Comparison between water balance using NBSS, MRSAC soil data with GSDA

Paradgaon, Bajar Wahegaon and Malegaon Village

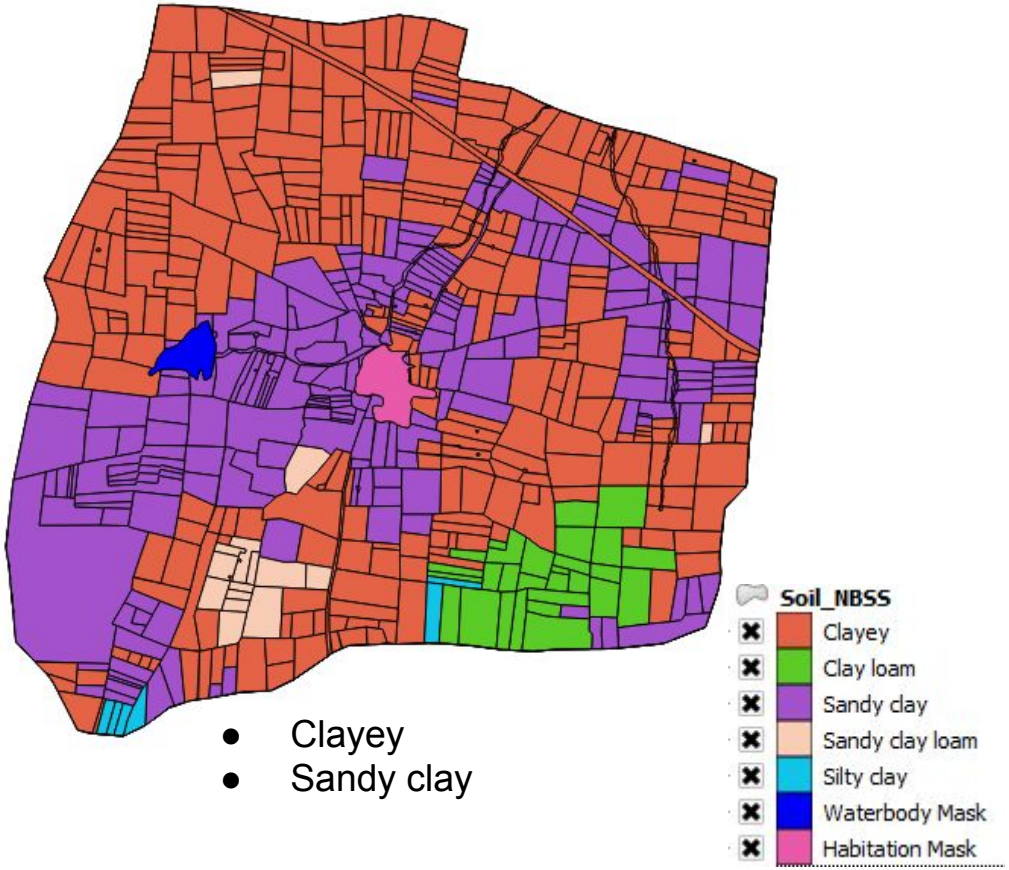
IITB

August 2020

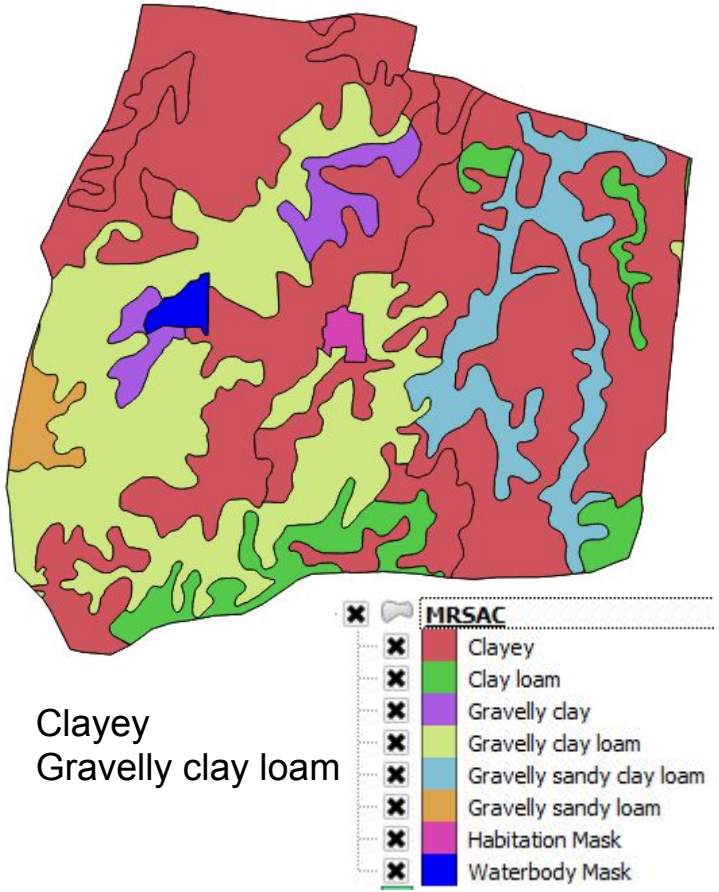
Outline

- Soil texture Maps of NBSS and MRSAC
- Soil Depth Maps of NBSS and MRSAC
- Description of rainfall and cropping pattern for the three villages.
- Comparison of water Balance components like rainfall, runoff, groundwater recharge
- Observations

NBSS and MRSAC Soil Texture

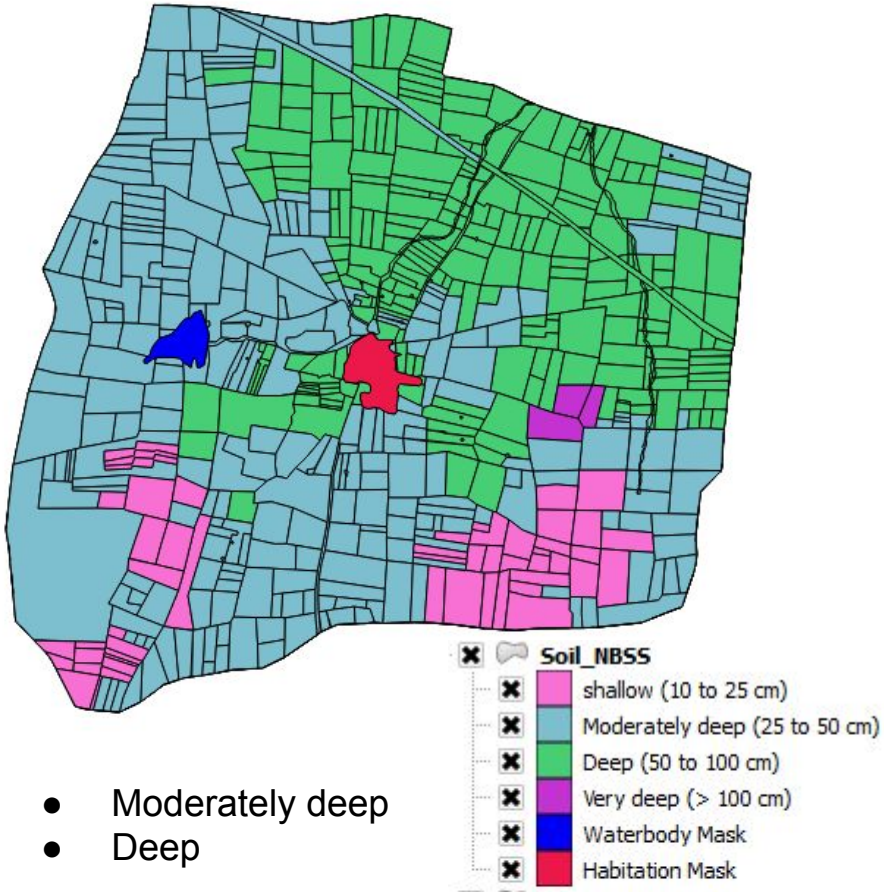


- Clayey
- Sandy clay

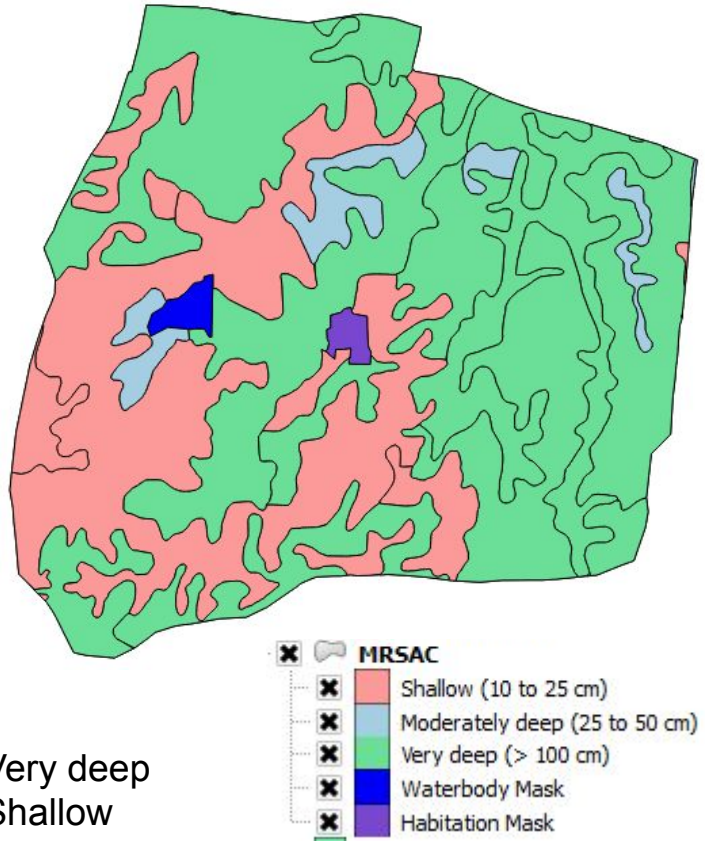


- Clayey
- Gravelly clay loam

NBSS and MRSAC Soil Depth



- Moderately deep
- Deep



- Very deep
- Shallow

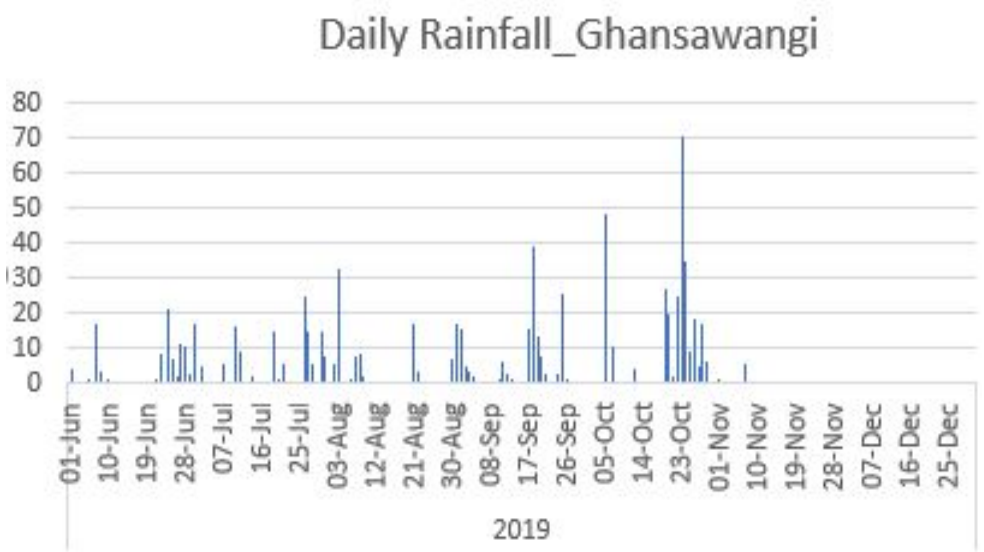
Description of soil maps

- Soil polygons for texture are different from each other. Soil polygons for depth are different from each other.
- NBSS dominant in clay and sandy clay, MRSAC is dominant in clay and gravelly clay loam.
- NBSS dominant in deep and moderately deep, MRSAC is dominant in very deep and shallow category.
- Classification classes used by NBSS were slightly different from MRSAC. E.g in MRSAC shallow soil is (shallow 10 to 25 cm). In NBSS shallow soil was shallow (shallow <25). A format was shared with the NBSS. MRSAC classification was adopted. There are some spelling mistakes in NBSS classes.

- For Water budget calculation year 2019-20 was used by GSDA. Same has been used for water balance model.
- Ranjani circle is closest to the Paradgaon. Data for this circle was used to run the model.
- GSDA used partur circle for its analysis which is taluka circle.
- Half of the Village area was under Cotton.
- Rainfall for year 2019 was well spread.

Cropping Pattern for Paradgaon

Sr. No	Landuse	Area (Ha)
1	vegetables	5
2	small_vegetables	3
3	udid	15
4	moong	271
5	sorghum	136
6	bajra	139.5
7	soybean	507.5
8	cotton	1392.5
9	tur	306
10	sugarcane	12.5
11	grapes	1.5
12	sweetlime	34
13	lemon	18.5
14	current fallow crop	19
15	scrub	16.5
16	wasteland	33.5
17	permanant fallow crop	11
18	rabi_sorghum	187
19	rabi_maize	13
20	gram	330.5
21	rabi_wheat	272.5



Hourly water balance results for Paradgaon village 2019

Sr.No	Item	NBSS(mm)	MRSAC(mm)
1	Rainfall_monsoon_End	551.25	551.25
2	Monsoon_cropwater_requirement	395.46	395.46
3	Monsoon_AET	365.59	359.38
4	monsoon_crop_deficit	29.86	36.08
5	storage_capacity	29.32	29.32
6	Monsoon_Gw	53.23	50.71
7	Monsoon_Runoff	75.03	51.80
8	post_monsoon_soil_moisture_available	51.21	82.00
9	Loss from Non-Ag land	6.19	6.19
10	Post_Monsoon_rainfall	317.00	317.00
11	Post_Monsoon_Gw_Total	68.28	88.60
12	Post_Monsoon_Runoff_Total	120.90	85.17
13	Post_Monsoon_Gw(Long_kharif+annual)	23.00	33.70
14	Post_Monsoon_Runoff(Long_kharif+annual)	60.40	39.82
15	Post_Monsoon_Gw(kharif)	45.28	54.91
16	Post_Monsoon_Runoff(kharif)	60.50	45.35

Observations

- Pre Monsoon Rainfall is 550mm.
- Water demand for most of the crops was fulfilled during the monsoon period.
- MRSAC soils are more deep and have more soil moisture and less runoff.
- In 2019, there were late monsoon showers. In this case around 317mm.
- Post monsoon GW and runoff is on higher side as compared to monsoon. This is because in model after kharif fields were empty.
- If we look only at Long kharif and annual crop land-use, there is reasonable GW and runoff.
- We should only consider half the runoff and recharge from the kharif land for post monsoon scenario.

GSDA Budget paradgaon cluster

	Jalna
Year for Budget	**2019-2020**
Village Area	2926
Rainfall Actual Year(Partur Circle)	747.5
Rainfall used for runoff calculation	591
Runoff coefficient used	0.09
Runoff generated in mm	54.38
% Runoff of actual rainfall	7.27%
% Runoff of rainfall used for calculation	9.20%
Gross GW Recharge in mm	68.87
% GW Recharge of actual rainfall	9.21%
% GW Recharge of rainfall used for calculation	11.65%

- GSDA has mentioned it used partur circle rainfall which was 747mm in 2019 till the time of survey.
- Rainfall used by them in calculation was 547mm.
- There is difference of 120mm between ranjani(skymet) and partur circle(GSDA).
- Skymet has reported 796mm rainfall at partur circle in 2019. Difference of 70mm with ranjani circle.

Comparison between NBSS, MRSAC and GSDA

Sr.No	Item	NBSS(mm)	MRSAC (mm)	GSDA(mm)
1	Rainfall	868	868	591 (747)
2	Recharge	121	139	54
3	Runoff	195	136	68

Table 1 gives the result for rainfall, runoff, and gw for whole year.

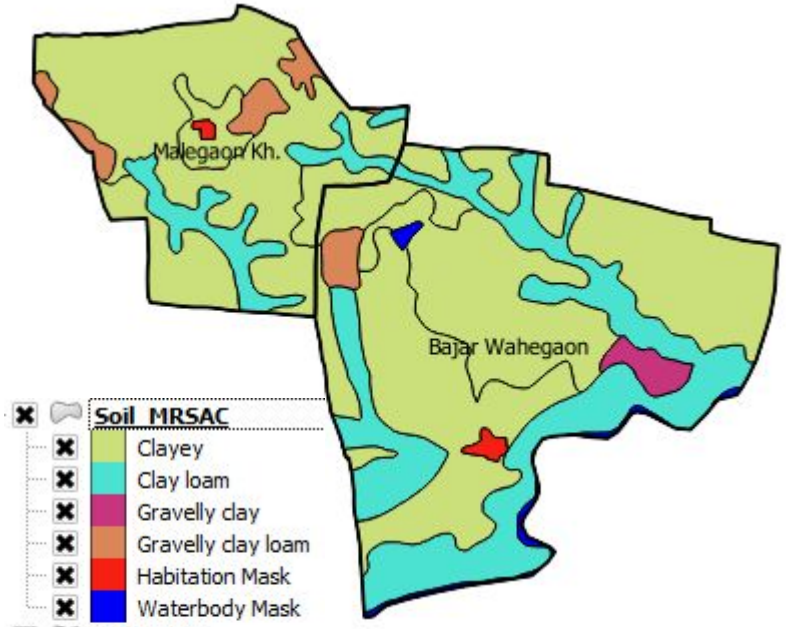
Sr.No	Item	NBSS (mm)	MRSAC (mm)	GSDA(mm)
1	Rainfall	868	868	591 (747)
2	Recharge	98.4	111.5	54
3	Runoff	164.8	113.3	68

Tabel 2 reduced runoff and GW from kharif land has been considered.

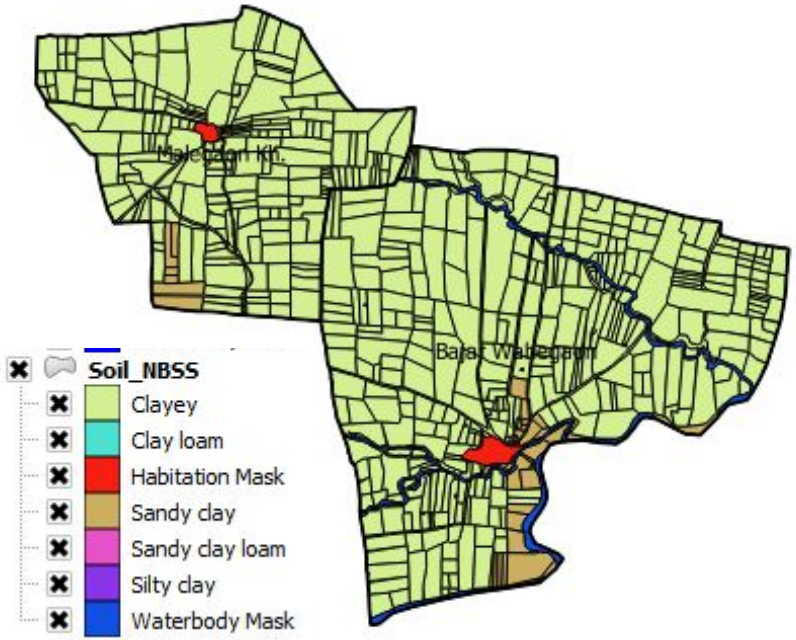
Let us look at the table result of table 2. GSDA recharge and runoff values are very low as compared to the result obtained from the NBSS and MRSAC. One reason is due to low rainfall considered.

Texture - Bajar Wahegaon and Malegaon Village

MRSAC

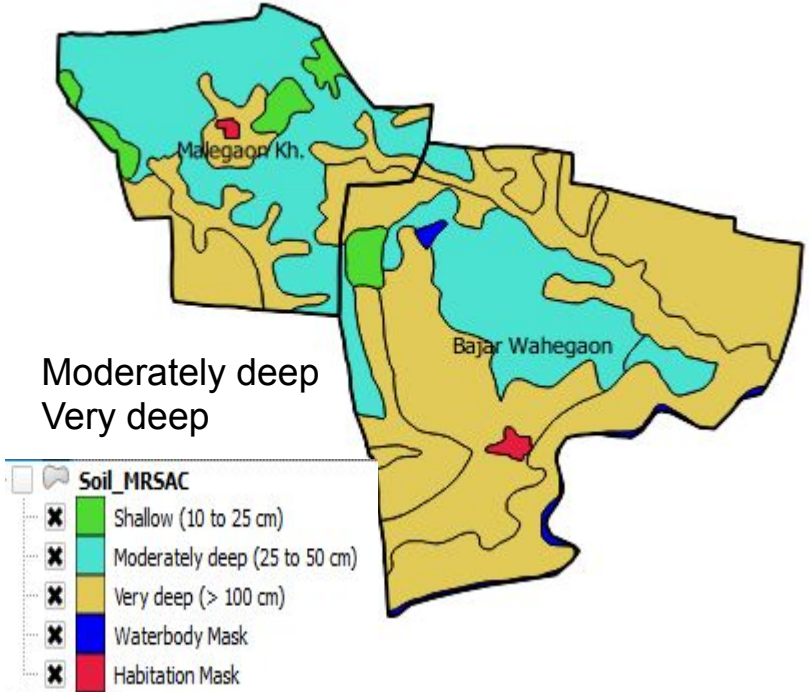


NBSS

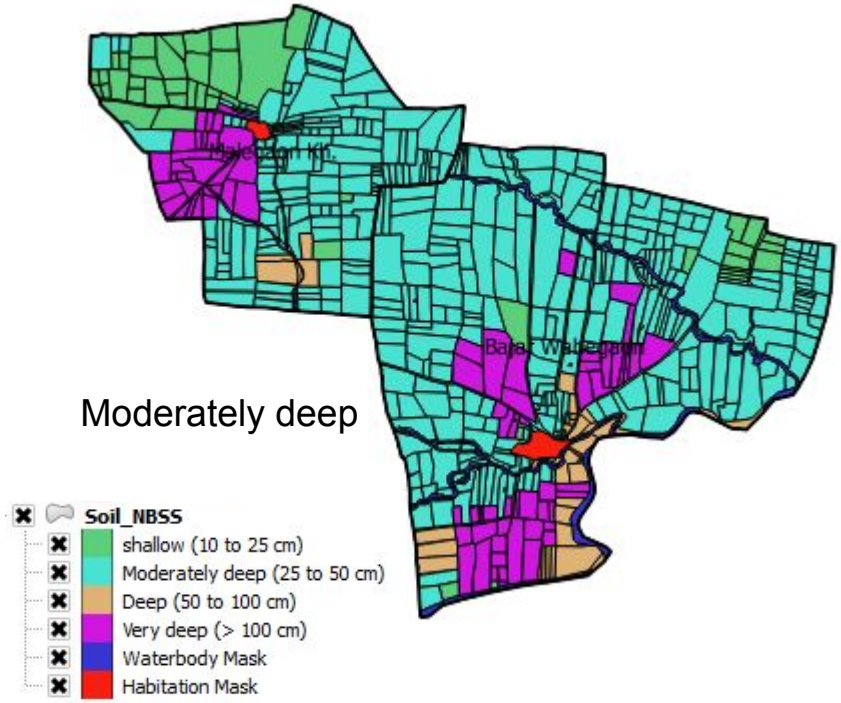


Depth - Bajar Wahegaon and Malegaon Village

MRSAC



Moderately deep
Very deep



Moderately deep

Cropping Pattern Bajar Wahegaon and Malegaon

Sr. No	Crop Name	Area Ha
1	maize	66.5
2	bajra	59.5
3	moong	80
4	udid	52
5	fodder_crop	39
6	soybean	171
7	small_vegetables	54.99
8	groundnut	12
9	cotton	822
10	tur	113.5
11	grapes	7
12	sweetlime	123
13	pomegranate	25.2
14	rabi_wheat	43
15	rabi_fodder	8
16	gram	85
17	rabi_vegetables	8
18	rabi_sorghum	210

Sr. No	Crop Name	Area Ha
1	maize	29.5
2	bajra	24
3	moong	22.5
4	udid	10
5	fodder_crop	0.655
6	soybean	84
7	groundnut	2.5
8	small_vegetables	17.5
9	cotton	561.72
10	tur	48
11	sweetlime	36.99
12	grapes	2
13	pomegranate	5.7
14	rabi_sorghum	139
15	gram	16
16	rabi_wheat	7
17	rabi_vegetables	3

Water balance for year 2019

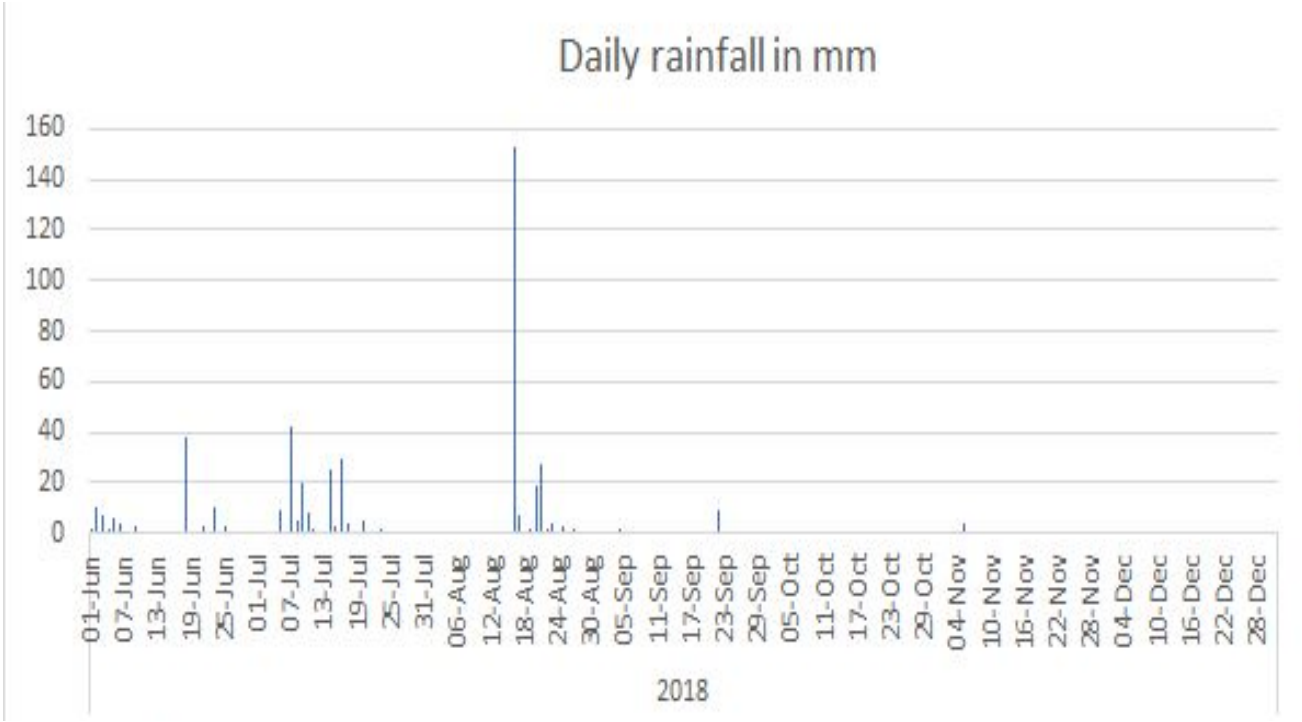
Description	MRSAC		NBSS	
	Bajar Wahegaon (mm)	Malegaon (mm)	Bajar Wahegaon (mm)	Malegaon (mm)
rainfall_mm	482.75	482.75	482.75	482.75
monsoon_cropwater_requirement	443.63	468.51	443.63	469.06
monsoon_crop_deficit	128.04	188.74	178.99	220.15
monsoon_storage_available	17.78	37.59	17.78	37.63
monsoon_groundwater_available	8.40	13.29	13.34	14.83
monsoon_balance	-101.87	-137.86	-147.87	-167.69
monsoon_index	-0.26	0.27	0.17	0.24
post_monsoon_crop_water_requirement	254.03	259.24	254.03	259.54
post_monsoon_drinking_water_requirement	6.20	5.30	6.20	6.20
post_monsoon_storage_available	17.78	37.59	17.78	37.63
post_monsoon_groundwater_available	16.79	26.58	26.68	29.65
post_monsoon_soil_moisture_available	55.72	25.36	18.89	15.73
post_monsoon_balance	-169.93	-175.02	-196.87	-182.72
post_monsoon_index	0.35	0.34	0.24	0.31
runoff_generated	70.32	135.28	153.40	171.73
runoff_available	35.16	67.64	76.70	44.60
runoff_available_for_impounding	-0.40	-7.53	41.14	-30.66

Bajar Wahegaon and Malegaon

Bajar Wahegaon	MRSAC (mm)	NBSS (mm)	GSDA (mm)
Rainfall	482.75	482.75	487
Runoff	70.32	135.28	34.5
Groundwater	25.19	39.86	74.4

Malegaon	MRSAC	NBSS	GSDA
Rainfall	482.75	482.75	487
Runoff	135.28	171.73	34.5
Groundwater	39.86	44.47	74.4

Rainfall Badnapur Circle 2018(skymet)



Observation

There is single rainfall event of 150mm on 16-Aug-2018. This is leading to high runoff generation.

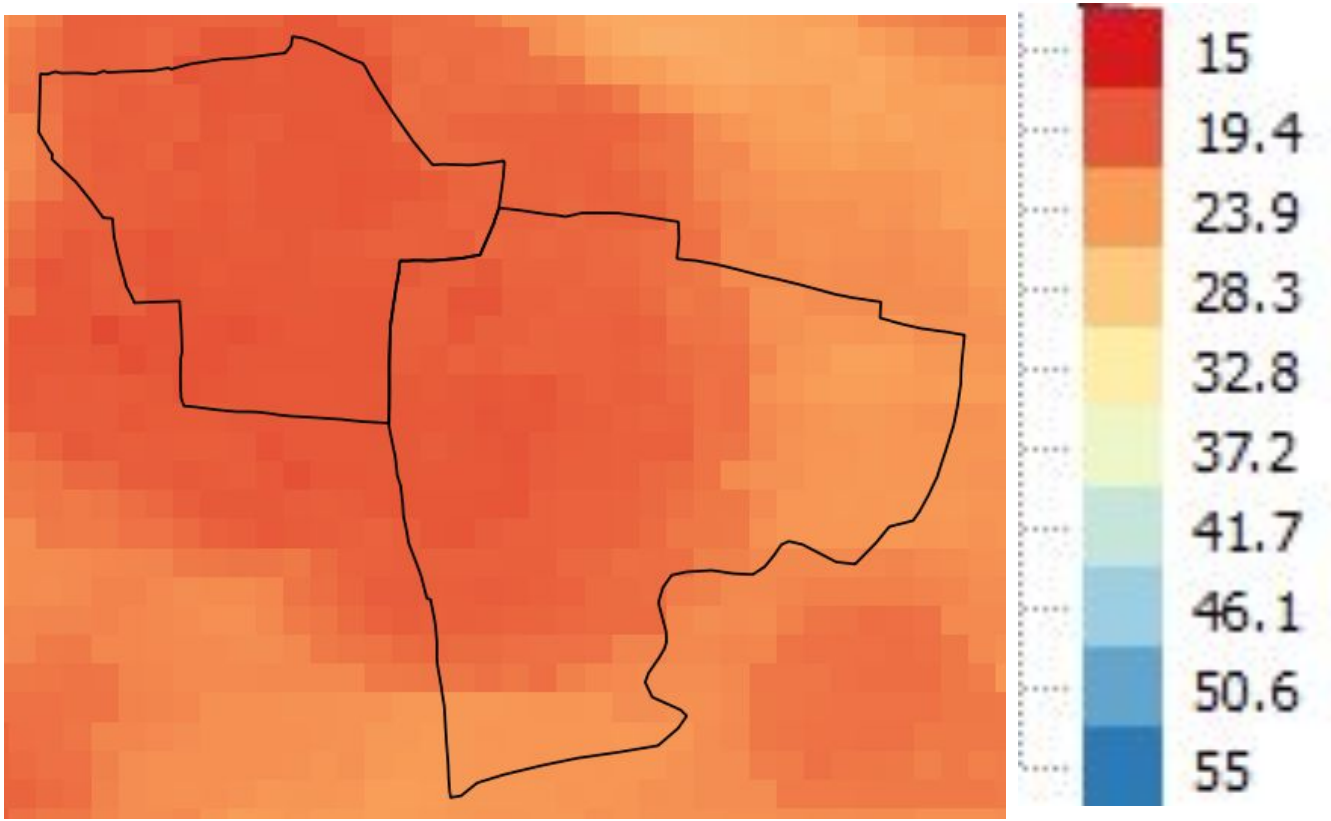
MRSAC Soil in Bajar Wahegaon are deep, due to which less percolation and runoff. More water is added to soil moisture.

MRSAC soil in Malegaon are moderately deep. Soils get saturated and lead to increase in percolation and runoff rate.

NBSS soils are moderately deep and clayey in nature. Soils get saturated and lead to increase in percolation and runoff rate.

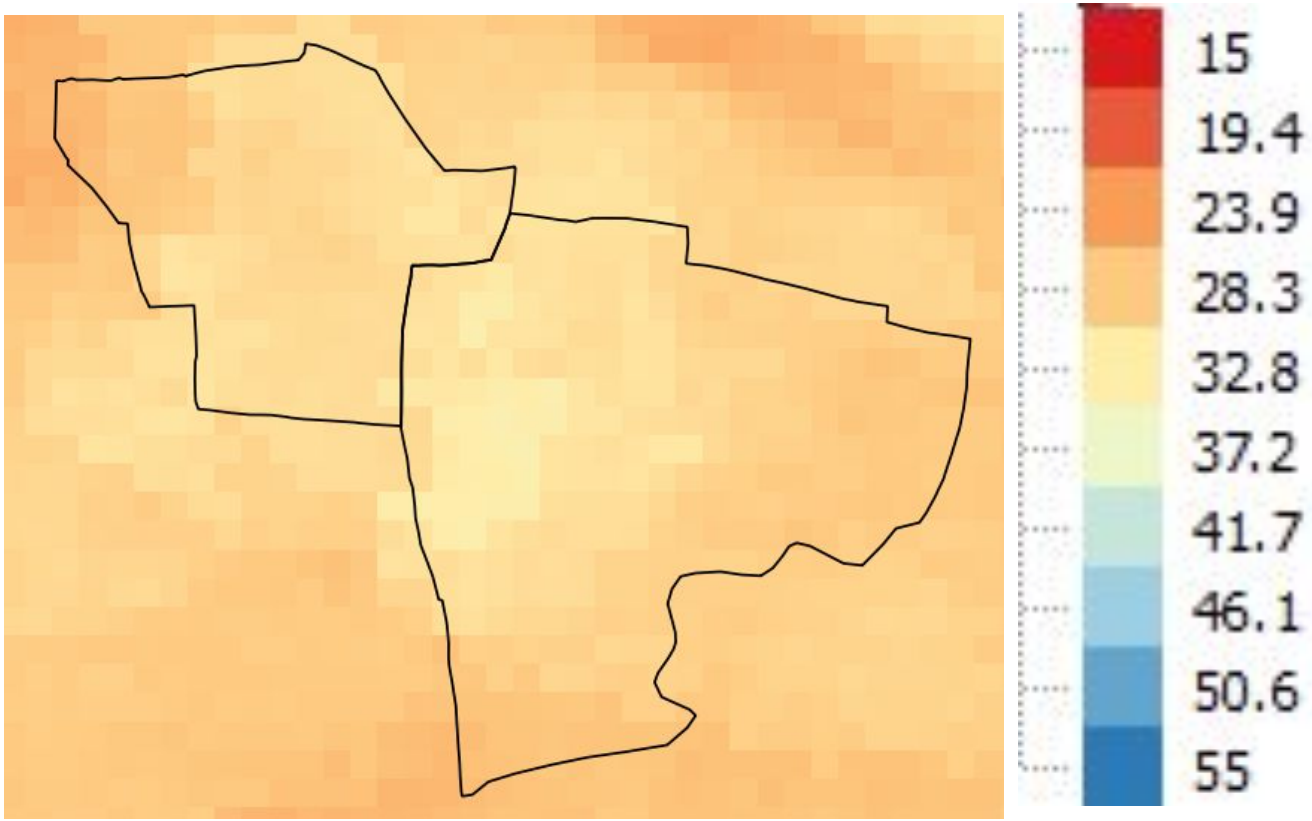
	Bulk_Densi	Clay	Sand	Silt	NCOI	THNCODE	NCOD	L_NAM	NCOI	ELECTE	ni_Wa	Circle	Area_ha	opulatio	mpan	BDIVIS	BJECT	EN_CI	_COD	_NAM	_NAM	ICATIC	CODI	PIN	THER	/IL_CE	LN_M	N_MA	pth_C	Texture_Cl
559	1.58	48	20.5	31.5	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	NU...	S2	022...	132...	236...	Ver...	Clayey
560	1.58	46.9	20.6	32.5	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	130	P2	022...	132...	236...	Mo...	Clayey
561	1.59	47.2	20.8	32	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	130	P2	022...	132...	236...	Mo...	Clayey
562	1.56	48.7	20.4	30.9	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	78	NU...	022...	132...	204...	Mo...	Clayey
563	1.58	48.5	20.4	31.1	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	78	NU...	022...	132...	204...	Mo...	Clayey
564	1.57	48.7	20.4	30.9	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	91	NU...	022...	132...	205...	Mo...	Clayey
565	1.58	46.9	20.6	32.5	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	135	NU...	022...	132...	236...	Ver...	Clayey
566	1.6	47.2	20.7	32.1	514	04128	547...	Ma...	177...	Yes	514...	Ro...	844.31...	839	Ma...	Jalna	220...	022...	271...	JAL...	Ba...	Ma...	180...	136	NU...	022...	132...	236...	Ver...	Clayey
567	1.59	47.3	22.3	30.4	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
568	1.59	47.6	22.4	30	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
569	1.59	47.6	22.4	30	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
570	1.58	47.8	21.5	30.7	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
571	1.59	47.2	22.7	30.1	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
572	1.59	47.6	22.4	30	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
573	1.59	47.3	22.6	30.1	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
574	1.59	47.3	22.3	30.4	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay
575	1.59	47.5	22.4	30.1	514	04128	547...	Baj...	177...	Yes	514...	Ro...	1626.8...	2424	Baz...	Jalna	221...	022...	271...	JAL...	Ba...	Baj...	180...	NU...	S4	022...	138...	214...	De...	Sandy clay

% Sand 5 cm depth



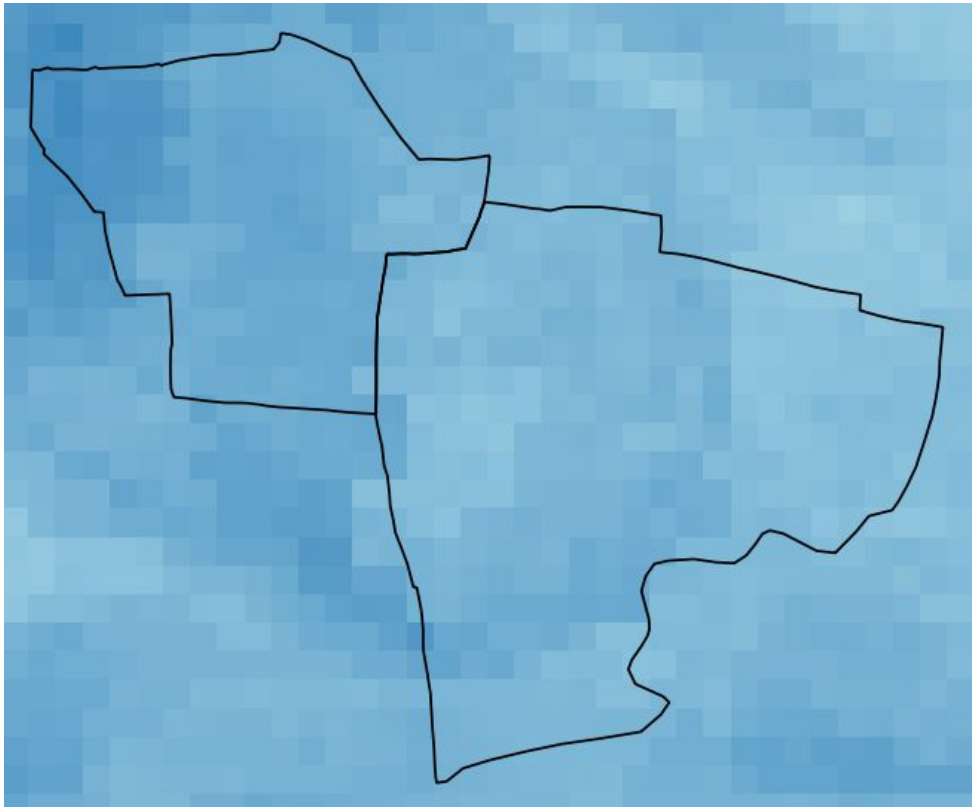
% Sand Varies from 19% to 25%

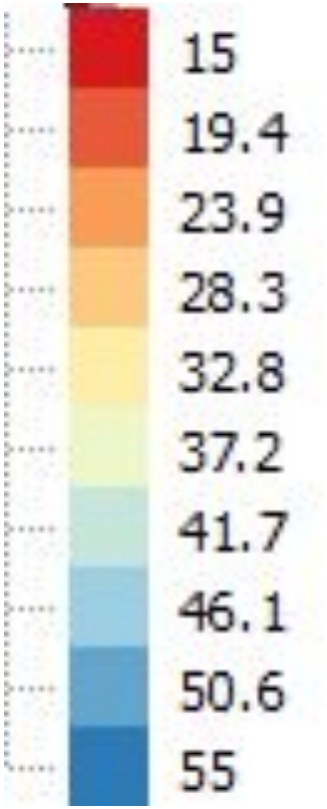
% Silt 5 cm depth



% Silt Varies from 25 to 32%

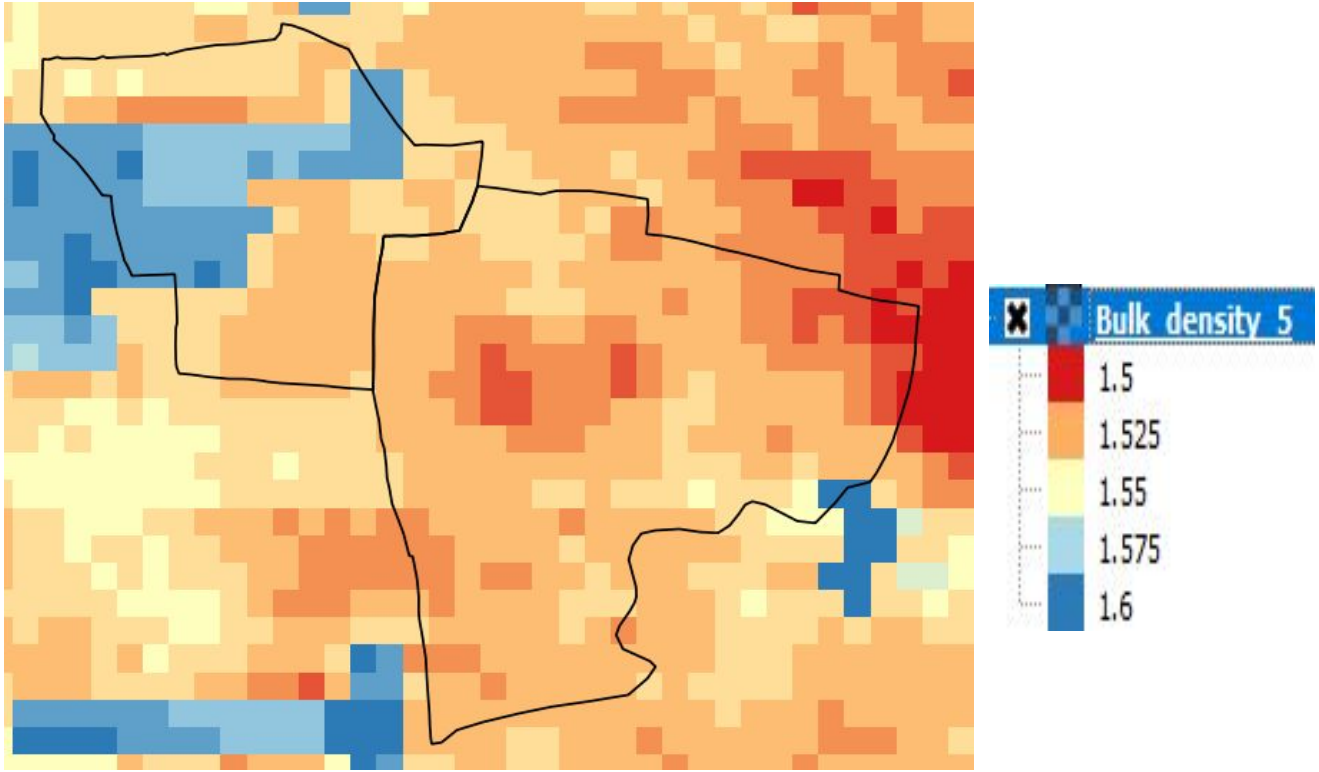
% Clay 5 cm depth





% Clay Varies from 46% to 52%

Bulk Density

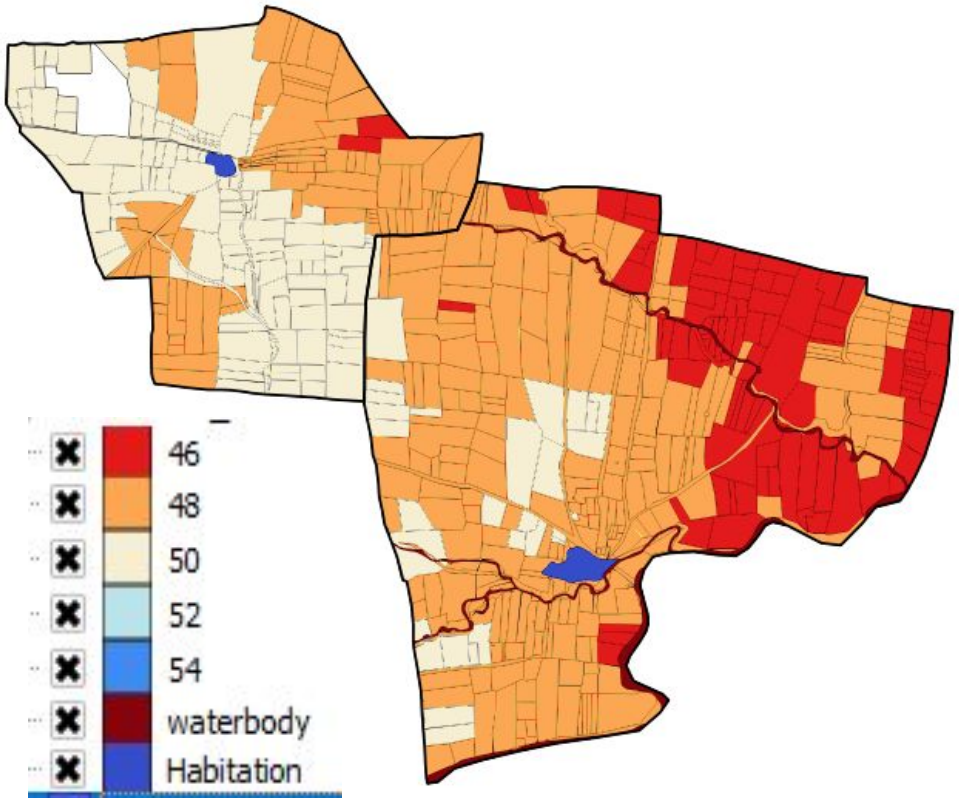


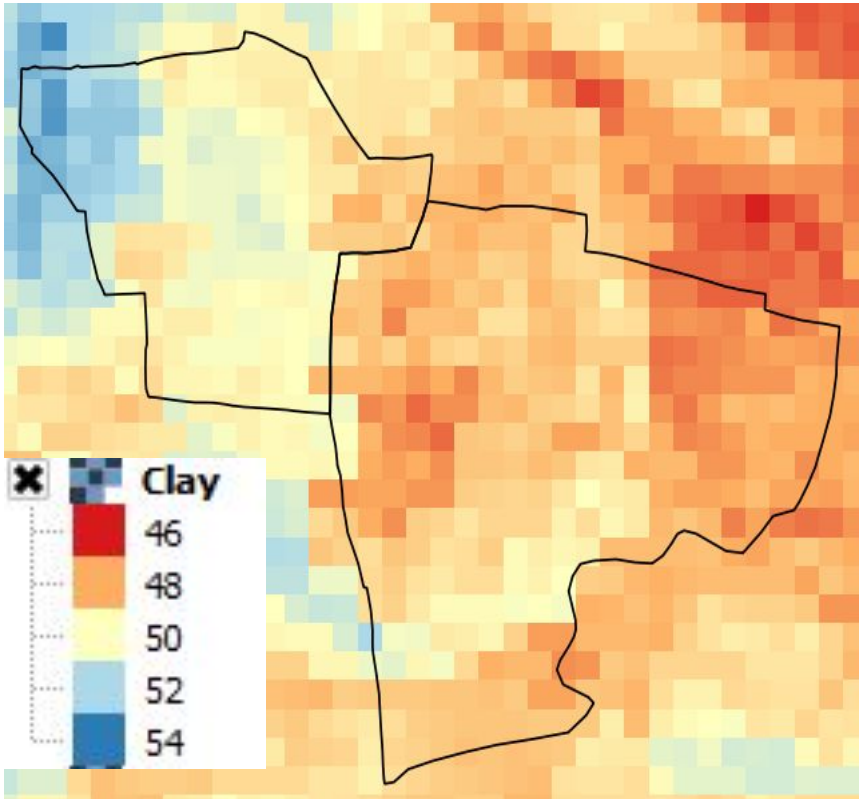
Bulk Density Varies from 1.5 to 1.6

Above data downloaded from the following websites.

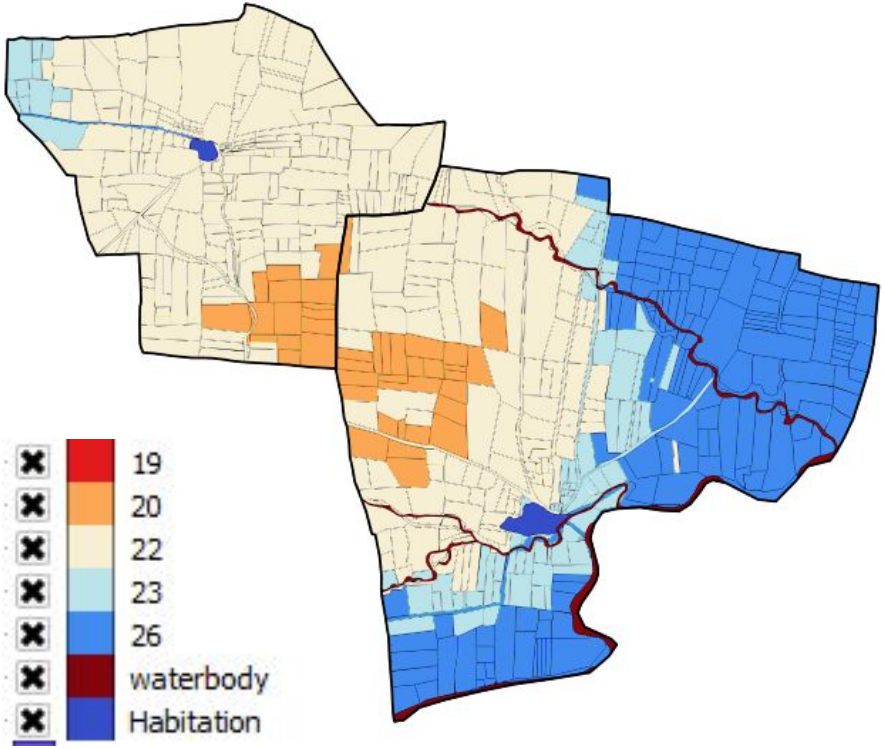
https://soilgrids.org/

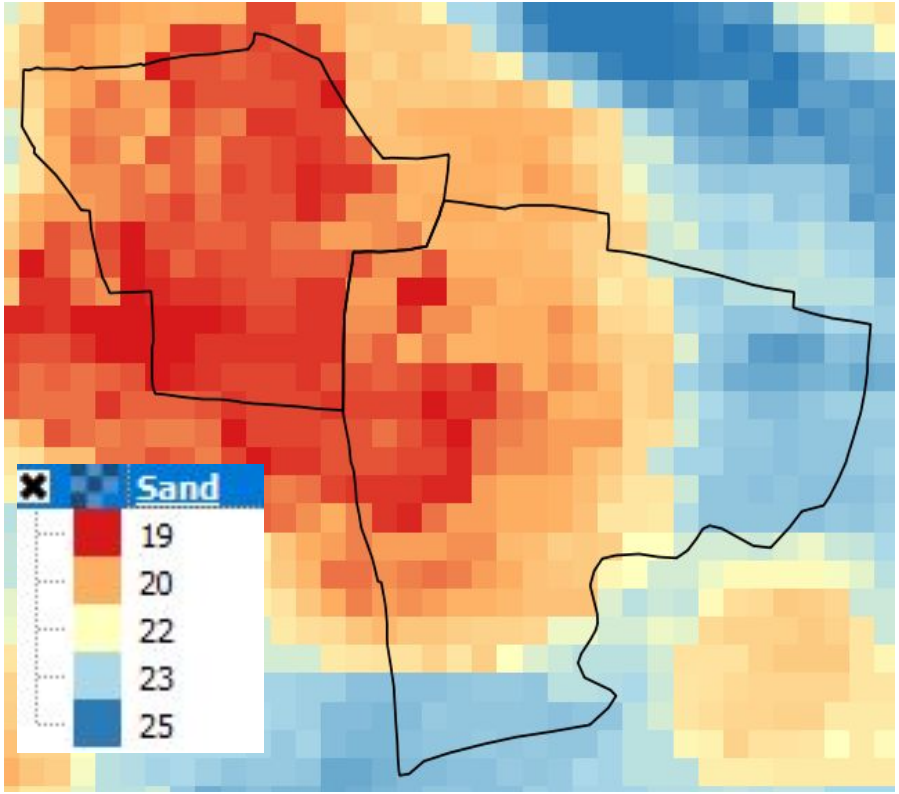
% Clay content from NBSS shapefile and website(15cm depth)

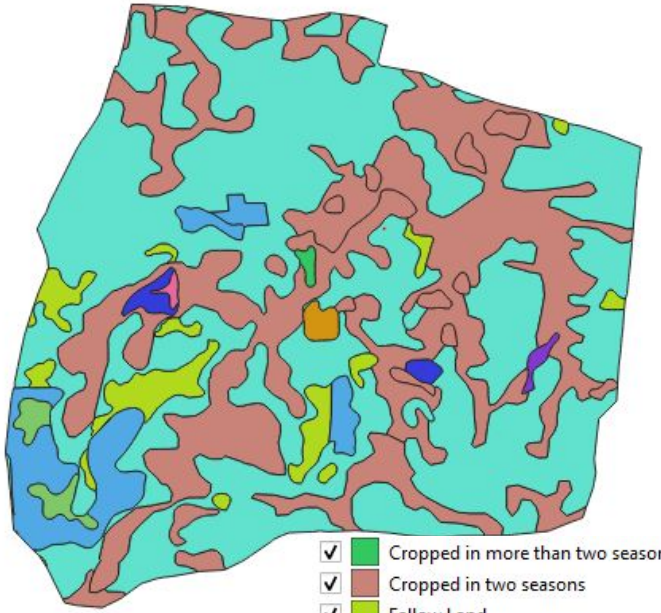




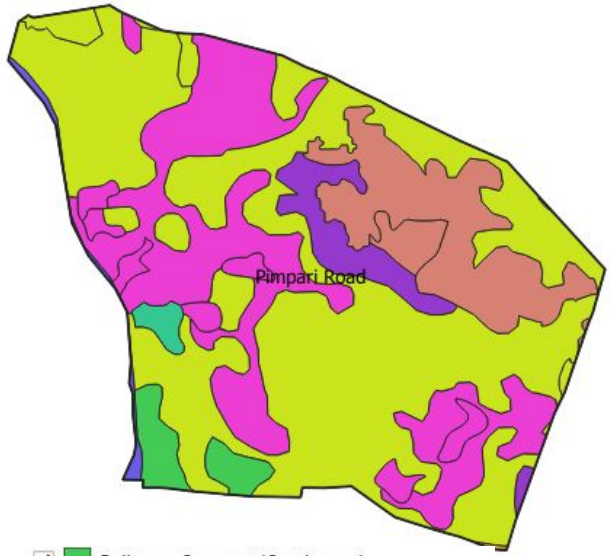
% Sand content from NBSS shapefile and website(15cm depth)



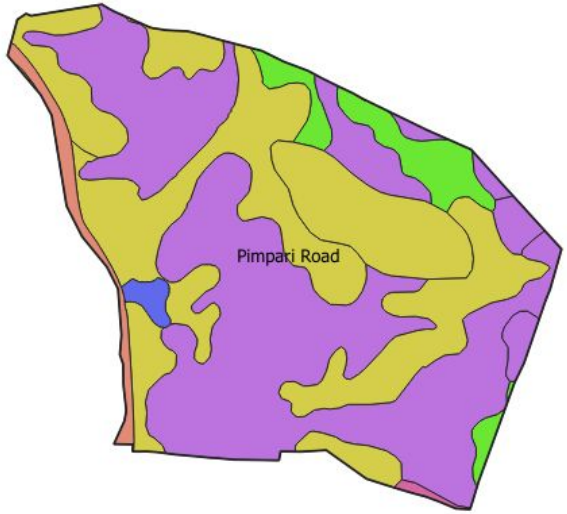


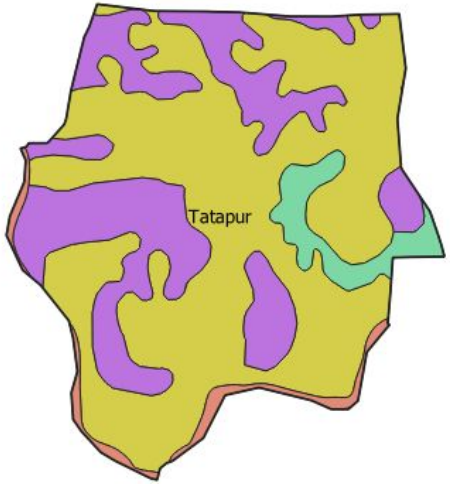


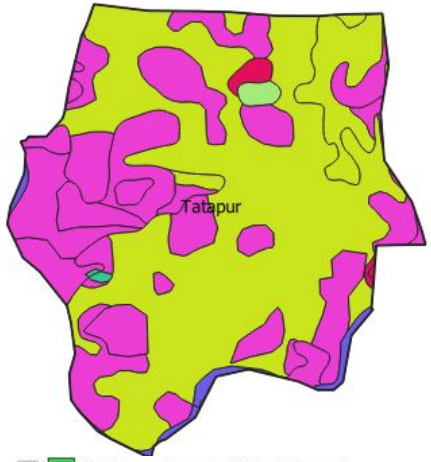
- Cropped in more than two seasons
- Cropped in two seasons
- Fallow Land
- Kharif
- Rabi
- Reservoir/ Tanks - Permanent
- Reservoir/ Tanks - Seasonal
- Rural
- Scrub Land - Dense/ Closed
- Scrub Land - Open



- Built up - Compact (Continuous)
- Cropped in more than two seasons
- Cropped in two seasons
- Deciduous (Dry/ Moist/ Thorn) - Dense/ Closed
- Deciduous (Dry/ Moist/ Thorn) - Open
- Kharif
- Rabi
- River - Perennial
- Rural
- Scrub Land - Open
- Tree Clad Area - Dense/ Closed

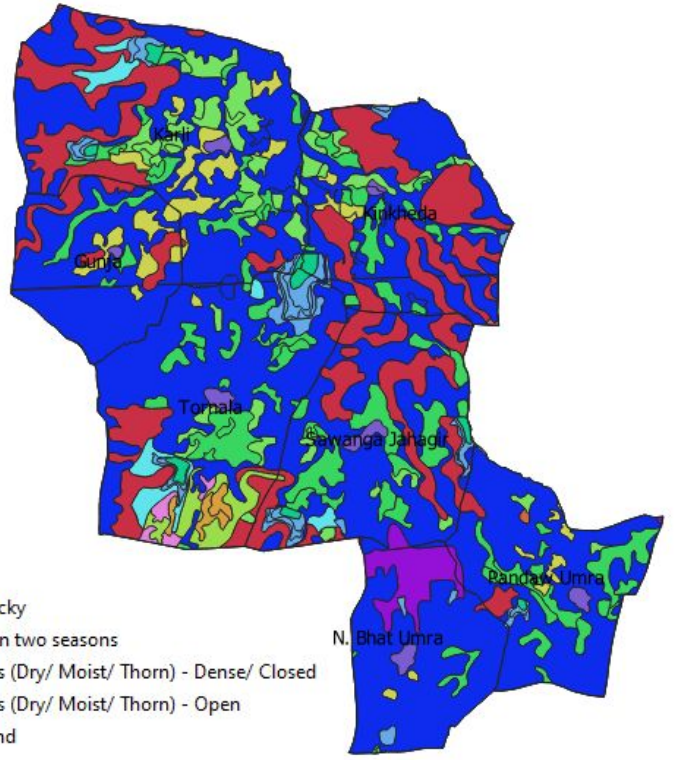






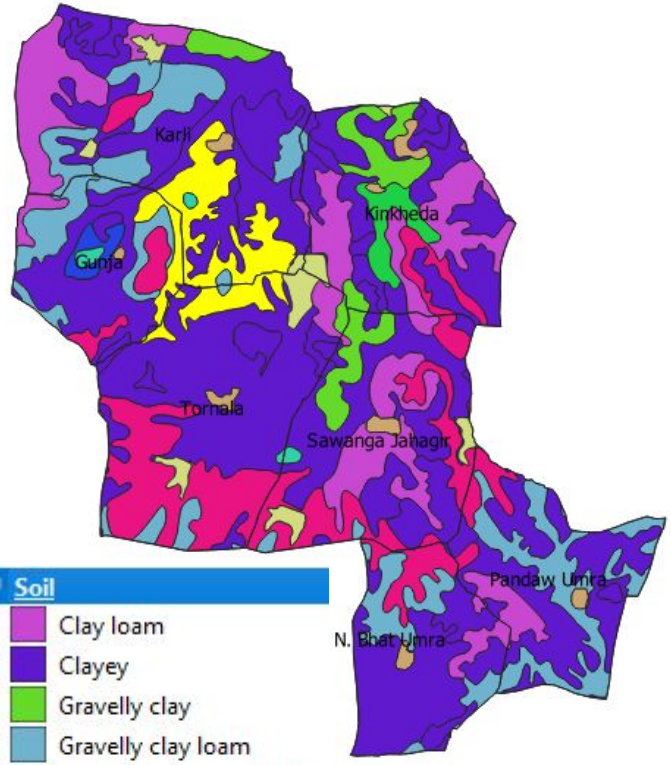
- Clay loam
- Clayey
- Gravelly clay loam
- Gravelly sandy clay loam
- Gravelly sandy loam
- Habitation Mask
- Waterbody Mask

- Built up - Compact (Continuous)
- Cropped in more than two seasons
- Cropped in two seasons
- Deciduous (Dry/ Moist/ Thorn) - Dense/ Closed
- Deciduous (Dry/ Moist/ Thorn) - Open
- Kharif
- Rabi
- River - Perennial
- Rural
- Scrub Land - Open
- Tree Clad Area - Dense/ Closed



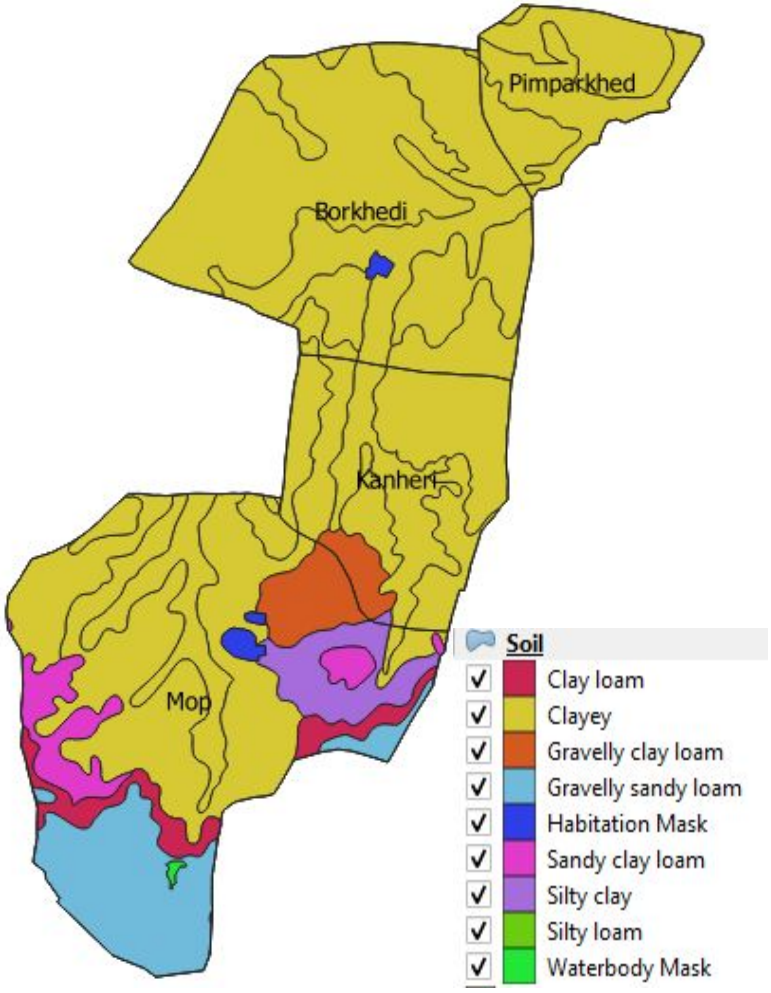
LULC

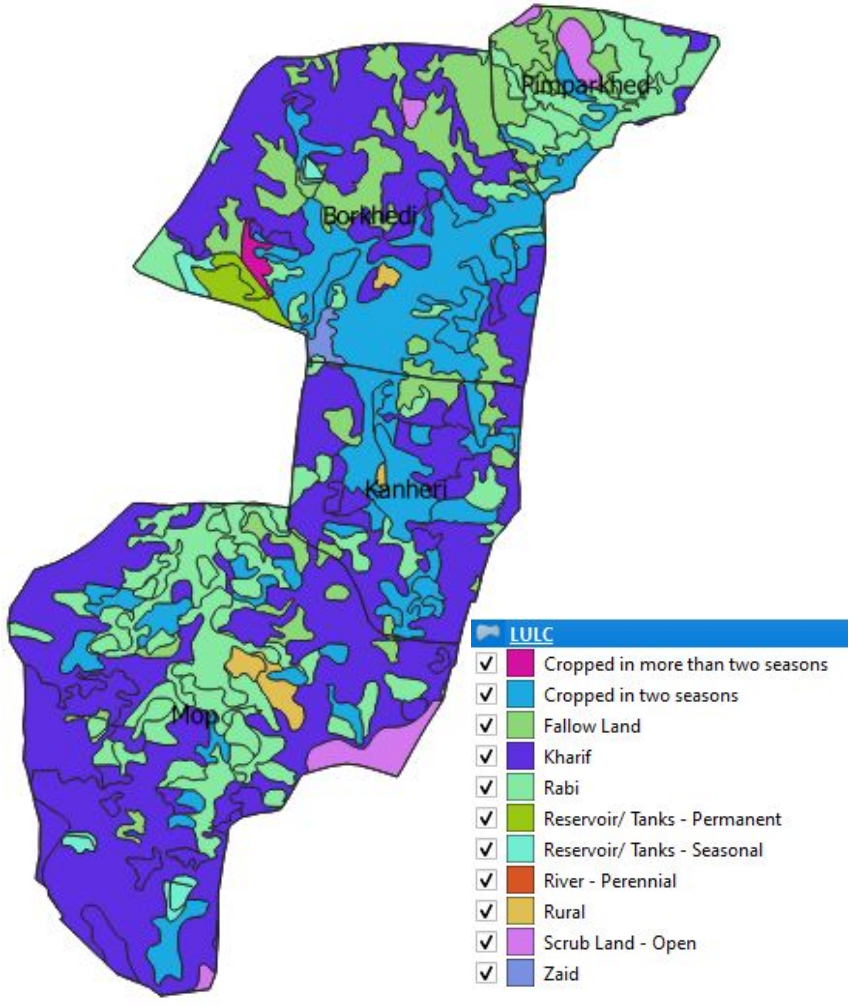
- Barren Rocky
- Cropped in two seasons
- Deciduous (Dry/ Moist/ Thorn) - Dense/ Closed
- Deciduous (Dry/ Moist/ Thorn) - Open
- Fallow Land
- Kharif
- Lakes/ Ponds - Seasonal
- Rabi
- Reservoir/ Tanks - Permanent
- Reservoir/ Tanks - Seasonal
- Rural
- Scrub Forest
- Scrub Land - Dense/ Closed
- Scrub Land - Open

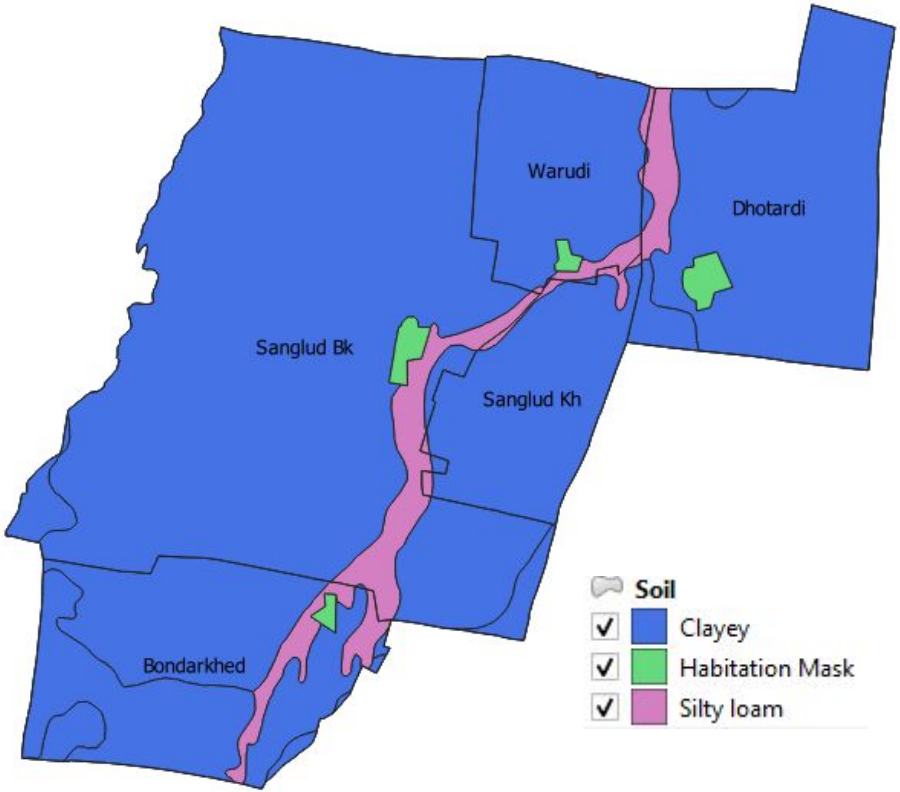


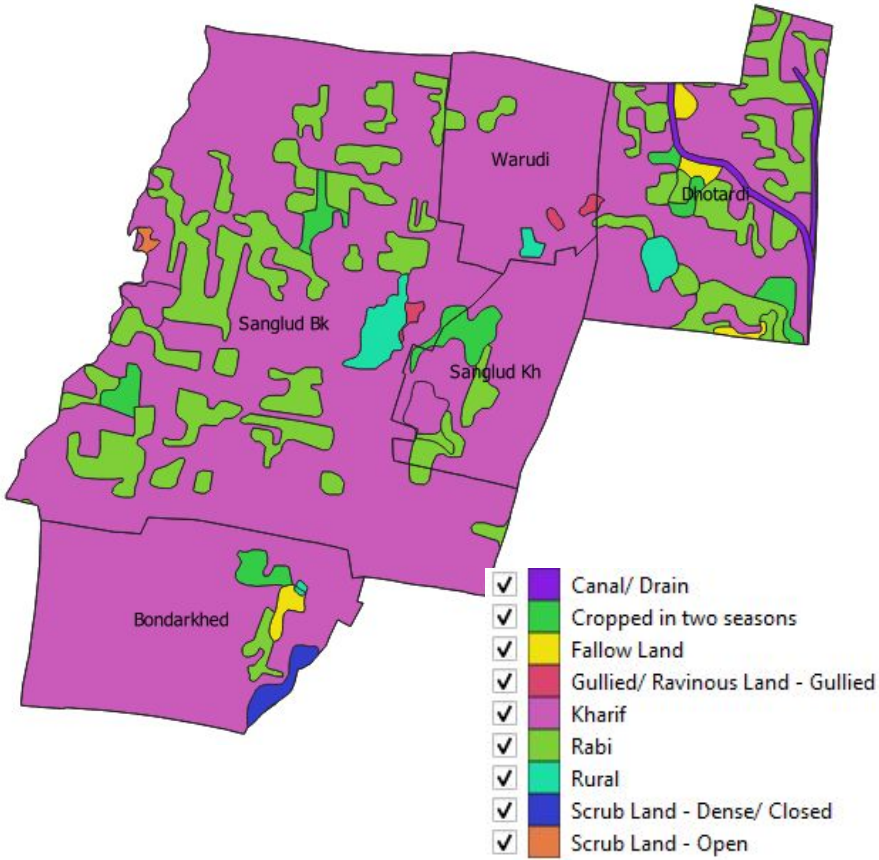
Soil

- Clay loam
- Clayey
- Gravelly clay
- Gravelly clay loam
- Gravelly sandy clay loam
- Gravelly sandy loam
- Habitation Mask
- Sandy clay loam
- Silty loam
- Waterbody Mask


Pimparkhed
Borkhedi
Kanheri
Mop
Soil
Clay loam
Clayey
Gravelly clay loam
Gravelly sandy loam
Habitation Mask
Sandy clay loam
Silty clay
Silty loam
Waterbody Mask


Pimparkhed
Borkhedi
Kanheri
Mop
LULC
Cropped in more than two seasons
Cropped in two seasons
Fallow Land
Kharif
Rabi
Reservoir/ Tanks - Permanent
Reservoir/ Tanks - Seasonal
River - Perennial
Rural
Scrub Land - Open
Zaid


Warudi
Dhotardi
Sanglud Bk
Sanglud Kh
Bondarkhed
Soil
Clayey
Habitation Mask
Silty loam


Warudi
Dhotardi
Sanglud Bk
Sanglud Kh
Bondarkhed
Canal/ Drain
Cropped in two seasons
Fallow Land
Gullied/ Ravinous Land - Gullied
Kharif
Rabi
Rural
Scrub Land - Dense/ Closed
Scrub Land - Open