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AN ASSESSMENT OF SOIL RESOURCE OF HISAR DISTRICT USING GEOSPATIAL TECHNOLOGY

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Abstract

Soil and water are the main vital non-renewable natural resources that are the base of all practices monitoring production of agriculture. Over exploitation of land & water resources create substantial changes in the land use which have hostile consequence to the natural environment. As the land resources have been sole resources of sustenance of mankind, the timely mapping, management and monitoring of land resources became a prime requisite for developmental management of natural resources. Latest technologies like Geo-informatics have developed as significant tools in present era for management and monitoring of water and land resources. Thus the novelty of the present research is to access the soil and water resources in Hisar district.

Keywords:

Remote Sensing;
GIS;
Satellite Data;
Soil Resources;
Resources Management.

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1. Introduction

Hisar, one of the important and largest agriculturally potential districts of Haryana has wide variation in soils, landforms and land degradation-desertification, wind erosion, water logging, salinity, alkalinity and soil fertility. The potential production of soil differs with its fertile capacity and intrinsic limitation. It is a dynamic living system formed from combined effects of climate, vegetation, soil, flora & fauna and tie on rocks and parent material. Its proper husbandry is essential for both continued agriculture productivity and prevention of soil degradation. There has been a steady and continuous degradation of agriculture land due to soil erosion and depletion of nutrient and consequent loss of soil efficiency.

2. Study Area

The location of the district is 28°53'45" to 29°49'15" North latitude and 7475°13'15" to 76°18'15" East longitude having 3983 square kilometres area. It has surrounded by Fatehabad and Jind districts of Haryana in north east and north respectively. Eastern side shares boundary with Rohtak district while southern side share boundary with Bhiwani district of Haryana. Western side of the district shares boundary with Hanumangarh district of Rajasthan State. The annual rainfall in the district is 307.7 mm (average). It usually increases towards south west to north east direction. The location map of Hisar district is displayed in Figure-1.

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3. Database & Methodology

For the completion of any research work data and methodology are required to fulfil the research complete. Therefore different kinds of data were used. The data used in present study discussed below.

Data used

Data related to soil series were collected from Haryana Space Applications Centre, Hisar with their physical and chemical properties. Toposheets of Survey of India (44O/7,8,11,12,14,15,16, 44P/9,13 and 53C/3,4) were used for defining locations of villages, transport network, cultural features, canal network and demarcation of major & minor towns/ cities. Climatic data, published literature, maps and reports were collected, consulted and used pertinent.

Software used:

Arc GIS Desktop 9.3, Microsoft office 2007.

Methodology:

The study is mainly concerned to access the soil resources with their physical and chemical properties in Hisar district of Haryana. An extensive use of GIS and remote sensing software's (Arc GIS, ERDAS Imagine) will be used for analysing the spatial distribution of soil resource was taken up for study. GIS techniques will be used in order to create different layers of different chemical and physical properties of soil resources.

Figure 1. *Location Map of Study Area*

4. Results & Analysis

Different physical and chemical properties of soil resources are discussed below.

Soil Series

Eleven soil series have been observed in the district and soils are classified according to Soil Taxonomy as given in Figure 2. Description of various soil series with respective area, physiographic unit, taxonomy and soil series important characteristics is displayed in Table 1. Soil description as family wise is presented in Figure 3 and soil sub group distribution is presented in Figure 4 respectively.

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Table-1

Soil Series	**Physiography**	**Soil Taxonomy**	**Important Characteristics**	Area in sq. km.
Bas	Nearly level to very gentle sloping alluvial plain	Fine Loamy, Fluventic Haplustepts	Mixed non calcareous hyperthermic, deep, moderately well drained, medium to high AWC, few fine iron concretions, very potential for agriculture and good permeability.	55.24
Bichpari	Gentle to moderately sloping interdunal aeolian plain	Coarse Loamy, Typic Ustipsamments	Mixed non calcareous hyperthermic, deep, well drained, medium to high AWC, moderate to high permeability and low fertile soil.	394.95
Dabra	Nearly level alluvial plain	Fine Loamy, Typic Haplustepts	Mixed calcareous hyperthermic, deep, Imperfectly drained, very high AWC, very low permeability, slightly sodic/ saline soil and potential for agriculture.	333.68
Dhingasra	Nearly level fluvio-aeolian plain	Coarse Loamy, Nitric Haplustepts	Mixed calcareous hyperthermic, deep, well drained, medium AWC, good permeability, moderately sodic/ saline soil and potential for agriculture but need some reclamation measures.	714.39
Fatehpuri	Nearly level alluvial plain	Fine Loamy, Typic Haplustepts	Mixed calcareous hyperthermic, deep, moderately well drained, medium AWC, good permeability, slightly light texture soil and potential for agriculture.	389.38
Gangwa	Nearly level plain over fluvio – aeolian plains	Coarse Loamy, Typic Haplustepts	Mixed calcareous hyperthermic, deep, well drained, medium AWC, good permeability, moderately sodic/ saline soil and potential for agriculture but need some reclamation measures.	50.77
Jaundli Khurd	Very gentle sloping interdunal aeolian plain	Coarse Loamy, Typic Ustifluvents	Mixed calcareous hyperthermic, deep, well drained, high AWC, good permeability, slightly waterlogging/ flooding and undulating topography.	410.57
Kanala	Nearly level alluvial plain	Fine Loamy, Typic Haplustepts	Mixed calcareous hyperthermic, deep, moderately well drained, medium to high AWC, good permeability, slightly heavy texture soil and potential for agriculture.	53.05
Kharia	Gently sloping aeolian plain with stabilised and interdunal plains	Sandy, Typic Ustipsamments	Mixed non calcareous hyperthermic, deep, excessively drained, very low AWC, high permeability, sandy texture soil and low fertility.	259.08
Niyana	Nearly level alluvial plain	Fine, Aeric Halaquents	Mixed calcareous hyperthermic, deep, poorly drained, very high AWC, low permeability, heavy texture soil, moderately saline /sodic soil and waterlogging.	63.68
Ratia	Very gentle sloping recent flood plains	Fine Loamy, Fluventic Haplustepts	Mixed calcareous hyperthermic, deep, well drained, medium AWC, good permeability, slightly and very potential for agriculture.	1298.27
Habitation	-	-	-	146.52
Waterbody	-	-	-	0.93
Total				4170.51

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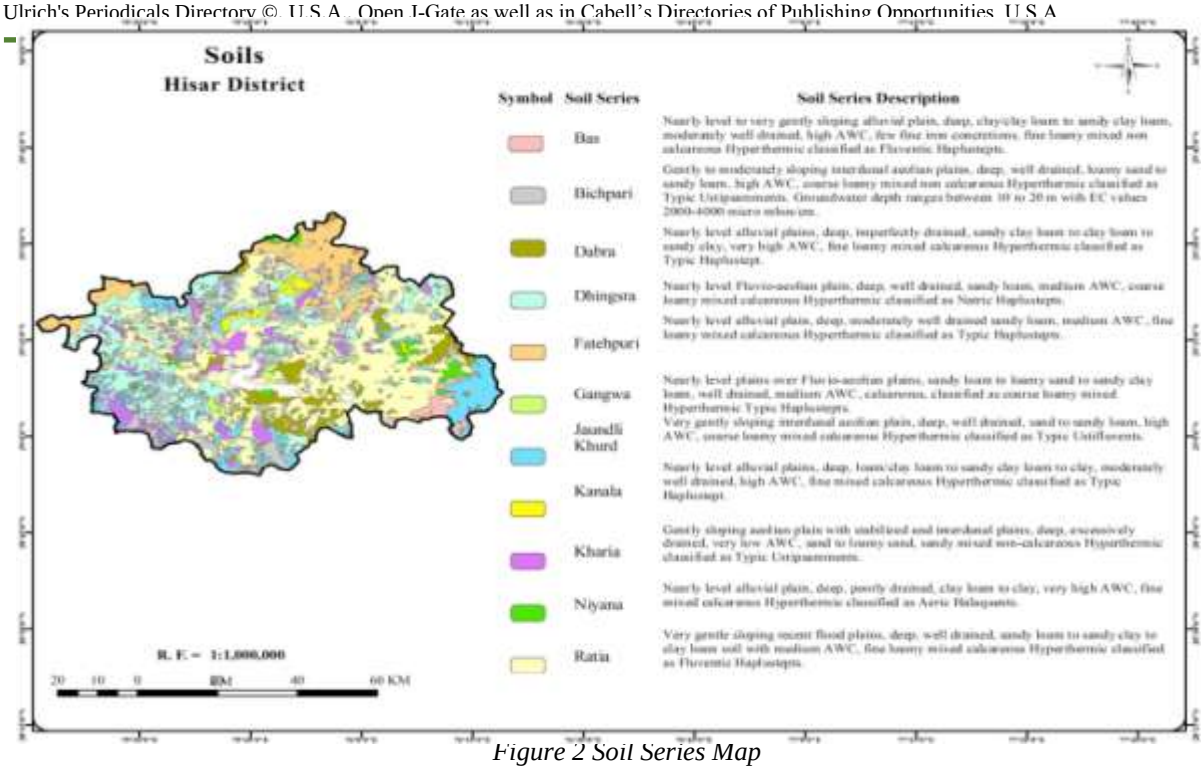

Figure 2 Soil Series Map

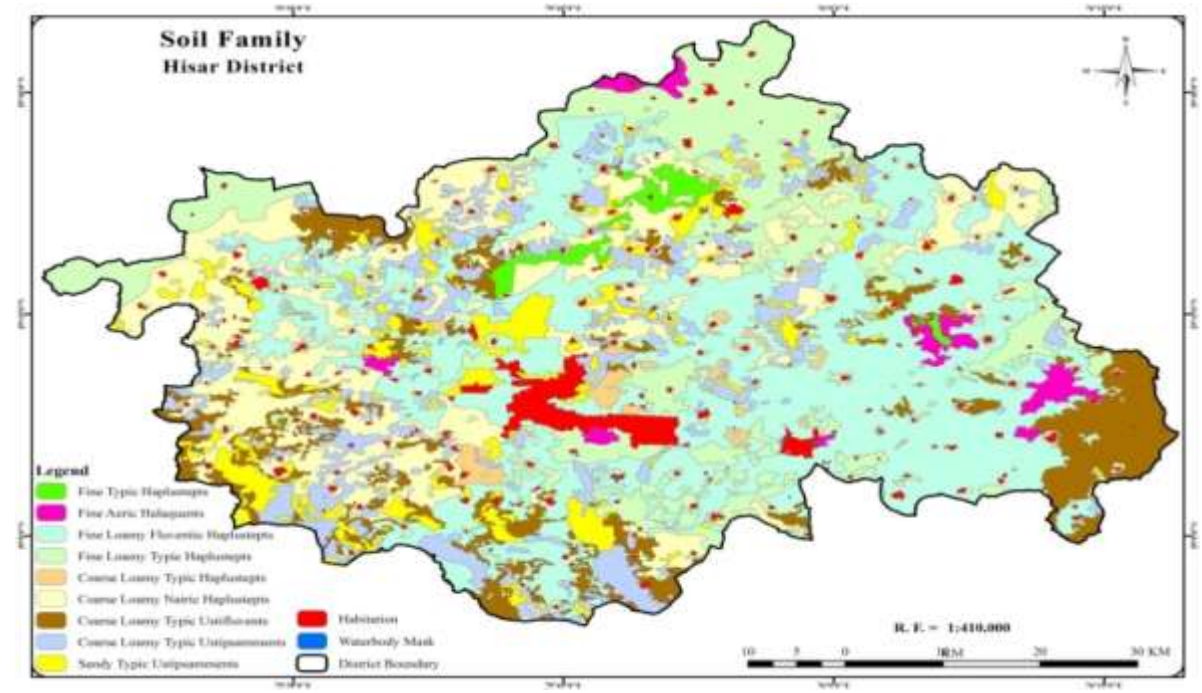

Figure 3 Soil family Map

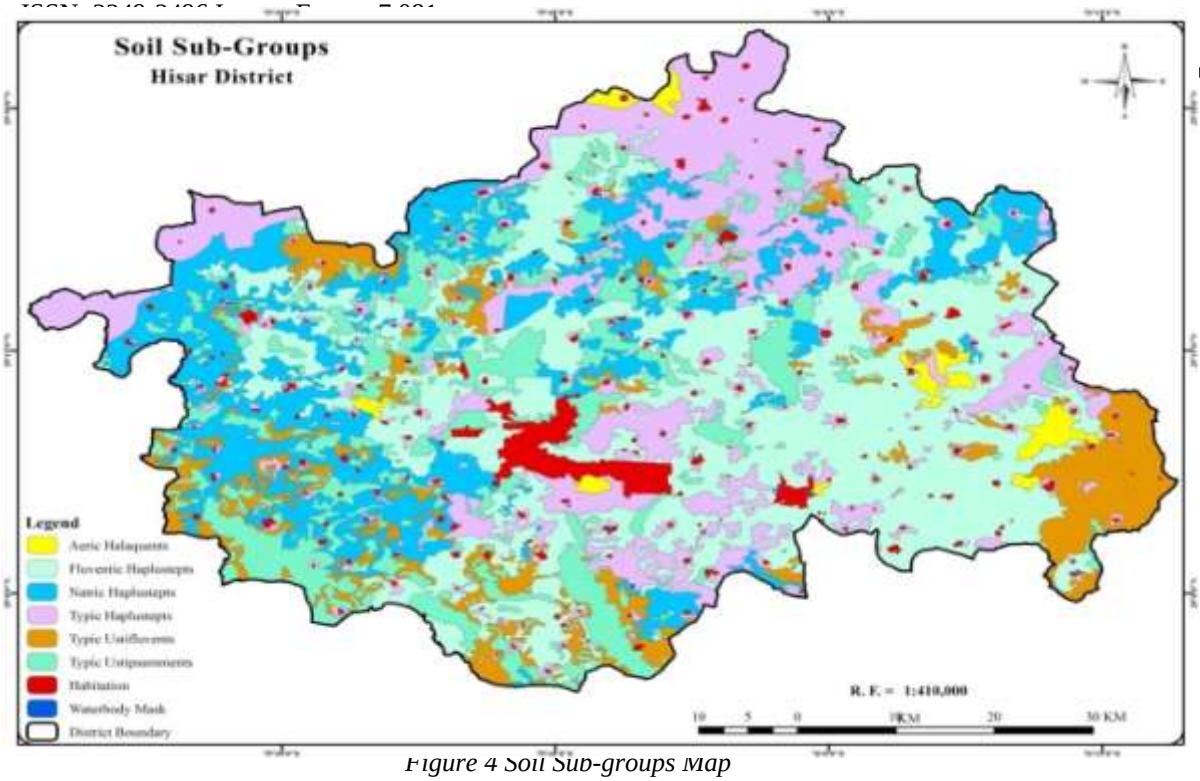

Figure 4 Soil Sub-groups Map

Soil Texture

Soil texture explains soil characteristic that is base of crop production and ground executive. Texture based class of a soil is decided by the percentage of clay, sand and silt. It was found that various soil texture family classes like Coarse loamy, Fine loamy, Fine and Sandy are present in the district. Fine loamy class covers 2076.56 square kilometers area that is 49.794 % of the district. Mainly this class is found in eastern part of the study area in Narnaund, Uklana, Hansi-I, Hansi-II and Hisar-I blocks. Second largest class is coarse loamy that covers 1570.67 square kilometers area which is 37.66 % of the district. This class is dispersed in western part of the study area in Adampur, Hisar-II and Agroha blocks. Spatial distribution of soil texture is displayed in Figure 5 and area under different classes of soil texture is presented in Table 2.

Table 2 Texture wise soil classification and their respective area

Soil Texture Type	Area in sq. km.	Percentage to total Geographical Area
Fine	116.74	2.80
Coarse Loamy	1570.67	37.66
Fine Loamy	2076.56	49.79
Sandy	259.08	6.21
Habitation	146.53	3.51
Waterbody Mask	0.93	0.02
Total	4170.51	100.00

Soil Drainage

The natural processes by which water move through out or across the soil due to gravity. Soil drainage can define which types of tree and plant develop best in any region. Poor drainage pattern that is mainly found in water-logged areas could often be recognized by examining the soil texture or colour. It dominated by longer ages of saturation and reducing conditions. 2868.94 square kilometers km area of the study area is under well drained class which was 68.79 % of the study area. This class occurs mainly in whole study area. Other main class is moderately well drained that cover 497.67 square kilometres area and mostly lies in Uklana block of the study area. Detailed information regarding area and spatial arrangement are presented in Table3 and Figure 6.

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Table 3 Area under different class of Soil Drainage

Soil drainage type	Area in sq. km.	Percentage to total Geographical Area
Poorly Drained	63.68	1.53
Imperfectly Drained	333.68	8.00
Excessively Drained	259.08	6.21
Moderately Well Drained	497.67	11.93
Well Drained	2868.94	68.79
Waterbody Mask	0.93	0.02
Habitation	146.52	3.51
Total	4170.51	100.00

Available Water Holding Capacity of Different Soils

The soils capacity of water holding is very significant agronomic property. Soils which hold substantial amounts of water are fewer subject to escape sufferers of nutrients or soil applied insecticides. This is fact that due to a sandy loam textured soils with imperfect holding of water volume achieved the saturation point much earlier than a the clay loamy textures soil with high water holding capacity. Soils are saturated with the entire of the surplus water and few of the pesticides and nutrients that are leached downward in the soil profile through the process of solution. 2452.81 square kilometers area of the study area has medium water holding capacity soil that was 58.81 percent of the total geographical area of the district. This class covers maximum area of the district. Second largest class is high AWC class that covering 913.80 square kilometres area and distributed in scattered patches in whole study area. Area under various class of soil water holding capacity is presented in Table4 and displayed in Figure 7.

Table4 Area under different class of soil water holding capacity

AWC Class	Area in sq. km.	Percentage to total Geographical Area
Very high	397.83	9.54
High	913.80	21.91
Medium	2452.81	58.81
Very low	259.08	6.21
Habitation	146.06	3.50
Waterbody Mask	0.93	0.02
Total	4170.51	100.00

4. Conclusions

The main objective of present study is to generate maps for different chemical and physical properties of soil resources for the study area. These thematic maps of soil resource have taken into attention present-day technology, resources potential along with terrain and climatic parameters. It is concluded that existing soil resource utilization and management is not sustainable. These thematic maps were analyzed in term of resources potential and limitations individually and jointly. The potentials benefit of soil resource assessment in the form of increased production of food grains and agricultural production. The increased fodder production and correspondingly production of livestock products. This resources mapping and management will improve over all environmental conditions of area in form of saving the land from degradation, improve the soil fertility increasing the area under irrigation and reducing the impact of drought.

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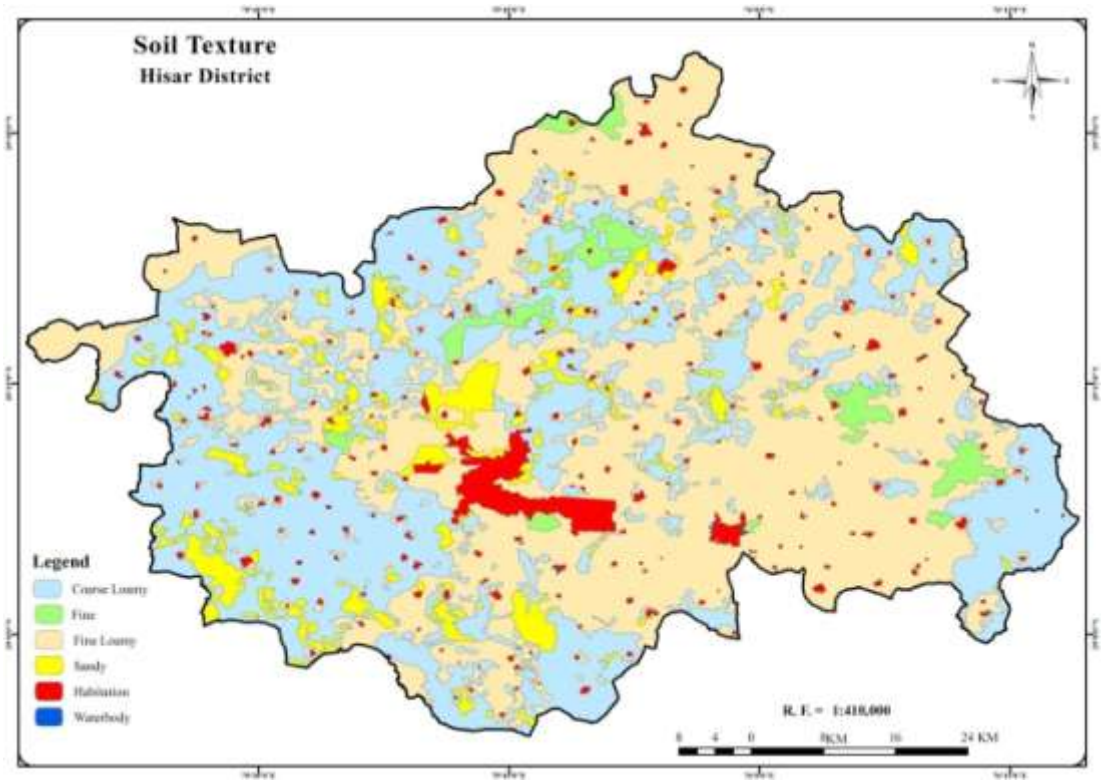

Figure 5 Soil TextureMap

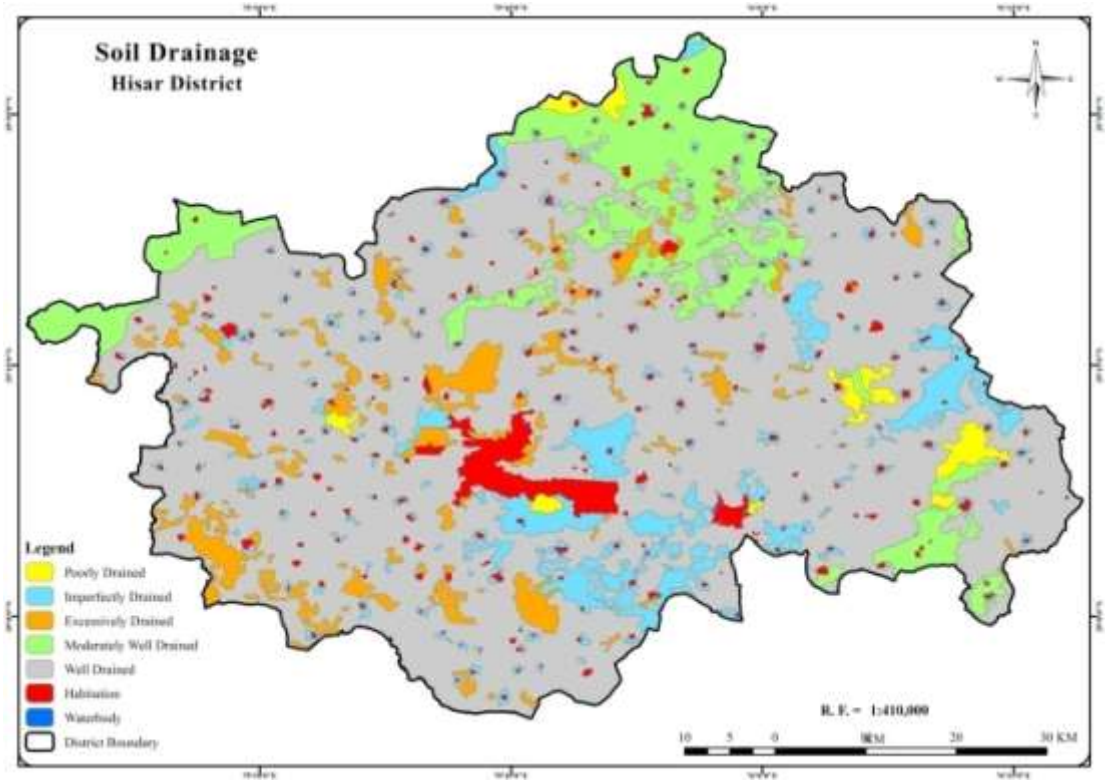

Figure 6 Soil Drainage Map

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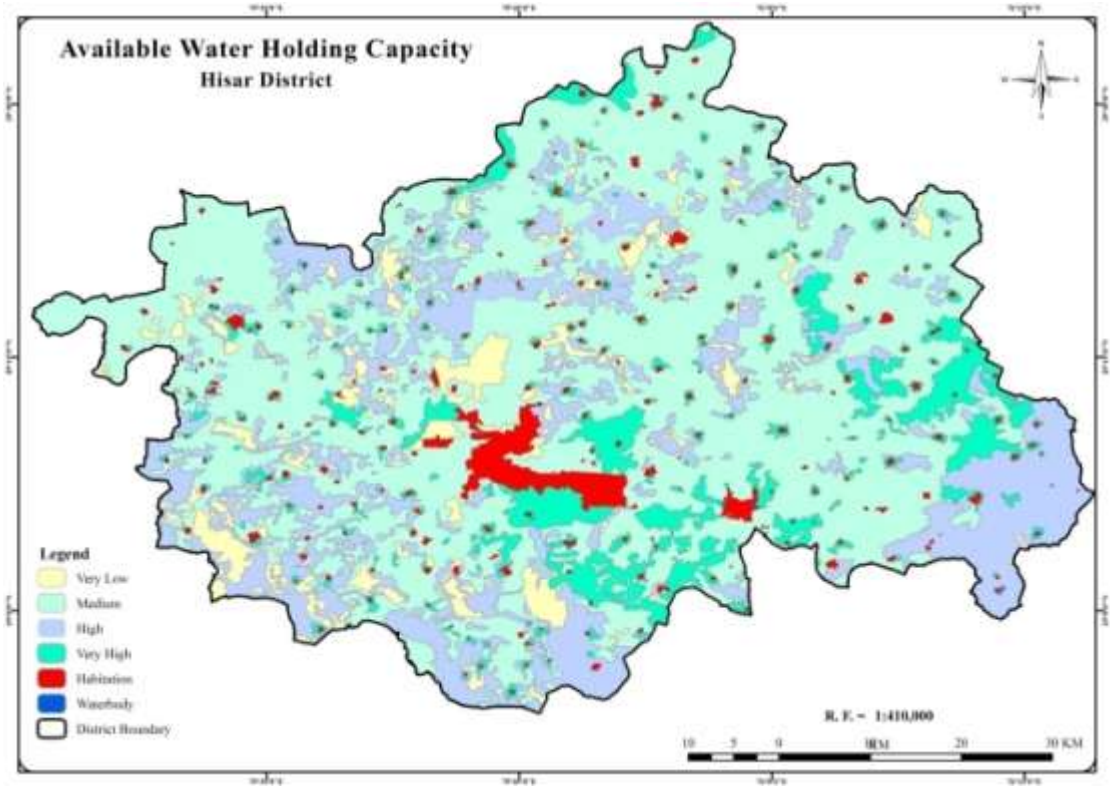

Figure 7Available Water Holding Capacity Map

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