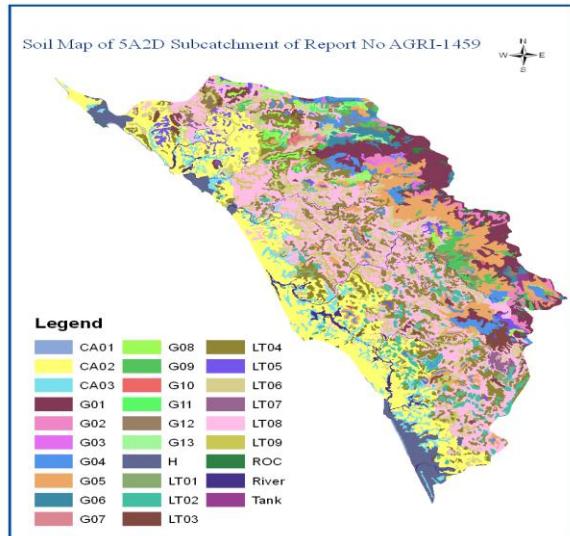
and Central portion and medium to high in the Eastern part. Pediments are generally noticed in the Central part of the survey area, below the hill and the extent is very less. Coastal alluvial plains occur in a smaller tapper on the sea coast adjoining Arabian Sea in the Western part of the survey area. The width of coastal plains occur 3-5kms. The slope ranges from 0-3%.

Geologically, the survey area is made up of three landscapes i.e. Granite Laterite and Coastal Alluvium. The survey area is a part of archaean shield, which have undergone much folding, faulting, crushing, metamorphosis and weathering. Granite Gneiss, Greywacke and Laterite have given rise to insitu soils while coastal area is dominated by Alluvium or secondary soils.

Climatically, the rainfall data depicts that the area receives an annual average of 3032mm rainfall. The moisture regime is Udic. The temperature data depicts that the area experiences mean annual temperature of 26.8°C to with a mean maximum temperature of 30.4°C and mean minimum annual temperature of 23.2°C. In general the area experience a very cool and pleasant climate throughout the year in the Central and Eastern part of the survey area except along the coastal track. The mean annual soil temperature ranges from 21°C to 32°C and the temperature regime is hyperthermic

The soils of the area are derived from the weathered products of Granite Laterite and Coastal Alluvium. Based on solum thickness, these soils are grouped into three depth categories viz. Very deep, Deep to very deep and Moderately deep. Very deep red soils are derived from weathered products of Coastal alluvium and Granite. They are having a sandy surface texture and pale yellow to dark grayish brown colour and occurring in coastal alluvial plains and lower pediplains at a slope range of 0-3% and 1-5%. These soils are usually under orchards and multiple cropping with a small portion under single crop terraced cultivation. Deep to very deep red soils are derived from weathered products of granite and laterite that cover the maximum area in the surveyed area. These soils occur in almost all the physiographic positions as well all the slope ranges. Generally, these soils are under homestead cultivation and multiple cropping with Paddy, Coconut, Pepper, Banana etc. moderately deep red soils are derived from weathered products of Granite and Laterite. They have gravelly fine loamy texture and yellowish red in colour. These soils occur in upper pediplain and pediments with a slope range of 1-5% and are usually under open scrub. The survey area has five types of land use such as Dense forest, multiple crops,

open scrub, orchards and estates. The Eastern part



of the survey area is mostly covered with forest. Forest exists on different physiography such as hill, pediments and pediplains. The area under plantation in the survey area is broadly grouped into three categories based on ground cover. The important plantation crops are Areca Nut, Cardamom, Coffee, Coconut, Banana, Rubber, Vanilla, Cashew Nut etc. The area under agriculture is mostly restricted to plain, narrow valleys and coastal plains. Major grown crop is Paddy. The areas under open scrub are mostly restricted to crests and coastal lands.

#### *Priority categories of Microwatersheds*

S.No.	Priority Categories	No. of microwatershed	Area(ha)	Percentage
1.	Very high	26	30420	12.47
2.	High	54	68397	28.03
3.	Medium	81	110517	45.29
4.	Low	27	34708	14.21
	Total	188	244042	100.00

#### *District wise distribution of area(ha) under different priority categories*

S. No.	Priority Category/ No. of MWS	Kerala			Pondicherry	Total	Percentage
		Kannur	Kozhikode	Wayanad			

1.	Very High	721	26760	2939	0	30420	12.46
	No. of MWS	3	26	10	0	39	
2.	High	18992	48472	933	0	68397	28.03
	No. of MWS	17	43	3	0	63	
3.	Medium	40787	68994	0	736	110517	45.29
	No. of MWS	32	53	0	4	89	
4.	Low	10339	24211	0	158	34708	14.22
	No. of MWS	10	19	0	2	31	
	Total	70839	168437	3872	894	244042	100.00
		62	141	13	6	222	

## 6.2 Detailed Soil Survey Reports

### **Report No. Agri. 1440-Report on detailed Soil Survey and Land use of 4E5E4p', 4E5E4q' and 4E5E4ft Sub watersheds of Goshikhurd catchment, Tehsil-Pandhurna and Multai, District Betul and Chhindwara, Madhya Pradesh State.**

The report covers an area of 10182ha spread over Goshikhurd catchment situated in Tehsil Pandhurna and Multai, District Betul and Chhindwara, Madhya Pradesh State lies between 21°38' to 21°47' North latitude and 78°21' to 78°31' East longitude covered by survey of India toposheets no. 55K/5,K/6 and 55K/10.

Physiographically, the survey area comes under Basaltic landscape comprising Hills, Plateau Plains and Pediplain. The geomorphic units may be subdivided into physiographic units. The general gradient of the sub watersheds runs from North West to southeast direction. Hills have strongly to steep slopes and excessive relief and are situated between 600m to 750m above mean sea level. Pediplain and undulating upland are confined between 480m to 580m above mean sea level. The relief of the area is normal in general, but excessive and sub-normal relief is also noticed at hill side slopes and undulating upland/undulating plateau.

Geologically, the area falls under the Deccan trap with Basalt as dominant rock. The Basalt rocks are uniform over a wide area. The weathering of Basalt with Spheroidal exfoliation and give rise to rounded boulders,

which is a common feature of the region. Basalt is grayish and yellowish brown to dark red, fine to medium grained and basic igneous rock. Basalt is composed mainly of Plagioclase, Pyroxene, Iron-ore etc. The most striking peculiarity of the basalt is the prevalence of vesicular character. The presence of green tinge is a special characteristic of the Basalt.

The climate of the area in general is a sub tropical monsoonal type characterized by mild winters, hot summer and a short rainy season. The climate on the whole is dry etc. during south west monsoon season. The mean annual precipitation of Chhindwara is 826.6mm of which about 92% rain is received during June to December. The mean minimum temperature and maximum temperature are 21.4°C to 28.8°C respectively. The mean annual summer temperature and mean annual winter temperature are 27°C and 20.1°C respectively with a difference of 6.9°C and the soils of the area falls under 'Hyperthermic' temperature regime.

It is observed, in the survey area that's about 59.7% area is not cultivated and 10.2% area is under double cropping. The forest village is spread over an area of 17.3% restricted to the hills and their surroundings. About 2.9% area is under grasslands, bush vegetation and waste land. 2.8% land is under current fellow and 11.4% is under other fellow lands. Similarly, 5.9% area is under public utility viz river/nalla, road, tank and building

structures. About 34.8% area is under cereals namely Paddy, Wheat, Jowar, Bajra and Maize. Similarly, 17.1% area is under pulses, namely Tur, Udid, Mug, Gram, Masoor, Kulth, Pea, and other Pulses. About 33.3% area is cultivated with oil seed crops, namely Sesamum, Rai, Alsi, Soyabean and Groundnut. 3.7% area is under millets namely kodo, kutaki and others. 7.4% area is cultivated with fiber crop-cotton. Remaining 3.7% area is under various fruits and vegetables. Seven soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physiochemical properties. A brief description as follows:

Borgaon(BG), These soils are deep, fine textures, moderately well drained, developed over Basalt and occurring on very gently sloping to gently sloping lower paddy plains. The surface horizon ranges from 10-15cm in thickness with grayish brown to very dark grayish brown colour, clay texture and moderate, medium, sub angular blocky structure. The soil mapping unit identified is BG4rB2.

Dhokli(DK), These soils are shallow, fine loamy textured, well drained, developed over basalt and occurring on very gently sloping to Mohi(MH), These soils are very shallow, fine loamy, well drained, developed over basalt and occurring on very gently sloping to moderately sloping under pediplain. The surface horizon ranges from 8-10cm in thickness with brown to dark brown colour, clay loam to gravelly clay loam texture and weak, fine, sub angular, blocky structure. The soil mapping units identified are MH1eD2S, MH1eD3S, MH1eD3SF, MH1hC2, MH1hCS and MH1hC3S.

Semariya(SM), these soils are deep fine textured, moderately well drained, developed over basalt and occurring on very gently sloping plateau plains. The surface horizon

moderately sloping plateau plain. The surface horizon ranges from 10-18cm in thickness with brown to dark brown colour, clay loamy to gravelly clay loam and gravelly loam texture and weak , fine, sub angular blocky structure. The soil mapping units identified are DK2eD2S, DK2eD3S, DK2eD3SF, DK2hC2, DK2hC2S, DK2hC3S and DK2hC3SF.

Gwara (G), These soils are moderately deep, fine textured, well drained, developed over basalt and occurring on very gently sloping to gently sloping plateau plains. The surface horizon ranges from 9-12cm in thickness with brown to dark brown colour, clay textured and moderate, medium, sub angular blocky structure. The soil mapping units identified are G3rB2 and G3rC2.

Kusumdhana(KD), These soils are shallow, coarse loamy, excessively drained, developed over basalt and occurring on strongly sloping to steep hill side slopes. The surface horizon ranges from 10-23cm in thickness with brown dark colour, gravelly clay loam texture and weak, fine, sub angular blocky structure. The soil mapping units identified are KD2eF3GSF, KD2eF3SRF, KD2eG3SRF, KD2hE3GSF and KD2hE3SRF.

ranges from 10-15cm in thickness with dark grayish brown to very dark grayish brown in colour, clay texture and moderate, medium, sub angular blocky structure. The soil mapping units identified is SM4rB2.

Tigaon(T), These soils are moderately deep, fine textured, and moderately well drained, developed over basalt and occurring on very gently sloping to gently sloping lower pediplains. The surface horizon ranges from 9-11cm in thickness with grayish brown to very dark grayish brown in colour, clay texture and moderate, medium, sub angular blocky structure. The soil mapping units identified are T3rB2 and T3rC2.

*Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Group	Soil Hydrologic Group
1.	BG4rB2	IIes-1	B	2st	2	C
2.	DK2eD2S	IVes-2	D	4st	4	D
3.	DK2eD3S	IVes-3	D	4st	4	D
4.	DK2eD3SF	-	-	-	--	-
5.	DK2hC2	IVes-2	D	4st	4	D
6.	DK2hC2S	IVes-2	D	4st	4	D
7.	DK2hC3S	IVes-3	D	4st	4	D
8.	DK2hC3SF	-	-	-	-	-
9.	G3rB2	IIIes-1	C	3st	3	C
10.	G3rC2	IIIes-2	C	3st	3	C
11.	KD2eF3GSF	-	-	-	-	-
12.	KD2eF3SRF	-	-	-	-	-
13.	KD2eG3SRF	-	-	-	-	-
14.	KD2hE3GSF	-	-	-	-	-
15.	KD2hE3SRF	-	-	-	-	-
16.	MH1eD2S	VIes-2	E	6st	4	D
17.	MH1eD3S	VIes-3	E	6st	4	D
18.	MH1eD3SF	-	-	-	-	-
19.	MH1hC2	VIes-2	E	6st	4	D
20.	MH1hC2S	VIes-2	E	6st	4	D
21.	MH1hC3S	VIes-3	E	6st	4	D
22.	SM4rB2	IIes-1	B	2st	2	C
23.	T3rB2	IIIes-1	C	3st	3	C
24.	T3rC2	IIIes-2	C	3st	3	C

**Report No. Agri. 1441-Report on detailed soil survey and land use of NV6k, NV6p, NV6r& NV6u Subwatersheds of Narmada catchment, Tahsil & districts-Mandla, Madhya Pradesh State.**

The report covers an area of 8341ha spread over Narmada catchment situated in the Mandla district of Madhya Pradesh State. The survey area lies between 22°35' to 22°46' North latitude and 80°18' to 80°28' East longitude covered by the Survey of India toposheets no. 64B/5 & 64B/6 on 1:50,000 scale.

Physiographically, the survey area is developed over two geomorphic landscapes, namely basaltic and alluvium landscape. It consists of four major geomorphic units i.e. Hills, Pediplain, Valley Plain and Alluvial plain. The geomorphic units may be subdivided into physiographic units based on slope. Foot slopes commonly bordering hill ranges and undulating slope lands which extend downward in valley plain and alluvial plain. The general drainage pattern varies from sub parallel and dendritic to sub dendritic. The relief of the area is normal in general, but excessive and subnormal reliefs are also notice at hills side slopes and dissected stream banks respectively.

Geologically, major rock formation of the area comprises basaltic lava flows of upper cretaceous to lower Eocene age. These flows are designated by as Deccan trap and almost horizontally disposed. Fractures and joints are common feature in this rock. Weathering of Deccan basalt causes development of black soils and alluvial soils which are mainly confined along the major river/stream banks of alluvial plain. These trap flows may be grouped as very hard, massive and compact in nature. The innumerable rounded and oval shape vesicles are usually filled with Zeolite, Calcite and Quartz. The vesicular basalt is gray to brown in colour and soft to medium grained. The climate of the area is tropical monsoonic type characterized by mild winters, hot summer and a short rainy season. The climate on the whole is dried except during monsoon season. The mean annual precipitation of the survey area is 1317.6mm of which 92% rate is received during June to September. The mean maximum and minimum temperature are 30.6°C and 15°C respectively. The mean annual temperature is 22.8°C. The mean summer temperature is 26.6°C and means winter is 16.2°C respectively with a difference of 10.4°C. Thus the soils of the area fall under ‘Hyperthermic’ temperature regime and “Ustic” moisture regime.

It is observed that about 40.5% is not cultivated and 15.5% is under double cropping. Village forest is spread over an area of 20.6% restricted to the hills and their surroundings. About 5.4% area is under grasslands and bushy vegetations and wasteland. 6.2% land is under current fallow and 18.2% is under other fellow lands. Similarly, 7.8% area is under public utility viz roads, nallah, river, tank and building structures. About 68% area are under cereals namely paddy, wheat and other cereals. About 52.4% of the total village area is under cultivation of paddy. Similarly, 18.7% area is under pulses, namely background, pea, lentils, and other pulses. About 6.4% area is

under millets namely Kodo-Kutki, Arhar-Kodo etc. about 5.9% area is cultivation of oil seed crops, namely Sesamum, Soyabean, Mustard, Niger and Linseeds.

Seven soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description is follows:

**Barela(BR):** This soil series consists of excessively drain moderately dark grayish brown to dark reddish brown, gravelly clay loam and non-calcareous soils developed over basalt on strongly to very steeply sloping side slopes of hills. These soils suffer from moderate to severe erosion. The water holding capacity and fertility status of the soil is moderate. These soils are associated with slightly stony phase. These soils are mostly under reserve forest area having mixed deciduous vegetations comprising mainly of Teak and Bamboo and mixed deciduous trees viz. Mahua, Bel and Palas sps. The soil mapping units identified are BR3hE3S, BR3hF3SR and BR3hG3SR.

**Dadratola(DR):** This soil series consist of well drained, shallow, dark grayish brown to radish brown, gravelly clay loam, non calcareous soils developed over basalt on gently to moderately sloping upper pediments. These soils suffer from moderate to severe erosion and are associated with slight surface gravelliness and rockiness. The water holding capacity is moderate and fertility status is poor. These soils are under grass cover and bushy vegetation, occasionally cultivated for minutes such as Kodo, kutki, etc. under rainfed condition with poor yield. The soil mapping units identified are DR2hC2, DR2hC3 and DR2hD3S.

**Gonjhi(GN):** This soil series consist of moderately well drained to well drained, very deep, yellowish brown to dark yellowish brown, clay loam to loam, calcareous soil. They are developed over recent alluvium on gullied, dissected stream or river banks with

gentle to moderate slopes. These soils suffer from moderate to very severe erosion hazards and are under bushy and shrubby vegetations on both sides of stream bank. At places they are cultivated for Watermelons, Muskmelons and Vegetables. The soil mapping unit identified are GN5eC3, GN5eD4 and GN5hC2.

**Jamukoh(J):** These soil series consist of moderately well drained, moderately deep, dark yellowish brown to dark yellowish brown, gravelly clay loam and non calcareous soils. These are developed over basaltic parent material on very gently to moderate sloping upper measa top/hill top. These soils suffer from moderate to severe erosion and are under forest, grasses and cultivated in place in rainfed conditions for kodo, kutki, kodo-rahar etc. with poor yield. The soil mapping units identified are J3hB2S, J3hC2S, J3hC3S, and J3hD3S.

**Khairi(K):** These soils consist of moderately well drained, very deep, dark grayish brown to very dark grayish brown, clayey, non calcareous, high shrink, swell potential, cracking soils occurring on nearly level to gentle slopes over alluvial plain and adjoining stream bank. They are developed alluvium. The cracks are 2-3cm wide up to 50cm depth and remain open for 150 days or

more in most of the years. These soils suffer from slight to severe erosion and intensively cultivated with multiple crops under both irrigated and rainfed condition and crops like Paddy i.e. Wheat, Mustard, and Gram are grown. The soil mapping units identified are KR5rB(A)1, KR5rB2, KR5rC(A)1, KR5rC2 and KR5rC3.

**Pipariya(PI):** These soils are moderately deep, very gently sloping, developed over basalt and occurring on very gently sloping to gently sloping upper pediments. These soils are dark brown to very dark grayish brown in colour, clay texture and moderate, medium, sub angular blocky structure. The soil mapping units identified are PI3rB2, PI3rC(A)1, PI3rC2 and PI3rC3.

**Silpuri (SP):** These soil series consists of moderately well drained, deep, dark grayish brown to very dark grayish brown, fine textured, non calcareous, cracking soils developed over basalt on very gently sloping lower valley plain/nala bank. They have a slight erosion hazard. These soils are cultivated mostly under irrigated condition and rain fed at places and crops like Wheat, Paddy, Gram, Pea Mustard and orchards are grown with moderate yields. The soil mapping units identified are SP4rB(A)1, SP4rB2, SP4rC(A)1 and SP4rC2.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	BR3hE3S	VIes-2	F	F	F	F
2.	BR3hF3SR	VIIes-1	F	F	F	F
3.	BR3hG3SR	VIIes-1	F	F	F	F
4.	DR2hC2	IVes-3	D	4st	4	D
5.	DR2hC3	VIes-1	D	4st	4	D
6.	DR2hD3S	VIes-1	D	4st	4	D
7.	GN5eC3	IVe-1	C	3t	4	B
8.	GN5eD4	VIe-1	C	6t	4	B
9.	GN5hC2	IIe-1	C	3t	3	B

10.	J3hB2S	IIIes-3	C	3st	3	C
11.	J3hC2S	IIIes-3	C	3st	4	C
12.	J3hC3S	IVes-2	C	3st	4	C
13.	J3hD3S	IVes-2	C	3st	4	C
14.	KR5rB(A)1	IIs-1	B	2st	2	D
15.	KR5rB2	IIs-1	B	2st	2	D
16.	KR5rC(A)1	IIs-1	B	2st	2	D
17.	KR5rC2	IIIes-1	B	3st	3	D
18.	KR5rC3	IVes-1	B	3st	3	D
19.	PI3rB2	IIIes-2	C	3st	3	C
20.	PI3rC(A)1	IIIIs-1	C	3st	3	C
21.	PI3rC2	IIIes-2	C	3st	3	C
22.	PI3rC3	IVes-2	C	3st	3	C
23.	SP4rB(A)1	IIs-1	B	2st	2	D
24.	SP4rB2	IIs-1	B	2st	2	D
25.	SP4rC(A)1	IIs-1	B	3st	3	D
26.	SP4rC2	IIIes-1	C	3st	3	D

**Report No. Agri. 1445-Report on Detailed Soil Survey and Land use of Aj9i, Aj9j, Aj9k, Aj10a, Aj10c, Aj10d, Aj10f, and Aj10g subwatersheds of 'Aj' Subcatchment, Nagarjunsagar catchment in Dharwad district, Karnataka State, using remote sensing technique.**

The report covers an area of 36078.00ha falls under Aj, Nagarjunsagar catchment spread over Dharwad district of Karnataka State. The survey area of Aj9 watersheds lies between 15°25'57" to 15°28'16" North latitude and 75°0'43" to 75°19'55" East longitude and Aj10 watershed lies between

15°14'49" to 15°25'24" North latitude and 75°10'32" to 75°25'30" East longitude covered by Survey of India toposheets no. 48M/3,4 and 7.

Physiographically, the survey area is a part of the Deccan plateau. In general the survey area appear to be an erosion landscape in an advanced stage pediplanation. The area is almost plain lands and has nearly level to undulating topography with isolated subdued level hillocks. The physiographic units of the area are upper pediplain, lower pediplains,

pediments, stream banks and isolated subdued hillocks. The relief of the surveyed

area is normal to excess. The area is situated between an altitude of 578m above mean sea level. The drainage pattern is dendritic to sub dendritic.

The Geological formation of the area comprises the archaean formation such as Granites, Granodiorites. They are highly metamorphosed and have undergone folding, faulting, crushing and metamorphism as a consequent given rise to the syclinal ridges and anticline valleys. These archaean rocks vary in structure, texture and petrological, composition. Some of the intrusions of banded Magnetite and Quartzite lead to different geological composition. Except for this variation the soil of the survey are chiefly derived from Granite and Alluvium of Halocene to sub recent age.

Climatically, the mean maximum temperature is 39°C in the month of April and minimum temperature is 12.6°C in the month of December. The difference between mean summer and mean winter is less than 5°C, so the soil temperature regime is isohyperthermic since the mean annual

temperature is 22°C. The climate of the surveyed area is semi arid.

Agriculture is the main occupation of the habitants of the area. About 75% of the population is dependent on agriculture. Dry land farming is generally practiced in the area there is no community based irrigation projects in the area. Only in few area seasonal streams, open wells, and bore wells are utilized for irrigation purpose. Generally, agriculture in the survey area is operating at a low input level, which is vulnerable to high risk. Only a few farmers have utilized financial assistance from the Government Agency to extent irrigation facilities. Out of the total geographic area of Dharwad district (427329ha), 190825ha area is under cultivation. Major cereals cultivated in the area are Paddy, Jowar, Wheat and Maize. The main Kharif crops grown in the area are Green Gram, Onion, Chilly, Ground Nut, Maize, Hybrid Jowar, Sunflower etc. where as Rabi crops are Jowar, Sunflower, Cotton, Ground Nut, Wheat, Bengal Gram, Green Gram, Chillies etc.

Nine soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description is as follows:

Behatti (BH): This series comprises fine textured, calcareous, moderately deep, very dark grayish brown to dark brown soils. They generally occur on very gently sloping to gently sloping, upper pediplain with slope range of 1-5% and developed over Shale landscape. This soil series have high shrink and swell potential type of clay mineral. Crop like Jowar, Wheat, Cotton, Chilly, Maize, Sunflower, Green Gram etc. are grown on these soils under rainfed condition. These soils are susceptible to moderate to severe erosion. The soil mapping units identified are BH3rB2, BH3rC2 and BH3rC3.

Dyampor (DY): This series comprises deep, very dark grayish brown to dark brown, very fine texture soils and occur on very gently to gently sloping mid upper pediplain with a slope range of 1-5% and developed over weathered Granite landscapes. These soils have the expending type of clay, which swells and shrinks upon wetting and drying. These soils are mostly under rainfed cultivation and have poor infiltration rate, tilth and moderate fertility. The soil mapping units identified are DY4rB2 and DY4rC2. Hebli(HB): These soil series comprises fine textured, very deep, very dark grayish brown to dark brown soils. They generally occur on very gently sloping to gently sloping, upper pediplain with slope range of 1-5% and developed over Shale landscape. These soils have the expending type of clay, which swells and shrinks upon wetting and drying. These soils have high water holding capacity and moderately slope permeability. These soils are mostly under rainfed cultication. The soils mapping units identified are HB5rB2, HB5rC2 and HB5Rc3.

Hebsur(H): This series comprises fine textured, very deep and very dark grayish brown to very dark gray soils. They Generally occur on very gently sloping to gently sloping, lower pediplain with slope range of 1-5% and developed over Granite gneiss landscape. These soil series have expending type of clay, which swells and shrinks upon wetting and drying. The identified soil mapping units are H5rB2 and H5rC2.

Kallur(K): This series comprises very deep, fine textured, calcareous, very dark grayish brown to dark brown, alluvial soils. They occur along river and stream banks with a slope gradient of 1-5% and developed over alluvium landscape. These soils have the expending type of clay mineral and swell/shrink upon wetting and drying in kharif crop like Maize, Wheat, Jowar,

Sunflower etc. are grown on these soil under rainfed condition. Very few crops are under irrigation and have poor tilth and moderate fertility status. The soil mapping units identified are K5rB2, K5rC2 and K5rC3.

**Navalur(N):** This soil series comprises very fine textured, deep, very dark grayish brown, to dark brown soils. They generally occur on very gently to gently sloping lower pediplains with slope gradient of 1-5% and are developed over shale landscape. The soils have expanding type of clay, which swell, shrink upon drying and wetting. Crops like Maize, Wheat, Jowar, Sunflower, etc. are also grown on these soils under rainfed condition. The soil mapping units identified are N4rB2, N4rC2 and N4rC3.

**Shivalli(SH):** This series comprises fine loamy skeletal textured, shallow, reddish brown to dark reddish brown soils and generally occur on strongly sloping isolated subdued hillocks with slope gradient rocks 1-5% and developed over shale landscape. The soils are under grass cover and at places under Eucalyptus plantation. The soil

mapping units identified are SH2hE2G and SH2hE2GS.

**Sulla(SU):** This series represents gravelly, gray textured, moderately deep, reddish brown to dark reddish brown soils and occur on very gently sloping to gently sloping pediments with slope range of 1-5% and developed over shale landscape. These soils are thick, reddish brown to dark reddish brown, gravelly clay, weak medium sub angular to moderate medium sub angular blocky structure. The soil mapping units identified are SU3rB2G and SU3rC2G.

**Thimmapur(T):** This series represents very fine textured, deep, dark grayish brown to dark brown soils and occur on very gently sloping to gently sloping upper pediplains with slope range of 1-5% and developed over granite gneiss landscape. These soil series has high expanding and contracting type of clay mineral. Moderate soil fertility, poor tilth, susceptible to runoff loss is among the limitation, which can be corrected by summer ploughing, increased use of organic manure and conservation practices. The soil mapping units identified are T5rB2, T5rC2 and T5rC3.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	BH3rB2	IIIes-2	C	2st	3	C
2.	BH3rC2	IIIes-3	C	3st	3	C
3.	BH3rC3	IVes-1	C	3st	3	C
4.	DY4rB2	Iles-1	B	2st	2	C
5.	DY4rC2	IIIes-1	B	3st	3	C
6.	H5rB2	Iles-1	B	2st	2	C
7.	H5rC2	IIIes-1	B	3st	2	C
8.	HB5rB2	Iles-1	B	2st	2	C
9.	HB5rC2	IIIes-3	B	3st	3	C
10.	HB5rC3	IIIes-3	B	3st	3	C
11.	K5rB2	Iles-1	B	2st	2	C
12.	K5rB3	Iles-1	B	2st	2	C
13.	K5rC3	IIIes-3	B	3st	3	C
14.	N4rB2	Iles-1	B	2st	2	C

15.	N4rC2	IIIes-1	B	3st	3	C
16.	N4rC3	IIIes-3	B	3st	3	C
17.	SH2hE2G	VIes-1	E	5st	4	D
18.	SH2hE2GS	VIes-1	E	6st	4	D
19.	SU3rB2G	IIIes-3	D	4st	3	B
20.	SU3rC2G	IIIes-4	D	4st	3	B
21.	T5rB2	IIIes-1	B	2st	2	C
22.	T5rC2	IIIes-1	B	3st	3	C
23.	T5rC3	IIIes-3	B	3st	3	C

**Report No. Agri. 1446-Report on detailed soil survey and land use of 5D1A8p3, 5D1A8p4, 5D1A8p5, 5D1A8p6, 5D1A8p7, 5D1A8p8, 5D1A8r2, 5D1A8r3, 5D1A8r4, 5D1A8r5 and 5D1A8r6 microwatersheds of Bhukhi Karjan subcatchment, districts Narmada & Surat of Gujarat state.**

The report covers an area of 6825ha falls under Bhukhi Karjan subcatchment spread over Narmada and the Surat district of Gujarat State and the survey area lies between 21°27' to 21°34' North latitude and 73°31' to 73°36' East longitude covered by the Survey of India toposheets no. 46G/10 and 46G/11. Physiographically, the survey area comprises small hillocks and gently sloping to undulating pediments at places hill intercepts narrow valley. Isolated hillocks are present in the South West portion of the surveyed area. The North East and Central part of the area is pediplains with 1-5% slopes. The hillocks are under result forest and have sparse vegetation covers. The general slope direction of area is from South West to North East. The pediplain has normal relief, whereas hillocks have sub normal relief.

Geologically, the survey area falls under Deccan trap region belonging to Mesozoic lower tertiary and upper Cretaceous and Eocene Age with chief formation of Basalt. The most striking peculiarity of the Basalt

area is the prevalence of vesicular character and Amygloids chiefly of Zeolite and Agate. These basalts are extra ordinary uniform in composition with dark gray to dark grayish gray. The variation is due to petrographical colour and chemical characteristic of Basalt. Mineralogical variation and topography together with other soil forming factors resulted in occurrence of five different soil series. These series are developed from the basaltic parent material.

The climate of the area is tropical, humid with mild winter and hot summer with high humidity. The average annual rainfall in the area is 1457.2mm. The average mean annual temperature recorded is 27.5°C and mean summer soil temperature computed as 29.9°C and mean winter soil temperature computed as 26.5°C. The difference between mean summer and mean winter is less than 6°C. Thus, the survey area qualifies for the isohyperthermic temperature regime. The mean annual temperature is higher than 22°C. Therefore, the soil temperature regime is Ustic.

Agriculture is the main occupation of the inhabitants. In most of the survey area soils are less productive, as the maximum area has shallow to moderately deep soils which do not support for good crop growth and production as crops suffers from moisture stress in rainfed condition. Major crops grown in the area are Cereals (Jowar, Maize, Wheat and Paddy), Pulses (Bengal gram, Red gram, Black gram, Green gram) and

Vegetable & Spices (Chillies, Tomato, Brinjal, Lady Finger and Ginger).

Five soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physico chemical properties. A brief description is as follows:

**Chandarvan(CN):** The soil of this series occurs on very gently to gently sloping pediplain, developed over basalt. These soils have moderately well drained, moderately deep, very dark grayish brown to very dark brown, clay loam to clay texture, moderate to severe erosion hazard. These soils are mostly under rainfed cultivation. The soil mapping units identified are CN3rB2 and CN3hC3G.

**Dungra(DN):** The soil of this series occurs on strongly to moderately steep sloping hillside slopes developed over basalt. These soils have excessively drained, shallow, brown to dark brown, gravelly clay loam, non calcareous, having severe erosion hazards. These soils are mostly under forest and pasture lands. The soil mapping units identified are DN2hF3G(F) and DN2hE3G(P).

**Hiroha(HR):** The soil of this series occur on very gently to gently sloping, pediplains developed over basalt. These soils are moderately well drained, moderately deep,

brown to dark brown clayey, non calcareous with moderate to severe erosion hazards. These soils are cultivated under rainfed condition for jowar and arhar at places, they are under irrigation. In Rabi season the survey area cultivated for wheat and gram crops. Occasionally, it is under forest plantation at few places. The soil mapping units identified are HR3rB2, HR3hB2(F), HR3hC(B)1, HR3hC3, HR3hC3G, HR3hC3(F) and HR3hC3G(P).

**Jambar(JM):** The soil of this series comprise of shallow, brown to dark brown, fine loamy, well drained, soils developed over gently to moderately sloping basaltic landscape. These soils are under the rainfed cultivation of jowar, maize and arhar and at places under forest plantation and pasture. The soil mapping units identified are JM2hC2, JM2hC3G, JM2hD3G(P) and JM2hD3G(F).

**Sagbara(SG):** The soil of this series occur on very gently to gently sloping, pediplain and developed over basalt. These soils are moderately well drained, deep, dark brown to very dark grayish brown, clay, having moderate to severe erosion hazards. These soils are bunded and cultivated for under rainfed condition. The soils of this series suffer from moderate to severe erosion hazards. The soil mapping units identified are SG4rB2 and SG4rC3.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	CN3rB2	IIIes-1	C	3st	3	D
2.	CN3hC3G	IVes-1	C	4st	4	D
3.	DN2hE3G(P)	VIes-1	E	6st	4	D
4.	DN2hF3G(F)	P/M	-	-	-	D
5.	HR3rB2	IIIes-1	C	3st	3	C
6.	HR3hB2(F)	P/M	-	-	-	C
7.	HR3hC3	IVes-1	C	4st	4	C
8.	HR3hC(B)1	IIIes-1	C	4st	3	C

9.	HR3 <u>h</u> C3G	IVes-1	C	4st	4	C
10.	HR2 <u>h</u> C3(F)	P/M	-	-	-	C
11.	HR3 <u>h</u> C3G(P)	IVes-2	C	4st	4	C
12.	JM2 <u>h</u> C2	IVes-2	D	4st	4	D
13.	JM2 <u>h</u> C3G	IVes-3	D	4st	4	D
14.	JM2 <u>h</u> D3G(P)	IVes-3	D	6st	4	D
15.	JM2 <u>h</u> D3G(F)	P/M	-	-	-	D
16.	SG4rB2	IIes-1	B	2st	2	C
17.	SG4rC3	IIIes-2	B	3st	4	C

**Report No. Agri. 1452-Report on detailed soil survey and land use of 2C1D3m1, 2C1D3m2, 2C1D3m3, 2C1D3m4, 2C1D3m5, 2C1D3m6, 2C1D3m7, 2C1D3n1, 2C1D3n2 and 2C1D3n3 microwatersheds of LB-Upper Ken subcatchment of Ken FPR catchment in Tehsil & district Damoh, Madhya Pradesh State.**

The report covers an area of 12537ha falls under Lb-Upper Ken sub-catchment of Ken FPR catchment situated in Tehsil and District of Damoh, Madhya Pradesh State. The survey area lies between 23°46' to 23°53' North latitude and between 79°26' to 79°36' East longitude covered by survey of India toposheets no. 72L/11 and 72L/15 on 1:50,000 scale.

Physiographically the survey area is made up of up hills, foot slope/toe slope and valley plain. Moderately steep to steep hills of sand stones, very gently to gently sloping foot slope, valley plain of sandstone and shales are met in the survey area. The drainage pattern of the survey area is parallel to sub parallel and has normal to excessive relief. Due to high slope gradient and excessive erosivity of the survey area, the surface runoff generation potential high enough to resulting sediment, detachment and its transportation to the active river stone.

All the microwatersheds of the survey area fall under left bank of upper Ken sub catchment (2C1D) of Ken catchment. The area is represented by sand stone and shales of Vindhyan system. The soils developed

over sand stone is loamy skeletal to fine loamy and fine loamy to fine on shales. A mostly hill of the survey area has less than 10% vegetative cover except protected/reserved forest area.

Climatically, the survey falls under sub humid, subtropical climatic zone having distinct three seasons i.e. winter, summer, and monsoon in succession. The annual average rainfall of the surveyed area is 1291.6mm and mean annual temperature is 25.2°C. The average maximum and minimum temperature of the surveyed area are 31.3°C and 19.2°C respectively. The temperature data reveals that the difference between mean summer and mean winter temperature is more than 6°C and hence the soil temperature is "Hyperthermic".

Agriculture is the main source of livelihood for the people of the area. Nearly 75% of the population depends on agriculture and the other are engaged in business, service and other petty jobs. Intensive cultivation following modern farming technique with the application of fertilizers etc. is not practiced by common cultivators of the area. Main cropping seasons are Kharif and Rabi. Besides farming, villagers supplement their income by collecting fuel woods, Bidi leaves and Sal leaves from the forest and selling them at local market. Land on a favorable slope with proper budding and terracing are intensive cultivated for paddy in kharif season. Wheat, Moong, Mustard, and Maize are grown in the mid up land plain and homestead areas during the Rabi season.

Thirteen soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physico chemical properties. A brief description of individual is follows:

Aanu(A): This series comprises a very deep, dark grayish brown to dark brown, very fine, poorly drained, calcareous soils developed from weathered parent materials of shale. These soils occur on very gently sloping to gently sloping valley plain. The soils of the surface horizon range from 14-18cm in thickness, dark grayish brown to very dark grayish brown in colour, clay loam to clay in texture with moderate, medium, sub angular blocky structure. The soils of this series have slow permeability and very high water holding capacity and are generally poorly banded to moderately banded and are susceptible to slide to moderate erosion. These soils are mostly under double crop cultivation i.e. Wheat, Soyabean, Mustard, Bengal gram etc. The soil mapping units identified are A5hB1, A5hB2 and A5hC2.

Damoh(D): This series comprises shallow, brown to dark brown, loamy skeletal, excessive drained, non calcareous soils developed from weathered parent materials of sand stones. These soils occur on strongly sloping to very steep hill side slope. The soils of the surface horizon range from 8-10cms in thickness, brown to dark brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, fine, angular structure. The soils of this series have rapid permeability and low water holding capacity. These soils are mostly unbanded and are susceptible to severe erosion. These soils are mostly under open scrub. The soil mapping unit identified are D2dEF3G, D2dFG3G and D2dGH3G.

Dharampura (DH): This series comprises a very deep, brown to dark yellowish brown, fine loamy, moderately well drained, calcareous soils, developed from the weathered parent material of shale. These soils occur on very gently sloping to

gently sloping stream bank. The soils of the surface horizons ranges from 13-17cm in thickness, brown to dark brown in colour, loam to clay loam in texture with moderate, fine, sub angular, blocky structure. The soils of this series have moderate permeability and moderately high water holding capacity. These soils are mostly unbanded to poorly banded and are susceptible to moderate to severe erosion. These soils are mostly under double crop cultivation i.e. Wheat, Bengal Gram, Mustard, Jowar etc. The soil mapping units identified are DH5eC3, DH5hB2 and DH5hC3.

Erora(E): This series comprises a very deep, brown to very dark grayish brown, fine, poorly drained, non calcareous soils developed from the weathered parent material of shale. These soils occur on nearly level to very gently sloping valley plain. The soils of the surface horizon range from 14-18cm in thickness, brown to dark brown colour, loam to clay loam in texture with moderate, medium, sub angular blocky structure. This series have very slope permeability and high water holding capacity. These soils are mostly moderately banded to well banded and are susceptible to slight erosion. These soils are mostly under double crop cultivation i.e. Paddy, Wheat, Bengal gram etc. The soil mapping units identified are E5eB1, E5hA1 and E5hB1.

Guwari(G): This series comprises moderately deep, brown to dark yellowish brown, fine loamy, well drained, non calcareous soils developed from weathered parent materials of sand stone. These soils occur on gently sloping to moderately sloping hillocks/hummocks. The soils of the surface horizon range from 9-14cm in thickness, brown to dark yellowish brown in colour, gravelly sandy loam to loam in texture with week, fine, angular structures. This series has moderately rapid permeability and moderately high water holding capacity. These soils are mostly unbanded and are

susceptible to severe erosion. These soils are mostly under open scrub. The soil mapping units identified are G3dC3G and G3dD3G.

**Hardua(H):** This series comprises a very deep, dark brown to dark yellowish brown, fine loamy, well drained, non calcareous, soils developed from weathered parent materials of sand stone. These soils occur on very gently sloping to gently sloping valley plain. The soils of the surface area range from 11-15cm in thickness, dark brown to dark yellowish brown in colour, loam to sandy clay loam in texture with moderate, medium, sub angular blocky structure. The soils of this series have moderately rapid permeability and moderately high water holding capacity. These soils are mostly unbundled to poorly banded and are susceptible to moderate to severe erosion. These soils are mostly under forest with < 10% canopy cover. The soils mapping units identified are H5eB2 and H5kC3.

**Jamuniya(J):** This series comprises a very deep, brown to very dark grayish brown, fine, poorly drained, non calcareous soils developed from the weathered parent material of shale. These soils occur on very gently sloping to gently sloping valley plain. The soils of the surface horizon range from 14-18cm in thickness, brown to dark yellowish brown in colour, clay loam in texture with moderate, medium, sub angular blocky structure. This series has very slow permeability and high water holding capacity. These soils are mostly unbundled to moderately banded and are susceptible to slight to severe erosion. These soils are mostly under double crop cultivation, such as Wheat, Soya Bean, Mustard, Bengal gram etc. The soil mapping units identified are J5hB1, J5hB2 and J5hC3.

**Khamkheda(K):** This series comprises very deep, brown to strong brown, coarse loamy, well drained, non calcareous soils developed from weathered parent material of sand

stones. These soils occur on very gently to gently sloping valley plain. The soils of the surface horizon ranges from 10-15kms in thickness, brown to dark brown in colour, gravelly sandy loam to loam in texture with weak, medium and sub angular blocky structure. This series have rapid permeability and moderately high water holding capacity. These soils are mostly unbundled to moderately banded and are susceptible to moderate to severe erosion. These soils are mostly under forest with < 10% canopy cover. The soils mapping units identified are K5dB2, K5dC2 and K5dC3.

**Marah(M):** This series comprises deep, yellowish brown to olive brown, fine, moderately well drained, non calcareous soils developed from the weathered parent material of sand stones. These soils occur on very gently sloping to moderately sloping foot hill. The soils of the surface horizon range from 11-15cm in thickness, dark brown to dark yellowish brown in colour, sandy loam to sandy clay loam in texture with weak, fine, sub angular structure. This series has moderately slow permeability and moderately high water holding capacity. These soils are mostly unbundled to moderately banded and are susceptible to moderate to severe erosion. These soils are mostly under open scrub. The soil mapping unit identified are M4dB2, M4dC3G, M4dD3G, M4kC2 and M4kC3G.

**Pathriya(P):** This series comprises a very deep, dark brown to dark yellowish brown, fine, moderate, well drained, non calcareous soils developed from the weathered parent material of shale. These soils occur on very gently sloping to gently sloping valley plain. The soils of the surface horizon range from 14-18cm in thickness, dark brown to dark yellowish brown in colour, loam to clay loam in texture with moderate, medium, sub angular blocky structure. These soils have moderate permeability and moderately high water holding capacity. These soils are

mostly unbunded to well banded and are susceptible to slight to severe erosion. These soils are mostly under double crop cultivation such as Wheat, Soya Bean, Mustard, Bengal Gram etc. The soil mapping units identified are P5eB1, P5B2, P5eC2, P5eC3, P5hB1, P5hB2 and P5hC2.

**Rajnagar(RJ):** This series comprises moderately deep, brown to dark brown, fine loamy, well drained, non calcareous soils developed from weathered parent materials of sand stone. These soils occur on strongly sloping to very steep hills side slopes. The soils of surface horizon ranges from 10-15cm in thickness, brown to dark brown in colour, sandy loam in texture with weak, fine, sub angular, blocky structure. This series have moderately rapid permeability and low water holding capacity. These soils are mostly unbanded and are susceptible to severe erosion. These soils are mostly under forest with open scrubs. The soils mapping units identified are Rj3dEF3G and Rj3dGH3G.

**Salaiya(S):** This series comprises very deep, dark yellowish brown to brown, fine, imperfectly drained, non calcareous, soils, developed from weathered parent materials of sand stone. This series occurs on very gently to gently sloping foot hills. The

surface horizon ranges from 14-18cm in thickness, brown to dark yellowish brown in colour, sandy loam to loam in texture with weak, fine, sub angular blocky structure. This series have very slow permeability and high water holding capacity. These soils are mostly well banded and are susceptible to slight to severe erosion. These soils are mostly under double crop cultivation such as wheat, soya bean, mustard, bengal gram etc. The soil mapping units identified are S5dB(A)1, S5dB(A)2, S5dB2 and S5dC3.

**Tapariya(T):** This series comprises very deep, brown to strong brown, fine loamy, moderately well drained, non calcareous soils developed from weathered parent material of sand stone. These soils occur on very gently sloping to gently sloping toe slope. The surface horizon ranges from 15-18cm in thickness, brown to dark yellowish brown in colour, sandy clay loam to sandy loam in texture, with weak, fine, angular and sub angular blocky structure. This series have moderately rapid permeability and high water holding capacity. These are mostly unbanded to poorly banded and are susceptible to moderate to severe erosion. These soils are mostly under open scrub. The soils mapping units identified are T5dC3, T5kB2 and T5kC3.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	A5hB1	IIIs-1	B	2sdt	2	C
2.	A5hB2	IIIs-1	B	2sdt	2	C
3.	A5hC2	IIIes-1	B	3sdt	3	C
4.	D2dEF3G	VIes-1	E	6st	4	D
5.	D2dFG3G	VIIes-2	E	6st	4	D
6.	D2dGH3G	VIIes-2	E	6st	4	D
7.	DH5eC3	IIIes-2	B	2st	3	B
8.	DH5hB2	IIIs-1	B	2st	2	B
9.	DH5hC3	IIIes-2	B	2st	3	B

10.	E5eB1	IIs-1	B	2sdt	2	C
11.	E5hA1	IIs-1	B	2sd	1	C
12.	E5hB1	IIs-1	B	2sdt	2	C
13.	G3dC3G	IVes-1	C	3st	3	C
14.	G3dD3G	IVes-2	C	3st	4	C
15.	H5eB2	Forest	-	-	-	B
16.	H5kC3	Forest	-	-	-	B
17.	J5hB1	IIs-1	B	2st	2	C
18.	J5hB2	IIs-1	B	2st	2	C
19.	J5hC3	IIIes-2	B	3st	3	C
20.	K5dB2	Forest	-	-	-	B
21.	K5dC2	Forest	-	-	-	B
22.	K5dC3	Forest	-	-	-	B
23.	M4dB2	IIs-1	B	2st	2	C
24.	M4dC3G	IIIes-2	B	3st	3	C
25.	M4dD3G	IVes-1	B	4st	4	C
26.	M4kC2	IIIes-1	B	3st	3	C
27.	M4kC3G	IIIes-2	B	3st	3	C
28.	P5eB1	II-1	A	2t	2	B
29.	P5eB2	IIe-1	A	2t	2	B
30.	P5eC2	IIIe-1	A	3t	3	B
31.	P5eC3	IIIe-2	A	3t	3	B
32.	P5hB1	II-1	A	2t	2	B
33.	P5hB2	IIe-1	A	2t	2	B
34.	P5hC2	IIIe-1	A	3t	3	B
35.	Rj3dEF3G	Forest	-	-	-	C
36.	Rj3dGH3G	Forest	-	-	-	C
37.	S5dB(A)1	II-1	A	2	1	C
38.	S5dB(A)2	IIe-1	A	2	1	C
39.	S5dB2	IIe-1	A	2t	2	C
40.	S5dC3	IIIe-2	A	3t	3	C
41.	T5dC3	IIIe-2	A	3t	3	B
42.	T5kB2	IIe-1	A	2t	2	B
43.	T5kC3	IIIe-2	A	3t	3	B

**Report No. Agri. 1454-Report on detailed soil survey and land use of Nv6a, Nv6b, Nv6c, Nv6d, Nv6f, Nv6g and Nv6j sub watersheds, Narmada catchment Tahsil & district- Mandla of Madhya Pradesh State.**  
The report covers an area of 12687ha falls comprises seven sub watersheds such as Nv6a, Nv6b, Nv6c, Nv6d, Nv6f, Nv6g and Nv6j sub watersheds of Narmada catchment

spread over Mandla district of Madhya Pradesh State. The survey area lies between 22°42' to 22°52' North latitude and 80°12' to 80°27' East longitude covered by Survey of India toposheets no. 64B/1,64B/5 and 64B/6. Physiographically, the survey area is developed over two landscapes zones namely basaltic landscape and alluvium landscape. It consists of three major geomorphic units i.e. hills pediments, and alluvial plain. Pediments are commonly border hill ranges and undulating lands which extents

downward in alluvial plain. The general drainage pattern varies from sub parallel and dendritic to sub dendritic. The relief of the area is normal in general but excessive and sub normal relief are also noticed at hill side slopes and dissected stream banks.

Geologically, major rock formation of the area comprises basaltic lava flows of upper cretaceous to lower Eocene age. These flows are designated as deccan trap and almost horizontally disposed. Weathering of deccan basalt causes development of black soils, which are mainly confined along the major river/stream banks alluvial plain. These traps flows may be grouped as very hard, massive and compact in nature. The innumerable rounded and oval shape vesicles are usually filled with Zeolite, Calcite and Quarts. The vesicular basalt is gray to brown in colour and soft to medium grained.

The climate of the area is tropical monsoonic type characterized by mild winter, hot summer, and short rainy season. The climate on the whole is dry except during monsoon season. The mean annual precipitation temperature of the area is 1317.6mm. The mean maximum and minimum temperature are 30.6°C and 15°C respectively. The mean annual temperature is 22.8°C. The mean summer and winter temperature is 26.6°C and 16.2°C respectively with a difference of 10.4°C. Thus, the soil of the area falls under hyperthermic temperature regime and Ustic moisture regime.

In the surveyed area, it is observed that about 41% is net cultivated and 23% is under double cropping. Village forest is spread over an area of 18% restricted to hills and their surroundings. About 10% area is under grass lands, bushy vegetation and waste land. 5% land is under current fellow and 7% under fellow lands. Similarly, 15% area is under public utility viz. road, nala, river, tank and building structures. About area are under cereals namely Paddy, wheat and other cereals. About of total village area is under cultivation of paddy. Similarly, area is under

pulses, namely Black gram, Pea, Lentils and other pulses. About area is under millets namely kodo-kuti, arhar-kodo etc. About area is cultivated with oil seeds, crop namely, Sesamum, Soya Bean, Mustard, Niger and Linseeds.

Six soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description is as follows:

**Barela(BR):** These soils are moderately deep, strongly sloping, developed over basalt and occurring on strongly sloping to steep hills side slopes. The surface horizon ranges from 12-16cm in thickness with brown to dark brown colour, gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified are BR3hE3S, BR3hF3SR and BR3hG3SR.

**Dadratola(DR):** These soils are shallow, gently sloping, developed over basalt and occurring on gently sloping to moderately sloping upper pediment. The surface horizon ranges from 12-16cm in thickness with brown colour, texture and weak, medium, sub angular blocky structure. The soil mapping units identified are DR2hC2, DR2hC3 and DR2hD3S.

**Jamukoh(J):** These soils are moderately deep, very gently sloping, developed over basalt and occurring on very gently sloping to moderately sloping hill tops. The surface horizon ranges from 12-26cm in thickness with reddish brown to dark reddish brown colour, gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified are J3hB2S, J3hC2S, J3hC3S and J3hD3S.

**Khairi(KR):** These soils are very deep, very gently sloping, developed over alluvium and occurring on very gently sloping to gently sloping alluvial plains. The surface horizon ranges from 11-12cm in thickness with dark brown to very dark grayish brown colour,

clay texture and weak to moderate, medium to coarse, sub angular blocky structure. The soil mapping units identified are KR5rB(A)1, KR5rB2, KR5rC(A)1, KR5rC2 and KR5rC3.

**Khudiyan(KN):** These soils are very deep, gently sloping, developed over basalt and occurring on gently sloping dissected stream banks. The surface horizon ranges from 13-15cm in thickness with dark yellowish brown to very dark grayish brown colour, gravelly gray loam to loam texture and weak, medium, sub angular, blocky structure. The

soil mapping units identified are KN5eD3 and KN5hC2.

**Narayanganj(N):** These soils are moderately deep, very gently sloping, developed over basalt and occurring on very gently sloping to gently sloping lower pediplain. The surface ranges horizon from 12-14cm in thickness with brown to dark brown in colour, clay texture and weak, medium, sub angular blocky structure. The soil mapping units identified are N3rB2, N3rC(A)1, N3rC2 and N3rC3.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	BR3hE3S	Forest	-	-	-	-
2.	BR3hF3SR	Forest	-	-	-	-
3.	BR3hG3SR	Forest	-	-	-	-
4.	DR2hC2	IVes-3	D	4st	4	D
5.	DR2hC3	VIes-1	D	6st	4	D
6.	DR2hD3S	VIes-1	D	6st	4	D
7.	J3hB2S	IIIes-1	C	3st	3	C
8.	J3hC2S	IIIes-2	C	3st	3	C
9.	J3hC3S	IVes-2	C	3st	3	C
10.	J3hD3S	IVes-2	C	4st	4	C
11.	KR5rB(A)1	IIIs-1	B	2st	2	C
12.	KR5rB2	IIes-1	B	2st	2	C
13.	KR5rC(A)1	IIIs-1	B	2st	2	C
14.	KR5rC2	IIIes-1	B	3st	3	C
15.	KR5rC3	IVes-1	B	3st	3	C
16.	KN5eD3	IVe-1	B	3t	3	B
17.	KN5hC2	IIe-1	B	3t	3	B
18.	N3rB2	IIIes-1	C	3st	3	C
19.	N3rC(A)1	IIIs-1	C	3st	3	C
20.	N3rC2	IIIes-2	C	3st	3	C
21.	N3rC3	IVes-2	C	3st	3	C

## **4E5E5w', 4E5E5x and 4E5E5x' subwatersheds of Goshikhurd catchment, Tahsil-Mohkher and Pandhurna, DistrictChhindwara, Madhya Pradesh State.**

The report covers an area of 12390ha comprising sub watersheds 4E5E5w, 4E5E5w', 4E5E5x and 4E5E5x' of Goshikhurd catchment falls under Tahsil-Mohkher and Pandhurna, District-Chhindwara of Madhya Pradesh State. The survey area lies between 78°38' to 78°52' East longitude and 21°48' to 21°57' Northlatitude covered by Survey of India toposheets no. 55K/9 and 55K/13 on 1:50,000 scale. Physiographically, the surveyed area comes under Hills, Plateau &Pediments and physiographic units of basaltic and Granitic landscape. The plateau side slopes in Basaltic landscape are running from East to West direction while granitic hill side slopes are running from South East to North West directions. The plateau tops had plain lands and pediplains in gneissic landscape were obvious in the vicinity of drainage system. The hill side slopes and foot hill slopes have excessive and sub normal relief pediplains have normal relief. In general the slope of the surveyed area is from North to South direction and drained by baman nala into kanhan river which finally meets to Wainganga river. The drainage pattern of the area is sub parallel to sub dendritic.

Geologically the Eastern portion of the area is the part of deccan trap. The basement rock is granite gneiss which reveals itself in South West direction of the surveyed area. The Eastern part of surveyed area is covered by basaltic landscape and Western part covered by granitic gneiss landscape. The basaltic capping over granitic gneiss rocks were observed in transitional zones. The area has semi arid to sub tropical monsoonic type of climate. It has been defined summer rainy and winter season. The average annual

precipitation is 826.6mm. The mean annual temperature is 25.1°C. The mean summer temperature is 27°C and mean winter temperature 20.1°C. The difference between mean summer and mean winter temperature is more than 6°C. thus, the temperature regime of the area comes under hyperthermic temperature regime.

The survey area is inhabited by farmers, agricultural labours and forest labours. The inhabitants are mainly engaged in farming and other business. Generally, single crops cultivation is adopted in kharif season for want of irrigation facilities. Few progressive farmers adopt rotation where irrigation facilities exist. The common crop rotation practices are paddy, wheat, green gram, black gram, maize etc. The gross cultivated area within the total surveyed area is 6818ha. The net cultivated area is 5162ha (68.8%). Wheat is the main cereal crops of the survey area and occupies 32.71% of the total cultivated area. The other cereals are maize, jowar, paddy which covers smaller area. Among pulses udid, moong, gram and tur occupies 8.2%, 11.2%, 62.4% and 18.2% area respectively. Among oil seeds, ground nut, mustard, sun flower, til are grown and soya bean is the main crop which occupies 42.7% of the total cultivated area.

Eight soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description is as follows:

**Bhairopani(BP):** These soils are shallow, developed over basalt and occurring on nearly level to moderately sloping plateau plains. The surface horizon ranges from 12-22cm in thickness with strong, brown to brown colour, clay loam to gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping unitsidentified are BP2hC2S, BP2hD3S, BP2hB2S and BP2hC2S.

**Bandiya(BD):** These soils are moderately deep, developed over basalt and occurring on very gently sloping to gently sloping plateau plains. The surface horizon ranges from 12-20cm in thickness with brown to very dark grayish brown colour, clay texture and moderate, medium, sub angular blocky structure. The soil mapping units identified are BD3hC2S and BD3rC2.

**Deogarh(DG):** These soils are deep, very gently sloping, developed over Basaltic landscape and occurring on very gently sloping to gently sloping valley plain. The surface horizon ranges from 11-17cm in thickness with brown to dark brown colour, clay texture and strong, coarse, sub angular blocky structure. The soil mapping units identified are DG4rB2 and DG4rC2.

**Kusumdhana(KD):** These soils are shallow, developed over Basalt and occurring on strongly sloping to very steep hills side slopes. The surface horizon ranges from 10-16cm in thickness with brown to dark brown colour, clay loam to gravelly loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified are KD2hG2SRF, KD2hG3SRF, KD2hH3SRF, KD2hF2SRF and KD2hG3SRF.

**Majhiyapar(M):** These soils are very deep, developed over Basalt and occurring on very gently sloping to gently sloping under pediplains. The surface horizon ranges from 13-19cm in thickness with very dark grayish

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	BP2hC2S	IVes-2	D	4	NS	D
2.	BP2hD3S	IVes-3	D	4	NS	D
3.	BP2hB2S	IVes-1	D	4	NS	D
4.	BP2hC2S	IVes-2	D	4	NS	D
5.	BD3hC2S	IIIes-2	C	3	F	C
6.	BD3rC2	IIIes-1	C	3	F	C

brown colour, clay texture and moderate, coarse, sub angular blocky structure. The soils mapping units identified are M5rB2 and M5rC2.

**Mohpani(MP):** These soils are shallow, developed over Granite gneiss and occurring on strongly sloping to very steep hills side slopes. The surface horizon ranges from 10-17cm in thickness with brown to dark brown colour, sandy loam to gravelly sandy clay loam texture and weak, fine, sub angular blocky structure. The soil mapping units identified are MP2dG3SRF, MP2hF3SRF, MP2kH3SRF and MP2kG2SRF.

**Palaspani(PP):** These soils are shallow, developed over granite gneiss and occurring on gently sloping to moderately sloping pediplains. The surface horizon ranges from 8-10cm in thickness with light yellowish brown to dark yellowish brown colour, sandy loam texture and moderate, medium, sub angular blocky structure. The soil mapping units identified are PP2dD3S, PP2dC2S, PP2kD3SRF and PP2kC2S.

**Panathanwari(PT):** These soils are deep, very gently sloping, developed over Basalt and occurring on very gently sloping to gently sloping plateau plains. The surface horizon ranges from 12-19cm in thickness with dark brown colour, clay texture and moderate, coarse, sub angular blocky structure. The soil mapping units identified are PT4rB2 and PT4rC2.

7.	DG4rB2	Iles-1	B	2	G	C
8.	DG4rC2	Iles-2	B	2	G	C
9.	KD2 <u>h</u> G2SRF	-	-	-	-	-
10.	KD2 <u>h</u> G3SRF	-	-	-	-	-
11.	KD2 <u>h</u> H3SRF	-	-	-	-	-
12.	KD2 <u>h</u> F2SRF	-	-	-	-	-
13.	KD2 <u>h</u> G3SRF	-	-	-	-	-
14.	M5rB2	Iles-1	B	2	G	C
15.	M5rC2	Iles-2	B	2	F	C
16.	MP2 <u>d</u> G3SRF	-	-	-	-	-
17.	MP2 <u>h</u> F3SRF	-	-	-	-	-
18.	MP2 <u>k</u> H3SRF	-	-	-	-	-
19.	MP2 <u>k</u> G2SRF	-	-	-	-	-
20.	PP2 <u>d</u> D3S	IVes-3	D	4	NS	D
21.	PP2 <u>d</u> C2S	IVes-2	D	4	NS	D
22.	PP2 <u>k</u> D3SRF	-	D	-	-	-
23.	PP2 <u>k</u> C2S	IVes-2	D	4	NS	D
24.	PT4rB2	Iles-1	B	2	G	C
25.	PT4rC2	Iles-2	B	2	G	C

**Report No. Agri. 1457-Report on detailed soil survey and land use of Nv5n, Nv5q,Nv5r, Nv5s, Nv5t, Nv5u and Nv5y sub watersheds of Narmada RVP catchment, Tahsil: Niwas, District-Mandla Madhya Pradesh State.**

The report covers an area of 13238ha comprising sub watersheds Nv5n, Nv5q, Nv5r, Nv5s, Nv5t, Nv5u and Nv5y of Narmada RVP catchment falls under, Tahsil Niwas, District Mandla of Madhya Pradesh State. The survey area lies between 22°51' to 22°55' North latitude 80°17' to 80°28' East longitude covered by Survey of India toposheets no.64A/8 and 64B/5.

Physiographically, the survey area comes under basaltic landscape comprises hills, very plains, plateau plains and pediments. The geomorphic units may be sub divided into physiographic units. The general gradient of the sub watersheds runs from West-East to South-North direction. Hills have strongly to steep slopes and excessive relief and are

situated between 418mt to 700mt above mean sea level. The relief of the area is normal in general, but the hilly area having excessive relief.

Geologically, the area falls under the Deccan trap with basalt as dominant rock. The basalt rocks are uniform over a wide area. The weathering of basalt with spheroidal exploitation and give rise to rounded boulders, which is a common feature of the region. Basalt is grayish and yellowish brown to dark red, fine to medium green and basic igneous rock. Basalt is composed mainly of phagioclase, pyroxene, iron-ore etc. The most striking peculiarity of the basalt is the prevalence of vesicular character. The presence of green tinge is a special characteristic of the basalt.

The climate of the area in general to sub tropical monsoonal type characterized by mild winters, hot summer and a short rainy season. The climate on the whole is dry except during the South-West monsoon season. The mean annual precipitation of

Niwas is 1481mm. The mean minimum temperature and maximum temperature are 15.40°C and 29.70°C respectively. The mean annual temperature is 22.80°C. The mean annual summer temperature and mean annual winter temperature are 26.6°C and 16.2°C respectively with a difference of 10.4°C. Thus, the soils of the area fall under the hyperthermias temperature regime.

The main occupation of the people of the surveyed area is farming. Mostly farmers inhabit the area. The supplementary works are dairying, cattle farming, carpentry, shoemaking, black smithy which is popular and profitable business in the area. It is observed that about 35.3% area is not cultivated and 9.9% area is under double cropping. Village forest is spread over an area of 45.4% restricted to hills and their surroundings. About waste land 14.8% page under current fallow and 1.3% is under other old fallow lands. Similarly, 3.1% area is under public utility viz. River/nala, road, tank and building structures. Generally, the Single cropping pattern is practiced on dry land, but wherever irrigation facilities are available double cropping system is adopted. The main crops grown in the area are Paddy, Wheat, Jower, Bajari, Maize and Pulses are Tur, Udid, Moong, Gram, Masur, Kulth, Pea and Oil Seeds are Til, Rai, Soya Bean and Ground nut.

Nine soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description of the individual is as follows:

Babaliya (BB): These soils are shallow, gently sloping, developed over Basalt and occurring on gently sloping to moderately sloping, upper pediments. The surface horizon ranges from 7-18cm in thickness with yellowish brown to dark brown colour, gravelly clay to gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified

are BB2hC2GS, BB2hC3, BB2hC3SR and BB2hD3SR .

Bandria(B). These soils are shallow, very gently sloping, developed over basalt and occurring on very gently sloping to moderately sloping upper pediment. The surface horizon ranges from 11-16cm in thickness with reddish brown to dark brown colour, gravelly clay loam to gravelly clay texture and weak, medium, sub angular blocky structure. The soil mapping units identified are B2hB2GS, B2hC2GS, B2hC3GS, B2hD2GS and B2hD3GS.

Bastrā (BT): These soils are shallow, strongly sloping, developed over basalt and occurring on strongly sloping to steep hill side slopes. The surface horizon ranges from 15-23cm in thickness with reddish brown to dark reddish brown colour, clay loam to gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified are BT2hE3SR, BT2hF3GS and BT2hG3GS R.

Chhipabad(CH): These soils are deep, very gently sloping, development over basalt and occurring on very gently sloping narrow hill valleys. The surface horizon ranges from 13-14cm in thickness with brown to dark brown colour, clay texture and moderate to strong, medium to coarse, sub angular blocky structure. The soil mapping units identified are CH4rB(A)1 and CH4rB2.

Jamli(JM): These soils are very deep, very gently sloping, developed over Basalt and occurring on very gently sloping lower pediment. The surface horizon ranges from 12-15cm in thickness with brown to dark brown colour , gravelly clay loam to clay texture and moderate to strong, medium, sub angular block structure. The soil mapping units identified are JM5rB(A)1, JM5rB2, JM5rB2S and JM5rC2.

Khardi (KH): These soils are shallow, very gently sloping, developed over basalt and occurring on very gently sloping to moderately sloping upper pediments. The surface horizon ranges from 10-17cm in

thickness with yellowish brown to dark brown colour, gravelly clay to gravelly clay loam texture and weak to moderate, medium to coarse, sub angular blocky structure. The soil mapping units identified are KH2hB(A)1, KH2hB2GS, KH2hB2GS, KH2hC2GS, KH2hD2GS and KH2hD3GS.

**Khudri(KD):** These soils are moderately deep very gently sloping, developed over basalt and occurring on very gently sloping to moderately sloping side slope of upper pediment. The surface horizon ranges from 12-14cm in thickness with yellowish brown to dark brown colour, clay loam to gravelly clay loam texture and weak to moderate, medium, sub angular blocky structure. The soil mapping units identified are KD3hC2GS, KD3hD3SR, KD3hB2S and KD3hC2GS.

**Maldha(ML):** These soils are moderately deep, very gently sloping, developed over Basalt and occurring on very gently sloping to gently sloping upper pediment. The surface horizon ranges from 9-16cm in thickness with yellowish brown to dark brown colour, gravelly clay to gravelly clay loam texture and weak, medium, sub angular blocky structure. The soil mapping units identified are ML3hB2, ML3hB2GS, ML3hC2 and ML3hC2GS.

**Ramtila(RT):** These soils are deep, very gently sloping, developed over Basalt and occurring on very gently sloping to gently sloping plateau plains. The surface horizon ranges from 10-12cm in thickness with brown to dark reddish brown colour, clay to clay loam texture and weak to moderate, medium, sub angular blocky structure and soil mapping units identified are RT4hB2 and RT4hC2.

#### *Interpretative grouping of soils*

S.No.	Soil Mapping Unit	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Paddy Soil Group	Hydrologic Soil Group
1.	BB2hC2GS	IVes-2	D	4st	P/US	D
2.	BB2hC3	IVes-2	D	4st	P/US	D
3.	BB2hC3SR	IVes-2	D	4st	P/US	D
4.	BB2hD3SR	IVes-3	D	4st	P/US	D
5.	B2hB2GS	IVes-1	D	4st	P/US	D
6.	B2hC2GS	IVes-2	D	4st	P/US	D
7.	B2hC3GS	IVes-2	D	4st	P/US	D
8.	B2hD2GS	IVes-2	D	4st	P/US	D
9.	B2hD3GS	IVes-3	D	4st	P/US	D
10.	BT2hE3SR	Forest	-	-	-	-
11.	BT2hF3GS	Forest	-	-	-	-
12.	BT2hG3GS R	Forest	-	-	-	-
13.	CH4rB(A)1	IIs-1	B	2s	VG	C
14.	CH4rB2	IIs-1	B	2st	G	C
15.	JM5rB(A)1	IIs-1	B	2s	VG	C
16.	JM5rB2	IIs-2	B	2st	G	C
17.	JM5rB2S	IIs-2	B	2st	G	C
18.	JM5rC2	IIIs-1	B	2st	F	C

19.	<u>KH2hB(A)1</u>	IVs-1	D	4st	F	D
20.	<u>KH2hB2GS</u>	IVes-1	D	4st	P/US	D
21.	<u>KH2hB2GS</u>	IVes-2	D	4st	P/US	D
22.	<u>KH2hC2GS</u>	IVes-2	D	4st	P/US	D
23.	<u>KH2hD2GS</u>	IVes-2	D	4st	P/US	D
24.	<u>KH2hD3GS</u>	IVes-3	D	4st	P/US	D
25.	KD3hC2GSR	Forest	-	-	-	-
26.	KD3hD3SR	Forest	-	-	-	-
27.	KD3hB2S	Forest	-	-	-	-
28.	KD3hC2GS	Forest	-	-	-	-
29.	ML3hB2	IIIes-1	C	3st	F	B
30.	ML3hB2GS	IIIes-2	C	3st	F	B
31.	ML3hC2	IIIes-2	C	3st	F	B
32.	ML3hC2GS	IIIes-3	C	3st	P/US	B
33.	RT4hB2	Iles-1	C	3st	G	C
34.	RT4hC2	Iles-1	C	3st	F	B

### 6.3 Soil Resource Mapping Reports

#### Report No. SRM-11-Report on Inventory of Soil Resource Mapping of Anantpur District of Andhra Pradesh State using Remote Sensing and GIS techniques.

The report covers an area of 1915053ha of the Anantpur District of Andhra Pradesh State. The survey area lies between 76°47' to 78°26' East longitude and 13°41' to 15°14' North latitude. The surveyed area is bounded on the East by Cuddapah and North by Kurnool District and on the South West and Western sides by Karnataka State.

Physiographically, a major part of the district forms pediplain from South to North with hill ranges scattered, especially in the South West and South East portion. The area is covered by major Granite gneiss landscape with subdivision within of Granite-Gneiss followed by Shale and Dolomite, Metabasalt and Amphibolites schist complex with mixed Quartzite and Limestone in terreces and Alluvial landscape near major stream rivers.

The landscape found in the area is subdivided into land form i.e. Physiography units such as Alluvium, Granite gneiss, Shale and Dolomite, Quartzite and Limestone, Schist. Generally, the district slopes from south to North. The general elevation the south is about 670mt above mean sea level

and declines to 305mt above mean sea level at Gooty in the North and 275mt above mean sea level at Tadpatri in North East. The main geological formation of the district comprises of older metamorphic sequences of Archaean age and younger group of sedimentary rocks belonging to Proterozoic age. The oldest metamorphic rock is governed by Amphidolites, Schist and Granite Gneiss of Archaean age and Proterozoic age comprises of Quartzite and Shale and Dolomite complexes. The area shows remnants of ancient sea flow on which Limestone, Quartzite extra had been deposited.

Quaternary, gravel as lensoidal bodies along river pennar are found in the southern and central parts of the district. The rest of the district is covered by Schist, Gneiss, Quartz, Veins and basic dykes that had been metamorphosed and Recrystallised. The general trend of foliation of the peninsular gneiss complex and metamorphic is NNW-SSE with steep dips.

The geographical position of the peninsular renders it, the driest part of the State and hence, agriculture condition is precarious. Monsoon also evades the part due to its unfortunate location as being deprived of North East monsoon and the South West

monsoon, resulting drought very often. The normal rainfall of the surveyed area is 500.4mm which is least compared to other parts of Andhra Pradesh State. The normal rainfall of South West monsoon is 306.6 mm and North East monsoon is 147.00 mm. The maximum temperature of the surveyed area is ranging between 29°C to 42°C in summer whereas in winter temperature ranges of 17.2°C with mean summer temperature of 37.3°C and mean winter temperature of 30.8°C and the difference between the mean summer and mean winter temperature is 6.5°C and the mean annual temperature is 27.8°C. Thus, the temperature regime assumed to be hyperthermic. Anantpur district depends predominantly on agriculture, mainly rainfed farming and 10% under irrigation. The cropping pattern of this district varies from situation to situation due to different agro-climatic conditions. Most of the area in Kharif is under rainfed where ground nut and red gram are predominant. The surveyed area is a resource for arid region with very low and erratic average rainfall annually and witness drought in three ends of five years. This varied arid climatic data reflect the presence of natural vegetation to be very scarce in forest area under shrubs and bushes, very less cover and therefore are very poor in biomass.

Forty seven soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description of individual, soil series is as follows:

Akampalli: This series comprises moderately deep, clayey textured, moderately well drained soils developed over shale. These soils occur on very gently sloping to gently sloping (1-5%) lower pediplains. The soils of the surface horizon ranges from 11-13cm in thickness, brown in colour, clay loam in texture with moderate, medium, sub angular blocky structure. This series is moderately managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

Amaladini: This series comprises moderately deep, loamy textured, moderately well drained soils developed over . These soils occur on very gently sloping (1-3%) lower pediplains. The soils of the surface horizon ranges from 10-14cm in thickness, dark grayish brown to dark brown in colour, clay loam in texture with weak to moderate, fine to medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion.

Amohrpalli: This series comprises moderately deep, loamy textured, imperfectly drained soils developed over granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains and foothill slopes. The soils of the surface horizon ranges from 5-10cm in thickness, brown to dark brown in colour, clay loam to sandy clay loam in texture with weak, fine to medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

Anantpur: This series comprises a very deep, fine textured and imperfectly drained soils developed over Granite gneiss. These soils occur on nearly level (0-1%) lower pediplains. The soils of the surface horizon ranges from 12-14cm in thickness, dark gray to very dark grayish brown in colour, clay loam in texture with moderate, medium, sub angular blocky structure. These series are well managed, mostly under multiple crop cultivation and are susceptible to none to slight water erosion.

Beluguppa: This series comprises deep, fine textured, moderately well drained soils developed over Granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 16-17cm in thickness, dark grayish brown to very dark grayish brown in colour, clay in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly

under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**Bodgandaddi:** This series comprises deep, fine loamy textured, imperfectly to moderately drained soils developed over Granite gneiss. These soils occur on nearly level (0-1%) lower pediplains. The soils of the surface horizon ranges from 10-11cm in thickness, brown to dark yellowish brown in colour, sandy clay loam in texture with moderate, medium, sub angular blocky structure. These series are well managed, mostly under multiple crop cultivation and are susceptible to none to slight water erosion.

**Chimalavagupalli:** This series comprises deep, fine textured, moderately well drained soils developed over Shale. These soils occur on very gently sloping (1-3%) lower pediplains. The soils of the surface horizon ranges from 16-20cm in thickness, dark grayish brown to very dark grayish brown in colour, clay in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to moderate water erosion.

**Daditola:** This series comprises shallow, loamy skeletal textured, moderately well to well drained soil developed over Quartzite. These soils occur on strongly sloping to steep(10-33%) undifferentiated hills side slope and hillocks/hummocks/subdued hills. The soils of the surface horizon ranges from 14-16cm in thickness, strong brown to brown in colour, clay loam in texture with weak, fine, sub angular, blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible moderate water erosion.

**Darga:** This series comprises shallow, loamy textured, moderately well drained soils developed over Limestone. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 10-13cm in thickness, dark brown to very dark grayish brown in colour,

sandy loam in texture with weak to moderate, fine to medium, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Doduluru:** This series comprises moderately deep, coarse loamy texture, moderately well to well drained soils developed over Granite, Gneiss. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 18-20cm in thickness, yellowish red, to dark reddish brown in colour, sandy loam in texture with weak, fine, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**East Ramgiri:** This series comprises deep, fine loamy textured, moderately well drained soils developed over schist. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 9-10 cm in thickness, colour varies from strong brown to dark brown in colour, sandy clay loam in texture with weak, fine to medium, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Erraguntapalle:** This series comprises a very deep, fine textured, moderately well drained soils developed over Shale. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 8-10cm in thickness, dark grayish brown to very dark grayish brown in colour, clay in texture with weak, fine to medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**Hajwalidarga:** This series comprises moderately deep, clayey textured, moderately well drained soils developed over Limestone.

These soils occur on very gently sloping (1-3%) pediments and upper pediplains. The soils of the surface horizon ranges from 12-14cm in thickness, very dark grayish brown in colour, sandy clay in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

Hanchanihalu: This series comprises a very deep, very fine textured, moderately well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0-3%) alluvial plains. The soils of the surface horizon ranges from 12-18cm in thickness, very dark grayish brown in colour, clay in texture, with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

Hindupur: This series comprises moderately deep, coarse loamy texture, moderately well to well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0-3%) Alluvial plains. The soils of the surface horizon ranges from 10-14cm in thickness, dark brown to very dark grayish brown in colour, sandy loam in texture with weak to moderate, medium, sub angular blocky structure. These series are well managed, mostly under multiple crop cultivation and are susceptible to none to slight water erosion.

Kamalapad: This series comprises a very deep, fine loamy texture, moderately well drained soils developed over alluvium. These soils occur on very gently sloping to gently sloping (1-5%) stream banks and alluvial plains. The soils of the surface horizon ranges from 11-15cm in thickness, dark grayish brown to very dark grayish brown in colour, clay to sandy clay in texture with moderate, medium, sub angular blocky structure. These series are moderately

managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion.

Kamali: This series comprises a very deep, fine textured, imperfectly drained soils developed over shale. These soils occur on nearly level to very gently sloping (0-3%) lower pediplains. The soils of the surface area ranges from 18-20cm in thickness, grayish brown to dark grayish brown in colour, sandy clay loam in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

Kandakuru: This series comprises deep fine loamy textured, moderately well to well drained soils developed over Granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 11-12cm in thickness, yellowish red to reddish brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, fine, sub angular blocky structure. These series are well managed, mostly under agriculture and are susceptible to moderate water erosion.

Kondapalli: This series comprises moderately deep, loamy skeletal textured, well drained soils developed over Granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 8-10cm in thickness, dark yellowish brown to dark brown in colour sandy loam in texture with weak, fine, sub angular blocky structure. These series are moderately managed, mostly under deciduous forest (Single storey veg) and are susceptible to moderate water erosion.

Kondapuram: This series comprises shallow, loamy skeletal textured, well to moderately well drained soils developed over Shale. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated

hills side slope and hillocks/hummocks/subdued hills. The soils of the surface horizon ranges from 11-13cm in thickness, strong brown to dark brown in colour, clay loam in texture with weak to moderate, fine, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible moderate water erosion.

**Kottalapalli:** This series comprises moderately deep, loamy skeletal textured, moderately well to well drained soils developed over Schist. These soils occur on moderately steep (15-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 9-10cm in thickness, strong brown to dark brown in colour, clay loam in texture with weak, fine to moderate, sub angular blocky structure. These series are moderately managed, mostly under deciduous forest (Single storey veg) and are susceptible to moderate water erosion.

**Kristipadu:** This series comprises deep, fine textured, moderately well drained soils developed over Dolerite. These soils occur on very gently sloping (1-3%) lower pediplains. The soils of the surface horizon ranges from 10-15cm in thickness, dark grayish brown to very dark grayish brown in colour, sandy clay loam to sandy clay in texture with moderate, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**Kunuturu:** This series comprises very deep, fine loamy textured, poorly to imperfectly drained soils developed over Granite gneiss. These soils occur on nearly level (0-1%) lower pediplains. The soils of the surface horizon ranges from 14-16cm in thickness, dark yellowish brown in colour, sandy loam to loamy sand in texture with weak to moderate, fine to medium, sub angular blocky structure. These series moderately managed, mostly under scrub/shrub lands and

are susceptible to none to slight water erosion to moderate water erosion.

**Madalapalle:** This series comprises very shallow, fine loamy texture, poorly drained soils developed over Dolerite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope and hillocks/hummocks/subdued hills. The soils of the surface horizon ranges from 6-10cm in thickness, dark reddish brown in colour, clay loam in texture with weak, fine, granular to sub angular blocky structure. These series are poorly managed, mostly under deciduous forest (Single storey veg) and are susceptible to moderate water erosion.

**Madugupalle:** This series comprises very shallow, loamy skeletal texture, poorly drained soils developed over Dolerite. These soils occur on steep to very steep (25-50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 6-10cm in thickness, dark brown in colour, gravelly clay loam in texture with weak, fine, granular to sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands are susceptible to moderate water erosion.

**Malyavantham:** This series comprises moderately deep, loamy skeletal textured, moderately well to well drained soils developed over Granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 12-13cm in thickness, strong brown to reddish brown in colour, clay loam in texture with weak, fine, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to moderate water erosion.

**Mamillipalle:** This series comprises shallow, loamy textured, excessively drained soils developed over Granite gneiss. These soils occur on steep to very steep (25-50%) undifferentiated hill side slope and hill escarpments/cliffs. The soils of the surface

horizon ranges from 12-16cm in thickness, yellowish red to dark brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Manesamudram:** This series comprises very deep, fine loamy textured, moderately well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0-3%) alluvial plains. The soils of the surface horizon ranges from 11-15cm in thickness, yellowish brown to dark grayish brown in colour, sandy loam in texture with weak, fine, granular to sub angular blocky structure. These series are well managed, mostly under agriculture and are susceptible to none to slight water erosion.

**Marumu:** This series comprises very deep, fine textured, moderately well drained soils developed over Granite gneiss. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 12-14% in thickness, dark brown to very dark grayish brown in colour, clay in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**Marutlacheruvu:** This series comprises shallow, loamy skeletal textured, well drained soils developed over granite gneiss. These soils occur on moderately sloping to strongly sloping (5-15%) hillocks/hummocks/subdued hill and pediments. The soils of the surface horizon ranges from 14-16cm in thickness, light yellowish brown to dark yellowish brown in colour, loamy sand in texture with weak, fine, sub angular blocky structure. These series are moderately managed, mostly under

scrub/shrub lands and are susceptible to moderate water erosion.

**Mudiguppa:** This series comprises shallow, loamy textured, moderately well drained soils developed over Gneiss and Granite gneiss. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains and lower pediplains. The soils of the surface horizon ranges from 18-20cm in thickness strong loam in colour, sandy loam in texture with weak to moderate, fine, sub angular blocky structure. These series are moderately managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Mugattimanapalle:** This series comprises deep, fine textured, moderately well to well drained soil developed over Dolerite. These soils occur on nearly level to very gently sloping (0-3%) upper pediplains. The soils of the surface horizon ranges from 10-14cm in thickness, yellowish red to dark reddish brown in colour, clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

**Mutrukota:** This series comprises shallow, loamy textured, moderately well drained soils developed over Dolerite. These soils occur on gently sloping to moderately sloping (3-10%) upper pediplains. The soils of the surface horizon ranges from 10-14cm in thickness, brown to dark brown in colour, sandy clay loam in texture with weak, fine, granular to sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to moderate water erosion.

**Mutssukota:** This series comprises shallow, loamy textured, poorly drained soils developed over Shale. These soils occur on moderately sloping to strongly sloping (5-15%) pediments. The soils of the surface

horizon ranges from 7-10cm in thickness, strong brown in colour, sandy loam in texture with weak, fine, granular structure. This series are unmanaged, mostly under scrub/shrub lands and are susceptible to moderate water erosion. Narsapuram: This series comprises shallow, loamy textured, well drained soils developed over Granite gneiss. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hill side slope and hillocks/hummocks/subdued hill. The soils of the surface horizon ranges from 18-22cm in thickness, strong brown to yellowish red in colour, sandy loam in texture with weak to moderate, fine to medium, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible to moderate water erosion.

Nashinpalle: This series comprises shallow, loamy textured, well drained soils developed over Granite gneiss. These soils occur on gently sloping to moderately sloping (3-10%) pediments and upper pediplains. The soils of the surface horizon ranges from 11-12cm in thickness, reddish brown to dark reddish brown in colour, sandy loam in texture with weak, fine sub angular blocky structure. These series are moderately managed mostly under unculturable waste lands and are susceptible to moderate water erosion to severe water erosion.

Paddacpalli: This series comprises moderately deep, clayey texture, moderately well drained soils developed over Schist. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 15-20cm in thickness, dark brown to very dark grayish brown in colour, clay in texture, with moderate, medium sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to non to slight water erosion to moderate water erosion.

Poguru: This series comprises very deep, coarse loamy textured, moderately well to well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0-3%) Alluvial plains and Stream banks. The soils of the surface horizon ranges from 16-20cm in thickness, brown in colour, sandy loam in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under single crop cultivation and are susceptible to none to slight water erosion to moderate water erosion.

Ramgiri: This series comprises moderately deep, loamy skeletal textured, moderately well drained soils, developed over Sand stone and Schist. These soils occur on gently sloping to moderately sloping (3-10%) Plateau plains/Hill tops/Mesa and upper pediplains. The soils of the surface horizon ranges from 10-11cm in thickness, dark reddish brown in colour, sandy loam in texture with weak, fine, sub angular blocky structure. This series are moderately managed, mostly under grass land/pasture and are susceptible to moderate water erosion to severe water erosion.

Regudi: This series comprises very deep, fine textured, moderately well drained soils developed over Schist. These soils occur on very gently sloping (1-3%) upper pediplains and Plateau plains/Hill tops/Mesa. The soils of the surface horizon ranges form 15-16cm in thickness, dark brown to very dark grayish brown in colour, clay in texture with moderate, medium, sub angular blocky structure. This series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

Siparam: This series comprises shallow, loamy skeletal textured, well drained soils developed over Schist. These soils occur on moderately steep (15-25%) undifferentiated hill side slope. The soils of the surface

horizon ranges from 11-13cm in thickness, dark reddish brown in colour, sandy loam in texture with weak, fine, granular to sub angular blocky structure. These series are moderately managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion.

**Somedapalli:** This series comprises very deep, sandy textured, excessively drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0-3%) Alluvial plains and Stream banks. The soils of the surface horizon ranges from 18-20cm in thickness, yellowish brown to dark yellowish brown in colour, sandy loam in texture with structure less to weak, fine, single grain structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion.

**Tadimiri:** This series comprises very shallow, loamy textured, moderately well to well drained soils developed over Quartzite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hill side slope and Hillocks/Hummocks/Subdued hills. The soils of the surface horizon ranges from 8-10cm in thickness, dusky red to dark reddish brown in colour, gravelly clay loam in texture with weak, fine, sub angular blocky structure. These series are unmanaged, mostly under deciduous forest (Single storey veg) and are susceptible to moderate water erosion.

**Tadpatri:** This series comprises deep, fine loamy textured, moderately well to well drained soils developed over Quartzite. These soils occur on very gently sloping (1-3%) narrow hill valleys and Plateau plains/Hill tops/Mesa. The soils of the surface horizon ranges from 12-16cm in thickness, dark grayish brown to very dark

grayish brown in colour, sandy clay loam in texture with moderate to strong, medium, sun angular blocky structure. These series are moderately managed, mostly under single crop cultivation (RF/Single crop) and are susceptible to none to slight water erosion.

**Talaricheruvu:** This series comprises shallow, loamy textured, well drained soils developed over Quartzite. These soils occur on very gently sloping (1-3%) Plateau plains/Hill tops/Mesa. The soils of the surface horizon ranges from 10-11cm in thickness, yellowish brown to strong brown in colour, sandy loam in texture with weak to moderate, fine to medium, sub angular blocky structure. These series are unmanaged, mostly under scrub/shrub lands and are susceptible to none to slight water erosion to moderate water erosion.

**Timmapuram:** This series comprises very deep, fine textured, moderately well drained soils developed over Dolerite. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 14-18cm in thickness, dark grayish brown to very dark grayish brown in colour, clay loam in texture, with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under agriculture and are susceptible to none to slight water erosion to moderate water erosion.

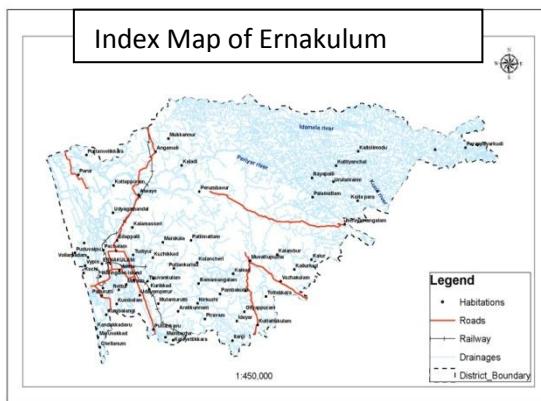
**Virapuram:** This series comprises shallow, loamy textured, moderately well drained soils developed over Shale. These soils occur on very gently sloping (1-3%) upper pediplains. The soils of the surface horizon ranges from 17-20cm in thickness, dark yellowish brown in colour, sandy clay loam in texture with moderate, medium, sub angular blocky structure. These series are moderately managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion.

S. No.	Land scape class	Land Capability Class
1.	Alluvium	II, III
2.	Dolerite	II,III,VI,VII
3.	Granite Gneiss	II,III,IV,VI,VII
4.	Lime Stone	III,IV
5.	Quartzite	III,VI,VII
6.	Schist	II,IV,VII
7.	Shale	II,III,IV,VII

### **Report No. SRM-12-Inventory of Soil & Land Resource of Ernakulam District, Kerala State Using Remote Sensing Techniques.**

The report covers an area of 307331ha of Ernakulum District of Kerala State. The survey area lies between 76°12' to 76°46' East longitude and 9°42'38" to 10°18'00" North latitude covered by Survey of India toposheets no. 58B/4,7,8,11,12, 15,16;58C/1, 5, 9, 13 and 58F/3,4 on 1:50,000 scale.

The surveyed area is bounded by 30kms of coastal belt of Arabian Sea on the West, Kottayam and Alappuzha district on the

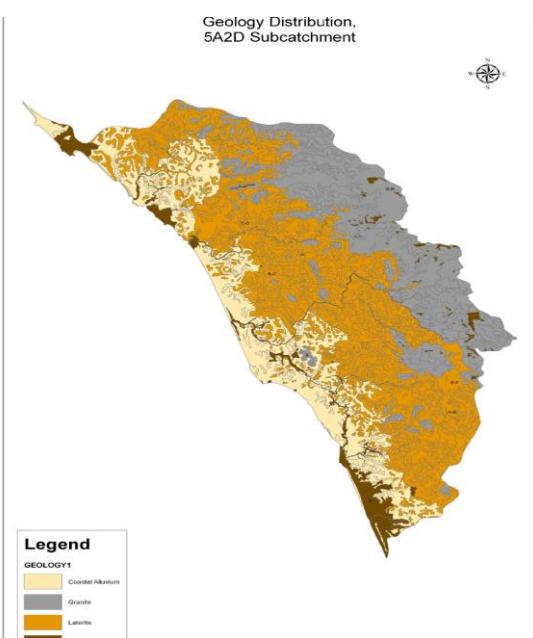


South, Idukki on the East and Thrissur on the North. Physiographically, the survey area divided into three natural divisions-High land,Middle land and Low land. The low

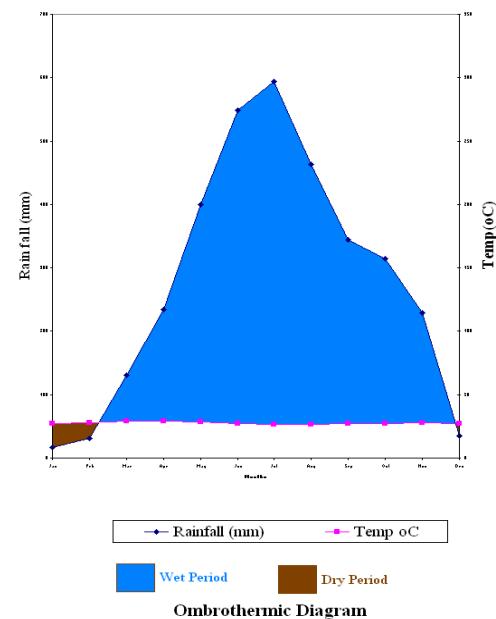
land i.e. Coastal Alluvium division includes the entire Paravoor and Kochi Taluk and the Western part of Kanayannur taluk. Aluva, Muvattupuzha, Kothamangalam and the Eastern portion of the Kanayannur taluk come under the mid land region. The major part of the kunnathunadu taluk is in the mid land region and the remaining portion is in the high land region. The district is drained by the Periyar and its tributaries on the North and Muvattupuzha river on the South. Periyar, the longest river in the State originates from the cardamom hills of the Western Ghats and enters the district at Nerialmangalam and near Bhuthathankettu, it is joined by major tributaries. At Aluva the river bifurcates into two branches, which in turn branches into several distributaries before draining into Lakshadweep Sea. The survey is divided into following physiographic units viz. Hill side slope, undifferentiated hill side slopes, Pediments, Upper pedi plain, Lower pediplain and sub dendritic to dentritic in the Central and Eastern part of the survey area while it is parallel to sub parallel in the Western part near the Sea coast.

Geologically, two distinct litho units are discernible in the area. The Eastern part is occupied by hard rock's representing pre Cambrian metamorphosed rocks while the coastal track in the West is covered by soft rocks or the unconsolidated Coastal Alluvium. Major part of the district is occupied by Charnockite and Migmatite groups of rocks of precambrian age. Charnockite, gneiss, laterite and coastal

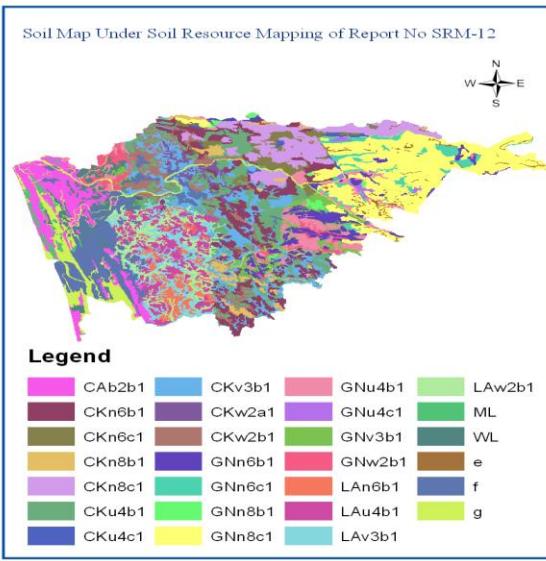
alluvium are the four major geologies found in the district.



Climatically, the survey area falls in the Agro-climatic zone and has a wet monsoon type of climate. The district experience heavy rainfall during South West monsoon season followed by North East monsoon. The annual rainfall ranges from 2863mm to 4080mm at different places of the district. The district received on an average 3341mm of rainfall annually. The mean monthly maximum temperature ranges from 29.9°C to 35.7°C and a minimum temperature ranges from 20.3°C to 23.9°C. The humidity ranges from 86% to 93% during morning hours and 64% to 87% during evening house. The Difference between the mean summer and mean winter temperature is <2°C thus the soils temperature regime of the area is assumed to be Isohyperthermic.



The survey area is dominated by deep to very deep soils. The soils of the area are derived from the weathered products of Charnockite, Gneiss, Laterite and also from Coastal Alluvium. Based on solum thickness these soils are grouped into three depth categories very deep, deep to very deep and shallow to moderately deep. In the survey area, the maximum area about 72% is under deep to very deep red soils. Deep to very deep red soils are derived from weathered products of Charnockite, Gneiss and Laterite. These soils occur in all the physiographic positions and in all the slope ranges. Mostly red soils are found in cultivation area. They are localized in occurrence and found mostly in North East and South East parts of the survey area. The variety of crops such as Pineapple, Vegetables, Banana and Tapioca etc. are grown. The texture of hill soil is loam to clay loam, with average gravel percentage of 5-10%.



Agriculture, plantation, forest, waterbodies, built up lands, marshy land and mangroves are major land use/land cover categories identified in the surveyed area. Homestead farming which is typic of Kerala condition where House, Cattle shed, Kitchen garden, open well as well as mixed plantation with multi-tier cropping such as Coconut, Areca Nut, Pepper, Pineapple etc. are established within the land holding is, in major part of the survey area. Coconut is the principal crop followed by Rubber, Paddy and Tapiocao. The pattern of agriculture land use shows that agricultural area of the district is mainly concentrated in the central and some of the up land region of the district. The pattern also reveals that the concentration pattern of agricultural land use is also influenced by location of waterbodies.

Thirty two soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description of individual are as follows:

**Aaramile:** This series comprises very deep, fine loamy textured, moderately well drained soil developed over Gneiss. These soil occur on gently sloping to moderately sloping (3-10% ) pediments. The soils of the surface horizon ranges from 10-12cm in thickness, brown in colour, sandy clay loam in texture

with weak, medium, sub angular blocky structure. These series are mostly under plantation (Teak, Bamboo, Casuarina etc.) Moderately managed and are susceptible to moderate water erosion.

**Askaranadu:** This series comprises moderately deep, fine loamy texture, moderately well drained soils developed over Laterite. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 5-8cm in thickness, brown in colour, sandy clay loam in texture with weak, medium, sub angular, blocky structure. This series are mostly under orchards (Coconut, Citrus, Mango&Areca nut) well managed and are susceptible to moderate water erosion.

**Bhutattankattu:** This series comprises very deep, fine textured, moderately well drained soil developed over Gneiss. These soil occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 9-13cm in thickness, dark yellowish brown in colour, sandy clay loam in texture with weak, medium, sub angular blocky structure. These series are mostly under forest (Teak, Bamboo etc.) Moderately managed and are susceptible to none to slight water erosion.

**Chandrapra:** This series comprises deep, fine textured, moderately well drained soils developed over Charnockite. These soil occur on moderately sloping to strongly sloping (5-15% ) pediments. The soils of the surface horizon ranges from 8-11cm in thickness, brown in colour, sandy loam in texture with weak, fine to medium, crub to sub angular blocky structure. These series are mostly under estate (Rubber, Cashew etc.) moderately well managed and are susceptible to moderate water erosion.

**Eastmaradi:** This series comprises deep, fine textured, moderately well drained soils developed over Gneiss. These soils occur on steep to very steep (25-50%) undifferentiated hill side slopes. The soils of the surface horizon ranges from 11-13cm in thickness,

brown in colour, sandy clay loam in texture with weak, medium, sub angular blocky structure. These series are mostly under estates (Rubber, Cashew) moderately managed and are susceptible to moderate water erosion.

**Kaladi:** This series comprises very deep, fine texture, moderately well drained soils developed over Charnokite. These soils occur on steep to very steep (25-50) undifferentiated hill side slopes. The soils of the surface horizon ranges from 9-14cm in thickness brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate (Rubber, Cashew) poorly to moderately managed and are susceptible to moderate water erosion.

**Kannimangalam:** This series comprises deep, fine loamy texture, moderately well drained, soils developed over Charnokite. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 5-7cm in thickness, dark grayish brown in colour, sandy loam in texture with weak to moderate, fine to medium, crumb to sub angular blocky structure. This series are mostly under deciduous forest (double storey vegetable) moderately managed to well managed and are susceptible to non to slight water erosion.

**Kizhiillam:** This series comprises deep, fine texture, moderately well drained, soils developed over Charnokite. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 9-11cm in thickness, brown in colour, sandy loam in texture with weak to moderate, medium, sub angular blocky structure. This series are mostly under estates (Rubber & Cashew) moderately managed and are susceptible to moderate water erosion.

**Kochal:** This series comprises very deep, coarse loamy texture, well drained soils developed over Coastal Alluvium. These soils occur on nearly level (0-3%) to very gently sloping. The soils of the surface horizon ranges from 9-13cm in thickness, brown in colour, sand in texture with weak, fine, crumb to angular structure. This series are mostly under orchards (Coconut, Mango & Arecanut) unmanaged to poorly managed and are susceptible to moderate water erosion.

**Kolancheri:** This series comprises deep, very fine texture, moderately well drained soils developed over Laterite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 7-10cm in thickness, reddish brown in colour, clay in texture with moderate, medium, sub angular, blocky structure. This series are mostly under orchards (Coconut, Mango & Arecanut) moderately managed to well managed and are susceptible to moderate water erosion.

**Kothamangalam:** This series comprises very deep, fine loamy textured, well drained soils developed over gneiss. These soils occur on steep to very steep (25-50%) undifferentiated hills side slopes. The soils of the surface horizon ranges from 7-10cm in thickness brown in colour, sandy loam in texture with weak, fine, granular to sub angular blocky structure. This series are mostly under deciduous forest (Double Storey veg) moderately managed and are susceptible to moderate water erosion.

**Manjapra:** This series comprises very deep, fine textured, moderately well drained soils developed over Charnockite. These soils occur on nearly level to very gently sloping (0-3%) upper pediplains. The soil of the surface horizon ranges from 9-13cm in

thickness, brown in colour, sandy clay in texture with weak to moderate, fine, sub angular blocky structure. This series are mostly under orchards (Coconut, Mango & Arecanut) well managed and are susceptible to moderate water erosion.

**Mulavur:** This series comprises very deep, fine textured, moderately well drained soils developed over gneiss. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 6-8cm in thickness, brown in colour, sandy clay loam in texture with weak, fine to medium, sub angular, blocky structure. This series are mostly under estates (Rubber & Cashew) moderately managed to well managed and are susceptible to moderate water erosion.

**Muvattupuzha:** This series comprises very deep, fine textured, moderately well drained soils developed over gneiss. These soils occur on steep to very steep (25-50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 5-7cm in thickness, brown in colour, sandy clay loam in texture with weak, fine to medium, sub angular, blocky structure. This series are mostly under estates (Rubber & Cashew) moderately managed to well managed and are susceptible to moderate water erosion.

**Nerimangalam:** This series comprises very deep, coarse loamy textured, well drained soils developed over gneiss. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 8-10cm in thickness, brown in colour, sandy loam in texture with weak, fine, crumb to granular structure. This series are mostly under deciduous forest (Double Storey veg) moderately to well managed and are susceptible to moderate water erosion.

**Pambakuda:** This series comprises deep, fine textured, moderately well drained soils

developed over Charnockite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 5-7cm in thickness, brown in colour, sandy clay in texture with weak to moderate, medium to subangular blocky structure. This series are mostly under estates (Rubber & Cashew) moderately managed and are susceptible to moderate water erosion.

**Panjasheri:** This series comprises deep, fine textured, moderately well drained soils developed over Laterite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 5-7cm in thickness, reddish brown in colour, clay in texture with moderate, medium, sub-angular blocky structure. This series are mostly under orchards (Coconut, Citrus, Mango, Areca nut) moderately to well managed and are susceptible to moderate water erosion.

**Parakkadavu:** This series comprises deep, fine textured, moderately well drained soils developed over Laterite. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 5-7cm in thickness, brown in colour, sandy clay in texture with weak to moderate, medium, sub-angular blocky structure. This series are mostly under estates (Rubber & Cashew) well managed and are susceptible to moderate water erosion.

**Pattimattom:** This series comprises deep, fine textured, moderately well drained, soil developed over laterite. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 5-7cm in thickness, brown in colour, sandy clay texture with deep to moderate, medium, sub angular blocky structure. These series are mostly under estates (rubber & cashew) well managed and are susceptible to non to slight water erosion.

**Pattukua:** This series comprises deep, fine texture, moderately well drained soils developed over Charnockite. These soils occur on very gently sloping to gently sloping (1-5%) lower pediplains. The soils of the surface horizon ranges from 9-12cm in thickness, reddish brown in colour, sandy clay in texture with moderate, medium, sub angular blocky structure. These series are mostly under multiple crop cultivation (IR/Multi crop) moderately to well managed and are susceptible to moderate water erosion.

**Pulluvazhi:** This series comprises deep, fine loamy texture, moderately well drained soils developed over Charnockite. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 6-8cm in thickness, brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate (Rubber &Cashew) well managed and are susceptible to moderate water erosion.

**Puthrukka:** This series comprises moderately deep, fine texture, moderately well drained, soil developed over laterite. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 9-11cm in thickness, reddish brown in colour, clay in texture with moderate, medium, sub angular blocky structure. These series are mostly under estate(Rubber& Cashew) well managed and are susceptible to moderate water erosion.

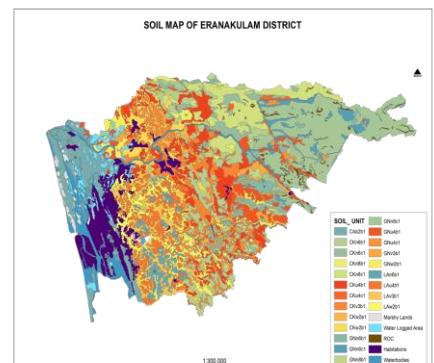
**Ramamangalam:** This series comprises deep, fine textured, moderately well drained soils developed over Charnockite. These soils occur on steep to very steep (25-50%) undifferentiated hills side slope. The soils of the surface horizon from 6-8cm in thickness upper pediplains. The soils of the surface horizon ranges from 7-9cm in thickness,

brown in colour, sandy clay in texture, with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate(Rubber&Cashew) and are susceptible to moderate water erosion.

**Randampuzha:** This series comprises very deep, fine loamy textured, moderately well drained soils developed over Charnockite. These soils occur on strongly sloping to moderately steep (10-25%) undifferentiated hill side slope. The soils of the surface horizon ranges from 14-17cm in thickness, very dark gray in colour, sandy loamy in texture with weak, fine, crumb to granular structure. These series are mostly under deciduous forest (Single storey veg) moderately managed and are susceptible to moderate water erosion.

**Sreemulanagaram:** This series comprises very deep, fine loamy textured, moderately well drained soils developed over Charnockite. These soils occur on nearly level to very gently sloping (0-3%) lower pediplains. The soils of the surface horizon ranges from 9-12cm in thickness brown in colour, sandy loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate (Rubber &Cashew) moderately managed and are susceptible to moderate water erosion.

**Tekkumaradi:** This series comprises deep, fine textured, moderately well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1-5%)



colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate( Rubber &Cashew) moderately to well managed and are susceptible to moderate water erosion.

Vadakkemaradi: This series comprises deep, fine loamy textured, moderately well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 8-10cm in thickness, brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under estate(Rubber & Cashew) moderately to well managed and are susceptible to moderate water erosion.

Vadattupara: This series comprises very deep, fine loamy textured, moderately well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The soils of the surface horizon ranges from 10-11cm in thickness, dark grayish brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular blocky structure. These series are mostly under orchards (Coconut, Mango &Arecanut) moderately managed and are susceptible to non to slight water erosion to moderate water erosion.

Varapuzha: This series comprises very deep, coarse loamy textured, well drained soils developed over Coastal Alluvium. These soils occur on nearly level (0-3%) to very gently sloping. The soils of the surface horizon ranges from 8-10cm in thickness, dark grayish brown in colour, sandy in texture with weak, fine, crumb structure. These series are mostly under orchards (Coconut, Mango & Arecanut) unmanaged to

poorly managed and are susceptible to non to slight water erosion to moderate water erosion.

Vazhakkulam: This series comprises very deep, fine loamy textured, moderately well drained, soils developed over Charnockite. These soils occur on gently sloping to moderately sloping (3-10%) pediments. The Soils of the surface horizon ranges from 5-7cm in thickness, brown in colour, sandy clay loam in texture with weak to moderate, medium, sub angular, blocky structure. These series are mostly under estate (Rubber & Cashew) moderately managed and are susceptible to moderate water erosion.

Vengola: This series comprises deep, fine textured, moderately well drained soils, development over laterite. These soils occur on very gently sloping to gently sloping (1-5%) lower pediplains. The soils of the surface horizon ranges from 7-9cm in thickness, reddish brown in colour, sandy clay loam in texture, with weak to moderate, medium, sub angular blocky structure. these series are mostly under orchards (Coconut, Mango &Arecanut) moderately to well managed and are susceptible to non to slight water erosion.

Vengur: This series comprises very deep, fine textured, moderately well drained soils developed over Charnockite. These soils occur on very gently sloping to gently sloping (1-5%) lower pediplains. The soils of the surface horizon ranges from 15-19cm in thickness , reddish brown in colour, sandy clay loam in texture with moderate, medium, sub angular blocky structure. These series are mostly under multiple crop cultivation (IR/Multi crop), moderately to well managed and are susceptible to non to slight water erosion.

*Interpretative grouping of soils*

S. No.	Soil Mapping Unit	Landscape class	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Hydrologic Soil Group
1.	CAb2b1	Coastal alluvium	III	C	3	A
2.	CKn6b1	Charnockite	V	D	3	D
3.	CKn6c1	Charnockite	-	-	-	-
4.	CKn8b1	Charnockite	VI	D	4	D
5.	CKn8c1	Charnockite	-	-	-	-
6.	CKu4b1	Charnockite	II	B	2	C
7.	CKu4c1	Charnockite	-	-	-	-
8.	CKv3b1	Charnockite	II	B	2	B
9.	CKw2a1	Charnockite	II	B	2	B
10.	CKw2b1	Charnockite	II	B	2	B
11.	GNn6b1	Gneiss	V	D	3	C
12.	GNn6c1	Gneiss	-	-	-	-
13.	GNn8b1	Gneiss	VI	D	4	C
14.	GNn8c1	Gneiss	-	-	-	-
15.	GNu4b1	Gneiss	II	B	2	C
16.	GNu4c1	Gneiss	II	B	2	C
17.	GNv3b1	Gneiss	II	B	2	B
18.	GNw2b1	Gneiss	II	B	2	B
19.	LAn6b1	Laterite	IV	D	4	D
20.	LAu4b1	Laterite	III	C	3	C
21.	LAv3b1	Laterite	II	B	2	B
22.	LAw2b1	Laterite	II	B	2	B

**Report No. SRM-13-Inventory of Soil & Land Resources of Palakkad District of Kerala State Using Remote Sensing Techniques.**

The report covers an area of 447660 ha of Palakkad District of Kerala. The survey area lies between 76°02' to 76°54' East longitude and 10°21' to 11°14' North latitude covered by Survey of India toposheets no. 58A/8, 12, 16 and 58B/1,2,5,6,7,9,10,11,13,14,15

on 1:50,000 scale. The surveyed area is bounded by high hills of the Nilgiris in the north and north-east and somewhat subdued hills and spurs of the western ghat in the east and south-east, which separate it from the Coimbatore district of Tamil Nadu. In the South and the South West it is bounded

partly by high hills and partly by the river Karapara separating it from the Trichur district of Kendra and in the West and North West it is bounding partly by low ridges of laterites and partly by Pulantod river separating it from the Mallapuram district also of Kerala State.

Physiographically, the district is highly hilly and undulating in the major part i.e. 60-65% and closely associated with the Nilgiri hills and the Southern Sahyadris which are highly hilly, undulating and dissected mountain ranges. Remaining area which is about 35-40% has somewhat subdued topography. The surveyed area looked upon as a mid up land dissected plain be part higher elevation than the adjoining coastal plains. In general the elevation of the district ranges between

20meter above mean sea level in the west central portion and about 1500 meter above mean sea level on the Nilgiris and southern Sahyadris in the east, although several peaks of higher elevation are also met with over the area. The Palakkad district can be divided into following major physiographic units viz.:- Hill side slope, Foot hill slope, Pediments, Upper pediplain, Lower pediplain.

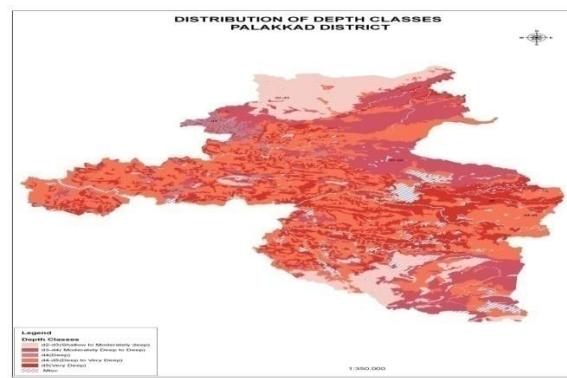
Geologically, the survey area is broadly divided into six geology/landscape i.e. Charnockite- This group has dominant in the western and some part of northern side of the district. Gneiss This landscape formed by complex of Hornblende- Biotite gneiss, Garnet- Biotite gneiss, Quartz Feldspathic gneiss, Garnet-sillimanite gneiss and dominant in central and eastern part of the district. Granite Gneiss-It is found in a strip in west to east of north central part of the area. Schist- This landscape found in a Wynad group that is represented by rocks of upper Amphibolite to lower Granulite facies metamorphism. This type of geology has exposed in the northern side of the area. Laterite- It formed over Gneiss landscape and found in north-western part of the area. Alluvium-This landscape formed by alluvium material of the different geological complex that's moved by Bharathapuzha river and found in western side of the district.

The surveyed area falls in the Agro-climatic zones. The area has wet monsoon type of climate. The district experiences heavy rainfall during southwest monsoon season followed by northeast monsoon. The annual rainfall ranges from 1997.1 to 2607.2 mm at different places of the district. The district receives on an average 2302 mm rainfall annually. The mean monthly maximum temperature ranges are from 29.3 to 35.9 °C and the minimum ranges are from 20.7 to 24.7 °C. The difference between the mean summer and mean winter temperature

is < 2.2°C. The soil temperature regime of the area is "Isohyperthermic".

The survey area is dominated by deep to very deep soils. The soils of the area are derived from the weathered products of Gneiss, Charnokite, Granite Gneiss, Schist, Laterite and Alluvium. Based on solum thickness these soils are grouped into four depth categories (1) Very deep (more than 100 cm.) (2) Deep to very deep (50-100 cm) and (3) Shallow to moderately deep (25-50 cm), (4) Very shallow to shallow (10-25 cm). In the survey area, a maximum of 172101 ha (38.4%) is under deep to very deep soils. Deep to very deep red soils are derived from weathered products of Gneiss, Charnockite, Granite gneiss and Laterite. These soils occur in all the physiographic positions and in all the slope ranges. Mostly red soils are found in cultivation area. They are localized in occurrence and found mostly in central to western part of the survey area.

The major land use/ land cover categories identified within the study area are: Agriculture, plantation, Forest, Water bodies,



Built-up lands or habitation, Scrub land and waste land. Homestead Farming which is typical of Kerala condition where house, Cattle shed, Kitchen garden, Open well as well as field crops i.e. Paddy, Cotton, and Groundnut; mixed plantation with multi-tier cropping such as Coconut, Areca nut, Banana, Papaya, Pepper, Pineapple, Cashew etc. are established within the land holding is common in major part of the district.

Whereas Tea, Coffee and Cardamom are grown in estate farming in hilly terrain area of south eastern part of the district. Paddy and coconut is the principal crop followed by Rubber, Areca nut, Mango etc. Under this system only one crop can be taken in a year. After harvest suitable varieties pulses are grown in the fields which are more profitable. Activities allied to agriculture such as dairy and poultry play an important role in the economy of the district.

Paddy is the major crop of area and grown in all seasons (Autumn, Winter and Summer) in lowland as well as some part of high land area in contour farming and other field crops i.e. Cotton, Groundnut, Sugarcane, some vegetables etc. grown in rainy season.

Fifty seven soil series have been identified and mapped in the surveyed area on the basis of soil morphological and physic chemical properties. A brief description of individual are as follows:

**Amakkavu:** Amakkavu series comprises deep, clayey skeletal textured, moderately well to well drained soils developed over Laterite. These soils occur on very gently sloping to gently sloping (1-5%) upper pediplains. The soils of the surface horizon ranges from 11 to 15 cm in thickness, red to Dark red in colour, gravelly clay to Gravelly clay loam in texture with weak to moderate, fine, subangular blocky structure. The thickness of the subsurface horizons varies from 60 to 75 cm, colour varies from red to Dark red, texture ranges from gravelly clay to Gravelly clay loam with weak to moderate, fine, subangular blocky structure. Amakkavu series are unmanaged to poorly managed, mostly under Orchards (Coconut, Citrus, Mango & Areca nut) and are susceptible to moderate water erosion.

**Anakkal:** Anakkal series comprises deep, clayey skeletal textured, moderately well to well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) foot hill slopes and pediments. The soils of the surface

horizon ranges from 8 to 12 cm in thickness, dark brown in colour, sandy clay loam to gravelly Sandy Clay in texture with weak to moderate, fine, subangular blocky structure. The thickness of the subsurface horizons varies from 67 to 79 cm; colour varies from dark brown, texture ranges from gravelly sandy clay loam to gravelly sandy clay with weak to moderate, fine, subangular blocky structure. Anakkal series are poorly managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Ananganadi:** Ananganadi series comprises shallow, loamy skeletal textured, excessively drained soils developed over Charnockite. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 8 to 11 cm in thickness, Dark brown in colour, gravelly sandy loam to Sandy Loam in texture with weak, fine to medium, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 7 to 11 cm; colour varies from Dark brown, texture ranges from gravelly sandy loam to sandy loam with weak, fine to medium, granular to subangular blocky structure. Ananganadi series are well managed, mostly under Scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Anjumurtimangalam:** This series comprises very deep, fine loamy textured, poorly to imperfectly drained soils developed over Charnockite. These soils occur on nearly level to Very gently sloping (0 - 3%) lower pediplains. The soils of the surface horizon ranges from 9 to 13 cm in thickness, dark yellowish brown in colour, clay to clay loam in texture with moderate to weak, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from dark yellowish brown, texture ranges from clay to Clay Loam with

moderate to weak, medium, subangular blocky structure. Anjumurtimangalam series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Attappad:** This series comprises moderately deep, loamy skeletal textured, excessively drained soils developed over Granite gneiss. These soils occur on steep to very steep (25-50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 16 cm in thickness, dark brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 19 to 30 cm; colour varies from dark brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, fine, granular to subangular blocky structure. Attappad series are well managed, mostly under Scrub/shrub lands and are susceptible to severe water erosion.

**Ayalur-1:** This series comprises moderately deep, fine loamy textured, well to excessively drained soils developed over Charnockite. These soils occur on steep to Very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 9 to 13 cm in thickness, dark reddish brown in colour, sandy loam to Sandy Clay Loam in texture with weak to moderate, medium, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 27 to 33 cm, colour varies from dark reddish brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, granular to subangular blocky structure. Ayalur-1 series are well managed, mostly under Deciduous forest (Double Story Veg) and are susceptible to moderate water erosion to severe water erosion.

**Bhutivali:** This series comprises deep, loamy

skeletal textured, excessively drained soils developed over Schist. These soils occur on steep to very steep (25-50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 10 to 13 cm in thickness, strong brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, medium to fine, subangular blocky structure. The thickness of the subsurface horizons varies from 47 to 65 cm, colour varies from Strong brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, medium to fine, subangular blocky structure. Bhutivali series are well managed, mostly under deciduous forest (single story veg) and are susceptible to moderate water erosion to severe water erosion.

**Chembra:** This series comprises moderately deep, loamy skeletal textured, moderately well to well drained soils developed over Charnockite. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 8 to 12 cm in thickness, Yellowish red in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 23 to 32 cm, colour varies from Yellowish red, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, fine, crumb to subangular blocky structure. Chembra series are moderately managed, mostly under orchards (Coconut, Citrus, Mango& Areca nut) and are susceptible to moderate water erosion to severe water erosion.

**Chuduvalattur:** This series comprises Very deep, fine loamy textured, moderately well drained soils developed over Charnockite. These soils occur on nearly level to Very gently sloping (0 -3%) lower pediplains. The soils of the surface horizon ranges from 12 to 16 cm in thickness, Brownish yellow to yellowish brown in colour, sandy loam to

sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from Brownish yellow to yellowish brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, subangular blocky structure. Chuduvalattur series are unmanaged, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion to moderate water erosion.

**Chulanur:** This series comprises deep, fine loamy textured, moderately well to well drained soils developed over Gneiss. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 9 to 12 cm in thickness, Brown to dark brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 69 to 83 cm, colour varies from Brown to dark brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, subangular blocky structure. Chulanur series are moderately managed to well managed, mostly under deciduous forest (double story vegetation.) and are susceptible to moderate water erosion.

**Chullimada:** This series comprises shallow, loamy skeletal textured, well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 5 to 9 cm in thickness, yellowish red to reddish brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 10 to 13 cm, colour varies from yellowish red to reddish brown, texture ranges from gravelly sandy loam to gravelly

sandy clay loam with weak to moderate, medium, subangular blocky structure. Chullimada series are poorly managed to moderately managed, mostly under Scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Chullisseri:** This series comprises deep, fine textured, moderately well to well drained soils developed over Granite gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 8 to 14 cm in thickness, reddish brown in colour, sandy loam to sandy clay loam in texture with weak, fine to medium, subangular blocky structure. The thickness of the subsurface horizons varies from 60 to 71 cm, colour varies from reddish brown, texture ranges from sandy loam to sandy clay loam with weak, fine to medium, subangular blocky structure. Chullisseri series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion to severe water erosion.

**Chulliyamkulam:** This series comprises very deep, fine textured, well drained soils developed over Gneiss. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 16 cm in thickness, Brown in colour, sandy clay to clay in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from brown, texture ranges from sandy clay to clay with weak to moderate, medium, subangular blocky structure. Chulliyamkulam series are well managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Edathanathukara:** This series comprises deep, clayey skeletal textured, moderately

well to well drained soils developed over Laterite. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 9 to 13 cm in thickness, reddish brown in colour, gravelly clay loam to gravelly clay in texture with weak, medium to fine, subangular blocky to crumb structure. The thickness of the subsurface horizons varies from 53 to 72 cm, colour varies from reddish brown, texture ranges from gravelly clay loam to gravelly clay with weak, medium to fine, subangular blocky to crumb structure. Edathanathukara series are moderately managed to well managed, mostly under Estates (Tea, Coffee, Rubber) and are susceptible to moderate water erosion.

**Elambulasseri:** This series comprises moderately deep, clayey skeletal textured, well to excessively drained soils developed over Granite gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 8 to 11 cm in thickness, brown to dark brown in colour, gravelly sandy clay loam to gravelly clay in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 22 to 33 cm, colour varies from brown to dark brown, texture ranges from gravelly sandy clay loam to Gravelly clay with weak, fine, crumb to subangular blocky structure. Elambulasseri series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Erimayur:** This series comprises very deep, fine textured, moderately well to well drained soils developed over Charnockite. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 9 to 15 cm in thickness, yellowish red to reddish brown in colour, sandy clay loam to clay loam in texture with weak to moderate, medium to

fine, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from yellowish red to reddish brown, texture ranges from sandy clay loam to clay loam with weak to moderate, medium to fine, subangular blocky structure. Erimayur series are poorly managed, mostly under orchards (Coconut, Citrus, Mango&Arecanut) and are susceptible to moderate water erosion.

**Inchikkunnu:** This series comprises deep, coarse loamy textured, excessively drained soils developed over Granite gneiss. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 15 cm in thickness, dark brown in colour, sandy loam to sandy clay loam in texture with weak, fine to very fine, granular to crumb structure. The thickness of the subsurface horizons varies from 60 to 75 cm; colour varies from dark brown, texture ranges from sandy loam to sandy clay loam with weak, fine to very fine, granular to crumb structure. Inchikkunnu series are moderately managed to well managed, mostly under Orchards (Coconut, Citrus, Mango &Arecanut) and are susceptible to severe water erosion.

**Irumbamutti:** This series comprises very deep, clayey skeletal textured, excessively drained soils developed over Granite gneiss. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 13 to 18 cm in thickness, dark reddish brown in colour, gravelly sandy clay loam to gravelly clay in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from dark reddish brown, texture ranges from gravelly sandy clay loam to Gravelly clay with weak, fine, crumb to subangular blocky structure. Irumbamutti series are well managed, mostly under Estates (Tea, Coffee &Rubber) and are susceptible to moderate water erosion to

severe water erosion.

**Kaliyod:** This series comprises deep, fine loamy textured, moderately well drained soils developed over Granite gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 9 to 13 cm in thickness, dark brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 49 to 60 cm; colour varies from dark brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, fine, granular to subangular blocky structure. Kaliyod series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee& Rubber) and are susceptible to moderate water erosion.

**Kalkalam:** This series comprises very deep, coarse loamy textured, moderately well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 9 to 13 cm in thickness, yellowish brown to dark yellowish brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm colour varies from yellowish brown to dark yellowish brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, subangular blocky structure. Kalkalam series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Kallikkad:** This series comprises deep, fine loamy textured, well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon

ranges from 8 to 12 cm in thickness, brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 58 to 69 cm, colour varies from brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak to moderate, medium, subangular blocky structure. Kallikkad series are poorly managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion.

**Kalmukkiyur:** This series comprises moderately deep, coarse loamy textured, well drained soils developed over Schist. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soil of the surface horizon ranges from 8 to 13 cm in thickness, yellowish brown to dark yellowish

brown in colour, loamy sand to sandy loam in texture with weak, medium, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 24 to 31 cm; colour varies from yellowish brown to dark yellowish brown, texture ranges from loamy sand to sandy loam with weak, medium, granular to subangular blocky structure. Kalmukkiyur series are moderately managed to well managed, mostly under scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

**Kandalam:** This series comprises moderately deep, fine textured, moderately well drained soils developed over Charnockite. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 8 to 12 cm in thickness, dark reddish brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, medium, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 25 to 31 cm; colour

varies from dark reddish brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, medium, crumb to subangular blocky structure. Kandalam series are moderately managed to well managed, mostly under deciduous forest (double story vegetation) and are susceptible to moderate water erosion.

**Karakkurussi:** This series comprises moderately deep, clayey textured, excessively drained soils developed over Laterite. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 15 cm in thickness, dark reddish brown in colour, sandy clay loam to clay in texture with weak, medium, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 26 to 31 cm, colour varies from dark reddish brown, texture ranges from sandy clay loam to clay with weak, medium, crumb to subangular blocky structure. Karakkurussi series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion to severe water erosion.

**Kayiliyad:** This series comprises very deep, clayey skeletal textured, moderately well to well drained soils developed over Charnockite. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 12 to 17 cm in thickness, brown to dark brown in colour, gravelly clay loam to gravelly clay in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons >100 cm colour varies from brown to dark brown, texture ranges from gravelly clay loam to gravelly clay with weak, fine, crumb to subangular blocky structure. Kayiliyad series are moderately managed to well managed, mostly under Estates (Tea, Coffee, Rubber) and are susceptible to moderate water

erosion.

**Kinasseri:** This series comprises very deep, fine loamy textured, imperfectly to poorly drained soils developed over Gneiss. These soils occur on nearly level to very gently sloping (0 - 3%) lower pediplains. The soils of the surface horizon ranges from 10 to 13 cm in thickness, dark yellowish brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from dark yellowish brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, subangular blocky structure. Kinasseri series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Kottayi:** This series comprises very deep, fine textured, poorly drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0 - 3%) stream banks. The soils of the surface horizon ranges from 10 to 15 cm in thickness, very pale brown to light yellowish brown in colour, sandy loam to sandy clay loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from very pale brown to light yellowish brown, texture ranges from sandy loam to sandy clay loam with weak, fine, granular to subangular blocky structure. Kottayi series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Kulakkad:** This series comprises deep, fine textured, well to excessively drained soils developed over Charnockite. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from

12 to 16 cm in thickness, brown in colour, clay loam to Clay in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 69 to 78 cm, colour varies from brown, texture ranges from clay loam to clay with weak to moderate, medium, subangular blocky structure. Kulakkad series are moderately managed to well managed, mostly under Scrub/shrub lands and are susceptible to moderate water erosion to severe water erosion.

Kulapalli: This series comprises moderately deep, clayey textured, moderately well to well drained soils developed over Charnockite. These soils occur on gently sloping to moderately sloping (3 - 10%) foot hill slopes. The soils of the surface horizon ranges from 10 to 13 cm in thickness, brown to dark brown in colour, sandy clay loam to sandy clay in texture with weak, fine to medium, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 19 to 28 cm, colour varies from brown to dark brown, texture ranges from sandy clay loam to sandy clay with weak, fine to medium, crumb to subangular blocky structure. Kulapalli series are moderately managed to well managed, mostly under Deciduous forest (Double Story Vegetation) and are susceptible to moderate water erosion to severe water erosion.

Kulikkiyad: This series comprises very deep, fine textured, moderately well drained soils developed over Granite gneiss. These soils

occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 14 to 18 cm in thickness, reddish brown to dark reddish brown in colour, sandy loam to sandy clay loam in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from reddish brown to dark reddish brown, texture ranges from sandy loam to

sandy clay loam with weak, fine, crumb to subangular blocky structure. Kulikkiyad series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

Kumbamala: This series comprises moderately deep, loamy textured, excessively drained soils developed over Gneiss. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 12 to 16 cm in thickness, very dark grayish brown to very dark gray in colour, sandy loam to gravelly Sandy Loam in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 17 to 20 cm; colour varies from very dark grayish brown to very dark gray, texture ranges from sandy loam to gravelly sandy loam with weak, fine, crumb to subangular blocky structure. Kumbamala series are moderately managed to well managed, mostly under deciduous forest (Single Story Vegetation) and are susceptible to severe water erosion.

Kundur: This series comprises very deep, loamy skeletal textured, well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 9 to 13 cm in thickness, brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak to moderate, medium, subangular blocky structure. Kundur series are poorly managed to moderately managed, mostly under orchards (Coconut, Citrus, Mango & Areca nut) and are susceptible to moderate water erosion.

**Kunpulli:** This series comprises moderately deep, fine loamy textured, well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 7 to 11 cm in thickness, brown to dark brown in colour, sandy loam to sandy clay loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 24 to 34 cm, colour varies from brown to dark brown, texture ranges from sandy loam to sandy clay loam with weak, fine, granular to subangular blocky structure. Kunpulli series are moderately managed, mostly under deciduous forest (Double Story Vegetation) and are susceptible to moderate water erosion.

**Malampuzha:** This series comprises deep, loamy skeletal textured, well to excessively drained soils developed over Gneiss. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 10 to 15 cm in thickness, dark brown to very dark gray in colour, gravelly sandy loam, in texture with weak, very fine to fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 49 to 60 cm, colour varies from dark brown to very dark gray, texture ranges from gravelly sandy loam, with weak, very fine to fine, crumb to subangular blocky structure. Malampuzha series are moderately managed to well managed, mostly under scrub/shrub lands and are susceptible to severe water erosion.

**Mandur:** This series comprises very deep, fine textured, moderately well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 10 to 13 cm in thickness, reddish brown in colour, gravelly sandy clay loam to gravelly clay loam in texture with weak, fine to medium, subangular blocky structure. The thickness of the subsurface

horizons >100 cm, colour varies from reddish brown, texture ranges from gravelly sandy clay loam to gravelly clay loam with weak, fine to medium, subangular blocky structure. Mandur series are poorly managed to moderately managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Mangalam:** This series comprises deep, fine textured, poorly drained soils developed over Charnockite. These soils occur on nearly level to very gently sloping (0 - 3%) lower pediplains. The soils of the surface horizon ranges from 10 to 14 cm in thickness, yellowish brown in colour, sandy loam to sandy clay loam in texture with weak, fine to medium, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 50 to 59 cm; colour varies from yellowish brown, texture ranges from sandy loam to sandy clay loam with weak, fine to medium, granular to subangular blocky structure. Mangalam series are unmanaged, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion to moderate water erosion.

**Mannangod:** This series comprises deep, fine textured, excessively drained soils developed over Charnockite. These soils occur on steep to very steep (25 - 50%) undifferentiated hills side slope. The soils of the surface horizon ranges from 12 to 16 cm in thickness, yellowish red to reddish brown in colour, gravelly sandy clay loam to sandy clay in

texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 49 to 64 cm, colour varies from yellowish red to reddish brown, texture ranges from gravelly sandy clay loam to sandy clay with weak, fine, crumb to subangular blocky structure. Mannangod series are moderately managed to well managed, mostly under Scrub/shrub lands and are susceptible to moderate water

erosion to severe water erosion.

**Mannur:** This series comprises very deep, fine textured, well drained soils developed over Gneiss. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 16 cm in thickness, reddish brown in colour, gravelly clay loam to gravelly clay in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from reddish brown, texture ranges from gravelly clay loam to gravelly clay with weak to moderate, medium, subangular blocky structure. Mannur series are moderately managed to well managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Mattattukkad:** This series comprises very deep, fine textured, moderately well to well drained soils developed over Schist. These soils occur on very gently sloping to gently sloping (1 - 5%) narrow hill valleys. The soils of the surface horizon ranges from 9 to 14 cm in thickness, Yellowish red to reddish brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from yellowish red to reddish brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak to moderate, medium, subangular blocky structure. Mattattukkad series are poorly managed to moderately managed, mostly under Orchards (Coconut, Citrus, Mango & Arecanut) and are susceptible to moderate water erosion.

**Muppankulam:** This series comprises deep, fine textured, moderately well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 9 to 13 cm in thickness,

yellowish brown to dark yellowish brown in colour, sandy clay loam to sandy clay in texture with weak, fine to medium, subangular blocky structure. The thickness of the subsurface horizons varies from 71 to 80 cm, colour varies from yellowish brown to dark yellowish brown, texture ranges from sandy clay loam to sandy clay with weak, fine to medium, subangular blocky structure. Muppankulam series are poorly managed to moderately managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Muthikkulam:** This series comprises very deep, fine textured, moderately well to well drained soils developed over Granite gneiss. These soils occur on extremely steep (50 - 100%) undifferentiated hills side slope. The soils of the surface horizon ranges from 11 to 14 cm in thickness, brown in colour, sandy clay loam to sandy clay in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from brown, texture ranges from sandy clay loam to sandy clay with weak, fine, crumb to subangular blocky structure. Muthikkulam series are moderately managed to well managed, mostly under Evergreen Forest (Double Story Vegetation) and are susceptible to moderate water erosion to severe water erosion.

**Nilipara:** This series comprises deep, loamy skeletal textured, moderately well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon range from 8 to 13 cm in thickness, yellowish brown to dark yellowish brown in colour, gravelly loamy sand to gravelly sandy loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 62 to 71 cm colour varies from yellowish brown to dark yellowish brown, texture ranges from gravelly loamy sand to gravelly sandy loam with weak, fine,

granular to subangular blocky structure. Nilipara series are poorly managed, mostly under orchards (Coconut, Citrus, Mango & Arecanut) and are susceptible to moderate water erosion.

**Nochchipulli:** This series comprises moderately deep, loamy skeletal textured, well drained soils developed over Gneiss. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 9 to 13 cm in thickness, dark reddish brown in colour, gravelly sandy clay loam, in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 21 to 27 cm; colour varies from dark reddish brown, texture ranges from gravelly sandy clay loam, with weak, fine, granular to subangular blocky structure. Nnochchipulli series are moderately managed, mostly under forest (Teak, Eucalyptus & Casuarina, etc) and are susceptible to moderate water erosion.

**Pallippadi:** This series comprises moderately deep, clayey skeletal textured, well drained soils developed over Laterite. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 11 to 16 cm in thickness, Reddish brown in colour, gravelly sandy clay loam to Gravelly clay loam in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 20 to 29 cm colour varies from reddish brown, texture ranges from gravelly sandy clay loam to gravelly clay loam with weak, fine, granular to subangular blocky structure. Pallippadi series are poorly managed to moderately managed, mostly under Estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Panayur:** This series comprises deep, clayey skeletal textured, moderately well to well drained soils developed over Laterite. These soils occur on gently sloping to moderately sloping (3 - 10%) foot hill slopes. The soils

of the surface horizon ranges from 10 to 13 cm in thickness, dark reddish brown in colour, gravelly clay loam to gravelly clay in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons varies from 52 to 64 cm; colour varies from dark reddish brown, texture ranges from gravelly clay loam to Gravelly clay with weak, fine, granular to subangular blocky structure. Panayur series are poorly managed to moderately managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Pattambi:** This series comprises very deep, coarse loamy textured, well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0 - 3%) stream banks. The soils of the surface horizon ranges from 8 to 12 cm in thickness, yellowish brown to dark yellowish brown in colour, loamy sand to sandy loam in texture with weak, very fine to fine, granular structure. The thickness of the subsurface horizons >100 cm, colour varies from yellowish brown to dark yellowish brown, texture ranges from loamy sand to sandy loam with weak, very fine to fine, granular structure. Pattambi series are moderately managed, mostly under grasslands/pasture and are susceptible to moderate water erosion.

**Peringode:** This series comprises deep, fine loamy textured, well drained soils developed over Alluvium. These soils occur on nearly level to very gently sloping (0 - 3%) stream

banks. The soils of the surface horizon ranges from 12 to 18 cm in thickness, yellowish brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 58 to 71 cm, colour varies from yellowish brown, and texture ranges from sandy loam to Sandy Clay Loam with weak to moderate, medium, subangular blocky

structure. Peringode series are poorly managed, mostly under multiple crop cultivation (IR/Multi crop) and are susceptible to none to slight water erosion.

**Peringottukurussi:** This series comprises very deep, fine loamy textured, moderately well drained soils developed over Gneiss. These soils occur on nearly level to very gently sloping (0 - 3%) lower pediplains. The soils of the surface horizon ranges from 10 to 13 cm in thickness, yellowish brown to dark yellowish brown in colour, sandy loam to sandy clay loam in texture with weak to moderate, medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from yellowish brown to dark yellowish brown, texture ranges from sandy loam to sandy clay loam with weak to moderate, medium, subangular blocky structure. Peringottukurussi series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi crop) and are susceptible to none to slight water erosion.

**Pombra:** This series comprises moderately deep, fine loamy textured, excessively drained soils developed over Granite gneiss. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 8 to 13 cm in thickness, dark brown in colour, gravelly sandy clay loam to gravelly clay loam in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 22 to 31 cm, colour varies from dark brown, texture ranges from gravelly sandy clay loam to gravelly clay loam with weak, fine, crumb to subangular blocky structure. Pombra series are moderately managed to well managed, mostly under deciduous forest (Single Story Vegetation) and are susceptible to moderate water erosion to severe water erosion.

**Pontiyambaram:** This series comprises very

deep, fine loamy textured, poorly drained soils developed over Granite gneiss. These soils occur on nearly level to very gently sloping (0 - 3%) lower pediplains. The soils of the surface horizon ranges from 11 to 15 cm in thickness, brownish yellow to yellowish brown in colour, sandy clay loam to sandy clay in texture with weak, fine, granular to subangular blocky structure. The thickness of the subsurface horizons >100 cm colour varies from brownish yellow to yellowish brown, texture ranges from sandy clay loam to sandy clay with weak, fine, granular to subangular blocky structure. Pontiyambaram series are poorly managed, mostly under multiple crop cultivation (IR/Multi Crop) and are susceptible to none to slight water erosion.

**Pudur:** This series comprises very deep, fine textured, moderately well drained soils developed over Gneiss. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 10 to 14 cm in thickness, dark brown to very dark grayish brown in colour, clay loam to clay in texture with moderate, medium, angular blocky structure. The thickness of the subsurface horizons >100 cm colour varies from dark brown to very dark grayish brown, texture ranges from clay loam to clay with moderate, medium, angular blocky structure. Pudur series are unmanaged to poorly managed, mostly under multiple crop cultivation (IR/Multi crop) and are susceptible to none to slight water erosion.

**Puttukkarakolumbu:** This series comprises very deep, fine loamy textured, well drained soils developed over Charnockite. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 10 to 13 cm in thickness, reddish brown in colour, clay loam to clay loam in texture with weak, fine, crumb to subangular blocky structure. The thickness of the subsurface

horizons >100 cm, colour varies from reddish brown, texture ranges from clay loam to clay loam with weak, fine, crumb to subangular blocky structure. Puttukkarakolumbu series are moderately managed to well managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Tiruvazhamkunna:** This series comprises deep, clayey skeletal textured, well drained soils developed over Laterite. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 8 to 12 cm in thickness, reddish brown in colour, gravelly clay loam to gravelly clay in texture with weak, fine to medium, subangular blocky structure. The thickness of the subsurface horizons varies from 57 to 70 cm, colour varies from reddish brown, texture ranges from gravelly clay loam to gravelly clay with weak, fine to medium, subangular blocky structure. Tiruvazhamkunna series are moderately managed to well managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Vadakkancheri:** This series comprises very deep, fine loamy textured, moderately well to well drained soils developed over Charnockite. These soils occur on very gently sloping to gently sloping (1 - 5%) upper pediplains. The soils of the surface horizon ranges from 13 to 18 cm in thickness, brown in colour, gravelly clay loam to gravelly clay in texture with moderate, fine to medium, subangular blocky structure. The thickness of the subsurface horizons >100 cm, colour varies from brown, texture ranges from gravelly clay loam to gravelly clay with moderate, fine to medium, subangular blocky structure. Vadakkancheri series are poorly managed to moderately managed, mostly under estates (Tea, Coffee & Rubber) and are susceptible to moderate water erosion.

**Valipparamlat:** This series comprises moderately deep, fine textured, well drained

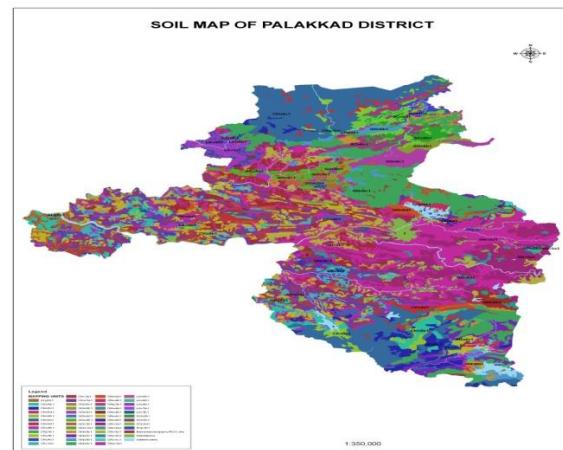
soils developed over Gneiss. These soils occur on strongly sloping to moderately steep (10 - 25%) undifferentiated hills side slope. The soils of the surface horizon ranges from 6 to 9 cm in thickness, reddish brown to dark reddish brown in colour, gravelly sandy loam to gravelly sandy clay loam in texture with weak, medium, subangular blocky structure. The thickness of the subsurface horizons varies from 24 to 33 cm colour varies from reddish brown to dark reddish brown, texture ranges from gravelly sandy loam to gravelly sandy clay loam with weak, medium, subangular blocky structure. Valipparamlat series are moderately managed to well managed, mostly under deciduous forest(Single Story Vegetation) and are susceptible to moderate water erosion.

**Velladikunnu:** This series comprises deep, fine textured, moderately well drained soils developed over Charnockite. These soils occur on gently sloping to moderately sloping (3 - 10%) foot hill slopes. The soils of the surface horizon ranges from 11 to 15 cm in thickness, reddish brown in colour, sandy clay loam to sandy clay in texture with weak to moderate, fine, crumb to subangular blocky structure. The thickness of the subsurface horizons varies from 60 to 74 cm colour varies from reddish brown, texture ranges from sandy clay loam to sandy clay with weak to moderate, fine, crumb to subangular blocky structure. Velladikunnu series are poorly managed to moderately managed, mostly under orchards (Coconut, Citrus, Mango & Areca nut) and are susceptible to moderate water erosion to severe water erosion.

**Vengasseri:** This series comprises very deep, fine textured, moderately well to well drained soils developed over Charnockite. These soils occur on gently sloping to moderately sloping (3 - 10%) pediments. The soils of the surface horizon ranges from 11 to 15 cm in thickness, red to dark red in colour, clay loam to clay in texture with moderate, medium, subangular blocky structure. The

thickness of the subsurface horizons >100 cm, colour varies from red to dark red, texture ranges from clay loam to clay with moderate, medium, subangular blocky structure. Vengasseri series are moderately managed, mostly under orchards (Coconut, Citrus, Mango & Arecanut) and are susceptible to moderate water erosion.

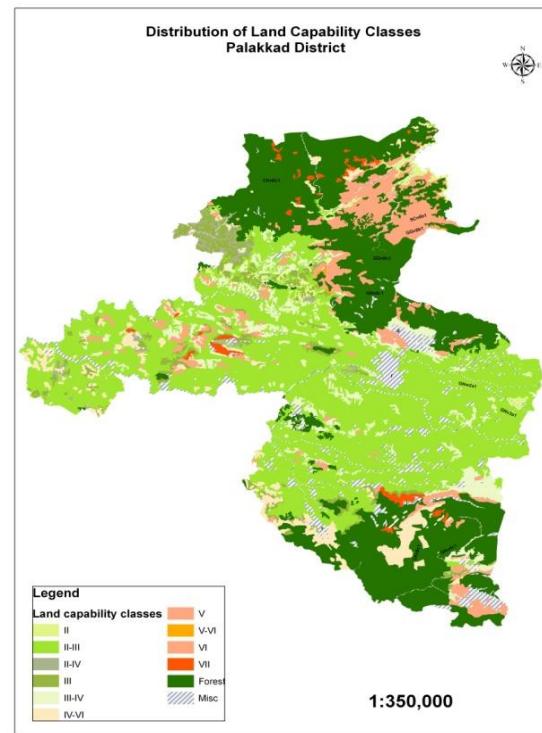
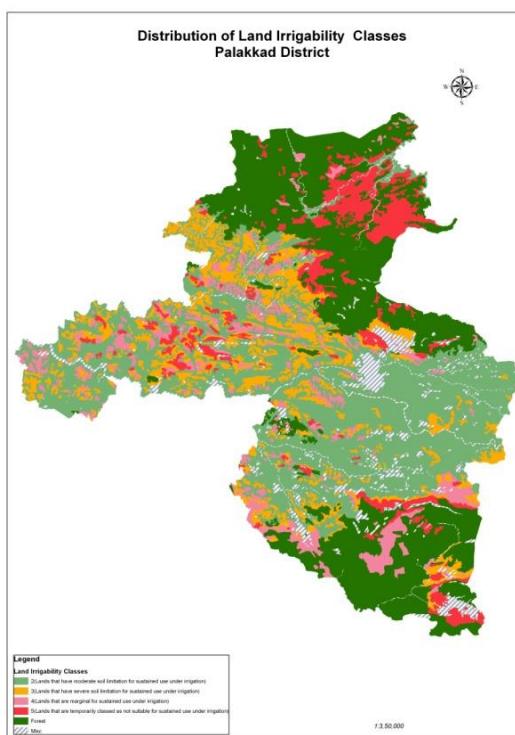
cm, colour varies from red to dark red,



### *Interpretative grouping of soils*

S. No.	Soil Mapping Unit	Land scape class	Land Capability Class	Soil Irrigability Class	Land Irrigability Class	Hydrologic Soil Group
1.	ALg2a1	Alluvium	II-III	B-C	2-3	B-C
2.	CKn6b1	Charnockite	IV-VI	C-E	4-5	B-D
3.	CKn6c1	Charnockite	Forest	-	-	-
4.	CKn6d1	Charnockite	V	E	5	D
5.	CKn8b1	Charnockite	IV-VI	C-E	4-5	B-D
6.	CKn8c1	Charnockite	Forest	-	-	-
7.	CKn8d1	Charnockite	VII	E	5	D
8.	CKo4b1	Charnockite	III	C	3	C
9.	CKp3b1	Charnockite	II-III	B-C	2-3	C
10.	CKu4b1	Charnockite	II-III	B-C	3	C
11.	CKu4c1	Charnockite	Forest	-	-	-
12.	CKv3a1	Charnockite	II-III	B-C	2-3	B-C
13.	CKv3b1	Charnockite	II-III	B-C	2-3	B-C
14.	CKw2a1	Charnockite	II-III	B-C	2-3	B-C
15.	GGn6c1	Granite gneiss	Forest	-	-	-
16.	GGn8b1	Granite gneiss	VI	D	5	E
17.	GGn8c1	Granite gneiss	Forest	-	-	-
18.	GGn8d1	Granite gneiss	V-VI	D	5	D-E
19.	GGu4b1	Granite gneiss	III	B-C	3	C-D
20.	GGv3b1	Granite gneiss	II-III	B-C	3	C
21.	GGw2a1	Granite gneiss	II	B	2-3	B-C
22.	GNn6b1	Gneiss	VI	D	5	E
23.	GNn6c1	Gneiss	Forest	-	-	-
24.	GNn8b1	Gneiss	VI	D	5	E
25.	GNn8c1	Gneiss	Forest	-	-	-

26.	GNn8d1	Gneiss	VI	D	5	E
27.	GNo4b1	Gneiss	III-IV	C	3	D
28.	GNp3b1	Gneiss	II	B	2-3	B-C
29.	GNu4a1	Gneiss	III-IV	C	3-4	D
30.	GNu4b1	Gneiss	III-IV	C	4	D
31.	GNu4c1	Gneiss	Forest	-	-	-
32.	GNu4d1	Gneiss	III-IV	C	4	D
33.	GNv3a1	Gneiss	II-III	B-C	2-3	C
34.	GNv3a2	Gneiss	II	B-C	2	C
35.	GNv3b1	Gneiss	II-III	B-C	3	C
36.	GNv3b2	Gneiss	II	B-C	2	C
37.	GNv3c1	Gneiss	Forest	-	-	-
38.	GNw2a1	Gneiss	II-III	B	2-3	C
39.	LAn6b1	Laterite	IV-VI	B-C	3-5	D
40.	LAo4b1	Laterite	III	B	3	C
41.	LAu4b1	Laterite	III	B	3	C
42.	LAv3a1	Laterite	II-IV	B	2-3	C
43.	LAv3b1	Laterite	II-IV	B	2-3	C
44.	SCn6b1	Schist	V	B	5	D
45.	SCn8c1	Schist	Forest	-	-	-
46.	SCn8d1	Schist	V	B	5	D
47.	SCp3b1	Schist	II	B-C	2	B-C



## **7. Training Imparted**

During this year 2013-14, the following trainings had been organized by the organization for different departments of different state Governments.

### **Training at Central fertilizer Quality Control and Training Institute, Faridabad (21-23th Jan, 2013).**



*Sh. R. B. Sinha, Hon'ble Joint Secretary, Ministry of Agriculture and Dr. Ramesh Kumar, Chief Soil Survey Officer during the inaugural function*

Five days short course training has been conducted during 21-25 January, 2013 at the Institute. It was inaugurated by Sh. R. B. Sinha, Jt. Secretary (NRM), Dept. of Agriculture and Cooperation , Ministry of Agriculture.

The training course was designed exclusively for Haryana State. Twenty two officials from the Department of Agriculture and Forest, State of Haryana participated in the programme. The course module includes theoretical, practical classes and field demonstration covering various aspects of soil and land resources and also the application of advanced technology using Remote Sensing and Geographical Information System.

The programme was concluded on 25<sup>th</sup> by Dr. Ramesh Kumar, Addl. Commissioner (NRM) and Chief Soil Survey Officer, SLUSI with the distribution of course certificates to the trainee officials.

### **Training at Central Soil and Water Conservation research and Training**



*Group photograph of trainee officers, faculty members, guests and SLUSI officers*

### **Institute, Dehradun (19-21, February 2013).**

The programme was inaugurated by Dr. P. K. Mishra, Director, CSSWCRTI in presence of Dr. Ramesh Kumar, Chief Soil Survey Officer, SLUSI on 19<sup>th</sup> Feb., 2013. The training course comprises 15 various theoretical classes, practical demonstration and a field visit to an experimental model watershed of CSWCRTI.

The training was arranged for the officials of Agriculture, Horticulture and Forest departments of Uttrakhand State. Altogether 21 officials of the State working in the various watershed development programmes have attended the course with utmost interest and interaction. An orientation programme was also conducted at Bengaluru Centre for Agricultural Scientist and Postgraduate students of the University of Agricultural Sciences, GKVK, and Bengaluru. On dated 16<sup>th</sup> Jan, 2013 and 1<sup>st</sup> Feb, 2013 in which 43

participants had taken part to acquaint with

soil survey and related activities.

## **8. Research Scholar facilitated by the organization.**

During this year one student of M.Tech (Hydrology) from IIT, Roorkee has been facilitated by the organization with the supply of survey data as required by the student data for research project regarding land use map of Doon valley, Dehradun District.

## **9. Distinguished Visitors**

The following dignitaries visited the soil & Land Use Survey of India office during the year 2012-13. Sh. Siraj Hussain, Additional Secretary, Ministry of Agriculture, Govt. of India

1. Director NBBS & LUB visited SLUSI headquarter Office

2. Dr. Ajay Group Director, SAC and Dr. P.S.Dhindwa, Scientist from SAC visited SLUSI Headquarter

## **10. Training Received by the Officers/Officials**

About 12 officials from Soil and Land Use Survey Organisation received in house training in the field of Soil survey and application of Remote Sensing and GIS in generation of Soil Resource Data inventory for users need.

## **11. Web Services of Soil and Land Use Information.**

Digital database is the key demand in present time. Different user agencies are taking in use the digital data for different development purposes. SLUSI has created digital spatial data base on watersheds soil and land information. It's also to host GIS based Web services for which necessary infrastructure for Information Communication Technology (ICT) has also been created in the organization. The development of digital spatial data base is aimed at GIS applications under G2G domain for online planning by various user agencies for development and



Figure 1: Home page of Web GIS System

planning purposes. Data generated under different type of surveys i.e. RRS, DSS, SRM and LDM has been interlinked with each other. The users may extract spatial and non-Spatial information about the soil and land characteristics for their area of interest.

## 11.1 How to Access

Web based GIS Soil and Land use Information is hosted at NIC GIS server, which is available at <http://gisserver.nic.in/aisluso> to the Government to Government (G2G) services. In order to access these G2G services, users has to register online and inform the same to the SLUSI via e-mail:[csso-slusi@nic.n](mailto:csso-slusi@nic.n) or [slusi-agri@nic.in](mailto:slusi-agri@nic.in). After analysis of the details provided by the user departments, the login and password to excess the data uploaded, will be provided to the user.

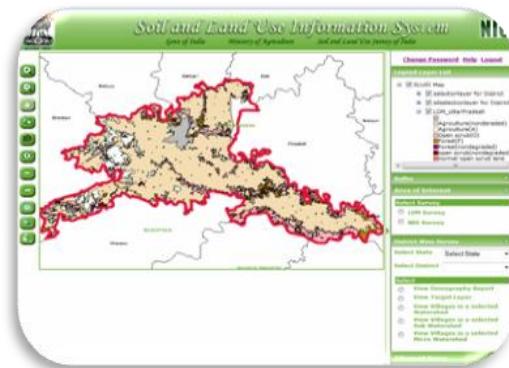


Figure 2: Land use map of Agra District of Uttar Pradesh – a part.

12. Centre wise survey area of jurisdiction with State and RVP/FPR Catchment

CENTERS	STATES(Full/partially)	CATCHMENT NAME(RVP/FPR)
Ahemdabad	Gujarat, Rajasthan, Maharashtra and Dadra Nagar Haveli	<b>RVP Catchment-</b> Dantiwada, Mahi, Damanganga, Narmada and Non-RVP Catchment area.
Bangalore	Karnataka, Tamil Nadu, Kerala and Pondichery	<b>RVP Catchment-</b> Kunda, Nagarjunasagar, Kabini Lower Bhawani, Tungabhadra, Vaigai-Periyer and Non-RVP Catchment area.
Hyderabad	Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra	<b>RVP Catchment-</b> Nagarjunasagar, Nizamsagar, Machkund Sileru, Upper Kolab and Non-RVP Catchment area.
Kolkata	West Bengal, North Eastern States, Orissa and Bihar	<b>RVP Catchment-</b> DVC, Gumti, Kangsabati, Mayurkshi, Pagladia, Rengali Mandira, Indravati, Tista. <b>FPR Catchment-</b> Ajoy, Kosi, Rupnarayan, Singla and Non-RVP/FPR Catchment area.
Nagpur	Maharashtra, Madhya Pradesh, Chhattisgarh, Orissa and Goa	<b>RVP Catchment-</b> Ghod, Hirakud, Tawa, narmada, Pochampad, Ukaian and Non- RVP Catchment area.
Noida	Delhi, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Punjab, Haryana, Himachal Pradesh, Chandigarh (U.T.), Rajasthan and Jammu & Kashmir	<b>RVP Catchment-</b> Beas, Chambal, Mahi, Matailla, Pohru, Ramganga, Sutlej, Thein. <b>FPR Catchment-</b> Banas, Ghaggar, Gomti, Sahibi, Sone, Upper Ganga, Upper Yammuna and Non-RVP/FPR Catchment area.
Ranchi	Bihar, Jharkhand, Orissa, Madhya Pradesh and Uttar Pradesh	<b>RVP Catchment-</b> Indravati, Rengali, Mandira. <b>FPR Catchment-</b> Punpun, Sone and Non-RVP/FPR Catchment area.

## 13. Managerial Position

**Dr. RAMESH KUMAR**

*Chief Soil Survey Officer*

### **Head Quarters**

Dr. T.K. Deb: *Sr. Soil Survey Officer*  
Dr. V. Ranga Rao: *Computer Programmer*  
Sh. R.K. Sharma: *Asstt. Soil Survey Officer*  
Dr. Munish Kumar: *Asstt. Soil Survey officer*

### **Noida Centre, Noida**

Dr. S.P Singh: *Soil Survey Officer*  
Sh. Bhajan Lal: *Asstt. Soil Survey Officer*  
Dr. A.K. Yadav: *Asstt. Soil Chemist*

### **Nagpur Centre, Nagpur**

Sh. Ravinder Kulkarni: *Soil Survey Officer*  
Sh. Pankaj Laghate: *Asstt. Soil Survey Officer*  
Sh. A.W.M. Joseph: *Asstt. Soil Survey Officer*  
Sh. A. Kanketkar: *Cartographic Officer*

### **Kolkata Centre, Kolkata**

Dr. S. Royhowdhury: *Soil Survey Officer*  
Dr. Saumen Saha: *Asstt. Soil Survey Officer*  
Sh. N.S. Gahlod: *Asstt. Soil Survey Officer*

### **Bangalore Centre, Bangalore**

Sh. R.L Meena: *Soil Survey Officer*  
Dr. M.A. Anantkumar: *Asstt. Soil Survey Officer*  
Sh. Y. Surshkumar: *Asstt. Soil Survey Officer*  
Sh. S.A. Dhale: *Asstt. Soil Chemist*  
Sh. V. Venkateshwaran: *Cartographic Officer*

### **Hyderabad Centre, Hyderabad**

Sh. Dinesh Patel: *Soil Survey Officer*

### **Ahemdabad Centre, Ahemdabad**

Sh. Pradeep Jha: *Asstt. Soil Survey officer*

### **Ranchi Centre, Ranchi**

Sh. Mahesh Chand: *Soil Survey Officer*  
Sh. B.S. Chafle: *Asstt. Soil Survey Officer*

