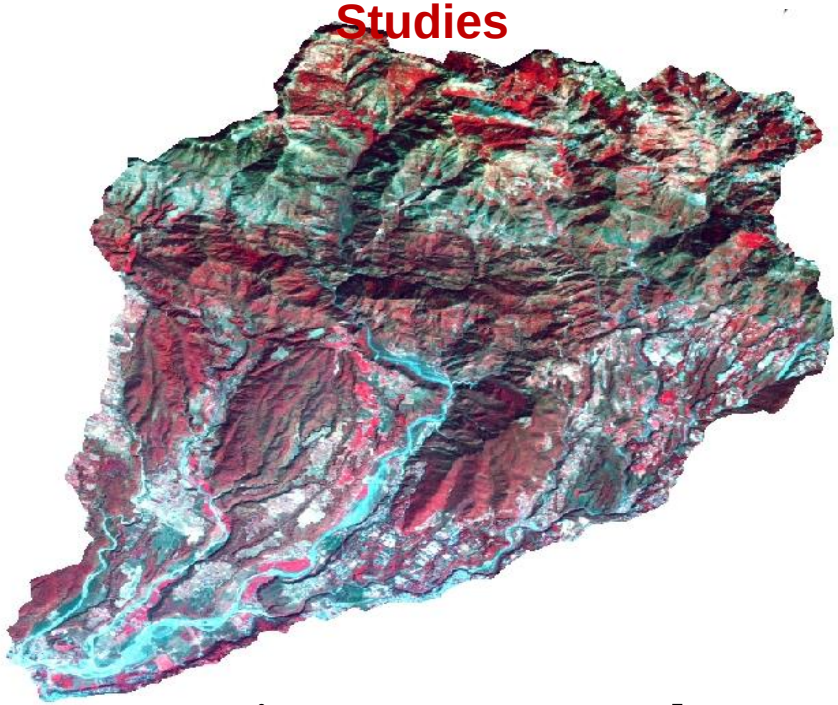
LAND EVALUATION FOR LAND USE PLANNING: A Geoinformatics Approach for Watershed Studies



Programme : Five year Integrated M.Sc., Geography / M.Sc., Geography

Course : Watershed Studies

Dr. P. Masilamani
Assistant Professor
Department of Geography
Bharathidasan University
Tamil Nadu
E-mail: masilamani@bdu.ac.in

Land evaluation is the process of estimating potential of the land and is essential for optimal land use planning for agriculture and non-agriculture purposes.

Objectives

- To prepare land use/ land cover map by visual interpretation to analyse the present status of land.
- To study the physiographic-soil relationship and prepare physiographic-soil map.
- To evaluate the soils for land capability and prepare land capability map.

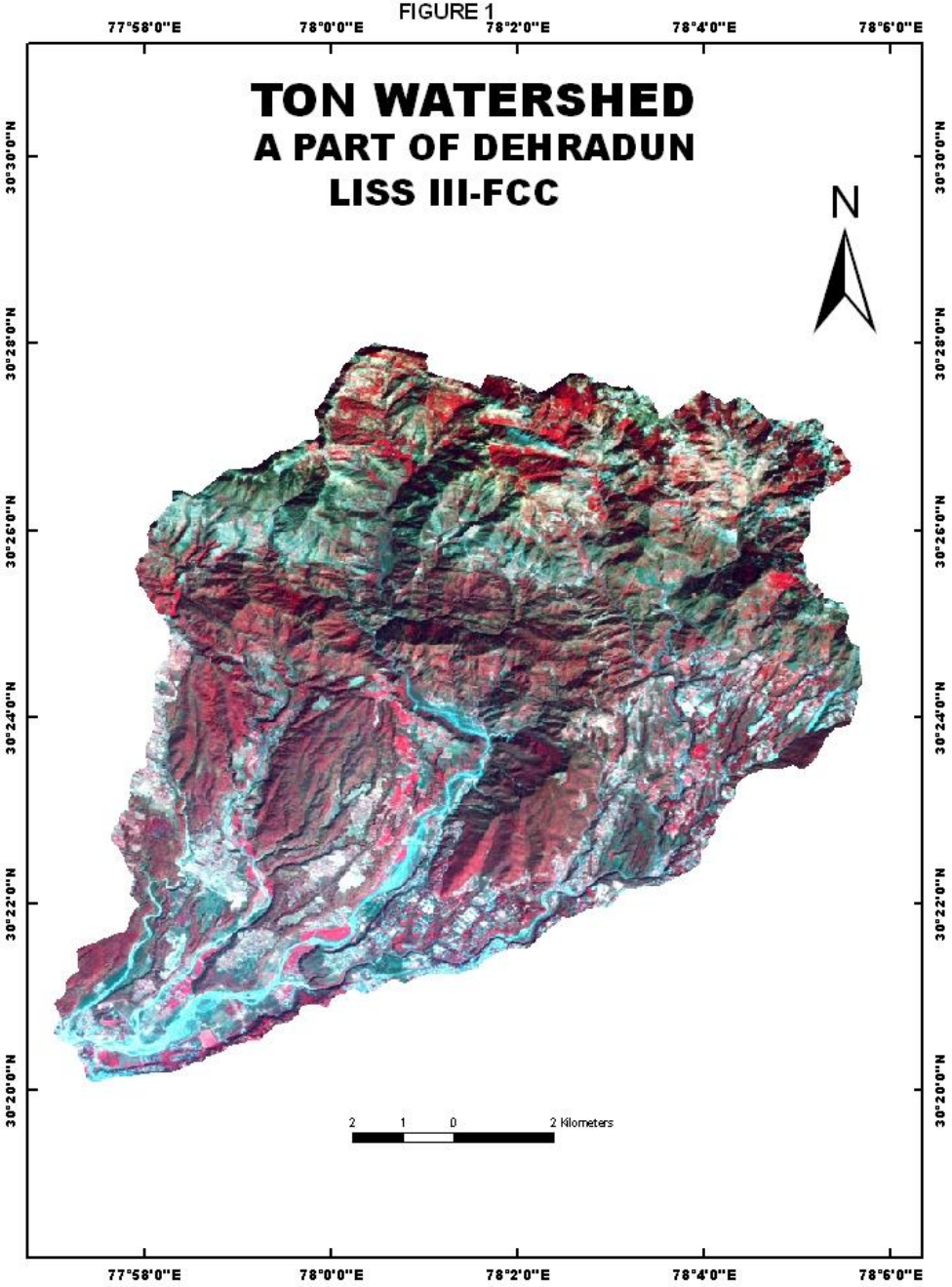
Study Area

- The present work is undertaken in a Himalayan watershed named **Ton watershed** which is located in the district of Dehradun of Uttarakhand state of India.

- This watershed falls under the Survey of India Toposheets No. 53F15 and 53J3.

- The geographical coordinates of the watershed are 30^0 20' 06" to 30^0 28' 00" North latitude and 77^0 57' 04" to 78^0 05' 42" East longitudes

FIGURE 1


TON WATERSHED
A PART OF DEHRADUN
LISS III-FCC
N
77°58'0"E
78°0'0"E
78°2'0"E
78°4'0"E
78°6'0"E
30°30'0"N
30°28'0"N
30°26'0"N
30°24'0"N
30°22'0"N
30°20'0"N
2 1 0 2 Kilometers

Materials

- **Primary data used**

  Remote sensing data IRS-IC LISS III Imagery (Soft Copy)
  Type : FCC (Geo coded)
  Projection :Polyconic
  Data of acquisition : 14th December 2004

- **Secondary data used**

  Survey of India Toposheets
  Toposheet No :53F/15,53J/3

Methods

- **Land Use and Land Cover Map**

  Land Use and Land Cover Map has been prepared visually using IRS-ID LISS III Imagery

- **Physiographic Soil Map**

  Physiographic Soil map of the study area was prepared using Survey of India toposheet

Methods

- **Contour Map**

  Survey of India toposheet was used for preparation of contour map.

- **Generation of DEM from Contour map**

  DEM prepared using ILWIS software

Syntax for prepare DEM =S_Dem=iff (isundef(boundary),?,Dem)

Methods

- **Slope map**

S_ DEM map was used to generate dx and dy maps using filtering operation with the linear filters dfdx and dfdy respectively. The following map calculation is used for creating slope map.

Slope =100*HYP(DX,DY)/23.5)

Methods

Creation of Soil Data Base

Soil attribute table is prepared adding criteria information on soil texture, soil depth, drainage, coarse fragments and soil erosion and maps of different attributes are prepared.

Methods

Land Capability Map

Soil suitability map is derived by typing syntax for the suitability of respective soil parameter.

Terrain suitability map is derived by typing syntax for the suitability of slope.

Land capability map is prepared by computing the max value by combining soil suitability and terrain suitability map.

Density slicing has been done for land capability map to get land capability classes.

CRITERIA FOR LAND CAPABILITY CLASSIFICATION

Characteristics	I	II	III	IV	V	VI	VII	VIII
1. Texture (Surface)	Medium(M)	Fine loamy (FL)	Coarse loamy (CL)	Sandy(s)	Very fine Very coarse fine	---	---	--
2. Coarsefrag (%) (Surface)	1-3	3-15	15-40	40-75	---	>75	---	---
3. Soil depth	>150	100-150	50-100	25-50	---	10-25	---	<10
4. Drainage	Well	Mod.Well	Imperfect	Poor	V.Poor	Excessive	---	--
5. Erosion	e0	e1	e2	e3	e4	---	e5	--
6. Slope%	0-1	1-3	3-8	8-15	--	15-35	35-50	>50

1. Textural Class **Texture**

Medium	l
Medium-fine (Fine loamy)	scl,sil,sicl,cl
Medium coarse (Coarse loamy)	sl
Coarse	ls
Very coarse or very fine	s,c,sic

2. Erosional class

Nil erosion	-	e0
Slight erosion	-	e1
Moderate	-	e2
Severe	-	e3
Very Severe	-	e4

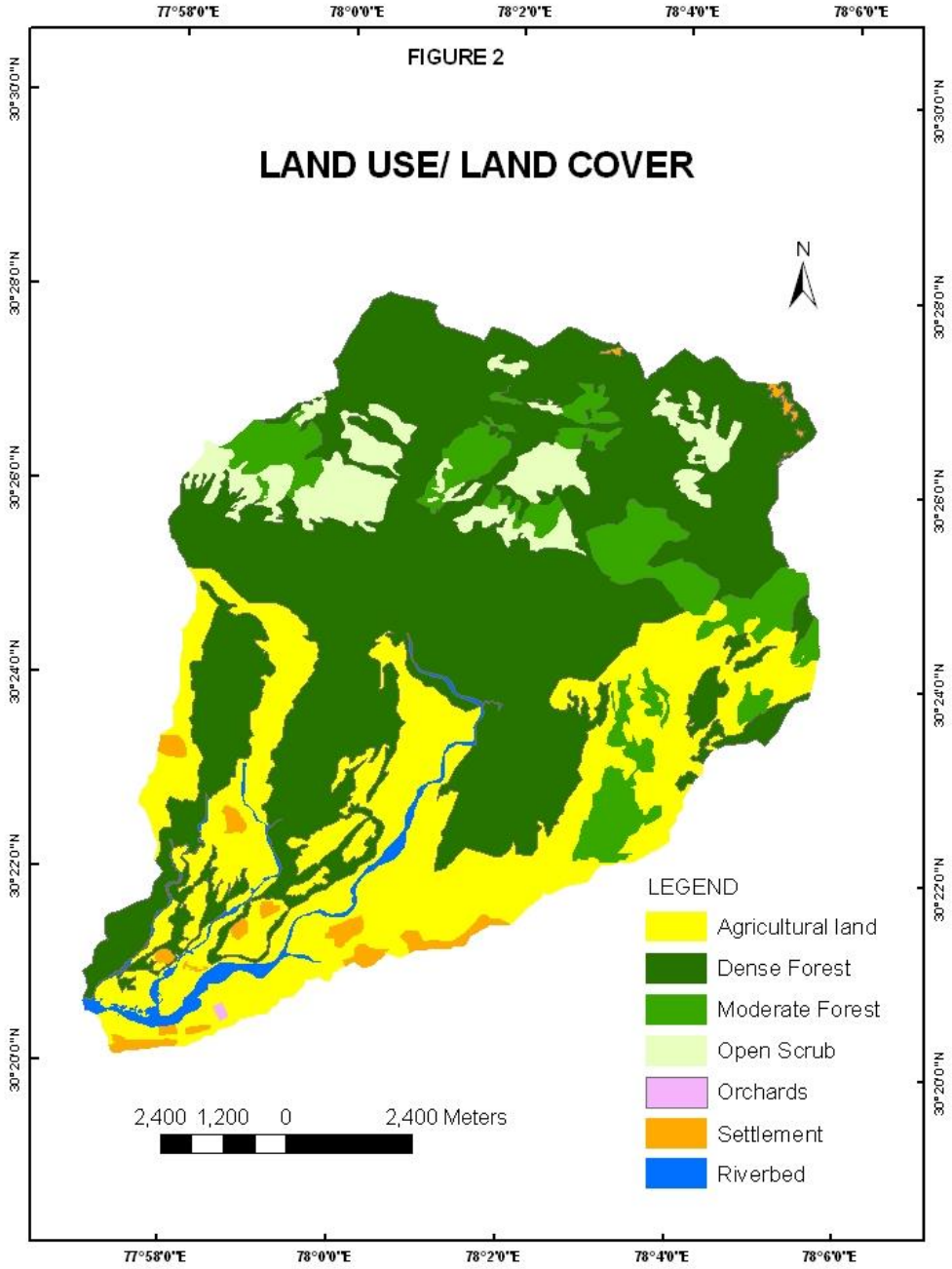
GENERAL CHARACTERISTICS OF MAPPING UNITS THEIR SOIL COMPOSITION

Mapping Units	Physiographic-Soil units	Soil Taxonomy	Soil texture	Soil depth (cm)	Drainage	Coarse fragments	Erosion
H11	Very Steep Himalayan (Agriculture)	L.S.Typic Udorthents	sl	35	Well	35	e3
H12	Very Steep Himalayan (Forest)	L.S.Typic Udorthents	gsl	40	Well	55	e3
H13	Very Steep Himalayan (Scrub)	Fragemental Typic Udorthents	gsl	20	Excessive	80	e4
H21	Steep Himalayan (Agriculture)	C.L.Typic Udorthents L.S.Typic Udorthents	gsl	45	Well	40	e3
H22	Steep Himalayan (Forest)	C.L.Typic Udorthents L.S.Typic Udorthents	sl	40	Well	55	e2
H23	Steep Himalayan (Scrub)	L.S.Typic Udorthents	sl	30	Excessive	70	e4
P1	UpperPiedmont	C.L.Typic Udorthents C.L.Typic Hapludepts	sl	50	Well	10	e2
P21	Uplifted Terrace (Lower)	F.L.Type Hapludepts C.L.Typic Hapludepts	gl	70	Well	15	e2
P22	Uplifted Terrace (Upper)	C.L.Typic Hapludepts	l	60	Well	15	e2
P3	Lower Piedmont	F.L.Typic Hapludepts	L	80	Mod.Well	5	e1
RH	Residual Hills	F.L Typic Hapludepts	l	45	Well	30	e2
SH	Shiwalik Hills (Structural)	L.S.Typic Hapludepts	sl	55	Excessive	35	e2
R	River	------	--	---	----	-----	---

Areal Extent of Various Land Use/Land Cover classes in Ton Watershed

Land Use / Land Cover	Area (ha)	Area in Percentage
Agricultural Land	3513.64	27.56
Dense Forest	6938.69	54.43
Moderate Forest	1107.54	08.69
Open Scrub	775.47	06.08
Orchards	06.63	0.05
Settlement	179.59	1.41
River bed	226.75	1.78
Ton Watershed	**12748.30**	

FIGURE 2


LAND USE/ LAND COVER
77°58'0"E
78°0'0"E
78°2'0"E
78°4'0"E
78°6'0"E
30°30'0"N
30°28'0"N
30°26'0"N
30°24'0"N
30°22'0"N
30°20'0"N
N
LEGEND
Agricultural land
Dense Forest
Moderate Forest
Open Scrub
Orchards
Settlement
Riverbed
2,400 1,200 0 2,400 Meters

Distribution of Area under different Mapping Units in Ton Watershed

Mapping Units	Physiographic-Soil units	Area (ha)	Area in Percentage
H11	Very Steep Himalayan (Agriculture)	299.82	2.35
H12	Very Steep Himalayan (Forest)	804.30	6.30
H13	Very Steep Himalayan (Scrub)	1111.18	8.71
H21	Steep Himalayan (Agriculture)	197.65	1.55
H22	Steep Himalayan (Forest)	225.21	1.76
H23	Steep Himalayan (Scrub)	1293.37	10.14
P1	UpperPiedmont	2665.65	20.90
P21	Uplifted Terrace (Lower)	399.61	3.13
P22	Uplifted Terrace (Upper)	70.08	0.54
P3	Lower Piedmont	1852.80	14.53
RH	Residual Hills	1648.68	12.93
SH	Shiwalik Hills (Structural)	1955.40	15.33
R	River	226.15	1.77
Ton Watershed		**12749.91**	

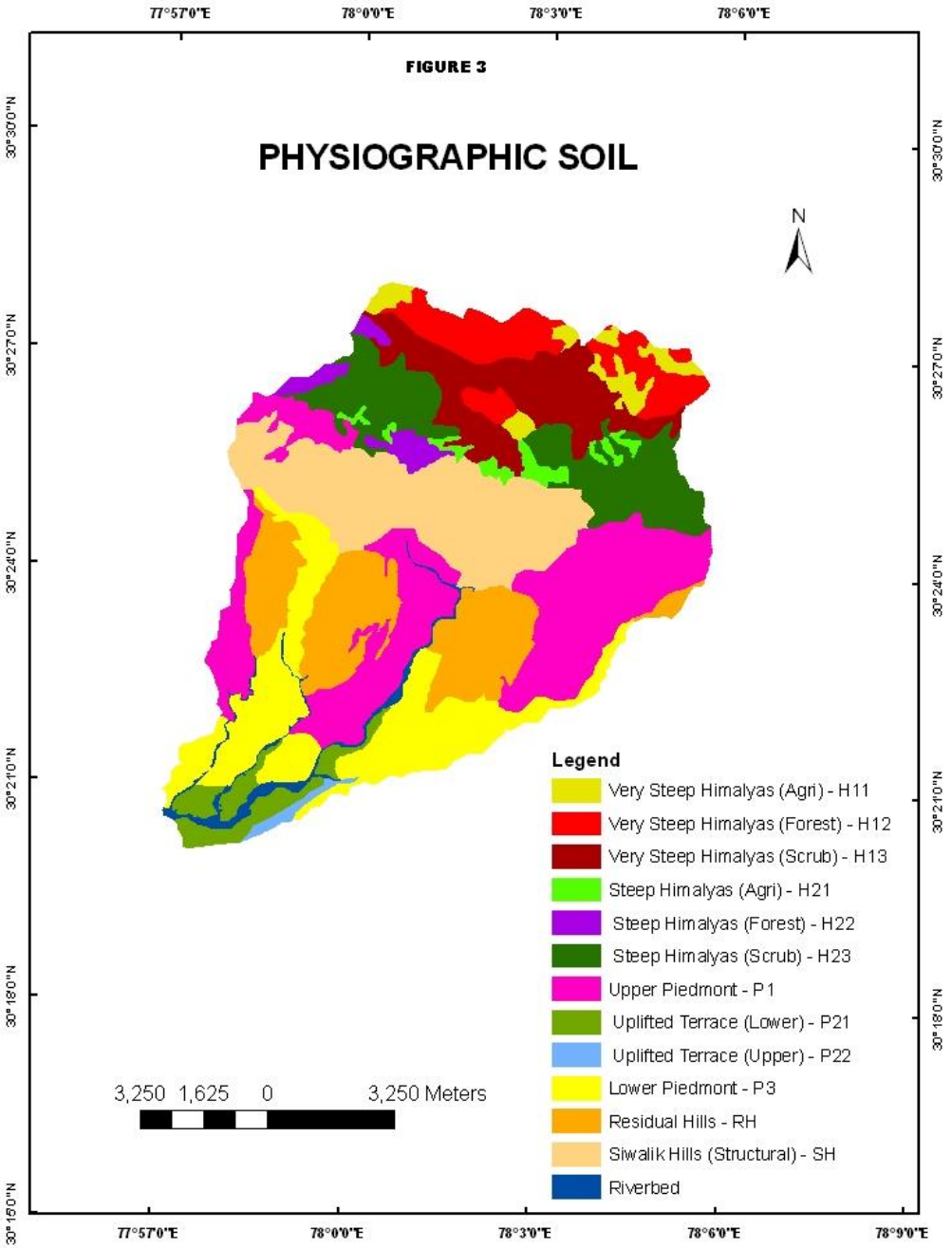


FIGURE 3
PHYSIOGRAPHIC SOIL
N
77°57'0"E
78°0'0"E
78°3'0"E
78°6'0"E
78°9'0"E
30°30'0"N
30°27'0"N
30°24'0"N
30°21'0"N
30°18'0"N
30°15'0"N
3,250 1,625 0 3,250 Meters
Legend
Very Steep Himalyas (Agri) - H11
Very Steep Himalyas (Forest) - H12
Very Steep Himalyas (Scrub) - H13
Steep Himalyas (Agri) - H21
Steep Himalyas (Forest) - H22
Steep Himalyas (Scrub) - H23
Upper Piedmont - P1
Uplifted Terrace (Lower) - P21
Uplifted Terrace (Upper) - P22
Lower Piedmont - P3
Residual Hills - RH
Siwalik Hills (Structural) - SH
Riverbed

FIGURE 4

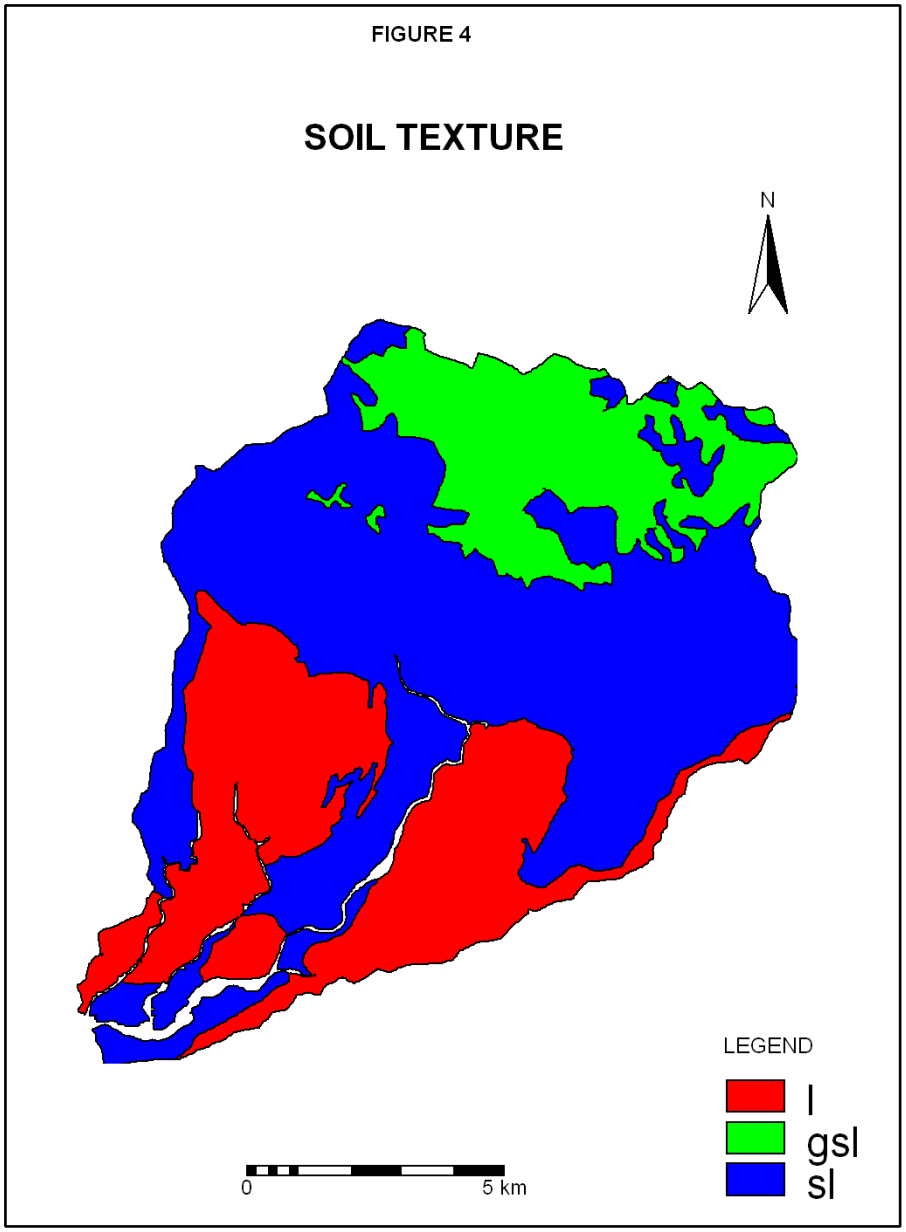


FIGURE 5

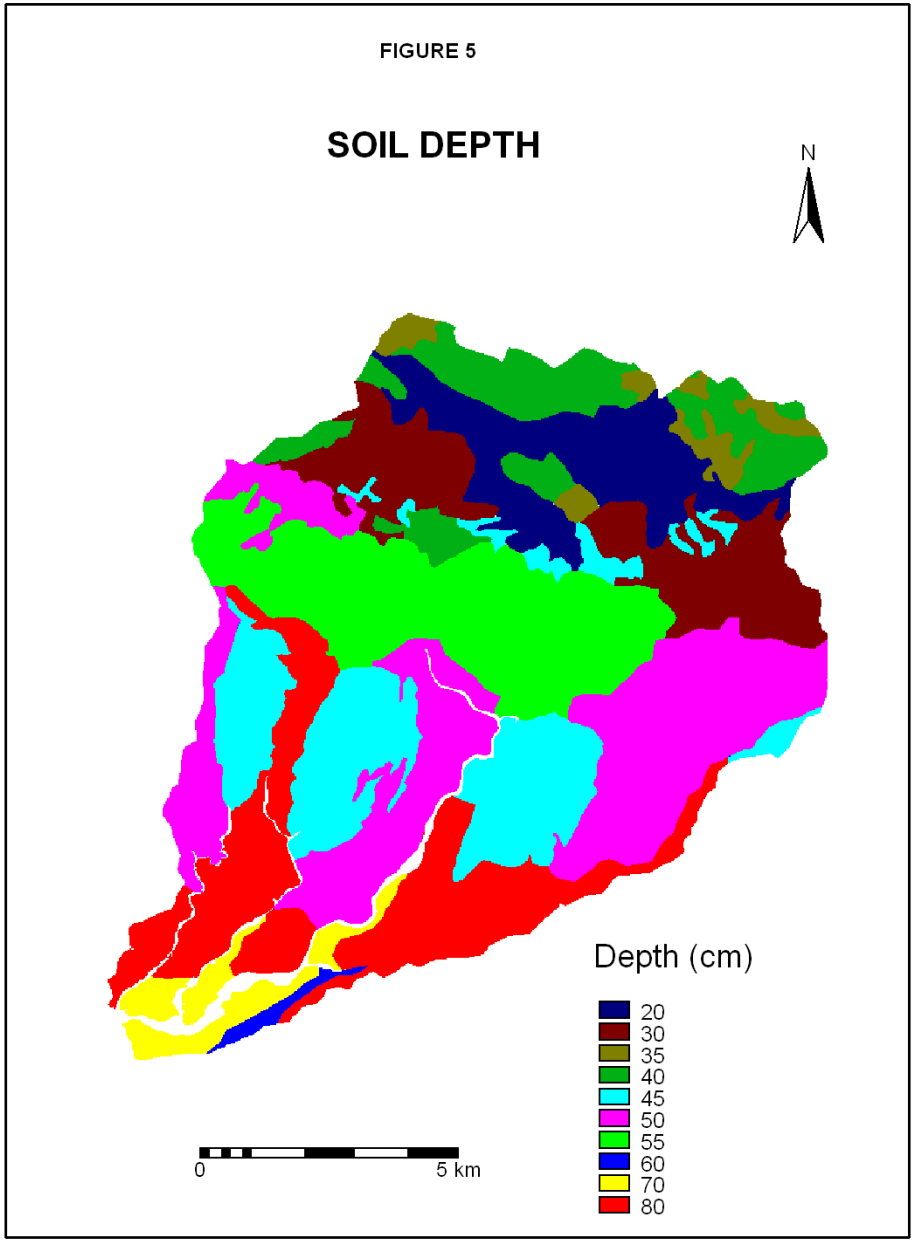


FIGURE 6

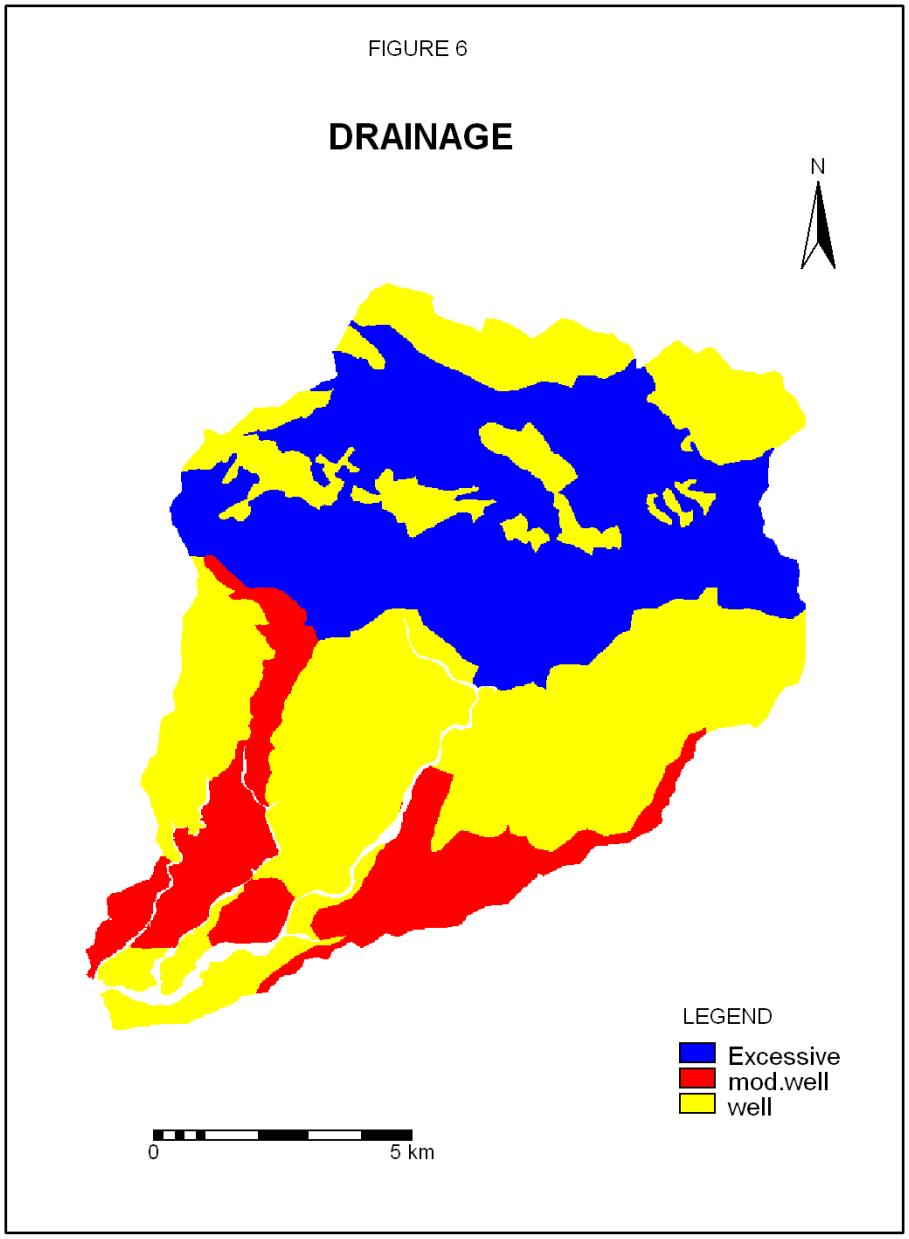


FIGURE 7

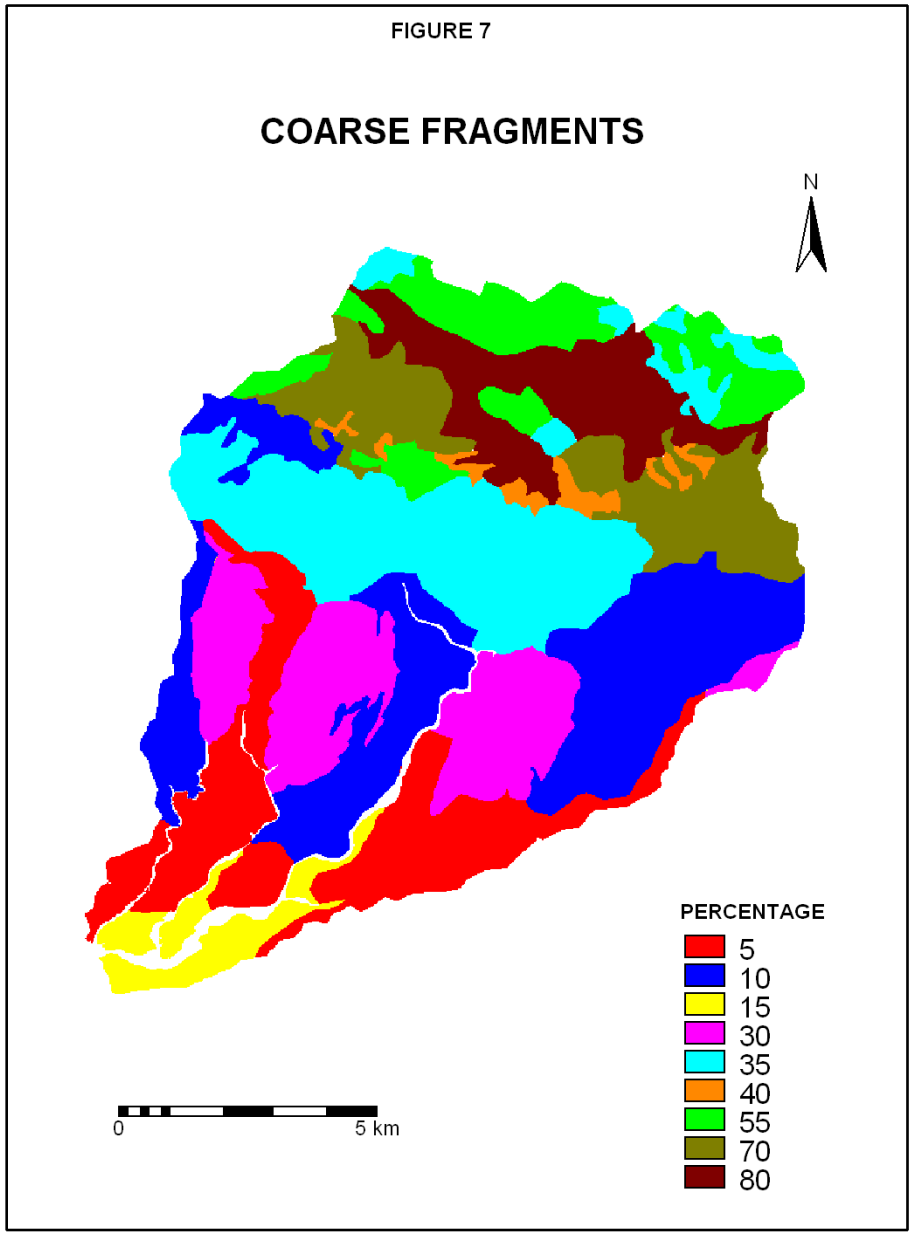


FIGURE 8

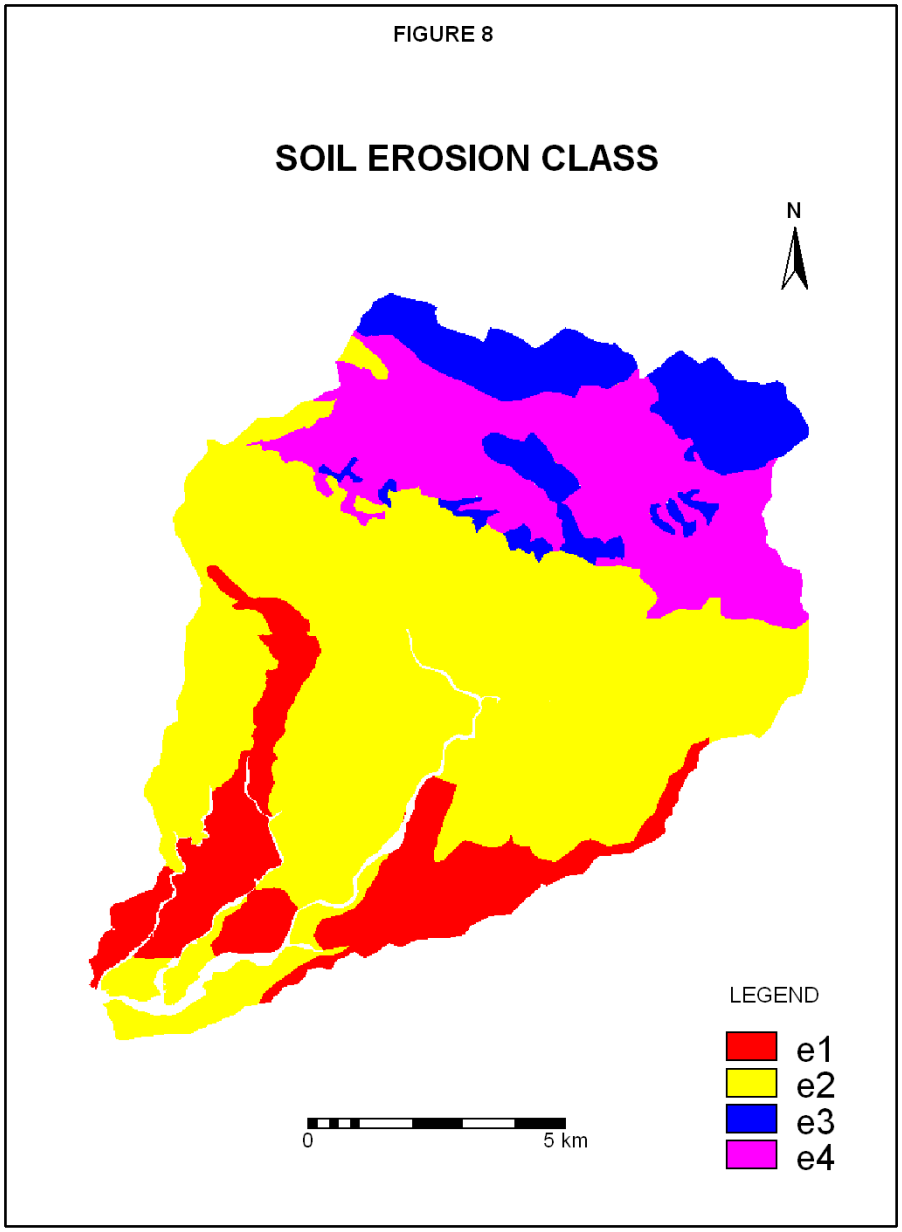


FIGURE 9

SLOPE CLASS

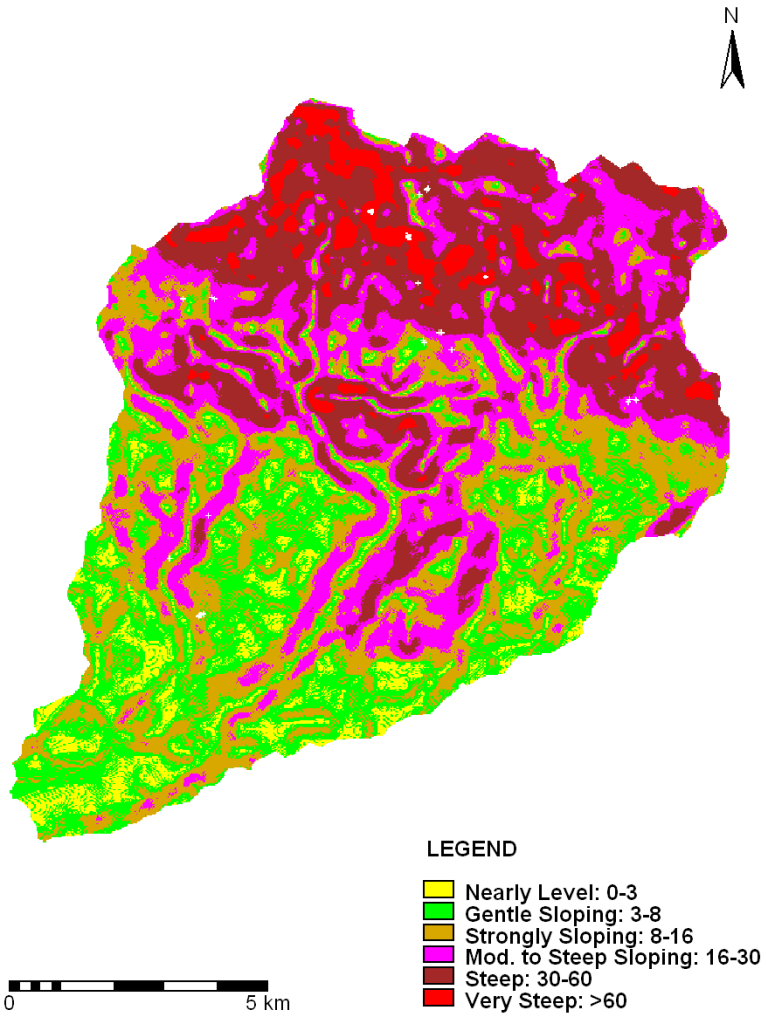
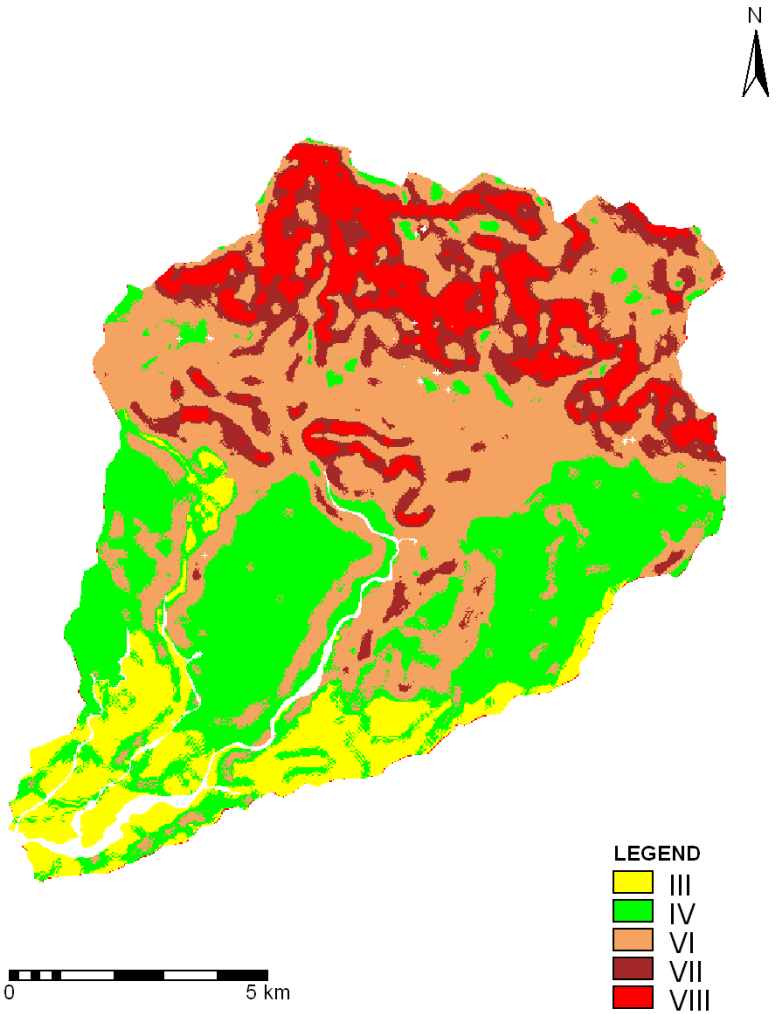


FIGURE 10

LAND CAPABILITY



Conclusion

- Most part of the study area is covered by Himalayan mountain and piedmont plain.
- To determine the land capability classes, soil texture, soil depth,drainage,coarse fragments, erosion hazards and slope are taken in to consideration for study area.
- More than half of land of **Ton watershed** comes under IV and VI land capability classes.
- About 36.84 % land is found under class VI followed by class IV 29.64 %.

THANK YOU

FOR YOUR

KIND ATTENTION