Crop Suitability Analysis of Groundnut and Sunflower using Geoinformatics, A Case Study of Jallutu Watershed, Tamil Nadu

M.Tech., Geoinformatics

Course : Advances in Geospatial Technologies

Land Suitability Analysis

Weighted Overlay - Multi Criteria Analysis

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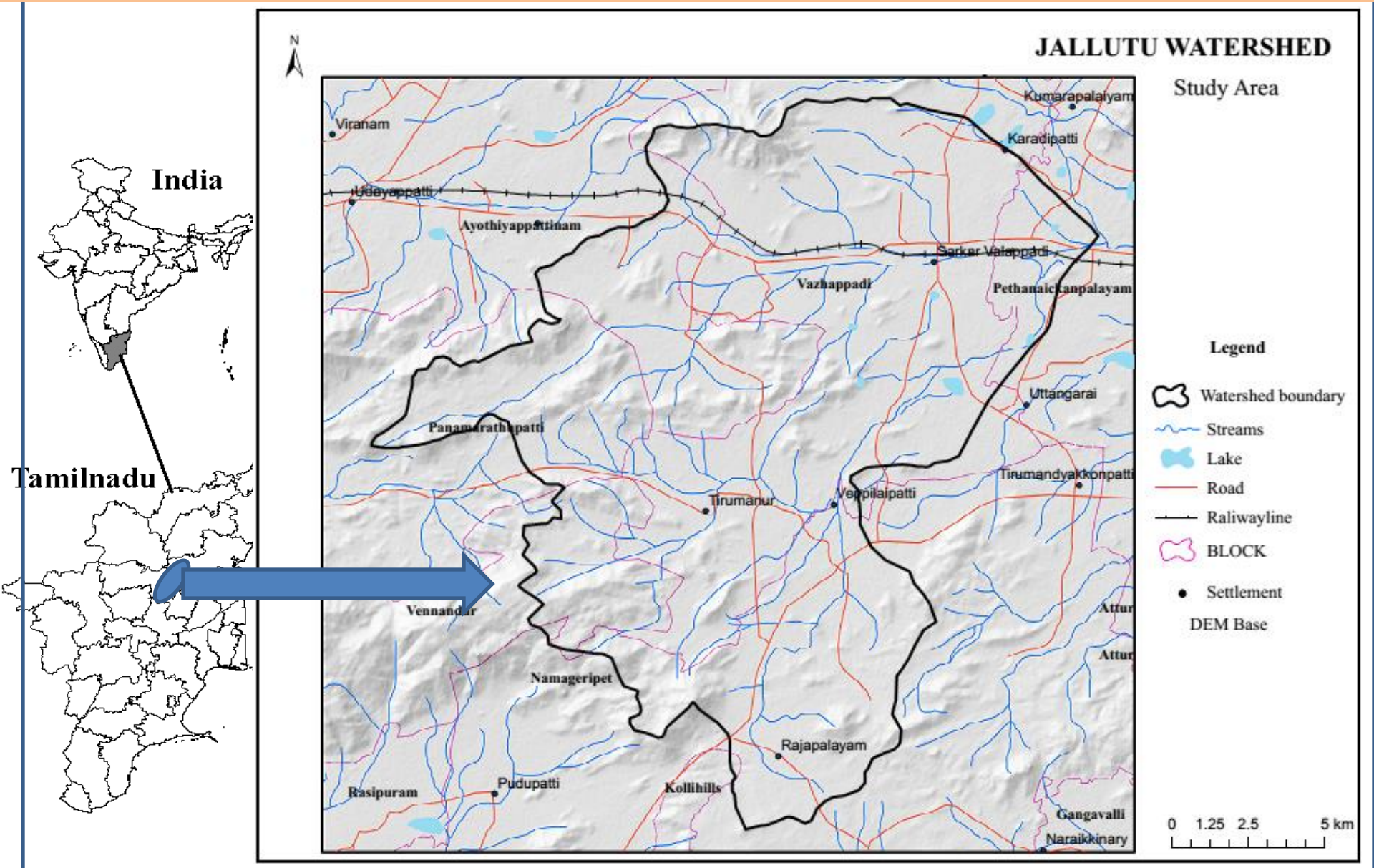
JALLUTU WATERSHED



Aim of the study is to assess the Crop Suitability Analysis of Groundnut and Sunflower using Geoinformatics, A Case Study of Jallutu Watershed, Tamil Nadu

Study Area: Located in North central Part of Tami Nadu

$11^0 15'$ to 11^0 45' N and 78^0 15' to 78^0 58'

It runs through **Salem, Namakkal**

Districts of Tamil Nadu and it covers an area about Area 280 Sq km^2

It Originate from **Nainarmalai** on west run towards east and join with River Vellar Near Attur, in SalemDistrict.

Data Source

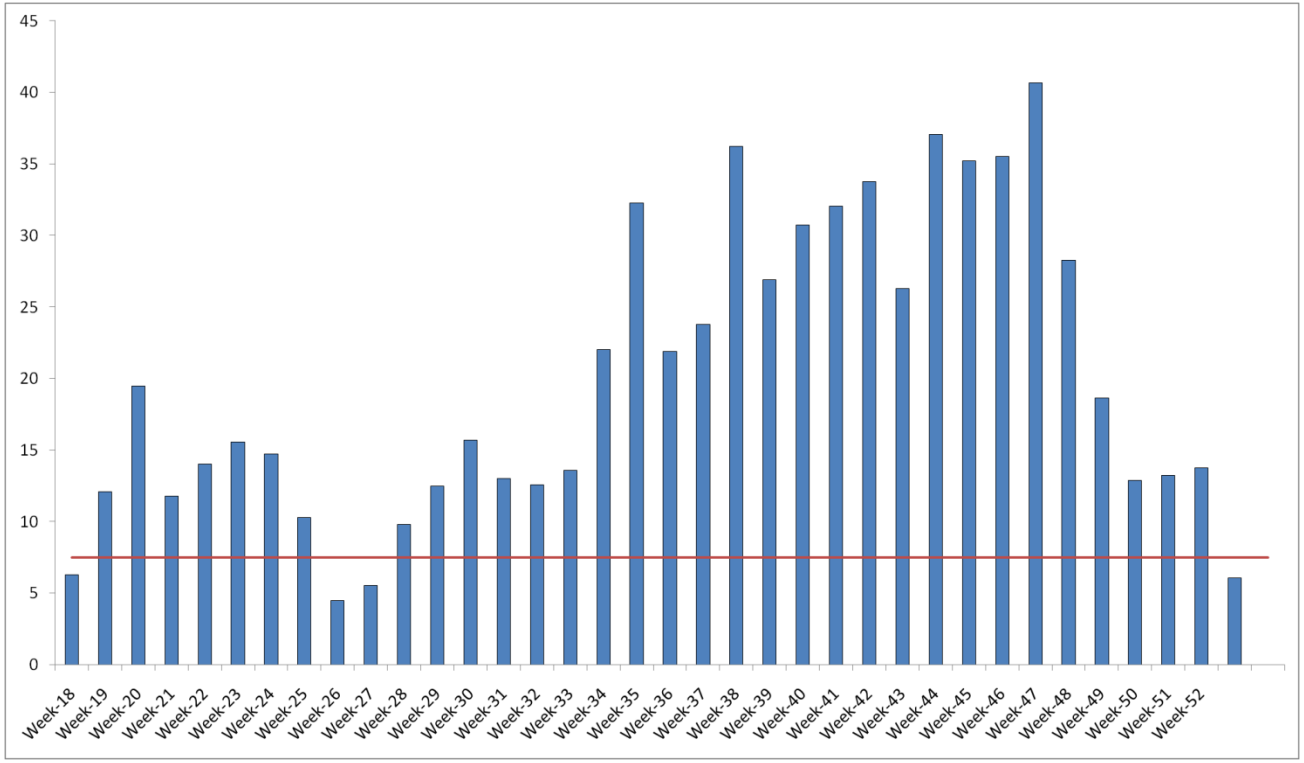
- Draiange Network and Watershed (OSM/SOI)
- Land Use/Land Cover : LISS IV (Resourcesat)
- Geomorphology : LISS IV (Resourcesat)
- Data Period 1980 - 2010
- Rainfall Department of Economic and Statistics (GoTN)
- Temperature and Soil Data: Remote Sensing Agro
- Climatic Research Centre (TNAU)

Software: ArcGIS & Erdas Imagine

Rainfall and Temperature

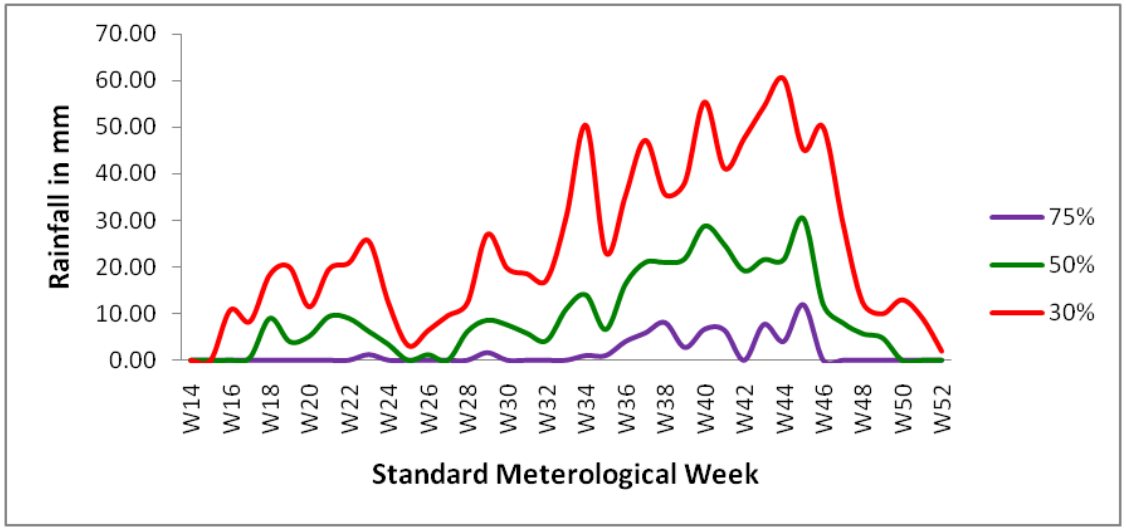
The average Temperature is 27 Degree C

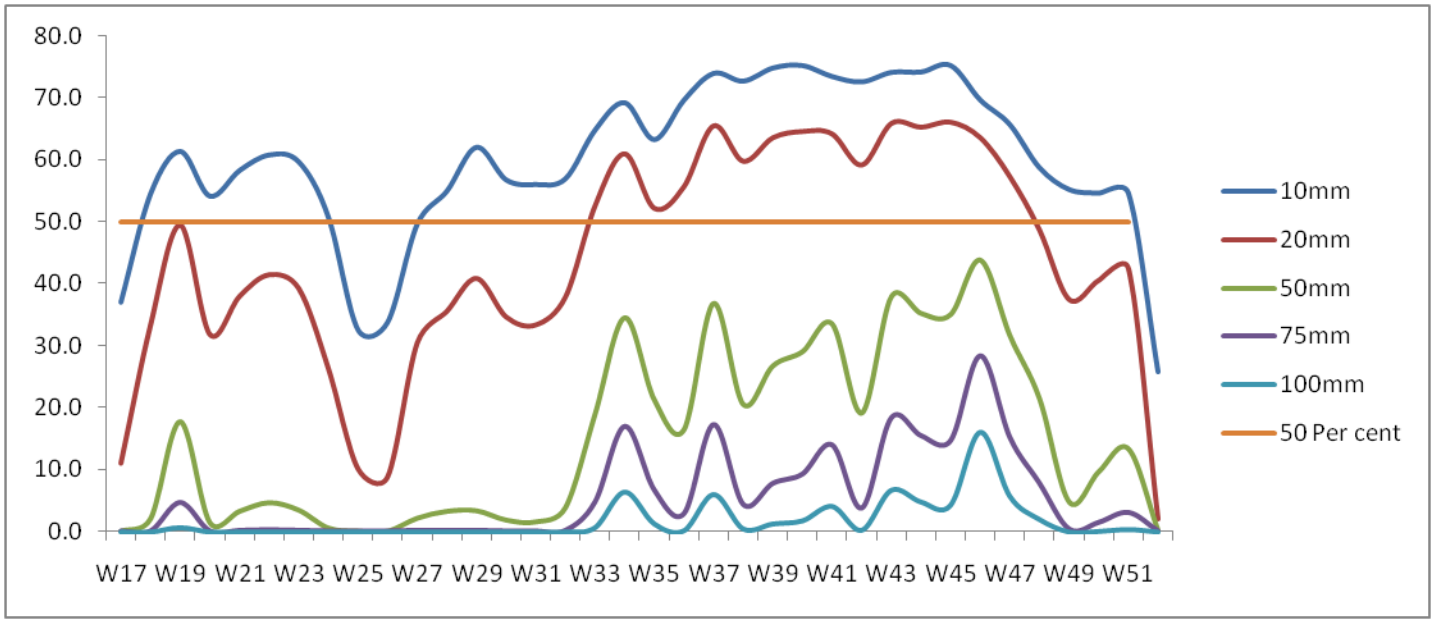
The average rainfall of the area is about 850 mm annually



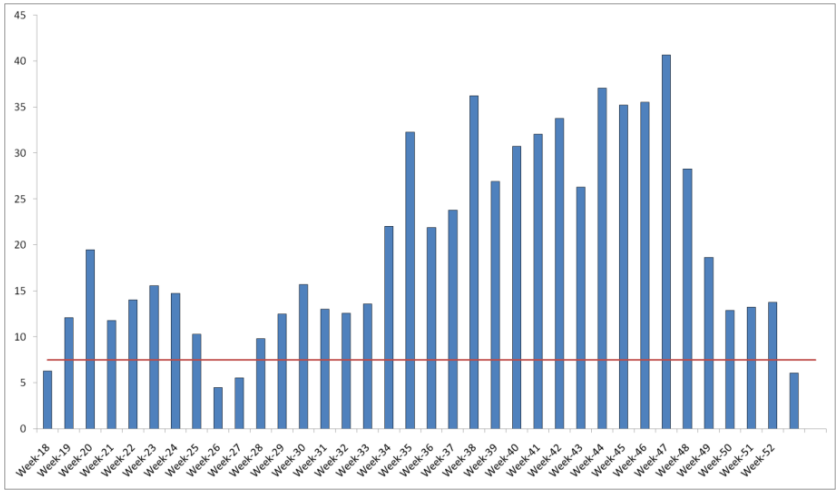
Week-16	8.76	163.85
Week-17	6.29	178.08
Week-18	12.07	152.66
Week-19	19.48	169.19
Week-20	11.79	147.20
Week-21	14.02	138.16
Week-22	15.57	131.40
Week-23	14.71	131.22
Week-24	10.29	148.73
Week-25	4.50	270.17
Week-26	5.54	192.61
Week-27	9.79	202.92
Week-28	12.49	161.61
Week-29	15.68	118.85
Week-30	13.00	136.26
Week-31	12.59	136.76
Week-32	13.58	151.65
Week-33	22.00	144.16
Week-34	32.28	137.94
Week-35	21.89	160.79
Week-36	23.76	113.02
Week-37	36.19	113.12
Week-38	26.89	104.38
Week-39	30.71	101.16
Week-40	32.02	101.27
Week-41	33.75	112.74
Week-42	26.26	103.53
Week-43	37.05	113.19
Week-44	35.20	110.77
Week-45	35.50	105.71
Week-46	40.64	147.09
Week-47	28.25	160.59
Week-48	18.65	211.79
Week-49	12.88	172.24
Week-50	13.25	212.58
Week-51	13.75	237.27
Week-52	6.08	353.54

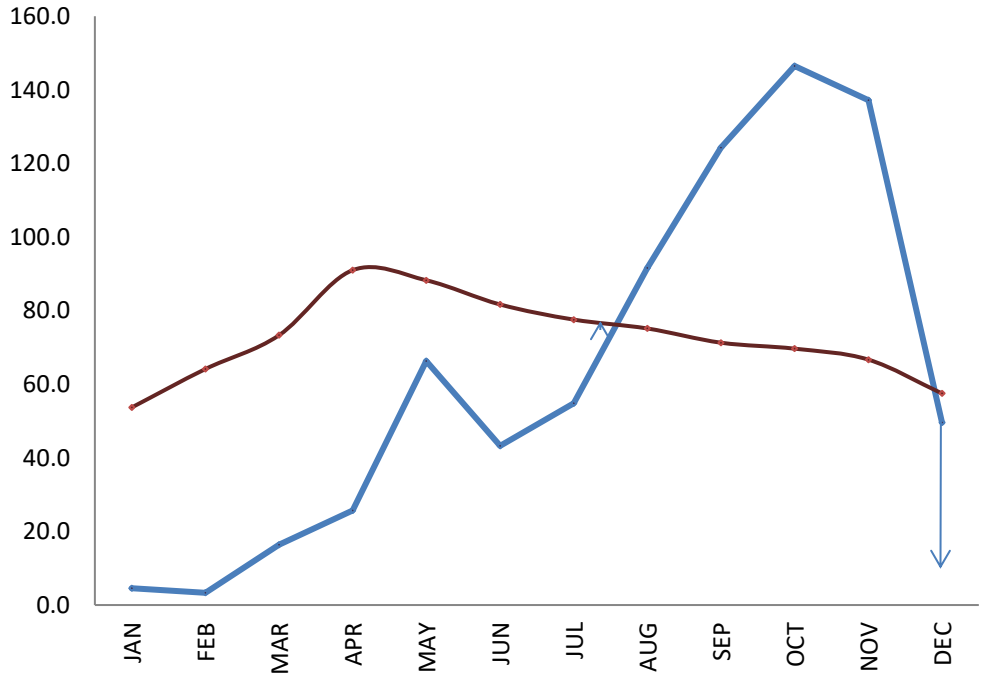
Rainfall Probability





Length of Growing Period (LGP)





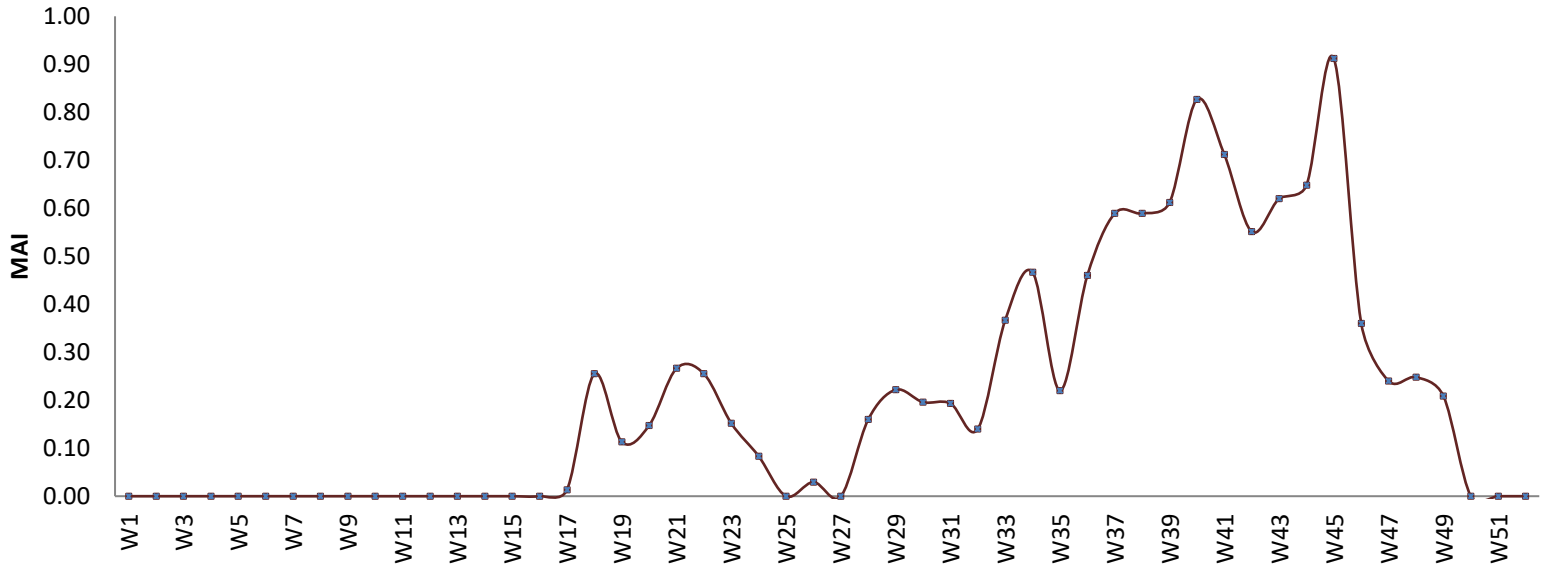
Moisture Adequacy Index (MAI)

Moisture availability index (MAI) was worked out using the following MAI equation as suggested by Sarkar and Biswas (1988) and Balasubramanian *et al*. (1996).

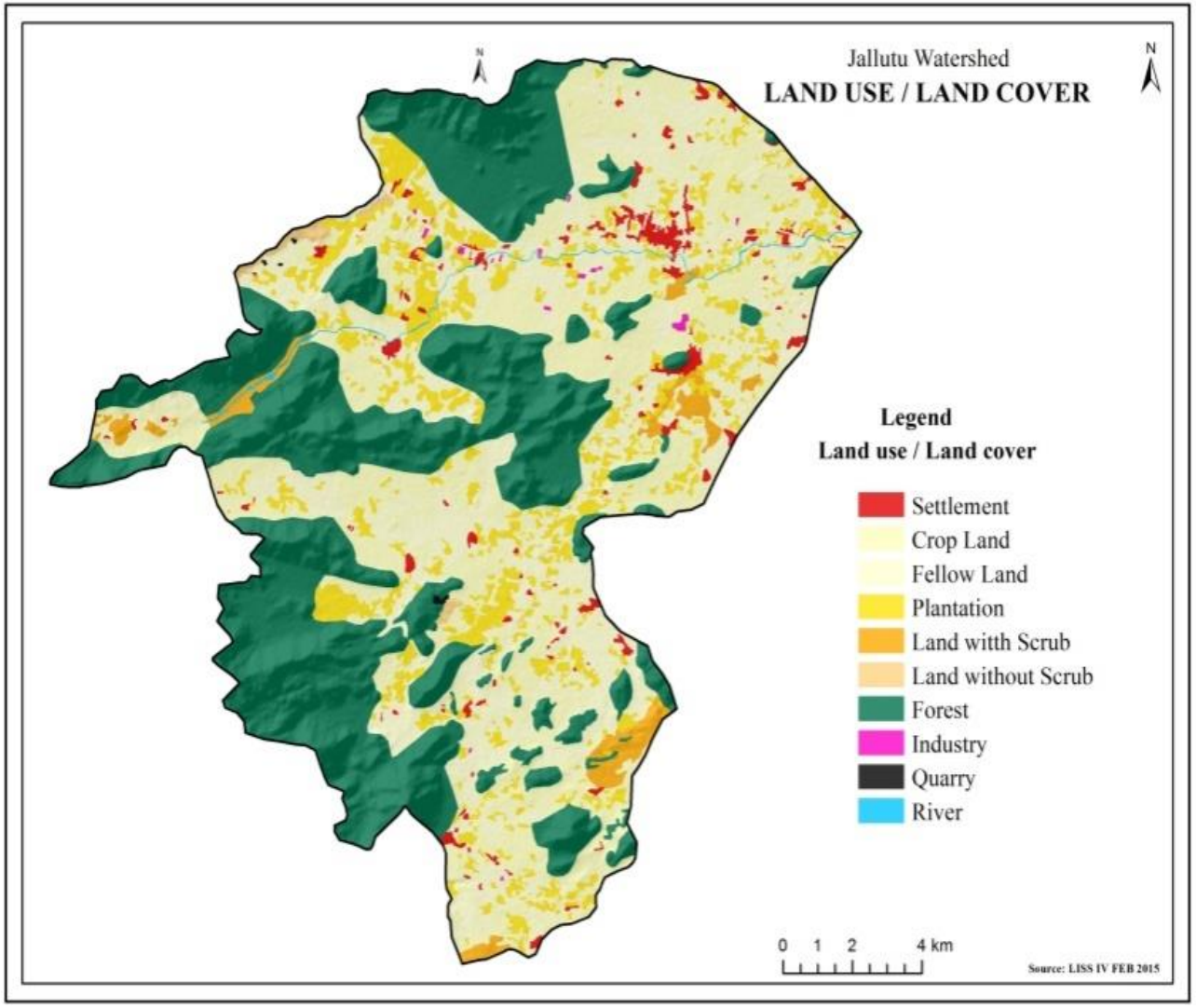
MAI = Weekly assured rainfall 50% / PET (Potential Evapotranspiration)

P. PARASURAMAN Madras Agric. J. 90 (10-12) : 726-728 October-December 2003

Attur and Thampampatti

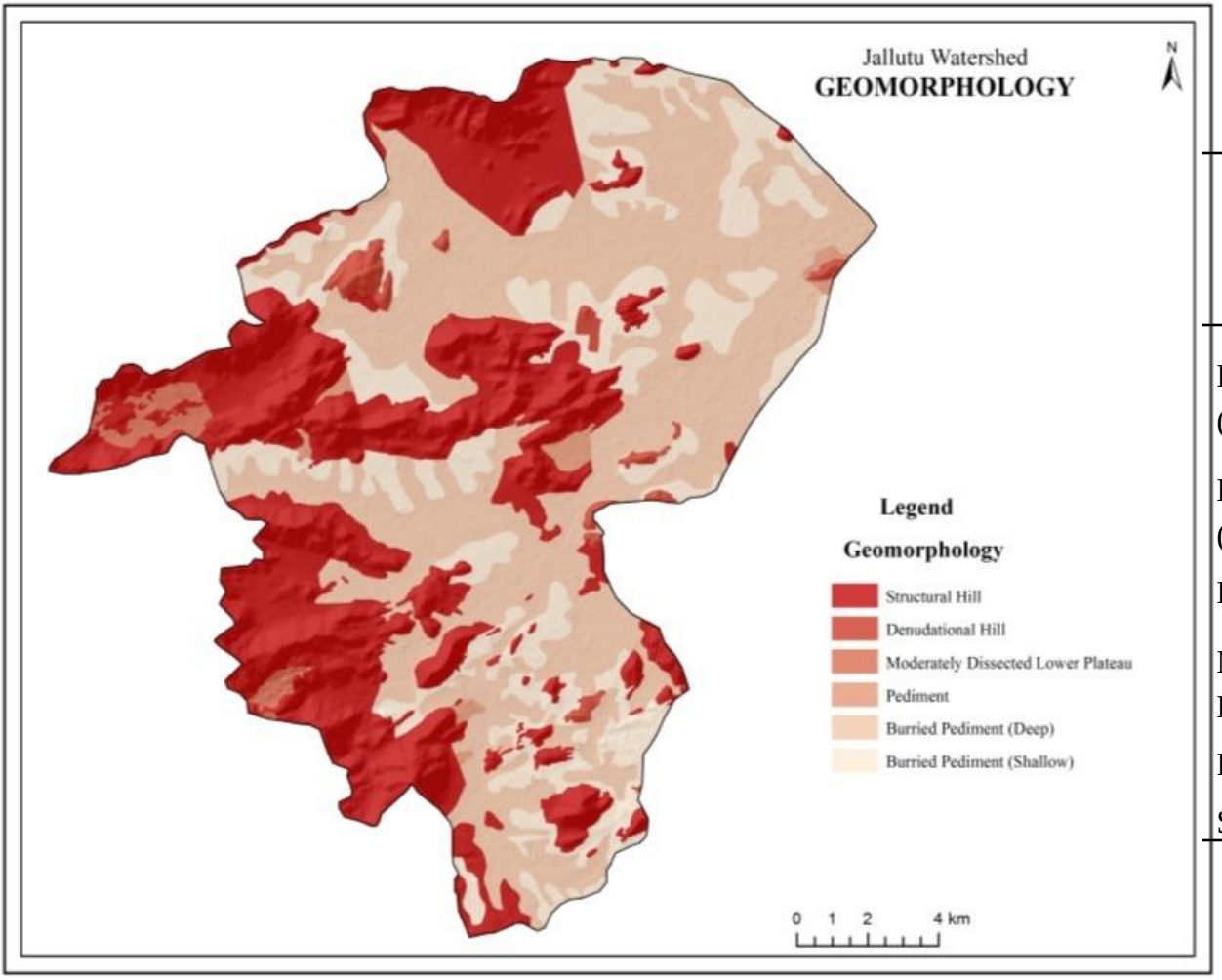


Land Use / Land Cover



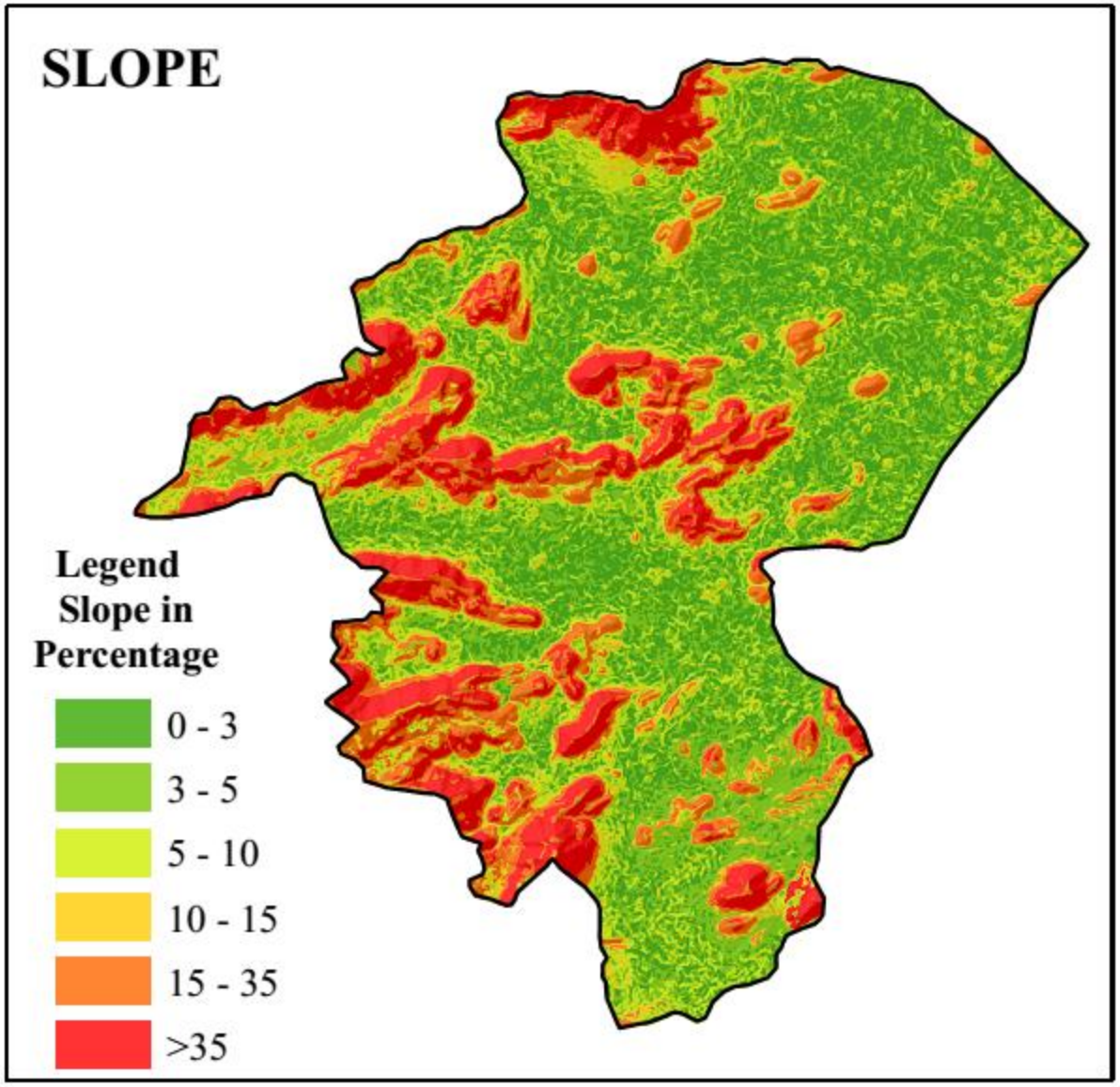
Land use / land cover	Area in Sq. km^2	Percentage
Settlements	5.32	2.00
Crop Land	66.38	22.99
Fellow Land	68.64	24.52
Plantation	31.30	11.18
Land with Scrub	6.31	2.25
Land without Scrub	1.17	0.42
Forest	99.97	35.70
Quarry	0.12	0.04
Industry	0.38	0.13
River	0.78	0.28

Geomorphology



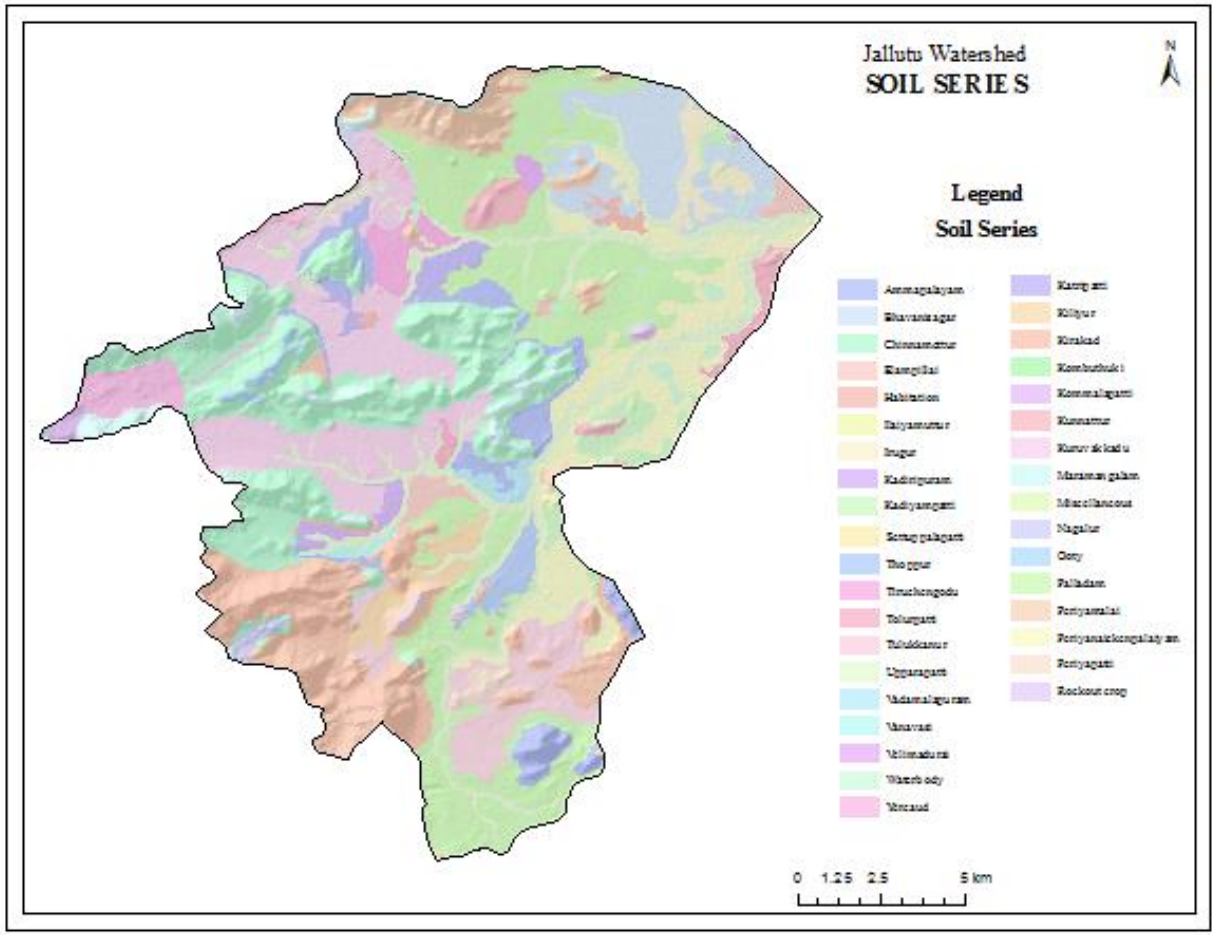
Geomorphology	Area Sq. km^2	Percentage
Buried Pediment (Deep)	111.61	40.00
Buried Pediment (Shallow)	53.25	18.77
Denudation Hill	4.73	1.69
Moderately Dissected Lower Plateau	4.62	1.36
Pediment	3.69	2.00
Structural Hill	102.24	36.51

Slope



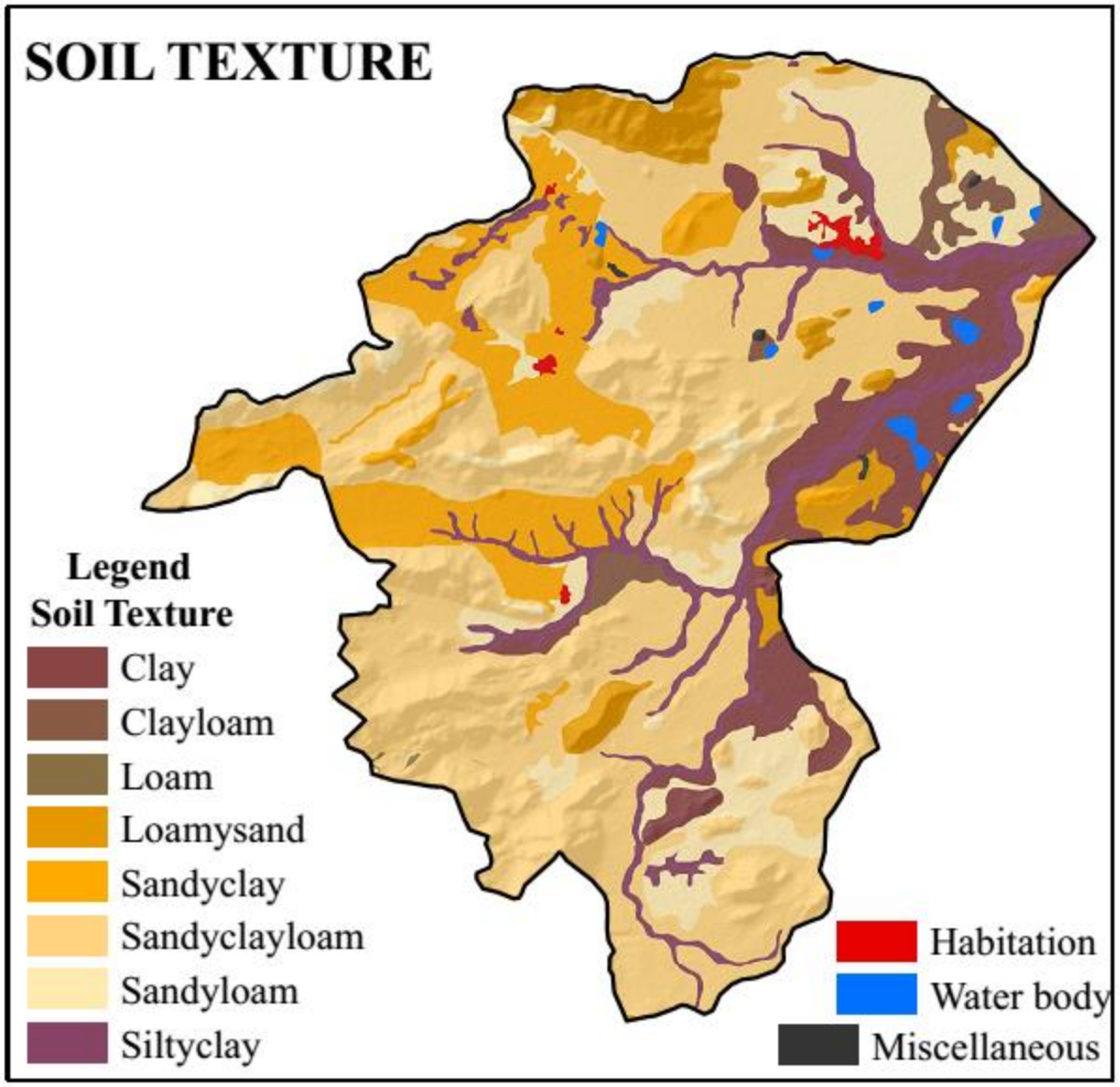
Slope in Percentage	Slope	Area Sq. km^2	Percentage
0 to 3	Very Gentle	64.83	23.15
3 to 5	Gentle	83.30	28.90
5 to 10	Moderate	42.91	16.50
10 to 15	Moderate Steep	14.58	5.21
15 to 35	Steep	38.49	13.75
More than 35	Very Steep	35.90	12.82

Soil



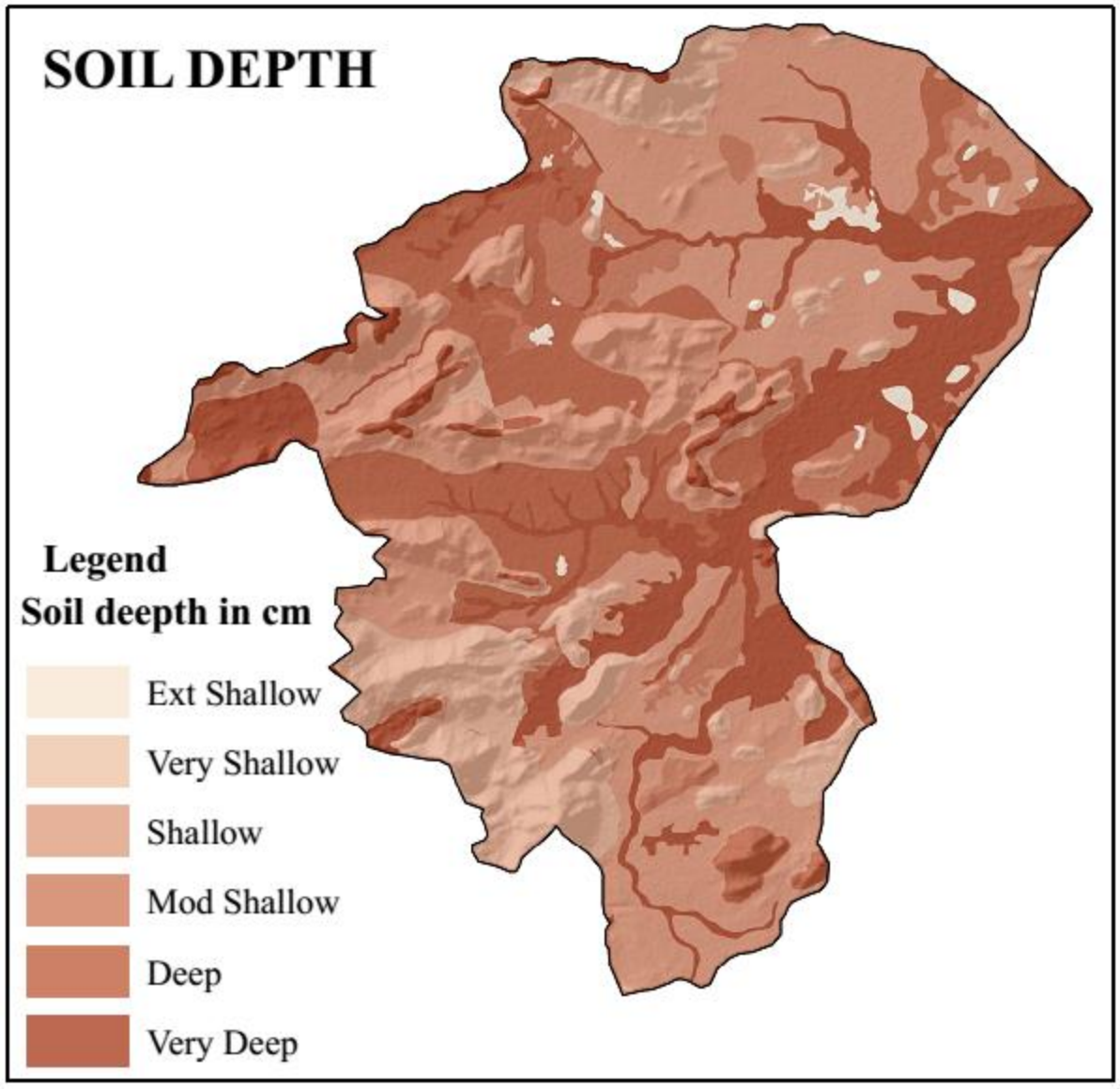
Soil Series	Area Sq. km^2	Percentage
Palladam	46.66	16.66
Chinnamettur	39.92	14.26
Kirakad	26.79	9.57
Kuruvakkadu	26.61	9.50
Periyanaicken palaiyam	20.45	7.30

Soil Texture



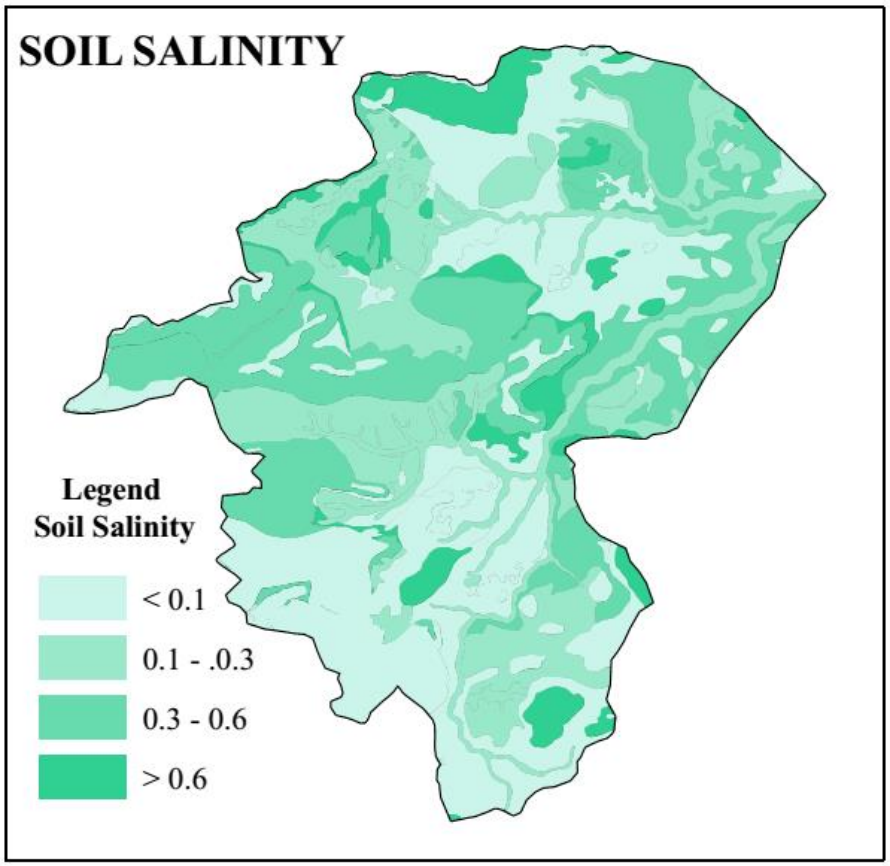
Texture	Area Sq. km^2	Percentage
Clay	*25.66*	*8.27*
Clayloam	*9.00*	*3.10*
Loam	*0.10*	*0.03*
Loamysand	*15.94*	*5.69*
Sandyclay	*38.14*	*13.62*
Sandyclayloam	*135.68*	*48.46*
Sandyloam	*35.27*	*12.33*
Siltyclay	*20.32*	*9.23*

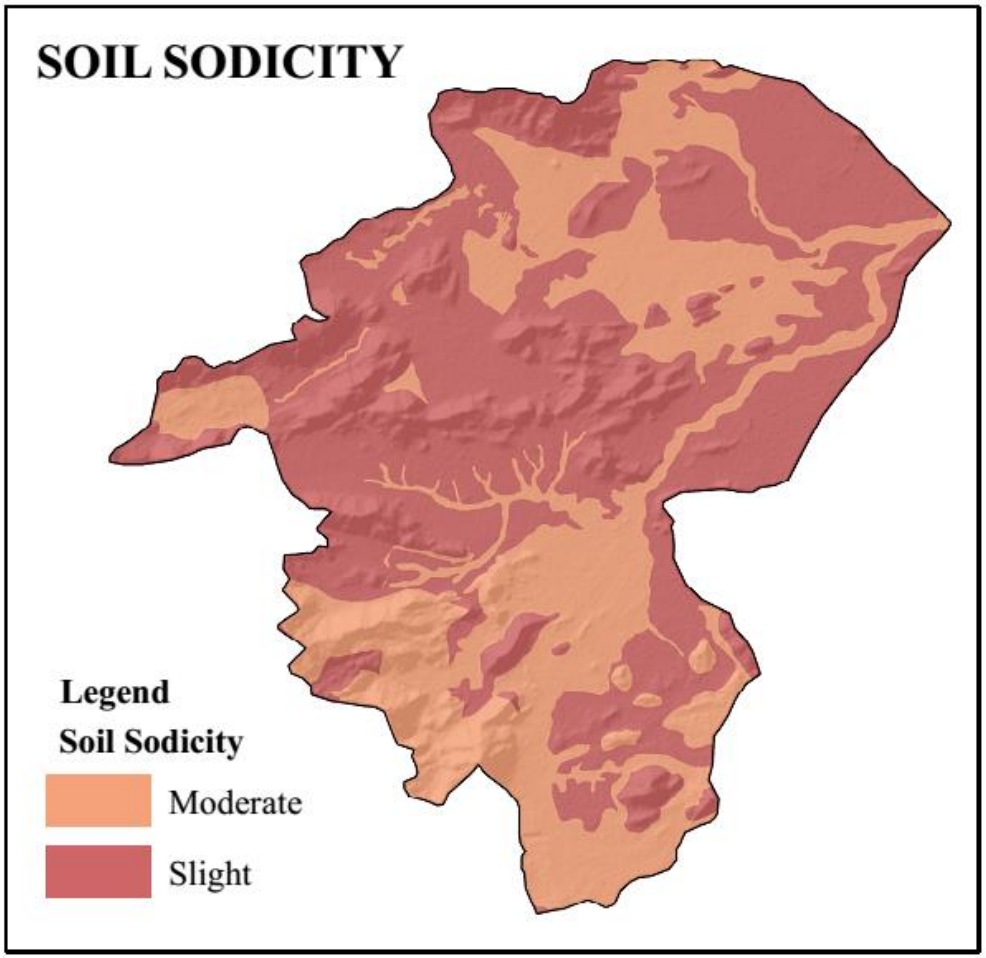
Soil Depth



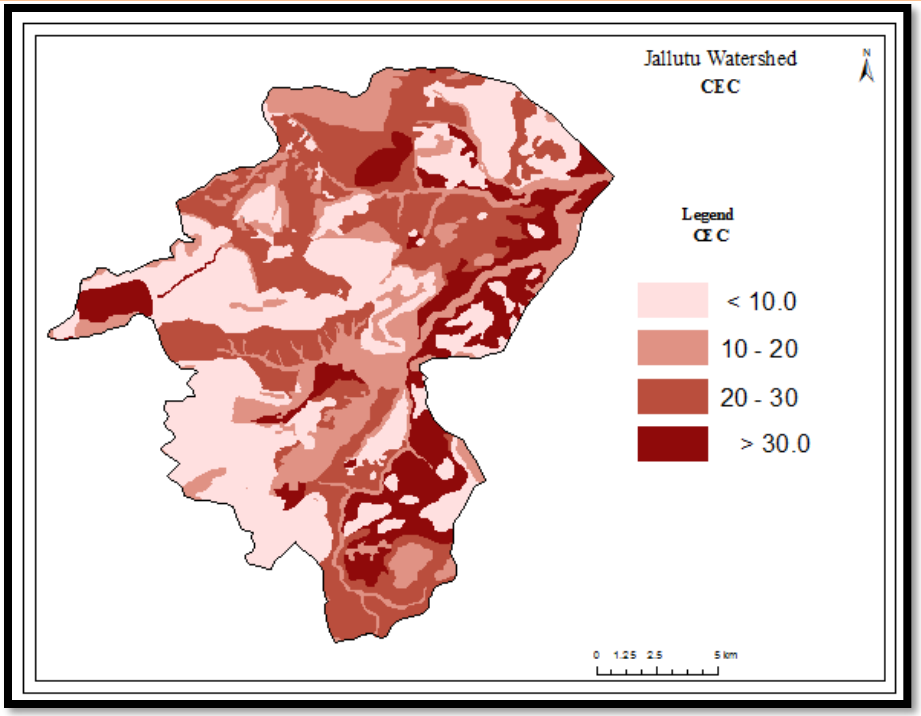
Soil Depth in cm	Area Sq. km^2	Percentage
Very Shallow	40.26	14.23
Shallow	116.22	41.51
Mod. Shallow	14.96	7.26
Mod. Deep	48.26	16.54
Deep	60.82	20.65

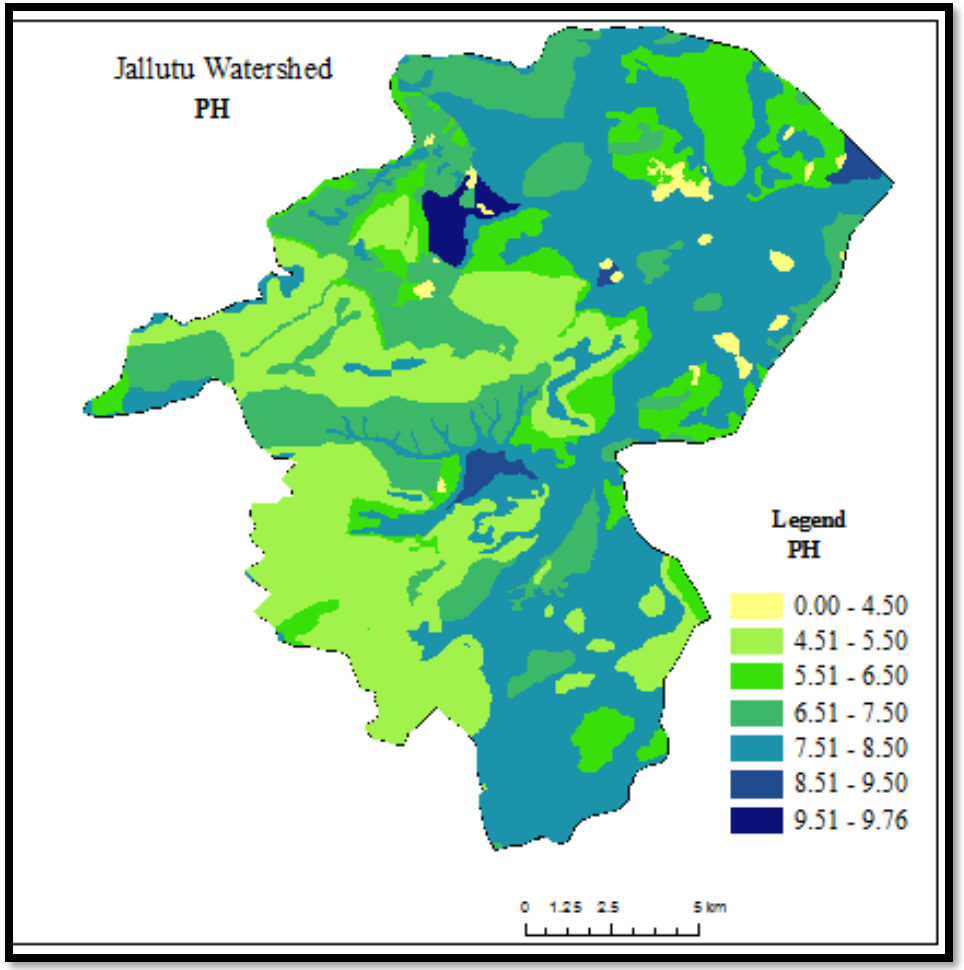
Soil Salinity & Sodicity



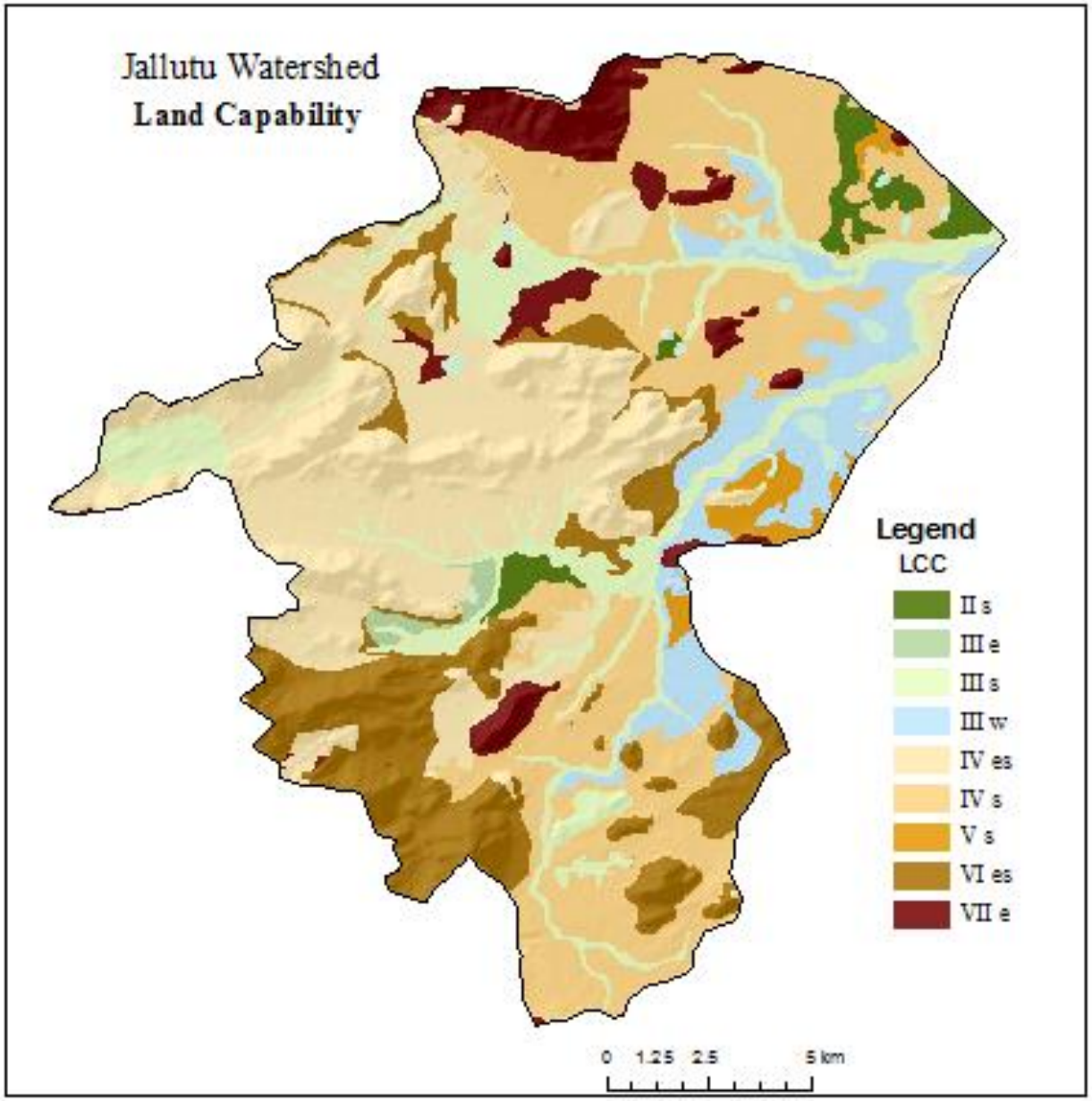


Soil CEC & pH

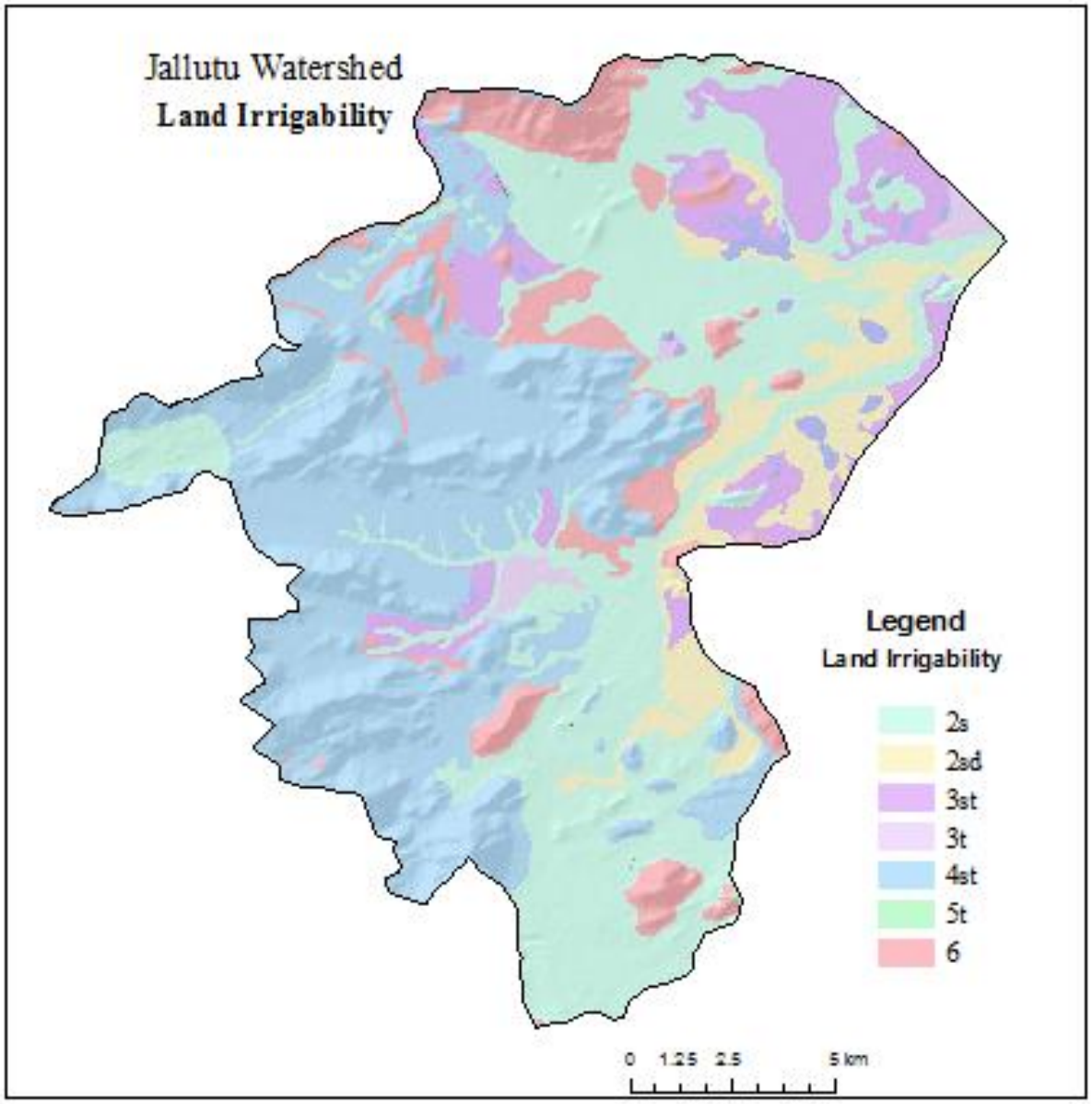

Jallutu Watershed
CEC
N
Legend
CEC
< 10.0
10 - 20
20 - 30
> 30.0
0 1.25 2.5 5 km


Jallutu Watershed
PH
Legend
PH
0.00 - 4.50
4.51 - 5.50
5.51 - 6.50
6.51 - 7.50
7.51 - 8.50
8.51 - 9.50
9.51 - 9.76
0 1.25 2.5 5 km

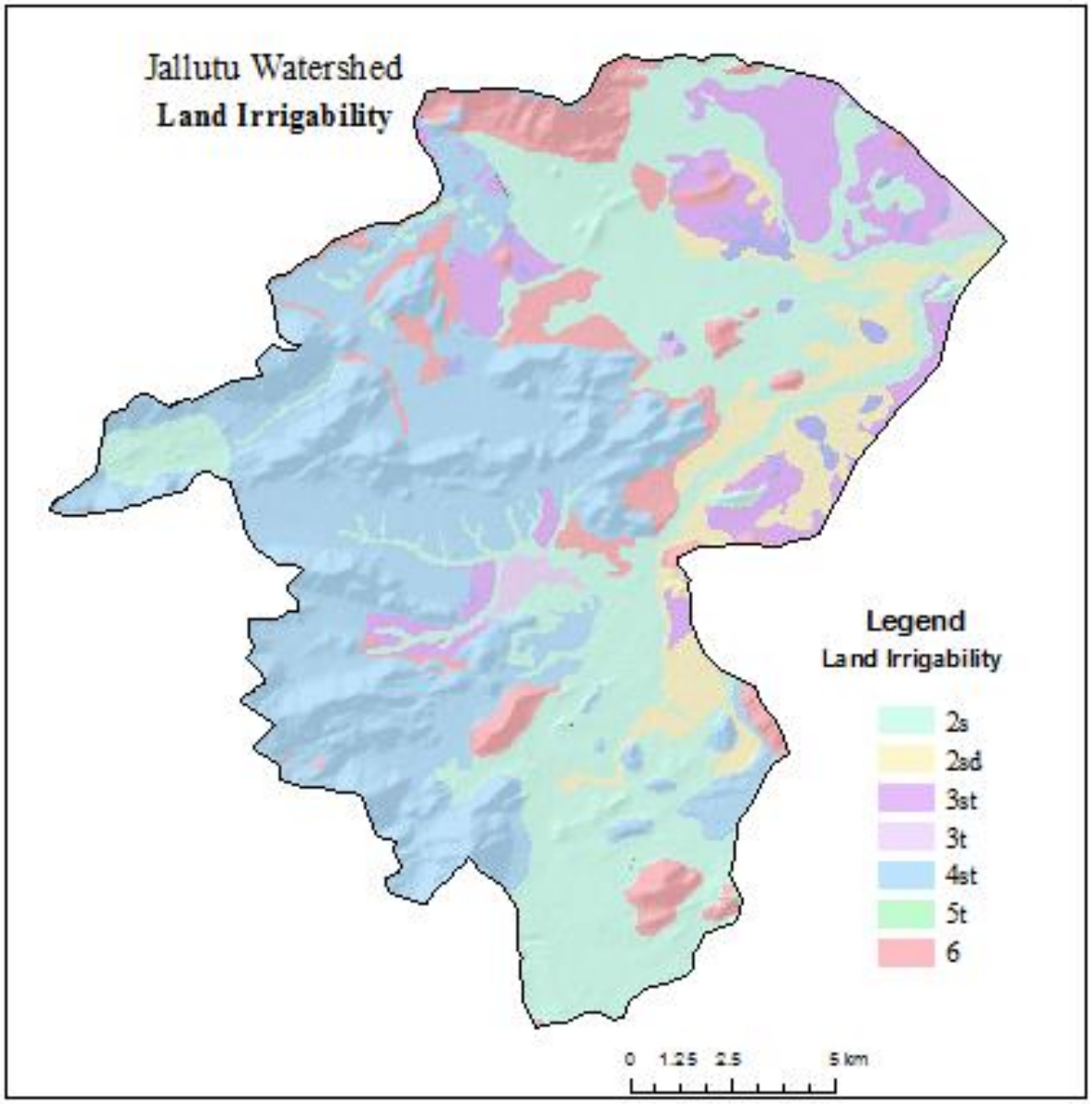
Land Capability Jallutu Watershed



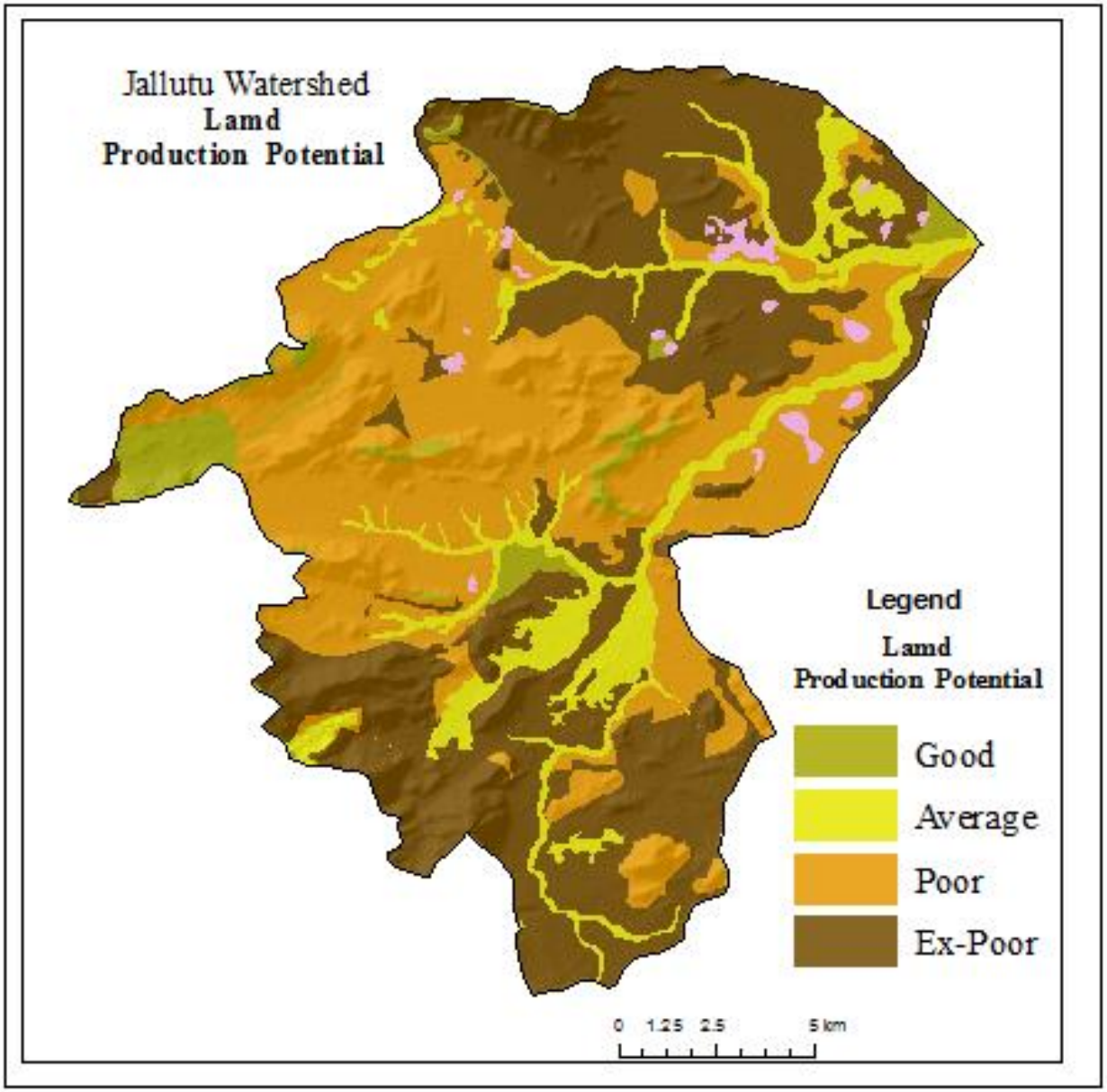
Land Irrigability Jallutu Watershed



Land Irrigability Jallutu Watershed

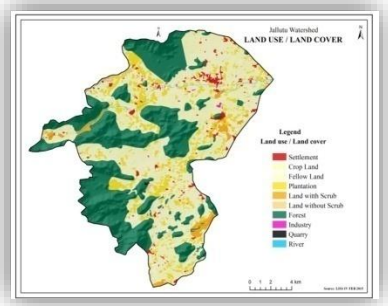


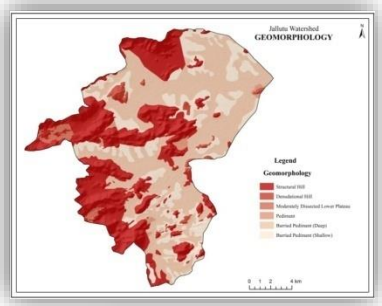
Land Production Potential - Jallutu Watershed

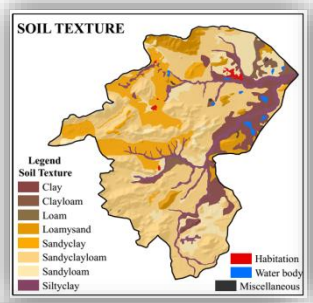


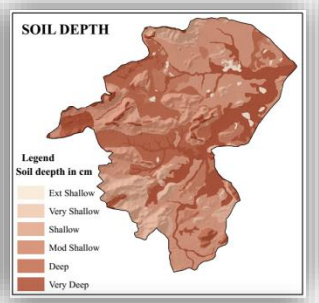
Land Units

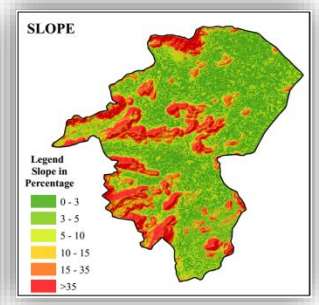
Land mapping units are mapped area of land with specified characteristics

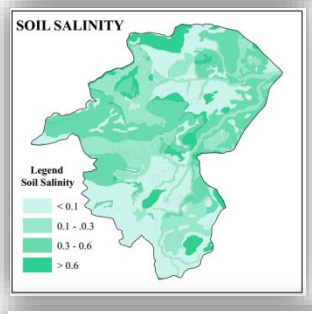


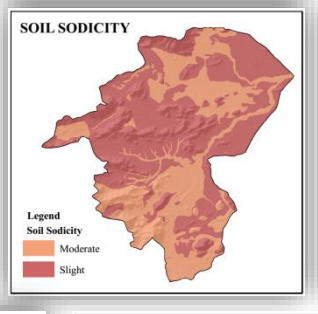


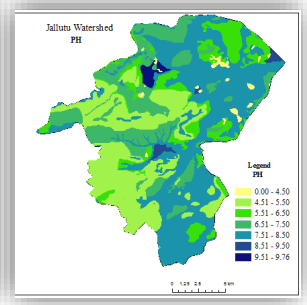


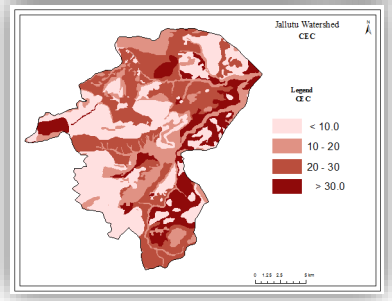


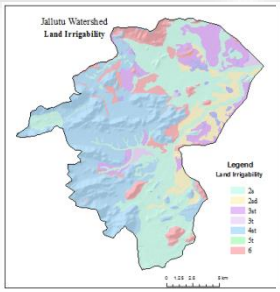


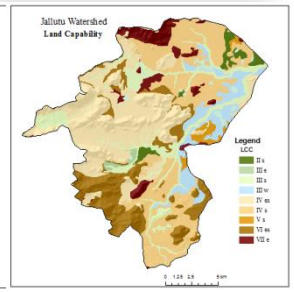


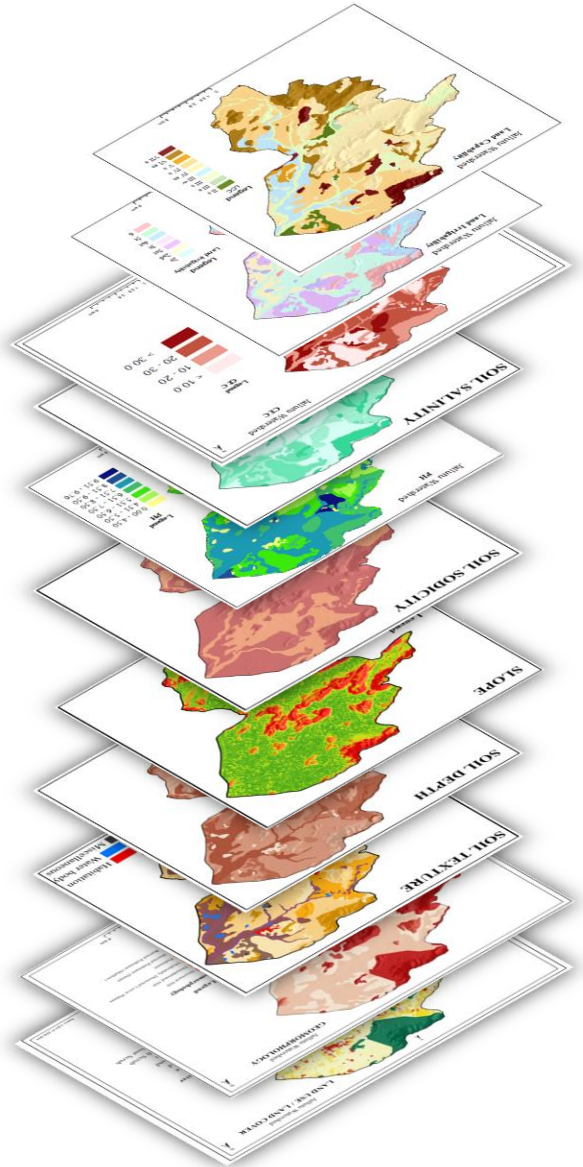






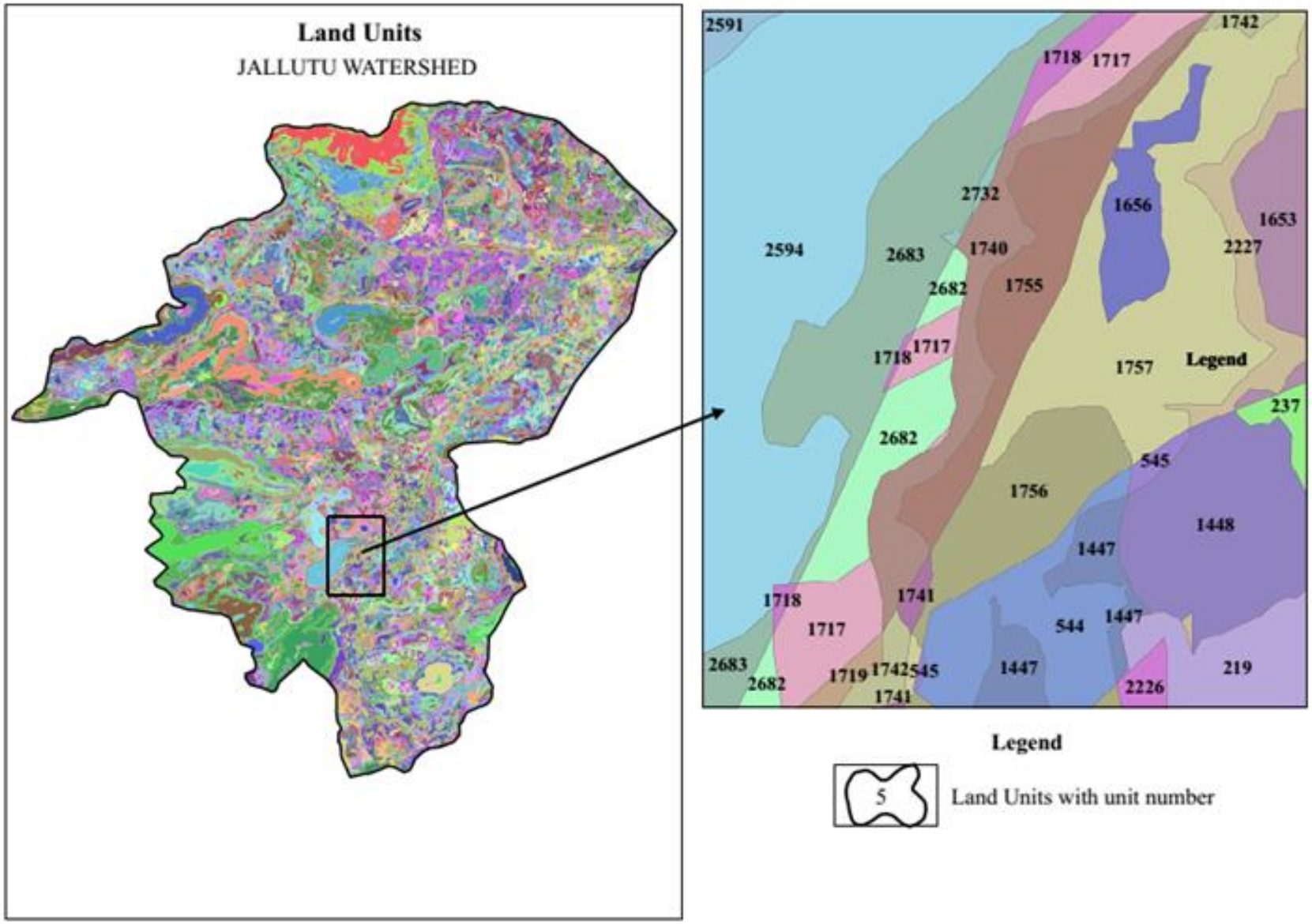






Land Units

Land mapping units are mapped area of land with specified characteristics



Land Units

Land mapping units are mapped area of land with specified characteristics

Geomorphology	Slope	Soil depth	Texture	Land capability	Land Irrigability	Ph	Ec	CEC	Oc per	Esp	Land Use	Land Unit No.
Buried Pediment (Deep)	*0 - 3*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Crop Land*	**1**
Buried Pediment (Deep)	*05-10*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Crop Land*	**2**
Buried Pediment (Deep)	*0 - 3*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Crop Land*	**3**
Buried Pediment (Deep)	*0 - 3*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Plantation*	**4**
Buried Pediment (Deep)	*0 - 3*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Fellow Land*	**5**
Buried Pediment (Deep)	*0 - 3*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Fellow Land*	**6**
Buried Pediment (Deep)	*05-10*	*160*	*Silty clay*	*III s*	*2s*	*8.43*	*0.16*	*18.8*	*0.24*	*7.05*	*Plantation*	**7**
Buried Pediment (Deep)	*05-10*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Plantation*	**8**
Buried Pediment (Deep)	*05-10*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Crop Land*	**9**
Buried Pediment (Deep)	*05-10*	*46*	*Sandy Clay loam*	*IV s*	*2s*	*8.2*	*0.1*	*23.31*	*0.92*	*10.64*	*Fellow Land*	**10**

Crop Suitability Analysis: Crop Requirements for Sunflower

Soil-site characteristics			Rating			
		Unit	Highly suitable S1	Moderately suitable S2	Marginally suitable S3	Not suitable N
Climatic regime	Mean temperature in growing season	°C	24–30	31–34 20–23	35–38 16–19	>38 <16
	Total rainfall	mm	600-700	500-600	400-500	<400
Land quality						
Moisture availability	Length of growing period	Days	>90	80–90	70–80	<70
Oxygen availability to roots	Soil drainage	Class	well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture	Class	l, cl, sil, sc	scl, sic, c	c >60%, sl	ls, s
	pH	1:2.5	6.5–8.0	8.1–8.5; 5.5–6.4	8.6–9.0; 4.5–5.4	>9.0; <4.5
Rooting conditions	Effective soil depth	cm	>100	76–100	50–75	<50
	Coarse fragments	Vol %	<15	15–35	>35	
Soil toxicity	Salinity (EC saturation extract)	dS/m	<1.0	1.0–2.0	2.0–4.0	>4.0
	Sodicity (ESP)	%	<10	10–15	>15	
Erosion hazard	Slope	%	<3	3–5	5–10	>10

Source: Naidu (2002)

Land Units with Weights

	Sunflower											Groundnut										
Land Units	*Geomorphology*	*Slope*	*Soil Depth*	*Texture*	*Land Capability*	*Land Irrigability*	*PH*	*EC*	*ESP*	*Land use*	*Suitability Class*	*Geomorphology*	*Slope*	*Soil Depth*	*Texture*	*Land Capability*	*Land Irrigability*	*PH*	*EC*	*ESP*	*Land use*	*Suitability Class*
1	S1	S1	N1	S2	S3	S1	S2	S1	S2	S1	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S1	S2
2	S3	S3	N1	S2	S3	S1	S2	S1	S2	S1	S3	S3	S3	S3	S2	S3	S1	S2	S1	S3	S1	S3
3	S1	S1	N1	S2	S3	S1	S2	S1	S2	S1	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S1	S2
4	S1	S1	N1	S2	S3	S1	S2	S1	S2	S1	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S1	S2
5	S1	S1	N1	S2	S3	S1	S2	S1	S2	S2	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S2	S2
6	S1	S1	N1	S2	S3	S1	S2	S1	S2	S2	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S2	S2
7	S1	S3	S1	S2	S2	S1	S2	S1	S1	S1	S1	S1	S3	S1	S3	S2	S1	S2	S1	S2	S1	S2
8	S1	S3	N1	S2	S3	S1	S2	S1	S2	S1	S2	S1	S3	S3	S2	S3	S1	S2	S1	S3	S1	S2
9	S1	S3	N1	S2	S3	S1	S2	S1	S2	S1	S2	S1	S3	S3	S2	S3	S1	S2	S1	S3	S1	S2
10	S1	S3	N1	S2	S3	S1	S2	S1	S2	S2	S2	S1	S3	S3	S2	S3	S1	S2	S1	S3	S2	S2
11	S1	S1	N1	S2	S3	S1	S2	S1	S2	S2	S2	S1	S1	S3	S2	S3	S1	S2	S1	S3	S2	S2
12	S1	S3	N1	S2	S3	S1	S2	S1	S2	S2	S2	S1	S3	S3	S2	S3	S1	S2	S1	S3	S2	S2
13	S1	S3	S1	S2	S2	S1	S2	S1	S1	S2	S2	S1	S3	S1	S3	S2	S1	S2	S1	S2	S2	S2
14	S1	S3	S1	S2	S2	S1	S2	S1	S1	S1	S1	S1	S3	S1	S3	S2	S1	S2	S1	S2	S1	S2
15	S1	S1	S1	S2	S2	S1	S2	S1	S1	S1	S1	S1	S1	S1	S3	S2	S1	S2	S1	S2	S1	S1

Suitability Class:

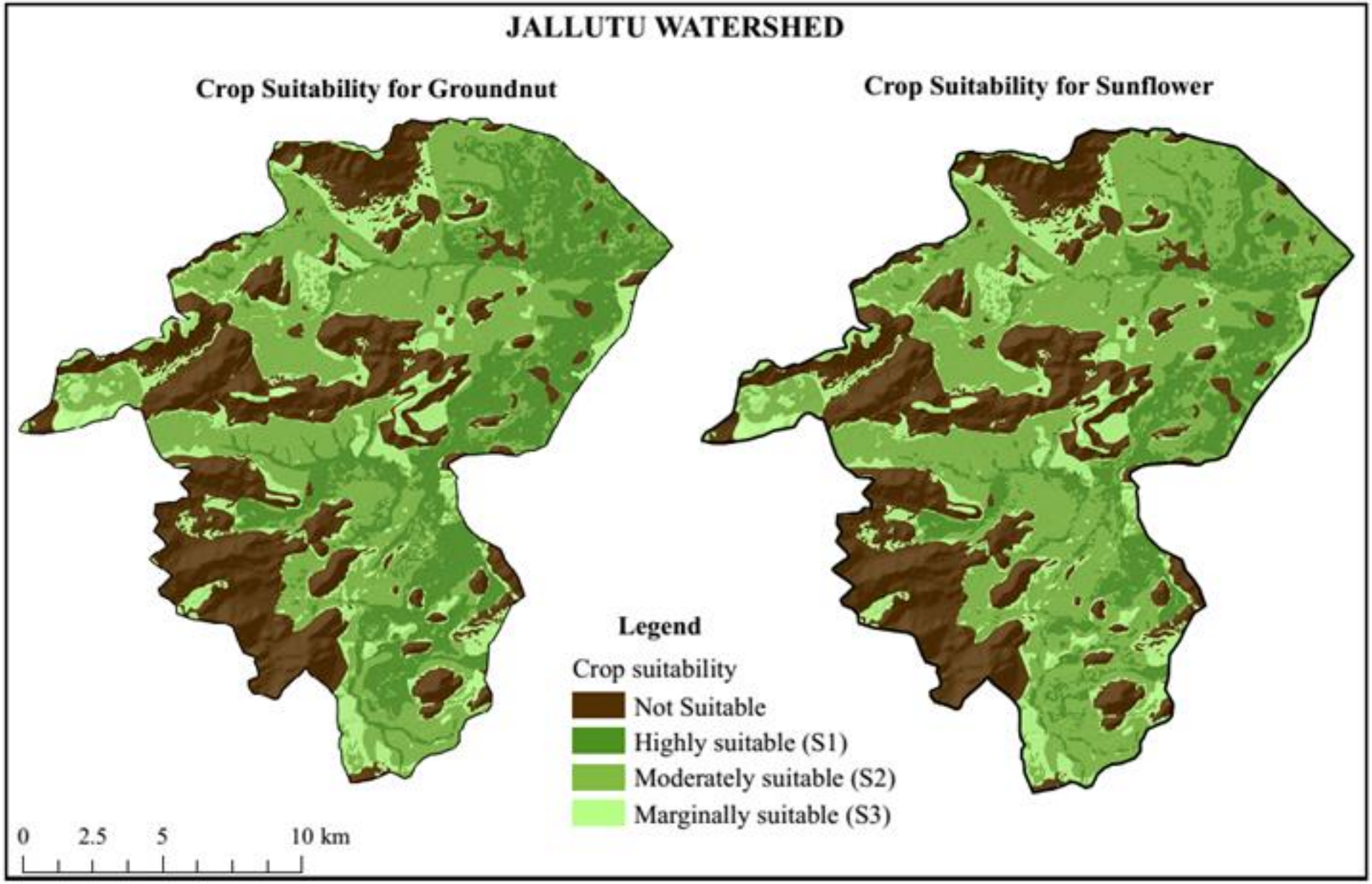
Suitable (S) Highly Suitable (S1),
Moderately Suitable (S2)
Marginally Suitable (S3)

Not suitable (N) Currently Not Suitable (N1)
Permanently Not Suitable (N2)

Crop Suitability Analysis: Crop Requirements for Groundnut

Soil-site characteristics			Rating			
		Unit	Highly suitable S1	Moderately suitable S2	Marginally suitable S3	Not suitable N
Climatic regime	Mean temperature in growing season	°C	24–30	22–23 31–33	20–21 34–40	<20 >40
	Total rainfall	mm	700-1000	500-700	350-500	<350
Land quality	Land characteristics					
Moisture availability	Length of growing period					
	Bunch varieties	Days	100–125	90–105	75-90	
	Spreading varieties	Days	120–135	105–120	90–105	
Oxygen availability to roots	Soil drainage	Class	Well drained	Moderately well drained	Imperfectly drained	Poorly drained
Nutrient availability	Texture-surface	Class	ls, sl	cl, sicl, scl	c, sic	
	Texture-sub surface	Class	sil, l, scl, cl, sicl	Sc, sic, c	s, ls, sl, c>60	
	pH	1:2.5	6.0–8.0	8.1–8.5; 5.5–5.9	>8.5; <5.5	
	$CaCO_3$ in root zone	%	High	Medium	Low	
Rooting conditions	Effective soil depth	cm	>75	51–75	25–50	<25
	Crusting		None	Slight	Moderate	
	Coarse fragments	Vol %	<35	35–50	>50	
Soil toxicity	Salinity (EC saturation extract)	dS/m	<2.0	2.0–4.0	4.0-8.0	>8.0
	Sodicity (ESP)	%	Non sodic	5–10	>10	
Erosion hazard	Slope	%	<3	3–5	5–10	>10

Crop Suitability for Groundnut & Sunflower



Crop Suitability for Groundnut & Sunflower

Suitability Class	Groundnut	Sunflower
S1	*60.65 Sq. km2 21.84(%)*	*40.27 Sq. km2 14.07(%)*
S2	*89.36 Sq. km2 31.95(%)*	*112.35 Sq. km2 39.86(%)*
S3	*40.26 Sq. km2 14.34(%)*	*39.82 Sq. km2 14.38(%)*
N	*90.36 Sq. km2 31.87(%)*	*88.51 Sq. km2 31.95(%)*

Thank you