MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

VISAKHAPATNAM -10/2013-14
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
March-2023

T 0 - T 1 - T 2 - T 3 - T 4 - T 5

AGRICULTURE & SOIL DIVISION
Andhra Pradesh Space Applications Centre (APSAC)
ITE&C Department Govt. of Andhra Pradesh

RURAL DEVELOPMENT AND WATERSHED MONITORING DIVISION
Land Resources and Land Use Mapping and Monitoring Group,
Remote Sensing Application Area,
National Remote Sensing Centre, ISRO

DEPARTMENT OF LAND RESOURCES
Ministry of Rural Development
Government of India

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EXECUTIVE SUMMARY

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1. Integrated Watersheds Management Project (IWMP) is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development (MRD).
2. National Remote Sensing Centre (NRSC), ISRO has designed and developed Bhuvan Geo-ICT Web portal tools namely – Srishti and Drishti for monitoring and evaluation of IWMP watersheds. It uses high spatial and temporal resolution sensors viz., Carto-1/2(2.5 m) , LISS-IV(5.8 m color).
3. Current summary report gives details of Project – IWMP-10/2013-14, Visakhapatnam District of Andhra Pradesh. The total geographical area of the project is 5,382 ha. It comprises of 14 micro watersheds.
4. In the project area 15 Drishti photos were uploaded showing check dams/Rock fill dam, livelihood activities, and remaining showing other activities.
5. Water bodies have shown an increased by 1.63 ha, which correspond to the other land use classes that have been converted into various water bodies in this period.
6. Major percentage i.e. 35 % is covered by the agriculture, 61 % is covered by scrubland, 1.36 % is covered by forest and remaining by other land use classes.

STUDY AREA
PROJECT : JERRILA WATERSHED- IWMP-10/2013-14
DISTRICT : VISAKHAPATNAM , STATE : ANDHRA PRADESH

- The study area falls in G K Veedhi Mandal of Visakhapatnam district of Andhra Pradesh state. The total geographical area of the project is 5,382 ha. It comprises of 14 micro watersheds. Location Map of the study area is shown in Figure 1. Analysis is done for 2013-14 (T0) period (Batch -1) projects taking 2021-22 (T5) period satellite images, seen in Table 1 & 2,Fig 04.

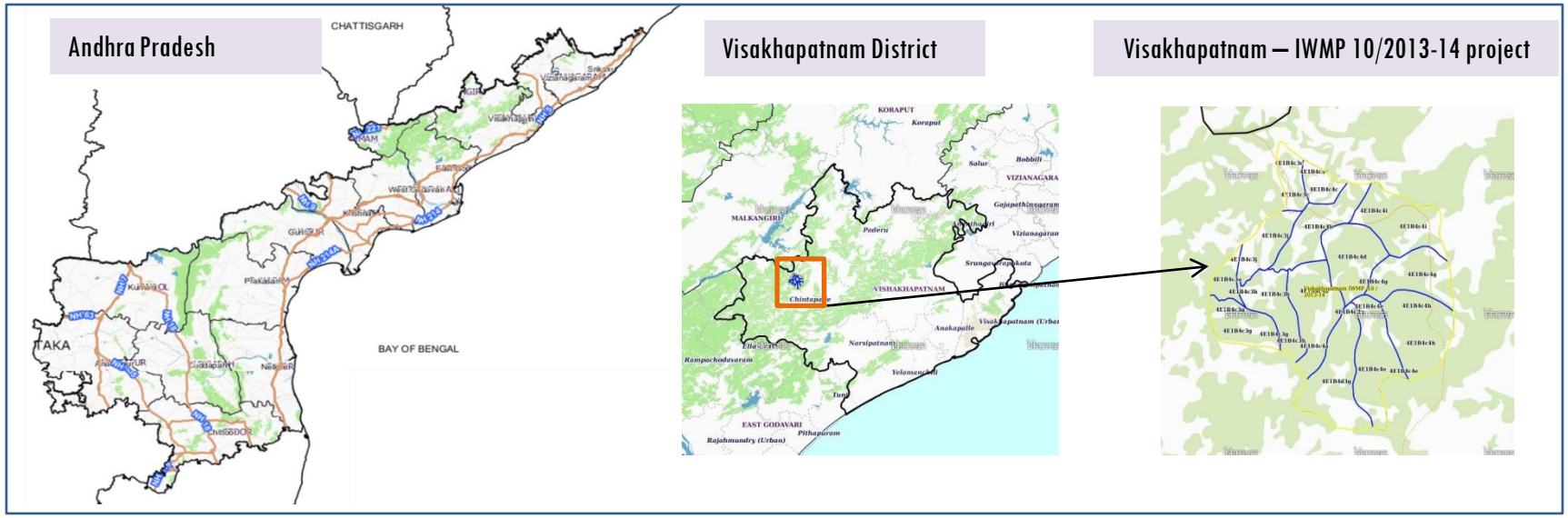


Fig.1. Location map of Jerrila Watershed (IWMP-10/2013-14) in Visakhapatnam District, A.P

- Visakhapatnam has a tropical wet and dry climate. The annual mean temperature ranges between 24.7 °C to 30.6 °C, with the maximum in the month of May and the minimum in January; the minimum temperatures ranges between 20-27 °C.
- The climate of the district is varied and has differing climate conditions in different parts. Near the coast the air is humid and moist and relaxing, but gets warmer towards the interior and cools down in the hilly areas on account of elevation and dense vegetation.

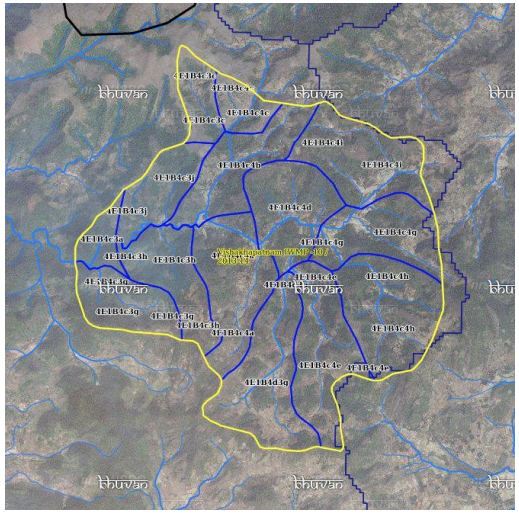
Table 1. Satellite Data and Ancillary Data

Satellite data*	T0-A**	T0-B**	T5
	2013-14	2011-12	2021-22
LISS IV	2013-14		
SCENE 1			5-Jan-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			5-Jan-22
SCENE2			
SCENE 3			
SCENE 4			

Table 2. Ancillary Data

	Category	Sub category	Status
1	Thematic maps		
	LULC (1: 10 000)		
		DRAIANGE	YES
		SETTLEMENT	YES
		ROADS/RAILS	No
	LULC (1: 50 000)		
		2005-06	
		2008-09	
2	Activity Plan Maps		
3	Drishti Photographs		
		Total	15
4	Detailed Project Report		

Fig 2. Natural Color Composite overlaid with Project boundaries and high detail stream network



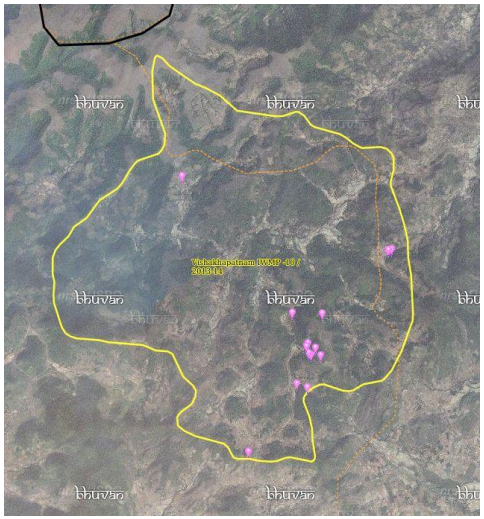
Legend

Drainage (1:10000 Scale)

MWS Boundary

Project Boundary

Fig 3. Natural Color Composite overlaid with Drishti Points



Drishti Upload Status

Table 3. Classification of the Activities

Sr. No	Activity	Number of Photographs uploaded in Drishti Mobile Application	Visible on satellite in Srishti Geoportal
1	Afforestation	0	0
2	Horticulture	0	0
3	Agriculture	0	0
4	Pasture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Terrace	0	0
8	Checks & Plugs	4	4
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams/Rock fill dam	8	8
12	Nallah Bunds/Drainage treatment	0	0
13	Percolation tanks / Ground water recharge structure	0	0
14	Production System and Micro-Enterprises	0	0
15	Livelihood Activities-Plantation/Horticulture	0	0
16	Capacity Building Activities	0	0
17	Entry Point Activity	1	1
18	Others	2	2
	TOTAL	**15**	**15**

03. MONITORING IN THE PROJECT AREA

3.1 Site Wise Changes in the Project

- Impacts of the activities carried out are presented through combination of Drishti and Srishti captures.
- T0 is the baseline period before implementation (2013-14) and T5 is 2021-22 period for monitoring.
- Captures are also provided wherever changes are observed in satellite images, that may match expected activity related impact, even though they don't have Drishti report yet, figure 05 & 06.

Fig 4. Jerrila Watershed (IWMP-10/2013-14) Natural Colour Composite (NCC)-2013-14 to 2021-22

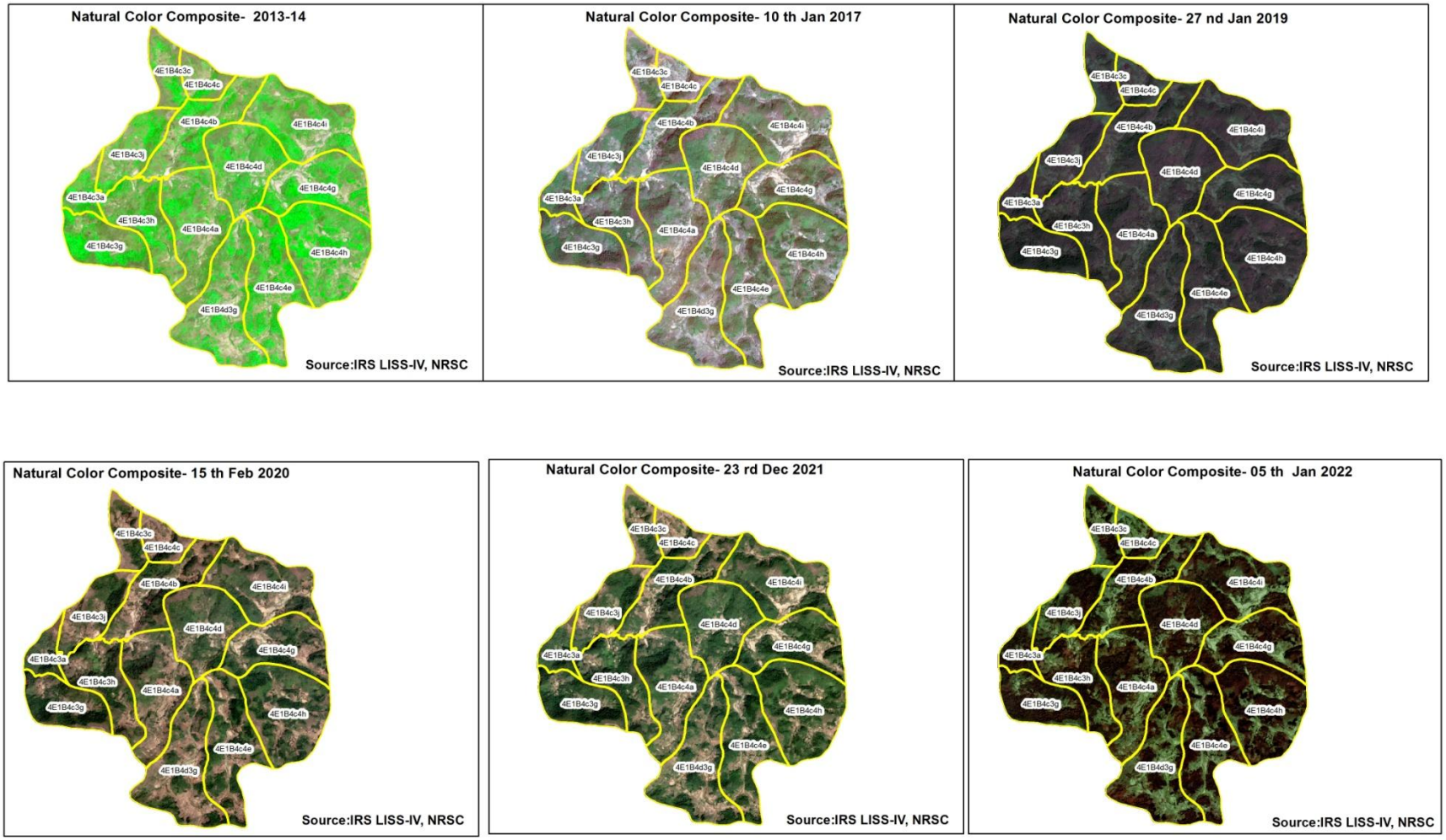
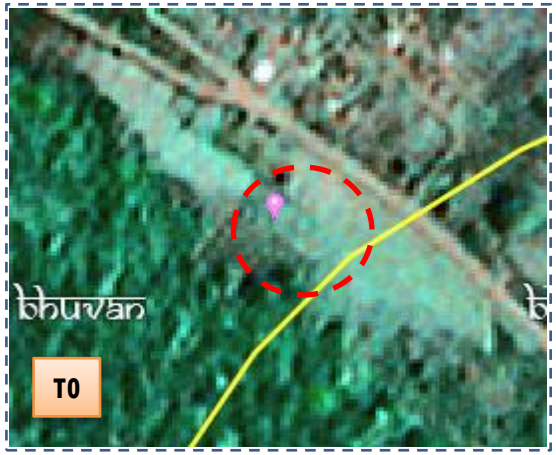


Fig 5. Monitoring of activities in Jerrila Watershed (IWMP-10/2013-14) Visakhapatnam District Andhra Pradesh



T0:2013-14

T1: 01 November 2018

Drishti SI no. 1341555 MWS : 4E1B4c4e

Farm pond

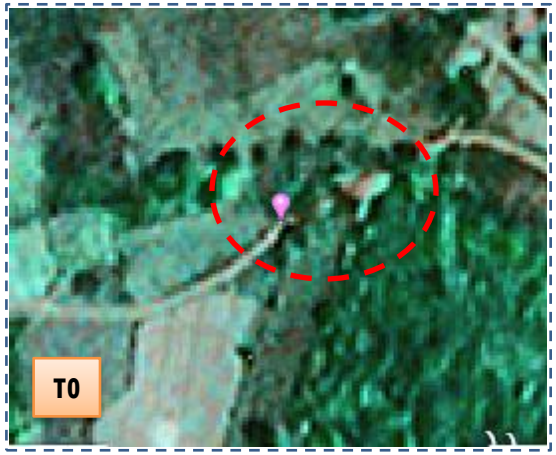
T0:2013-14

T1: 06 June 2017

Drishti SI no. 1344379 MWS : 4E1B4c4e

Farm pond

Fig 6. Monitoring of activities in Jerrila Watershed (IWMP-10/2013-14) Visakhapatnam District Andhra Pradesh

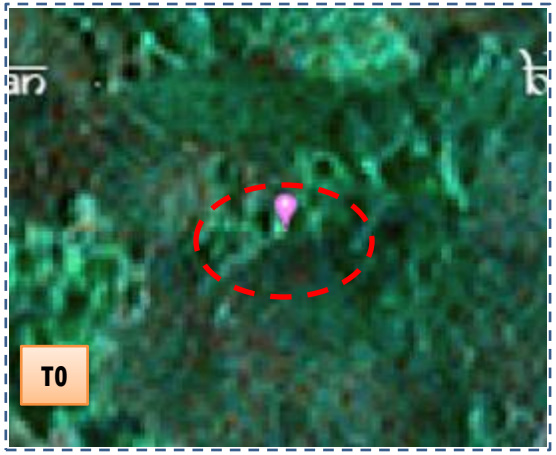


T0:2013-14

T1: 06 June 2017

Drishti Sl no. 1341555 MWS : 4E1B4c4e

Percolation Tank



T0:2013-14

T1: 06 June 2017

Drishti Sl no. 1344356 MWS : 4E1B4c4e

Rock fill Dam

3.2 Land use and Land cover Changes in the Project

- Change in land use and land cover form T0 to T5 are analyzed in terms of built up, mining/dump, agriculture, plantation- horticulture, forest, barren rocky waterbody-streams/river/reservoir and waterbody –ponds, seen in fig 07 to fig 11.
- Captures are also provided wherever changes are observed in satellite images, that may match expected activity related impact, even though they don't have Drishti report yet, seen in fig 12 & 13 .
- The result obtained for the period T0 to T5 are given in the change matrix table, seen in table 04 to table 08.
- In matrix table column represents the T0 (2013-14) and row represents the T5 (2021-22)

Fig 7. Jerrila Watershed (IWMP-10/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

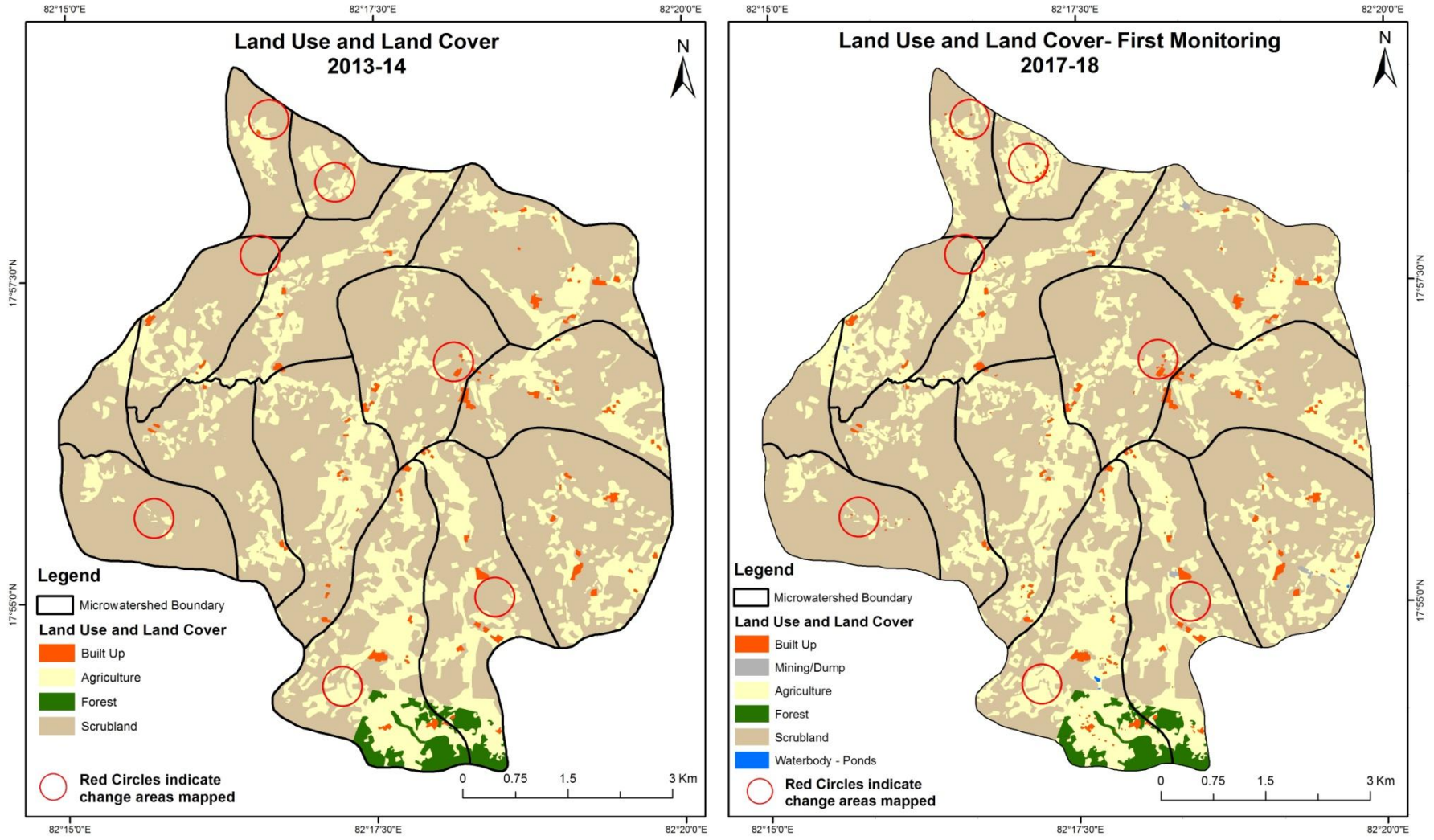
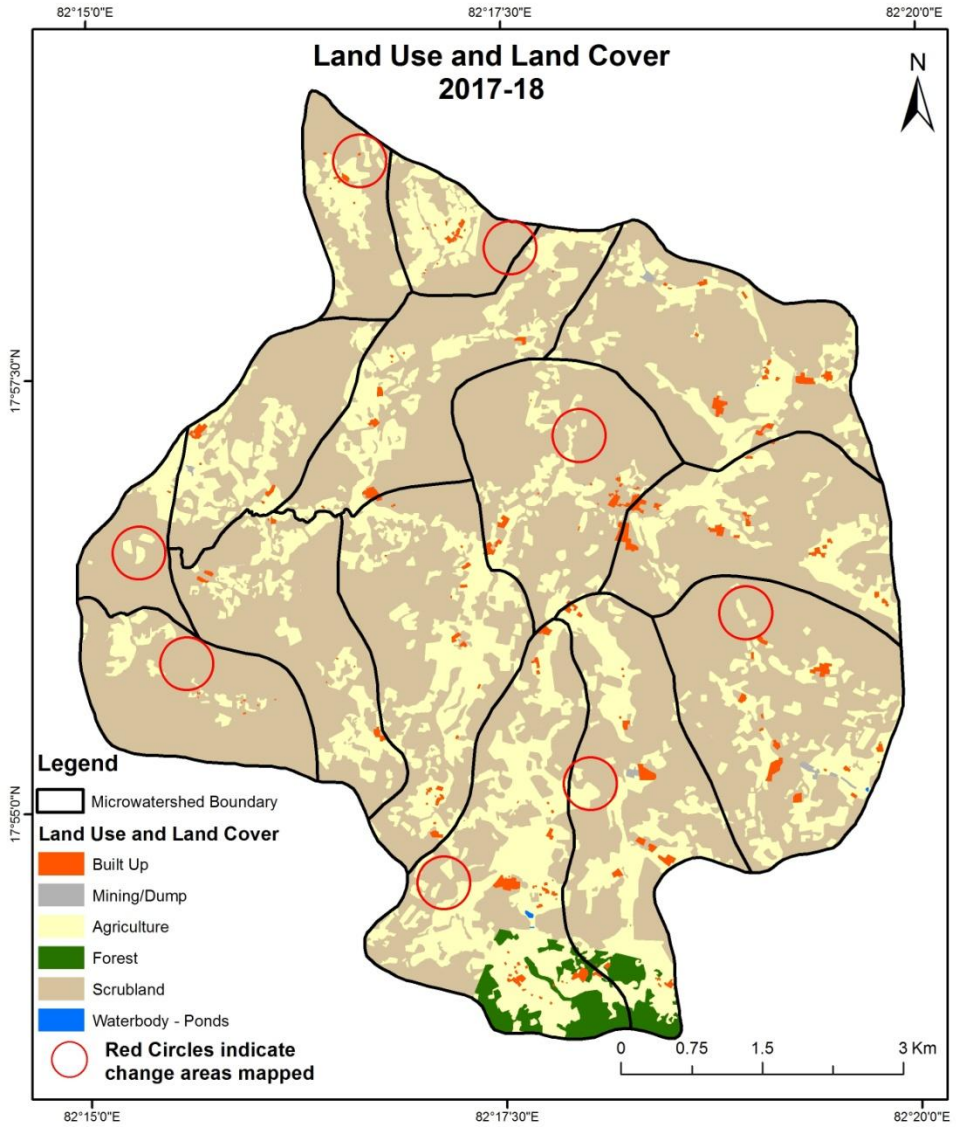


Fig 8. Jerrila Watershed (IWMP-10/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000



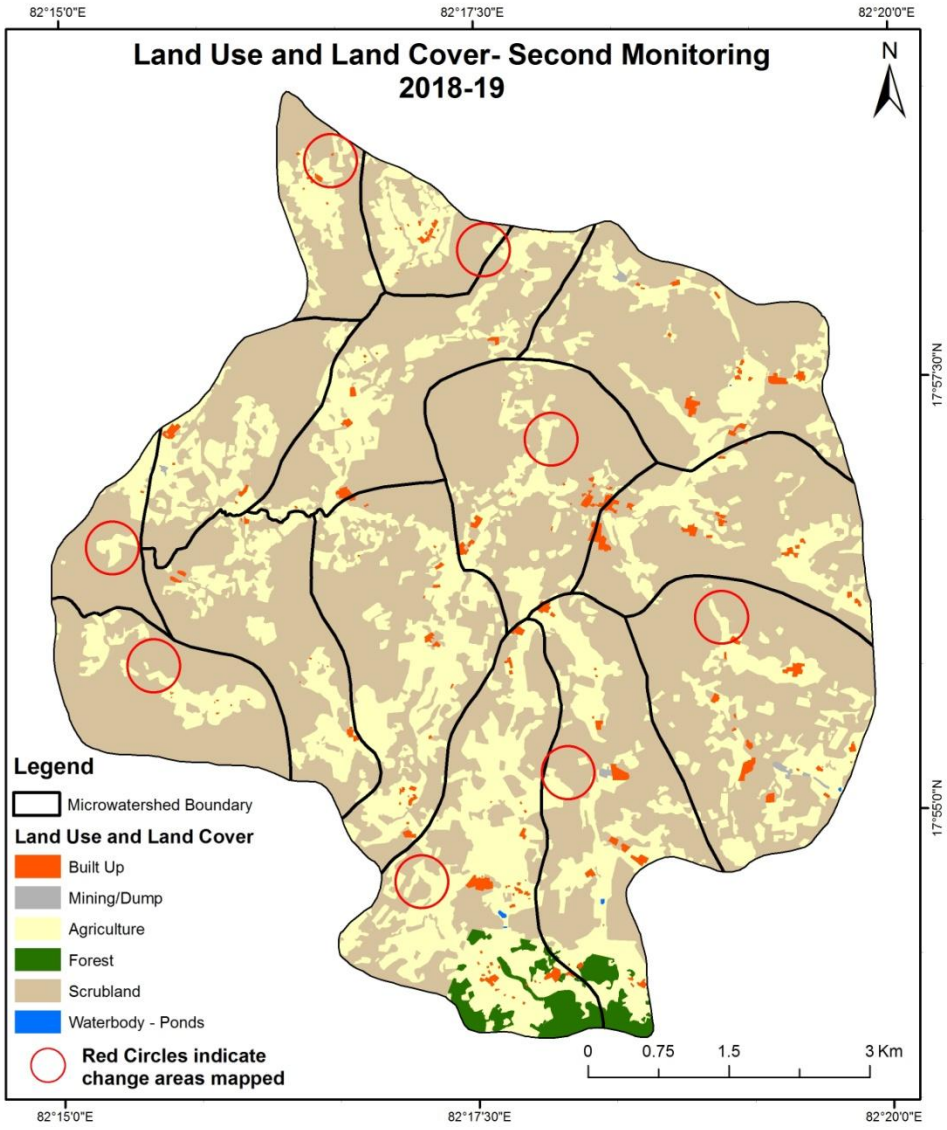
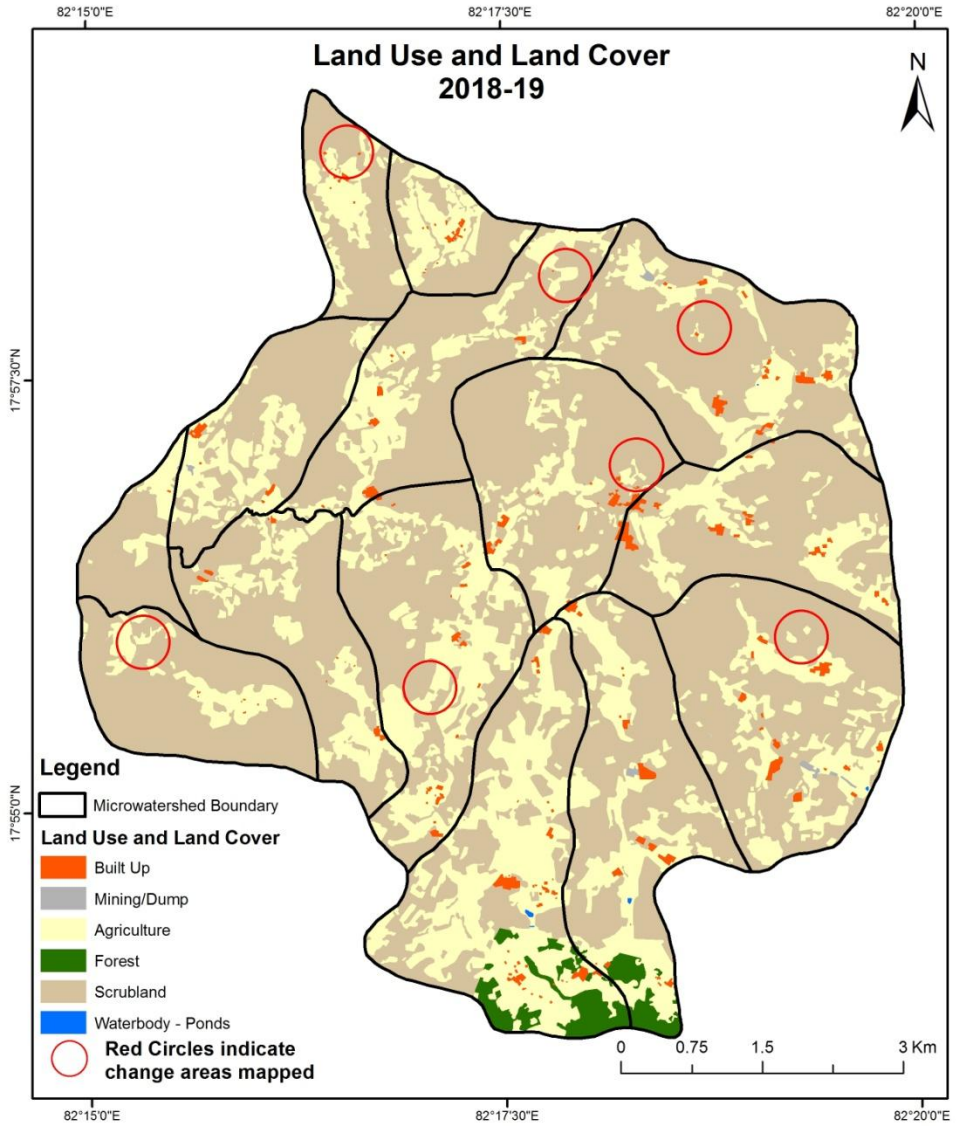


Fig 9. Jerrila Watershed (IWMP-10/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000



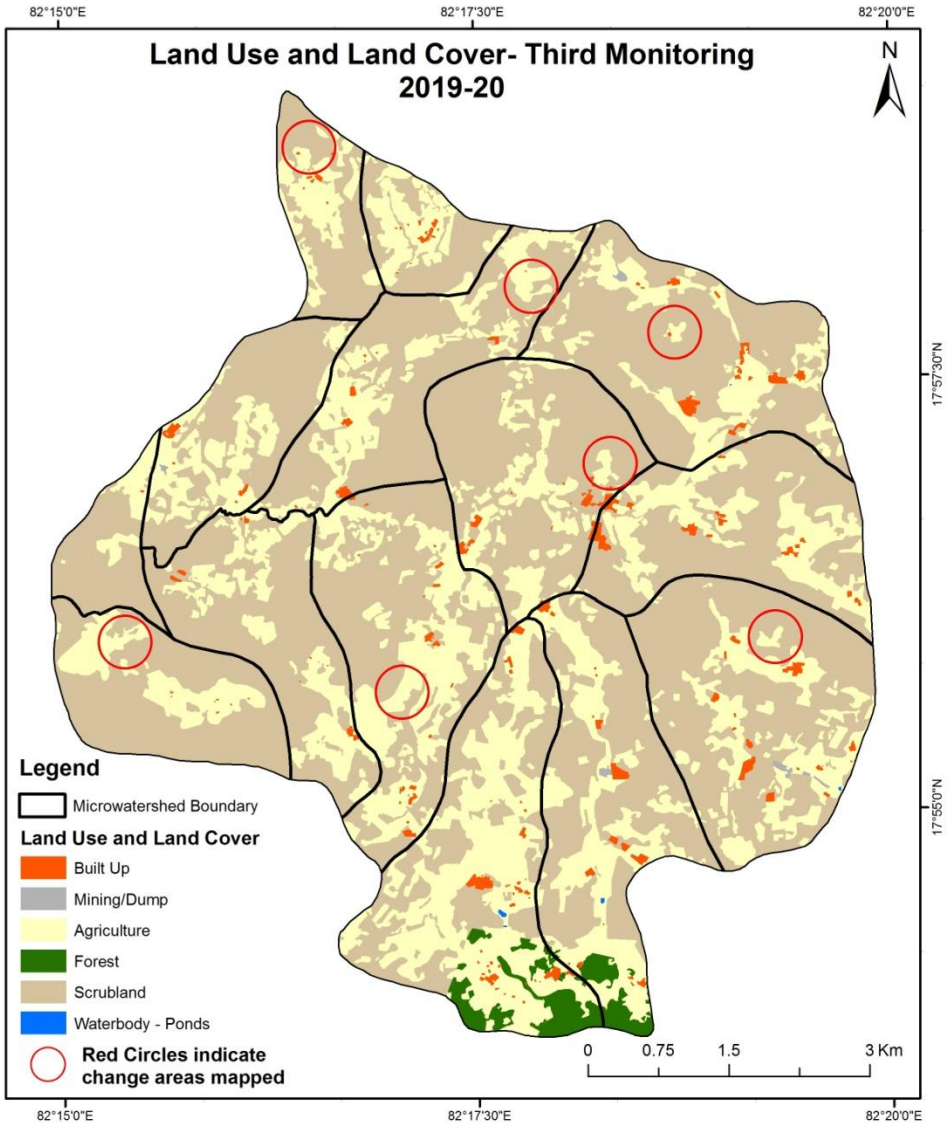
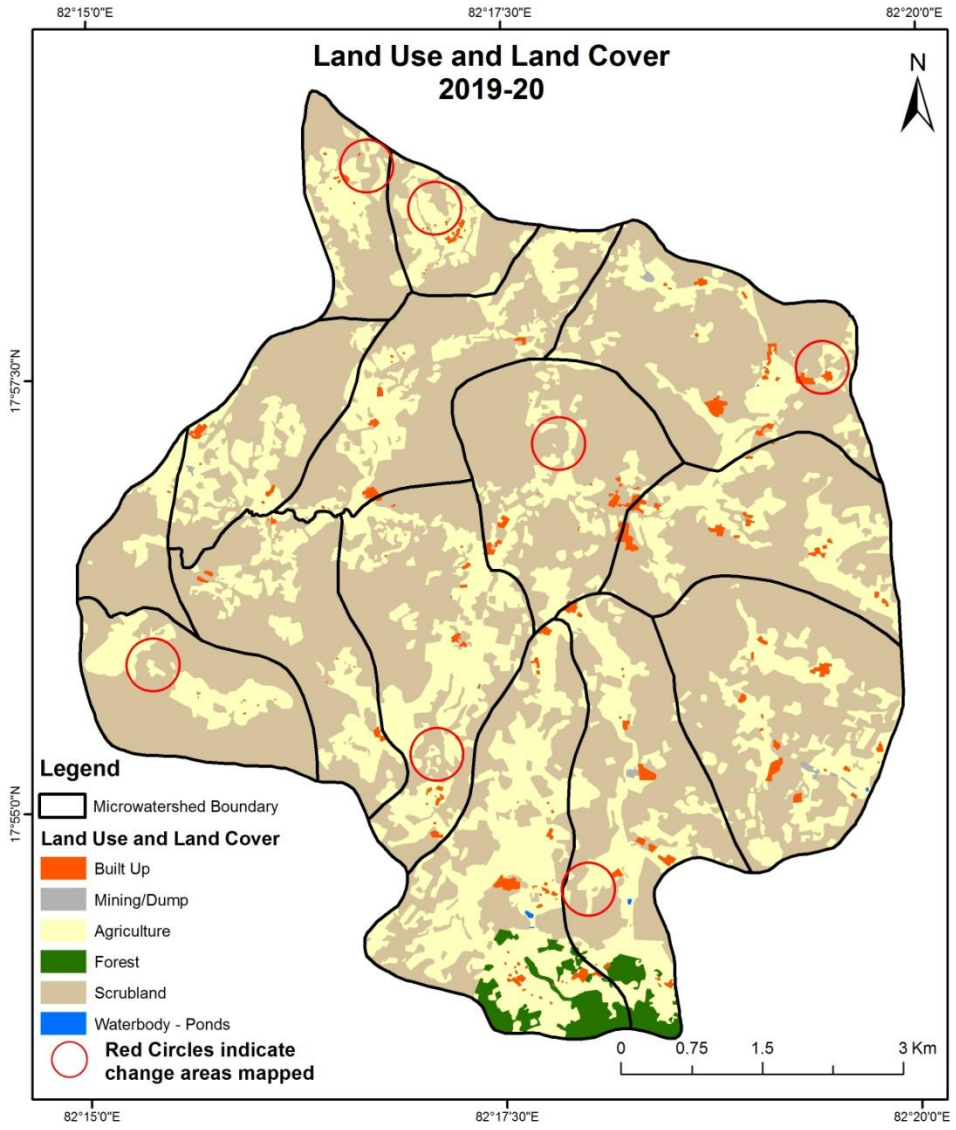


Fig 10. Jerrila Watershed (IWMP-10/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000



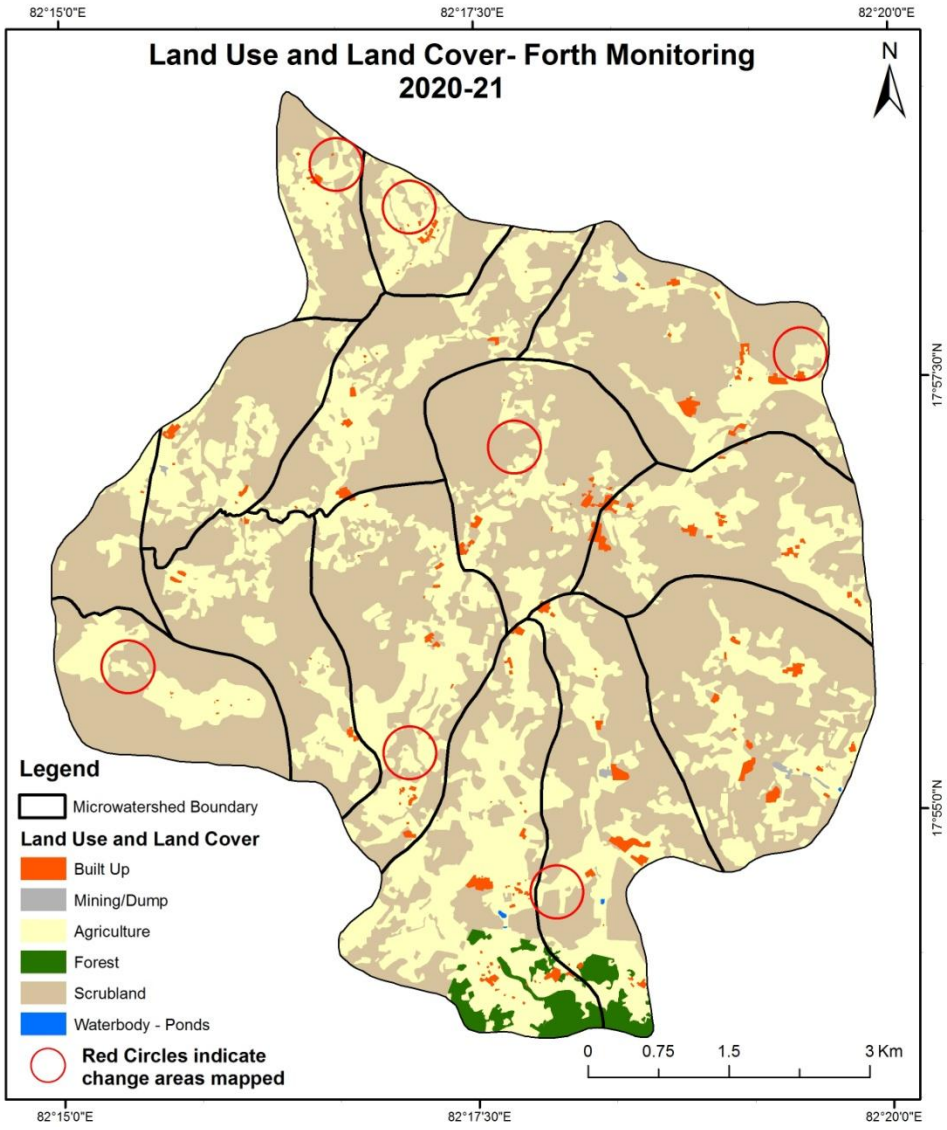
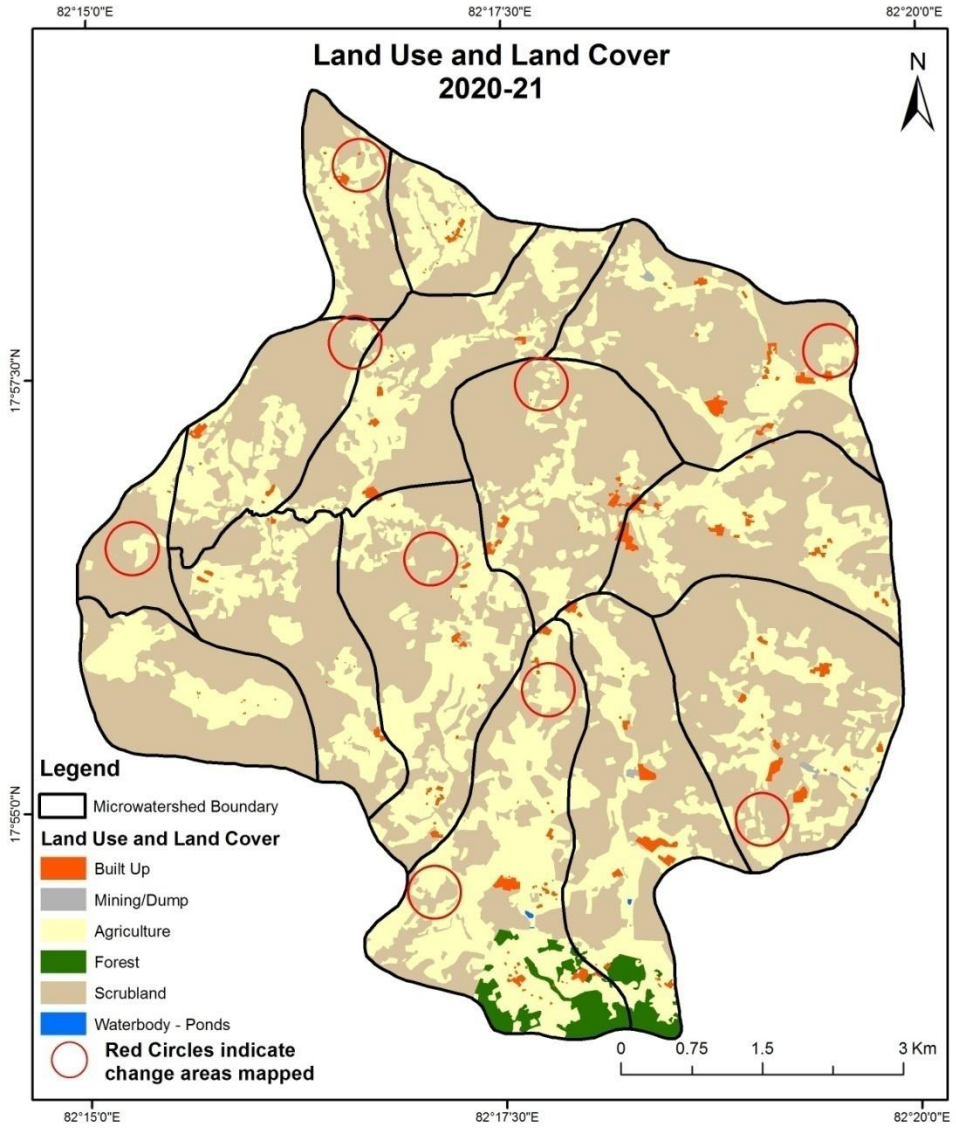


Fig 11. Jerrila Watershed (IWMP-10/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)

Scale: 1:10000



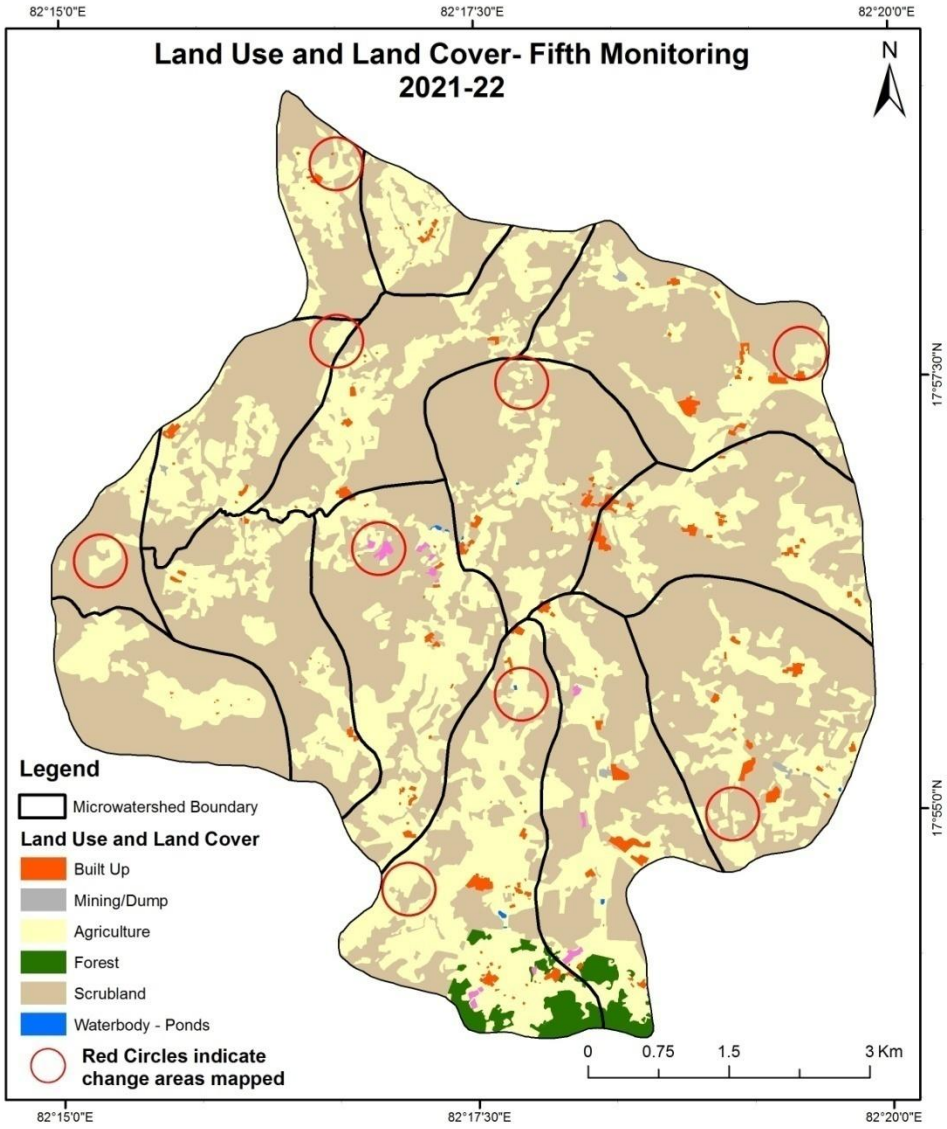
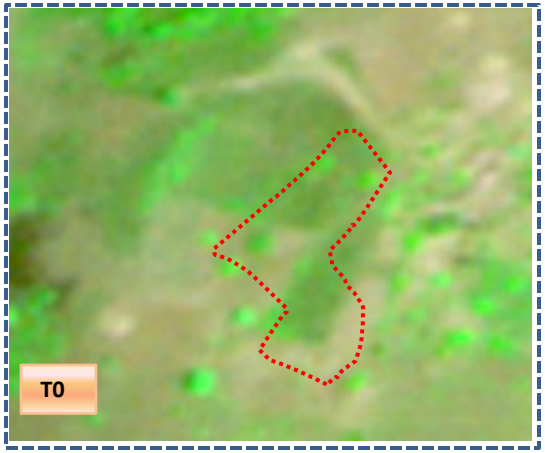
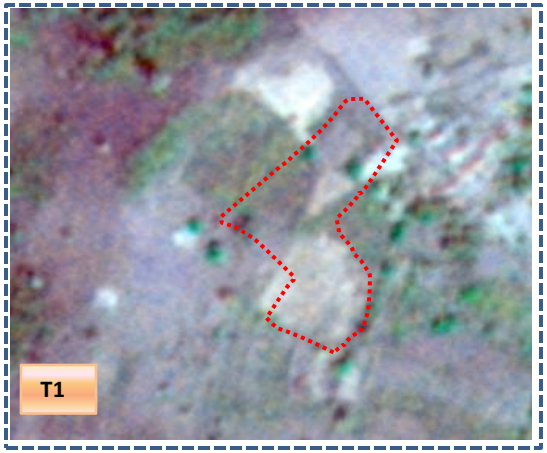


Fig 12. Jerrila Watershed (IWMP-10/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Scrub to Agriculture

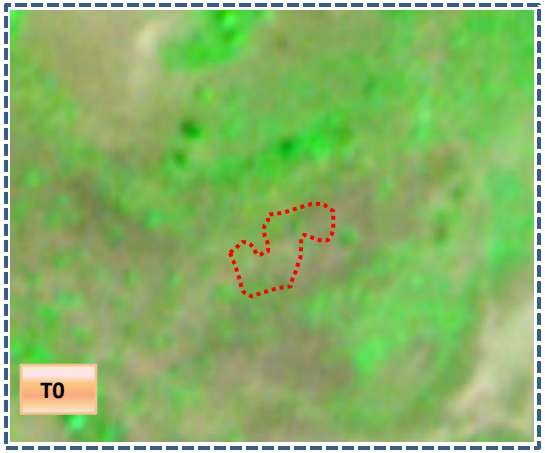


T0: 2013-14 (82°15'35.747"E 17°57'9.282“N)

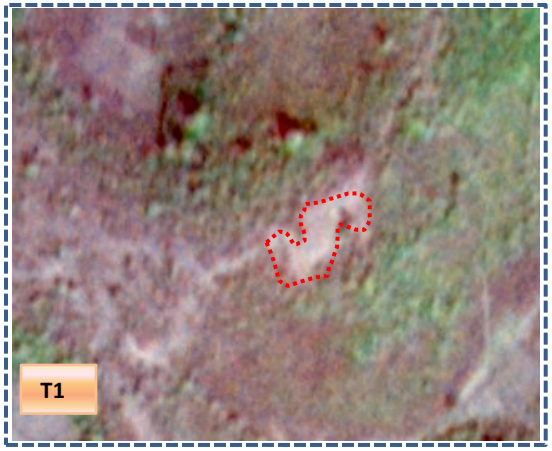


T1: 10 January 2017

Scrub to Agriculture



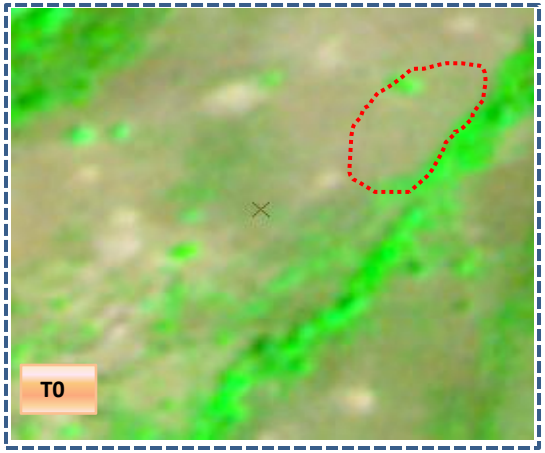
T0: 2013-14 (82°17'53.353"E 17°57'53.522“N)



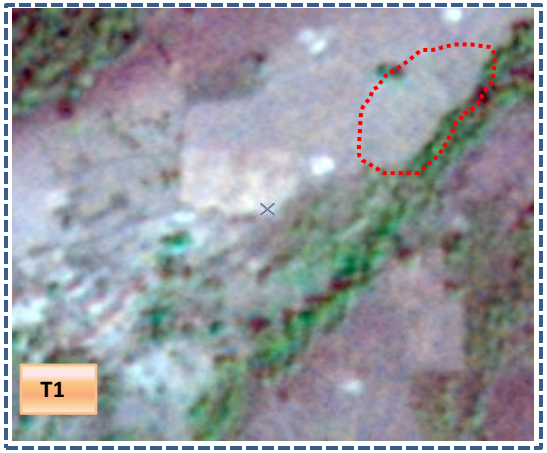
T1: 10 January 2017

Fig 13. Jerrila Watershed (IWMP-10/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Scrub to Agriculture

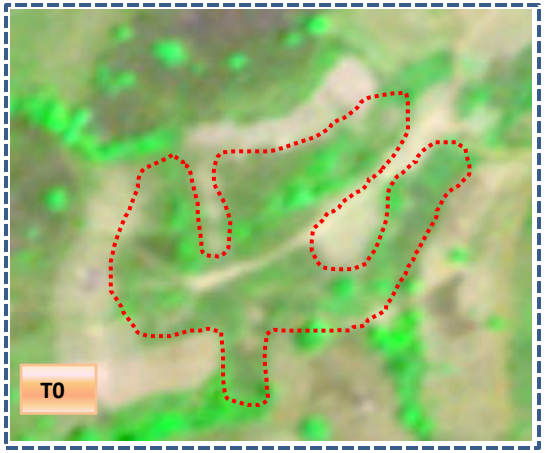


T0: 2013-14 (82°15'47.707"E 17°57'15.359“N)

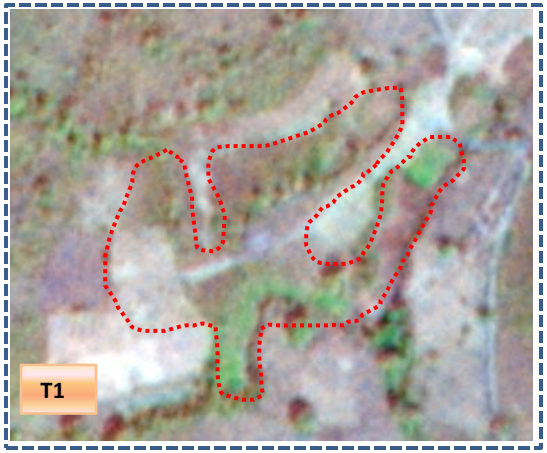


T1: 10 January 2017

Scrub to Agriculture



T0: 2013-14 (82°17'9.413"E 17°54'25.25“N)



T1: 10 January 2017

Table 4. showing change matrix depicting Land cover transitions for Jerrila Watershed (IWMP-10/2013-14) during study period-2013-14 to 2017-18

Land cover	Monitoring period (T1)										Units in Hectares
T0	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	55.38										**55.38**
Mining/dump											
Agriculture	5.35	5.38	1260.8		0.14			0.39		0.66	**1272.72**
Plantation Horticulture											
Forest	0.06		3.78		84.55						**88.39**
Forest Plantation											
Barren Rocky											
Scrub	6.02	0.05	201.55					3758.59			**3966.21**
Waterbody-Streams/River											
Waterbody – Ponds											
Grand Total	**66.81**	**5.43**	**1466.13**		**84.69**			**3758.98**		**0.66**	**5382.7**

Interpretation: The example of "Agriculture" Land cover for the period 2013-14 to 2021-22

1. In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents the changes in between the classes.

2. In T0 12 ha of the agriculture area has decreased and it is converted into Built-up (5.3 ha),mining/dump (5.3 ha), scrub (0.3 ha) and water body (0.6 ha) in T1.

3. In T1 205 ha of the agriculture area has increased from forest (3.7 ha) and scrubland (201 ha) of T0.

Table 5. showing change matrix depicting Land cover transitions for Jerrila Watershed (IWMP-10/2013-14) during study period-2017-18 to 2018-19

Land cover	Monitoring period (T2)										Units in Hectares
T1	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	66.81										**66.81**
Mining/dump		5.43									**5.43**
Agriculture	0.51		1465.4							0.22	**1466.13**
Plantation Horticulture											
Forest			6.89		77.8						**84.69**
Forest Plantation											
Barren Rocky											
Scrub	0.47		167.23					3591.28			**3758.98**
Waterbody-Streams/River											
Waterbody – Ponds										0.66	**0.66**
Grand Total	**67.79**	**5.43**	**1639.52**		**77.8**			**3591.28**		**0.88**	**5382.7**

4. In T1 0.7 ha of the agriculture area has decreased and it is converted into Built-up (0.51 ha) and water body (0.22 ha) in T2.

5. In T2 174 ha of the agriculture area has increased from forest (6.8 ha) and scrubland (167 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Jerrila Watershed (IWMP-10/2013-14) during study period-2018-19 to 2019-20

Land cover	Monitoring period (T3)										Units in Hectares
T2	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	67.79										**67.79**
Mining/dump		5.43									**5.43**
Agriculture			1639.52								**1639.52**
Plantation Horticulture											
Forest					77.8						**77.8**
Forest Plantation											
Barren Rocky											
Scrub	2.4		120.24					3468.64			**3591.28**
Waterbody-Streams/River											
Waterbody – Ponds										0.88	**0.88**
Grand Total	**70.19**	**5.43**	**1759.76**		**77.8**			**3468.64**		**0.88**	**5382.7**

6. In T3 120 ha of the agriculture area has increased from scrubland (120 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Jerrila Watershed (IWMP-10/2013-14) during study period-2019-20 to 2020-21

Land cover	Monitoring period (T4)										Units in Hectares
T3	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	70.19										70.19
Mining/dump		5.43									5.43
Agriculture	0.75		1759.01								1759.76
Plantation Horticulture											
Forest					77.8						77.8
Forest Plantation											
Barren Rocky											
Scrub	3.1		110.57					3354.97			3468.64
Waterbody-Streams/River											
Waterbody – Ponds										0.88	0.88
Grand Total	74.04	5.43	1869.58		77.8			3354.97		0.88	5382.7

8. In T3 0.75 ha of the agriculture area has decreased and it is converted into built-up (0.75 ha) in T4.

9. In T4 110 ha of the agriculture area has increased from scrubland (110 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Jerrila Watershed (IWMP-10/2013-14) during study period-2020-21 to 2021-22

Land cover	Monitoring period (T5)										Units in Hectares
T4	Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	74.04										**74.04**
Mining/dump		5.43									**5.43**
Agriculture	0.91		1863.15	5.3						0.22	**1869.58**
Plantation Horticulture											
Forest			3.76	0.79	73.25						**77.8**
Forest Plantation											
Barren Rocky											
Scrub			36.25	3.04				3315.15		0.53	**3354.97**
Waterbody-Streams/River											
Waterbody – Ponds										0.88	**0.88**
Grand Total	**74.95**	**5.43**	**1903.16**	**9.13**	**73.25**			**3315.15**		**1.63**	**5382.7**

10. In T4 6.4 ha of the agriculture area has decreased and it is converted into built-up (0.9 ha), plantations/horticulture (5.3 ha) and water body (0.22 ha) in T5.

11. In T5 40 ha of the agriculture area has increased from forest (3.7 ha) and scrubland (36.2 ha) of T4.

Conclusion

1. The Land Use/Land Cover shows that there is an increase in Crop land, Built up area, Reservoir / Tanks & decrease in Scrubland as presented in the change matrix for different years.
2. There is an decrease of 0.75 Hectares in Reservoir / Tanks area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
3. There is an increase of 193, 173, 120, 109 & 33Hectares from T0-T1, T1-T2, T2-T3 & T3-T4 respectively and overall increase of 630 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2012-13 (T0) & 2021-22 (T5) years.
4. About **9.13 ha of the plantation/horticulture area has been increased** in during the monitoring period of 2012-13 (T0) to 2021-22 (T5) years.
5. There is a decrease of 39 Hectares in Scrubland area as compared between 2012-13 (T0) & 2021-22 (T5) years.
6. Farm ponds (0) is visible on IWMP (Integrated Watershed Management Programme) Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (0) verified from the portal.

Abbreviations

- IWMP -Integrated Watershed Management Programme
- LU/LC-Land Use/Land Cover
- DRISHTI- a mobile based android application
- SHRISTI- a web GIS interface on Bhuvan
- LISS – Linear Image Self Scanner
- PAN - Panchromatic Image
- FCC – False Colour Composite
- NCC – Natural Colour Composite
- NRSC – National Remote Sensing Centre
- DoLR – Department of Land Records